



# **DEPARTMENT OF MEDICAL RESEARCH**

**(Lower Myanmar)**

## **FURTHER DEVELOPMENT OF MEDICAL RESEARCH IN MYANMAR**

**(1987 to 2011)**

**Editor**

**AUNG THAN BATU**

Written by

Sixty-five Authors

From Departments of Medical Research (Lower, Upper, Central Myanmar), Department of Medical Science (Universities of Medicine, Universities of Nursing, University of Pharmacy and similar technological institutions, University of Public Health, University of Community Health), Department of Health, Department of Traditional Medicine, Department of Health Planning- Ministry of Health; Myanmar Academy of Medical Science; Directorate of Medical Services-Ministry of Defense; Myanma Scientific and Technological Research Department-Ministry of Science and Technology; Central Pharmaceutical Research Organization- Ministry of Industry

Yangon, Myanmar (2013)

## **FOREWORD**

by

**Professor Pe Thet Khin**

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Myanmar has a long established, well developed 'health research system' which functions as the 'brain' of the health system, through appropriate architecture and mechanisms. The health research system has five essential functions: (1) stewardship-to develop strategic visions for health research in response to knowledge needs of the health services (2) capacity development for health research (3) knowledge generation (4) utilization and management of knowledge for health improvement (5) mobilization of resources for health research.

The political, social and economic changes that have occurred in recent years have brought wide opportunities for further robust growth of medical research in many new directions in Myanmar. Myanmar has opened its doors to let in new scientific ideas, new approaches and new health technologies that would advance medical science and improve health in the country. The winds of change are blowing in the country and there is a feeling of excitement and expectation of great progress to come. The health sector is part of all this and medical research has an important role to play in these changes. The health research system should be able to respond adequately to the changes taking place in the country. The country expects the health research system as the 'brain' of the health system to perform its functions, not just well, but with excellence. In this time of rapid changes in the country and in the health sector, there is a great need for clear strategic vision for health research in response to knowledge needs of the health services. Medical research institutions as key components of the system should be able to generate knowledge and fulfill such knowledge needs effectively and efficiently; Universities of Medicine and other academic institutions are important components of the system, and should also be able to generate knowledge as well as to transmit knowledge. The utilization and management of knowledge for health needs is a function of the health research system which is especially important because knowledge unutilized is research effort wasted, which we can scarcely afford. It is heartening to see the large developments in health research capacity at medical research institutions and it is hoped that research capacity development at Universities of Medicine and academic institutions will

be accelerated. With the influx of many potential partners in medical science and medical research there is great prospect for the mobilization of resources for health research, which is one of the important functions of the Health Research System.

The authors who have contributed to this account of further development of medical research in Myanmar during the last two and half decades are responsible persons from medical research, medical education and health service institutions as well as from professional organizations, non-governmental organizations and industrial research institutions and are key persons in the health research system; the authors also include a few of the older generation who still continue to be involved in medical research, in one capacity or the other, and whose knowledge, experience and vision would help to make the story to be told now richer and more meaningful. The authors have participated in the recent developments of medical research and this record of what they know of research development in their organizations and institutions and the critical overviews by the Editor will be of value to health professionals including decision makers in research, academic medicine and the health services as well as to some scientists in other disciplines. It is most appropriate that this sequel to the previous volume on medical research development in Myanmar has come out in time for the Golden Jubilee of the Department of Medical Research. A review of past medical research development in Myanmar, which this book and the previous volume has done, would better prepare the present generation of persons responsible for research in academic, service and research institutions and organizations to meet the challenges of the future

**Prof. Pe Thet Khin**  
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## **PREFACE**

by

**Dr Ko Ko**

**WHO Regional Director Emeritus**

Myanmar Academy of Medical Science published "The Growth and Development of Medical Research in Myanmar (1886-1986)" by Professor Aung Than Batu in the year 2003. The present book, Volume No. 2 is in fact practically the continuation of the first Book published in 2003. I have had an opportunity of going through the manuscript of the first Book when it was being prepared. At that time I understood from the author that this Book covers 100 years from 1886, the year of occupation of Burma by British-India, to the year 1986, an arbitrary cut out date for 100 years but it also coincides with the year of his retirement as the Director-General of Medical Research in the year 1987. Dr. Aung Than Batu was hoping that from 1986 onwards the events and further development in medical research in Myanmar would be covered by the new generation of health workers who are better acquainted personally.

Therefore, unlike in the case of the first Book, which was actively written by himself, Professor Aung Than Batu this time, for preparing of the second Book, invited contributions from the individual health workers. He gave an outline of the Book with proposed chapters, accompanied by working guidelines and personally discussed with the prospective contributors. Since individual contributions come direct from the horses' mouth, the write-ups reflect personal view points, actual situation in the field and practicalities, both positive and negative aspects.

Prof Aung Than Batu made preparations two or three years in advance with wide consultations with individual scientists, departments and institutions. He worked hard with contributors on content of various chapters, gave general guidelines and stimulated detailed work of the individual contributors. However, the incoming material would vary from one another in approach, style of presentation, quality and length of write-ups, and finally in the use of the English language.

It has been a gigantic task to collect individual contributions and compile them into a text and finally to edit the complete Book. Most of the chapters were rewritten by the original authors after discussions with Professor Aung Than Batu. In a few, Prof Aung Than Batu used the contents and he personally recast and re-wrote the chapter himself. One may quote examples of such chapters as the following: Research of the Department of Health, Research in public health, parts of Research in Nutrition, and parts of Research in malaria. Since some of the chapters are written by more than one contributor, they are relatively much longer, such as in Malaria and Tuberculosis compared to a few, like leprosy, which is adequately covered in its own context. The period this second Book covers, 1987 to 2012, saw great changes and advances- internationally as well as nationally in Myanmar. The dawning of the Twenty-first Century, not only ushered in a New Century, but also marked the beginning of a new era world-wide. The United Nations not only celebrated the beginning of the Twenty-first Century by a Special United Nations General Assembly, but also propounded

the UN's Millennium Development Goals (eight in total) with targets by 2015; since the Earth's Conference of 1990, the entire world has recognized Global warming with all the consequences; the Human Genome Project, which started about two decades ago completed sequencing all Genes by 2005; Global Population grew fast, estimated to exceed 7 Billion by 2009; new viral diseases emerged- HIV/AIDS, SARS, H8N1 Avian influenza; Swine influenza, etc.

In Myanmar, there had been dramatic changes leading to unheard-of advances during these two decades, with the adoption of the new democratic constitution in 2008; election of democratic parliament in 2010; emergence of democratic President Thein Sein in 2011; and national recognition of Daw Aung San Suu Kyi as a political leader. Political animosity of the big powers against Myanmar is beginning to thaw, paving the way to easing of political and economic sanctions with enormous international support and collaboration in many sectors. Even though the individual chapters of the Book do not deal specifically with the great advances taking place internationally and in Myanmar, the contents directly or indirectly reflects these great events in general terms. On the whole, the contents of the Book are very informative and stimulating in many places. The chapters on the role of the three Depts. of Medical Research show the collaborative integrated approach in Research Policy and Management. The research efforts of the Depts. under the Ministry of Health, the Universities and the Institutes indicate the positive research climate and environment of these Academecia in the frame of the Medical Education System and Human Resources Development in the area of medical sciences.

Prof Aung Than Batu concluded his first Book in 2003 by stating that in the ensuing era, the unfolding story of international and national level developments should be told by those who are better acquainted and closely involved. I would say that today, Professor Aung Than Batu is still well acquainted with contemporary developments even though he may not be personally involved.

I would conclude by quoting Dr Hafdan Mahler, former Director-General of the World Health Organization.

*\*"To look forward with vision, it is wise to glance back with perception- not to be bound by what we have done before, nor to blame ourselves or our predecessors, but to learn lessons in order to build a stabler and healthier future"*

*H. Mahler  
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(\*From Foreword to "A Decade of Health Development in South-east Asia" New Delhi, World Health Organization, Regional Office for South East Asia, 1978)

## **PREFACE**

**by**

**Professor Mya Tu**

**Former Director General of Medical Research**

Yet again the medical research community has reason to be grateful to Professor Dr Aung Than Batu, for his signal service in producing another significant contribution to the literature on the history of health and medical research in Myanmar. Although retired, he has kept in touch actively with the academic and research community, and is therefore eminently qualified to bring all these information together and present an overview in a coherent and meaningful manner.

This time he has brought together as contributors, an array of Myanmar medical researchers past and present, and as Editor of the expanded, comprehensive and up-to-date account of medical and health research in the country, he has continued his thoughtful and insightful analysis of the progress of medical and health research in the country and the contributions research has made towards the health of the people of Myanmar and ultimately towards the health of mankind in general.

I am certain that the present publication and the previous volume of the series “The Growth and Development of Medical Research in Myanmar (1886 to 1986)” will prove immensely useful to future researchers, research managers and policy makers. These two publications should find a permanent and prominent place on the bookshelves of all future researchers, research managers and policy makers in Myanmar.

Professor Dr Mya Tu  
Founder and First Director General,  
Burma Medical Research Institute, and  
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(1963-1977)  
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## **PREFACE**

**by**

**Professor Myint Myint Khin**

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Man's insatiable curiosity must be the primeval factor that led him to the path of enquiry and learning. Knowledge thus gained made him yearn to try out a primitive mode of experimentation, employing trial and error methodology, which might be called research, though not in the strict scientific and technological sense of today. Thus, I think began man's first steps on the journey to research as we know now. Concomitantly, and because of the efforts expended thus far in evolution, men's brain began to develop like no other living being, and the divide between men and animals first appeared and as progress, which is commonly dependent on success, marched on, the gap between man and the rest of sentient beings widened and became unbreachable today. But progress measured in time was painfully slow.

It was only in the sixteenth century, that the so-called scientific revolution took place, when science was put on a firmer foundation and stalwarts in the history of science, the likes of Nicolaus Copernicus, Isaac Newton, Galileo Galilei, made possible the giant leaps of advances in science and research. As Newton aptly expressed, "if we can see further, it is because we are standing on the shoulder of giants"; Newton and his cohorts were, themselves, giants. But though the progress was steady and consistent, the rate and momentum, seen in the light of today's state and level that science had attained, could only be described as nondescript, till the last few decades of the previous millennium. But the greatest and truly unbelievable quantum leap took place when Watson and Crick were able to complete the genome sequencing on 14th April 2003. This ushered in an explosive revolution of gargantuan dimension, that man had never experienced since creation. Even more astounding were the unimagined impacts that this brought, that shook the very foundation of the human condition, the scope and span of which was so incomprehensibly wide-ranging, encompassing all branches of science, philosophy, religion, law and legality, mores and morals and other value systems, and even the very nature of human identity.

It is in this complex and confounding milieu that today's researcher has to carry on his routine of research. Then arise the crucial questions of why research is important and who should take an interest in and do research. It is plain and easy enough to answer the first question, it being, all who have a problem to solve, and is there anyone who does not have one? Take an example from corporate culture; is there any company which does not feature a R and D department? It therefore becomes transparently clear that it is wrong to limit research to special institutions and centres of academic excellence. This, unfortunately, seems to be the prevailing attitude in our country, the perceived underlying causes being, lack of research culture among medical and health community and deficient exposure and experience in research and knowledge as regards scientific and research methodology.

Limiting to the narrower confines of clinical medicine, research had been an integral part of clinical care from the time of founding fathers of health care professionals. Besides, time has shown how immensely contributory this component of medicine is to general progress in care and in particular patient well-being, so that it is only right and proper to advocate every clinician to undertake research. Another strong incentive is the emergence of new arenas in research. We are reminded of the time when Health System Research was introduced and what good it did to health care and care delivery system. In this day and age, the heyday of lifestyle diseases, the clinician is offered with more avenues for research, and herein lies the need for incorporation and greater and precise use of research tools borrowed from social sciences. Other broad areas of topical concern would be, public policy in health in the presence of attendant intricacies associated with changed political system; enquiry into effective and efficient introduction of the advances in modern day science and technology and its further development (to facilitate the catching up to be done so as to be at par with with the rest of the world ); the huge area of diverse components of critical importance to the nation's health; novel challenges that demand innovative solutions but as yet uncatered for, such as the field of mental health with special reference to psychological adjustments to the conditions of a society in transition. Better defined subjects of importance, that deserve urgent attention would be, those relating to ageing, a phenomenon, considered to be an exploding health crisis of first priority importance of this millennium, and which hitherto has received scant attention in our country; continuing research efforts in the unfinished agenda of the communicable diseases as enunciated in MDGs (Millennium Development Goals)

At this juncture, Myanmar needs to be forward looking, as regards prioritisation of research agenda and furthermore, the complex, complicated and confusing times call for caution as well as giving due consideration for the necessary urgency of certain prevailing issues. The forward looking example is set by the US President Obama when he allowed a budget of 100 million US dollars for 'Brain Science' research.

There remains another area where research played an indisputable and abiding role, namely, the academic and intellectual world of medicine and health. In all the curriculum of post-graduate medicine; Master and Ph D courses, which have of late been multiplying most gratifyingly, research figures as an essential requisite. Herein lies the great and golden opportunity to inculcate in those individuals - some of whom would henceforth be among the nation's highest echelon research workers - an intellectual maturity, facilitated by the protracted duration of training course - 4-5 years in the case of Ph D - and close supervision by knowledgeable and seasoned researchers. It constitutes a reliable and valid format for the development of theoretical concepts, the fine and profound intellectual qualities of critical thinking, critical analysis and evaluation, self-awareness, self-assessment, proficiency in the systematic search, organisation, and analysis of relevant information. Another group deserving of attention is students in medical schools, in whom the quest for scientific truth must be instilled, during their formative years as medical students.

This brings us to the next prime and, for Myanmar at present time, priority issue, namely the promotion and further nurturing of "research culture"; the belief in research as being part and parcel of life as a doctor, a dedicated and motivated commitment to research and recognition of it as mark of prestige and status among peers and scientific community

and above all a sense of sublime mental achievement that it engenders, which is the highest reward for a true researcher.

The promotion of research culture should be classified at present as one of crying needs, among many others, in research in Myanmar. It represents a gigantic project, perhaps beyond the capacity of the resources currently available; to my knowledge, a desultory attempt had been made, on a conceptual basis, but did not proceed further, again, due to resources deficiency, in particular the human resources. This crucial requisite, so essential for the future of research in the nation, should not be abandoned lightly, continuing effort by responsible persons is mandatory.

Documentation of the historical facts is the most valuable and by far the primal worth of books like the one being reviewed. History is the recording of facts of reality which are unalterable and immutable; at least that is what historians should aim at. As such factual documentation is a sine-qua-non for any human endeavour in the human existence. For this contribution alone the book merit the highest approbation for there has been no such record so far on research in Myanmar; and who else could have done it better than the editor, who is a researcher and administrator of renown with life-long experience and commitment to research and has attained an admirable stature in the field of research and the team of highly qualified contributors he has assembled. There is another felt need of great central importance that this book has, most fortuitously, filled, namely, to serve as a powerful tool towards achievement of the highly desirable goal of promoting research culture.

For this beneficial act of filling a hiatus of signal importance in research in Myanmar, which also render an inestimable service to the present and posterity, the editor and his team of contributors have earned the gratitude of all of us of the research and scientific community in Myanmar.

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20 April 2013

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To Dr Myo Khin, Acting Director-General, Department of Medical Research (Lower Myanmar), I am very grateful for willingly agreeing and making it possible to publish this book as one of the Golden Jubilee publications of DMR (LM).

Dr Ye Htut, Deputy Director-General and staff of DMR (LM) gave me all the assistance needed to prepare the book for publication.

Dr Su Su Khine of the Editorial Office of the Myanmar Journal of Current Practice painstakingly converted the drafts from the authors into a printable book format during the period of over a year when I was preparing the book.

Dr Ni Thet Oo, Research Scientist, Publication Division, DMR (LM) very ably put the book through the final stages of publication.

The Librarians of UM1 & UM 2, Yangon, UM, Mdy, DMR (LM) and WHO (Ygn) provided me with all the necessary references and Daw Cho Mar Oo, Research Officer, Central Biomedical Library, DMR (LM) took on the onerous task of preparing the Index.

Finally I thank Professor Arthur Sun Myint, one of my former student of Institute of Medicine 2, Mingaladon for unexpectedly volunteering to bear part of the cost and DMR (LM) for bearing the rest of the cost of publication of this book

Aung Than Batu  
Insein, Yangon  
Myanmar  
June, 2013

## ABBREVIATIONS

AIDS	=	Acquired Immunodeficiency Syndrome
BMRI	=	Burma Medical Research Institute
BMRC	=	Burma Medical Research Council
DMR (LM)	=	Department of Medical Research (Lower Myanmar)
DMR (UM)	=	Department of Medical Research (Upper Myanmar)
DMR (CM)	=	Department of Medical Research (Central Myanmar)
DOH	=	Department of Health
DHP	=	Department of Health Planning
DHF	=	Dengue Hemorrhagic Fever
DOMS	=	Department of Medical Science
DOTM	=	Department of Traditional Medicine
DOSPF	=	Department of Sports and Physical Fitness
DMS	=	Directorate of Medical Services (Ministry of Defence)
DrMedSc	=	Doctor of Medical Science
DSGH	=	Defence Services General Hospital
DSMA	=	Defence Services Medical Academy
G&D Med Res	=	Growth and Development of medical Research in Myanmar (1886-1986)
HRP Program	=	UNDP/WHO/World Health Human Reproductive Health
HSR	=	Health Systems Research
HIV	=	Human Immunodeficiency Virus
IM	=	Institute of Medicine
JICA	=	Japan International Cooperation Agency
MDY	=	Mandalay
MMA	=	Myanmar Medical Association
MMJ	=	Myanmar Medical Journal

MJCMP	=	Myanmar Journal of Current Medical Practice
MSTRD	=	Myanma Scientific and Technological Research Department
MPF	=	Myanmar Pharmaceutical Factory
MOH	=	Ministry of Health
MOD	=	Ministry of Defence
MMedSc	=	Master of Medical Science
MSc	=	Master of Science
PhD	=	Doctor of Philosophy
RGH	=	Rangoon General Hospital
SEARO	=	South east Asia Regional Office, World Health Organization
TDR	=	UNDP/WHO/World Bank Tropical Diseases Research Program
TB	=	Tuberculosis
UM	=	University of Medicine
UNICEF	=	United Nations Children's Fund
UN	=	United Nations
UNDP	=	United Nations Development Program
UM 1	=	University of Medicine 1, Yangon
UM 2	=	University of Medicine 2, Yangon
UM (Mdy)	=	University of Medicine (Mandalay)
VH	=	Viral Hepatitis
WHO	=	World Health Organization
YGH	=	Yangon General Hospital
YGN	=	Yangon

## **THE EDITOR**

### **Academic and Professional Qualifications and Training**

M.B.,B.S.(Rangoon)1955, M.R.C.P.(Edin) 1960, F.R.C.P.(Edin)1970

- Awarded Collegiate Scholarship and Matthew Hunter Prize at University of Rangoon; graduated from Faculty of Medicine, Rangoon; professional training as physician with respiratory diseases as specialty in Edinburgh, London, United Kingdom; clinical research training at Hebrew University, Hadassah Medical School, Jerusalem, Israel.

### **Positions**

- Director-General, Department of Medical Research, Ministry of Health, Myanmar (1977-1987), Head of Hematology and Clinical Research Division (1963-1977) concurrently with other duties
- Medical Specialist, Defense Services General Hospital, Mingalardon (1963-1977)
- Professor of Medicine, Institute of Medicine 2, Mingalardon, Yangon (1972-1977) and concurrently Consultant Physician North Okkalapa General Hospital, Department of Health (1970-77)
- Director (Research and Human Resources) World Health Organization, Regional Office for South-east Asia, New Delhi, (1989-93), Regional Advisor Medical Research (1987-1989)
- Advisor, Directorate of Medical Services, Ministry of Defense (1995)

### **Awards and Honors**

- Collegiate Scholarship, University of Rangoon
- Matthew Hunter Prize, University of Rangoon
- Pyithu-Wundan Kaung Medal, Government of the Union of Burma 1990
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- Emeritus Medical Researcher, Ministry of Health, Government of Myanmar (2011)

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## INTRODUCTION

This account of "Further Development of Medical Research in Myanmar (1987-2011)" is the sequel to the previous volume for the period (1886-1986). The author of the first volume, Dr. Aung Than Batu states in the concluding paragraph of the first volume as follows:

“The 1990’s saw the dawning of a new development period opening up wide opportunities for robust growth of medical research in many new directions in Myanmar – the unfolding story of which should be told one day by those better acquainted and closely involved”.

This unfolding story will now be told in this second volume by knowledgeable persons involved in executing research or managing research during the decades following 1986 and a few of the older generation who still continue to be involved in medical research, in one capacity or another, and whose knowledge, experience and vision would help to make the story to be told now richer and more meaningful.

As in the previous volume, this volume gives a broad picture of medical research development in Myanmar and not just confined to particular departments or sectors.

The meaning of the term “medical research” in this volume will be the same as explained in the first volume. “Research means the generation of new knowledge, and not just the accumulation of facts and figures. It means the discovery of new concepts to explain observed phenomena. All these as related to prevention, cure of diseases and the promotion and maintenance of health would be encompassed by the term “Medical Research”, which is used in preference to “Health Research” because it is more familiar and better recognized by professionals and laymen alike. Research includes Health System Research which “includes all types of research that contributes to improving the functioning of the health system through providing new information for decision-making in the health system or providing information to support advocacy for change in the system or through contributing to the body of knowledge relating to theories, concepts and methods that is required for generating such information. Thus health research seems to go beyond discovery of new phenomena, new methods or new concepts concerning health”. Like in the first volume, the editor of the second volume has used “with latitude, both the traditional view of medical research as well as the newer concept of health system research to scrutinize the medical and health activities for inclusion in this account of medical/health research in Myanmar”.

Aung Than Batu

June, 2013

Yangon, Myanmar

# Further Development of Medical Research in Myanmar (1987-2011)

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## **CHAPTER 1**

### **DEVELOPMENT OF THE HEALTH RESEARCH SYSTEM**

**3**

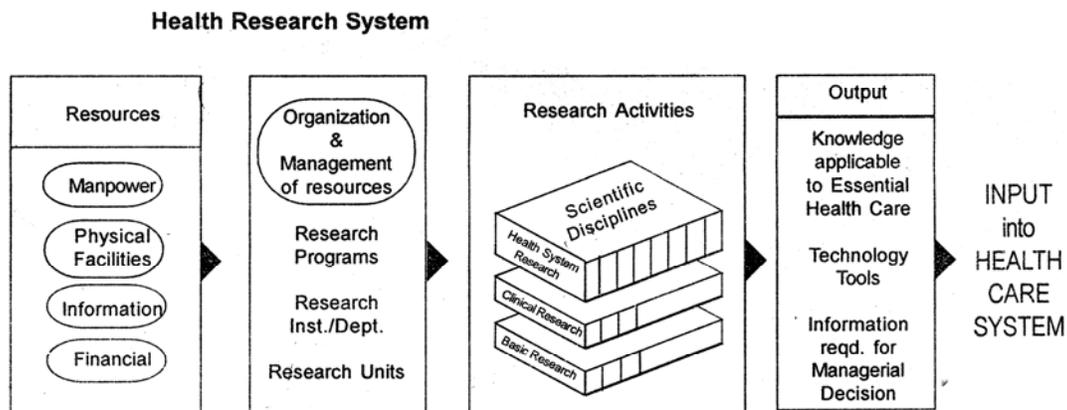


## CHAPTER 1

# DEVELOPMENT OF THE HEALTH RESEARCH SYSTEM IN MYANMAR

by Aung Than Batu

Medical research may be viewed holistically as a system – with resource inputs such as manpower, physical facilities, finance and information; organized as research programs, research institutes/departments which undertake research activities; from which the output is knowledge, technology and information. The output of the health research system then becomes input into the health care system.



From : Health Research Strategies of the South East Asia Region  
World Health Organization Regional Office for SEAsia New Delhi -1993.

A **health research system** functions as the “brain” of the health system, to enable it to respond effectively to the health challenges. The key objective of a health research system is to coordinate health research through appropriate architecture and mechanisms. There is an array of specific objectives of a health research system, which include, inter alia, setting health research priorities, generating knowledge, building capacity, developing standard procedures and mechanisms to ensure ethics, quality, accountability and transparency, mobilizing resources and conducting advocacy for better partnership. A prime objective is immediate response and being alert to the continuing needs and challenges of health development.

**Five essential functions** have been identified as the core of a health research system. The first is **stewardship** - the quality leadership to promote and develop strategic visions for the development of the health research system, in response to the knowledge needs of the health system. The second function is **capacity development**, for both the demand and supply sides of health research. **Knowledge generation** is the third function, which helps in improving the health science as well as the management of health systems. The fourth function is the **utilization and management of knowledge** for health improvement where new knowledge derived from research has to be translated into a suitable format for policy or actions. The fifth essential function is **mobilization of resources** for health research. Strategic planning is required to ensure appropriate human, financial and other material resources.

An appropriate **structure of a health research system** is needed to govern the above core functions. The different contexts and needs of countries shape the structure of each national health research system so as to best fulfill the unique needs of the countries.

*(Excerpts from “Strategies for Health Research Systems Development in South-East-Asian Region”. WHO/SEARO document 2001 produced by a Consultative Group in which Dr Aung Than Batu participated)*

**In Myanmar, a well-organized Health Research System has developed.** It emerged in the 1960’s, some years after independence in 1948, well before those in many neighboring South East Asian countries except India, and has continued to evolve and develop.

In the early years, during the 1960’s, the Burma Medical Research Council was the body responsible for medical research policy, for coordinating medical research in the country, and for strategy and direction. Later, in the 1970’s the Ministry of Health assumed the policy-making authority; and research promotion, co-ordination and support functions partly devolved upon the Department of Medical Research (successor to the Burma Medical Research Institute) (*see G&D Med Res*).

Important changes in Myanmar Health Research System have taken place in the years after 1986 – the year when the period covered by G&D MedRes ended. The National Health Policy was promulgated in 1993 and successive National Health Plans were prepared, approved and implemented. The National Health Plan for 2001-2006 and 2006-2011 provided for implementing the Health Research Program drawn up in accordance with Health Research Policy guidelines for health research.

There are now new mechanisms for coordination of health research between different levels of the Departments under the Ministry of Health (MOH) as well as with Non-governmental organizations (NGO’s) in the health sector. Technical committees, scientific committees and study groups, long standing or ad-hoc, are formed from time to time by Director-Generals of Medical Research or of other Departments, to plan, co-ordinate and collaborate in research at institutional, research division, or individual levels. An important means of interaction and co-ordination, functioning for many decades, is at the level of scientists.

There have also been new developments in the structure of Myanmar’s Health Research System which comprises a strong government component and a relatively weak non-governmental component. The government component in the health sector consists of a large number of departments, institutions and organizations under the Ministry of Health, some of which undertake health research as their primary function, (Depts. of Medical Research) and others undertake health research in addition to their primary functions such as delivery of health services, (Dept of Health, Dept of Traditional Medicine) production of human resources for health (Dept of Medical Sciences) health planning (Dept. of Health Planning). Some government departments, directorates or institutions in other sectors including the Ministry of Education, Ministry of Agriculture, Ministry of Live-stock, Ministry of Defense, Ministry of Industry, Ministry of Science and Technology and Ministry of Sports and Physical Fitness also undertake health related research secondary/in addition to their primary functions and therefore they also are components of the Health Research System. Non-governmental professional organizations in the health sector like the Myanmar Medical Association, Myanmar Nursing Association, and a few private health institutions sometimes undertake health research; and similarly other organizations in other sectors may sometimes do health related research, all therefore forming part of the Health Research System in the country.

## CHAPTER 1 DEVELOPMENT OF THE HEALTH RESEARCH SYSTEM IN MYANMAR

The Health Research System expanded considerably and changed shape during the four decades after 1986. This is because of elevation of Institutes of Medicine, Nursing & Paramedical Sciences to University status, addition of new Universities of Medicine, University of Public Health, University of Community Health and establishment of new Departments of Medical Research in Upper and Central Myanmar thus opening up new directions, possibilities and potentials. Adoption of the market system in the national economy has resulted in rapid, vigorous growth of the private health sector. Private enterprises have not only upgraded medical facilities from small individual clinics to the level of large collective medical centers and hospitals and diagnostic facilities/ laboratories but have ventured into production and manufacture of medical goods, especially traditional medicines, on a large industrial scale. Development of the health industry in this way creates new necessities and opportunities for the private component of health research to expand, but this is not yet very large.

All the above developments in the Health Research System of Myanmar are commensurate with the overall health, educational and scientific developments of the country.



**CHAPTER 2**

**NATIONAL HEALTH POLICY AND PLANS**

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## Section 2.1

### National Health Planning

by Aung Kyaing

*(See National Health Plan (2006-2011) document,  
Ministry of Health, Union of Myanmar)*

#### Policy Basis

The State has laid down political, economic and social objectives to build a modern and developed nation. In implementing the National Health Policy in conformity with the objectives laid down by the State, the Ministry of Health is undertaking the activities for health sector development effectively, under the leadership and guidance of the National Health Committee. In implementing activities for health sector development the objectives of the Ministry of Health are "to enable every citizen to attain full life expectancy and enjoy longevity "and "to ensure that every citizen is free from disease"

In developing National Health Plans the Ministry of Health has formed the Central Committee and Work Committee comprising responsible persons from the departments under the ministry, related ministries and social and non-governmental organizations to undertake plan formulating activities in a coordinated way. The Central Committee is headed by the Minister of Health and the Work Committee is chaired by the Director-General of the Department of Health Planning.

#### Identification and Listing of Priority Diseases and Health Conditions

Procedure for such identification has evolved and become more refined over the years. This was done in stages by (a) developing criteria to be considered (b) assigning weight to each criteria (c) identifying diseases and health conditions (d) priority ranking them.

During formulation of National Health Plan (1996-2001) objective and subjective criteria were explicitly used to identify and prioritize diseases and health conditions which are to be dealt with in the National Health Plan.

The objective criteria include:

1. The results of prevailing health information systems for managerial support.
2. Morbidity rates based on in- patient and out- patient statistics from the various institutions in Myanmar.
3. Mortality of diseases or conditions in hospitals and relevant studies.
4. Disease trends showing past 10 years.

The subjective criteria include:

1. Political concern: -diseases/ condition which are considered to be of public health importance by the Government policy making bodies were given a high priority.
2. Community concern: - diseases/ condition which the community considers to be important health problems scored high.
3. Availability of preventive technology: - a high score was given to particular disease/ condition if preventable technology is available (costs, timeliness and feasibility of implementation affected the scoring).

4. Availability of curative technology:- (same as above)
5. Socio- economic impact: - appropriate scoring was given depending on the extent of the impact.

(Source: NHP 1996 – 2001, p 6)

Objective criteria were largely based on Annual Hospital Statistics which included morbidity and mortality pattern of in-patients in hospitals and outpatient morbidity. In 2005 single leading causes of mortality (in hospitals) were:

Sr. No.	IDC Basic code	Causes	Number
1.	281	Other injuries of specified, un specified and multiple body regions	106228
2.	243	Single spontaneous delivery	98205
3.	043	Malaria	71071
4.	005	Diarrhea and gastroenteritis of presumed infectious origin	78305
5.	242	Other complications of pregnancy & delivery	63148
6.	236	Other pregnancies with abortive outcome where classified	44342
7.	179	Other disease of the respiratory system	37088
8.	032	Other arthropod- borne viral fevers and	41664
9.	285	Toxic effects of substances chiefly non-medicinal as to source	23219
10.	184	Gastritis and duodenitis	21174
11.	007	Respiratory tuberculosis	26467
		All other causes	392422
		Total	1003333

In 2005, single leading causes of morbidity (in hospital outpatients) were:

Sr. No.	ICD grouped Basic codes	Cause Groups	Number
1.	001-057	Certain infectious and parasitic disease	8173
2.	143-164	Diseases of the circulatory system	4174
3.	165-179	Diseases of the respiratory system	2762
4.	271-289	Injury, poisoning and certain other consequences of external causes	2574
5.	245-253	Certain conditions originating in the prenatal period	2245
6.	180-197	Disease of the digestive system	2092
7.	267-270	Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere	2185
8.	058-096	Neoplasms	823
9.	120-129	Diseases of the nervous system	771
10.	101-110	Endocrine, nutritional and metabolic diseases	534
11.	211-233	Diseases of the genitourinary system	579
12.	234-244	Pregnancy, childbirth and puerperium	559
13.	097-100	Diseases of the blood and blood-forming organs and certain disorders involving	401
14.	254-266	Congenital malformations, deformations and chromosomal abnormalities	153
15.	111-119	Mental and behavioural disorders	209
16.	198-199	Diseases of the skin and subcutaneous tissue	77
		All other causes	174
		Total	28485

(Source: Annual Hospital Statistics Report 2006.DHP and DOH. December2007.P 36, 42)

During formulation of the National Health Plan (2006-2011) identification and prioritization of diseases and health conditions became more refined. 7 criteria were used and given weightage as here under:

Sr. No.	Criterion	Definition	Weight
1.	Disease Burden	Magnitude and severity of the morbidity, physical & social disability, mortality and type of the affected population	0.20
2.	Public Health Importance	disease with epidemic potential and conditions threatening health and life of the people	0.19
3.	Political Concern	Any disease or health condition with high political concern	0.16
4.	Vulnerability to Intervention Technology	Availability of intervention which is feasible, affordable and cost effective	0.13
5.	Economic impact	Disease or conditions with negative economic impact on patients, families, communities and the nation	0.12
6.	Social Impact	Diseases or conditions which can lead to negative social consequence to the patients, their families and community	0.10
7.	Availability of health Information	Availability of health information from all possible sources such as HMIS, MICS, U5MR, survey, MMR, survey, FRHS, HMN, etc	0.10

(Source: NHP 2006-11, p12)

Diseases and health conditions were then ranked from 1 to 42. The first 15 in rank were:

No.	Disease/ Health Condition	Rank
1.	Acquired Immune Deficiency Syndrome	1
2.	Malaria	2
3.	Tuberculosis	3
4.	Diarrhoea/ Dysentery	4
5.	Cholera	5
6.	Avian influenza	6
7.	Dengue Hemorrhagic Fever	7
8.	Vaccine preventable disease	8
9.	Protein Energy malnutrition	9
10.	Postpartum and Ante- partum Haemorrhage	10
11.	Drug Abuse	11
12.	PET and Hypertensive Disorder pregnancy	12
13.	Leprosy	13
14.	Sexually Transmitted infections	14
15.	Disasters	15

(Source: NHP 2006-11)

**The National Health Plan has the following broad Objectives and Target Indicators**

**Objectives**

- (a) To facilitate the successful implementation of the social objective "uplift of health, fitness and education standards of the entire nation"
- (b) To implement the National Health Policy
- (c) To strive for the development of a health system that will be in conformity with the political, economic and social evolution in the country as well as global changes
- (d) To enhance the quality of health care and coverage
- (e) To accelerate rural health development activities

**Target Indicators**

- (a) Health service indicators
- (b) Health status indicators
- (c) Nutritional indicators
- (d) Environmental health indicators
- (e) Health outcome/impact indicators

**Broad Programs to be included in the National Health Plan 2006-2011 were:**

- Community Health Care Program
- Disease Control Program
- Hospital Care Program
- Environmental Health Program
- Health System Development Program
- Health Promotion Program
- Health Management Information System Program
- Development of Human Resources for Health Program
- Health Research Program
- Laboratory Services and Blood Safety Program
- Food and Drug Control Program
- Traditional Medicine Development Program

Outline for developing the program

- Introduction
- Objectives
- Strategies
- Projects to be implemented

Outline for developing the project

- Introduction
- Situational analysis
- Objectives-general and specific
- Strategies
- Targets
- Activities
- Resource requirements
  - Human resources requirements
  - Financial resources requirements
- Monitoring and evaluation
- Benefits



## Section 2.2

### National Health Research Coordination and Management

by San Shwe

*(Excerpt from "Review Articles compiled from DMR Bulletins (1986-1997) – Department of Medical Research (Lower Myanmar) Ministry of Health, Myanmar July 2001. DMR Bulletin, Vol. 11, No.4, October 1997), "Current status of health research coordination and management in Myanmar"*

#### 1. Introduction

In Myanmar, the importance of health research is well recognized. The National Health Policy promulgated in 1993, gives priority to health research as seen in Article 11 of the Policy which gives the following statement:

“To encourage conduct of medical research activities not only on prevailing health problems but also giving due attention in conducting Health Systems Research” (3).

The Ministry of Health has undertaken the responsibility of raising the health status of people through its various departments by implementing promotive, preventive, curative and rehabilitative activities. “Health for all by the year 2000” objectives and targets were formulated since 1978, and activities towards achieving them have been implemented as People’s Health Plans I,II and III, each lasting a four-year period from 1978 to 1990. Then the People’s Health Plan III was followed by a two-year National Health Plan (NHP 1) from 1990-1992 and a four-year National Health Plan (NHP II). The present National Health Plan (1996-2001) has been formulated which took into account the existing and feasible manpower, budget and materials to get the most effective and beneficial results. The formulation of the National Health Plan was guided by the National Health Policy.

In the current National Health Plan, there are six broad programs viz. Community Health Care Program, Disease Control program, Hospital Care Program, Environmental Health Program, Health Systems Development Program and Organization and Management Program. Health Research Project has been identified under the Health Systems Development Program.

#### 2. Hierachy of Organizations

<u>Organization</u>	<u>Chief function</u>
The National Health Committee (NHC)	Policy guidance and adoption of National Health Plan (NHP)
Ministry of Health (MOH)	Adherence to policy and overall supervision of NHP including health research project
Health Research Policy Board	Formulation of national health research policy
Health Research Working Committee	Materialization of the research policy
Health Research Promotion Sub-Committee	Promotion of health research

**The Health Research Policy Board** is the highest body concerned with direction of health research activities in Myanmar. The Minister for Health functions as the chairman and the Director General (DG) of the DMR acts as the secretary.

The Health Research Policy Board has laid down the following guidelines:

- (1) To promote health research by strengthening research capability through development of manpower, technologies and infrastructure;
- (2) To identify factors affecting national health, and to conduct research for effective control and therapeutic measure;
- (3) To identify factors promoting national health and to institute appropriate measures for community practice;
- (4) To promote and conduct health systems research;
- (5) To investigate major communicable and non-communicable disease problems prevalent in Myanmar for effective control and therapeutic measure;
- (6) To investigate major nutritional problems prevalent in Myanmar for effective control and therapeutic measure;
- (7) To promote and conduct reproductive health research in accordance with the National Health Population Policy;
- (8) To translate research findings into practical applications.

It may be noted that the following broad areas have been given priority for health research:

- Common communicable diseases
- Common non-communicable diseases
- Major nutritional problems
- HSR
- Reproductive health
- Factors affecting national health, and
- Factors promoting national health

**Health Research Working Committee-** was formed with the aim of facilitating Health Research Activities in Myanmar. The Director-General of the DMR is the Chairman of the Committee, and the members are directors from other departments under MOH, Lecturers from Institutes of Medicine, and representatives from Myanmar Medical Association, etc.

**Health Research Promotion Sub-committee-** was formed for assisting the Health Research Working Committee in matters concerning the promotion of Health Research. The Deputy Director General of DMR leads the committee and 21 members are included. The members are representatives (directors or professors) for the Departments under the Ministry of Health, Institutes of Medicine, Institute of Nursing, Para-medical Institute, and from Non-governmental Organizations such as Myanmar Medical Association, and Myanmar Dental Association.

The functions of the committee are:

- (1) To draw and implement a suitable plan for the adoption of appropriate measures for the promotion of health in the country;
- (2) To identify, select and carry out priority research areas for solving the health problems related to the need of the country;
- (3) To draw and implement appropriate measure for more effective co-ordination, promotion and training of Health Research personnel;

- (4) To plan and execute activities for further utilization of health research findings in the organizations concerned;
- (5) To organize plans for dealing with ethical issues in relation to health research and to conduct them;
- (6) To supervise and evaluate regularly the implementation status of health research work; and
- (7) To report regularly the implementation status of health research work.

### **3. Role of DMR in Research Management**

**The Department of Medical Research (DMR)** is the principal organization which sponsors and conducts research in Myanmar. Moreover, the Department of Health , Medical Sciences, Traditional Medicine, Health Planning and related institutions and departments under MOH also implement research activities in addition of their principal functions. DMR has been established since 1963.

The DMR conducts medical research. It promotes and supports medical research in the country and is also generally responsible for coordination, organization, and general supervision of all medical research in Myanmar.

The **principal aim** of research conducted at the DMR is to improve the health of the people of Myanmar. Within this context, the programs are directed (i) to identify the current and future health problems and their determinants; (ii) to discover or develop new and improved methods for control, diagnosis and management of the identified major health problems and diseases in Myanmar.

In selecting projects for research in the various areas the following **criteria** are used:

- (1) Magnitude and priority as a health problem,
- (2) Probability of finding a solution or an important clarification,
- (3) Benefits expected from the application of the results of successful research efforts,
- (4) The potential usefulness of the research in finding solutions to other problems, and
- (5) The existence of a situation which covers a special advantage for a particular research and which should be exploited.



## **CHAPTER 3**

### **RESEARCH AT DEPARTMENTS OF MEDICAL RESEARCH**

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- Organization
- Promotion
- Coordination
- Training
- Research capacity development
- Human resources for research development
- Research support funding
- Research technology development
- Research infrastructure
- Prioritization
- Major research areas and programs
  - Research on viral hepatitis
  - Research on human reproductive health
  - Research on malaria, tuberculosis, dengue, leprosy, HIV
  - Research on diarrhoea, dysentery, cholera, typhoid
  - Snake bite research
  - Research on hypertension and diabetes
  - Research on micronutrient deficiencies
  - Research on sports medicine, growth and fitness
  - Traditional medicine research
  - Research on environmental health
  - Social science studies
- Output
- Outcome
- References

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- Introduction
- Organization
- Coordination

- Capacity development and development of human resources for health
  - Physical facilities
  - Staff recruitment and capacity development
  - Long term institutional development grant
- Training for research
- Prioritization
- Priority research areas
  - Traditional medicine research
  - Reproductive health research
  - Malaria research
- Support facilities
- Research funding
- Research outputs
- Dissemination and utilization of research findings
- List of research studies

**Section 3.3 Department of Medical Research (Central Myanmar)**

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- Introduction
- Organization
- Laboratory equipment
- Research personnel
- Research training
- International training and technology transfer
- Research activities
- Development of research programs
  - Research on Communicable diseases
  - Research on Non-communicable diseases
  - Research on traditional medicine
  - Research on academic and technology development
  - Research on health systems
  - Research on environmental health
  - Research on capacity strengthening
- Development of research procedures
- Research papers presented
- Conclusion

**Section 3.4 Overview**

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**1. New phase of growth and development of DMR's from 1990's onwards**

- National Health Research Committee and health research Policy Board
- New Departments of Medical Research
- Further expansion of DMR (LM)
- Central coordination of health research
- A vision of future research needs as seen on 2001
- Response to new research needs
- Advances in information technology
- Health technology development and transfer
- Human resources development
- International support, partnership and links
- National level scientific partnership and links

**2. Major research areas and research programs at the DMR's, and the policy basis for choice of programs and projects**

- Research on Communicable diseases
  - Malaria research
  - Tuberculosis research
  - Dengue infection and DHF research
  - Viral hepatitis research
  - Diarrhoea and dysentery research
  - Acute Respiratory infection research
  - Avian influenza and SARS research
  - Leprosy research
- Research on Non communicable diseases
  - Snake bite research
  - Research on environmental health
  - Nutrition research
  - Research on health of the elderly
  - Research on reproductive health
- Health Systems Research
- Traditional Medicine Research

**3. The interrelationship between developments in medical research, medical education and health services****4. S.W.O.T. Analysis**



## Section 3.1

### Department of Medical Research (Lower Myanmar)

by Kyaw Min

The current Department of Medical Research (Lower Myanmar) was first established in 1963 as the Burma Medical Research Institute. At that time it was the sole research institute undertaking medical research in Myanmar. As the years passed it developed and expanded to its current status and its name was changed to Department of Medical Research in 1973 and then (Lower Myanmar) was added to its name in 1999 with the establishment of a similar research department in PyinOoLwin. In a few years time the Department of Medical Research (Lower Myanmar) will be celebrating the golden anniversary of its establishment.

The life-span of the Department can be arbitrarily divided into two periods each lasting about a quarter of a century.

The Department then was quite different in organizational setup, research direction and professionalism of the researchers in comparison to the subsequent second period.

#### Organization

The Department of Medical Research (Lower Myanmar) and its predecessors started in 1963 with 14 research and support personnel and gradually increased its staff strength to 347 sanctioned posts in 1988 and reached 612 sanctioned posts in 2006. In 1988, there were a lot of changes in the country as well as in the Department of Medical Research. This was the start of the second period of DMR and was the starting point for further expansion and technology development. There were changes in organizational setup, research direction, nature and type of research, collaboration and management.

There was more reorganization and expansion of the organization setup of the Department in 1990. The new organizational setup had sanctioned posts of 519 researchers and support personnel. There was a fifty percent increase in manpower and two new divisions, namely Health System Research Division and Computer Division, were added. In the earlier setup the Department was headed by the Director-General assisted by a sole Director. There were four Deputy Directors each heading a group of research divisions or support divisions. The divisions were headed by either an Assistant director/Research Scientist or a Research Officer. In the new setup all were upgraded one rank above. There were a new Deputy Director-General and four Directors each heading biomedical, clinical and socio-medical research centers and administrative and support group. Heads of the research divisions were upgraded to Deputy Directors. In the non-officer other ranks, a post of Chief Technician was created. Qualification criteria for all ranks were also spelled out in the new organization setup. In 1997, a new Diagnostic and Vaccine Research Centre was established with 36 sanctioned posts in DMR. This led to the development of Hepatitis B vaccine and subsequently to the establishment of a vaccine factory with the staff strength of 118 sanctioned posts. In 2002, a new National Blood Research Centre was added. This centre comprises two research divisions with 36 sanctioned posts. Realizing the dangers of poisons and environmental pollutions the government had laid down a programme to establish a National Poison Control Centre. The Department successfully inaugurated the National Poison Control Centre in 2003 with 4 toxicology divisions comprising sanctioned posts for 21 scientists and 40 technicians. The peak of the organization structure was in 2006 with 730 personnel before the transfer of the vaccine factory to Myanmar Pharmaceutical Industries after DMR and its vaccine factory had successfully test produced Hepatitis B vaccines. The

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Department transferred 118 sanctioned posts of the factory and the diagnostic and vaccine research centre in 2006. Thus the department is currently left with 612 sanctioned posts with (6) research centers/group, (21) research divisions, (6) support divisions and (3) administrative divisions.

	<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director General	184	428
Deputy Director General		
Director Administration and Support Group	20	173
Director Biomedical Research Centre	49	58
Director Clinical Research Centre	35	53
Director Socio-medical Research Centre	30	47
Director National Blood Research Centre	27	57
Director National Poison Control Centre	21	40
	<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director Administration and Support Group	20	173
Deputy Director		
General Administrative Division	4	125
Budget and Accounts Division	2	12
Stores, Procurement and Distribution Division	2	15
Instrumentation Division	10	21
	<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director Biomedical Research Centre	49	58
Bacteriology Research Division	6	7
Virology Research Division	9	10
Pathology Research Division	6	7
Immunology Research Division	6	9
Parasitology Research Division	9	10
Medical Entomology Research Division	6	8
Biochemistry Research Division	6	7
	<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director Clinical Research Centre	35	53
Clinical Research Division	9	18
Pharmacology Research Division	9	11
Physiology Research Division	7	10
Nutrition Research Division	9	14

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		<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director Socio-medical Research Centre		30	47
	Epidemiology Research Division	11	12
	Health Systems Research Division	4	6
	Medical Statistics Division	3	5
	Computer Division	3	5
	Central Biomedical Library Division	5	10
	Publications Division	3	9
		<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director Vaccine Research Centre		10	26
		<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director National Blood Research Centre		27	57
	Experimental Medicine Research Division	9	10
	Blood Research Division	6	9
	Blood Programming Division	5	11
	Nuclear Medicine Research Division	3	5
		<u>OFFICERS</u>	<u>OTHER RANKS</u>
Director National Poison Control Centre		21	40
	Pharmaceutical Toxicology Division	5	10
	Chemical Toxicology Division	5	10
	Biological Toxicology Division	5	10
	Radiation Toxicology Division	5	10

**Promotion**

Priority research conducted by the Department mostly concern diseases and was clinical in nature. To promote such types of research, Clinical Research Units (CRU) were stationed together with the researchers and technicians from DMR (LM) in the hospital wards, thus enabling the clinicians to conduct clinical research. Altogether 10 CRUs were stationed in 8 specialist hospitals and in the University of Medicine (2) to promote research activities of these institutions with each CRU specializing in one priority disease.

There is also a special research fund known as external research grant for the health personnel outside DMR who need funding for their research projects. Although it is a small scale funding, the Department was supporting 2 to 3 projects yearly for the past two decades.

The facilities and laboratories of the Department were also made available for post graduate students of the Universities of Medicine to conduct experiments for their research theses so as to promote medical research. Senior researchers of the Department also acted as supervisors and examiners for post graduate students. They also sat in the protocol and ethical boards of the Universities of Medicine.

For the promotion of research and dissemination of the research findings, the Department also publishes Myanmar Health Research Journal, quarterly editions, and DMR Bulletin, monthly editions. Apart from these regular publications the Department also

produced books such as annotated bibliographies of major diseases, traditional medicine formulations and research methodologies which are very useful for the researchers and post graduate students as references.

The senior and mid level researchers and scientists of the Department conducted various courses related to health research at the universities, departments and Myanmar Medical Associations so as to promote research activities and to educate medical professionals in the conduct of research. They presented scientific papers in international and local meetings and seminars and also contributed research articles in journals and periodicals culminating in receiving awards including National Literacy award.

Disease-wise scientific groups were also established with researchers of DMR as well as clinicians, academicians and managers of disease control programme. These groups conducted scientific meetings regularly and discussed research activities and exchanged information and technical development about the specific disease. This was augmented with regular journal reading sessions at some research divisions.

According to the state policy of promoting research and development the new Departments of Medical Research were established at PyinOoLwin and NayPyiTaw in 1999 and 2002 respectively. The Department of Medical Research (Lower Myanmar) was involved in planning and establishing these departments. DMR (LM) provided necessary expertise in writing of the organization setup, provided the nucleus of their scientists, contributed initial basic equipment and gave training to their new personnel. The Department also served as the mentoring institute for these new departments.

The Department also conducted commissioned research for the private enterprises, NGOs and other governmental organizations so as to promote research and to provide scientific input; the majority of these research projects and scientific inputs were concerned with safety and efficacy testing of traditional medicine. The Department also conducted health system research for evaluation of major diseases programs.

### **Co-ordination**

Being the focal institution in medical research and its Director-General also being the secretary of Medical Research Council almost all research activities carried out within the country is directly or partly related to the Department. In formulating the short term and long term health plans the senior researchers of the Department take the responsibility of writing research component in consultation with other health departments concerning their research needs. The major research projects or research programs concerning major diseases were segmented or compartmentalized and assigned among the three Departments of Medical Research so as not to overlap or duplicate. DMR (LM) also hosted annual research congresses and co-ordinate among the departments as well as between researchers presenting papers.

At the basic level or disease-wise level, the scientific groups which comprise researchers of DMRs, academicians from medical universities, clinicians and managers of health care sector discussed and decided on matters requiring co-ordination and co-operation among health departments and health personnel at their level..

### **Training**

To be a good and qualified researcher the basic necessity is to be a person with a keen interest in doing research. Almost all the new recruits to the department were not trained in research methodologies before joining the department. They only got the proper research training after recruitment. This started as on-the-job, hands-on training and through in-house training courses and gradually advanced later to further training abroad. The new technicians

and officers joining the department were given laboratory safety courses, medical and research equipment handling courses and basic statistics courses. Research methodology workshops were also conducted yearly which were compulsory for attendance by newly recruited officers. Apart from these courses disease-wise special research courses for scientists were conducted jointly by the visiting consultants from abroad and senior scientists within the DMR. The current policy of the DMR (LM) concerning the training is to encourage young scientists to attend postgraduate Master degree courses locally and then pursue higher degrees and special courses at the universities abroad affiliated with the DMR (LM). The young scientists undergoing Master courses locally are allowed to do research for their thesis at the DMR (LM), closely guided and supervised by senior scientists. Those who are attending courses for higher degrees in affiliated universities abroad are allowed to attend required courses for the degree abroad and come back to DMR and do research for their thesis. After completing the research they have to go back abroad to write and defend their thesis. This sandwich programme for high level training of research scientists is arranged with the agreement of the foreign universities as academic collaboration. This arrangement results in the scientists spending less time abroad, less government funding and enables scientists to conduct research locally with funding from abroad. In this way more than a dozen scientists of the DMR (LM) obtained doctoral degrees from universities in Australia, Japan and United Kingdom.

### **Research Capacity Development**

The capacity to conduct research depends on many factors. As usual it depends on human resources, financial resources and infrastructure. These factors can be provided and can be made to materialize. There are however many hidden factors that are intangible and cannot be quantified. These include a healthy research environment, research culture and individual qualities. The researcher should be free from worries and pressures and should have a liberal way of thinking. To achieve these factors DMR (LM) had gradually built up a healthy research environment, research culture among researchers and a system within the Department for effective and efficient functioning.

There is a protocol board consisting of top researchers and its meetings may be attended by any researcher. A researcher has to submit his/her project to this protocol meeting which it is subjected to critical discussion from the attendees. The board members act as arbitrators. These meetings build up the capacity of researchers as well as the research environment.

After passing the protocol board the research project has to pass the ethical board consisting of top scientists, ethical experts from both within and outside medical profession. The researcher or the principle investigator is subjected to the close screening of the board. Through this systemic process the research capacity and the ability of the researchers to conduct research is developed further.

### **Human Resources for Research Development**

The department was headed by an academician and a clinician consecutively for a long duration during the first period of development. As both of them have a keen interest in health research, the Department was firmly established with qualified researchers at the end of this period. The majority of the researchers during that time were cross-overs from medical schools or from health care services with keen interest in research. None of them started their career as a researcher. Only a handful of non- medical doctor- researchers started their career as young technicians and climbed up the career ladder to become research scientists. With the adoption of the new setup, rejuvenation of the Department was done by recruiting young

graduates as research officers or technicians. Mid level and high level personnel from medical schools and hospitals were also transferred to the Department to take up the newly created senior posts. Fresh graduates who joined the government service were recruited as new research officers at the basic officer training courses after talks concerning medical research given by the senior officers of DMR (LM).

### **Research Support Funding**

Although the majority of the funding for research was from the government it was used up for basic spending such as salaries, maintenance of buildings and equipments, requisition of new equipments and infrastructure development. The large chunk of the government funding was used for the day-to-day running of the Department. In spite of the yearly increasing funding from the government, it could not catch up with the rising costs of the material and equipments needed for technology development. Only a very small portion of this government funding was used for actual or purely research activity of any specific project.

Currently the annual appropriation for use from the government as annual budget of DMR (LM) is six hundred millions kyats for current use and for the capital use for buildings and equipments it is about fifteen hundred millions but it varies according to the health plans. The annual governmental budget for DMR (LM) has a trend of five percent annual increase in current expenditure.

Most of the funding for actual research activities came from external sources such as international and UN organizations, especially WHO. The scientists of DMR themselves had to compete with the scientists of other member countries within these organizations to get the funding. This, in another way, polished the overall capability of the scientists.

From the government allotted budget, a small portion was set aside as External grants for small research projects conducted by health personnel outside DMR (LM) to promote research. The usual practice adopted by the Department was to fund the small research projects with the government funds. For the medium and large projects, application from external organizations was encouraged or required. If there were emergency or ad-hoc but necessary research projects their funding had to be tapped from spending from daily running costs. The young and newly recruited researchers were stimulated to conduct research projects and they were funded from the contributions made by the senior scientists who got funding from external organizations and who were required to contribute two to ten percent of the acquired funding, depending on the size of their projects.

Apart from these funding or grants, DMR (LM) also acquired special grants, namely from Tropical Diseases Research (TDR) and from Human Reproductive Health Research Programme (HRP). DMR (LM) was awarded 10 years long term institutional development grant (LID) and 5 year resource maintenance grant (RMG) from HRP. DMR had been able to send scientists for higher level training abroad with the support of TDR. DMR (LM) also received special funding in early and mid nineties from United Nation Development Programme (UNDP) for the development of medical instrumentation division and for the development of plasma derived hepatitis B vaccine.

### **Research Technology Development**

Previously, almost all of the research was done in the DMR at the basic level with a small portion at the cellular level. The researchers who were sent abroad in the late 1990s for higher level training were exposed to the molecular level research techniques and they in-turn introduced these techniques into DMR (LM). The Department made plans for molecular research and acquired some high technology equipments that were needed. Due to the high

cost and limitation of the funding for the equipments, molecular research could only be carried out to some extent locally and to full extent with the help of the collaborating foreign institutions abroad. After the year 2000, many scientists were able to train in molecular techniques abroad and do molecular level experiments locally. Many consultants visiting DMR (LM) recently were able to impart knowledge of molecular techniques to local scientists through short training courses.

During the first period of development and the early part of second period, apart from the laboratory and clinical studies, the research carried out at DMR(LM) were public health research with a handful of social science research and a limited use of qualitative research methods. There were neither properly trained nor qualified social scientists in DMR (LM). In the late 1990s and early 2000s many young and mid level researchers were sent abroad to study social science. This resulted in many Master degree level social scientists and four Doctoral degree level social scientists at DMR (LM) which became a focal centre in Myanmar undertaking social science studies. Methodologies for qualitative type of research were also established and thus DMR (LM) becoming a centre for training in these new methods.

World- wide rapid development of e information and communication technology had a direct impact on DMR (LM) in carrying out research. DMR (LM) was the first medical institution to use computer technology widely. Before the introduction of computers it was very time consuming and tedious to do research especially literature search, data analysis and documentation. The library of the DMR (LM) was the first e-library in the country and a focal institution of the WHO/SEARO health literature and information (HELLIS) network.

Herbal medicine or traditional medicine is widely used in rural areas where the majority of the population live. Although it was used widely as an alternative medicine it was neither scientific nor standardized. DMR (LM) promoted and educated the traditional medicine practitioner as well as the drug producers regarding the standardization and scientific formulation and production of traditional medicine. It also did research on efficacy and safety of reputed traditional medicine formulations for the priority diseases and transferred production technology to Ministry of Industry (1).

### **Research Infrastructure**

As the research in medical field was developed enormously in the past two decades there was an introduction of sophisticated machines or equipments to carry out the experiments needed by the research. During the past two decades of enormous developments in medical research a lot of sophisticated machines and scientific equipment required for experimental and other types of research had to be introduced into the DMR (LM), which then led to the problem of their maintenance and repair. Foreseeing this, DMR had expanded and upgraded the medical instrumentation division by sending engineers abroad to train for maintenance and repair of medical and research equipments under UNDP funding in early 1990s.

The biomedical type of research could not be done without the use of the proper type of laboratories and facilities. DMR (LM) had developed and equipped different types of laboratories to conduct different types of research. Modern research equipments which can handle molecular level experiments were acquired and installed.

The world is now facing the danger of highly infectious diseases and re-emerging diseases and to combat these diseases, special types of laboratories and facilities are needed to do research for diagnosis, confirmation, prevention and control. Realizing this situation DMR (LM) had installed infectious disease laboratory in 2000 and bio-safety level 3 laboratory in 2004 within its means to undergo infectious diseases research.

For clinical research, laboratories were established in DMR (LM) and ten Clinical Research Units (CRUs) were installed in eight hospitals.

A new national blood center was established in 2002 with two divisions, one dealing with blood research and the other aiming for blood safety. A modern blood mobile unit was also made available for the blood bank to collect blood donation in the communities. The donated blood is screened for common infectious diseases which can be transmitted by blood.

Realizing that the environment is teeming with harmful micro organisms, chemicals and other materials emitted, a new national poison control center was established in 2003. It has four divisions dealing with drugs, chemicals and bio-organisms. For the benefit of the public and health care personnel an information unit with a hot-line link was set up to immediately respond to requests for help and information about poisons such as identification, antidotes, treatment procedures, control and containment.

The world is rapidly developing in information and communication technology (ICT). ICT becomes a necessity in every place. DMR (LM) made improvements in this area by computerizing the entire Department. A main server and fiber-optic backbone was installed, ADSL and internet were subscribed. All the divisions and rooms in the DMR (LM) are now able to access internet directly.

In most of the biomedical and clinical studies animal experiments are necessary. To provide animals for these studies DMR (LM) maintains a standard laboratory animal breeding and testing facility. It is the only such facility in the health sector and provides laboratory animals to other departments.

### **Prioritization**

Generally and traditionally the functioning of the Department goes according to the priority spelled out in the Department's missions and goals. At the same time the Department sees to it that they are in-line with the policy of the state organs, national health committee and international trends. The State, through the National Health Committee, (NHC) had drawn up a 30 years long term and 5 years short term health plans. The Department functions according to the priority spelled out in these health plans. Usually and because of urgency, infectious diseases research has landed in the top spot in prioritization. Infectious diseases such as influenza (all types), HIV/AIDS, Malaria, Tuberculosis and hepatitis are at the top.

When both infectious and non-infectious diseases are taken together- malaria, tuberculosis, hypertension, diabetes, diarrhea and dysentery are the six highest ranking diseases among the top 15 priority diseases on which research is undertaken. Research on traditional medicine (as alternative medicine) concerning these six commonest infectious and non-infectious diseases is also given higher priority.

### **Major Research Areas and Programmes**

Research at DMR (LM) is according to the priorities and urgency as given above.

#### **Research on Viral Hepatitis**

In the 1980s and early 1990s there was outbreaks of hepatitis in some parts of Myanmar and DMR involved in the research of hepatitis on diagnosis, identification, control and vaccine development. The researchers and technicians were sent to CDC and New York Blood Centre of USA and to medical institutes and laboratories of Korea, Japan, Thailand and Malaysia under UNDP assistance for training in hepatitis research. It ended with the establishment of a diagnostic and vaccine centre and a modern vaccine factory in DMR (LM).

### **Research on Human Reproductive Health**

In 1990, DMR invited two senior scientists from the WHO/UNDP/WB Human Reproductive Health Program (HRH) for discussion about introducing human reproductive health research in Myanmar. A baseline study on human reproductive health was made and this launched the human reproductive health research in early 1990's. This was prior to HRH programme of the Department of Health. DMR (LM) acquired two continuous five years long term institutional strengthening grants (LID) and subsequent 5-year resource maintenance grant (RMG). Universities of Medicine (1), (2), Mandalay and Central Women Hospital (CWH), as collaborating institutes, also benefited from these grants. Many human reproductive health research studies were done and scientist and clinicians from the above institutions were trained abroad as well as locally.

### **Research on Malaria, Tuberculosis, Dengue, Leprosy, HIV**

In infectious diseases research - malaria, tuberculosis, dengue, leprosy, HIV and other viral diseases are the major research programmes in DMR (LM). Malaria which is the commonest and top priority disease in Myanmar was studied in many aspects since the establishment of DMR. It was studied for infectivity, transmission, vectors and vector control, drug resistances and control measures. The studies were made in close collaboration with WHO, malaria control program and vector borne disease division of the department of health.

Dengue infection is also studied since the major outbreak in 1980s. Blood specimens from the dengue infected patients in the past 30 years were collected and stored for sentinel survey and for further study.

Other viral diseases such as Japanese encephalitis, Rota virus, Rabies, Seasonal influenza and quite lately SARS, Avian influenza, H1N1 human influenza and chickengunya were also studied.

### **Research on Diarrhoea, Dysentery, Cholera, Typhoid**

Bacterial diseases were also a major study area in DMR (LM). The scientists conducted research in diarrhoea, dysentery, cholera, typhoid fever, wounds infections, sepsis and tuberculosis.

Infectious diseases especially the major diseases were studied for diagnosis, prevention and control in close collaboration with specific disease control programmes of the department of health namely malaria, tuberculosis, HIV and leprosy control programmes.

### **Snake-bite Research**

Snake bite, although not an infectious disease is at the top in morbidity and mortality. DMR (LM) was conducting snake bite research for the past 30 years since early 1980s. It was studied for first aid measures, venom characterization, envenomation, immunogenicity, anti-venom potency and efficacy, anti-venom storage, control measures and production of anti-venom from different animals lately from chicken yolk.

### **Research on Hypertension, and Diabetes**

### **Research on Micronutrient Deficiencies- Iron, iodine, Vitamin B1, Vitamin D**

### **Research on Sports Medicine, Growth and Fitness**

Non infectious diseases, although they have a slow impact, are major health problems of the country. Hypertension and diabetes, both being common and increasing in prevalence, were studied from the clinical and prevention aspects.

Micronutrient deficiencies such as iron, iodine, vitamin B1, vitamin A, vitamin D deficiencies were studied.

Beside non-infectious diseases research, DMR (LM) is also conducting sports medicine research for the athletes, and fitness and growth research for adolescents and school children.

### **Traditional Medicine Research**

Traditional Medicine as an alternative medicine is still widely used in Myanmar. DMR (LM) conducted research in herbal plants, herbal formulation, characterization of reputed herbal plants, safety and efficacy of herbal plants and formulations.

### **Research on Environmental Health**

Currently the major issue, hotly debated, is the effect of environmental factors on health. Realizing this problem the DMR (LM) had formed a new poison control centre to tackle this problem. This centre conducted studies on pharmaceutical, chemical and biological contaminations and toxicities.

### **Social Science Studies**

In the process of acquiring diseases, both infectious and non infectious, the human factor is a hidden major component apart from the visible chain of causal organism, host and the vector/environment. The knowledge, perception and behavior of humans greatly influence this process. Therefore, the role of social scientists becomes important and essential. Many studies of the social science aspect of diseases were conducted by the social scientists of DMR (LM).

### **Output**

The output of the DMR (LM) can be seen at a glance at the papers and presentations made at the annual research congresses. Yearly, about 100 research papers and poster presentations were made at the annual research congress which are usually held in January. Among them two thirds were made by the scientists of DMR (LM). Some of these presentations were published in local as well as international publications. Previously, at least an article or a project a month written by the scientists of DMR (LM) was published in international publications. Currently the trend is downwards because the authors are facing difficulty paying publication fees in hard currency. Even then two to three scientists from DMR (LM) have been invited annually to the international conferences and meetings to present their research papers

The other notable output for DMR (LM) in the second period was the development and production of diagnostic test kits, procedures and vaccines for health care services. DMR (LM) was able to produce test kits for the hepatitis B infection, iodine deficiency, iron deficiency and laboratory diagnostic procedures for hepatitis C, tuberculosis, malaria, leprosy, snake bite and confirmatory tests for HIV infection.

The development of vaccines and anti-venom were the big achievements for DMR (LM). The laboratory scale production of plasma derived hepatitis B vaccine was successful in 1998 after many years of research and since then more than a hundred thousand people were vaccinated with this vaccine. In 2002, a high-tech hepatitis B vaccine factory was built with foreign loan. It was successfully test- run and after completion of factory construction, DMR (LM) scientists successfully began producing commercial scale recombinant hepatitis B vaccine from 2004 onwards.

An anti-snake venom for Russell viper bite was successfully test produced from chicken egg yolk in the DMR(LM) laboratories recently and it is currently now in clinical trial stage. Educative, preventive and treatment support procedures such as- application of pressure pad method in snakebite, venom estimation and anti-snake venom storage in remote areas- were also developed.

In malaria research there was a breakthrough in late 1980s when malaria parasite culture was successfully developed. Field surveys identified malaria transmission rate and patterns, cross border transmission and anti-malarial drug resistance pattern..

HSR studies of tuberculosis control program by DMR (LM) were supportive in improving DOTS and training of control personnel of DOH.

The long term laboratory and HSR studies on leprosy by the DMR (LM) scientists helped in eradication of leprosy and in maintaining this status.

DMR (LM) also developed Western Blot test for HIV confirmation.

Dengue research in DMR (LM) produced a lot of outputs. The blood specimen collected from the patients during the past thirty years gave very valuable material and information for research. Dengue incidence and prevalence pattern were known from the studies of these specimens. Dengue variants and their relationship was shown by using molecular techniques and molecular epidemiology studies enabled dengue outbreaks to be predicted beforehand.

In traditional medicine research, 52 standard Myanmar traditional medicine formulations were characterized and tested for safety and efficacy. Traditional Medicine Myanmar National Formulary was developed. Research on six priority disease produced alternative traditional herbal drugs for treatment for each disease. Three drugs including production technology was transferred to Myanmar Pharmaceutical Factory for mass production. A treatment procedure of combining five herbal formulations with two regular second-line anti-tuberculosis western drug for treatment of multi drug resistant tuberculosis (MDR-TB) was successfully developed and tested clinically.

Knowledge and information hotlines were installed in DMR (LM). An information hotline was installed at the Poison Control Centre which provided information and treatment aids to the public and healthcare personnel. To tackle the lack of knowledge about reproductive health especially among adolescents the DMR (LM) had installed a hotline to answer all the queries about reproductive health.

## **Outcome**

For any kind of research there will be outputs but the outcome or impact is more difficult to assess. The outcome cannot be seen or realized immediately. The outcome of more than forty years of research has emerged only after some time. Outputs are useful for immediate actions but the outcomes are for planning, correction and later implementation.

Infectious diseases research helped in reducing these diseases. Development of the hepatitis B vaccine (HBV) reduced the incidence because of the population acquiring immunity through vaccination. Hepatitis B test kits used in donated blood screening weeded out the infected donors and helped in bringing down hepatitis B incidence from 8% to 3% among blood donors.

DMR (LM) had done a lot of research on malaria in the past forty years and produced many quality outputs. WHO recognized this malaria research by designating the DMR (LM) as a WHO Collaborating Centre for Malaria Research and Training.

Epidemiology and molecular epidemiology studies helped in prediction of disease outbreaks and were very useful for control and containment. The work of the social scientists in DMR (LM) reached a peak when WHO's prestigious Leon Bernhard prize was awarded to the top social scientist of DMR (LM).

References:

1. Office Records
2. Organizational set- up
3. Myanmar Health Science Research Journal – issues.

## **Section 3.2**

### **Department of Medical Research (Upper Myanmar)**

**by Thein Tun**

#### **Introduction**

The Department of Medical Research (Upper Myanmar) was founded in November 1999 with the aim of improving the health status of the people of Upper Myanmar. The strategic approach adopted is to implement this through dissemination and propagation of recent/latest scientific knowledge from researches conducted to medical professionals with the expectation that these scientific findings will be applied for prevention and elimination of health problems whenever and wherever it is relevant. After being temporarily stationed at the University of Medicine Mandalay during construction of the physical facilities, the Department moved in March 2001 to its present site near Anisakhan, at an altitude of 3200 feet, on the way from Mandalay to PyinOoLwin.

The Department started functioning to accomplish its Objectives which are; strengthening manpower, technology and facilities for health research; conducting research on problem diseases in Upper Myanmar; validating indigenous drugs for safety, security and reliability; preservation and propagation of the rare species of herbal plants through the establishment of a herbal garden; promotion of health system research; and performing research on reproductive health and family planning in accordance with the National Health Policy.

#### **Organization**

The Department of Medical Research (Upper Myanmar) is one of seven departments under the Ministry of Health. The Director General, head of the department is assisted by one Deputy Director General. There are four main sections- namely administration, clinical research, bio-medical research and socio-medical research, each headed by a director. General administration, budget and accounts, store, procurement and distribution, instrumentation, laboratory animal service, computer and library science are under the section of administration. Clinical research section includes parasitology, pharmacology, medical entomology, clinical research, experimental medicine, nutrition and nuclear medicine. Pathology, biochemistry, bacteriology, and immunology are under the bio-medical research centre. Socio-medical research centre consists of epidemiology, health system research and medical statistics. Because of limited manpower, clinical research, experimental medicine, nutrition, nuclear medicine, and immunology sections are not functioning. By early 2009, out of 448 sanctioned staff only 168 (37.5%) could be appointed.

#### **Coordination**

The seven departments under the Ministry of Health are the Department of Health, the Department of Medical Sciences, the Department of Traditional Medicine, the Department of Medical Research (Lower Myanmar), the Department of Medical Research (Upper Myanmar), the Department of Medical Research (Central Myanmar) and the Department of Health Planning. The Executive Committee, consisting of the Minister as the chairperson, two deputy ministers and all directors general holds the Ministerial level meeting at the Ministry of Health every week or at least once every two weeks. Research matters related with various departments are coordinated at this meeting. The respective directors general communicate with each other and coordinate as is necessary. Scientists/researchers from

different departments meet and discuss matters at every step starting right from the beginning with proposal development.

There is also an informal coordination mechanism within the Department whereby different sections under different Director routinely co-ordinate with each other in planning and executing various research projects.

### **Capacity Development and Development of Human Resources for Research**

#### *Physical Facilities*

The main administrative building was first constructed in 1999. Construction of research buildings was continued up to 2005. Altogether 44 buildings comprising 3 for administration, 9 for research and 32 residential quarters were completed. All are one-storey buildings. The administrative buildings contains offices, and fully equipped bio-medical library, computer section, main meeting hall and two conference rooms. There are nine research buildings each accomodating two research sections provided with up-to-date laboratory equipment. One building was specially designed for breeding laboratory animals. The thirty two residential buildings accommodate over 120 staff and their families.

#### *Staff Recruitment and Capacity Development*

Senior staffs from other departments such as the Department of Medical Sciences, the Department of Health and Department of Medical Research (Lower Myanmar) are recruited and reassigned to lead some sections. The Ministry of Health transferred the appropriate medical officers from Department of Health. Potential researchers from the Department of Medical Sciences and Department of Health were recruited by promoting them to the next level as an incentive. Young graduates from the Arts and Sciences University were recruited through Public Service Selection and Training Board to serve as research officers. Supporting staff were selected from locals with various qualifications in accordance with the types of duties and responsibilities. A broad program of research training was instituted as detailed below:

Research officers were encouraged to attend postgraduate master course on public health, pathology, and microbiology for the medical professionals and zoology and chemistry for the non-medical graduates inside the country. Among the scientists and research officers, 26 are master degree holders and two have PhD degree.

During the last decade, some scientists/research officers were sent abroad for advanced training on various fields such as virology, bacteriology, food sanitation, chemical analysis of water, medicinal plants, HINARI, experimental laboratory animals, malaria diagnosis, family planning, research methodology and reproductive health, infectious hepatitis, diagnosis of HIV/AIDS, web publishing, epidemiology and statistics and advanced epidemiology to- India, Thailand, Japan, Switzerland, Italy and Korea. Moreover, arrangements were made for other staff to get the opportunity to attend the research-related in-country training workshops conducted at other departments like the Department of Medical Research (Lower Myanmar), Department of Medical Research (Central Myanmar), National Health Laboratory, Vector-borne Diseases Control Project etc. In addition, as supplement for the rest of the staff a series of in-house training courses were planned and conducted within the Department mostly with the WHO budget. International experts and experienced scientists from DMR (Lower Myanmar) were invited to supervise and conduct the training courses. These were trainings on research methodology, operational research methodology, social science research methodology, malaria research, qualitative data analysis, and basic statistics for data analysis in health research, e-health activities, proposal development workshop, scientific writing workshop and ethical workshop. In addition,

supporting staff were also sent for trainings on various disciplines such as budget and account, library training, computer and network training, and public service training.

#### *Long Term Institutional Development Grant*

The DMR (Upper Myanmar) was awarded a long term institutional development grant funded by WHO HRP (Special Program of Research, Development and Research training in Human Reproduction) in 2007. The grant comprised of funding for training workshops, fellowship, library resources and data processing facilities. A series of workshops were conducted with LID grant at DMR (Upper Myanmar) from 2007 to 2009 and a few scientists were sent to Thailand for postgraduate degrees and training.

Books were acquired for the library; computers were purchased for the Department as well as for collaborating institutions in Mandalay such as the Central Women's Hospital and participating academic departments of the University of Medicine, Mandalay.

Such institutional strengthening efforts resulted in the initiation of research projects concerning reproductive health which expanded in scope and depth as the Department became more competent in this new field of research

#### **Trainings for Research**

Arrangements were made for Departmental scientific staff to attend training courses on many topics on many occasions as follows:

- (1) At other Departments inside the country-- on various topics including entomology, traditional medicine, research methodology, use of sophisticated instruments like HPLC, etc.
- (2) At institutions abroad --on various topic including cultivation and processing of medicinal plants, HIV/AIDS diagnosis, in-vitro cell- culture, etc.
- (3) Within the Department (in-house) - on various topics including social science and qualitative research methodology, scientific writing, ethical issues in medical research, etc.

#### **Prioritization**

The DMR Lower Myanmar, DMR Upper Myanmar and DMR Central Myanmar are three organizations that mainly conduct researches in Myanmar. Health Research Program is one important component of the National Health Plan. "Promotion and conduct of reproductive research" was one out of eight guidelines laid down by the Health Research Policy Board. Seven research projects which were expected to be achieved in the Health Research Program of National Health Plan (2006 - 2011) included research on traditional medicine, research on communicable diseases, research on non-communicable diseases and research capacity strengthening project. These became priority areas for research in DMR Upper Myanmar after considering the existing situation, resources and expertise.

#### **Priority Research Areas**

##### *Traditional Medicine Research*

Traditional medicine has been accepted and widely used for centuries in the country. The Government has given the directive to uplift the quality and to promote the systematic development of traditional medicine. Traditional medicine practitioners are practicing in private sector as well as giving services through the traditional medicine hospitals or dispensaries established under the Ministry of Health. Moreover, traditional medicinal

products in various formulations meant for a variety of diseases are available in the market. Many of these products from different sources need to be tested for content of ingredients, safety and efficacy.

Since 2005, the DMR Upper Myanmar has invited private traditional practitioners, respective experts from the Department of Traditional Medicine and scientists from other departments under the Ministry of Health for annual meetings. During these meetings, proposal and discussion on selection (for analysis and research) were made, of the traditional drugs for treatment of most problematic diseases in the country such as hypertension, diabetes mellitus, malaria etc. The drugs may be either in the form of plant extracts or combinations of herbal crude products. Traditional medicines which were advertised frequently in the television program and those which were quite popular in the community were also collected from the market and tested for their activity. Except for the formulations, currently used in the Department of Traditional Medicine or which are widely accepted and used by the community, all drugs have to pass through the stages of assurance of authenticity of the herbal plants/plant products stated, animal toxicity test, and tolerability test in healthy human volunteers before being tested on patients.

Since 2005 DMR (UM) has selected traditional medicinal drugs that may be used in the treatment of problem diseases in the country such as hypertension, diabetes mellitus, malaria, etc as priority areas for research in traditional medicine. Drug formulations used in the Department of Traditional Medicine and some which are already widely accepted by the community are put through clinical trials in patients—and include reputed drug formulations for lowering blood glucose, blood pressure, and for anti-parasitic and anti-bacterial activity in malaria, diarrhea and dysentery.

The Department planted more than 500 species of herbal plants in herbal gardens and two herbal houses. It published two volumes of “Myanmar Medicinal Plants” (in Myanmar language) in 2006 and 2007

#### *Reproductive Health Research*

Research in reproductive health is a relatively new research field at medical institutions in Upper Myanmar and expanded greatly after receipt of the long term institutional strengthening grant by DMR (UM) and collaborating medical institutions. Priority research areas in reproductive health were identified at several national workshops on priority research in reproductive health conducted at the DMR Upper Myanmar in 2007.

Research areas in reproductive health that were subsequently developed as research proposals and are being carried out in Mandalay include knowledge, attitude , practice(KAP) studies on reproductive health in hitherto unreached target groups such as males and vulnerable youths like adolescent migrants and unmarried youths and on measures to improve their reproductive health; counseling practices concerning birth-spacing; improving the detection and caring of anaemia and pre-eclampsia during pregnancy; reduction of perinatal morbidity and mortality.

#### *Malaria Research*

Malaria is a long standing national health problem in all parts of Myanmar including Upper Myanmar and many decades of malaria research have been carried out in Myanmar according to needs, capability and opportunity.

The major areas where malaria research is being continued in Upper Myanmar include:-

- (a) Drug resistant malaria –therapeutic efficacy of Artemisin-based drug combinations in *P. falciparum* infections, and revived efficacy of chloroquine in *P. vivax* infections
- (b) Malaria epidemiology and entomological surveys—in selected townships and unreached areas and population groups
- (c) Studies of the role and functioning of different components of malaria control program such as:-sale of anti-malaria medicines in drug shops, provision of insecticide-treated bed nets to the community, compliance of basic health staff with standard anti-malarial control procedures; socio behavioural studies of forest related workers, participation of private general practitioners in malaria control, patient choice of treatment options for malaria, etc

### **Support Facilities**

Animal laboratory service—this service breeds and provides good quality animals to other research sections Development of computer facilities – establishment of local area network with computers in every section of the Department.

Biomedical library-although limited in books and journals the library has internet access to data bases in other libraries within the country and to data bases internationally such as HINARI, etc

### **Research Funding**

Funding for research projects derived from three main sources; government budget, WHO regular budget and special grants from WHO HRP (Reproductive Health)for long term institutional strengthening and from WHO/TDR for malaria research Almost all the research studies from traditional medicine were carried out at the expense of government budget. All the major laboratory equipments were purchased with allotted money from government budget on year to year basis. About 60% of WHO regular budget was used for research projects and 30% was allotted for fellowship program.

Another important source is the award of research grants from regional and international research funding bodies for which researchers are encouraged to apply for research projects in their area of interest relevant to overall Departmental research priorities; some are successful in doing so.

### **Research Outputs**

The proposals developed by the researchers are scrutinized and approved by institutional technical review committee and institutional ethical committee. Ethical committee consists of seven members with director general or acting director general as chairperson. Of the remaining six, one member is lady outsider who is also a member of township women affairs committee and other fives are senior staff from the department.

Research output during the time span of 8 years (2001-2009) as determined by the number of research papers published or read was considerable in spite of the fact that laboratory buildings were and equipment were still being built up during half the period , and that scientific manpower was limited and still growing to reach sanctioned strength.

Nine papers were published in international journals and eleven in local journals; forty papers were read at the Myanmar Health Research Congresses; four at international conferences/congresses; and seven at other scientific meetings within the country. In addition 17 theses/dissertations were produced by Departmental scientists as postgraduate students working for academic degrees. Seventy-four unpublished scientific reports were produced by

the Departments as well as two volumes of a treatise on “Myanmar Medicinal Plants “(in Myanmar)

### **Dissemination and Utilization of the Research Findings**

Of the total number of research studies carried out and completed only a small number culminated as published research papers because many were rejected for publication. Scientists from DMR (UM), like scientists everywhere, try to publish their findings in scientific journals and be accepted for presentation at scientific meetings because this is the principal means of reaching the scientific community from which valuable critical comments and confirmation of the results may be received and who may then utilize the findings. Other potential users are policy makers, health program managers, administrators, other health professionals and the public-- who may be reached by various other means such as departmental reports to policy makers and administrators and through the media to the public.

DMR(UM) endeavors to involve health program managers from relevant Departments at all stages of research from planning to execution and feed-back (such as in Health System Research and Reproductive health Research projects) which enable them to be aware of ongoing research aimed at solving particular health problems, anticipate research outcomes and have early access to freshly emerging results so that such information can be appropriately made use of during the planning cycle of health programs. Direct reporting of research results of particular interest to national leaders at State and Ministry level is also done on special occasions as directed.

### **List of Research Studies**

1. Papers published in Myanmar Health Science Research Journal—11
2. Papers published in international journals—9
3. Papers presented at Myanmar Health Research Congresses—40
4. Papers presented at other scientific meetings/ seminars in the country—7
5. Papers presented at international scientific meetings/congresses—4
6. Unpublished studies—74

## Section 3.3

### Department of Medical Research (Central Myanmar)

by Myo Khin

#### Introduction

It is recognized that health research plays a pivotal role in efforts to provide scientific evidence for the delivery of efficient and effective health care for the people of Myanmar. With the objective of further strengthening and promoting such research, the Department of Medical Research (Central Myanmar) was established in central Myanmar at Nay Pyi Taw in the year 2003.

After a preparatory phase, it became functional in 2004. The early months were mainly occupied with construction activities which continued together with other preparatory activities so that by end of 2003, construction of one main administrative building, 16 research buildings, one support building, and seven staff quarters had been completed, some basic laboratory equipment installed, and the Department was ready to start functioning and initiate some research activities by 2004. The cultivation of a herbal garden was begun in 2006 and construction of more laboratory buildings was also completed. An animal services building and incinerator were added in 2008.

#### Organization

The Department of Medical Research (Central Myanmar) is organized with 20 research divisions supported by administrative, library and instrumentation divisions. In general, the Department consists of four major divisions which include 16 research sections and seven administrative and research support sections. The sanctioned capacity of the Department of Medical Research (Central Myanmar) is 155 officers and 293 other ranks totaling 448 personnel. At present many vacancies exist and approximately 80% of the posts of officers and 74% of other ranks remain to be filled.

The setup of the Department of Medical Research (Central Myanmar) is as follows:

1. Administrative and research support division
  - a. Administrative section
  - b. Budget and accounts section
  - c. Stores and distribution section
  - d. Instrumentation section
  - e. Central Biomedical Library section
  - f. Computer section
  - g. Laboratory Animals Services section
2. Social Medicine Research Division
  - a. Epidemiology research section
  - b. Health systems research section
  - c. Statistics research section
  - d. Entomology research section
3. Biomedical Research Division
  - a. Biochemistry research section
  - b. Parasitology research section
  - c. Pathology research section
  - d. Immunology research section
  - e. Bacteriology research section
  - f. Virology research section

4. Clinical Research Division
  - a. Clinical research section
  - b. Experimental medicine research section
  - c. Physiology research section
  - d. Pharmacology research section
  - e. Nutrition research section
  - f. Nuclear medicine research section

#### **Laboratory Equipment**

The Ministry of Health provided substantial funds for purchase of laboratory equipment in the initial stages of development. Although government funding has been reduced in recent years laboratory equipment has been purchased using funds provided by the WHO. Also collaborative research programs with Japanese Universities and technology transfer has also upgraded the laboratory so that now, a decade from start-up, the laboratories at DMR (CM) are able to perform the following:

- Genetic DNA sequencing, conventional polymerase chain reaction, Real time Polymerase chain reaction (RT-PCR) - for studies of HIV, Hepatitis C and Human Influenza viruses
- In-situ hybridization of viruses, cell culture and cloning, cytogenetics and karyotyping, epigenetic analysis by MSP – for genetic studies and cancer research
- Atomic absorption spectroscopy, gas chromatography, mass spectrometry, Fourier transform infrared spectrophotometry, high performance liquid chromatography – for various physical and biochemical studies
- Fluorescent microscopy, immunochemistry, ELISA- for studies of rotavirus, mycobacteria, others
- Malaria parasite culture – for studies on drug resistant malaria

#### **Research Personnel**

As the Department is at a very early stage of development there are very few experienced scientific personnel overall. However, a core group of experienced scientific personnel exists in some fields of research and some have postgraduate qualifications with research experience. The level of technical support is also very low since most of the technicians with degrees from universities have had minimum exposure to research.

#### **Research Training**

Most of the technical staff needed to be trained in field research methods and laboratory procedures. After recruitment, some were given training in-house, some receive training at the DMR (LM) and some at the University of Medicine 2, Yangon.

Some researchers and technicians received training at training workshops organized in the country with funds from WHO regular program and a few (five scientists and three technicians) had the opportunity to be trained overseas. Later, more fellowships and trainees were sent through collaborative programs with Japanese Universities

#### **International Collaboration and Technology Transfer**

Research collaboration and technology transfer has taken place between DMR (CM) and Niigata, Okayama, Nagasaki and Miyasaki Universities in Japan. Research projects on betel- chewing and oral cancer have been carried out with Niigata University; and on cervical cancer with Okayama University. Molecular biology techniques have been transferred from these Universities to DMR (CM).

### **Research Activities**

The mission of the Department is to promote the health of the people of Myanmar through conduct of biomedical research, social research and traditional medicine research.

A number of research activities are in progress and some more collaborative research with other service departments and medical universities are taking place.

The Department has been functional since 2004. Up to 2009, the Department has carried out research in malaria, tuberculosis, diabetes mellitus, cancer, snake bite, reproductive health, oral health and influenza. The findings have contributed to their diagnosis, management, prevention, and to the understanding of etiology and pathogenesis of these health problems. The research findings are disseminated through presentations at Myanmar Health Research Congress and by publications in research journals.

Workshops have been organized by the Department in order to strengthen research capacity and to disseminate new techniques. Clinicians, scientists, academicians and laboratory personnel from departments and Universities under the Ministry of Health participated at the workshops. The topics include- malaria diagnostics, repair and maintenance of microscope, entomological research methods,, methodologies in traditional medicine research, health research methodology, advanced immuno-histochemical techniques, etc.

### **Development of Research Programs**

Following a series of discussions among the scientists of the Department of Medical Research (Central Myanmar), a medium-term plan has been drawn up. The plan covers the years (2007 to 2011) and is based on 8 headings.

(a) *Research on Communicable Diseases*

Forty-five research activities under this heading include research in malaria, acute respiratory infection, diarrhoea, dysentery, dengue haemorrhagic fever and hepatitis.

(b) *Research on Non-communicable Diseases*

Twenty-seven research activities are expected under this project and will include research activities on malignancies, nutrition, diabetes, hypertension and reproductive health.

(c) *Research on Traditional Medicine*

Thirty-two research activities on collection and identification of herbal plants, toxicity evaluation, laboratory-based evaluation and clinical evaluations of diabetic medicines, anti-malaria, anti-bacteria, and anti-hepatitis plants are planned.

(d) *Research on Academic and Technology Development*

For the development of technology on diagnosis of malignancies, management of common cancers, establishment of molecular techniques for bio-medical research for prevention and control of common diseases / conditions, 15 research activities are planned under this heading.

(e) *Research on Health Systems*

The plan of action for 18 research activities to be carried out on health systems includes; research on participatory role of NGOs, antenatal care seeking practices, health seeking behaviors, social factors associated with drug resistant tuberculosis and health needs of HIV positive adolescents among others.

(f) *Research on Environmental Health*

Four activities have been identified for determination of factors causing indoor air pollution, assessment of water quality in urban and rural areas of Central Myanmar.

(g) *Research on Capacity Strengthening*

Forty-five activities have been identified for research promotion, on human resources development, strengthening of research techniques, tools and methods; and for research support activities including, upgrading library and computer services, and promoting laboratory animal services

**Development of Research Procedures**

A Protocol Committee was reorganized and formed with specific terms of reference. An Ethical Committee with extensive guidelines was also formed. Both committees are functioning with maximum capacity.

**Research Papers Presented**

Nineteen research papers were presented at the Myanmar Health Research Congresses (2005 to 2007) in several broad areas of research as follows:

Research on communicable diseases- various topics including surveillance, KAP studies and preventive measures against DHF, malaria, measles

Research on functioning of health workers –various topics including role of nurses and volunteer workers in control of communicable diseases

Research on pharmacology and bioavailability of drugs – various topics including pharmacokinetics of amoxyllin, and digestibility assay of traditional medicine

**Conclusion**

In the early stages of the establishment of a research department, the type of research to be conducted may not require resources on a scale comparable with that necessary for the development of new drugs or new vaccines. However, the overall strategic plan requires the development of qualitative and quantitative research capacity to engage in a variety of research methods. It is therefore essential to upgrade not only the physical structures and to create a suitable work environment but also to develop the human resources required for research and in particular to nurture scientific personnel with keen interest in research.

## Section 3.4

### Overview

by Aung Than Batu

#### 1. New Phase of Growth and Development of the DMR's from 1990's Onwards

The political and economic changes that occurred in 1988 in the country also brought about large changes in health policy and health research policy. The 1990's saw the dawning of a new development period opening up wide opportunities for further robust growth of medical research in many new directions in Myanmar.

Myanmar has a long established, well developed 'health research system' which functions as the 'brain' of the health system, through appropriate architecture and mechanisms. (*see chapter 1, "development of the health research system in Myanmar"*). The Departments of Medical Research are one component, albeit a major crucial component of the system; others being the Universities of Medicine and other health related Universities; the health services - government and non-government; and the health industry – government and private. The health research system has five essential functions-(1) stewardship - to develop strategic visions for health research in response to knowledge needs of the health services (2) capacity development for health research (3) knowledge generation (4) utilization and management of knowledge for health improvement (5) mobilization of resources for health research.

Major advances have been made in all these five essential functions during the decades since 1986; and are summarized hereunder, as well as detailed elsewhere in other chapters.

Important changes in the Myanmar Health Research System have taken place. Improved stewardship became possible when the Health Research Policy Board was formed. The system expanded considerably and changed shape when Institutes of higher learning in health were elevated to University level, when new Universities were added and new research institutions created.

##### 1.1 *National Health Committee and Health Research Policy Board*

Of prime importance was the constitution of the National Health Committee to determine national health policy which was promulgated in 1993. Successive National Health Plans were prepared, approved and implemented.

The Health Research Policy Board was formed to determine national health research policy, formulate national level health research plans and provide guidelines for their execution; Health Research Working Committee was formed to implement the health research policy; and the Health Research Promotion Sub-committee was formed to promote health research.

It is noteworthy that the health research policy, as stated by these several recently constituted bodies, greatly emphasizes disease control and promotion of national health among the aims of medical research but does not include or mention 'advancement of medical science in the country' as one of the Aims of medical research, whereas the now defunct Burma Medical Research Council Act (1963) explicitly mentions 'advancement of medical science' together with 'improvement of health' among its Aims. This would be of importance in assessing the output and outcome of medical research carried out by the DMR's, the Universities and others.

The National Health Plan for 2001-2006 and 2006-2011 provided for implementing the Health Research Program drawn up in accordance with Health Research Policy guidelines for health research.

### **1.2 *New Departments of Medical Research***

Also far reaching was the creation of new and separate Departments of Medical Research in Upper Myanmar in 1999 and in Central Myanmar in 2003, each with its own organizational set up, budget, staff and research programs. The Burma Medical Research Institute (BMRI), which was established in 1963 under the Burma Medical Research Council became the Department of Medical Research under the Ministry of Health in 1973 and is now re-designated as the Department of Medical Research (Lower Myanmar). The mission of the three Departments of Medical Research, as stated in the Burma Medical Research Council Act 1963 and implicitly accepted unchanged throughout by the Ministry of Health of successive Governments and by the DMR's, is generally similar: " it is to promote medical research in the country; to undertake research in support of health programs which address the health needs of the country; to advance medical science in the country and contribute towards scientific knowledge" – however, the mission to undertake research in support of health programs which address the health needs of the country has always been paramount. Health Research Policy statements by the recently constituted Health Research Policy Board, Health Research Working Committee and Health Research Promotion Sub-committee re-emphasize that the principal aim of medical research is to improve the health of the people and enumerates the priority health problems confronting the country.(see Chapter 2) Research needs being generally similar throughout the country the research programs of the DMR's are also generally similar but some programs and projects, especially those of DMR (UM) and DMR (CM) may also have a regional orientation and a focus on the research needs of regional health problems.

### **1.3 *Further Expansion of DMR (LM)***

A new Diagnostic & Vaccine Research Centre was established in 1997 for research and development of Hepatitis B vaccine and for commercial scale production of the Hepatitis B vaccine comprising several Research Divisions under a Director (Research). A new building to accommodate this Centre began construction in 2001. In 2002 a new National Blood Research Centre was added comprising two Research Divisions under a Director (Research). In 2003 a new Poison Control Centre with 4 Toxicology research divisions under a Director (Poison Research) was again added. All these new Centre's and Research Divisions were fully equipped and accommodated in the newly completed Diagnostic and Vaccine Research Centre building and were now renamed the National Blood Research Centre and National Poison Control Centre. A separate Vaccine Factory where Hepatitis B Vaccine is to be manufactured was built in Hlegu, outside Yangon. In 2006 as a result of a change in policy by the Government the Diagnostic and Vaccine Research Centre and the Vaccine Factory with some of their sanctioned staff were transferred to the Myanmar Pharmaceutical Industries under the Ministry of Industry.

HSR is being further emphasized by the opening of a separate HSR Research Division in the Socio-medical Research Centre.

#### **1.4 *Central Co-ordination of Health Research***

The formation of policy-making bodies and coordinating mechanism for health research at national level in the 1990's is of great importance to the development of medical research in the country and a welcome revival of some of those which existed in the 1960's and disappeared in later decades. The Medical Research Council, constituted under the Medical Research Council Act in 1963, was an independent statutory body which set up various mechanisms and institutions to give direction, to coordinate and conduct medical research in the country. Later, in 1965, an apex level Research Policy Direction Board composed of Ministers was formed which then established the Research Development and Coordination Committee (RD&CC) to guide and coordinate all research in the country. Under RD&CC eleven Science Divisions were set up, one of which being the Medical Science Division responsible for coordinating health research and carry out other matters of common interest such as publication of a health science journal. All these bodies including the Burma Medical Research Council became defunct when the government was re-organized in 1973. The Burma Medical Research Institute was re-organized as the Department of Medical Research (DMR) and in addition to conducting medical research it became the principal source of advice to the Ministry of Health on matters concerning medical research. DMR assumed, by default, the research promotion, coordination and support functions of the defunct BMRC; and this role of DMR was endorsed, implicitly, by the Ministry of Health. Health research policy was determined implicitly, informally and ad hoc by The Ministry of Health.

The formation of the National Health Committee and the Health Policy Board in 1993 has now regularized and strengthened the former informal, ad-hoc mechanisms with which health research policy was determined and health research coordination at central level was done in the 1970's and 1980's. Formulation of national health research plans is now the responsibility of the Departments of Medical Research which they carry out in consultation with other Departments according to their research needs.

The Executive Body of the National Health Committee is the apex body which coordinates all health matters to be implemented by Departments under the Ministry of Health. Health research plans and programs to be implemented by the three Departments of Medical Research principally and by other Departments under the Ministry of Health, as appropriate, are coordinated by the Executive Body. When implementing national health research plans -- research programs and major research projects are assigned to different DMR's according to their respective research capabilities. The three DMR's are at different stages of development and their research capabilities differ so that in executing their mission, the DMR's take on tasks which differ in scope, level, magnitude, expertise and duration. The DMR (LM), being the first among equals, is assigned and take-on more of the national level, high technology, long term research programs and projects such as Hepatitis (B) Vaccine Research and Development and Poison and Toxin Research, for which it receives necessary support.

The DMR (UM) and especially DMR (CM) are still far short of their planned human resource requirements and infrastructure needs and are striving to fulfill these requirements while at the same time participating in some important long standing national level research programs like research on Drug Resistant Malaria, Snake-bite, Traditional medicine, and new programs such as Research on Human Reproduction, in addition to regional research programs of their own.

### **1.5 A Vision of Future Research Needs as Seen in 2001**

A vision of future research needs was projected in 2001 in the closing chapter of “The Growth and Development of Medical Research in Myanmar (1886 1986)” and is as follows:

*“In Myanmar, through successive development periods up to 1986, research planning and the research agenda had been according to disease entities and disease mechanisms, predominantly concerning diseases due to infection. In later years with the looming threat of the double burden of illness and recognition of the increasing importance of behavioral, socio-cultural factors underlying communicable and non-communicable diseases, a shift in the research strategy and emphasis was called for. Research strategies which take into consideration the epidemiological transition going on and which address both the double burden of illness – diseases due to deficiencies as well as diseases due to mal-adaptation, as the WHO Advisory Committee on Health Research puts it – were needed. Research strategies, plans and programs which were based on disease origins, which cut across disease entities and which deal with the underlying influences – such as urbanization, industrialization, demographic transition, life styles- were not visible up to the closing years of the development period ending 1986”*

### **1.6 Response to New Research Needs**

The appropriate response to the new research needs began to emerge during the new phase of growth and development in the 1990-2000 decades as reflected in the new organizational set up and change in research emphasis and research strategy of the DMR (LM), DMR (UM) and DMR (CM).

*Research direction upstream* -A new and important development is that the DMR’s, while conducting research that would help solve current and emerging priority health problems of the country, also began directing their research efforts upstream to study disease origins such as the socio-economic determinants of health and disease. DMR (LM), in particular, built up its capacity to undertake socio-medical research; it trained social scientists and introduced qualitative methods of research, and expanded the previous small nucleus of social scientists into a strong team with the capability of taking on important socio-medical research projects as well as to provide social science training to the newly established DMR’s in upper and central Myanmar. The high level of achievement of this team may be judged by the fact that its leading social scientist Dr Than Tun Sein was awarded the prestigious Leon Bernard Foundation Prize in 2007 at the World Health Assembly for outstanding service in the field of social medicine. He is considered a pioneer in the development of research methodology in equity and gender areas.

*Research direction downstream* - Moreover, the DMR’s were venturing downstream as well, into health technology development research which in previous decades was rudimentary at the DMR. Now, the DMR (LM) began producing vaccines, diagnostic kits and protective devices - which is a major shift in strategy. Hitherto, DMR had stopped short at invention and innovation, and although it may sometimes undertake production of new medical products and devices on a pilot, laboratory scale in order to demonstrate efficacy and feasibility, it then leaves further large scale production and manufacture to others (such as MPF), as in case of the Viper Venom Toxoid in the 1970’s. Now, however, DMR (LM) acquired the technology, developed the facilities, and not only succeeded in producing a recombinant Hepatitis B vaccine, it went on to manufacture this vaccine on a commercial scale at its Vaccine Manufacturing Factory.

It also ventured into commercial production of protective boots against snake-bite.

Such twinning of research and manufacture within a research institute and the placement side by side of research facilities of a research institute and manufacturing facilities of a commercial enterprise may also be seen in other countries - in India (at the Indian Institute of Immunology, Chandigarh), in Israel (at the Weizmann Institute of Science,) and in many developed countries. The realities of the present situation in the relationship between medical science, biological science and industry worldwide and now in Myanmar as well is that research institutions and Universities should not or would not be able to stay aloof from industry; it is a symbiotic relationship, a good example of which is Genentech - the first biotechnology company.

With the aim to conduct Research and Development of new vaccines, biological products and diagnostic test devices by using advanced technology Vaccine Research Centre was established at DMR (LM) in April 2012. Its Technology Development Division is currently engaged in the development of test kits for infection screening of donor blood. This is a collaborative project between DMR (LM) and Olipro Biotechnology Company from Malaysia. Two type of test kits are being developed –one which needs a scanner and computer for use at blood banks and, and another to develop a dipstick for use at the periphery.

This shift in strategy and expansion of function by DMR (LM) beyond research into commercial vaccine production was partly reversed when higher authorities decided to transfer the Hepatitis B Vaccine Factory with all its set-up to MPF; vaccine manufacture had always been within the domain of the Burma Pharmaceutical Industry (the predecessor of MPF) since it was established back in the 1950's. Another development which will further clarify the extent of DMR's role in such commercial enterprises is the production of ASV from animals other than horses. DMR (LM) has successfully developed a Viper antitoxin from chicken eggs which is now undergoing clinical trials. It remains to be seen whether DMR (LM) will be able to, or permitted to upscale from laboratory to commercial scale production of this Viper anti-toxin or whether it will transfer technology for commercial scale production elsewhere.

*Research cum service functions* - Another entirely new development in the functioning of the DMR was that it has deliberately stepped across the arbitrary, hazy boundary between research and service, to take on some service functions as well. Thus the recently opened Poison and Toxin Centre at DMR(LM) not only conducts research into environmental poisons but also performs analytical service to detect poisons in food and has even opened a "hot line" to give emergency information and advice to the public.

### **1.7 Advances in Information Technology**

BMRI/DMR has from its beginnings been making early use of technology to access, store, retrieve and share information, such as developing the Union Catalogue of medical library holdings in Myanmar, and being the focal point for WHO's Health Literature and Information Service (HELLIS) network, etc.

The rapid and tremendous advances in information technology in recent years enables large amounts of data and information to be handled very rapidly and efficiently; and the DMR's have seized the opportunities that have opened up. All three of them possess and effectively use computers and software for research and management of research. All or most research divisions and research units have access to the internet and to websites and data bases abroad. The libraries have become the nodal points for electronic transmission of data and information and repositories of electronic databases; they are rapidly becoming redundant as places for storing and lending books and printed material. This of course, is part of similarly changes in the country as a whole which is trying hard to keep abreast of the

rapid and tremendous advances in information technology taking place worldwide. The DMR's, especially DMR (LM), are making effective use of the advances in information technology with great beneficial effect on research and the way research is done. There need no longer be any substantial or significant gap in the information available to hinder research.

### **1.8 *Health Technology Development and Transfer***

Technology development has always been given strong emphasis by DMR (LM) and its predecessors and is one of the major strategies that have enabled it to keep abreast of developments in medical science elsewhere and to be the leading institution for medical research in the country.

BMRI/DMR has been at the forefront in transferring advanced up-to-date medical technology into the country. In the 1960's and 1970's decades, It was the first to use microbiological assay, radio-isotope labeling, radio-biochemistry, cell culture, parasite culture, chromatographic techniques, electron-microscopy, telemetric transmission of cardiac function, and many others. It pioneered the opening of new fields of study in medicine such as –virology, biochemistry, haemoglobinopathies and thalassemias, hepatology, others. Although In those early years it also made minor improvements and adapted imported technology, it did not make significant changes nor invent new technology. In recent decades, the DMR's, especially DMR (LM), have continued the pioneering tradition in health technology development and focused on Health Technology Development Research as a separate, priority field of study

DMR (LM) has established advanced techniques in molecular biology and molecular genetics including Polymerase Chain Reaction (PCR) and Reverse transcriptase PCR (RT-PCR) which has enabled it to precisely identify and genotype the bacterial, protozoal and viral agents of diseases like tuberculosis, malaria, dengue and HIV/AIDS. A concomitant development was the establishment of an Infectious Disease Laboratory (at bio-safety level 3) Other advanced techniques including high performance liquid chromatography (HPLC), atomic absorption spectrophotometry and Fourier transform infra red spectroscopy are being used for toxicological analysis in environmental studies.

A major advancement in technology was in the area of Hepatitis B vaccine development as part of the new downstream direction of research development. Development of the Hepatitis vaccine and its commercial production required large transfer of technology to DMR from abroad, followed by innovation and adaptation at DMR according to conditions in Myanmar.

### **1.9 *Human Resource Development***

The development of human resources for research is paramount-especially dedicated, qualified researchers. Skilled, well trained technicians are also important and essential for most types of research where complicated/sophisticated instruments have to be used routinely or where large quantities of data have to be collected routinely.

The number of doctors with postgraduate research degrees (MSc., M.Med.Sc., Ph.D., Dr.Med.Sc., etc) has increased greatly in Myanmar over the years, a considerable number being added every year; but only a few enter a career in academic medicine or medical research and so the pool of qualified medical researchers is limited. The DMR's draw upon this limited pool, as also other Departments and institutions with research programs, but to a much lesser extent. Therefore there is a large unfulfilled demand for qualified medical researchers and the number of sanctioned posts which remain unfilled is large, especially in DMR (UM) and DMR (CM).

**1.10 *International Support, Partnership and Links***

As stated in G&D Med Res In Myanmar, DMR (LM) has already gained a reputation for well-planned and executed research projects relevant to the country's health problems; this together with the excellent research infrastructure available continue to be a powerful attraction to the international research funding agencies seeking good and rewarding investments for health research and development in Myanmar; this reputation was reflected onto the other DMR's - (UM) and (CM) which opened later.

The principal source of international funding of the DMR's is WHO, TDR and HRP whose long term institutional strengthening grant (LID) and resource maintenance grant (RMG) continue to support much of the research and research development activities. UNDP provided support to DMR (LM) for further expansion of Medical instrumentation Division. UNDP also provided the support that enabled DMR (LM) to venture for the first time into commercial scale production of a vaccine: viz. plasma derived Hepatitis B vaccine.

Long term institutional strengthening support by JICA has terminated but Japanese research institutions and scientists continue to provide research training and form partnerships with individual DMR scientists in previously collaborated research fields such as Virology and particularly DHF studies.

A new partnership with Korean scientists has begun. Similarly, collaboration with IAEA continues with respect to Nuclear medicine; and also with Welcome Foundation and Oxford Clinical Tropical Unit with respect to snake-bite research.

Moreover, well qualified DMR researchers working in well-equipped research laboratories with good access to patients in hospitals and the community for field work were encouraged and able to compete successfully for grants from regional and international funding agencies such as WHO, TDR, HRP and UNICEF. Such competitive grants have not yet been very well utilized by universities of medicine, and they should be encouraged and helped to do so.

**1.11 *National Level Scientific Partnerships and Links***

The DMR's, in accordance with their functions and as coordinated by the Ministry of health and the Health Research Policy Board, forms partnerships and links with other Departments and health institutions under the Ministry of Health to collaborate in research activities as well as to provide support for health service programs, medical education and training programs of these other Departments and institutions.

However The DMR's have no formal standing partnership with other Departments and institutions under other Ministries and have, with a few notable exceptions (see 1.12.c. nutrition research, below), no ongoing collaborative research with other research institutions such as Central Research Organization, the Development Centre for Pharmaceutical Technology, and the Veterinary Research Institute (VRI) although there are occasional ad-hoc, short term collaborative research projects such as with the ARI on development of high iron content rice strains and there are always ad hoc contacts and interaction at scientist level. Establishment of Research Units at some Departments of Art and Science University may be a rewarding venture.

**1.12 *Medical Research Ethics***

DG/DMR (LM) is given the responsibility for organizing the National Medical Research Ethical Committee which scrutinizes and give ethical clearance for all national level research projects in the county especially those in collaboration with foreign counterparts. In 2012, with the growing need for promoting Bioethics in research institutions, the Department of Medical Research (Lower Myanmar) expanded its Ethical Review Committee with

members from outside the institution and implemented bioethics workshops with international and local speakers and attained Federalwide Assurance (FWA) for protection of Human Subjects.

## **2. Major Research Areas and Research Programs at the DMR's and the Policy Basis for Choice of Programs and Projects**

The *Health Research Program* is the framework within which the DMR's carry out their research and research development programs

*The 15 top priority health problems/conditions* set out according to refined criteria in the National Health Plan (2006-2011) are:

- (1) Auto-immune-deficiency syndrome /Human Immune Virus disease (AIDS/HIV)
- (2) Malaria
- (3) Tuberculosis
- (4) Diarrhoe, Dysentery
- (5) Cholera
- (6) Avian Influenza
- (7) Dengue Hemorrhagic Fever (DHF)
- (8) Vaccine preventable diseases
- (9) Protein Energy Malnutrition (PEM)
- (10) Post-partum hemorrhage/ante-partum hemorrhage
- (11) Drug abuse
- (12) Pre-eclamptic toxemia and hypertensive disease of pregnancy
- (13) Leprosy
- (14) Sexually transmitted diseases
- (15) Disasters.

**The Health Research Policy Board** has laid down the following *guidelines (HRPG)*:

- (1) To promote health research by strengthening research capability through development of manpower, technologies and infrastructure;
- (2) To identify factors affecting national health, and to conduct research for effective control and therapeutic measure;
- (3) To identify factors promoting national health and to institute appropriate measures for community practice;
- (4) To promote and conduct health systems research;
- (5) To investigate major communicable and non-communicable disease problems prevalent in Myanmar for effective control and therapeutic measure;
- (6) To investigate major nutritional problems prevalent in Myanmar for effective control and therapeutic measure;
- (7) To promote and conduct reproductive health research in accordance with the National Health Population Policy;
- (8) To translate research findings into practical applications.

The National Health Committee identified *six priority diseases* for research which are: malaria, tuberculosis, diarrhea, dysentery, diabetes, and hypertension.

The Health Research Program (HRP) was formulated in accordance with the National Health Research Policy and the Health Research Policy Guide-lines (HRPG) and also took into consideration the top ranking diseases identified in the National Health Plans.

Health Research Plan was implemented mainly by the Departments of Medical Research, although other Departments sometimes participated as collaborators in the implementation of

the HRP by the DMR's or they may sometimes undertake some of the relevant research projects on their own.

The *general objective* of HRP is to conduct research in order to solve the health problems of the community.

The *specific objectives* are:

- (1) Research on communicable diseases including emerging and re-emerging infectious diseases threatening national health
- (2) Research on non-communicable diseases highlighting diseases relating to changing life styles
- (3) Research on environmental health (within the general objective of research on other health problems which need further elucidation) with an emphasis on the hazards of environmental pollutants.
- (4) Health Systems Research with special emphasis on health delivery systems
- (5) Traditional Medicine research with emphasis on traditional drugs.
- (6) Academic and technology development applicable to disease diagnosis, prevention, control and management
- (7) Research capacity strengthening through development of infrastructure and human resources for effective health research

Within the general framework of the above research and research development activities *DMR (LM) adopts additional criteria* in choosing specific disease and health problems for research, namely:

- (1) Magnitude and priority as a health problem,
- (2) Probability of finding a solution or an important clarification,
- (3) Benefits expected from the application of the results of successful research efforts,
- (4) The potential usefulness of the research in finding solutions to other problems, and
- (5) The existence of a situation which covers a special advantage for a particular research and which should be exploited.

The newly opened DMR's probably used criteria which are similar to the above. Being newly opened and still building up resources they could undertake only a few of the research programs described below and carried out by DMR(LM), except for some research on malaria, reproductive health, HSR and a few others.

There may be ad-hoc shifts and changes quantitatively and qualitatively in research undertaken due to rapid changes in health conditions and developments in medical science or due to unforeseen feasibility and resource constraints.

It is noteworthy that whereas Nutrition research has been high on the priority research programs at DMR/BMRI from inception it is not now included separately as an objective, perhaps reflecting the fact that much is already known, through decades of research, about nutritional diseases and deficiencies and methods of solving or ameliorating them and that the results of research are already being incorporated in ongoing health care programs. For example, goiter and iodine deficiency disorders have been eliminated as a scourge in Myanmar and only mopping-up operations are in progress. Nutrition research is now being undertaken as a component of studies on Non-communicable diseases,

New fields of study have been opened up for the first time at the DMR's. Research in reproductive physiology was being done at IM2 in the early 1970's and some collaborative research on Maternal and Child Health was done by the Ob & Gyn. section of MMA in the 1980's but it was limited and not sustained. The new WHO/HRP sponsored research program on Reproductive Health, undertaken principally by DMR (LM) and DMR (UM) in collaboration with the Women's Hospitals in Yangon and Mandalay, is wide ranging and will

open up many new research topics as well as develop necessary infrastructure. Environmental health research has become recognized as a separate research objective reflecting harmful changes in the environment in Myanmar. Research to detect and monitor toxicological hazards -physical, chemical, biological—and development of measures to prevent and lessen their deleterious health impact is now being done by DMR (LM).

Although snake-bite is not ranked in the top fifteen priority diseases in the National Health Plan 2006-2011 snake bite research continues at the DMR especially at DMR (LM), one important reason being the promising results in the experimental production of anti-snake venom from hen eggs with the possibility that this may in future overcome deficiencies in the manufacture of ASV from horse serum.

## **2.1 Research on Communicable Disease**

Research on communicable diseases emphasized the three major diseases which are malaria, tuberculosis and HIV/AIDS; and include diarrhea, dysentery, viral hepatitis, DHF, leprosy, and others.

### **a. Malaria research**

DMR (LM) /BMRI started malaria research after the discovery of drug resistant malaria parasite in Myanmar in 1969, in which a DMR clinical scientist participated, By the 1970-80's it had established new research techniques in parasitology, biochemistry and entomology which hitherto were unavailable in Myanmar. Using animal models DMR was able to demonstrate significant anti-malaria activity in the *Artemisia annua* plants grown in Myanmar from seeds available from elsewhere. Malaria research continues now in DMR (LM) at many of its Research divisions especially Parasitology, Entomology, Epidemiology and the two Clinical Research Units for Malaria. Research on drug resistant malaria parasites is the main focus and includes detection and monitoring of current and emerging anti-malarials, especially Artemisine derivatives, as well as the renewed efficacy of chloroquine for *P. vivax*. The clinical aspects are investigated on patients in hospitals and public health aspects are studied on communities in the field. Parasitology Research Division is the only place in Myanmar where, since the 1980's, malaria parasites are cultured in-vitro and drug sensitivity may be tested. It is the only place where molecular techniques are used to detect resistant gene mutation. Entomological research continues at the Medical Entomology Research Division where insecticide resistance has been tested since the 1980's. It studies the bionomics and role of various *Anopheles* strains in malaria transmission. It is only place where mosquito colonies are been continuously bred and maintained and where biochemical, immunological (Elisa) and genetic methods including cyto-genetic techniques are used to study mosquito strains, their infectivity and population genetics. Epidemiology Research Division has been involved in malaria research since the early years; it pioneered the study of forest fringe malaria as a distinct ecological zone. It now engages in studies to study the effectiveness of various social interventions to prevent, detect and treat malaria at home and in the community.

*In vitro monitoring of drug resistant status of Plasmodium falciparum (P.f.) continued in different endemic areas revealed higher percentage of resistant cases and the requirement of higher effective doses of the drugs for parasite clearance compared to previous years.*

*In Paan and Tarchileick, mutation specific Polymerase Chain Reaction (PCR) using appropriate pairs of primers amplified the drug resistance loci of *Pfcr* and *Pfmdr1* for chloroquine and *dhfr* and *dhps* for sulphadoxine /pyrimethamine respectively.*

*Initial molecular entomology studies proved that *An. minimus* from Pyin Oo Lwin Township were provisionally identified as *An. minimus* species A and *An. dirus* species from Mudon Township were previously identified as species D. Cytogenetic method for detailed*

*identification of Anopheles culifacies was developed and standardized in the field and laboratory.*

*Studies on therapeutic efficacy of Artesunate-amodiaquine and Artemether-lumefantrine combination as randomized control trials in 4 sentinel sites: Yakhine, Kayin, Mon and Kachin States. Therapeutic efficacy investigated on 70 subjects showed 3 late treatment failure cases. On molecular analysis one re-infected case and 2 true recrudescence cases were detected.*

*Enhancing role of pfmdri86 mutations was found in increasing in vitro dihydroartemisinin sensitivity of P.f. Molecular tools were applicable in relation to invitro test for monitoring of CQ resistant vivax malaria.*

*Insecticide treated net studies and Parasitemia: The study conducted in three endemic areas revealed that deep knowledge in EDPT in malaria and trust towards Basic Health Staff could attract the interest of village authorities leading to success in organizing and consensus building for social mobilization.*

*An operation research explored dimensions of strengthening malaria prevention & EDPT in seven villages of Shan, Lahu and Akhar groups in eastern Shan State. Bridges for implementation were adaptation and acceptance towards impregnation of bed nets and easy communication of community owned resource persons to their local people.*

*Malaria volunteers: a cluster randomized controlled trial proved: the role of community volunteers on improving early diagnosis with rapid diagnostic test and treatment of malaria with artemisinin based combination therapy: its impact on malaria morbidity and mortality and the acceptability by the community and health staff.*

*(Excerpts from Khin Thet Wai, DD Research, DMR (LM) on Research Findings relevant to HIV/AIDS, Malaria & Tuberculosis: User Friendly Highlights)*

**Malaria research at DMR (UM) and DMR (CM)** consists mainly of drug resistant studies, epidemiological and entomological surveys, HSR and social studies.

The major areas where malaria research is being done at DMR (UM) include:-

(a) Drug resistant malaria –therapeutic efficacy of Artemisin-based drug combinations in *P. falciparum* infections, and revived efficacy of chloroquine in *P. vivax* infections, (b) Malaria epidemiology and entomological surveys—in selected townships and unreached areas and population groups (c) Studies of the role and functioning of different components of malaria control program such as:-sale of anti-malaria medicines in drug shops, provision of insecticide- treated bed nets to the community, compliance of basic health staff with standard anti-malarial control procedures; socio behavioral studies of forest related workers, participation of private general practitioners in malaria control, patient choice of treatment options for malaria, etc.

b. Tuberculosis research

Up to 1986 DMR (LM)/BMRI were not involved in TB research. Later, with the recognition of tuberculosis as among the top priority diseases in the National Health Plan, DMR took on tuberculosis research. It uses Polymerase Chain Reaction (PCR) to identify DNA of Mycobacterium tuberculosis and gives laboratory support for research which needs to detect M tuberculosis in minute amounts of biological material such as research on TB meningitis and research on co-infection with HIV and TB. It undertakes (in collaboration with DOH) the testing of anti-tuberculosis drug resistance pattern among various special groups and communities and evaluation of the utility of various diagnostic test kits for TB.

**Multi drug resistance was noted in 3.96 % of new sputum positive pulmonary tuberculosis patients. Anti-IgG ELISA test was better than anti IgM ELISA in sero diagnosis.**

*Acute Drug Reactions can affect compliance and defaulter rates in MDR TB treatment. The most frequently encountered acute drug events associated with second line anti TB drugs in MDR-TB patients include dizziness, vertigo, (47.9%) , nausea vomiting (34.4%) and abdominal pain (24.4%). ADR monitoring may be needed to overcome this problem.*

*Pattern of ant-TB drug resistance among HIV patients with pulmonary TB attending specialist Hospital, Waibagi, highlighted the magnitude of MDR-TB among HIV patients. Anti-TB drug resistance-68.2 %; MDR-TB 65.9%, SIRE +PZA- 11/29 MDR cases.*

*Study on treatment outcome of MDR-TB treated with **herbal drugs in combination with Amoxicillin ,clofazimine, ,quinolone and kanamycin** showed that 83.3% of patients in 30 Category II failure patients and 50% of in 14 culture positive MDR TB patients obtained cure after 2 years of treatment without subsequent relapse.*

*A **multi-center clinical trial of traditional medicine** on 50 MDR TB patients indicated sputum conversion to negativity in 27 out of 32 Cat II failure (84.4%) after 3-6 months of treatment, and 6 out of 18 Cat IV failure cases(33.3%) after 6-8 months of treatment..It can be rationally concluded that traditional medicine may have a potential in the treatment of MDR-TB patients in future.*

***Perspectives on DOTS program** in Pyay township reported compliance as a major factor for defaulter cases and non adherence to treatment as the commonest cause of 'failure'. The involvement of GP's in TB control could be beneficial to TB patients and the NTP..Lack of trust, limited resources in the public sector and weakness of township level coordination were the hindrances.*

*A study focuses on **strategies for public private partnership** in TB control. A weak system of paper referral and poor record keeping in both the public and private sectors resulted in weak evidence of GP's referral practices to the public sector. BHS views were sought with regard to the practice of GP's referring poor patients to the public sector. It is essential to sustain partnership between the private and public sector*

*(Excerpts from Khin Thet Wai, DD Research, DMR (LM) on Research Findings relevant to HIV/AIDS, Malaria & Tuberculosis: User Friendly Highlights)*

c. HIV/AIDS research

HIV/AIDS was beginning to loom as a threat to Myanmar by about the early 1980's. Recognizing this DOH began a program of surveillance which included serological testing and screening for HIV antibodies in different population groups. DMR also quickly responded by setting up Elisa and Western Blot tests and screened sex workers with negative results. Since DOH had adequate facilities to conduct the type of epidemiological studies that were required at that time and was doing a better job at it DMR discontinued all testing and did not pursue any more research on HIV/AIDS.

DMR resumed research on HIV/AIDS when it became the second ranking priority identified in the National Health Plan. It set up advanced molecular methods not readily available elsewhere to study the HIV virus including Reverse transcriptase polymerase chain reaction (RT-PCR) and in collaboration with NHL the inexpensive Peptide enzyme immunoassay (PEIA) tests. These were used to study molecular diversity of HIV 1 and to determine prevalence of HIV 1 subtypes among different risk groups from sentinel sites in Myanmar. Surprisingly very little directly relevant research was done by the Epidemiology and HSR Research Divisions of DMR and most of such research was carried on by DOH.

*A study on survival rate in symptomatic HIV infected patients determined the commonest clinical symptoms and **risk factors related to survival.***

*The molecular diversity of HIV 1 infection was investigated in 40 positive individuals and 22 samples were successfully amplified by reverse transcriptase- polymerase chain reaction (RT-PCR)*

*Although subtype C predominated among the heterosexuals definite subtype distribution could not be assigned to the other risk groups.*

*Plasma viral load measurements in patients on ART will lead to better monitoring of treatment and earlier detection of treatment failure*

*The usefulness of PCR in rapid and definite diagnosis of TB in smear negative HIV patients was proved. MDR-TB was found in 65.9% of isolates from HIV-TB co-infected patients at the Specialist Hospital, Waibagi. Pyrazinamide resistance was found in 41.4 % of isolates.*

*In management of HIV infections the total lymphocyte count could provide useful information to monitor degree of immunosuppression and could be used as an alternative to CD4 lymphocyte count.*

*(Excerpts from Khin Thet Wai, DD Research, DMR (LM) on Research Findings relevant to HIV/AIDS, Malaria & Tuberculosis: User Friendly Highlights)*

d. Dengue infection and Dengue Hemorrhagic Fever research

This subject has been studied by DMR (LM) since the 1970's when DHF first appeared in Myanmar. An important contribution to the understanding of DHF/DSS was the result of a study by DMR virologists in collaboration with others from DOH in the late 1980's that sequential infection with Dengue 2 was the probable pathogenesis for DSS. This was the only study (apart from earlier Thai study) that has provided valid scientific evidence that risk of developing DSS is significantly higher in secondary dengue infections, particularly with dengue serotype 2.

A new impetus to Dengue research was given when advanced virological, molecular and genetic methods were introduced to DMR from the 1990's onwards- such as PCR, RT-PCR and techniques to clone and sequence the virus isolates. New contacts between DMR and WHO Collaborating Centre for Arbovirus Reference and Research in Brisbane, Australia made some of this possible. Studies on genetic diversity in Myanmar dengue virus were carried out and new observations were made on the genetics of Dengue 1 virus in Myanmar. Molecular epidemiology studies were undertaken and phylogenetic trees drawn with the DNA sequences of dengue viruses to identify the emergence of new viral strains and establish the relationships between Myanmar dengue strains and global strains. Analyses of dengue 1 viruses isolated from one of the largest outbreaks of dengue in Myanmar revealed that the lineage that had been circulating for the past 25 years had become extinct and two new lineages of dengue 1 (DEN-1) had emerged. These studies have important implications for the formulation of an effective dengue vaccine as well as timely implementation of control measures in preventing DHF outbreaks.

e. Research on Viral Hepatitis

Viral hepatitis has been studied by DMR (LM)/ BMRI since its earliest years in the 1960's. By the 1970's and 1980's DMR was doing pioneering research on Non-A non B hepatitis in Myanmar which later turned out to be Hepatitis E. It studied the epidemiology of vertical and horizontal transmission of Hepatitis B virus and demonstrated the possibility of preventing vertical transmission by vaccination with plasma derived Hepatitis B vaccine and later a yeast based Hepatitis B vaccine was also tested. The results paved the way for future program of Hepatitis B control in Myanmar.

Innovative studies from early 1990 s to date included the development of local immunodiagnostic test kits; studies on the prevention of hepatitis infection by vaccination

and the development of vaccines; the molecular biology, immunology and the genetics of hepatitis viruses; and the epidemiological and clinical consequences of infection. It developed new treatment modalities for chronically infected patients which are appropriate for developing countries.

DMR has emphasized the emerging danger of hepatitis C infection in Myanmar which has been tested positive in 2.5% of the general population 25% in patients with liver disease. DMR is pursuing research on clinical and preventive aspect of this infection which poses a danger of developing liver cancer. Clinical trials have been conducted to test various agents including interferon and immune-modulators and systemic phlebotomy.

In collaboration with WHO, UNDP, IAEA and JICA, DMR has developed several immunodiagnostic test kits which have been used for routine screening, diagnostic and confirmatory purposes as well as for sero-epidemiological surveys. These are RPHA and ELISA and RIA test Kits for hepatitis B, micro PA test and ELISA test kits for hepatitis C, ELISA tests for hepatitis A, hepatitis E and alfa-fetoprotein.

Another important leap ahead is the successful setup of the molecular biology laboratories at DMR to carry out the molecular and genetic research on hepatitis viruses. Molecular research is being done by using Reverse Transcription (RT) and Polymerase Chain Reaction (PCR). Determination of HCV types and subtypes by RT PCR amplification and nucleic acid sequencing is being done and further phylogenetic analysis revealed that 3 new type 6 subgroups exist in Myanmar

The outstanding achievement for DMR is the successful development of hepatitis B vaccines; the development and small scale production of plasma-derived and yeast-derived hepatitis B vaccine in collaboration with WHO and UNDP, which has been used all over Myanmar since 1997. Later, the development of recombinant hepatitis B vaccine was carried out at the WHO GMP standard Hepatitis B Vaccine Plant at Hlegu with assistance from Republic of Korea in 2004. Clinical trials conducted by DMR scientists in 2006-2007 confirmed the safety and immunogenicity of both vaccines in newborns. The local development of effective vaccines will play a key role in the control of viral hepatitis in Myanmar.

f. Research on Diarrhoea and Dysentery

Research continues as before on etiological agents and drug resistance using conventional serological as well as newly developed molecular methods. Studies were done on decontamination of water, and reduction of bacterial pathogens by means of alum, sunlight, citrous lime-juice.

Studies continue on rota-virus diarrhoeas including efficacy, safety and complications of rota-virus vaccines. Recently molecular biology techniques have been introduced and PCR is now being used to detect and characterize etiological agents of diarrhoea prevalent in Myanmar.

g. Research on Acute Respiratory infections

This is mainly on identification and surveillance of causal agents and drug resistance using conventional, serological methods as well as newly developed molecular methods.

h. Research on Avian Influenza and Severe Adult Respiratory Syndrome (SARS)

DMR did confirmation tests on 8 clinically suspected cases of Avian Flu using RT-PCR. All cases were negative and this was re-confirmed at WHO Collaborating Centers in Japan and Australia as negative for H5N1 virus.

i. Leprosy research

DMR is the only place where mouse foot-pad inoculation method of drug sensitivity testing is being done since the 1980's. DMR continues to provide this service to DOH during the mopping up operations for remnant of leprosy cases in Myanmar.

Leprosy control activities are being used as an entry point for a new HSR project. (*see under HSR in Chapter 7*)

**2.2 Research on Non-communicable Diseases**

a. Snake bite research

DMR/BMRI started research on snake bite in the 1970's. Establishment of a Clinical Research Unit at Tharawaddy Hospital, up to date laboratory facilities and collaboration with Oxford University scientists enabled DMR to undertake an extensive program of research into the clinical, hematological, biochemical, pathological and therapeutic aspects of viper envenomation, which contributed much to current understanding of the mechanism underlying the clinical features and complications leading to death in some cases. They indicate how best to manage snake bite and viper envenomation. The sound scientific results of snake bite research of that period are the solid basis for further research now.

Another phase of extensive research including some innovative approaches began at DMR from the 1990's onwards. The research done could be classified as follows:-

Research on anti-venom- this included studies of potency, efficacy, stability and kinetics. Innovative study on the experimental production of potent ASV from chicken eggs was successfully carried out. Although such research originated elsewhere in Australia and India in 2010 and before, further modifications and adaptations had to be done at DMR. Clinical trials have been carried out; this is the first time such Viper ASV from hen eggs are tested in human patients. Production of ASV by this method will be easier and less expensive than in horses. There is good prospect that large scale production of ASV by this method will replace or supplement the present inadequate production in horses.

Research on clinical features was carried out extensively in different geographical places in Myanmar- to find common features, differences and prognostic factors.

Epidemiological research

This included incidence, case fatality rate, survival factors, knowledge/attitude/practice and treatment seeking/avoidance behavior; snake bite survey and control.

Research on First aids and preventive measures - this included trials in monkeys and humans to demonstrate the efficacy of compression-immobilization technique; tourniquet efficacy; and effectiveness of intramuscular injection. Research was done on boots to modify them so as to be safe against snake bites.

Research on immune diagnosis- this includes assessment of dip-stick, immunoassay and immune-metric methods.

Research on immunology- this included study of the cellular response and the humoral antibody response in green pit viper, king cobra, Russell viper bites; and humoral response to toxoid and to traditional immunization.

Research on pathophysiology and sequelae- this included hematological changes like disseminated intravascular clotting; endocrine, biochemical and cardiovascular changes; hepatic involvement; histological changes in many organs; renal function disturbances including acute renal failure and dialysis.

Research on venom-this included venom injected and venom yield; its composition, biological and biochemical properties. It also includes variations in amount according to age, length of snake, geography and season.

Research on toxoid-this included its properties like stability and reversion, immunogenicity, antibody response, trials

Research on different snakes- this included cobra, green pit viper, king cobra ,krait, Malayan pit viper, sea snake bites and spitting viper bites..

Research on management –this included management using anti-venom, heparin and management of acute renal failure; management in cases of unknown bites.

b. Research on Environmental Health

National Poison Control Centre (NPCC) was established was established in 2003 with six objectives one of which is: To conduct research on the hazards of poisoning, its prevention, control and management, and to apply and make recommendations from the findings in clinical and environmental settings.

It also aims to provide analytical toxicology services, conduct surveillance and monitoring of hazards of poisoning and provide preventive toxicological information to the community, especially high risk population groups.

NPCC is currently conducting research on:- presence of various toxic chemicals like arsenic, lead, pesticide in ground water, food, and in the blood of selected groups; presence of bacteriological and mycotoxins in food and furthermore it is studying the consequence and effects of such poisonings. It is also studying the present situation of acute poisoning in hospitals (YGH, YCH) and of pesticide residues in the environment (Inlay ecosystem) and poisoning in the community.

c. Nutrition research

BMRI/DMR (LM) has been conducting Nutrition research since inception and made pioneering studies on Iron and folic acid nutrition among Burmese population groups. DMR (LM) is now continuing similar types of studies in general. Nutritional studies are now more focused on adolescent age groups both female and male. An innovative new research project on iron content of rice varieties in Myanmar and measures to produce a mutant strain with high iron content induced by gamma irradiation was carried out in collaboration with the Agricultural Research Institute. A new program of research on the diet of Diabetics in Myanmar has been started.

d. Physical Fitness

The importance of the study of Physical Fitness was recognized by the Burma Medical Research Council when it established the "Expert Technical Committee for the Study of Physical Fitness of the Burmese" in 1968.This Committee undertook some studies and laid down a program of research which served as guidance for many future years.

DMR collaborated with the Dept of Sports and Physical Fitness in studies of athletic performance and physical fitness during the early years since 1968 and up to about 2000 decade.( see section 5.6) Later it took up the WHO Project on Adolescent Health focusing mainly on the social and behavioral aspects as well as physical fitness of adolescents.

e. Research on Health of the Elderly and of Youth

Research on the Elderly program at DMR started in 2009. Base line data on health and resource needs of the elderly is being collected

f. Research on Reproductive Health

This new research program was in accordance with Guideline of the HRP and made possible by long term institutional strengthening grant of WHO/UNDP Human Reproductive Health Program (HRP) and carried out in collaboration between the 3 DMR's and Women

Hospitals of the DOH. It focuses research not only on health problems during pregnancy and childbirth such as pre-eclampsia but also on reproductive health in hitherto unreached target groups like adolescent youth and vulnerable groups like adolescent migrants; it includes studies on the social-economic and cultural determinants, knowledge-attitude-practice studies; and on measures to improve reproductive health.

### **2.3 Health Systems Research**

HSR is a major area of research at the DMR's and the HSR Research Division of DMR (LM) takes the lead in quantity and quality. However many Research Divisions of all three DMR's also carry out HSR which account for a large volume of the total output. A content analysis of HSR done at DMR (LM) during the last decade has been carried out with respect to what, where and how utilized. A similar study of HSR at DMR (UM) and DMR (CM) has also been carried out. (*see under Chapter 8 section 8.7 on HSR*)

### **2.4 Traditional Medicine Research**

Research on traditional medicine has been carried out at BMRI/DMR since its early years. A research program for the standardization, pharmacological and toxicological evaluation of traditional drugs and herbal medicines was started then at the Pharmacology Research Division and continues. Clinical trials are now being done at the Clinical Research Unit (Traditional Medicine) established by DMR (LM). DMR (UM) conducts research on traditional medicine along similar lines. Like DMR (LM) it also selects traditional medicinal drugs that may be used in the treatment of problem diseases in the country such as hypertension, diabetes mellitus, malaria, etc. as priority areas. It performs clinical trials on drug formulations used in the Department of Traditional Medicine and some which are already widely accepted by the community including reputed drug formulations for lowering blood glucose, blood pressure, and for anti-parasitic and anti-bacterial activity in malaria, diarrhea and dysentery.

Standardization studies on traditional drug formulations are now being carried out also at the Department of Traditional Medicine

## **3. The Interrelationship Between Developments in Medical Research, Medical Education and Health Services**

The complementary role of medical research to medical education and vice-versa is best exemplified by the reciprocal beneficial impact of the multiplication of post graduate courses at the Institutes of Medicine and successor Universities of Medicine from about 1970's onwards - and the opening of research departments, disciplines and laboratories such as Virology, Entomology, Experimental Medicine ; and research programs such as on snake-bite , nutritional anemia, haemoglobinopathies, viral hepatitis B,C E, Reproductive health, Traditional medicine, and many others at the Burma Medical Research Institute and the successor Department of Medical Research /DMR(LM) from 1963 onwards. Further advancement of this reciprocal benefit took place when the DMR (UM) and DMR (CM) were opened in close proximity to the Universities of Mandalay and University of Magwe. The variety of scientific activities of the DMR's including scientific meetings and scientific workshops in which the nearby Universities participate has enabled students, especially postgraduates, to have better and easier access to up-to-date scientific knowledge and technologies. Also, postgraduates of the Universities of Medicine who were attached to the DMRs' for the research component of their academic courses were able to gain entrance into these new research areas and disciplines available at the DMR.

Similarly, many health service programs of the Dept of Health such as malaria, polio, leprosy, AIDS, health of the elderly, etc. include embedded research components, programs and projects in which researchers of the Departments of Medical Research and teachers and postgraduates of the Universities of Medicine participate and gain mutual benefits. Professors and senior Faculty members of the Institutes/Universities of Medicine now have a continuous stream of research assistants to carry out research, and research departments and research programs of other Departments could also tap this large reservoir of research assistants to help with their research projects while offering research training, supervision and advanced laboratory facilities or clinical facilities, field stations and access to patients and community.

The research institution was the place where previously many new medical innovations and new medical technology were introduced into the country and disseminated, such as electron microscopy, radio-biochemistry, virology, microbiological assay, cell culture, medical statistics, etc. at BMRI/DMR, in the 1960 and 1970 decades. The DMR's continue to do so - such as the establishment of PCR, malaria parasite culture, DNA technology, etc at DMR (LM) in recent years.

Health services, particularly teaching hospitals, are also now taking the lead in introducing new medical technology into the country in order to provide advanced medical care to patients but which then become available for teaching and research. New Imaging techniques such as ultrasonography, computed tomography, magnetic resonance imaging enable better visualization of body structure and organs; new methods of assessing cardiac, pulmonary, hepatic, renal and hematological function are now available at specialty units of teaching hospitals; even some aspects of brain function such as sleep physiology is now being studied. Some of these advances in medical technology are gradually rippling out peripherally to regional and township hospitals and even becoming available at private medical hospitals and clinics. None of the above clinical medical technologies are available at medical research institutions but are now accessible to them at the service institutions for research purposes. The opening of such specialty units with advanced medical technologies have made it possible for new academic courses and degrees to be given by the Universities of Medicine such as Dr Med Sc (Respiratory Medicine) (Nuclear Medicine) (Thalassemia), etc.

A comparison of the research done at the DMR's, Universities and DOH shows the following:

Generally, DMR research projects seem to be more compartmentalized according to division/department (like Bacteriology dept. etc); vertically disease oriented (like malaria, snake-bite, etc) in spite of the professed intention to focus on underlying causes upstream like urbanization, industrialization, etc. They are executed by staff who are anchored at DMR for laboratory work with occasional temporary visits/trips/ to work-sites, hospitals/ wards /clinics/field to collect specimens or for occasional bed-side laboratory tests but not for clinical work which is not within their responsibility or capability.

Whereas some of the service programs are *horizontal* and broad (like Vector borne diseases control program; vaccine preventable childhood diseases control program, healthy cities and healthy rivers service projects). Some DOH planned research projects, although vertically disease oriented like malaria and planned at central level by program managers, are executed by basic level multipurpose workers in the field or by clinically or technically competent staff in hospital. Unplanned Operational Research which comprises the bulk of DOH research activities are done as part of routine activities by DOH staff at different levels including basic multipurpose workers.

Maybe research upstream is not feasible for health research organization to do alone and need more coordination and collaboration with other sectors.

#### **4. A SWOT ANALYSIS – strength, weakness, opportunity, threat**

A **SWOT** analysis of the DMR's reveals the following:

**STRENGTHS** at present are:

1. Research is designated as the primary function of DMR's by the government whereas research is designated as secondary or tertiary function of other health organizations/institutions.
2. DMR's have well formulated plans and programs for research and mechanism for proper coordination of its projects.
3. DMR scientists mostly have postgraduate research qualifications/degree and specialized research training.
4. DMR's have advanced facilities and skills for basic research which are superior to those of others.
5. DMR's attracts postgraduate to do its research projects and collaborators from within and without the country for joint research projects.
6. DMR's can access, attract and obtains research funds from other governmental organizations as well as NGO's from the SEA region and elsewhere.
7. DMR produces proportionately the largest number of high quality research papers some of which are published in prestigious international journals.

**WEAKNESSES** at present are:

1. Most of DMR's research programs are correctly meant to support health service needs and programs. They are now mostly dependent upon and follow the initiation of health service programs and are seldom independent or lead in front of the service programs.
2. DMR's are weak in the number of skilled and experienced clinical scientists and perhaps also in the number of public health scientists with wide practical field experience
3. DMR's government research budget is limited and cannot cover essential items which extra-budgetary funds will not support ( e.g. library)
4. DMR's are called upon to show that its research programs and projects are utilizable and utilized and benefits the health of the country; that they are utilizable for health care and health services and not just of a high scientific quality.

It is often overlooked that one of the aims of DMR is to increase the level of scientific knowledge in the country. Its output is largely judged by its ability to improve the health of the people and economy of the country.

5. DMR's are unable to adequately support research in other health institutions which is one of its stated missions.

**OPPORTUNITIES** at present are:

1. DMR's are free from pressure to perform and provide services and able to plan its own Departmental level research programs.

**THREATS** at present are:

1. DMR's may be by-passed or marginalized by the increasing capability of other organizations/institutions to undertake research, especially by the health services which are usually dependent upon DMR's research output for effectiveness of their service programs and projects.

2. DMR's may not be able to maintain an intellectual climate conducive to research.

An unacceptably large proportion of the research projects may be pedestrian, or routine. A large proportion of their scientists may not be dedicated or committed to research and keep on working unimaginatively to a well worn path.

## **CHAPTER 4**

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## **Section 4.1**

### **University of Medicine 1(Yangon)**

**by Aye Maung Han**

#### **1. Research Role**

The University of Medicine (1) Yangon undertakes medical research as one of its functions in addition to its primary function of producing basic and specialist medical doctors. Therefore the University imparts knowledge and also generates knowledge. Research is undertaken as an integral component of its post-graduate teaching program and also as collaborative or individual research programs in the respective departments as time and opportunity/funding allows. Consultant medical staff of hospitals under the Department of Health (DOH) designated as Teaching Hospitals of The University of Medicine (1) Yangon provide patient care as well as teach clinical medicine, performing joint functions as service personnel and teachers. They also undertake clinical research as an additional task, thus carrying out the triple function of service/ teaching/ research in varying degrees in that order.

#### **2. Research Facilities**

##### **At pre-clinical teaching department**

Research facilities can be provided for the postgraduate candidates by some pre-clinical teaching departments of the University of Medicine (1) but there are departments that are still unable to provide such facilities, especially adequately equipped laboratories, and therefore additional support is provided by institutions/Departments under the Ministry of Health such as the Department of Medical Research, National Health Laboratory or institutions under other Ministries such as Myanmar Pharmaceutical Factory (MPF) and Myanmar Scientific and Technological Research Department, (MSTRD)formerly the Central Research Organization (CRO).Part of the research is then carried out at these places with technical training for a particular or advanced methodology/technology given by the staff there. However, the generation of the idea for the research project, the supervision and guidance for the writing up of the protocol, the formulation of the aims and objectives and help in procuring relevant literature, making formal contact with the authorities concerned for continuation of work at extra-departmental institutions, supervision of part of the research work which can be done at the department laboratory and finally supervision and guidance of the writing up of the whole thesis including discussion of the findings is solely the responsibility of the main or chief supervisor who is usually a senior faculty member of the university. If, however, the postgraduate goes into an ongoing long term research program of the host Department/institution, then the overall aim, strategic approach and general methodology of research may already have been largely determined and the postgraduate's research project would be part of and within the broad research program of the host institution. Senior scientists at the host institution give permission to use their laboratory and other research facilities; provide training in advanced technology and interpretation; provide joint research supervision also as necessary sometimes; and may therefore be designated as co-supervisors.

##### **At clinical departments at Teaching Hospitals**

Most clinical departments of teaching hospitals like Internal Medicine, General Surgery, Obstetrics & Gynecology, Pediatrics, Orthopedics, Ophthalmology, Ear, Nose, Throat departments, and subspecialty clinical units like cardiology, respiratory medicine, urology, etc

usually have sufficient facilities for routine patient care and have access to routine supportive services like Radiology, Nuclear Medicine, Clinical Microbiology, Clinical Pathology, etc., and these may be sufficient for clinical research in many topics. They may sometimes require special diagnostic laboratory tests and measurements for which the clinical departments may be able to collaborate with laboratories elsewhere such as at the Department of Medical Research or the National Health Laboratory (eg. for Renal function tests, measurement of glomerular filtration rate, alpha fetoprotein test, etc).

### **3. Research Programs**

In the first volume of the account of medical research in Myanmar (*see Bibliography*) it was stated that in Institutes of Medicine, during the 1970 decades, "most of the research projects were undertaken ad-hoc because of the absence of a research program in most departments" This situation still exists in some preclinical and paraclinical departments. Although their Faculty are highly qualified and well experienced, facilities in their departments have not kept up with the rapid technological advances being made worldwide and even with the modest technological acquisitions elsewhere in Myanmar such as in the Departments of Medical Research and in the National Health Laboratory. Their postgraduates need to be familiar and trained in the use of such advanced technologies for their research projects. These University departments therefore are to a certain extent dependent on other Departments for research facilities, especially advanced laboratory facilities, and for attachment of their post graduate students who have to participate in such research programs as are ongoing or planned by the host Departments. The research topic then chosen depends on the interest of the host Department and also the postgraduate candidate who is to carry out the research for the thesis and also on the facilities available and the collaboration which is offered. For these reasons, the research projects of these departments appear to be ad-hoc and not within a common frame work. Furthermore, junior staff of the Faculty who, as postgraduate students, acquired research skills and experience in depth in one research area seldom have the opportunity to continue such research nor the chance to upgrade their expertise in that particular technology especially in laboratory techniques when they return to their University department where such facilities are still lacking .

However, this is not always the case; some University departments can and do have independent research programs or research themes within which postgraduates as well as teaching staff undertake a series of interlinked research projects .Some types of research such as epidemiological research, socio-medical research, anthropological research, and health system research may need only simple laboratory facilities or none at all. The Faculty of University departments like Preventive and Social Medicine have the knowledge, skill and training to do such research, using epidemiological methods, biostatistics, and qualitative methods such as Focus Group Discussion, Delphi technique, etc. Similarly, the technology for studying gross anatomical structures is available within the Anatomy department. Therefore these departments are able to have their own independent research programs and their postgraduates need not be attached elsewhere to acquire the necessary technical know-how for research projects leading to academic degrees. Nevertheless, their teaching staff and postgraduates often contribute their expertise and capability to participate in studies on diseases of national importance undertaken by other Departments like DOH.

At most clinical teaching departments, the facilities available for patient care are usually sufficient for many clinical research projects. Clinical departments as well as supportive departments of the teaching hospitals have acquired large inputs of medical technology such as endoscopy, imaging, radio-isotope tracer techniques, immunobiochemistry, etc.; they may collaborate with laboratories elsewhere for additional facilities. They therefore are able to select the clinical research projects to be carried out. They could formulate and pursue short term or

long term departmental research programs which are cohesive, consistent and continuing and some do so, but many do not, and research is without any long term or medium term cohesive agenda. Other departments and researchers elsewhere such as from the Department of Medical Research or other service units of Department of Health or pre-clinical departments of the University sometimes seek collaboration with clinical units of hospital for research projects in a topic of mutual interest. The DMR collaborates with University clinical departments in high priority problem areas and diseases by establishing Clinical Research Units (CRU) for clinical research in malaria, snakebite, DHF, AIDS, Traditional Medicine totaling seven in number at present and one Research Unit (RU) for a research laboratory development. Such CRUs and RUs have a well formulated cohesive research program/agenda.

There are many constraints for faculty members to conduct research on a regular basis. The first and foremost priority of the faculty is *teaching* and to be a *good and up-to-date teacher* for the multitude of undergraduate and postgraduate students. Some departments are responsible for teaching other postgraduate courses in addition to their own. The second priority is research but time restraint, job overload, attending meetings and seminars are other constraints of the University staff. Research therefore cannot be the top priority of the teaching faculty. Nevertheless, supervision of the post graduate research program has always been an integral part of the duties of senior faculty members.

Universities impart knowledge as well as generate knowledge and every University staff should engage in research and faculty members should be encouraged and be motivated to do so. An increasing number are doing so but many cannot overcome personal and external hindrances. Most research granting bodies like WHO/UNDP/WB Tropical Diseases Research Program or Reproductive Health Research and Training Program offer research and research training grants which is of direct relevance to health service programs in national priority areas; and therefore Departments and institutions participating in such service programs like DMR, DOH and NHL have prior access to them; and resources for research and research training may be seen flowing into them whereas Universities, where research is given second priority seldom get any share, leaving them high and dry of any kind of research assistance and little chance of exposure of their faculty to research advances and interchange of research information overseas and a broadening of their scientific horizons. However, Universities have now been considerably upgraded with respect to libraries and information technology and an increasing number of their teaching staff have acquired high academic qualifications nationally and abroad which includes research training as well. All of them have indirectly increased the research capability of all university departments.

#### **4. Research Organization and Co-ordination**

There are Committees at Ministry level and between Rectors and Director-Generals to co-ordinate research and arrange collaboration for large, long term research programs, which are disease orientated, national level research programs.

At University level there is an Institutional Research and Ethical Committee chaired by the Rector with Professors/Heads as members which oversees the scientific basis of the projects as well as the ethics component of the research before the candidates are allowed to embark on their research. This Committee gives research direction, coordinates interdepartmental research activities and mobilize resources.

There are then postgraduate boards of studies in each department which not only oversee the teaching curriculum but also supervises and directs the research projects that are implemented by the postgraduate candidates. These are chaired by the Professor and Head of respective Departments of the Medical Schools with representatives from counterparts of other medical schools as well as senior faculty of the related disciplines. Although approval for

research project for M.Med Sc is normally given by the Departmental PG Board, research proposals for Doctorate thesis must be screened and approved by the Institute Scientific and Ethical Committee. University departments may pursue purely scientific research of interest, which, although not applicable at the moment, contributes to a better understanding of some issues directly or indirectly related to clinical medicine. A common factor for clinical as well as non-clinical research is the choosing of studies which are related to priority diseases in the country, the magnitude depending on the availability of resources and financial situation.

## **5. Research Capacity Development**

The research capacity of the Institutes of Medicine (University of Medicine) was gradually developed since the initiation of the postgraduate courses in the early 70s and later strengthened in stages both in human resources and technical facilities.

The National Health Plan 2001-2006, 2006-2011 and previous national health plan provided only limited financial support to build up the research capacity of the teaching departments of UMI Yangon such as development of combined research laboratory for the use of all teaching departments and separate equipment, instruments and supplies required for research at individual teaching departments. Enhancing the primary teaching function of the University such as computerized teaching aids and internet facilities and development of e-library have indirectly strengthened its research capacity.

### **Human resources for health research**

After completing the post-graduate course and obtaining their diploma/ degree, qualified persons return to their mother departments at the University of Medicine I Yangon and other health-related Universities like the Universities of Nursing where, as teachers with research training, they add to the research capacity of the teaching departments. Others may join the Department of Medical Research where they become full time researchers. Many will return to DOH as specialists in various hospitals, clinics, laboratories, where although their primary task is service, they could take up research for continuing professional development according to their interest and availability of resources.

The UMI Yangon has thus contributed considerably to the large pool of potential researchers in the country which may be tapped when the need arises.

## **6. Research Training**

At all Universities of Medicine, there is a formal introductory course for postgraduate master and doctorate candidates on the principles and concepts of research including guidelines on how to write a research protocol and writing up a thesis or dissertation. This is also supplemented by research training workshops held at DMR (LM) and Department of Planning and Statistics.

## **7. Technology Development and Transfer**

Teaching staff sent abroad for further postgraduate studies return with the know-how to use advanced technologies relevant to their respective disciplines and disseminate this to other staff in the University. DMR also transfers technological know-how to the University through its many workshops.

But technology transfer is complete only if equipment and the know-how to use it are both acquired. University departments, especially the pre-clinical departments, sorely need to acquire advanced equipment commensurate with their teaching function and with their additional task of enabling postgraduates to undertake research leading to postgraduate academic

degrees. However, there has been technology development at the University in other aspects. The Dept of Health has put in many resources for advances in diagnostic and therapeutic technologies at clinical teaching departments of the Teaching Hospitals and this helps considerably to improve clinical research. Moreover considerable advances in information technology have been made through the acquisition of computers with access to the internet for the library and the setting up of LAN network and this also promotes and support research at the University in many ways.

## **8. Research Funding, Resource Mobilization**

There is limitation in funding for research at the University. There is no separate Research Fund at the University.

Students incur considerable expenditure for their research work, including fees for use of technical services at government host institutions and elsewhere, and for purchase of special laboratory reagents and biological not routinely available at the mother department of the University.

Small research grants are sometimes available from the DMR but not sufficient for research projects leading towards an academic degree. Short term and long term research grants from regional international agencies such as WHO may be applied for on a competitive basis but very few pre-clinical and paraclinical depts. have succeeded in obtaining such grants. Teaching staff take part as researchers in research projects of other departments which have succeeded in winning research grants. Clinical departments of the University collaborating with DOH or with DMR on important diseases like Malaria, DHF as CRUs are able to win Research grants.

## **9. Research Output**

In spite of the difficulties in conducting research as described above it should be emphasized that UM1 Ygn has produced a large number of the following categories of health professionals during the period up to 31.12.2011

- 2385 Masters of Science(M.Sc)
- 52 Doctors of Philosophy (Ph.D)
- 165 Doctors of Medical Science (DMedSc)

Post graduates of UM 1, Ygn have completed a large number of research projects during the years in a wide variety of topics. Publications: a large number of research papers and scientific articles have been published by teaching staff and postgraduates.

CHAPTER 4 RESEARCH AT UNIVERSITIES UNDER THE MINISTRY OF HEALTH AND HEALTH  
RELATED RESEARCH AT OTHER UNIVERSITIES

## Section 4.2

### University of Medicine 2 (Yangon)

by Tha Hla Shwe

#### Introduction

Research has always been an integral function of all institutions of higher learning all over the world. Medical schools, designated as Medical Universities in Myanmar and some countries, are no exception. These schools have to undertake three basic functions – education, service and research. These are also the basic functions of the University of Medicine 2 (UM2), Yangon, formerly Institute of Medicine 2 (Yangon). Education and research constitute essential functions of all departments/disciplines of the University. Service however is confined mainly to paraclinical and clinical disciplines working in health care settings in laboratories and hospitals.

#### Existing Research Status and Facilities

The types of research undertaken at UM2 could be differentiated broadly into non-medical and medical research. The non-medical research comprised of research work in science disciplines other than medicine like, botany, zoology, chemistry, and physics. Medical research could again be differentiated into non-clinical like the basic sciences - Anatomy, Physiology, Biochemistry, and, para-clinical disciplines like Microbiology, Pharmacology, Pathology, Forensic Medicine and Preventive & Social Medicine; clinical research – research involving patients undertaken by some para-clinical and clinical disciplines; and health systems research mainly undertaken by Preventive & Social Medicine and also some clinical disciplines.

Even though the Academic Board of the Institute was concerned mainly about medical research, both non-medical and medical research activities were promoted among the staff members. However, as Aung Than Batu (2003, p.297) stated, *the vast potential for more and better contribution to medical science by the Institutes of Medicine with their highly qualified Faculties and large numbers of M.Sc/M.Med.Sc postgraduates – was not fully realized up to the end of 1973-86 period.* This state of affairs persisted into the later years (1990's). In the absence of basic research facilities like well developed reference library, well equipped laboratory, trained staff to advise and supervise research, and research training programs for faculties, the faculty members turned to other resources like Department of Medical Research (DMR), National Health Laboratory (NHL), Central Research Organization (CRO), Disease Control Programs of Department of Health (DoH) for support. These resources being away from the campus and because of logistical problems, formalities and sometimes bureaucratic requirements, many attempts at research were not completed successfully.

The author himself had that experience at the Institute of Medicine 2, Yangon. In 1970-71, under the exhortation of Dr Ko Ko, Professor of Preventive & Social Medicine Department, the junior teaching staff conducted a study on the effects of medical education on students' health. The study employed a number of indicators from which to draw conclusions - social, physical and biochemical indicators - which were planned to be collected from a cohort group of students over the years. The samples for biochemical tests had to be sent to DMR and NHL. One constraint was in arranging transportation with the motor transport pool, and samples could not be sent in time. Another constraint was in arranging for chest x-rays of the students yearly, with the NTP sending over a mobile van

which stopped after a year due to many reasons. These are examples of a few constraints among many others.

## **Research Capacity Development**

### Development of research culture

The Academic Board of the Institute, being aware of low interest and tepid efforts on the part of academic staff concerning research activities, even nearing the end of the millennium, made a decision to promote research culture among them. After deliberating for some time, the Rector applied in 1998 for a grant from the China Medical Board of New York, Inc., (CMB), for Development of Research Culture among the faculties through upgrading of the Institute library, setting up a Common Research Laboratory, sending faculties and laboratory staff for advanced training abroad and conducting compulsory research methodology training for postgraduate student. The CMB awarded a grant of over a million USD (Tint Swe Latt, 2010) for the Institute to realize its aspirations.

### Research facility development

#### Upgrading of library facilities

The Institute was thus able to upgrade its library to become an Electronic Library by 2001. The email access together with LAN network initiated in 1998 was finally developed into a full Internet service in 2002 and was made available to the faculties and postgraduate students at first, then finally to undergraduate students in 2003. This made the literature search and review much more comprehensive and effective for faculties and students. Internet access indeed widened the scope of educational attainment which included the capacity to plan and carry out research.

#### Laboratory and human resources development

A well equipped Common Research Laboratory (CRL) was also established in August 2000. CRL aim to help research activities of the faculty members and postgraduate students of UM2 and where ever possible help researchers/postgraduate students from other Universities – Medical, and medically related, as well as students from other universities including Yangon Arts & Science University. The Academic Board (AB) was also able to send many faculty members and laboratory staff for research training abroad and they brought back technologies with them – the distinctive technologies were Immunohistochemistry technique for medical researchers and tissue culture technology for botanists which they passed on to others. Lately a molecular DNA study section was also added to the facilities available at the CRL in early 2008.

The Academic Board also made a decision and implemented compulsory research methodology training for all postgraduate students of the University starting from 2001. Faculties with PhD and those having undergone research training and with research experience run the course. At first the course was not very popular but later on it became a much sought after course as students come to realize its value in carrying out studies for their theses.

## **Research Outputs**

The results of all these inputs were the surge in research activities not only among the faculties of UM2 but also among other researchers as well. Before 2002, mention of research activity in Institute Handbooks could only be seen in the history of Department of Medicine

where Malaria Research Unit was being established in collaboration with Department of Medical Research; also the statement for the Department of Obstetrics & Gynaecology specifically mentioned research as a function of the department (UM2 Handbook 1998-1999). Starting from 2002 Handbook, a section covered the research activities carried out in the CRL and completed during the stated year.

The following table which is definitely not exhaustive will illustrate the research activities being carried out at the UM2 CRL which were most likely to be the result of developing research culture among faculty members. The actual number of research may very well be more than what is shown in the table as many faculty members and postgraduate students also conducted research in facilities outside the University campus as stated previously.

Numbers of research conducted and completed for some indicated years

Academic year	Conducted	Completed
2001-2002	10	3
2004-2005	33	15
2007-2008	32	19

(Ref: IM2/UM2 Handbooks 2002, 2005, 2008, Tint Swe Latt, 2011)

Regarding the quality of research, Aung Than Batu (2003, p.210) wrote “*Most of the research projects were undertaken ad-hoc because of the absence of a research program in most departments. Only some were original.*” He also wrote “*Many of the research projects were clinical surveys and case-series recording the occurrence in Myanmar of a variety of diseases and clinical conditions and clinical trials of drugs and techniques newly introduced into the country. Some were local innovative adaptation of existing diagnostic criteria and indexes.*” Aung Than Batu (2003, p.210) also provided some justification for this and stated “*the researches undertaken for qualification as M.Sc/M.Med.Sc provided training in research which, although limited because of the main emphasis on professional training and clinical competence, was nevertheless the first time such research training had become possible for doctors in Myanmar.*” The present author concurred with these observations as many studies published were more or less descriptive in nature but would like to point out that when faced with many shortfalls and constraints, the very attempt to conduct a research project is indeed laudable.

Many studies/researches are still in the category of descriptive research even to this date. These are studies where researchers tried to identify existing Knowledge, Attitude and Practice regarding some health/medical topic. However we can now find developmental studies like Development of Public Health Skills Audit Tool for Township Medical Officers in Myanmar (San San Myint Aung, 2008), and Community-based Voluntary Health Insurance Scheme in Nyaung-don (Hla Hla Win, 2006) which are more or less quite original.

Public Health Auditing is still in the early stages of development all over the world. There is no one public health audit tool which is applicable worldwide and this study will definitely contribute towards development of a generic public health audit tool applicable in many situations. Likewise, health insurance is definitely being considered as a health financing method in Myanmar and the findings from Hla Hla Win’s study will provide some contributions towards its development. There are also many more which will have some impact locally as well as in the international arena.

The University of Medicine 2 Handbook for 2005 and 2008 indicate some of the research projects being carried out by its academic departments. According to the Hand books for the year 2005 and 2008, 15 and 19 research projects respectively were completed by various academic departments and there were 9 ongoing research projects. Four research

projects including one on Dentistry were carried out at the Common Research Laboratory during 2008 using advanced techniques such as Polymerase chain reaction (PCR), genetic analysis and in-vitro methods of detecting drug resistance by malaria parasite. Although quite a number of these studies may still be categorized as descriptive in nature and fall into the categories observed by Aung Than Batu in 2003, some were applying advanced biomedical techniques using facilities present in the CRL and some progressed to the analytical stage in trying to judge the diagnostic value of the parameters being measured (Tin Moe Mya and Khine San Yin, 2005).

### **Conclusion**

Looking at what have been presented above there can be no doubt that medical research in UM2 have progressed over the years and is at present contributing quite significantly to development of medical research and through it to health care delivery in Myanmar. This contribution should be credited to the Rector and faculty of UM2 who have successfully developed research culture among our medical graduates. It is hoped that UM2 will be able to sustain this progress and development into the future.

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## **Section 4.3**

### **University of Medicine (Mandalay)**

by **Aung Gyi**

#### **1. Introduction**

Mandalay is situated at the geographical centre of Myanmar and so Mandalay and its environs reflect health conditions in Upper Myanmar; also, people and places in Upper Myanmar are easier accessed from Mandalay. The University of Medicine, Mandalay (UMM) and other health institutions in Mandalay are the obvious places from which to study health conditions in Upper Myanmar, especially those which are peculiar to Upper Myanmar or are more prevalent there.

Thus, as early as in 1951-53, a Tuberculosis Demonstration and Training Centre was set up in Mandalay (in addition to one in Yangon) where some initial studies of Tuberculosis were undertaken. Studies of Goitre in the Chin Hills during the colonial period and Pilot Demonstration Malaria Control Projects in Lashio, Northern Shan States, during the early years after Independence may have been accessed from Mandalay.

#### **2. Research Role**

The University of Medicine, Mandalay, undertakes medical research as one of its functions in addition to its primary function of producing basic and specialist medical doctors. The role of the University in relation to research is explicitly stated in the objectives of the University: “the graduate of the University should be capable of updating oneself by continuing education and research”.

From the time the predecessors of the UMM were opened, (first as a sub-Faculty of the University of Rangoon in 1954, as a Faculty of the University of Mandalay in 1958, as the Institute of Medicine, Mandalay (IMM) in 1966 and then eventually as the University of Medicine, Mandalay in 2005) its faculty has participated in various medical research activities being undertaken in Myanmar. The Rector of the Institute of Medicine, Mandalay, was on the Burma Medical Research Council (1963), and its teachers participated actively in the proceedings of the First and Second Medical Research Conferences in 1965 and 1968 respectively, which were landmark events in the development of medical research in Myanmar where medical scientists, for the first time in Myanmar, took part in the formulation of medical research policy and the future program of medical research in the country.

As early as in the late 60s (1965-66), 2<sup>nd</sup> year medical students were given small research projects in physiology and were also encouraged to present their findings to the teachers and fellow students for feedback and criticisms. It was to be noted that the first post-graduate course in medicine in Myanmar was opened in Physiology Department of Institute of Medicine, Mandalay in 1967. The importance of research in post-graduate as well as undergraduate medical education was recognized by the founders of the University even in the nascent years of its establishment. Successive Rectors have contributed to the development research at UMM. They introduced research in the undergraduate curriculum, opened the first postgraduate course in the University; developed a standardized format for writing a thesis; and made the Common Research laboratory functional and productive. They all tried to disseminate research culture in the University.

### **3. The Organization and Co-ordination of Research**

This is generally similar to what is done at IM/UM 1 Yangon. There are Committees at Ministry level and between Rectors and Director-Generals to co-ordinate research and arrange collaboration for large, long term research programs such as the new Reproductive Health program as well as long standing disease orientated, national level research programs like malaria and snake bite or emerging health threats like Avian flu.

At University level there is so far no Research coordination body to give direction to research activities of the University. Research topics are chosen ad hoc.

There are Postgraduate Boards of Studies in each department which not only oversee the teaching curriculum but also supervises and directs the research projects that are implemented by the postgraduate candidates.

All research protocols at the master level are rigorously examined by the respective board of studies and the specially invited experts from the respective field. The methodology section is given more attention than others by all members of the board. Research design and statistical methods are discussed more by the professor of Preventive and Social Medicine, who is well versed in these areas. All research protocols at the doctorate level have to go through another board i.e. Ethical and Research Committee. This board consists of some members the academic board of the University as well as some retired senior professors of the University who take a keen interest in research.

### **4. Research Program**

In the 1960's, during the early years of organized research in Myanmar, the Professors/Heads and teachers of the Departments of Medicine, Surgery, Obstetrics & Gynecology, Physiology, Radiology, Orthopedics and Microbiology received medical research grants which were then awarded for the first time in Myanmar by the Burma Medical Research Council; and this was the beginning of active, productive research at IMM/ UMM which expanded considerably when postgraduate courses in the medical sciences started and multiplied in the 1970's and has been sustained since then. Noteworthy among the research done in IMM during those early years was the pioneering research in 1970 on the use of ivory prosthesis for femoral head of femur which received international recognition.

The research program of the University however is fragmented and there is no sign of integration among basic science departments as well as between basic science departments and clinical departments as far as research program is concerned. As mentioned above, the research area was determined not only by the interest of the researcher but also by the availability of laboratory facilities and expertise of the laboratory personnel. Some of the research activities are variations on the same theme. The same methodology is employed but the area of research is made slightly different. For example, the research on medicinal plants was pioneered by one postgraduate student of pharmacology and it was copied and followed by flurry of research on some different medicinal plants by other students. So also is true in the area of pathology where research on tumor suppressor gene was repeatedly reproduced by different students of pathology over a period of time. Some of the therapeutic trials were somewhat linked to the pharmaceutical industry and this kind of research was rigorously scrutinized by the ethical and research committee of the University.

*Research Programs as Part of Academic Postgraduate Courses*

During the period of rapid multiplication of postgraduate academic courses in medical sciences at the Institutes of Medicine in the 1970's and gradual development later in the 1980's, the IMM opened postgraduate courses and began conferring the Master and Doctorate degrees, part requirement for which was the conduct and completion of a relevant research project.

The following were offered over the years:-

- (1) Master of Science (M.Sc.) -  
M.Sc (Physiology) in 1972 - which was the first time a Master degree in science was awarded in Myanmar; M.Sc. (Biochemistry) in 1986; M.Sc. (Microbiology) in 1982; M.Sc.(Pharmacology) in 1975; M.Sc.(Public Health) in 1975
- (2) Master of Medical Science (M.Med.Sc.) –  
M.Med. Sc. (Internal Medicine) in 1976;M.Med.Sc.(Obstetrics & Gynaecology) in 1975;M.Med Sc. (Orthopedics) in 1972; M.Med.Sc.(Otorhinology) in 1983;M.Med.Sc.(Pediatrics) in 1980; M.Med.Sc.(Surgery) in 1975;M.Med.Sc.(Anesthesiology) in 2002  
M.Med.Sc.(Hospital Administration ) in 2006;M.Med. Sc. (Medical Jurisprudence) in 2001; M.Med.Sc. (Mental Health) in 2004; M.Med Sc. (Ophthalmology) in 2005; M.Med.Sc. (Pathology) in 1996; M.Med.Sc (Radiology) in 2004; M.Med.Sc.(Rehabilitation Medicine) in 2006.
- (3) Doctorate in Philosophy (Ph.D.)  
Ph.D (Anatomy) in 2002;Ph.D (Biochemistry) in 2007;Ph.D (Microbiology) in 2003;Ph.D (Pathology) in 2001;Ph.D (Pharmacology) in 2007.Ph.D (Public Health ) in 2002;Dr.Med Sc. (Anesthesiology) in 2004;
- (4) Doctorate in Medical Science (Dr.Med.Sc)  
Dr Med Sc (Cardiology) in 2004; Dr Med Sc (Gastroenterology) in 2006  
Dr Med Sc (Internal Medicine) in 2003; Dr Med Sc. (Medical Jurisprudence) in 2005; Dr Med Sc (Obstetrics & Gynaecology) in 2003  
Dr Med Sc (Orthopedics) in 2003; Dr Med Sc (Otorhinology) in 2006  
Dr Med Sc (Surgery) in 2005

Thus, research conducted by postgraduate students of the IMM and the teaching staff supervising them spans a wide range of subjects within each of which a large variety of research topics are covered.

These research topics reflect the research needs of the service departments, health institutions, research institutions and teaching hospitals where the post-graduate students are usually attached for their actual research work and research supervision and not necessarily those of the academic department especially in the case of pre-clinical departments; this is because the special, up-to-date laboratory and other facilities necessary for the type of research acceptable for obtaining academic degrees are frequently not available in the academic department. Sometimes however it is possible for the research topic of interest to the academic department to be carried out because it may only require those facilities commonly available within the department or the University for routine teaching purposes or obtained by the dept/ University through research grants or some other means; then the postgraduates are not attached elsewhere and all research is done under the direct supervision of the academic department; as for example in the case of Anatomy, where gross structural studies are possible with the facilities available in the department; or Public Health or HSR, where no special facilities are required except the professional expertise available within the academic department and the field practice area which is readily accessible to IMM/UMM.

The establishment of a Common Research Laboratory in 2002 (see below) has enabled more postgraduate research projects to be undertaken within the University instead of being done elsewhere; this has enabled academic departments to pursue their own research interests more frequently.

#### **5. Major Research Programs and Projects -clinical, para-clinical and basic/ biomedical**

As mentioned before there were no institutional or departmental research programs and research done by postgraduates and teachers was ad- hoc. However some of the ad- hoc research projects carried out in the departments of Medicine, Public Health and Pharmacology may come within major health problem areas such as malaria, snake bite, tuberculosis; and some in the departments of surgery and orthopedics may be grouped as research on traumatic injuries.

#### **6. Research Grants Won by the Faculty /Teachers from Local, Regional and International Sources**

As mentioned, when in the 1960's the Burma Medical Research Council started conferring research grants many of the teaching staff were able to obtain these grants; and some continued to receive them later from DMR, usually together with the postgraduate students they supervise. Teachers individually or as a team were not seen to have competed for and obtained research grants from regional and international research grant awarding bodies such as WHO, UNICEF, and the WHO/UNDP/WB -TDR, HRP program.

#### **7. Research Funding, Resource Mobilization**

There is no research fund at the University from Government and internal sources and the PG students and teachers who did research had to rely entirely on themselves as far as research fund was concerned For example research on ivory prosthesis and gastric physiology in earlier decades was done by the researchers on their own. There are some concessions to the cost of laboratory tests and imaging done in the hospital when a PG student did clinical research. Resource mobilization from foreign sources did not seem to be actively pursued or encouraged till recently when a mutually beneficial partnership program with Mahidol University on Thalassemia was begun.

#### **8. Research Facilities**

It is seldom that the Institutes/Universities of Medicine or other health related Universities are specifically strengthened for research capability- research being considered a secondary function, even though research of an acceptable standard is a necessary requirement for post-graduate academic degrees offered.

However, recent upgrading since the 1990's onwards, of library facilities, installation of computer facilities and internet access, and acquirement of Master and Doctorate degrees by the faculty has indirectly strengthened their research capacity.

##### At pre-clinical teaching departments

Nearly all the departments are meagerly equipped with research facilities and they are meant for teaching undergraduate students. Only the physiology department is more or less well equipped with facilities that can made use of by the postgraduate students. The postgraduate students from other department have to go to Department of Medical Research for their research when sophisticated facilities are required to do it.

However, with the establishment of Common Research Laboratory (CRL) in the year 2002 with the aid of China Medical Board (CMB), many equipments and supplies were procured. Thus the research work of the basic scientists in the University was facilitated more than ever and became more productive.

#### At clinical teaching departments

Research capacity of the Clinical departments have also benefited from the recent opening of new specialty and sub-specialty units for patients care at the teaching hospitals- such as Cardiology, Nephrology- and the build-up of special diagnostic and treatment facilities . Most clinical departments and particularly the medical and surgical specialties now have sufficient facilities for the research work of their postgraduate students. With the introduction of modern imaging techniques such as CT scan, MRI, angiography ,Doppler ultrasound and nuclear imaging and of endoscopic techniques which has enabled visualization of the surface of most internal organs as well as the lumen of most hollow organs, there was a proliferation of research activities centered on these imaging and endoscopic techniques. The introduction of new laboratory tests also allowed the students to do research in areas that were inaccessible previously.

These patient-care facilities are being used by the postgraduate students and supervising teachers for research leading to academic degrees as well as for other independent research by the faculty. Very recently, the O&G department of the teaching hospital was strengthened for participation in a long term program of research and development in Human Reproductive Health.

### **9. Research Capacity Development**

Two developments in this area are worth mentioning.

(1) One is the establishment of Research and Development Committee as a Sub-committee under Myanmar Medical Association (Mandalay). In fact it was set up under the academic leadership of the University and nearly all members are from the University. The committee held workshop/seminar and talk every year since 2004 up to the present. The topics covered are diverse but most are centered on research methodology and how to write a thesis protocol. The sample topics are:

*“Workshop on biostatistics”*

*“How to write a scientific paper”*

*“Presentation of a scientific paper”*

*“R & D for the medical doctor”*

*“Panel discussion on Writing a Protocol”*

*“How to retrieve medical information from internet”*

*“Evidence-based medicine”*

*“Seminar on clinical trials”*

The workshops and seminars were conducted at the University/MMA and attended by all PG students. In some panel discussion sessions, the 2<sup>nd</sup> year PG student who had successfully passed through the presentation of research protocol himself recounted how he had gone through all the processes that were required to do it. The panel members as well as other attending teachers and students actively participated in the discussions that followed. The research protocol was seen through the eyes of a student and some of the views presented were rather refreshing and stimulating even to the senior teaching staff. The R & D committee itself conducted some research projects and one of these is “Wearing of helmets by the motorbikes riders in Mandalay”.

(2) Another development in the area of research capacity development is the establishment of Common Research Laboratory in the University since 2002. Apart from procuring equipments and supplies for the laboratory, the Supervisory Committee for CRL has focused on training of the young researchers as well as the laboratory staff. As a consequence two faculty members and two technicians were sent to Japan in 2005 for training in molecular biology. Since then the teaching and laboratory staff were sent to neighboring countries for a short course of training from time to time. The most productive one regarding research capacity development was one of that collaboration between the University and Siriraj Hospital, Mahidol University. The professor and 4-member team (lab technicians) from Mitochondrial and Metabolic disease laboratory from that hospital were invited to the University and 5-day intensive hands-on training on basic techniques in molecular biology (DNA extraction and PCR technique) was conducted. Sixteen teachers from six basic science departments attended the course. An agreement between the University and Siriraj Hospital was reached to set up a Thalassemia Project in the University. Sharing of experiences and expertise of the visiting scientists is one that was most valued by the young teachers and potential researchers of the University. The young teachers were inspired by the enthusiasm, passion and workmanship shown by the visiting scientists/technicians.

#### **10. Research Training**

There is no formal research training program at UMM so far but some on-the-job-training, hands on training does take place at the Common Research Laboratory. Some of the postgraduates are able to participate in the research training programs run by the DMR's.

#### **11. Technology Development and Transfer**

Technology transfer within country takes place within country from the many workshops held by the three DMR's. It also occurs when new diagnostic and therapeutic measures are introduced in the clinical departments of teaching hospitals – such as radiological, ultrasound and nuclear imaging techniques and endoscopies. Also when many new types of equipment were bought with the aid of China Medical Board for the Common Laboratory and they are being used by some PG students.

#### **12. Reference**

- (1) University of Medicine, Mandalay- handbook, 2006

## **Section 4.4**

### **University of Medicine (Magwe)**

**by Aung Than Batu**

The University of Medicine (Magwe) was opened in 2000 and is developing gradually to come on a level with other Universities of Medicine in Myanmar. It is struggling to get its full Faculty on a permanent basis. Meanwhile, it is coping with a core of permanent staff and some teaching staff who are posted on a temporary basis by rotation. Teaching facilities and laboratory facilities for teaching purposes are being built up at the various University departments. The Divisional hospitals at Magwe and Minbu are tertiary care hospitals and serve as University teaching hospitals. Clinical service departments and supportive departments existed since the hospitals were opened some time ago and are now functioning jointly as service departments of DOH and clinical teaching departments of the University.

With the opening of post graduate courses for the various disciplines, research is being undertaken by postgraduate students as part requirement for the degrees offered. Postgraduate research which does not require advanced laboratory facilities is possible. Because of its geographical location the University of Medicine (Magwe) has some advantages and opportunities for research in some areas. It is geographically nearer to NayPyiTaw and the facilities there including the DMR (central Myanmar). More important, being located in the central arid hot zone of Myanmar it has opportunities for research on the health impact of climate change and rising temperatures, and the health impact of rapidly changing environmental conditions due to irrigation and other man made measures. Heat stroke and heat- ailments would be plentiful for systemic study. Some early research on snake bite was done at Magwe General Hospital. The particular occupation of the surrounding areas such as toddy palms could be an opportunity for research in the injuries due to toddy climbing and similar other injuries.

CHAPTER 4 RESEARCH AT UNIVERSITIES UNDER THE MINISTRY OF HEALTH AND HEALTH  
RELATED RESEARCH AT OTHER UNIVERSITIES

## Section 4.5

### University of Public Health

by Nay Soe Maung

#### Organizational Set-up and Educational Program

University of Public Health is situated in Yangon, Myanmar and was formally inaugurated on July, 2007 by Minister for Health, Yangon Mayor and Regional Director of WHO South-east Asia Region Office. It is one of the universities administratively under Department of Medical Sciences, Ministry of Health.

The vision of University of Public Health is **the pursuit of population health in service of society** and its mission is **to develop leaders and managers in the health sector by educating health and health-related personnel, by conducting the quality research, and by participating in the practice of health care services.**

It is formed with nine departments namely:

1. Biostatistics,
2. Epidemiology,
3. Health Behaviour and Communication,
4. Health Policy and Management,
5. Medical Education Science and I.C.T,
6. Nutrition and Food Safety,
7. Occupational and Environmental Health,
8. Population and Family Health, and
9. Public Health Laboratory Sciences.

The strength of permanent faculty is: 1 rector, 3 professors, 2 associate professors, 2 postgraduate lecturers, 8 lecturers, and 6 assistant lecturers.

UPH has other part-time professors and Lecturers who are public health professionals from Department of Health, Department of Health Planning, Department of Medical Research and other Medical Universities. The visiting professors and lecturers from local and abroad including WHO experts also contribute their knowledge and share experiences to UPH students.

The university confers the degrees of Diploma in Hospital Administration (6 month course), Diploma in Medical Education (9 months), Master of Public Health (MPH) (1 year) and Ph. D (Public Health) (3- 5 years).

Among the courses, the aim of Master of Public Health is to produce qualified personnel capable of playing a leadership role in public health and managerial roles in Planning, Implementation and Evaluation of health care programs. During training period, MPH candidates have to undertake a field survey on selected public health-related projects in both urban and rural areas and these candidates have to present what they had seen in their field visit at a seminar chaired by rector and attended by faculty members including those of related universities. The postgraduate candidates have to conduct individual research studies for their thesis and dissertations.

Future plans are also laid down for development of the university in the areas of: collaboration with other public health institutions including China Medical Board;

development of human resources, technologies and facilities; expansion of additional courses like a short course on epidemiology and basic medical statistics, and an MPH program for other medical personnel.

With an intention of collaboration with external institutions the university has registered as a member of South-east Asia Public Health Education Institution Network (SEAPHEIN) since January, 2008.

## **Research**

### The organization and coordination of research

This is generally similar to the Universities of Medicine but more simple and informal because of the smaller number of the Faculty and smaller number of research activities. The Board of Studies for the postgraduate courses supervises the teaching program including the research done as part requirement for the degrees.

### Research program and projects

The majority of research activities are undertaken by postgraduate students as part requirement for their degrees and as component of the teaching program of for the academic degrees conferred by the University. There is no separate research program.

However, apart from teaching duties the faculty is expected to also undertake research like in all universities. The research studies done by the faculty members on health hazards posed by street vendors were of high quality and won the Best Applied Research Prize at the Health Research Congress.

Research projects undertaken by post graduates and supervisors include the following:-

- Descriptive epidemiological studies of a variety of health conditions of different local population groups, their awareness and knowledge-attitude-practice (KAP) on specific health matters
- Factors determining health related behavior of specific local population groups
- A few case control studies of disease and possible determinants
- A few cost analysis of treatment for specific disease at specific health care facilities

### Research facilities, training and funds

The university also conducted workshops and seminars on public health research needs, climate change, operations research, and health and rural development, seminar on health care financing in last three year. Workshop on Active and Healthy Aging and Health Promotion in Practice are conducted in 2012. Moreover an inter-country meeting on public health, with WHO aid, was also held in November, 2007.

Faculty members took tour visits to Public Health Institutions in Thailand and Indonesia in 2007 and to Harvard University and UCLA in 2009 to gain international exposure and experiences. Recently some members attended short course trainings on health care financing in Thailand and Indonesia.

It is planned to upgrade the field training program; and to hold inter-country workshops and meetings on public issues. There are plans to enable more research by the faculty.

There is as yet no Research Funds available from the Government or from international research support bodies.

## Section 4.6

### Universities of Nursing

by May Winn Aung Khin & Khin Mae Ohn\*

*\*(With contributions and support given by colleagues, the Retired Rector of UON Mandalay, the Present Rector of UON Yangon, the Senior Nursing Teaching staff from UON Yangon, UON Mandalay and Military Institute of Nursing and Paramedical Science (MINP).*

#### Nursing Education

The role of nurses in Myanmar is as important and essential as doctors and realizing this health authorities in Myanmar have from the earliest times made efforts to produce enough qualified nurses to meet the needs of the population. Nursing education in Myanmar has had a long history starting from 1877.

#### Nursing Training Courses at Hospitals

In the past there were no separate training schools for the nurses. The training courses for nurses were conducted at the District Hospitals in Myanmar. It was more or less an informal education conducted by the senior hospital staff and was recognized by a certificate of satisfactory performance given out at the end of a one year training course. Nursing education progressed gradually with opening of hospital based nurses training schools in large hospitals in various parts of the country.

#### Nursing Training Centre

The Nursing Training Centre (NTC) was first instituted in 1986 and began the training of nurses and mid-wives. Construction of the building for NTC at the corner of Bogyoke Aung San Road and Phone-gyi Road in Lanmadaw Township in Yangon with the support of Japanese Government began on 1<sup>st</sup> July 1986.

The aims of NTC are:

- To promote and improve the health of the increasing population and also to help implement the people health plan and program
- To change the doctor, nurse ratio from 1:87 to 1:2
- To improve the quality of trainees
- To establish a separate modernized high standard Nurses Training School

The Nursing diploma course at NTC took 3 years and was extended to 3½ years for Nurse-midwifery course. The curriculum was primarily hospital based.

#### Institutes of Nursing

*Institute of Nursing (Yangon)* - Nursing Education in Myanmar was re-orientated when the 3-year community oriented Diploma of Nursing curriculum was instituted in 1991. The Nursing Training Centre was then upgraded to become the first Institute of Nursing (ION) in Myanmar on November 5, 1991. The Institute of Nursing was on par with the other universities within the higher education system and awarded the baccalaureate degree in nursing (*B.N.Sc.*).

Because of the annually increasing intake of nursing students the ION building was expanded to the other side of Bogyoke Aung San Road in March, 1996.

Up to the year 2000, the Institute offered a 2-year Bachelor of Nursing Science *BNSc (Bridge)* program, a 4 year *B.N.Sc (Generic)* program and a 3-year *Diploma Nursing* program simultaneously. From 2000 onwards there was no more 3-year Diploma program in the Institute of Nursing Yangon.

In the year 1996, 1997 and 1998 the distance education program for the degree of *Master of Nursing Science MNSc* offered by the University of Adelaide, Australia was conducted at the Institute of Nursing Yangon. Then since 2001, the Institute of Nursing has commenced its own local *Master of Nursing Science* Program. After completing the MNSc course these qualified nursing staff can coach the new generation of BNSc nursing students effectively and also can give effective care to the clients both in the hospital and in the community.

In 2000-2004, *Ph.D Nursing* course was conducted between Institute of Nursing, Yangon and the Latrobe University, Australia (as a sandwich program) Since 1999, *Post basic certificate courses in Specialty Nursing*, including Orthopedic Nursing, Mental Health Nursing, Pediatric Nursing, Eye, Ear, Nose, Throat Nursing and Critical Care Nursing courses have been conducted at the Institute. In December 2002 all these certificate courses of Specialty Nursing, together with Dental Nursing Course were upgraded to *Diploma courses in Specialty Nursing*.

*Institute of Nursing (Mandalay)* - on November 28, 1998, Institute of Nursing Mandalay (ION-Mdy) was established in Mandalay. First it offered a 4 year *B.N.Sc (Generic)* program and a 2 year *BNSc Bridge* programme started in 2002. The Institute of Nursing Mandalay also started its local *Master of Nursing Science* Program in 2004. The curriculum used for both undergrads and post grads courses are almost the same in the institutes - ION (Yangon) and (Mandalay).

### **Universities of Nursing**

Similar to other medical and related institutes, the Institutes of Nursing Yangon and Mandalay became the Universities of Nursing (UON) in the year 2005.

### **WHO Collaborating Centre for Nursing**

Since 2004, University of Nursing Yangon is recognized as WHO Collaborating Centre. It has since served as a resource centre for research in nursing and midwifery development in national, regional and international community.

### **Nursing Schools**

Apart from the two Universities of Nursing in Myanmar there are (24) nursing schools all over the country which offers a 3-year *Diploma Nursing* Program.

### **Military Nursing Education**

*(Defence Services Institute of Nursing and Military Institute of Nursing and Paramedical Science (MISN))*

Military nursing education orientated to the need of the Defense services was started on 2<sup>nd</sup> March, 1953 and it offered *third grade nursing, second grade nursing, first grade nursing and medical assistant courses*. In the year 1959 Nursing Training Wing (NTW) was established and produced nursing officers for caring the military personal and their family members. NTW offered certificate for sick Nursing, *Diploma in Nursing and Midwifery* course up to the 16<sup>th</sup> Batch. NTW also conducted *Specialty courses* such as Child Health

Nursing, Intensive Care Nursing and Psychiatric Nursing in collaboration with Ministry of Health.

When the Bachelor of Nursing Science BNSc (Bridge) program was started in ION, Yangon in 1991, Military Nursing Officers who matched with the prerequisite requirements joined the course. Altogether 28 numbers of Senior Military Nursing Officers attended the course No.1 in ION Yangon. In this way BNSc course was introduced to the military setting.

The first *BNSc* course was established in the military setting in 1996 as a branch of Defence Services Medical Academy (DSMA). The curriculum used was adopted from that of ION Yangon. Then the Defence Services Institute of Nursing (DSIN) was formed for male nursing students and continued the BNSc program. Later DSIN was reformed and extended as Military Institute of Nursing and Paramedical Science (MINP) in 2000 and continued BNSc program.

When the distance education program for the Degree of Master of Nursing Science MNSc course offered by the University of Adelaide, Australia was conducted at ION Yangon in 1996, 1997 and 1998, altogether six BNSc holders from the Military setting attended the course and completed *MNSc degree*.

In collaboration with La Trobe University Australia, *Master of Clinical Nursing* (MCN) was conducted in MINP and a total of eight teaching staffs completed MCN through distance learning program.

Some teaching staff from MINP also attended local MNSc course conducted in UON Yangon. At present MINP also offered 2 years *MNSc* program for military nurses since 2005.

Myanmar military nurses had completed *Doctor of Nursing* degree from La Trobe and Adelaide Universities, Australia. The first *local Doctorate* program from MISN started in 2001.

A visiting Professor from Latrobe University Australia came to Military Institute of Nursing and Parmedical Science (MINP) to supervise the PhD candidates and MCN candidates from 2003 to 2005

## **Nursing Research**

### **Development of Nursing Research in Myanmar**

The development of nursing research in Myanmar should be seen in the context of development in nursing education as given above. The above review of nursing education in Myanmar will make it easier for the development of nursing research to be better understood. The following is an account of how research came to be introduced into nursing education and accepted as a important component of nursing education. It may also be seen how advancement in nursing education, in particular, how opening of courses and offering of Master and Doctorate degrees in Nursing enabled progressively broader and higher levels of research to be carried out in the nursing profession. One can see that nursing education and nursing research developed side by side in the nursing profession in Myanmar.

In the early years when Myanmar nurses were trained in the District Hospitals, both in pre-war and post World War 2 periods, there was no notion about the need for research and no capability or the resources to do so. Hence there have been no systematic research activities at the time. It was the same when military nursing education started in 1953.

After the establishment of Nurses Training Centre (NTC) in 1986 and the commencement of the B.N.Sc course, the idea began to develop among nurses (both civilian and military) that they should and could try to find out hitherto unknown aspects of nursing care in Myanmar - for example, what sort of nursing care is being provided, and how and where provided in relation to health and disease conditions in the country. In other words, the

desire to do research emerged in the nursing profession and gradually grew stronger and became fully realized when the M.N.Sc and Ph.D Nursing courses were instituted.

In the beginning, however, only the theoretical aspect of research subject was introduced and included in the lectures. An early stimulus was given by the Myanmar Nurses Association (MNA) which urged the nursing staff of ION to submit research papers for MNA Conference and 4 papers were presented by the Faculty of the NTC. These research papers seemed to be the first research papers from the NTC.

### **Enhancing Research Capacity of Teaching Staff in ION/UON in the Early Period**

- Systematic teaching of Nursing Administration and Operational Research was included in the curriculum of diploma course for general nursing tutor. The WHO nurse educator and Myanmar counter parts led this initiative. (The research subject is also included in the curriculum of 3 year Diploma nursing course in nursing schools.)

- Training Course on “Introduction to Nursing Research” was held in 1992 and supported by Strengthening of Nursing Services Project (WHO & UNDP).

- MNSc courses were given by the University of Adelaide for 30 teaching staff in 1996-1998. This required the conduct of research and submission of individual dissertations.

- Doctoral courses were given in Adelaide for the teaching staff in 2000-2001- this required in depth research for completion of the thesis.

### **Research in the Bachelor of Nursing (BNSc) (Bridge Course)**

An introduction to research was included in the curriculum of nursing science when ION/UON started the BNSc (Bridge) Program. The then Rector of ION Yangon took this initiative. At that time, there were no defined contents for nursing research, and Department of Preventive and Social Medicine, University of Medicine (1) and ION shared the responsibility of teaching research. All the BNSc (Bridge) students starting from the first batch were required to conduct research and since 1994 till now they conduct research, make oral presentations and submit the results in a research paper as a group. Research proposals have first to be presented to the Research and Ethical (R&E) Committee of the University of Nursing. The research methodology used in those days was mainly quantitative.

Some of the studies were disease oriented, some were community oriented and some were related to nursing education. Most of the studies were mainly focused on priority diseases in the National Health Plan and common problems in the community. Students based their research on their own clinical experiences and the problems they met in their daily practice. All the studies were self-funded.

Nurses from military also attended the BNSc. Bridge Course No. 1 to 5 in ION Yangon. These military nursing students also prepared research proposal, did the research work and presented the research papers in ION Yangon.

Similarly, Bridge students from ION Mandalay had to prepare research proposal, do the research work and present research papers .

### **Research in Bachelor of Nursing (BNSc) (Generic Course)**

When the first batch of BNSc Generic Course commenced, research was included as a subject in the curriculum and generic students had to do research work and present research papers. Statistics was taught by teachers from Institute of Nursing, Institute of Medicine (1) and the Institute of Public Health, Hle-gu. A total of four batches were assigned to conduct research in groups of four or five students in the final year All proposals were required to be presented to the Research and Ethical Committee of the University. From the fifth batch

onwards, (1995-up to the present) the students were no longer required to conduct research but to submit research proposals only.

Like NSc generic students from ION Yangon, generic students from ION Mandalay and Nursing cadets Batch No.16 from NTW were introduced to research methodology but did not have to do the research work themselves.

### **Research in Master of Nursing (MNSc Course)**

In the year 1996, Master of Nursing Science was organized by WHO as an oversea study supervised by nursing faculties of University of Adelaide, Australia, and M.N.Sc. courses began at ION (Ygn). Altogether thirty candidates from ION obtained the Master of Nursing Sciences degree during the years 1996, 1997, 1998 in ION Yangon including six military nurses. In this way education standard of Myanmar nurses was upgraded and research capacity promoted. Qualitative research and mixed method approaches, which originate from the behavioral and social sciences, were first introduced to Myanmar nursing students during the MNSc course. Such qualitative research method included case studies, phenomenology, ethnography, grounded theory, feminist, historical, philosophical inquiry and critical social theory. In the mixed method, the final database represents both quantitative and qualitative information. The MNSc students are guided by the teaching staff from all nursing departments of the Universities of Nursing who themselves hold MNSc and PhD (Nursing) degrees; and also by medical scientists of the Department of Medical Research and Department of Health Planning.

### **Research Activity in Diploma of Nursing Course**

A brief description of nursing research is taught to all diploma nursing students. However they are not required to put up a proposal or to conduct a research during the 3 year course. After being appointed to a post, they can participate in conducting research or continue the research capacity development.

### **Research at the Military Institute of Nursing and Paramedical Science (MINP)**

As at the ION/UON Yangon and Mandalay, research training at MINP to military nurse is given by highly qualified military nurses with Master and Doctorate degrees. BNSc military cadets are primed to be research minded during their nursing practice. They are all required to prepare a thesis as group work. The first four batches of BNSc generic program military nurses produced 33 research papers. From 2000 onwards MINP offered BNSc generic program for male nurses who produced 63 research papers. So altogether 99 research papers were produced from BNSc program of MINP.

During the Master course in MINP, the candidates are trained to think broadly and to apply research in clinical practice thus combining nursing practice and research. Also, they are trained to do a systematic review of their subject and to practice evidence-based nursing. These MNSc candidates have presented altogether 99 research papers up till now.

### **Further Developments in Nursing Research**

Nowadays, nurses acquire research knowledge according to the nursing curriculum of the Universities concerned. All nursing research is organized by the respective University and research capacity development is promoted by the University concerned. However, there is no proper research infrastructure in these universities and there is no financial support for research. Although MNSc students and BNSc. Bridge student regularly undertake research projects in the Universities they are doing so at their own expense At present all the research

done in the Universities depend on student's preference and there is no definite research area at the UON's.

Training programs, seminars and research workshops etc. are arranged for the students. The Departments of Fundamental Nursing from UON Yangon and UON Mandalay and MINP are responsible for teaching research. The Department of Fundamental Nursing takes the responsibility of teaching nursing research and statistics to both BNSc (Bridge and Generic) students at UON. It produced a Handbook on *Development of Nursing Research*. Quantitative and Qualitative Research Methodology and sometimes Mixed Methodology are taught to students. However, BNSc students mostly use Quantitative Methodology whereas MNSc students are also capable of using Qualitative Methodology for their research.

### **Nursing Research Workshops and Nursing Research**

The following workshops on Nursing Research were held during 2000 to 2011 in Yangon, Mandalay and NayPyiTaw:

- Evidence Based Practice workshop
- Data Analysis and Qualitative Research Methodology workshop
- Conducting Operational Research in Nursing and Midwifery workshop
- Development of Basic skills in Nursing research workshop

As a consequence research proposals were generated and research projects were undertaken to study (a) Knowledge-Attitude-Practice(KAP) of nurses regarding a variety of topics such as:- role of nurses, nursing management of malaria patients, care of unconscious patients, etc; (b) KAP of patients and family regarding topics such as malaria, DOTs program, DHF, etc. (c ) Effectiveness of various nursing procedures and teaching methods such as discharge planning, teaching nursing practice in a clinical setting, etc; (d) Study of factors influencing effectiveness of various health care procedures like health education and psychotherapy;(e) Study of acceptability of invasive procedure like oesophagoscopy; and study of home care such as care of HIV patients by people living with them. Many of these studies were orientated to the social and behavioral aspects of health care.

Evidence Based Practice workshop was held in 2000, Data Analysis workshop and Qualitative Research Methodology workshop in 2001, and Evidence Based Practice workshop and application of QURN-VIVO Software in 2002.

Since 2006, MINP and Joanna Briggs Institute, Australia formed a Collaborating Centre in MINP in order to conduct Evidence Based Research and Systematic Review. As a result, Yangon Center for Evidenced Based Health Care was setup.

### **Nursing Research Output**

All the output of nursing research should be utilized in nursing education and nursing practice.

- (a) BNSc program of ION/UON produced some .research papers.
- (b) BNSc program of MINP produced altogether 99 research papers
- (c) MNSc Thesis/Dissertation- Up to now, there are 69 thesis where qualitative approach has been used in the research conducted by the former MNSc students. Among them, 43 are phenomenological studies, 8-feminist approach, 7-Ethnographic studies, 4-historical perspective, 3-mixed method, 3-action research and 1-grounded theory approach.

The University of Nursing (Yangon) publishes a Nursing and Midwifery Journal annually since December 2006. The Journal aims to serve as a medium for the development and advancement of Nursing and Midwifery in clinical practice and education at national level through the dissemination and exchange information among nurses and midwives. Some good research papers from MNSc program are published in this journal. This Journal is

distributed to the other WHO CCs in the Region, SEA, and to the universities and the training schools in Myanmar.

The WHO Collaborating Center translates/transcribes some of the best research papers from MSc Nursing programs in Myanmar including those from MISN and put them up on its web page

### **Collaborative Nursing Research**

- Collaboration with Department of Medical Research (LM) and Department of Health in conducting research in various fields.
- Participation in Research methodology workshops held by DMR and DHP

### **Dissemination of Research Findings**

Dissemination of nursing research findings take place through presentation at conferences, research congress, seminars and symposiums held in the country; it should be noted that such presentations are made not only to the nursing profession but to a wider audience of doctors, medical scientists and researchers such as at the Myanmar Health Research Congress. They are also disseminated through "The Nursing and Midwifery Journal" published by the Institute/University of Nursing, Yangon. Some are also posted on the website of the WHO Collaborating Center for Nursing (UON).



## **Section 4.7**

### **University of Pharmacy (and Others)**

by Marlar Myint

#### **1. Institutional Profile of the University and its Antecedent Institutions**

##### **1.1 Department of Pharmacy under the School of Paramedical Sciences**

Since 1964, a two-year Diploma Course in Pharmaceutics has been introduced in the Union of Myanmar with the establishment of the Department of Pharmacy under the School of Paramedical Sciences in the compound of Yangon General Hospital.

##### **1.2 Institute of Pharmacy**

As there was a great need of qualified pharmacists, Institute of Pharmacy was formerly opened in Yangon University Campus (BOC College), Thahton Street on 30<sup>th</sup> January 1992. Initially, a two-year B.Pharm (Bridge Course) for graduates with diploma was conducted. The four-year B.Pharm Course has been started in 1994 with an intake of 50 matriculated students.

On 7<sup>th</sup> May 2001, the Institute was moved to the present campus (19.958 acres) in Waibargi, North Okkalapa beside the Communicable Diseases Hospital. Student intake has gradually been increased to 200 and above.

##### **1.3 University of Pharmacy**

In 2005, the Institute was elevated to the status of University of Pharmacy, Yangon.

###### *1.3.1 Departments*

1. Administrative Department
2. Department of Student Affairs
3. Department of Finance
4. Teaching Departments
  - (a) Department of Pharmaceutics
  - (b) Department of Pharmaceutical Chemistry
  - (c) Department of Pharmacognosy
  - (d) Department of Pharmacology
  - (e) Department of Pathology
  - (f) Department of Biochemistry
  - (g) Department of Physiology
  - (h) Department of Anatomy
  - (i) Department of Chemistry
  - (j) Department of Botany
  - (k) Department of Zoology
  - (l) Department of Communication Science (Myanmar and English)
  - (m) Behavioural Science (taught by teaching staff from Yangon University)
  - (n) Mathematics and Medical Microbiology-(taught by teaching staff from University of Medicine -2)

### 1.3.2 *Institutional Personnel Strength*

It comprises 4 Administrative officers including Rector, 62 Teaching staff, 19 Technicians, and 27 clerical and supportive staff.

### 1.3.3 *Yearly Pharmacists Production*

- D.P.M.S. (Pharmacy), 1966 -1991=146
- B.Pharm. (Two-year Bridge Course), 1992-1998= 46
- Diploma in Pharmacy (One-year Course), 1998 – 2001=212
- B.Pharm. (Regular) 2000 (1994 intake), 2011=1412
- M.Pharm. 2006 (2003 intake), 2011=44

## 2. **Research at the University of Pharmacy**

### 2.1 **The Organization and Co-ordination of Research**

This is generally similar to what is usually done at Universities of Medicine. There is no formal body or committee at University level to organize, co-ordinate and direct research but there are Postgraduate Boards of Studies in departments where Master's course have been instituted, which not only oversee the teaching curriculum but also supervises and directs the research projects that are implemented by the postgraduate candidates. Research projects are selected ad-hoc depending to a large extent on the research programs and facilities available at host institutions where most of the laboratory research has to be done because of their lack within the University. Resource persons from other universities, departments under Ministry of Health and departments from other ministries supervise most of the postgraduate research. All the general remarks concerning research at Universities of Medicine apply also to the University of Pharmacy. The predominant aim of the University is transfer of knowledge and production of pharmacists to fill a large need; generation of knowledge has regrettably become a poor second; while service function is minimal.

Research activities at the University mostly revolve around what postgraduate students need to do as part requirement for the Master's degree in Pharmacy. There is no consistent, continuous departmental research program.

### 2.2 **Funding and Resource Gaps**

Similar to the Universities of Medicine there is no research fund and postgraduate students have to bear all research expenses including bench fees charged by host institutions. Resource persons from other universities, departments under Ministry of Health and departments from other ministries supervise most of the postgraduate research.

### 2.3 **Limitations for Research Activities**

Apart from the lack of funds and limited laboratory facilities mentioned above, the teaching staff has no time for research activities as there is a poor student-teacher ratio; there is poor incentive for doing research.

### 2.4 **Research Program, Activities and Output**

(a) **Research activities** have been initiated since the establishment of Master of Pharmacy Course in 2003. During the last 10 years forty-five + 5 research projects have been completed and 10 are ongoing. Among them there were a total of 9 research projects on infectious diseases prevalent in the tropics:- 4 on malaria, 1 on tuberculosis, 2 on diarrhoeal diseases, 1 on ascariasis and 1 on HIV. One research paper has been published in a national medical journal; 6 in international journals.

(b) **Research papers and posters-** 6 were presented by postgraduates and faculty of the University of Pharmacy at Myanmar Health Research Congresses and Medical Conferences, one of which won the *Best Poster Prize in 2008*, another won the *Second Best Paper Prize in Applied Research in 2009*; another won the *First Prize for the Best paper in Basic Health Science in 2010*; and another the *Third Prize for Basic Health Research in 2010*.

(c) **New products-** 2 new/modified pharmaceutical products have been developed by postgraduate students of the University of Pharmacy (in collaboration with the host institution where it was done) and are being processed for approval by the Myanmar Food & Drug Administration, namely:- (i) Piperisinin and (ii) Piperaquine, the first legally manufactured ACT in Myanmar.

This achievement by the University of Pharmacy deserves to be commended considering the relatively small number of postgraduate students and the short time span since the opening of the Master's course and the start of research activities at the University. Even though, like many other pre-clinical departments of most Universities of Medicine, postgraduates and teachers of the University of Pharmacy had to use the research facilities available elsewhere in collaboration with research and technical staff there, they have benefitted from the transfer of technology especially by focusing on pharmacokinetics. Also noteworthy is the new/modified ACT which will be very useful for the treatment of drug resistant malaria in Myanmar.

### **3. Other Technical Universities (Added by the Editor)**

Research at other Technical Institutes/Universities developed generally on the same lines as at the University of Pharmacy; and the comments made with respect to organization and coordination, finance and resources gaps, and research limitations generally also apply. Most of the research was done by postgraduates and their supervising Faculty when courses leading to Master's degree and Doctorates were opened; but the type of research and research programs done may be more technology oriented rather than disease oriented.



## Section 4.8

### University of Community Health

by Than Sein

#### 1. The Predecessors of the University of Community Medicine

##### (a) Aungsan Health Demonstration Unit and Training Centre

The *Aungsan Health Demonstration Unit and Training Centre (ASHDU&TC)* was established in 1951 by joint cooperation between Government of Union of Burma (GUB) and Technical Cooperation Agency (TCA) of USA. The Unit/Centre started its function in January 1953 and was completely taken over by GUB in October 1953. It was originally located in Aung San Myo 13 miles north of Yangon outside the municipal area in one of the premises of the Rehabilitation Brigade (Pyan-le-htu-taung-ye Brigade). When the municipal area was expanded to include Aung San Myo it was moved to Hlegu in 1965 where it was temporarily housed within Hlegu Township hospital and then moved to newly built premises in Hlegu. The Unit was managed by a Team Leader and the Township Medical Officer acted as Deputy Team Leader.

##### (b) School of Health Sciences

In 1989 the ASDU&TC was transferred from the Department of Health to the Department of Medical Science and placed under the *Health Assistant Training School (HATS)* which was renamed the "*School of Health Sciences*" in 1992, thus merging the overlapping roles of AHDU&T and HATS which was now responsible for pre-service and in-service training of HA as well as PHS I and PHS II. Then in 1995 the School of Health Sciences was again upgraded as the University of Community Health (UCM). Then in the year 2000, the University moved from Insein, Yangon to Magwe City, Magwe Division in central Myanmar. The field practice area for UCM was established and the staffs of former AHDU&TC were deployed at this public health field training centre, in Tawseik, Salin Township, situated in opposite bank of Ayeyarwaddy.

The *objectives* of the ASDU&TC as originally conceived in 1951 were (a) to provide all categories of public health workers with practical field training especially in rural health (b) to demonstrate proven health practices to the people (c) to carry out and to provide opportunities for *experimentation and research* in the field of public health. It was an imaginative, practical and pioneering enterprise for public health training and public health research.

#### 2. Research

The above initial objectives/functions of ASDU& had now devolved upon the University of Community Medicine; whether and to what extent experimentation and research in the field of public health had been taken up by the University and its predecessors is considered as hereunder-

Surveys of health conditions in the community were done by the team leader and staff of the ASDU&TC during the early years- such as prevalence of anemia among pregnant women in Saw-bwa-gyi-gone village, and prevalence of ascariasis in the community, etc. Some other such studies by medical students of Final Part 1 classes and DTM&H students were probably also carried out in the demonstration area of Aung San and Hlegu townships together with ASDU &TC staff. Sanitary latrines, fecal disposal and safe drinking water

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RELATED RESEARCH AT OTHER UNIVERSITIES

practices appropriate to local conditions were obvious research areas calling for experimentation, innovation and demonstration to the public; but except for the construction of concrete squatting plates for latrines and their distribution there is no records of such research activities at ASDU&TC and successive institutions.

The Sanitary Engineering section of DOH had been demonstrating and making use of some uniquely Myanmar and simple, innovative methods such as (a) getting rid of lethal concentration of toxic gases in old unused wells by lowering an opened, upturned umbrella into the well with a string and moving it vigorously up and down (b) testing for fecal contamination of well water from nearby latrines by pouring kerosene oil into the latrine and detecting fecal contamination if the well water smells of kerosene. (c) testing for significant iron content in tube well water by seeing whether Myanmar tea prepared with the well water turns dark brown or black (already well known to the community).(d) precipitation and clearing of muddy water to make it potable by using alum and Ye-kyi seed (already well known to the community). It is uncertain whether ASDU & TC staff were involved in the initial experimentation and testing of these innovative methods and quantitatively confirmed the crude household methods already well known and used in the community.

It is most probable that staff of the ASDY& TC and of the successor University of Community Health (UCH) participated in the public health studies carried out in the field practice areas at Hlegu and Salin townships by investigators from Universities of Medicine and others; but publications attributable to ASDY&TC or UCH cannot be found. Most of them may have been buried within departmental reports or within research reports where ASDY staff were perhaps not included as co-authors.

## **Section 4.9**

### **Defence Services Medical Academy**

**by Tin Maung Hlaing & Marlar Than**

#### **1. Historical Background**

The Defence Services Medical Academy was set up in 1992 as a separate institution of higher learning in Medicine. Previously, starting from 1963, military medical cadets received their medical education and academic training together with civilian medical students, at the Institute of Medicine (2) Yangon, located in the military cantonment of Mingalardon in the northern part of Yangon. The teaching hospital of IM2 was the Defense Services General Hospital with medical, surgical wings/wards; Family Wing comprising Obstetrics & Gynecology Ward and a Children's Ward; specialty services including Eye and Ear& Nose Throat departments as well as Dentistry; and ancillary services including radiology, physical medicine and the Medical Corps Central (MCC) laboratory. The Faculty/teaching staff of the clinical and para-clinical academic departments comprises military specialist doctors and general duty medical doctors of DSGH and MCC laboratory; and specially recruited full time/part-time civilian physicians, surgeon and obstetrician/gynecologist. The pre-clinical academic departments were taught by part-time Professors and teaching staff of the Institute of Medicine 1, Yangon. Later when the Ministries were re-organized in 1973 and the Institutes of Medicines were moved from under the Ministry of Education to the Ministry of Health, pre-medical departments were opened at IM2 with specially recruited teachers from the University of Rangoon.

Later, IM2 moved all its academic departments and Faculty to its new location in new buildings at North Okkalapa and its teaching hospital to the newly built North Okkalapa General Hospital with the Insein General Hospital as ancillary teaching hospital. It was then that the Defense Services Medical Academy was separately established for the purpose of educating and training military doctors only. It occupied the premises previously used by the Institute of Medicine 2.

Later, it moved into the fine, new, well equipped buildings and spacious grounds at its present location in Mingalardon. The greatly expanded DSGH with a newly built, well equipped Surgical Wing, newly built Family Wing and Renal dialysis Unit; as well as the newly built separate Orthopedic Hospital became its teaching hospitals. All the Faculty/teaching staff of DSMA are now well qualified, well trained military doctors and scientists.

The Nursing Training School for military nursing cadets established in 1953 at the premises of the MCC near DSGH was upgraded to the status of a military Nursing college and also moved to new quarters in the same compound as the DSMA.

#### **2. Function of the DSMA**

The function of DSMA, like all Universities, is generally to impart knowledge as well as to generate knowledge. Thus it teaches medicine and trains military medical cadets to become general duty medical officers and specialist medical doctors to serve in the Defense Services. Also, it carries out research in support of the mission of the Directorate of Medical Services (DMS) - which is to make soldiers 'fit to fight'.

### 3. The Organization of Research

(a) *Research and Development Committee* – has been established at DSMA whose function is to draw up strategic plans for research on problems especially relevant to the health of military personnel; and for research capacity development to enable research commensurate with the needs and resources of DMS.

(b) *Existing Research status and facilities* – a clinical research unit for cerebral and complicated malaria was established by DMR at No.2 Military Hospital in the 1980's headed by a military specialist which did pioneering research on drug resistant malaria. A clinical research unit for malaria was also set up independently by DMS later at DSGH.

However, there are no facilities specifically for research in the other clinical and preclinical subjects. Research when performed is done with the teaching facilities available at DSMA for pre-clinical subjects; with patient care facilities at DSGH and other military hospitals for clinical research; and with the facilities at the medical battalions and the service units for field research such as epidemiology and HSR. Recent large inputs to improve teaching facilities at DSMA - such as improvements in the library, the laboratories and in computer facilities are available for research and greatly adds to the facilities for research.

Most of the research at DSMA is done by postgraduate students as part fulfillment of the requirement for the academic degrees of M.Med.Sc. M.Sc and Doctorates; and also sometimes by teachers when they act as research supervisors in addition to administrative supervision. Apart from their involvement in such research, the teaching staff seldom undertake their own research projects. There are at present 18 M.Sc and M.Med Sc degrees being offered and Doctorate degrees. Most of the above research is done at DSMA or its teaching hospitals and field battalions; although some may be undertaken at the DMR's or at Medical Universities to which the postgraduates may be attached for research topics for which necessary facilities are unavailable at DSMA. Undergraduate students receive some research training during field trips for Community Medicine arranged by the Preventive and Social Medicine department.

(c) *Financial support of Research* – There is no fund earmarked for research and research development. DSMA does not receive institutional development grants for research like the DMR's and Universities of Medicine. The Faculty does not apply for nor receive individual research grants from national nor international sources. However, there is a collaborative research project between DMS and WHO to investigate drug resistant malaria and Professor of Medicine and some teaching staff from DSMA participate.

### 4. Research Capacity Development

(a) *Development of human resources* - most of the Faculty have now acquired a Master's or Doctorate degree and so have had research training and experience; some have been able to attend training courses for special research skills at research institutions or medical universities in the country and abroad as well as attend international or regional research conferences and thus have been able to build up their research expertise. Examples of recently acquired laboratory expertise are: tissue culture technology and immune-histological techniques. All postgraduates have to attend Research methodology training courses given at DSMA or at DMR's and Medical Universities. Undergraduate students receive some research training during field trips for Community Medicine arranged by the Preventive and Social Medicine department.

(b) There have been extensive upgrading of the library, the laboratories and computer facilities and although mainly meant for teaching purposes they are also available for research.

(c) Similarly, upgrading of patient care facilities at DSGH and other military hospitals at NayPyiTaw and elsewhere in the country means that they are available for research by postgraduates for research leading to academic degrees as well as available for research by teaching and service staff.

(d) The Myanmar Medical Military Conferences which are regularly held gives opportunity for exchange of knowledge between military researchers and medical scientists. This as well as participation at DMR Research Conferences and at MMA Annual Meetings and Meetings of MMA Specialty Sections are the means whereby research capacity development takes place.

## **5. Research Culture**

The development of a research culture is implicit in all institutions of higher learning like the DSMA. The love and pursuit of knowledge and evidence-based professional practice are some of the ingredients of a research culture. Like in most other medical universities in Myanmar, such a research culture is still not yet well developed at DSMA. Part of the reason in all medical Universities may be that the first priority is on imparting knowledge and acquiring knowledge whereas the generation of knowledge is a poor second. Even for post-graduates students, research is only a means to an end which is to become competent professionals and specialists. Much remains to be done for a research culture to become established at DSMA and the Medical Universities.

## **6. The Quality of Research**

Regarding the quality of research the remarks made in the first volume of Growth & Development of Medical research in Myanmar with respect to research at the Institutes of Medicine in the 1970's still generally apply to many of the researches at DSMA as well as the Medical Universities.

Nowadays conditions have improved considerably. Most of the research supervisors at medical universities are well qualified, experienced researchers and research facilities have improved so that proportionately more of the research is original and innovative although a variable number are repetitive and lack scientific merit. Most academic departments still do not have a consistent, continuing research program. Many research projects are supportive of health programs and the results are applicable and used in clinical practice, in the laboratory and in the field.

## **7. Research Programs, Projects and Research Areas**

The 18 academic disciplines in which M.Sc. and M.Meds Sc. degrees were offered by DSMA indicate the range of subjects on which research is being undertaken.

The type of research done includes: clinical surveys, case series, clinical trials of drugs and diagnostic methods and devices, Health Systems Research, medical education research and some basic biomedical research.

The research output given below indicates the variety and range of topics covered. The largest number is on infectious diseases of which the highest number is on malaria which is still the top health problem in the military.

## 8. Research Output

**8.1** The number of papers and publications by DSMA postgraduates and faculty during the period (1968 to 2009) were 781. There were 35 topics on which research was done and the distribution of papers by topic is given in Table 1.

**Table 1**

1	Anaesthesia	17
2	Biochemistry	2
3	Cardiology	20
4	Cardio-vascular & thoracic surgery	6
5	Endocrinology	10
6	Gastroenterology	7
7	Gastro-intestinal and hepato-biliary surgery	8
8	General surgery	22
9	Haematology	9
10	Health systems research	24
11	Hepatology	16
12	Immunology	8
13	Indigenous medicine	8
14	Infections	196
15	Maxilo-facial and dental surgery	12
16	Medical education	13
17	Medical nursing	44
18	Microbiology	16
19	Neurology	6
20	Neuro-surgery	5
21	Obstetrics and Gynaecology	67
22	Oncology	4
23	Ophthalmology	25
24	Orthopaedics and Traumatology	33
25	Oto-laryngology	10
26	Paediatrics	37
27	Pathology	11
28	Pharmacology	2
29	Psychiatric medicine	15
30	Public health	71
31	Radiology	20
32	Renal medicine	16
33	Respiratory medicine	8
34	Rheumatology and physical medicine	4
35	Uro-surgery	9

**8.2** The total number of theses published at DSMA in 18 academic disciplines is 478 which include 10 PhD and 28 Doctorates of Med Sc. The number of research projects done in each discipline as partial fulfillment for the post graduate degree is given in Table 2.

**Table 2**

1	Anaesthesia	61
2	Anatomy	10
3	Biochemistry	12
4	Medicine	75
5	Microbiology	17
6	Obstetrics & Gynaecology	15
7	Ophthalmology	10
8	Orthopaedics	25
9	Otolaryngology	15
10	Paediatrics	43
11	Pathology	43
12	Pharmacology	8
13	Physiology	7
14	Psychiatric medicine	5
15	Public health	55
16	Radiology	33
17	Rehabilitation	5
18	Surgery	39

### **8.3 Ad hoc research projects**

In addition to the research done as part of academic studies leading to postgraduate degrees ad-hoc studies were also carried out from time to time according to operational needs or personal interest, at DSMA and at field medical battalions. These were clinical surveys, report of case series and descriptive studies of local clinical and health conditions.

### **9. Future of Research at DSMA**

It is of utmost importance to carry out research strategically not necessarily based on mandate and intuition only. In order to keep research standard abreast with international level, softer components of research like research ethics and research governance should receive more attention while relying on hard data. Active involvement in international research network is seen and DSMA research team needs to be prepared for interoperability.

### **10. Conclusion**

DSMA is the Institute of Higher Learning for Medical Science which has been established by the Ministry of Defence for the purpose of producing medical doctors to serve in the Directorate of Medical Services whose primary mission is to make the soldier 'fit to fight'. Thus DSMA imparts knowledge and also generates knowledge by conducting research and undertaking research programs that will solve or reduce the special health problems of the military (including military families) and which will at the same time also address the health research needs of the country.

CHAPTER 4 RESEARCH AT UNIVERSITIES UNDER THE MINISTRY OF HEALTH AND HEALTH  
RELATED RESEARCH AT OTHER UNIVERSITIES

## **Section 4.10**

### **Universities of Arts & Science and Others**

**by Aung Than Batu**

Departments of the University of Rangoon have undertaken research relevant to health and medical care from the beginnings of medical research in Myanmar- particularly the Departments of Zoology and Botany. Post graduate students of these departments sometimes choose ad hoc many topics of interest both to biology as well as to medicine and health which they often carry out at health institutions such as the Department of Medical Research where advanced laboratory research facilities are available or at the Department of Health for field research.

Topics of mutual interest to Zoology and Medicine include the causative agents and vectors of diseases such as malaria, plague, leptospirosis and others. Thus extensive zoological studies of Anopheles mosquitoes, fleas and rats have been carried out both by postgraduates of the Arts & Science Universities as well as the Universities of Medicine. Snakes and snake-bites are also of great interest; the earliest systematic study of poisonous snakes of Myanmar in 1956 was by a doctor as a thesis for a postgraduate Zoology degree. Other topics, such as about the breeding and distribution of fish species and about the poisonous puffer fish, are relevant to nutrition and medicine. Recently, because of the emergence of Avian Influenza in the world and in South-east Asia the study of bird migratory routes into Myanmar has become a hot topic for medicine. Research done at Veterinary Science departments is also of much relevance to medicine; there is increasing awareness of the importance of Zoonotic diseases like anthrax and bovine encephalitis or mad cow disease to medicine.

The Department of Botany was interested in indigenous medicinal herbs from the early years after Independence and its Faculty and students have done extensive studies on their own as well as in collaboration with other scientists. The Burma Medical Research Society convened a symposium in 1960 on the status of research in Myanmar on indigenous medicinal plants with participation of the Faculty of Medicine, Faculty of Science, University of Rangoon, staff of the Union of Burma Applied Research Institute and the Directorate of Health Services.(see G&D Med Res volume 1,chapter 4, section 4.6) Later the Botany Department participated in the collaborative efforts to find the then new Chinese anti malarial herb Qinghausu or Artemesia annua in Myanmar and in efforts to cultivate it in Myanmar. Other studies of its own by the Botany Department such as the different varieties and seasonal distribution of pollen is of interest to medicine for the prevention allergic asthma and hay fever.

In recent years health service and research institutions have become increasingly aware of the importance of socio-economic, cultural and behavioral factors as determinants of disease and health. In addressing the double burden of disease (communicable as well as non-communicable) health scientists are using research strategies which cut across disease entities and which deal with the underlying influences –such as urbanization, industrialization, demographic transition, and life styles. Thus, research at Arts and Science Universities by social scientists about changing trends in life styles and human behavior relevant to health such as smoking, alcoholism, adolescent sexual behavior; research by economists about the distribution of household expenditure; research by psychologists about

CHAPTER 4 RESEARCH AT UNIVERSITIES UNDER THE MINISTRY OF HEALTH AND HEALTH  
RELATED RESEARCH AT OTHER UNIVERSITIES

addiction, Myanmar personality traits and development of standardized psychological interview schedules; and many other topics are of relevance to medical science. Medical scientists themselves have taken up many research topics in these areas and also sometimes in collaborative efforts with social scientists, economists, and psychologists. Thus, for example, DMR has been awarded a research grant to conduct studies of adolescent behavior; and development of research methodology in equity and gender areas by DMR (LM) social scientists have won international recognition.

Similarly, other Universities elsewhere in Myanmar would also have been undertaking research of relevance to health and medicine. Recently, studies successfully initiated by the Department of Medical Research (Lower Myanmar) on the production of anti-snake venom antibodies (of Russell's viper) in chicken eggs have been taken up also by the University of Technology.

Research reports of many of the above studies are read at Scientific Meetings of the Arts and Science Universities and published in their respective scientific Journals- Journal of the Myanmar Academy of Art & Science.

## **Section 4.11**

### **Universities of Dental Medicine**

**by Aung Than Batu**

*(based on information from the University of Dental Medicine, Yangon)*

Research at the Universities of Dental Medicine in Yangon and Mandalay are in general organized and undertaken in a way similar to the Universities of Medicine. Teaching and service takes precedence over research and what is stated about research co-ordination, research programs and research capacity development in the Medical Universities also generally apply to the Dental Universities. Like all Universities research accompanied the progressive opening of postgraduate courses for M.D.Sc. and Dr.D.Sc. at the various academic departments and disciplines.

The type of research done is also similar being mostly clinical research including descriptive and etiological studies of diseases of the oral cavity such as infections and cancers and causes of oral cancer such as betel chewing. A few genetic studies of oral cancer were also included.

Epidemiological studies were also done with respect to prevalence of dental diseases and dental defects. Public health research was done on the social and economic aspects of dental health and hygiene and evaluation of preventive measures such as fluoridation of tooth paste. Physiological and pathophysiological studies were done such as saliva flow and biting/chewing mechanism.

Because of the nature of dental medicine there is proportionately much greater emphasis on operative techniques and technological research – especially on dentures. Studies were done on the design and fabrication of dentures and investigation of the materials used as well as the effectiveness of dentures.

Some departments of the University participate in joint collaborative research with national and foreign academic institutions such as, with DMR (LM), on oral cancer screening and, with the George Institute for Global Health (Australia), on the burden of cancer and its economic impact on household in ASEAN countries (ACTION study).

CHAPTER 4 RESEARCH AT UNIVERSITIES UNDER THE MINISTRY OF HEALTH AND HEALTH  
RELATED RESEARCH AT OTHER UNIVERSITIES

## **Section 4.12**

### **Overview**

**by Aung Than Batu**

This is a general overview of research development in the medical and medically related Universities. However, these Universities are in different stages of development depending upon their historical background; and the observations and comments given hereunder apply in different ways and to different extent for each University.

### **Early Years**

In the early years of postgraduate medical education at Institutes of Medicine in the 1970's, most of the faculty were yet inexperienced in research and research facilities and research programs were absent or meager. Even then, there were a few good research programs. In G&D Medical Research (volume one) there is a vivid description of how in a few subject areas where faculty members with good research experience were already in position, a departmental program of research had been formulated, and most important, when the tools for research were either available in the department or readily accessible elsewhere (such as at DMR) – it only needed the opening of the M.Sc course attracting bright, dedicated post-graduate students to start off a series of closely linked research projects in a broad area of scientific interest and relevance to conditions in Myanmar, which was intellectually rewarding to the scientists, contributed to knowledge, and provided answers to research questions of importance for health development in Myanmar.

### **Recent Development**

Conditions for research in the Universities of Medicine (formerly Institutes of Medicine) and other Universities are now much better, having improved gradually since the 1990's. All teaching departments have faculty members with varying levels of research expertise; preclinical departments of the Universities (especially Yangon and Mandalay) may access appropriate laboratory tools for research easily or with some difficulty at research institutions (DMR) or service institutions (NHL, MPF), to which their postgraduates may also be attached for their research.

### **Research Function of Universities and research capability Strengthening**

The primary function of the Universities is to produce different categories of human resources for health and research is an additional or secondary function Research matters are usually considered as part of academic teaching activities. Research promotion and direction is not included among duties of the Academic Body. Research is conspicuously absent among the functions and activities of the University mentioned in the University handbooks; however, they do mention the research carried out at academic departments.

A significant step forward in the organization and direction of research is that in recent years academic departments of the University of Medicine 1, Yangon have developed 'Research Themes' of variable consistency and continuity, as mentioned in the Prospectus 2009. The other Universities of Medicine do not do not mention research theme of departments in their Handbooks (up to 2008) and departments probably do not have one, although the diverse subjects and topic on which research is being done is given.

While the Universities have been strengthened for better teaching, there has been no deliberate strengthening of research capacity or research infrastructure; laboratory facilities at pre-clinical departments are barely adequate for teaching of undergraduates and did not have the equipment necessary for higher level postgraduate teaching and research so that postgraduates requiring such facilities had to be sent elsewhere. However, the increased facilities for teaching, including modern information technology and computer networks, upgrading and expansion of the libraries, upgrading the qualification of teachers to Master and Doctorate levels – have all resulted indirectly in considerably better research capacity of the Universities. An important advance in improving the research capacity of Universities in recent years is the opening of Common Research Laboratories(CRL).The Common Research Laboratory at UC2,Yangon, was opened in 2000 and another at UMM was opened in 2002 thus reducing the necessity and disadvantages of sending postgraduates from its preclinical departments elsewhere; However UM1 still needs a CRL.

Similarly, teaching hospitals which have the dual function of service and teaching are taking on research as an additional function – the triple function of service, teaching and research being like a three legged stool. Many specialty and sub-specialty clinical dept/units have been added to teaching hospitals, and equipped with up-to-date diagnostic and therapeutic tools, and supported by modern imaging and clinical laboratory facilities. (*See under Developments in Clinical Research: chapter 8 section 8.1*). Moreover, DMR, in accordance with its mission of promoting research elsewhere has set up Clinical Research Units (CRU) on malaria and snake-bite in hospitals since the 1970's; it continues to do so and a few more have been added since then, so that there are now 8 CRU's on different subjects at clinical teaching departments of University Teaching hospitals and one Research Unit at University of Medicine 2, Yangon (*see under Developments in Clinical Research Chapter 8 section 8.1*). In addition, special facilities elsewhere at DMR, NHL or MPF could be accessed for research. All these clinical and support facilities are being used for patient care as well as for a wider range of better quality clinical research by service / teaching staff of clinical departments as well as by postgraduates.

One of the mechanism for ensuring that appropriate, adequate research is done by postgraduates of the Universities as required is to attach them to institutions elsewhere like DMR, NHL, where the necessary research facilities and research supervision is available. This arrangement has to be done by most preclinical teaching department like Physiology, Microbiology or Pathology of some of the Universities of Medicine especially for research projects where advanced laboratory facilities are necessary .This is an opportunity as well as a disadvantage sometimes. There is the opportunity to participate in research programs relevant to national priority diseases and health problems. The disadvantages to the pre-clinical teaching departments are that being dependent on other departments and institutions for research facilities their postgraduate students have to participate in such research programs as are ongoing or planned by the host departments and therefore these preclinical teaching departments do not have a research theme of their own. The faculty does not have the opportunity to acquire research skills, experience in depth in any one research area and to benefit from the continuous stream of postgraduates who may be used as research assistants for research projects and independent research themes of their own. The research topic is chosen ad-hoc and a research theme/program which, although not directly applicable to healthcare but nevertheless is of scientific importance to the development of the subject (such as Physiology or Pharmacology), may not be considered nor pursued. There may be exceptions but this is a big disadvantage. The recent opening of a Common Laboratory at UM2, Yangon, and UMM has reduced this disadvantage to some extent but UM1 still needs such laboratory facilities.

Some types of research such as epidemiological research or socio-economic research or health systems research do not require any special equipment and departments undertaking such research like the Department of Preventive and Social Medicine should be able to do research according to a research theme and program of their own. Similarly, the Anatomy department has sufficient facilities in-house to study gross anatomical structures in interlinked research projects within a common framework. Sometimes also the Professor /Head of the preclinical department may be able to negotiate with the host dept/institute to accept research projects proposed by them. Clinical teaching departments of the Teaching Hospitals however have the basic support facilities for clinical care as well as for clinical research and some also have advanced facilities so that their postgraduates need not be placed elsewhere. Moreover there are CRU's in some clinical teaching departments and further facilities are accessible at DMR and NHL. Therefore their postgraduates are kept in-house and need not be placed elsewhere with many advantages to both faculty and students. The postgraduates are under direct supervision by the faculty clinically and administratively as well as for research. The faculty has a continuous, ensured stream of clinical assistants and could therefore draw up a research theme/agenda if desired.

The health sector as a whole benefits from the numerous research projects undertaken by the postgraduates of the Universities especially in implementing national priority health programs despite the difficulties and disadvantages encountered by individual departments of the Universities. The impact on clinical, public health and laboratory practice is considerable and especially evident in some priority health problem areas such as malaria, snake-bite, DHF, diarrhea, ARI, AIDS, etc. Their contribution to advancement of medical science however is perhaps small but significant and noted elsewhere (see under Developments in Clinical Research Chapter 8 section 8.1).

The recognition of the University of Nursing (Yangon) as the WHO Collaborating Centre for the development of Nursing and Midwifery is a commendable example of contribution by a health related University to its academic discipline

The Department of Medical Science (DMS) is responsible for production of different categories of health professionals. (National Health Plan 2001-2006, 2006-2011 and prior Plans); the four Medical Universities and other Health Universities under DMS produce different categories of health professionals, doctors, nurses, dentists, etc as primary function; whereas they conduct research only as an additional function; they also produce health professionals with special qualifications of advanced level such as MSc, M.Med.Sc, Ph.D, D.Med.Sc.

The function of all Universities everywhere is to generate and transfer knowledge. The medical and medically related Universities in Myanmar, with many highly qualified faculty trained for teaching as well as research, have done a tremendous job in having to fulfill the large needs of the country for human resources for health. In doing so, they have had to give research and the generation of knowledge a low second place. Research capacity development is given low priority. Research at the Universities has not received direct, separate support and research facilities- (excepting the recent opening of the common laboratory at two Universities with funds from external sources). Departments and Faculty have not applied or have not been able to apply for the many competitive research grants available worldwide.

Especially, regionally at WHO, UNICEF and other UN Agencies, university clinical departments or individual clinicians should be able to obtain such grants because many of the clinical problems they are dealing with such as drug resistant malaria, diarrhea and DHF may be within the area of interest of these bodies. University preclinical departments should also

exploit such opportunities. However, they would need to develop departmental research themes which come within the interest of the grant giving bodies.

### **Hopes for Future Research Development**

Despite having to give research and the generation of knowledge a low second place, despite the disadvantages with respect to developing a congenial research culture, and despite limitations in advanced laboratory technology- research at the Universities of Medicine and medically related Universities are now on an upward curve. With the recent liberalization and opening up of opportunities it is to be hoped that the take-off point for a strong program of innovative research that contributes to the health of the people of Myanmar as well as to the advancement of medical science in Myanmar will soon be reached.

**CHAPTER 5**

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## Section 5.1

### Department of Health

by Aung Than Batu

#### Introduction

Research is not its primary function but DOH does undertake research as an ancillary activity, as and when possible, sometimes intentionally and often unintentionally, especially health research that supports its major service programs and projects, particularly and more often, the type of research termed Operational Research (OR) and Health Systems Research (HSR). (*see explanation of Operational and Health Systems Research, 3(1) below*)

DOH service programs and institutions at central, state/division, township levels undertake health research in two ways:

#### (1) Planned Research

Many of these researches are explicit and organized at central level according to well formulated research programs and projects, either by DOH alone or in collaboration with other Departments, Institutions and organizations in Myanmar or abroad and are relevant to national priority health research problems. Many of them are OR or HSR, particularly those done by DOH alone; but other types of research including clinical research, public health research, socio-medical research and some laboratory oriented research are also done, especially in collaboration with others. Such planned research is usually published as research papers and/or presented at medical scientific meetings or as reports to sponsor/funding agencies. Some studies such as evaluation of health service programs and projects may be presented only as reports to Departmental or Ministry of Health meetings like National Health Planning Committee Meetings.

#### (2) Unplanned Research

However, a large proportion of the research which has taken place and continues to be carried out by DOH is unintentional, ad-hoc; it is not conceived, executed and reported as research; and only retrospectively recognized to be research.

Many such research activities are Operational Research and Health Systems Research done at central or peripheral level. The national program manager or peripheral level medical officer/investigator undertaking such activities as part of a health service may be unaware and unconcerned as to whether it is or is not research. The main concern is effective and efficient service delivery; so, evaluation of performance and changes in methods of service delivery that will improve performance may be carried out but the outcome of such activities are not reported as research findings in research papers or research presentations but are embedded within reports of service activities and only become apparent as research findings retrospectively on review later by those who did it or by others. Many of the findings are relevant and useful to local situations only and a few are perhaps relevant and useful elsewhere; but in one or two instances they became cumulatively important nationally.(example: pilot studies done in the Trachoma Control Program and the quasi-experimental Integration Trials of vertical disease control programs into basic health services. (*see G&D Med Res vol. 1 Part 4, section 11*))

Some unplanned professional activities may be clinical or laboratory research - such as when a surgeon modifies and improves, an operative technique by trial and error or when a physician modifies diagnostic criteria or a bacteriologist at a hospital laboratory similarly

adapts and improves a laboratory procedure. These are done during the course of routine work and may be presented at a local clinical meeting but not written up as a scientific paper. The improved method may be of use only locally or it may be taken up by others if found to be useful. Such unplanned professional activity contains intrinsically the essential elements of research – the professional has an *objective* in mind i.e. an improved method; he/she performs *experiments* i.e. trial and error; *results* are obtained i.e. an improved method was developed which proves to be useful to the professional. It is *corroborated* if others found the improved method similarly useful. This process may be regarded as the type of research termed *developmental research*.

### (3) Type of Research

#### (1) *Public Health Research or Health System Research or Operational Research*

*[To clarify the overlapping and interdependent meaning of the terms Operation Research, Health Systems Research being used by DOH and elsewhere: It should be explained that:*

(a) *Health Systems Research is done to study and improve the functioning of the health system at different levels; or to study and improve the delivery of health services/health care at different levels. It includes research specifically meant to improve decision analysis and decision-making process in managing the health system. Health System Research, in a wider context, includes socio-economic and health behavior research.*

(b) *Operational research (as now practiced in Myanmar) is done to study the functioning/applicability of various scientific methods and procedures under different operational conditions, particularly under local conditions in the community, hospital and clinics, and laboratory.*

*Such studies encompass:- different medical procedures ; medical devices; drugs, drug- regimes and their drug delivery systems; disease prevention measures; and health promoting measures.*

*There is no distinct boundary between these two types of research as practiced in Myanmar now; they overlap but may sometimes be distinguished from each other.*

*Operations research in a narrow sense is an interdisciplinary mathematical science that focuses on the effective use of technology by organizations.*

*Operation research may be used in government when evidence-based policy is required.*

*Some or all of the of the research designated as HSR may also be termed Public Health Research but some aspects of OR may not be regarded as public health research.*

*In practice, it does not seem to matter how they are called so long as their purpose is made clear.*

Most of this type of research done by DOH is implicit, ad-hoc, unintentional, and carried out by DOH in many of its service programs/projects. When in the 1970's the concept of HSR became more widely understood in Myanmar, it came to be realized that some of the managerial activities carried out by DOH to evaluate and improve efficacy and efficiency of service delivery were indeed HSR or operational research activities.

The DOH systematically and periodically makes a situation analysis and evaluation of all of its service programs and projects, considers/seeks ways and means to improve them, and then make plans to implement the activities required . Such efforts frequently call for Operation Research (OR) or Health Systems Research (HSR) (both terms being used interchangeably); OR is implicitly employed as a strategy in many service programs/projects where valid information for rational management decisions is required/acquired.

A HSR Unit was opened at DOH in 1970 and functioned for about 4 years till 1974 when it was transferred to the Department of Health Planning and then became defunct. The DOH no longer had a separate HSR Unit but it explicitly stated that HSR would be carried out as a component within its service programs/ projects. The National Health Plan (2006-2011) states that operational research would be used in some of the service programs.

Planned HSR projects were undertaken within many of its service programs/projects, some on its own and some in collaboration with others, especially those in national health priority areas. However many of the OR and HSR activities continue to be merged and embedded without distinction as integral components within service programs/projects.

## **(2) Clinical research**

Clinical research is done at clinical units of teaching hospitals whose function is service, teaching and research – in that order; and the work actually done by the clinical staff of teaching hospitals is likewise service, teaching and research –in that order; although, over the years, designations and administrative supervision may change. The clinical research is usually done in collaboration with teachers and postgraduates of the Institutes /Universities of Medicine as part of academic programs. Some are also done in collaboration with scientists of the Departments of Medical Research. Clinical Research Units jointly established by the DMR(LM) and clinical departments of teaching hospitals are strong, well supported units where clinical research with defined objectives and well formulated programs are carried out with consistency and continuity on high priority topics like drug resistant malaria, snake bite, DHF, viral hepatitis and diarrhoea.

## **(3) Laboratory Research**

*(excerpts from a presentation in 2012 by Dr Ne Win, Director NHL)*

Laboratory research is done by DOH at the National Health Laboratory. It provides routine diagnostic laboratory support for public health research carried out by the service programs of DOH (for details of functions and responsibilities see volume 1, part 3 section 1 c) but it seldom undertakes experimental research.

The NHL, in collaboration with WHO and other international reference laboratories, monitors newly emerging and re-emerging infections like AIDS, Avian Flu, and Melioidosis. Such a monitoring role is especially appropriate for NHL because it is the National Reference Laboratory and responsible for supervising the work of all state/divisional and township government laboratories as well as responsible for the national quality control and assurance program.

NHL has been considerably strengthened in recent years, especially with respect to medical technology.(see Table 1 below) It has received considerable amount of advanced equipment as well as training, enabling it to more accurately diagnose and characterize, genetically and at molecular level, the causative organisms of newly emerging and re-emerging communicable diseases of national importance. Also, using advanced medical technology acquired, NHL has given laboratory support for the mopping up operations of fast disappearing diseases like polio and leprosy.

The various laboratories and section of NHL also function as Research laboratories and have an interest in certain research areas and conduct research on their own or provide laboratory support for studies in collaboration with others (*see Table 2 below*)

Table 1

It has established the following recently developed laboratory techniques

Real time RT-PCR	for detection of Pandemic (H1N1) 2009 strain
RT-PCR-	for diagnosis of Dengue viruses (1, 2, 3, 4) and chikungunya virus
HAI test	for diagnosis of Melioidosis
ARMS-PCR	for study of Beta-thalassemia mutations
Multiplex-PCR	for study of alpha- thalassemia gene mutations
GAP-PCR	for globin gene mutants
Restriction enzyme digestion	for haplotype analysis MDR1 genes

Table 2

NHL functions as a Research Laboratory in the following areas:

Laboratory/Section	Research area
Bacteriology section	MDR-TB, Meloidosis, Water Microbiology, <i>Staphylococcus aureus</i> DNA resistance
Laboratory	Anthropometry; leukemias; Thalassemias; Oncogenes; Genetic markers
Parasitology section	Malaria diagnostics
Clinical pathology section	Thalassemia, Nephropathies, Hemostasis
Serology section	Syphilis; Gonorrhea
Immunology section	AIDS
Mycology section	Dermatophytes
Virology section	Epidemiology

### Research undertaken by Department of Health (DOH) and its Predecessors during the Period up to 1986

This has been described in “Growth and Development of Medical Research in Myanmar (1886 to 1986) published by Academy of Medical Science, 2003.

See especially:

- Part 1. Medical Research in British Burma during the Colonial period, 1886-1947
  - Section 2. The role of the medical services in research
- Part 2. The Early Years after Independence, 1948 -1961.
  - Section 3.1. Demonstration health projects/units
  - Section 3.2. Hospitals
  - Section 3.4. The Harcourt Butler Institute of Public Health
  - Section 3.5. The Pasteur Institute
- Part 3. First Decade of Organized Medical Research, 1962-1972.
  - Section 1.1 b. Central Epidemiology Unit
  - c. National Health Laboratory
- Part 4 Sustained Development, 1973 -1986

Section 5. Peoples Health Plans and increase in research capacity of the Department of Health and Defense Medical Directorate

Section 11. Developments in Health Systems Research and Socio-medical research- Health Services Research, Health Systems Research, Health Behavior Research

It may be seen from the above that during the colonial period and up to 1962 the Directorate of Health Services and other predecessors of DOH were virtually the sole organizations undertaking the few, infrequent health research being done in Myanmar in those times. Later- with the establishment of the Burma Medical Research Institute in 1963, which later became the Department of Medical Research, and opening of Post-graduate School of Medicine and Postgraduate Courses in Medicine by Institutes / Universities of Medicine beginning about 1970 - health research in Myanmar accelerated rapidly and became dominated by these other institutions and the role of DOH diminished. Gradually DOH share of research expanded from about the 1980's onwards as its research capacity improved together with the general build up of its facilities and resources including input of new medical technologies into the clinical and clinical support departments of major hospitals and service cum training institutions.

### **Research undertaken by Department of Health from 1987 onwards**

#### **Research Areas and Prioritization of Research**

Many of the research activities carried out by DOH are embedded within service programs. Some may be designated as distinct research projects while others may not be so designated but may be identifiable as research or as studies of certain specific topics.

National Health Plans use explicit objective and subjective criteria to prioritize diseases and health problems and on this basis they were ranked from 1 to 42 in National Health Plan (2006-2011).

The top ranking 15 are given below and these are the subjects on which most of the research activities and studies of DOH (as well as other Departments) were focused.

The first 15 in rank were:

No.	Disease/ Health Condition	Rank
1	Acquired immune Deficiency syndrome	1
2	Malaria	2
3	Tuberculosis	3
4	Diarrhoea/ Dysentery	4
5	Cholera	5
6	Avian influenza	6
7	Dengue Hemorrhagic Fever	7
8	Vaccine preventable disease	8
9	Protein Energy malnutrition	9
10	Postpartum and Ante- partum Haemorrhage	10
11	Drug Abuse	11
12	Pre-eclamptic Toxemia (PET) and Hypertensive Disorders of Pregnancy	12
13	Leprosy	13
14	Sexually Transmitted infections	14
15	Disasters	15

Many of the Health care/service programs/ projects of DOH recognize the need for research and explicitly mention research in the strategies and activities undertaken to attain program/project objectives.

In the 2006-2011 National Health Plan, 6 service programs, that is:-

- Community Health Care program.
- Disease Control program
- Hospital Care program
- Environmental Health program

- Health Promotion program
- Food and Drug Administration program

explicitly mention that operational research or health system research or studies will be undertaken in 22 of their 47 service projects.

Research done on each of the above 15 priority diseases and health problems by all Departments and Institutions and Organizations including DOH are given in Chapter 7 (Research areas and activities directed at Health Problems and Diseases).

### **Organization and Coordination of Research in DOH**

There is no overall organization and coordination of research at the Departmental level. Operational research and Health system research including surveys and studies of specific topics done in various service programs and projects, if any, is presumably organized and coordinated at program/project level; and coordination, as required, with other service programs/projects or with academic and research projects of other Departments usually takes place directly.

### **Financial support for research in DOH**

There is no financial support for research as such to the Department of Health. There is no budgetary provision or allotment of other resources specifically for research to DOH by Government. Operational research and health systems research explicitly undertaken by DOH within some of its service programs/projects is done with the resources obtained for service delivery; indeed, such research is embedded within service activities and may seldom be distinguishable nor require separate resources. Sometimes however a survey or a specific study of a topic carried out within a service program/project may be supported by funds provided to the program/project from the Government budget or from other sources such to the National Malaria Project from TDR or to the Nutrition Development Project from the Italian government

### **Research output and outcome**

The output of research done by DOH alone cannot be measured because much of it is unplanned, embedded within service activities and not reported as research. It is probable that an un-measurable but probably considerable volume of such unplanned research by DOH at peripheral service units, especially ad-hoc research, is repetitive and do not add to new knowledge or to improvement of the health status, but serves only local administrative purposes.

The considerable volume of planned research activities, by DOH alone or in collaboration with others, within large service programs/projects such as the National Malaria control project, Nutrition Development Project, DIDS and Tuberculosis Control project, etc. are seldom reported as research papers/reports but as service reports and are not readily quantifiable.

The utility and influence of research done by DOH on health development is considerable. Some good examples are:-research to show the status of drug resistant malaria and research on measures to control drug resistant malaria; similar research concerning tuberculosis and AIDS; and research to show the nutritional status of the population and on measures to improve nutrition (which won the prestigious "Liguria" International Technology for Development Prize in 1991 awarded by the Italian government).

As reported in G&D Med Res vol.1 the pilot studies of the Trachoma Control Program and the Integration trials of vertical disease control programs into horizontal basic health services carried out in previous decades were exemplary studies of great practical benefit .The Ayadaw health and social development program and study (which may be regarded as HSR) by the Ayadaw Township People's Health Plan Committee in which DOH played a guiding role won the prestigious Sasakawa Health Prize awarded by the World Health Assembly in 1986.

*\*[More detailed information about the contribution of research by DOH (alone or in collaboration with others) may be seen in Chapter 7-Research areas and activities directed at Health Problems and Diseases].*



## Section 5.2

### Department of Medical Science

by Aung Than Batu

The Department of Medical Science (DMS) is responsible for production of different categories of health professionals. (National Health Plan 2001-2006, 2006-2011 and prior Plans) The four Medical Universities and other Health Universities under DMS produce different categories of health professionals, doctors, nurses, dentists, etc as primary function and they undertake research as an additional function. The three Departments of Medical Research are the principal organizations that sponsor and conduct research in Myanmar, and the Dept of Health, Medical Science, Traditional Medicine, Health Planning and related departments under various Ministries also undertake research activities in addition to their principal functions in a cohesive and concerted effort for the maximum achievement of national health. (National Health Plan, 2001-2006, 2006-2011 and prior Plans)

The Universities of Medicine also produce health professionals with special qualifications of advanced level (in accordance with the Human Resources for Health Development of Postgraduate categories Project-National Health Plan 2006-2011) such as MSc, M.Med.Sc, Ph.D, D.Med.Sc. In doing so the Universities of Medicine have to ensure that appropriate health research is done by the postgraduates, this being an essential requirement of the postgraduate courses.

The lofty Aims of postgraduate medical education in Myanmar (as given in Prospectus 2009, University of Medicine 1, Yangon) is to provide medical education of an advanced level; to produce personnel with specialized knowledge and skills of an advanced level for the health services as well as for teaching and research in medical sciences; to encourage continuous self- education, to foster a spirit of enquiry and research into medical problems; to provide the means and the intellectual environment which would enhance such enquiry and research. However there is no separate body/committee at Department and University level which is charged with the responsibility of implementing the research component of the Aims and of promoting, organizing and supporting research. Ethical and Research committees have been set up by each University to review doctorate level research projects by postgraduates. The Board of Studies of academic departments of Universities undertakes scientific supervision, organization and coordination of research done within their respective departments by postgraduates. Up to now there is no separate research fund from government or other sources to support research, award research grants to postgraduates and faculty doing research, and to promote research. Research matters are usually considered as part of academic teaching activities. Research promotion and direction is not included among duties of the Academic Body. Research is conspicuously absent among the functions and activities of the University mentioned in the University handbooks; however, they do mention the research carried out at academic departments.

A significant step forward in the organization and direction of research is that in recent years academic departments of the University of Medicine 1, Yangon have developed Research Themes of variable consistency and continuity, as mentioned in the Prospectus 2009. Furthermore, the University of Medicine 2 has established a Common Research Laboratory since the year 2000 where postgraduate students and faculty are able to do laboratory based research; there is a Supervising Committee for this Common Laboratory headed by the Rector which provides guidance and direction. Likewise the University of Mandalay established a Common Research Laboratory in 2002 for which equipment and supplies have been procured. In addition training of young researchers in research methods

as well as training of supportive laboratory staff has been carried out. Such measures to develop research capacity in the two Universities with support from external sources have greatly enhanced research especially in the basic sciences.

As a result of coordination with the Departments of Medical Research the three Universities of Medicine and their teaching hospitals have been able to share the support given by the WHO/UNDP Reproductive Health Program and participate in collaborative research on Reproductive Health in Myanmar.

Some clinical units of teaching hospitals like Neurology and Orthopedics and corresponding University clinical departments in Yangon have been collaborating with foreign universities and institutions and strengthened with respect to patient care, teaching and some embedded research projects since many years ago.

Recently the University of Mandalay has been able to establish scientific contact with Siriraj Hospital of Mahidol University. An agreement has been made to collaborate on the Thalassemia Project and laboratory training courses in molecular biology have been conducted. Such twinning arrangements will benefit teaching, patient care and research and should be encouraged in the pre-clinical departments as well.

More opportunities and facilities for research are becoming available at the medical Universities recently and a better climate for research is being gradually developed. (*see also Chapter 4 section 4.11*)

## Section 5.3

### Department of Traditional Medicine and Precursor Institutions

by Tin Nyunt

#### Introduction

Traditional Medicine has existed in Myanmar since ancient time and flourished under the Myanmar kings. There were scholarly treatises on traditional medicine and on Ayurvedic medicine from which it was mainly derived, but there was no formal system of traditional medicine teaching; knowledge and skills were handed on by teacher to pupil, person-to-person, by apprenticeship.

After Myanmar became a colony in 1886 western medicine was introduced into the country and penetrated to the cities and towns and traditional medicine declined but it continued to be used by the majority of the common people, especially by the rural population, who depended upon traditional medicine practitioners who lived and practiced in their midst.

After Independence in 1948 successive governments encouraged and built up traditional medicine.

A separate Traditional Medicine section was opened under the Directorate of Health Services to supervise matters concerning traditional medicine, including the regulation of traditional medical practice and practitioners; and delivery of traditional medical services through traditional medicine dispensaries. A *Traditional Medicine Promotion Office* was set up in 1953 under the Ministry of Health, to promote traditional medicine and to help expand the network of traditional medicine dispensaries in Yangon and Mandalay at first and gradually throughout the country, the number reaching 89 by 1997.

An *Institute of Traditional Medicine* (ITM) together with a traditional medicine teaching hospital was established in 1976 to teach traditional medicine and confer qualifying diplomas; and in 2001 this was reinforced and elevated to status of *University of Traditional Medicine* which conferred the degree of Bachelor of Myanmar Traditional Medicine. In 1989, a separate *Department of Traditional Medicine* (DOTM) was established under the Ministry of Health headed by a Director-General. This was expanded in 1997 and at present in 2010 comprises 4 divisions including “Research & Development”

#### Research Development

The Traditional Medicine National Formulary was compiled beginning 1980 and comprise 57 recognized traditional medicine formulations. *The Research and Development Division* of DOTM in collaboration DMR (LM) undertook the botanical and physico-chemical standardization and the toxicological and pharmacological evaluation of the formulations between 1984-89 and the research necessary to do this.

A drug research laboratory was established in 1998 with a laboratory staff which was expanded in 2003 and 2009 to include medical doctors, scientists, traditional medical practitioners. It is responsible for testing the quality, safety and plant authenticity of traditional drugs submitted for registration; and also for quality assurance of traditional drugs in the market.

In addition DOTM undertakes research to investigate efficacy and to conduct clinical trials on reputed traditional medicinal drugs for the six priority diseases: - viz. malaria, tuberculosis, diarrhoea, dysentery, diabetes, hypertension. It collaborates with the three

DMR's, the University of Pharmacy, and international organizations like UNDP, JICA and Nippon Foundation in carrying out its functions.

Ongoing research activities mainly consist of characterization and assessing the efficacy and safety of reputed traditional medicinal plants, drugs and treatment modalities in various diseases and disorders prevalent in Myanmar.

Thirty-one research papers were read at medical research conferences/congresses in Myanmar between 1991 and 2011, and some were published in local scientific journals.

### **Research in Traditional Medicine**

*(Excerpt from the Terminal Report of WHO Consultant Dr Mya Tu on "Development of Traditional Medicine Manpower, Myanmar, July 1990)*

"On top of the research activities carried out by the Department of Medical Research on traditional medicine, the TM Hospitals at Mandalay and Yangon have carried out (studies on ) usage of TM drugs for the following conditions on patients attending the hospitals.(a) Diabetes mellitus (b) Chronic ulceration (c) Arthritis (d) Various paralytic conditions.

The staff of the hospitals and the Institute needs training in research methodology, especially in clinical research.

Research paper reading sessions were held during 1987 and 1989. A total of 13 papers, consisting of such topics like new treatment for arthritis, remedies for hepatitis and jaundice, treatment of ulcers and sores, care for hypertension, integration of traditional medicine and western medicine, treatment of malaria, leucorrhoea, tuberculosis, Myanmar way of prevention of diseases, etc. were read at the paper reading session held at the Yangon TM Hospital in 1987. The second session was held at the DTM HQ Office in April 1989. and a total of 78 papers were read by both Allopathic and TM practitioners. A wide variety of experiences were exchanged during this paper reading session and especially the need for scientific research was further enhanced by this meeting".

"Scientific research in traditional medicine has been limited to the activities carried out by the Department of Medical Research, although some amounts of clinical studies have been carried out at TM hospitals. There are also TM preparations produced by the Myanmar Pharmaceutical Industry and Central Research Organization under the Ministry of Education (Industry) and the coordinated efforts should be made for some productive results. The staff from all these institutions should have training in research methodology especially in clinical research."

## **Section 5.4**

### **Department at Health Planning**

**by Tin Nyunt & Phone Myint**

The Department of Health Planning is primarily concerned with health planning and the collection and compiling of vital statistics and other types of health statistics that reveal the health situation in the country and the working of the health system and form the basis of health plans.

Realizing the importance of Research to obtain evidence-based information for planning and for managing health problems the Department of Health Planning has opened a Research and Development Division which regularly organizes workshops to raise awareness of the importance of valid information as a basis for sound planning.

This Division regularly organizes HSR Methodology Training Workshops among academia, researchers, middle and higher level health managers, policy makers and relevant stakeholders.

In order to build the national interest, skills and establish a critical mass in measuring population health and burden of disease, workshops on Burden of Disease Method were held in 2004 and 2006. Similarly, in 2009 and 2010 workshops have been conducted for disseminating concepts of health system and for imparting knowledge on health system research.

A workshop on development of national agenda for health policy and systems research was held in 2010 to raise the awareness of health policy and systems research for strengthening health systems. The current status of HSR was reviewed at the workshop on health policy and health systems research.

In 2009 and 2010 respectively, 362 and 375 post graduate students from medical universities were trained.

Research and development division of the Department of Health Planning has implemented health system research (HSR) activities since 1995 in order to enhance effectiveness of national and local health systems.

Research activities during the period 2004 to 2009 cover aspects of health services including health inequalities relating to household consumption expenditure, health system responsiveness, use of sanitary latrine, injury prevention, mortality statistics and cause of death verification.

Some studies on health care financing situation covering both supply and demand aspects were also conducted in the years 2007 to 2011. The studies demonstrated financial challenges associated with health services access and explored feasible options for better financing and protecting poor.

Results of research on scientific measurements of population health, the burden of disease and assessment of health system performance were published by the Research and Development Division.



## Section 5.5

### Department of Sports and Physical Fitness

by Ye Tint Lwin

The importance of the study of Physical Fitness was recognized by the Burma Medical Research Council when it established the "Expert Technical Committee for the Study of Physical Fitness of the Burmese" in 1968. This Committee undertook some studies and laid down a program of research which served as guidance for many future years.

The earliest study of physical performance was carried out in 1966 on Myanmar athletes who were undergoing training for the Fifth Asian Games. It was part of the Olympic Medical Archives Project of the Federation Internationale de Medicine Sportive (FIMS). Athletes in 11 sports categories were studied including: track and field, badminton, basketball, boxing, cycling, shooting, soccer, swimming, tennis, volley ball and weight lifting. Anthropometry, cardiovascular endurance, pulmonary function, physical performance, blood hemoglobin concentration, serum protein and cholesterol levels were measured. Later, other measurements were added: lean body mass, maximum heart rate, aerobic capacity ( $VO^2$  max). A remote controlled cardiac performance device was invented by DMR to take measurements of heart rate during actual performance such as running. A comparison was made between athletes studied in different years and between athletes and non-athletes: height, weight, lean body mass and leg lengths. A comparison was also made of the physiological profile of top Myanmar and other South East Asian and Asian top athletes. Myanmar athletes were found to be older, shorter and lighter than their international counterparts. Aerobic capacity was measured in male and female runners, muscle strength such as hand grip and back strength in rowers, throwers and weight lifters. Body Physique was determined in different sports according to requirement for stamina, speed and strength. Physical performance such as muscle strength, aerobic capacity, vital capacity was found lower in volley ball players than their international counterparts. Correlation between various parameters of physical fitness and athletic performance such as throw distance, kick distance was done in soccer players.

The energy intake and expenditure was studied in seven sport categories and found to be sufficient. A suitable drink for athletes engaged in endurance sports was developed, tested, and found to be effective and acceptable. Calorie requirement according to type of sports and body weight were calculated and provided for menu preparation of athletes. The actual diets consumed by the athletes were also measured and calorie and nutrition facts content were calculated, and necessary improvements were suggested.

The "Health record of Myanmar Athletes" from various Sports Disciplines and Events were carried out in 1994.

The impact of training on physical performance was studied and found to be beneficial.

Special studies on lactose intolerance, anemia and prevalence of intestinal parasites, G6PD deficiency and various thalassemias were carried out.

These studies on sports performance and physical fitness, using a battery of tests, were carried out between 1960's and about 2000 decades. They were collaborative projects between the Department of Sports and Physical Fitness and the Department of Medical Research and indicate the level of expertise of Myanmar scientists in Sports physiology and Sports Medicine.

### Summary

Myanmar athletes were found to be older an age, shorter in height and lighter in weight. Gold standard whereby the capacity of human to perform prolonged exercise is judged is maximum oxygen uptake ( $VO_{2max}$ ). Most of sports required high aerobic capacity (maximum oxygen uptake) and even in some sports, it is major factor determining athletic success. Male Myanmar long distance runner, female Myanmar middle and long distance runners were found to have maximum oxygen uptake in the range of international standard. This well coincides with their success in international competition. The athletes (both male and female) from other sports disciplines and events did not have international standard. In some sports, athletic success is highly relevant on muscle strength. Female Myanmar throwers (shotput and javelin), female weight lifters, female jumpers and male rowers marked excellent, good and average levels of international standard of muscle strength. This also coincides with their athletic success in international competition. However, athletes from other sports scored poor level.

The Department of Sports and Physical Fitness was transferred under a separate Ministry of Sports and Physical Fitness. It took up the Adolescent Health Project supported by WHO and is carrying out anthropometric and physical fitness studies of urban and rural adolescents populations in different regions of Myanmar.

## Section 5.6

### Government Industries and Scientific & Technological Research Organizations

#### 1. Myanmar Scientific and Technological Research Department

by Hla Myat Mon & Khin Khin Win Aung

Myanmar Scientific and Technological Research Department (MSTRD) of the Ministry of Science and Technology is conducting scientific and technological research and development activities for the industrial, economic and social development of the nation. It was initially created as the State Industrial Research Institute, and then went through a series of re-organizations and re-designations. It became the Union of Burma Applied Research Institute (UBARI), and then the Central Research Organization (CRO), and now the Myanmar Scientific and Technological Research Department (MSTRD) since 1994. MSTRD has 10 research and development departments doing various types of scientific technological research, two of which have areas of mutual interest with health institutions. The Director of UBARI was on the Burma Medical Research Council since it was constituted in 1963 and established BMRI, the predecessor of DMR. MSTRD and its predecessors have been engaged in health related research since the time of UBARI. They have collaborated and exchanged information with health institutions on research in mutually interested areas such as indigenous medicinal plants. UBARI participated in the Symposium on "Present status of research on indigenous medicinal plants in Burma" organized by the Burma Medical Research Society in 1960. Another area of common interest is nutrition and development of low cost nutritious foods.

##### 1.1 Pharmaceutical Research

The Pharmaceutical Research Division (PRD) of MSTRD is now continuing a strong and systematic program of research on indigenous medicinal plants which is broad in scope and considerable in depth. The present research activities of PRD have the following objectives:

- To find out potential medicinal plants for major diseases in Myanmar including six priority diseases
- To develop pharmaceuticals based on research findings
- To distribute research findings to the community, medicine manufacturers, and researchers

The six priority diseases are malaria, diabetes, tuberculosis, hypertension, diarrhea and dysentery; other important diseases are cancer, hepatitis and AIDS. It carries out research according to the following outline plan:

- Literature Survey
- Collection of the medicinal plants
- Botanical Identification
- Preliminary Phytochemical Tests
- Determination of Soluble extractives
- Preparation of Plant Extracts
- Bioactivity tests
  - *In vitro* Anti-malarial Test
  - Antimicrobial Sensitivity Tests
  - Toxicity test using Brine shrimp
- Isolation of active principle

- Identification of Isolated Compound by Spectroscopic Method

The outcome of research is as follows:

- 4000 Herbarium specimen sheets were preserved for researchers
- Research finding and results were collectively published as Reference books, Potential Myanmar Medicinal Plants, Vol. 1, Vol. 2, and Anti-malarial Medicinal Plants.
- 21 plants were found to possess potential anti-malarial activity
- Some test plant extracts and compounds showed potential anti-microbial activity

Future work of PRD of MSTRD will be:

- To study the Potential anti-malarial activity of plant extract combination by both *in vitro* and *in vivo* methods

Fractionation and Isolation of compounds from plant extracts with activity

- To produce phytochemicals for Industrial use
- To further study the antimicrobial activity of plant extracts
- To study anti-diabetic medicinal plants
- To study anti-cancer medicinal plants and establish *in vitro* cell culture laboratory for cytotoxicity assay

## 1.2. Food Technology Research Department

by Kyin Yee

This Department is concerned with the scientific production of healthy and nutritious foods from many varieties of cereals, vegetables and fruits.

It undertakes research to develop improved methods and technology for converting locally available raw materials –cereals, vegetables and fruits - into finished foods which are more nutritious, refined, suitable and attractive for consumption; and into preserved foods which last longer or better retain nutritional values or flavor and taste. Such technology is developed on a laboratory scale as well as sometimes on pilot scale for eventual industrial production.

1. Thus, over the years, it has carried out many developmental research programs and projects, which include the following:

- Preparation of various weaning foods – predigested weaning foods and instant weaning food
- Pilot scale production of chili sauce, soybean milk especially for infants,
- Preparation of mango bar, mango candy, mango juice, mango nectar; fruit jelly and candy;
- Preparation of brandy from cashew nut; sweet toddy, toddy wine, toddy champagne; wine making from grapes
- Peanut oil milling and processing of peanut cake into highly nutritious food
- Dehydration of vegetables, tubers, pumpkin; preservation of tubers
- Technology transfer of food irradiation to reduce post harvest food loss

An outline of the development of *Instant Weaning Food* is given below as an example of the scientific way in which the Department carries out its food technology development projects.

### 1.2.1 Preparation of Instant Weaning Food

*Objectives*-this nutritional weaning food is intended for weanling children as well as for malnourished, underweight and slow growing children, and children who are not breast fed. It may also be used for people who are unwell and have poor digestion.

Benefit -this nutritional weaning food provides: complete protein, 9-types of Essential Amino Acid, high nutritional value and can be bought at a reasonable prize. The Essential Amino acid content of Soybean, Rice and Sesame seed were analyzed and used as a basis for the preparation of this weaning food.

*The composition and food values* contained in it were compared with FAO recommended values and with a commercial product. It compared favorably with FAO recommended protein and fat values whereas the commercial product was deficient. The nutrient content of this nutrient weaning food in terms of carbohydrate, protein, and fat was shown. The commercial product was composed mainly of carbohydrates and "empty calories". The itemized estimated cost for a 300 grams plastic bag of Instant weaning food was given and compared favorably with the commercial product.

## **2. Central Research and Development Centre** **by Aung Htay Oo & Aung Than Batu**

The Central Research and Development Centre (CRDC) of the Ministry of Industry originated in 1982 as the Development Centre for Pharmaceutical Technology (DCPT). It was constructed and equipped with Japanese Government aid by mutual agreement with the Government of Myanmar. The general aim was to establish modern pharmaceutical techniques in Myanmar and to practice research and development in the field of pharmaceutical technology. DCPT was re-constituted as CRDC in 2012.

**Departments-** CRCD/DCPT comprises the following departments

- 1) Pharmaceuticals preparation Department
- 2) Fermentation Department
- 3) Medicinal Plants Department
- 4) Quality Control Department

The following were the stated objectives and activities of DCPT when it was established and were passed on to CRDC when it became the successor organization.

### **Objectives-**

- 1) To undertake development and research in the promotion of pharmaceutical products in forms suited to typical national needs
- 2) To undertake development and research in utilization of indigenous resources for pharmaceutical products
- 3) To undertake development and research in acquiring for production and control of drugs according to Good manufacturing Practices (GMP) and
- 4) To train personnel in the field of pharmaceutical technology
- 5) To train fermentation technology

### **Activities**

- 1) Pharmaceutical Preparation Department  
Formulation and development of essential drugs in compliance with GMP and training in modern production techniques
- 2) Fermentation Department  
Research and Development in the utilization of indigenous resources to produce antibiotics by fermentation, collection of industrial microorganism and training in basic fermentation technology
- 3) Medicinal Plants Department  
Training in basic and applied technology and research and development of of indigenous medicinal plants
- 4) Quality Control Department

Development, research and training in chemical, microbiological and pharmacological procedures.

A program of collaboration and technical training for the various pharmaceutical development activities began soon after establishment of DCPT. Training in Yangon was provided by visiting Japanese experts and consultants, and training in Japan was given to Myanmar counterparts. The program terminated in 1986 and there was no further scientific contact between DCPT/CRDC and Japanese experts and institutions since 1988.

However, despite constraints due to attrition of trained human resources and gradually ageing equipment after termination of the Japanese collaborative program, CRDC continued developmental research on pharmaceuticals, although limited in scope and depth. The main task of CRDC/DCPT is drug formulation research and establishment of Good Manufacturing Practices in the production of pharmaceutical for eventual manufacture by Burma Pharmaceutical Industry and its successor the Myanmar Pharmaceutical Factory. It also performs Quality Control of the products during manufacture as well as in the post-marketing period.

### ***Output***

(a) From establishment of DCPT to 2010

Developed techniques for the production of 14 new drug formulas in tablet form; 6 new drug formulas in injection form; and a few eye medication formulas, and transferred all these to BPI for manufacture.

Microbes with anti-microbial activity was found in the various samples of soil and preserved.

In 2004-2005, a significant technical achievement of potential use to medical care services in the country was the development of Piperamisinin tablet for treatment of malaria. Dihydroartemisinin compound was extracted from locally grown *Artemesia annua* plants and combined with Piperaquine phosphate to make the Piperamisinin tablet. It has potent schizonticidal activity on malaria parasites and can be used effectively in the treatment of malaria. After licensing from the Food and Drug Administration (Myanmar) it is being manufactured and distributed. However, because of low Artemisinin content in the plants grown locally and low yield of the active ingredients due to limited extraction and purification techniques, these tablets are not competitive against other imported brands in the market in Myanmar.

(b) From 2010 to date

Developed techniques for the production of 6 new drug formulas and revised the formula of 5 drug formulas already in use by BPI.

### ***Training***

Training and research supervision was given to MSc and PhD students from Arts & Science Universities and Universities of Medicine and the University of Pharmacy..

### ***Quality Control***

It also performs Quality Control of the products during manufacture as well as in the post-marketing period.

**3. Myanmar Pharmaceutical Factory****by Aung Than Batu** (based on information available)

The Myanmar Pharmaceutical Factory (MPF) and its predecessor, the Burma Pharmaceutical Industry (BPI), manufacture many of the essential pharmaceuticals required for the country. It conducts research, in conjunction with CRDC/DCPT, to develop new and suitable pharmaceuticals for the country, including biological products and vaccines, and to improve and test their efficacy. It studies as necessary the indigenous medicinal herbs used as ingredients in its pharmaceutical products. In 1969 it did pioneering research to develop the highly potent, mono-specific, enzyme refined equine anti-venom. In recent years it also produces snake anti-venom from ovine (sheep) with new technology. It took part, in collaboration with CRDC/DCPT and other departments and institutions, in the many studies that eventually led to the manufacture at MPF of Artemisinin compounds, (Dawnasunate, Dihydrodawnna and Piperamisinin) from *Artemisia annua* plants grown in Myanmar.



**Section 5.7**

**Overview**

by Aung Than Batu

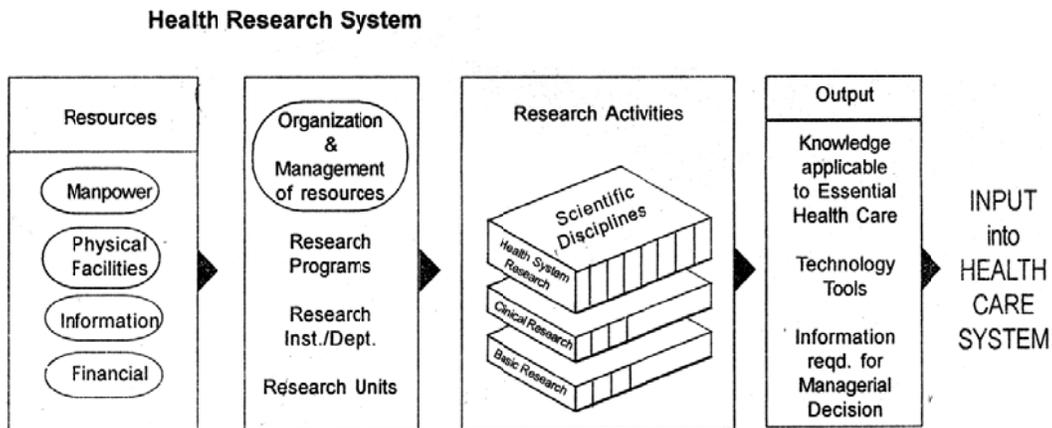
**Why do Government Departments do research?**

*In promoting health and longevity of the people and keeping them free from disease, research plays a vital role through the application of solutions that are already available and the generation of knowledge for the development of new solutions. Health strategies and programs and the way these are implemented should be based on valid scientific evidence, and such evidence requires research. Public health practice and clinical practice should be evidence-based and research can produce such evidence.*

*Professor Dr Kyaw Myint  
Minister of Health  
(September, 2003)*

The need for research by Government Departments is succinctly given above by the Minister of Health; and the role of Government Departments in the health research system is as shown in Figure below.

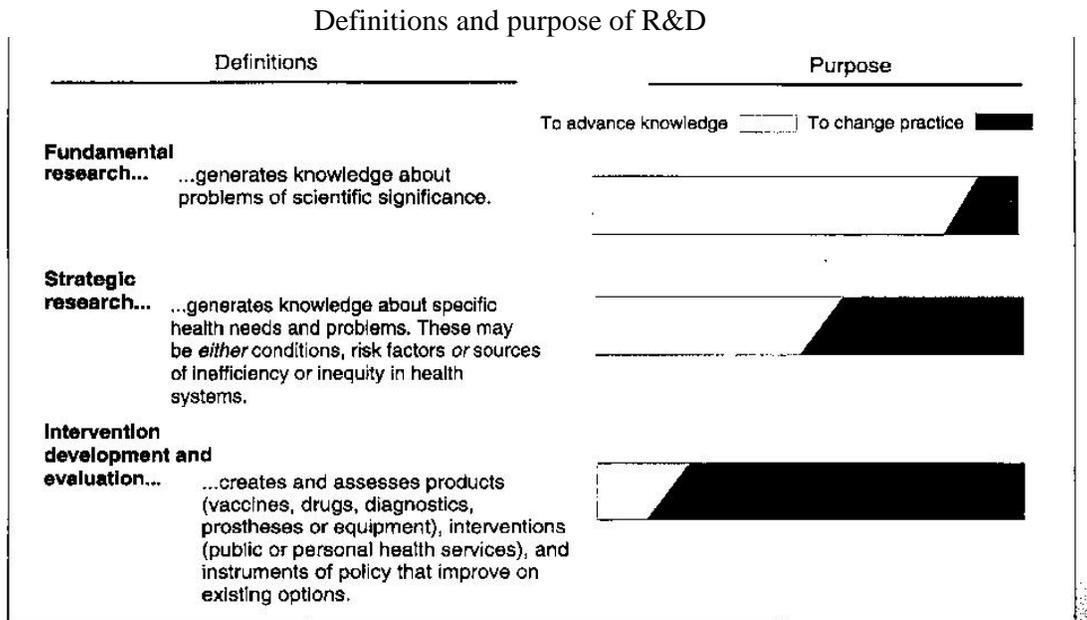
**Role of Government Departments in the Health Research System**



From : Health Research Strategies of the South East Asia Region  
World Health Organization Regional Office for SEAsia New Delhi -1993.

**Categories of Research done by Government Departments**

*(from Investing in Health Research and Development by Ad Hoc Committee on Health Research relating to Future Intervention Options)*



**Categories of Research**

1. Government Departments undertake Strategic Research and Research to create and assess products and interventions and sometimes also Fundamental Research as shown in Figure above.

They carry out systemic research programs and projects

- (a) to obtain knowledge about health conditions and diseases in Myanmar
- (b) to develop measures to control disease and improve health
- (c) to develop health technology including diagnostic tools, devices and tests that will enable better methods of doing (a) above
- (d) to develop drugs, pharmaceuticals, tools and devices that will enable better methods of doing (b) above

These are the main functions of departments and institutions specially established to do research such as the DMR's, MSTRD and CTRD/DCPT and are additional functions of service departments like DOH, DMS, DOTM.

Depending on their mission and competency they do clinical research, health system research, developmental research or basic research.

2. They also do Operational research to gather information about the functioning of the operation procedures and performance of personnel. This is usually done as an in-built part of the managerial process and all the Departments do this. The Department of Health also performs occasional assessment of work performance of its personnel such as basic health staff. The Department of Medical Science and the Medical Education Units of the Universities of Medicine also do this.

### **The Organization of Research**

Research at Departments and Institutes specially established for research such as DMR's is well organized. But research at other service Departments is a secondary or tertiary function and organized ad hoc; there is no unit or responsible person to oversee and coordinate research. A HSR unit was established within DOH at one time but later became defunct. Most of the research done by DOH is embedded within service programs and projects.

### **Health Impact of Research at Government Departments**

Health research in Myanmar is predominantly done at Government Departments (and the Universities organized under Government Departments) and so the entire output and outcome of health research may be attributed to research done at government departments; the health impact is significant and important.

Research is done mostly with government resources and with important financial and technical support by international agencies like WHO, UNICEF, UNDP and others, and by bilateral intergovernmental collaborative research agreements.

Other Non-Governmental Organizations (NGO's)-international and national- play a relatively much smaller but increasing role in conducting or supporting research in the country.

The part of private health industry in health research is insignificant but with the change towards a market economy there is great potential for it to become an important factor in health research.



## **CHAPTER 6**

### **RESEARCH AT HEALTH PROFESSIONAL ASSOCIATIONS AND OTHERS**

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- Role of Myanmar Medical Association (MMA) in research
- MMA as a professional NGO
- Research environment in MMA
  - Platform for publishing research findings
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- Myanmar Nurses and Midwives Association's role in research
- Myanmar Dental Association's role in research



## Section 6.1

### Myanmar Medical Association

by Chit Soe

#### Role of Myanmar Medical Association (MMA) in Research

##### MMA as a Professional NGO

In its initial stage, MMA was simply a social, academic and health services association.

The Myanmar Medical Association (MMA) is a registered NGO established in 1949, with permit number 1020 and office address at 249, Theinphyu Street, Mingalataungnyunt Township. Currently it has over 7, 000 members in 72 braches all over the country. It had 20 specialty societies supporting and promoting various aspects of medical knowledge and skills.

##### Research Environment in MMA

Forum for presentation of research findings of individual members and getting peer review

- Ministry of Health and Department of Medical Education opened more and more speciaslist training courses. Almost all these courses had requirement for presentation of a dissertation or a thesis at the end of the training. Apart from yearly research congress at DMR, yearly MMA conference and bi-annual speciality meetings are the only places for these young researchers to present their work.
- Following is the table of scientific papers presented at main MMA conference in last ten years.

Year	Medicine	Surgery	OG	Child	Total
46 <sup>th</sup> 2000	30	6	5	1	41
47 <sup>th</sup> 2001	59	40	8	11	118
48 <sup>th</sup> 2002	35	13	4	5	57
49 <sup>th</sup> 2003	21	8	4	4	37
50 <sup>th</sup> 2004	19	15	1	3	38
51 <sup>st</sup> 2005	26	13	6	6	51
52 <sup>nd</sup> 2006	24	9	-	1	34
53 <sup>rd</sup> 2007	14	21	9	3	47
54 <sup>th</sup> 2008	33	13	6	3	55
55 <sup>th</sup> 2009	37	15	9	5	66
<b>Total</b>	<b>298</b>	<b>153</b>	<b>52</b>	<b>42</b>	<b>546</b>

##### Platform for Publishing Research Findings (MMJ)

- Myanmar Medical Journal has IS number and is published quarterly. It gives space for publishing original papers together with review articles and case reports. At the moment, it is one of the only three medical journals together with Myanmar Research Journal and MJCMP.

### **Training of Members for Research Methodology and Research Culture**

- Preventive and Social Medicine Society had conducted yearly a two- day research methodology workshop for general practitioners and postgraduate students. Internal Medicine Society had also conducted occasional research methodology workshops at East Yangon General Hospital, Patheingyi General Hospital and Magway Medical University, etc.

### **Material Support for CME and Research**

- It has a library compiling all presentations of research works of past 50 years presented at MMA in program books.
- It has a web page with information and guideline of each speciality helping literature search.

### **Grants and International Collaborations**

- MMA is conducting disease control projects in collaboration with WHO, 3DF, GFATM, PSI, USAIDS etc., e.g. Quality Diagnosis and Standard Treatment of Malaria (QDSTM) project and Reproductive Health project (RHP). These project proposal requested base line data such as on current practice of GP in malaria management or on current behavior regarding reproductive health and treatment. WHO had technically and financially supported research in selected township to get baseline data. MMA also had to complete annual evaluation of improvement and achievement of the medical services supported by INGO and international agencies. Out of the abundant data, only some had been analyzed and presented as scientific presentations in local and international meetings.
- E.g. Malaria practice of general practitioners in Myanmar, C Soe, 2008, WHO Regional Meeting Phillipine.

### **Research to Practice**

MMA conferences are very popular among medical professionals (even had to limit attendance according to the available accommodation at the venue). The material presented drew heated discussion and led to change of practice in certain areas. E.g use of homemade spacer using plastic distilled water bottle had been very useful for district hospitals.

MMA projects had yearly meetings with all the participating GPs and refresher trainings quarterly. Mystery client research and interview research findings, pros and cons were discussed among participants and used as for guideline for refresher trainings. E.g we found RDT testing of GP are not correct in most area and had to train repeatedly in last 5 years. QDSTM project had distributed a health education VCD. WHO gave a grant to evaluate the coverage of the VCD and the effect of the VCD on GP practice. We use the weakness of the published VCD as lesson learnt and planned to produce better, concise and more attractive HE package for coming year.

Yearly presentations of increasing prevalence of rheumatic complaints and population survey data helped a lot in getting permission to open a new unit of Rheumatology in YGH.

## **Section 6.2**

### **Myanmar Nurse and Midwife Association and Other Professional Associations**

**by Nang Htawn Hla & Aung Than Batu**

The Myanmar Nurse and Midwife Association (MNMA) had been active since its early years in raising awareness of research in nurses and promoting research by nurses; in 1991 it started calling for research papers to be read at the Myanmar Nursing Conference. The first papers read at the Conferences in 1991 were from the Faculty of the Institute of Nursing. Later, the Myanmar Nursing Conferences held by MNMA from time to time continue to serve as forum for the presentation of research papers by nurses from Yangon as well as from towns in States/Divisions such as Loilem, Taungyi, Kyaingtone, Monywa and Mandalay. It is commendable that the NMA in these peripheral towns promoted and supported the research done.

[Other professional associations are mainly involved in social and educational activities. (Editor)]



### Section 6.3

## **The Role of UN Agencies and Other Non-Governmental Organizations in Health Research**

by Aung Than Batu

The UN Agencies, especially WHO, play an important crucial role in promoting and supporting health research in Myanmar. A portion of the WHO country budget is used to support research at the DMR's.

The UN Special programs such as TDR and HRP support important research projects on drug resistant malaria, diarrhoea research and control, and others. Various special health service projects of DOH which are supported by WHO, UNICEF or other UN Agencies contain a research component.

Recommendations and resolutions of WHO, UNICEF and other UN bodies and especially of the global and regional Advisory Committees on Health Research are taken note of by Ministry of Health and influences some important health research policy decisions.

Frequently, WHO's technical advice and support has launched research projects undertaken by DOH as component of its health service programs and projects; for example: in response to the urge by WHO SEAR to study the risk factors for major communicable diseases in the country, DOH and DMR did a survey on prevalence of diabetes mellitus and risk factors for NCD in 2003-2004 under the Hospital Care Program.

Apart from the professional organizations there are many Non-governmental Organizations (NGO's) whose activities concern health care in general or in specific areas like AIDS, Tuberculosis, Leprosy, Prevention of Blindness, Dental health, etc. Many of them gather health information and data relevant to their needs during the course of their work and some of them do so in a systemic manner, much like doing observational type of research; a few may even undertake or support intervention studies, clinical trials or quasi-experimental studies. The result of some of these research projects are reported in scientific meetings and published in health journals. But most of the results will be buried in administrative reports and become fugitive literature. Important information about health in Myanmar which may be of general use should be made more widely available in secondary or tertiary sources. Some of the NGO's undertaking or supporting health research in Myanmar are:

Myanmar Business Coalition on AIDS- conducted survey on condom use by men who have sex with men which is supported by Burnet Institute, Myanmar.

Burnet Institute is a well known NGO which aims to achieve better health for poor and vulnerable communities internationally through research, education and public health. In Myanmar it has focused on strengthening the HIV health care program. One of the activities of the Clinical Research Laboratory of its Centre for Virology is Translational Research; development of low cost assays for HIV resistance and novel low cost, point of contact CD4 test is of great interest and relevance to medical scientists and researchers in Myanmar with whom collaborative research is being planned.

International Agencies for the Prevention of Blindness – which together with other organizations such as 'Lion Sight First' and WHO launched the Vision 2020 –Right to Sight program in Myanmar, which carried out and supported activities to prevent avoidable blindness in Myanmar by the year 2020, including inbuilt operational research to gather necessary information for proper management, monitoring and assessment of the program; and sometimes to develop model replicable Eye care units.



## Section 6.4

### Overview

by Aung Than Batu

#### Myanmar Medical Association's Role in Research

An account of the Burma Medical Association during the Colonial period and in the early years after Independence and its activities with respect to research was given in G&D Med Res (vol.1). In those early years the scientific meetings of BMA and its journal, the Burma Medical Journal, were the only outlets for reading and publishing medical research papers and reports.. Nowadays, although other outlets have largely taken over this function, the MMA (successor to BMA) continues to play an important part in the promotion of research, especially to General Practitioners (GP), as well as in undertaking some research activities of its own. Studies by the MMA (central) of current practice by GP's with respect to management of malaria, reproductive health (as given above) fill gaps in knowledge required for effective and efficient delivery of health services to the large patient population catered to by GP's and which is perhaps largely beyond reach of government institutions and programs. Because of their reach GP's are being used to gather base line data on different subjects. The MMA and Speciality sections at Central level and the District Branches play an important role in Continuing Medical Education and Professional Development and this could easily blend into the promotion of research. The Role of MMA in research will certainly grow in future years.

**The Role of Myanmar Nurses and Midwives Association in Research-** the Myanmar Nursing Conferences provide a forum for the presentation of research papers by nurses from Yangon as well as peripheral towns and it is commendable that the local NMA's promotes and support the research done.

**The Myanmar Dental Association** also promotes and support research in a similar manner as the MMA.

Looking at the example of MMA, the outreach of the professional associations beyond that of government institutions provide a great opportunity for the several Associations to jointly launch a series of long term studies that will reveal a more comprehensive picture of daily health related behavior in the country and which can at the same time be an entry point for action research and participatory research that will change behavior and practice.



## **Chapter 7**

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## Section 7.1

### Introduction

by Aung Than Batu

#### Prioritization

Choice of research areas, research programs and projects depend principally upon nationally important diseases and health conditions identified in successive People's Health Plans and National Health Plans.

Procedure for such identification has evolved and become more refined over the years. During formulation of National Health Plan (1996-2001) objective and subjective criteria were explicitly used to identify and prioritize diseases and health conditions which are to be dealt with in the National Health Plan.

During formulation of the National Health Plan (2006-2011) identification and prioritization of diseases and health conditions became more refined. Seven criteria were used and given weight-age as hereunder:

No.	Criterion	Definition	Weight
1.	Disease burden	Magnitude and severity of the morbidity, physical & social disability, mortality and type of the affected population	0.20
2.	Public health importance	disease with epidemic potential and conditions threatening health and life of the people	0.19
3.	Political Concern	Any disease or health condition with high political concern	0.16
4.	Vulnerability to intervention technology	Availability of intervention which is feasible, affordable and cost effective	0.13
5.	Economic impact	Disease or conditions with negative economic impact on patients, families, communities and the nation	0.12
6.	Social impact	Diseases or conditions which can lead to negative social consequence to the patients, their families and community	0.10
7.	Availability of health information	Availability of health information from all possible sources such as HMIS, MICS, U5MR, survey, MMR, survey, FRHS, HMN, etc	0.10

Diseases and health conditions were then ranked from 1 to 42.

The first 15 in rank were:

No.	Disease/ Health Condition	Rank
1	Acquired immune Deficiency syndrome	1
2	Malaria	2
3	Tuberculosis	3
4	Diarrhoea/ Dysentery	4
5	Cholera	5
6	Avian influenza	6
7	Dengue Hemorrhagic Fever	7
8	Vaccine preventable disease	8

<b>No.</b>	<b>Disease/ Health Condition</b>	<b>Rank</b>
9	Protein Energy malnutrition	9
10	Postpartum and Ante- partum haemorrhage	10
11	Drug Abuse	11
12	PET and Hypertensive Disorder pregnancy	12
13	Leprosy	13
14	Sexually Transmitted infections	14
15	Disasters	15

Priority diseases and health conditions identified as above in National Health Plans are taken as the basis on which the Dept. of Medical Research, the Dept of Health, the Dept of Medical Science and the Dept of Traditional Medicine and other departments of the Ministry of Health selected and carried out specific, priority national level research programs and projects, either separately or in collaboration. Although priority as a health problem is the principal consideration other factors also influence the selection. DMR (LM) explicitly adopts certain additional criteria in choosing research programs and projects.

In practice – priority as a health problem, availability of resources including technology, human resources, financial resources, opportunity and urgency are the factors which determine selection, continuation and termination of research programs and projects.

Research is undertaken as an integral component of many health service programs of the Dept of Health -some of which, like Disease Control Program, explicitly mention the research element whereas some like the Hospital Care Program do not explicitly mention research but the research element is implicit.

Research carried out at the Directorate of Medical Services (DMS) under the Defense Ministry on diseases and health problems is prioritized and ranked according to importance to the military; most of them coincide and overlap with national priority diseases.

### **Research programs and projects**

All priority national health problems are selected as subjects for research either separately or as grouped under one research program. Some so chosen are long standing research programs which have been continued and carried on because of their continued importance as national health problems or as scientific problems-although the priority ranking in National Health Plans may have changed. Example: snake-bite research. New research programs were added as new priority diseases and health conditions such as AIDS and SARS emerged and some such as Studies of Oral Rehydration Therapy (ORS) were phased out when adequate information necessary for service programs have been obtained Some others such as environmental health and health technology development on which considerable new research has been done because of their emerging significance to national health have also been described although not highly ranked or included in National Health Plans. Some such as Disasters are among the top fifteen health problems for which separately identifiable research was not done. A Symposium on Disaster Management held by MAMS reveals that Operational Research activities like assessment and evaluation is in-built into the disaster management plan. There were of course many miscellaneous ad hoc research projects and activities undertaken.

The diseases, health conditions on which major or significant research programs and projects have been undertaken in Myanmar during the period under review are described hereunder:

CHAPTER 7 RESEARCH AREAS AND PROGRAMS DIRECTED AT HEALTH PROBLEMS  
AND DISEASES

1. Malaria
2. Dengue hemorrhagic fever
3. Gastrointestinal diseases
4. Viral hepatitis
5. Tuberculosis
6. Leprosy
7. AIDS and newly emerging infections
8. Vaccine preventable diseases
9. Nutritional diseases and disorders
10. Reproductive health
11. Snake bite
12. Hematological diseases and disorders.
13. Environmental health
14. Mental Health
15. Cancers and Other Diseases



## Section 7.2

### Malaria

by Marlar Than, Myat Phone Kyaw, Willoughby Tun Lin, Ye Htut, Soe Aung, Khin Mon Mon & Aung Than Batu

#### A. Previous Research on Malaria up to 1986

Research on malaria including the earliest malaria surveys and the earliest surveys of the vector *Anopheles* species and clinical study of black-water fever was done in British Burma (Myanmar) during the colonial period (1886 to 1947).

During the early years after Independence (1948-1961), the Malaria Demonstration Project which was established in 1951 continued research on malaria and undertook base-line epidemiological and entomological studies. Most important was the demonstration of the technical and operational feasibility of interrupting malaria transmission in Myanmar by indoor residual insecticide spraying with DDT carried out in the northern Shan States, as a result of which Government of Burma (GUB) launched the Malaria Control Project from 1953 onwards, in phases, throughout different parts of Myanmar, using indoor insecticide spraying as its main strategy.

Drug resistance of the malaria parasite *Plasmodium falciparum* to chloroquine was first detected in Myanmar in 1969 by the teaching staff of Institute of Medicine 2 at its teaching hospital, DSGH, Mingaladon. Confirmatory studies were done by the IM2 teachers and the Medical officer-in-charge at Indaing military station hospital, Directorate of Medical Services (DMS), Ministry of Defense. This crucial finding with far reaching consequences for malaria control and treatment was reported to the Ministry of Health which immediately took measures to have this report confirmed and the studies extended. The development of resistance was a challenge to medical research in Myanmar and provoked a vigorous and timely response by malariologists, public health workers, clinicians, parasitologists, pharmacologists, basic medical scientists, botanists, others; by full time researchers as well as those who took up research as part of other duties; by personnel under the Ministry of Health, Defense and Industry.

A large number of clinical and field studies of the geographical distribution and degree of resistance of *P. falciparum* to chloroquine, other 4 aminoquinolones and sulphadoxine-pyrimethamine were done by the Malaria Division of DOH and by DMS of the Defense Ministry. A sample of *Plasmodium falciparum* infected blood was conveyed to the WHO Collaborative Centre for Malaria at Maryland, USA where investigations on non-immune American volunteers characterized the drug resistant pattern of the *Plasmodium falciparum* strain received and confirmed the existence of drug resistant *Plasmodium falciparum* in Myanmar; the drug resistant strain of *P. falciparum* from Myanmar was designated as the (ThaU) strain.

Other studies on malaria were also carried out during the 1970's and 1980's. Investigations of the Chinese medicinal herb Qinghausu (*Artemisia annua*) – then newly recognized to have anti-malarial properties were begun from the 1980's onwards. Using Artemether injections from Chinese sources Myanmar clinicians confirmed the efficacy of Artemisinin derivatives for the treatment of uncomplicated malaria and were the first in South-east Asia to demonstrate their efficacy in cerebral and complicated malaria and for treatment of multi-resistant strains of *P. falciparum*. *Artemisia annua* was successfully cultivated in Myanmar and its extracts were tested in-vitro in an animal model and found to have potent anti-malarial property.

Clinical and in-depth patho-physiological investigations of cerebral and complicated malaria were carried out including studies of the sequestration of parasitized red cells in brain tissue and electron microscopic observation of attachment of parasitized red cells to vascular endothelium.

Parasitological studies of malaria parasite became more sophisticated. In-vitro culture became possible and parasitological studies advanced from morphology to biochemical characterization.

Entomological studies detected the development of insecticide and behavioral resistance by the vector Anopheles species. Anopheles strains were colonized and biochemical and genetic studies became possible. Taxonomic classification using cytogenetic techniques were done.

Health systems Research on malaria was an ongoing activity of DOH during its long years of field operations. HSR made variable contributions to the three major strategic decisions concerning malaria. First the decision in 1953 to launch the countrywide Malaria Control Program; second the decision in 1957 to convert the Malaria Control to the Malaria Eradication Program; and third the decision in 1967 to partly retreat from malaria eradication. HSR components were included in the situational analysis of VBDC Control Program (1976-85) and the WHO/CIDA/JICA/USAID Evaluation of the VBDC program in 1985. Many minor operational research activities continued as part of control activities such as time lag between blood slide collection and examination, etc.

## **B. Research on Malaria in Myanmar (1987 to 2011)**

Malaria research in Myanmar extended in volume, scope, and depth from the 1990's onwards and continues up to now in response to clinical diagnostic and therapeutic needs; to the operational requirements of health service programs- both civilian and military; and to the planning needs of Ministries, Departments and Directorates.

### **1. Departments, institutions and organizations undertaking malaria research in Myanmar**

Malaria research is being undertaken by the following:

#### **1.1 Department of Medical Research (Lower Myanmar) (DMR-LM) at-**

(a) Parasitology Research Division (PRD) where a major research program on the study of the malaria parasite (Plasmodium species) is undertaken, employing standard parasitological methods as well as advanced molecular techniques such as Polymerase chain reaction (PCR).

(b) Medical Entomology Research Division where Anopheles species are studied employing standard entomological methods and where molecular entomological techniques are being developed.

(c) Epidemiology Research Division which in previous decades innovatively studied malaria epidemiology in the then unexplored ecological zones.

(d) Health System Research Division (HSR-RD) where qualitative methods are being employed to study malaria in the community.

(e) Pharmacology Research Division (PRD.) where standard pharmacological methods including animal models are being employed to screen and study anti-malarial drugs including traditional medicinal herbs and remedies with promising anti-malarial properties.

(f) Clinical Research Units (CRU) for malaria at No. 1 Defence Services General Hospital, Mingaladon; at No2 Military Hospital, Yangon and at North Okkalapa General

Hospital (NOGH). These CRU's established by DMR (LM) are headed by the clinicians of the respective hospitals and coordinated by the Deputy Director/Head of the Parasitology Research Division of DMR (LM). Their functions are to monitor drug resistance by *in-vivo* and *in-vitro* methods; and to do clinical and safety studies of anti-malarial drugs and drug combinations being used in Myanmar and those newly introduced into Myanmar.

(g) DMR (LM) has also established a Scientific Group on Malaria to co-ordinate malaria research activities within the Department.

**1.2 The Department of Health (DOH)** (and its predecessors) - which have carried out malaria research since the colonial period and continue to do so up to now. It conducts malaria research at central and peripheral levels mainly as operational research activities and HSR and also undertakes some aspects of clinical research at:

(a) central department/directorate level by the National Malaria Control Project (which is a part of the Vector Borne Disease Control Project (VBDC))

(b) peripheral level by township VBDC units in township hospitals and field stations especially in border areas and at sentinel sites established with the support of Technical Support Network (TSP) set up by WHO since 2001. Studies at these sentinel sites are done as collaborative activities between VBDC team and DMR (LM), DMR (UM) and sometimes DMR (CM).

(c) Teaching Hospitals of DOH and DME where clinical in depth studies are done, mostly in collaboration with DMR and many as academic studies by postgraduate students of Universities of Medicine. (*see 3 below*)

(d) CRU for malaria jointly set up by DMR (LM) and DOH-(*see f above*)

**1.3 Universities/Institutes of Medicine under Department of Medical Sciences (DMS)**

Malaria research is done by some postgraduates as part of academic activities leading to DTM&H and to the degrees of M.Med.Sc. in some disciplines like Medicine, Public health, Microbiology, Pharmacology. Most of these malaria research studies by post-graduates are done at Departments/Institutes elsewhere especially at DMR's and health service units of DOH.

**1.4 The Directorate of Medical Services (DMS) under the Ministry of Defense**

It has also been carrying out a continuing program of malaria research since early Independence years at central and peripheral levels as follows:

(a) at the Defense Services Academy of Medicine as part of academic studies leading to postgraduate degree.(similarly to other Universities of Medicine)

(b) at field medical battalions on malaria research projects executed solely by DMS or frequently as collaborative projects with others like DMR and DOH.

**1.5 University of Pharmacy and University of Community Health**

It also carries out a few relevant malaria research activities sometimes.

**1.6 University of Public Health**

It was recently established and may take up malaria research as one of its academic or research activities

### **1.7 Myanmar Medical Association (MMA)**

It has been undertaking activities which aim to enhance the role of private medical practitioners and other stake-holders in disease control activities in the country including malaria. Malaria related research is being done as the MMA Malaria Project and as the Quality Diagnosis and Standard Treatment of Malaria Project (QDSTM).

### **1.8 Collaborative Studies**

They are jointly undertaken by the above Departments, institutions and organizations in different ways and combinations, some planned and some ad-hoc.

Thus it may be seen that malaria being a high priority health problem which is pervasive and threatens large populations in many parts of the country, malaria research is being undertaken by many units of different Departments, Institutions and Organizations at central and peripheral levels, as full time or part time activity.

## **C. Major Research Areas**

The scope and depth of malaria research in Myanmar may be surmised from the comprehensive list of Research Findings in the Annotated Bibliography "Malaria Research Findings Reference Book, Myanmar (1990-2000)" where the total of 429 research titles (and abstracts) have been listed under arbitrary, overlapping, and interrelated categories as follows:

1. Health education and health promotion-22 research papers
2. Surveillance, Prevention and Control of Malaria
  - 2.1 Epidemiology (Malaria Endemicity, Disease and Vector Surveillance and Control, etc-23 papers
  - 2.2 Entomology (Reduction of Man-vector contact, Repellents, Insecticide treated bed nets, Larvivorous fish, etc) -41 papers
  - 2.3 Parasitology (Parasite vector interaction, Prevalence, and Anti-Malarial activity of Traditional Medicinal Plants -10 papers
3. Drug Resistance, early Management and Case management of malaria
  - 3.1 Drug Resistance- 43 papers
  - 3.2 Early Management -11 papers
  - 3.3 Clinical Trials, Other Clinical and Basic Studies-254 papers
4. Programme Management – 25 papers

The major overlapping, interconnected areas where malaria research was carried out during the period under review by all Departments, institutions and organizations, singly or in combination, according to their responsibilities and interests and as conditioned by resources and opportunities are arbitrarily classified for the purpose of this account of malaria research in Myanmar as the following:

1. Epidemiology of malaria
2. Drug resistant malaria
3. Malaria control
4. Case management of malaria
5. Socio-economic and behavioral aspects of malaria
6. Parasite biology, genetics and mechanism of drug resistance
7. Vector biology, ecology, insecticide resistance and vector control.
8. Development of anti-malarial drugs and devices

## 2.1 Epidemiology of malaria

Descriptive studies of the prevalence and distribution of malaria continue. Epidemiological investigations were extended, in response to operational needs of the health services, to situations places, and special age and population groups not yet studied. Malariometric methods have evolved- serological indicators of malaria infection have been added and the parasite rate has become more sensitive and accurate as new immunological tests of infection with different species of malaria parasites became available. Vector Anopheles species have been studied in relation to the epidemiological situation and new Anopheles species have been incriminated as vectors in some localities. Malaria mortality and morbidity data have been systematically collected for many years throughout the country.

Malaria epidemics and their determinants have been systemically studied. Attempts were made to compare and analyze some of the different epidemiological features observed and to understand the determinants of the epidemiological situation seen. The influence of climatic changes, population movements and other factors on the general and local epidemiological situation was studied. The effect of the intervention measures singly or in combination on the malaria epidemiological situation in different places was studied.

The cumulative result of all these epidemiological studies have enabled the DOH to describe the changing epidemiological pattern of malaria in Myanmar -by region and in the country as a whole, as given in the excellent illustrations in the Report on Malaria in Myanmar-Program Perspectives, presented at the Symposium on Progress towards Malaria Control in Myanmar, Myanmar Health Research Congress 2011, held in January 2012. The Report shows Malaria Mortality Rate per 100,000 population (1959-1974); Population living under malaria risk areas in Myanmar 2010; Malaria Risk Areas in Myanmar; the Yearly Malaria Mortality and Morbidity Rate in Myanmar (1990-2010); State and Region wise Changing Malaria Morbidity Pattern in Myanmar; State and Region wise Changing Malaria Mortality Pattern in Myanmar; Malaria Vector Species in Myanmar ; Malaria Main Vectors in different States and Divisions in Myanmar; Insecticides Susceptibility in selected States and Divisions (2011);Malaria Epidemics in Myanmar and their causes (2000-2011); and includes other aspects of the Malaria Control Program in Myanmar.(see figures below)

## 2.2 Drug resistant malaria, drug resistant strains of Pf and Pv

The "Monograph on Drug Resistant Malaria in Myanmar" (2009) produced by a team comprising -Deputy Director-General, Directors and Deputy Director responsible for malaria at DOH, DMR (LM) DMR (UM), WHO Malaria Expert/Medical Officer (Myanmar) with the National Expert (Colonel retired) Dr Marlar Than as the principal and key contributor- gives a comprehensive review of drug resistant malaria in Myanmar which is fully documented and referenced. It most probably includes the 43 studies on drug resistant malaria listed in the Malaria Research Findings Reference book, Myanmar (1990-2000).

The following account is largely based on this Monograph from which excerpts have been taken and modified.

Drug resistance is reduced susceptibility of the causal agent to a drug. WHO defines resistance to anti-malarials as the ability of a parasite strain to survive and/or multiply despite the administration of and absorption of a medicine given in doses equal to or higher than those usually recommended but within the tolerance of the subject , with the caveat that the form of the drug active against the parasite must be able to gain access to the parasite or the infected red cell for the duration of the time necessary for its normal action .Resistance to anti-malarials arises because of the selection of parasites with genetic mutations or gene amplification that conferred reduced susceptibility.

Since the emergence of drug resistant malaria in Myanmar in 1969 many researchers, physicians and public health workers, individually or in groups organized by

Departments and institutions have investigated the efficacy of anti-malarial drugs that have been used in private as well as public sectors of the community by conducting *in vivo* and *in vitro* tests. For drug resistance monitoring, *in vivo* therapeutic drug efficacy tests are the gold standard (WHO-2001), but is time consuming and laborious to collect representative data from different geographical regions. *In vitro* drug sensitivity testing is tedious and expensive, though it provides useful information on the phenotypes of drug resistant malaria parasites. Advances in molecular technology, especially genomic studies of *Plasmodium falciparum* malaria parasites using polymerase chain reaction (PCR), have been exploited for the better understanding of drug resistance.

Many studies on assessment of drug sensitivity and resistance of *Plasmodium falciparum* malaria parasite to different anti-malarial drugs and drug combinations have been frequently carried out continuously over the years in Myanmar. But these investigations were carried out in different places and time periods, using different study designs, testing diverse drugs and drug combinations in different doses in different courses using various follow up plans. Level of resistance differed between sites in some studies, mainly due to difference in immune status of the population studied and sometimes also the varying sample size and the follow up periods. Therefore, an accurate comparative analysis of these results was difficult. However, the results of each study contributed some meaningful information on drug resistant malaria to some extent and they cumulatively built up a general picture of the development of drug resistant malaria in Myanmar during the 1970's and 1980's. Such results were the only available information at that time and the general picture drawn could be regarded as fairly representative of the actual conditions prevailing at that time. The information then available, the assessments made and the general picture inferred was usable and used as a basis for malaria control policy and drug policy decisions; planning and execution of health service programs; and malaria research programs and projects.

#### 2.2.1 Monitoring of drug resistance and clinical efficacy studies

This is a component of ' Early diagnosis and Appropriate Treatment' which is one of the three key interventions to control malaria. (Ref: DOH/MMR Res. Congress 2011)

##### 2.2.1.1 Monitoring the sensitivity and resistance of *Plasmodium falciparum* using *in-vivo* methods

Many of these studies were continuation of previous studies and may therefore include some of the previous studies in the 1970's and 1980's which merge with the later studies in the 2000 decade. Some were overlapping studies of the same drugs in the same or different places in the same or different years. As mentioned earlier the studies were using different designs, testing diverse drugs and drug combinations in different doses in different courses using various follow up plans The methodology for monitoring of therapeutic efficacy became standardized after 2004 and all the studies in Myanmar followed WHO standard 28 days follow up procedure in sentinel sites identified so that results became comparable.

Fever clearance and Parasite clearance times were determined. Most of the earlier studies applied the WHO 14 day *in vivo* test and were done in Rakhine, Shan and Mon states. Later studies in the late 1990's and 2000 included sites in Central and Northern Myanmar. Classification was by S, R1, R2, R3, before 2004 after which it was changed to Acceptable Clinical and Parasitological Response (ACPR), Early Treatment Failure (ETF) and Late Treatment Failure (LTF). Technical Support Network was set up by WHO in Myanmar in 2001 and Sentinel sites were identified in Kalay, Muse, Myitkyina, Buthidaung, Myawaddy, Tachilek and Kawthaung.

(a) Between 1991-1997, the *in vivo* response of *Plasmodium falciparum*(Pf) to the anti-malarials - Chloroquine (CQ), Sulphadoxine-Pyrimethamine (SP ), Mefloquine (MQ), and Amodiaquine (AQ)) was tested at 1 to about 4 or 5 study sites each in 11 states and divisions-(Sagaing , Bago, Yangon, Tanintharyi,, Mandalay, Ayeyarwaddy, Shan, Mon, Kachin and Rakhine).

(b) Between 1971-2003- 160 studies of the *in vivo* sensitivity of Pf were performed. Most of the studies were done at DSGH (Mingaladon) and Military Hospitals No.1, 2, 4 and at the Clinical Research Units for malaria at DSGH and North Okkalapa General Hospital. Many were also done at 1 to about 4 or 5 study sites each in 8 states and divisions (Mon, Shan States-north, east and south ,Kachin and Rakhine States; Mandalay, Sagaing, Bago, and Tanintharyi Divisions ); some were done repeatedly over several years and some only once. The drugs tested were initially Chloroquine (CQ), Sulphadoxine-Pyrimethamine(SP), Quinine (Q),Mefloquine (MQ), Halofantrine (Hal), Artemether(AM), Artesunate(AS), singly or in combination. Later the Artemisinin derivatives (Artemether and Artesunate) were the drugs mostly tested, in combination with tetracycline or clindamycin and in combination with MQ or Hal. Oral or intramuscular or intravenous formulations of the drugs, as available, were tested. Artesunate suppositories followed by MQ were tested.

(c) Similarly, between 2003-2008 — 27studies of the *in vivo* sensitivity of Pf were performed at test sites in States and Divisions as above and including Karen state and Ayeyarwaddy division and at CRU (Malaria) DSGH. Now the drugs tested were Artemisinin derivatives (Artemether, Artesunate,Dihydroartemesinine and Artemisinin) mostly in combination with either (Lumefantrine, Mefloquine,Amodiaquine,Peperaquine and Napthoquine) including co-formulated combinations. Malarone (Atovaquone-Proguanilcombination) was also tested. Intramuscular and Intravenous formulations were tested as well as artesunate suppositories followed by various drug combinations. Dawnasunate (Artesunate) and Dihydrodawnna( Dihydroartemesinine) from locally grown Artemisia and Piperamisinin (Dihydroartemesinine -Piperaquine combination) manufactured locally were also tested.

#### 2.2.1.2 *Monitoring the sensitivity and resistance of Plasmodium falciparum using in-vitro methods*

(d) Between 1978- 2008,-35 studies of the *in-vitro* response of Pf to anti-malarials was tested at the Parasitology Research Division of DMR(LM) on blood samples from patients with P falciparum malaria at test sites in Mon, Shan states-north, east ,south , Kachin,Rakhine States and Yangon, Magway, Tanintharyi Divisions including sites on the border between Thailand. Also from patients at DSGH, Military Hospitals and Medical Battalions and CRU's .The drugs tested were CQ,Q, AQ, SP, Hal, AS and Primaquine (PQ) and (Qinghausu) Artemisinin singly. The methods used for *in-vitro* testing included the WHO Standard *in vitro* drug sensitivity test, WHO micro test method, Radio-isotope micro method and Rickman's *in-vitro* method (between 1978-1983)

#### 2.2.1.3 *Monitoring the sensitivity and resistance of Plasmodium vivax using in-vivo and in-vitro methods.*

(e) Between 1979 and 2008- 8 studies of the *in-vivo* response of Plasmodium vivax (Pv) to the anti- malarials CQ,AQ,PQ, singly or in combination ; and one *in-vitro test* of the drug CQ were done at DMR, DMR(UM), CRU (DSGH) DOH from study sites in Northern Shan States, Rakhine, Yangon and Mandalay Division.

#### 2.2.1.4 Results of the Monitoring of Drug Resistance and Conclusion

The results of the studies (a) to (e) are given as consolidated tables in Annex 2,3,4,5 of the "Monograph on Drug Resistant Malaria in Myanmar" (2009)

#### 2.2.2 Conclusions (excerpts from Monograph on Drug Resistant Malaria in Myanmar)

(a) Based on the evidence obtained from studies performed up to now in Myanmar on drug resistance by *Plasmodium falciparum* it is evident that the trend of drug resistance to previously and currently used antimalarial drugs in falciparum malaria is progressing.

(b) According to the current reports

- The 28 days *in vivo* test for chloroquine showed a sensitivity of less than 30% in at Mudon (Mon State) in 1993.
- The 14 days *in vivo* test for chloroquine showed sensitivity between 62.5 and 77% in 2002/2003 in most areas.
- The 14 days *in vivo* test for SP showed a failure rate of 100% in Kayin state in 2002.
- Mefloquine sensitivity (S/R1) response was variable depending on the immune status of the patients at various sites but the *in vivo* 14 days tests showed S/R1 of 75% in the Kayin State.
- The *in vitro* sensitivity of isolates from Kawthaung (Mon State) and Buthidaung (Yakhine State) to Chloroquine, Amodiaquine, Quinine and Mefloquine in 2006, show high resistance rates of 83.67%, 81.63%, 24.48% and 14.28% respectively in Kawthaung and 73.91%, 84.73%, 0% and 17.39% in Buthidaung.
- Inhibitory concentration (IC 50, IC 90) and mean MIC level for Mefloquine and Quinine are increased.
- Quinine-tetracycline combination is still effective but has compliance problems and hence is often used only for severe malaria as the parenteral form.
- Artemisinin derivatives as monotherapy showed high recrudescence. All the newer ACTs have high cure rates over 90%.

The latest reports on decreasing responsiveness of *P. falciparum* to Artemisinin Combination Therapy (ACT's) are alarming and need to be addressed effectively without delay. The high treatment failure rates and prolonged parasite clearance times need to be closely monitored and further research to differentiate Artemisinin 'resistance' or 'tolerance' is needed. Monitoring of therapeutic efficacy, supported with PCR analyses and pharmacokinetic studies are needed to definitely confirm parasite resistance to these anti-malarial drugs.

(c) There is growing evidence of *P. vivax* resistance to chloroquine. A study in 1993 first reported that the parasitemia in patients with *P. vivax* infection failed to respond to adequate dose at satisfactory serum levels of chloroquine. A series of properly designed *in-vivo* trials with 28 day follow up period carried out in 2005, 2006 and 2007 at study sites in Rakhine, Shan and Mandalay states/divisions showed resistance rates of 8.5%, 4.8% and 3.3%; and *in-vitro* sensitivity of 81.82% in Rakhine. Further studies of the magnitude and geographic extent need to be monitored for timely control and prevention of spread.

(d) Review of research findings in Myanmar, on antimalarial drugs over the past 37 years revealed:-

- Reduced efficacy of almost all antimalarial drugs used as monotherapy. Regular monitoring of Chloroquine and Sulphadoxine-Pyrimethamine efficacy since 1970's and

Mefloquine since 1981 and Artemisinin derivatives since 1983 revealed the reduced efficacy of almost all antimalarial drugs used as monotherapy. The *in vivo* and *in vitro* drug sensitivity tests documented the increasing trend of antimalarial drug resistance in many parts of the country

- The increasing trend of antimalarial drug resistance has been documented by *in vivo* and *in vitro* drug sensitivity tests. (Annex 3, 4 and 5)
- *In vitro* results showed decreasing trend of sensitivity to Chloroquine, Amodiaquine, Quinine and Mefloquine. (Annex 6-Map 5, Annex 4b & 4c) in different areas.
- Molecular assays have recently been applied to investigate the drug resistance.

The increase in prevalence of drug resistant strains of *P. falciparum* continues to reduce the effectiveness of currently available antimalarial drugs. Although the data in hand bears limitations, it is obvious that *P. falciparum* in Myanmar has developed resistance to all kinds of blood schizonticides.

(In Myanmar, Chloroquine has been used as a chemotherapeutic drug for treatment of both falciparum and vivax malaria since about the end of World War II and Chloroquine remained an effective antimalarial drug in the early 1960's. The documented development of *P. falciparum* resistance to chloroquine in Myanmar since 1960s, led to a resurgence of malaria with increased morbidity and mortality in the 1970's to 1990's. Resistance to S-P emerged soon after its deployment in Myanmar in the 1980's. It is noteworthy to observe that at the time when Chloroquine or S-P were initially deployed in the National Malaria control program for *P. falciparum* malaria in Myanmar, resistance to these drugs had already been underway. So also, Mefloquine resistance was already beginning to develop when it was introduced in Myanmar. Quinine resistant strains are generally considered to be rare, but Quinine is cumbersome to use and reports on decreased sensitivity could be due to the poor adherence to the prolonged regimen.)

(e) Most of the newer ACTs (Artesunate + Amodiaquine, Dihydro-artemisinin+ Piperaquine, Artemisinin + Piperaquine, Artemisinin + Naphthoquinone) in the clinical trials in Myanmar between 2004 and 2008 showed ACPR above 90%.

(f) Drug trials on the locally grown /manufacture danti-malarial dihydro-artemisinine (Dihydro-Dawna) showed that it was effective and safe; whereas several traditional drugs including (Ayush), (Say-kha-gyi) and (Mu-yar-gyi) were unsatisfactory and not recommended for use in uncomplicated malaria

### 2.2.3 Studies on severe complicated malaria

Severe complicated malaria is mostly due to *P. falciparum* malaria and most often due to drug resistant *P. falciparum* malaria, which became a serious and pressing clinical management problem. It needed urgent answers to questions about the preferred drug regimen and dose; about early recognition and diagnostic indicators; and about other aspects of management including drugs other than anti-malarials and treatments other than with drugs. There was other less urgent but still unanswered questions about the pathophysiological mechanism which underlie most of the clinical management problem. The studies given hereunder are about recent trials of antimalarial drugs and other treatment modalities in severe, complicated drug resistant *P. falciparum* malaria. Other aspects will be given elsewhere.

#### 2.2.3.1 Trials of anti-malarial drugs in severe complicated malaria

Many trials were undertaken where the efficacy of Artemisinin derivatives in combination with mefloquine in different doses was compared with quinine plus tetracycline.

(a) Clinical trial of parenteral formulation of Artemisinin derivatives in cerebral malaria  
Myanmar clinicians were the first to show in 1992 that Artemisinin derivatives in combination with oral mefloquine were superior to quinine with tetracycline in treating severe, complicated cerebral malaria. This was subsequently confirmed in the 4 countries SEAQUAMAT randomized multi-centre trial in 2004 comparing Artesunate versus quinine for treatment of severe falciparum malaria. Further trials in Myanmar in 2004 also showed that Artesunate achieved a better cure rate than artemether when given intramuscularly in combination with mefloquine and became the treatment of choice for severe Pf adult patients.

(b) Clinical trial of rectal artesunate

Clinical trials done in 2004 demonstrated that rectal artesunate suppository followed by oral mefloquine cleared parasites in 3 days in Pf .patients and kept them parasite free during the 28 day follow up period. Furthermore, the initial single dose rectal artesunate was shown to be as effective as intravenous artesunate for rapid reduction of parasitaemia load within 24 hours. This finding was of greatest relevance to communities in rural areas, where parenteral treatment is often not immediately available.

#### 2.2.3.2 *Trials of other drugs and treatment modalities*

(a) Although previously shown by the Oxford scientists to be ineffective a further trial of steroid therapy was done with negative results. Similarly exchange transfusion was repeated inconclusively. The efficacy of African immunoglobulin IgG to enhance Artemether and mefloquine treatment showed shorter parasite clearance time but no significant difference in mortality. The effect of phosphate infusion was also tested.

### **2.3 Malaria Control**

#### 2.3.1 Mosquito control

##### 2.3.1.1 *Insecticide treated bed nets, blankets and clothes*

An important component of 'Prevention' which is one of the three key interventions to control malaria is the use of Insecticide Treated bed Nets (ITN) and Long Lasting Insecticide treated bed Nets (LLIN). (Ref. DOH, MMR Research Congress 2011) This was a variant and partial resumption of the strategy of mosquito control by use of insecticide sprays; it was introduced into Myanmar by WHO on the basis of scientific evidence provided by research elsewhere and was adopted in Myanmar during this period. ITN's which were introduced into Myanmar were tested in a large, well designed trial. A controlled, longitudinal, comparative study of two entomological interventions- (i) insecticide treated bed nets and (ii) indoor residual insecticide spraying was carried out in ten villages in malaria endemic, forested area in the foot hills of Bago. The objectives were to study the impact, cost effectiveness and sustainability of the two interventions. The outcome measures were: deaths due to clinically suspect malaria, malaria incidence as shown by fever cases, and prevalence of parasitaemia as shown by mass blood surveys. There were significant reductions in all the outcome measures at 6 months and one year but no significant difference between the two interventions. The acceptability and affordability to the community was compared.

Bioassay of Insecticide treated bed net (ITN) pieces were done to indicate mosquito knock down rates and duration of 100% mosquito mortality.

A controlled trial in Mudon township of the effectiveness of Insecticide treated Bed net (ITN) with Vectron showed that use of ITN is effective in indoor Anopheline mosquitoes. Mosquito density and parity decreased in test village compared to control and bioassays showed Vectron to be effective for three months. KAP showed that villages are aware that ITN will reliably prevent mosquito bites.

Controlled studies of insecticide treated blankets and battle dress uniform were also done with satisfactory reduction in measures of mosquito deterrence.

#### 2.3.1.2 Larval control

Larval control through various means have been tested frequently during previous decades since the beginning of malaria control activities in Myanmar and although no longer regarded as an important component of current strategies tests are still being carried out occasionally. The larvivorous potential of several indigenous fishes were evaluated in several areas and found to be promising.

#### 2.3.1.3 Indoor residual insecticide spraying (IRS)

This has been tested many times during previous decades at local level, in various sites large and small, as required for operational purposes -since its introduction after the earliest demonstration/pilot studies in the 1950's. Selective IRS is now a component of 'Prevention' which is one of the three key interventions. IRS was compared with the new strategy of insecticide treated bed nets. (See 2.3.2.1 above)

#### 2.3.2 Personal protection and chemoprophylaxis

Various means of personal protection have been tried over the years and continued. Controlled studies of insecticide treated battle dress uniform were done with satisfactory reduction in measures of mosquito deterrence. Chemoprophylaxis as personal protection and chemoprophylaxis of large population groups, especially the military and forest workers sometimes, have been well tested in previous decades.

#### 2.3.3 Case detection and treatment

Early diagnosis and appropriate treatment have become one of the three key interventions to control malaria (Ref DOH MMR Res Congress. 2011) - apart from being components of effective primary, secondary and tertiary medical care, because obviously, the earlier cases are diagnosed and appropriately treated the less chance there is of further malaria transmission. In line with international strategy Myanmar has focused on intensive case finding - which depends upon quick, sensitive and specific diagnostic tests and prompt and appropriate treatment -which for *Plasmodium falciparum* infection means preferably with Artemisinin combination treatment (ACT).

(a) Several studies aimed at Early Diagnosis and higher sensitivity and specificity were carried out.

Standard microscopy was compared with Immuno-chromatographic tests (ICT) including *P. falciparum* histidine rich protein 2 (Pf HRP2) rapid test first became available in the country in the 1990's and were demonstrated to be rapid (less than 5 minutes) with high predictive value, sensitivity (93%) and specificity(89%) for diagnosis of *Plasmodium falciparum* infection. Another finding from these trials was that parasite density was not associated with clinical severity and mortality in severe complicated malaria including cerebral malaria, which seems to contradict other findings elsewhere. Anti RESA antibody was related to clinical severity and showed some relationship to outcome. It was shown also that ICT, Parasight Rapid test and anti RESA antibody tests detected recrudescence 4-7 days earlier than standard microscopy.

PCR was compared to standard microscopy and shown to be more sensitive and specific in detecting all malaria parasite species. (*For tests of appropriate treatment see clinical trials elsewhere*)

## 2.4 Case Management of Malaria

### 2.4.1 *P. falciparum* malaria (Pf) -uncomplicated; severe, complicated; and drug resistant

Almost all severe, complicated cases of malaria are *P. falciparum* malaria and most of them are drug resistant. Many of the then available drug regimes including quinine (Q), chloroquine(CQ) and other 4 amino- quinolones, primaquine (PQ) and Sulphadoxine-pyrimidine (SP) alone or in combination, and in different formulations have undergone many comparative clinical trials for efficacy, dose finding, safety and side effects; and their usefulness in the treatment of *P. falciparum* was well known by the end of 1980 decade. Early trials of the Chinese antimalarial drug Artemisinin were also first done in the 1980's. Studies of *P. falciparum* malaria undertaken were as follows:

#### (a) Studies to assess and predict disease severity and indicate prognosis

It was shown that hypoglycemia was more frequent in all severe malaria and in cerebral malaria compared to control cases of meningitis. The role of blood measurements in severe complicated malaria in relation to Systemic Inflammatory Response Syndrome (SIRS) leading to multi-organ failure was investigated in DSGH, NOGH and in Anurudha, Sri Lanka. It was shown that in malaria cases with different degrees of severity 68.7% developed SIRS and hypermetabolic status. High levels of Tissue Necrosis Factor (TNF alpha) were associated with disease severity. Blood glucose measurement was important to assess clinical status and disease severity.

Study of prognosis in severe malaria including cerebral malaria showed that the risk factors were delayed treatment, first attack, unarousable coma, and multiorgan failure. Early treatment was crucial.

Fibrinogen Degradation Product (FDP) levels were measured and showed no significant difference between cerebral malaria and other malaria cases nor with normal controls; also no difference between fatal and non-fatal cases.

Renal function studies in Pf malaria including urea and creatinine levels, creatinine clearance, protein and albumin index, and fractional excretion of sodium (FENa) showed that 87% had no renal impairment, 10 % had transient non-oliguric renal failure and 2.5% developed oliguric renal failure requiring dialysis. Main cause of hemolysis in renal shut-down of Pf patients in another study was hypersensitivity to quinine, Osmotic fragility tests showed early hemolysis in acute renal failure

Tissue necrosis factor and anti RESA antibody determined by Elisa and Pf specific Monoclonal antibody measured by indirect immune-fluorescent assay were correlated with clinical severity, parasite density, mortality and gave variable results. TNF was related to clinical severity and not to outcome but inconclusive with respect to parasite density. Anti RESA antibody was related to clinical severity and showed some relationship to outcome but also inconclusive regarding parasite density. It was more sensitive and specific than standard microscopy and useful for detecting cases with low parasite density.

The tiny, small and large developmental stages of the malaria parasite were studied in relation to disease severity. It was found that the percentage of the small ring forms was highest compared to larger forms in cerebral malaria and it cleared earlier when antimalarial drug treatment was given. The small developmental stages of the Pf parasite have some relationship to cerebral malaria.

Studies of the relation of the genetic red cell disorders viz. alpha and beta thalassemia, G6PD deficiency and Hb. AE trait show that the mean parasite density is lower than in normal HB AA subjects and give some protection against malaria infection.

(b) Studies of malaria in pregnancy-

Studies of the magnitude of the problem of malaria in pregnancy at Tavoy showed that malaria infection was prevalent in pregnant women and that 30% of primigravida and 20% of multigravida developed cerebral malaria with high maternal mortality as well as high foetal mortality. The chief cause of maternal and foetal mortality was cerebral malaria. Another study showed that mefloquine was equally as effective for malaria as quinine but with lesser side effects and preferable. The frequency of parasitized placenta was found to be 30% and a classification scheme for parasitized placentas was proposed which would enhance understanding of pregnancy malaria and may lead to an explanation of reduced birth weight.

(c) Studies of malaria in children

Studies of malaria in children in YGH show that in low prevalence urban areas clinical diagnosis alone is not sufficient and require additional laboratory tests.

(d) Side effects of drug therapy

ECG studies in malaria patients treated with Quinine, Falcimax, Halofantrine show sinus bradycardia and prolonged QT interval changes but no severe hemodynamic effects.

## 2.5 Socio-economic and behavioral aspects and health education concerning malaria

Quantitative and methods as well as participatory action research methods were used for these studies.

### 2.5.1 Knowledge, Attitude, Practice Studies (KAP)

(a) KAP studies were conducted among patients, community and special groups especially soldiers to know their understanding of malaria and their behavior or practice with respect to prophylactic measures including chemoprophylaxis, treatment seeking behavior, use of insecticide treated bed nets, payment for diagnostic tests, utilization of diagnostic and treatment services, etc.

(b) KAP of health care providers including General Practitioners (GP) and nurses with respect to clinical management of malaria, nursing care of malaria patients procedures.

(c) Studies of Migrant populations

Migrant studies also contributed for targeting Migrant and mobile populations in Malaria Artemisinin Resistance Containment framework 2011 and onwards.

(d) Studies of fake drugs –

Prevalence of fake drugs in GMS contributed to strengthening market surveillance and QA.

## 2.6 Parasite biology, genetics and mechanism of drug resistance

### 2.6.1. Relationship between RBC infection by malaria parasites (Pf/Pv), genetic abnormalities of RBC, and RBC membrane permeability to nutrients and drugs

This was investigated in a series of basic parasitological and biochemical studies using advance technologies including tritium labeled isotopes of the nucleotide Adenosine and the antimalarial drug chloroquine (CQ), liquid scintillation counter, malaria parasite in-vitro culture, chromatography and spectroscopy.

These studies show that H<sup>3</sup> adenosine transport across membrane of genetically abnormal RBC (of persons with alpha and beta thalassemia, homozygous and heterozygous Hb E, G6PD deficiency ) is reduced compared to normals (with Hb AA) suggesting that nutrient deficiency may be a possible mechanism for relative resistance to malaria infection by RBC of such genetically abnormal subjects.

It was also shown that resistance to malaria infection by RBC of persons with the HbE gene is not due to inhibition of invasion by parasite but due to inhibition of the multiplication process within RBC. CQ resistant Pf strains multiplied faster in-vitro within RBC than sensitive strains. CQ uptake was decreased and efflux rapid in RBC infected with CQ resistant strain of Pf. It was demonstrated that there is a strong relationship between rapid CQ efflux and *in vivo* resistance to CQ.

Some studies on G6PD seem to favour the use of primaquine in *p. vivax* malaria.

#### 2.6.2. Other studies of parasite genetics and biology

##### (a) Genetic variants of Pf/Pv (other than drug resistant strains)

Circumsporozoite protein (CSP) variants of *Plasmodium vivax* have been detected in Myanmar using standard methods as well as ELISA and PCR. These variants are VK 210, VK 247 and mixed VK 310/247 CSP strains. (b) Relapse pattern of Pv patients from DSGH were compared to other patterns elsewhere. It was shown that the pattern was similar to *P. vivax* from Papua New Guinea (similar to the Chesson strain) in 28% of relapse cases.

### 2.7 Vector biology, ecology, insecticide resistance and vector control

#### 2.7.1 Studies of Anopheles mosquitoes and their relation to malaria transmission

Numerous studies of the biology, distribution, insecticide resistance and role in malaria transmission in different parts of the country have been carried out in past decades and currently continued.

(a) Studies in recent years show the malaria transmission role of rice field breeding and well breeding Anopheles species especially *A. dirus* strains in Mudon and Tanintharyi division.

(b) Isoenzyme characterization and investigation of Circumsporozoite protein antigen in Anopheles mosquitoes were done. Using ELISA for the first time, CSP antigen of Pf and Pv were detected in mosquitoes species collected from various parts of Myanmar.

#### 2.7.2 Effect of interventions

(a) An extensive, longitudinal study of the effect of two different entomological interventions was carried out in 10 villages in the malaria endemic, hilly, forested area of Bago division. It was shown that residual indoor insecticide spraying and use of insecticide treated bed nets are equally effective with respect to mean parasite rate. Other parasitological, epidemiological and serological data were collected and the acceptability and affordability compared.

(b) Effectiveness of insecticide treated bed nets and blankets on man-mosquito contact was studied.

(c) Effect of other factors on mosquito breeding and malaria transmission were studied including *B. sphaericus*, neem seeds, and household cattle

### 2.8 Development of anti-malarial drugs and devices

(a) *Artemisia annua* was successfully grown in Myanmar and various plant extracts were tested for activity against the malaria parasite using the *P. bergeri* mouse model. It was found that petroleum ether extracts were active and the ED50 and ED90 were determined. Water decoction was inactive. The Reicknan Rabbit *in vitro* test showed schizont inhibition of the active preparations.

**D. Health Impact – how did malaria research influence/or could influence clinical, public health and laboratory practice?**

Malaria research in Myanmar (after 1986) from the 1990's onwards (as exemplified by the research activities included in the Annotated Bibliography "Malaria Research Findings Reference Book. Myanmar. <1990-2000>) has had considerable beneficial impact on health of the people in Myanmar.

**3.1 Reduction of the burden of sickness, death and economic hardship due to malaria**

This was accomplished by providing scientifically valid evidence regarding the three important components of proper malaria management.viz, Diagnosis, Treatment and Prevention.

(a) *Diagnosis of malaria*- studies has demonstrated the validity, applicability and usefulness of the immunological tests for rapid diagnosis of malaria which had become newly available in Myanmar during those years. This has had great beneficial impact on the clinical management of malaria and has enabled the development and execution of one of the key interventions for the control of malaria which is "Early diagnosis and appropriate treatment".

(b) *Treatment of malaria* – many studies of the efficacy/limitation of existing and newly emerging antimalarial drugs including, most importantly, the Artemisinin derivatives, and of new drug regimens including Artemisinin Combination Therapy (ACT) – have enabled rational and effective treatment of severe, complicated Pf malaria as well as uncomplicated Pf and Pv malaria.

(c) *Prevention of Malaria* – extensive monitoring of drug resistance of Pf at sentinel sites and border areas and in many parts of Myanmar, in hospitals/clinics and the community; as well as monitoring the chloroquine resistance of Pv in some areas –have provided a clearer, up-to-date picture of the drug resistance pattern in Myanmar and enabled key interventions including "Early diagnosis and appropriate treatment " and the Myanmar Artemisinin Resistance Containment (MARC) program.

Large ,well designed trials of Insecticide Treated Bed nets and Long lasting Insecticide treated bed Nets in Myanmar (Bago and Mudon) have confirmed their efficacy and feasibility under conditions in Myanmar and contributed to their adoption as important component of 'Prevention' which is one of the three key interventions to control malaria

Socio-economic studies in previous decades have shown the importance of migrant populations in the spread of drug-resistant malaria; migrant populations have become important target populations especially in the framework of MARC since 2011 onwards.

**3.2 Development of policy and strategy regarding malaria**

Research has provided valid scientific evidence for the development and execution of evidence-based malaria control strategies and key interventions including MARC and development of Malaria Drug Policy.

**E. Scientific Significance - What was Added New to Existing Scientific Knowledge of Malaria?**

Some of the studies on malaria undertaken in Myanmar have contributed to new scientific knowledge regarding-

**4.1 Parasitology of Malaria**

(a) some studies of purine transport across red cell membrane generated new hypothesis concerning resistance to infection by malaria parasite by genetically abnormal RBC in alpha,

- beta thalassaemia and Hb. E homozygotes and heterozygotes which are prevalent in Myanmar
- (b) other studies on chloroquine efflux in RBC infected with chloroquine resistant Pf suggest new mechanism for development of resistance.
  - (c) new variants of Circumsporozoite Protein (CSP)-were detected in some Pv species of MMR.

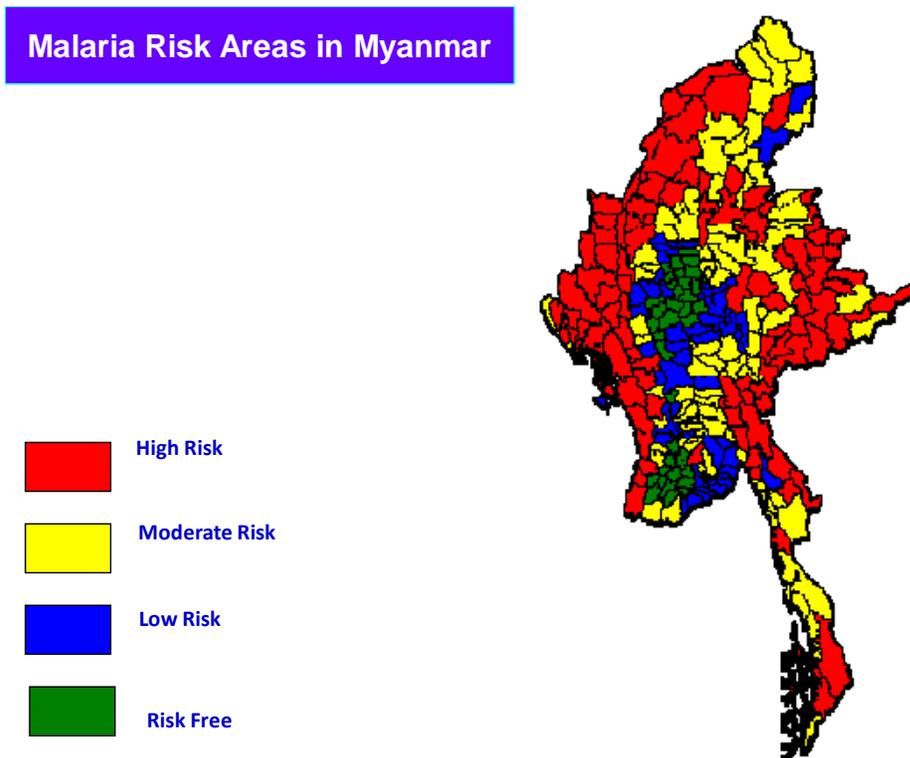
#### 4.2 Treatment of Malaria

Myanmar clinicians were the first to show in 1992 that Artemisinin derivatives in combination with oral mefloquine were superior to quinine with tetracycline in treating severe, complicated cerebral malaria.

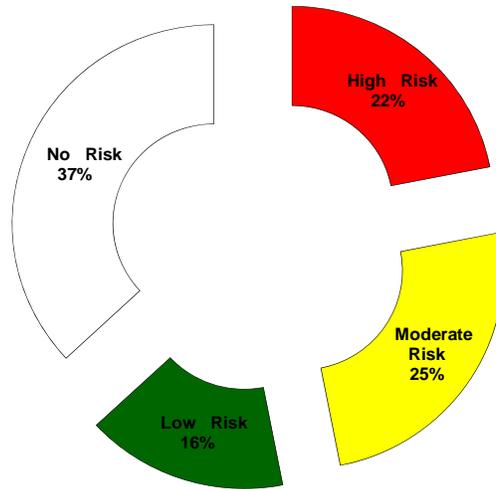
#### F. Conclusion

This account of Malaria Research in Myanmar in the past, and especially of research during the decades since 1986, shows the tremendous research efforts made by medical scientists, other scientists, institutions and organizations in Myanmar to obtain new knowledge that will help diagnose, treat and control malaria – which continues to be a national health problem.

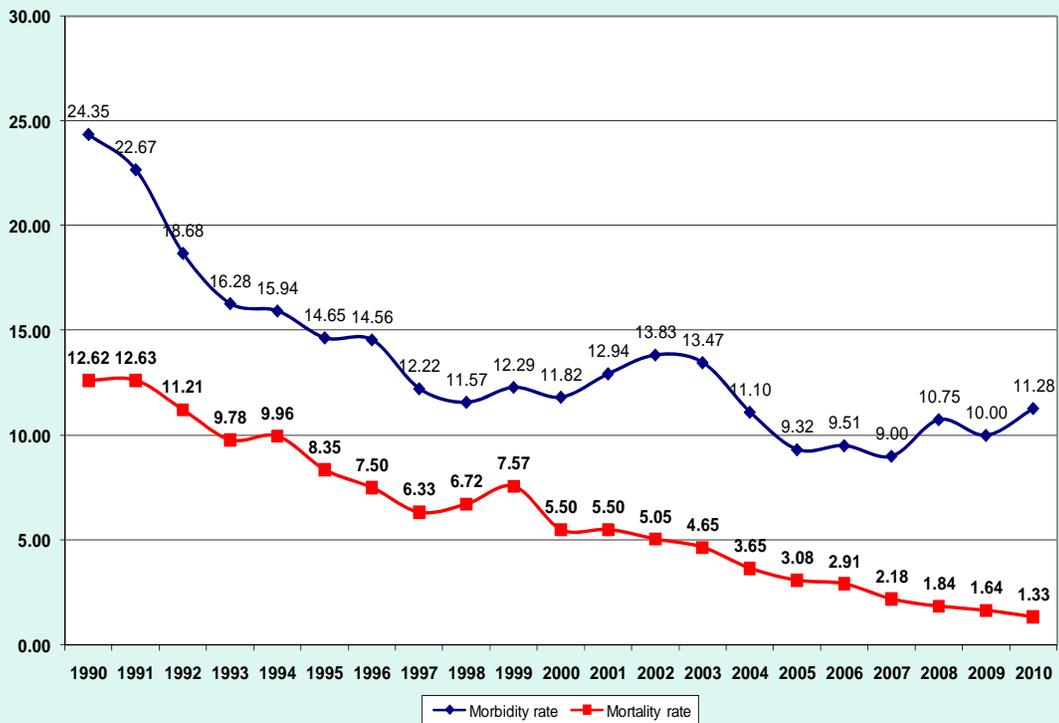
#### G. Diagrams and Figures

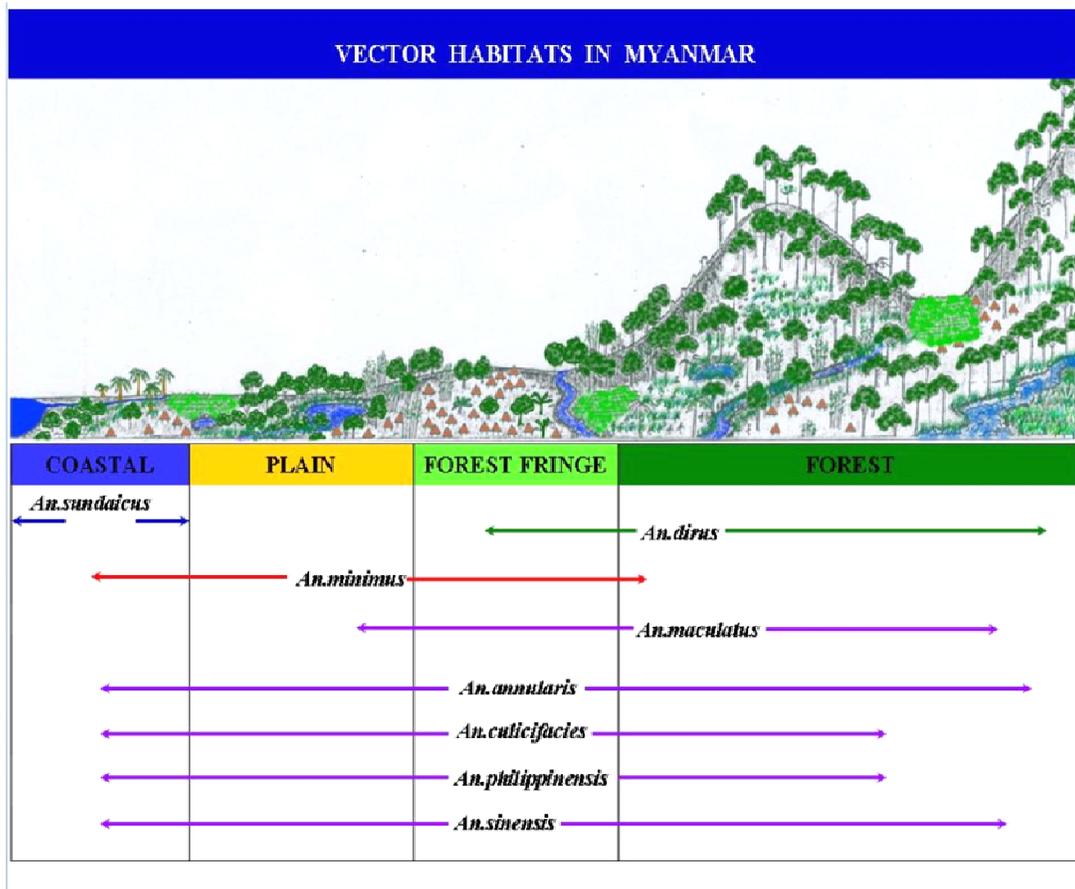
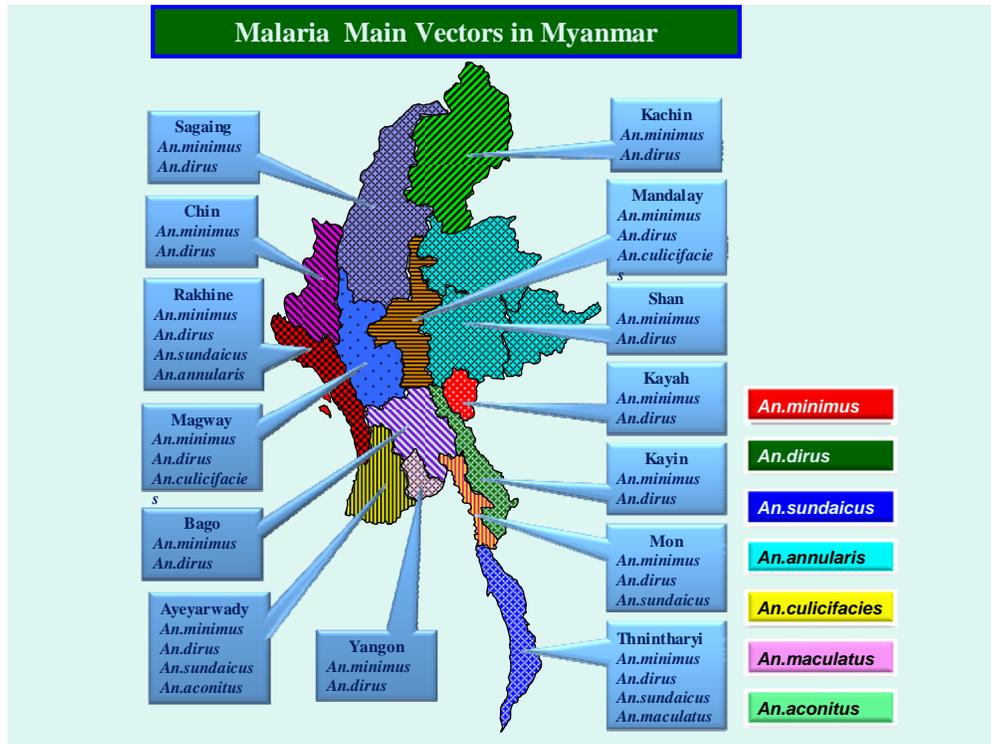


Population living under malaria risk areas in Myanmar,2010

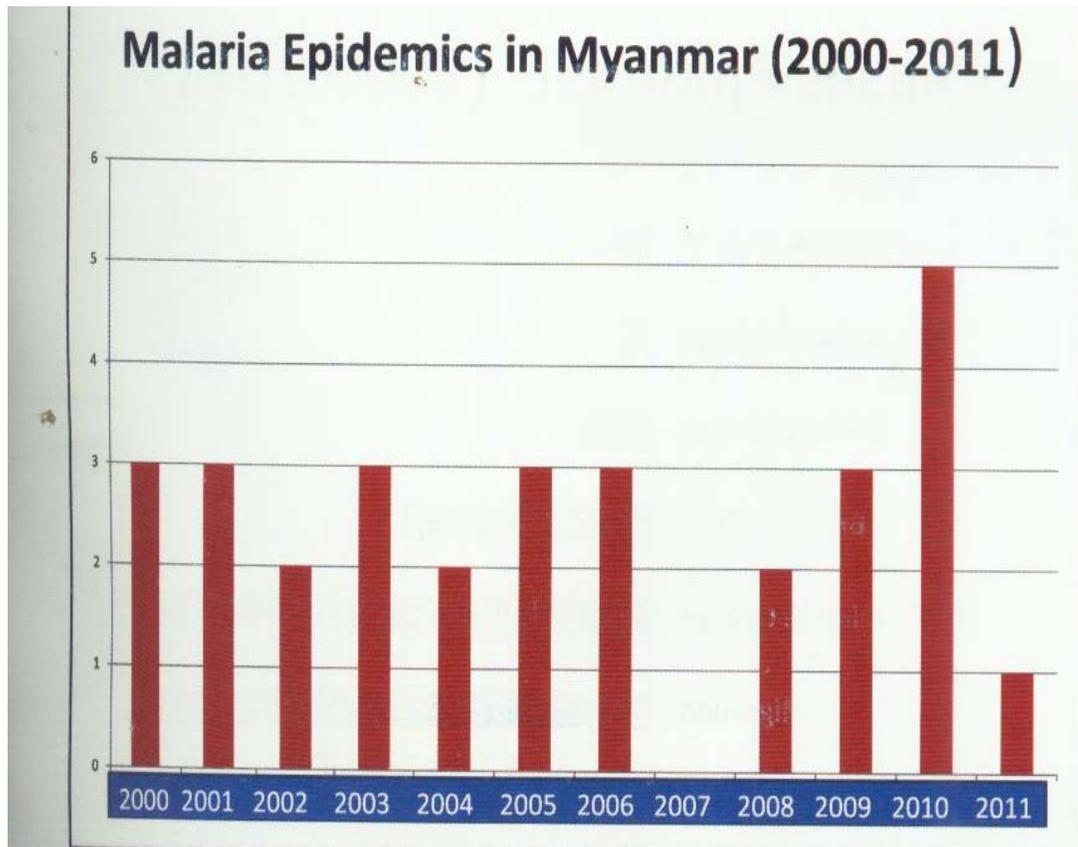
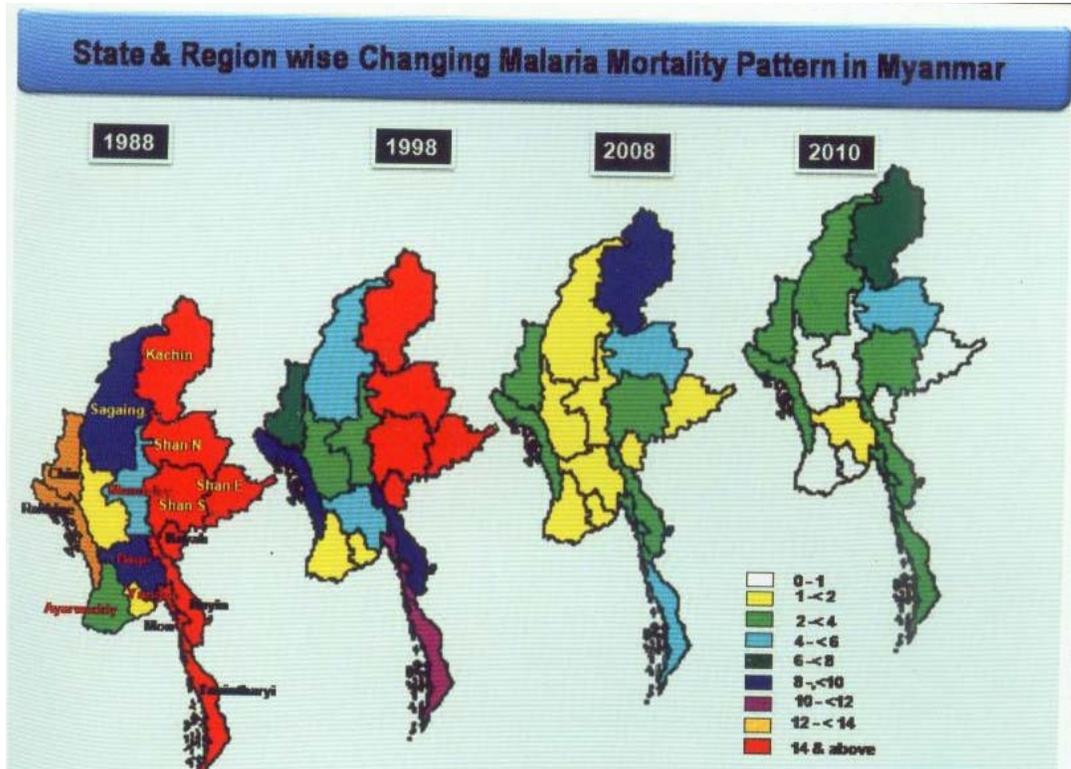


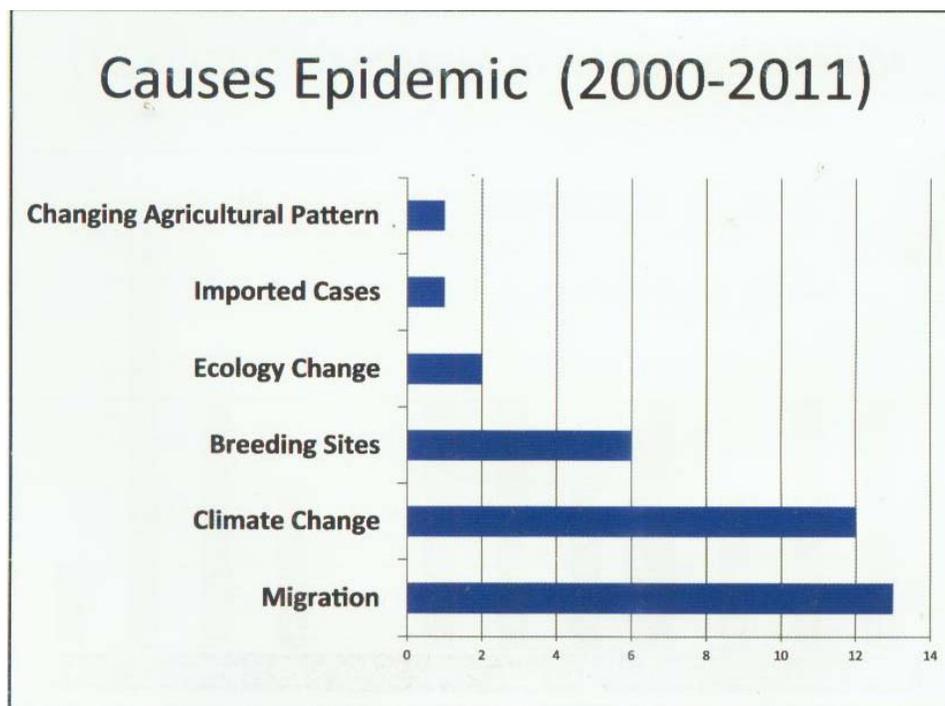
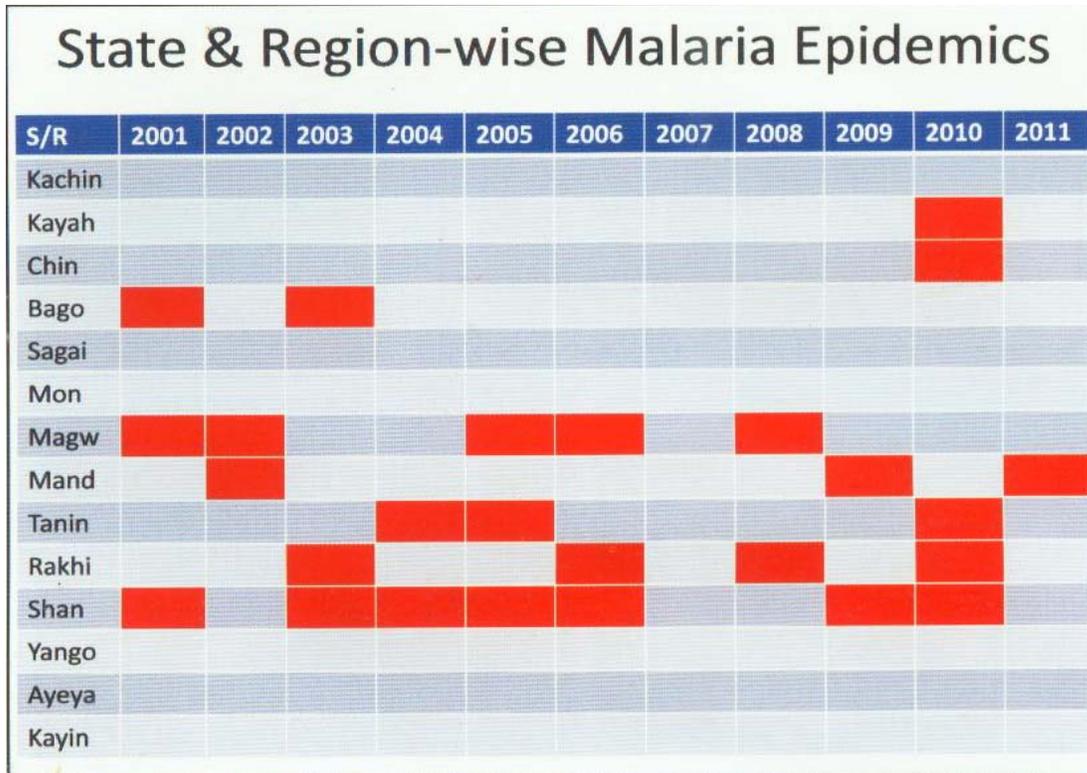
Yearly Malaria Morbidity & Mortality Rate in Myanmar (1990-2010)













## **Section 7.3**

### **Dengue and Dengue Hemorrhagic Fever**

by **Soe Thein, W. Tun Lin, Thaung Hlaing, Soe Aung, Hlaing Myat Thu & Khin Saw Aye**

#### **Previous Research**

Previous research on Dengue Fever/Dengue Haemorrhagic Fever ( DF/ DHF) in Myanmar has been very well summarized in Volume 1 of G&D Med. Res. Myanmar and in the Review of Dengue Hemorrhagic Fever in Myanmar by Soe Thein in DMR Bulletin (1991 July)

#### **Research from the 1990's onwards**

The following account of further research undertaken from the 1990's onwards is extracted from and based on the Report of the Working Group Meeting, Dengue Research Findings Reference Book Myanmar 1980-2002 There were 189 papers published of which 4(2%) were on Health education and health promotion, 32(17% )on program management, 23(12%) on Vector surveillance, dengue prevention and control, 91(45% on basic research) including 49 on basic entomological research and 42 on virological and pathophysiological basic research , and 45 (24%) on diagnosis and clinical management. 30% of the papers published or read at medical and research congresses were postgraduate theses of which 7 were for the Diploma in Bacteriology or Child Health, 36 were for MSc (Zoology), 14 for M.Med.Sc. (Pediatrics, Public Health, P&TM, Microbiology, Biotechnology, Master of Research) and 1 for Dr.Med.Sc.(Pediatrics)

#### **(1) Health Education and Health Promotion**

Studies were undertaken on Knowledge-attitude –practice and treatment seeking behavior of families regarding DF/DHF, source of information about the disease and measures undertaken by YCDC to prevent DF/DHF

#### **(2) Epidemiological Situation of DHF in Myanmar**

A Review of the epidemiological, biological, entomological and clinical aspects of DHF was done in 1991. The burden of DHF based on DALY and the effectiveness of intervention was assessed. It was reported that DHF was endemic in Yangon Division, that mortality was decreasing steadily, that CFR was now steady and that it was mainly an urban problem. Five epidemics occurred in Yangon division during 1970-1993. Case control study showed that poor maternal knowledge and failure to take ORS were factors associated with development of shock. Descriptive studies of DHF outbreaks and analyses of epidemiological situation in different States and Divisions and specific townships were done including Taungup and Sittwe townships in Rakhine State; Lashio township in Shan states, Moulmein township in Mon state, Bassien and Myaungmya townships in Ayeyarwaddy Division, Taungoo township in Bago division. Diagnostic criteria were presented and clinical management and control measures were assessed including larval control. Adult cases of DHF were observed in Lashio for the first time in Myanmar. The risk of DSS in relation to Dengue serotype and sequence of infection was analyzed on the basis of a multi-disciplinary epidemiological study in 1997. The risk of DSS was greater following an amnestic infection and many times more with Dengue 2 infection than with other serotypes. This was the first

confirmation outside Thailand of the sequential infection hypothesis for development of DHF proposed by Halstead.

### **(3) Vector surveillance and Dengue prevention and control**

A rational and pragmatic approach for DHF control was proposed comprising identification of key premises and key containers, various methods of categorization of containers and indexes of larval abundance including Breteau index, Premise condition index, etc. and categorization of containers, prioritization and targeting high risk areas for control activities. The efficiency of cotton net sweepers in removing *Aedes aegypti* larvae was reported.

Trials were conducted with respect to chemical control including use of ultra low volume fogging, larvicides like abate, etc. The efficiency of mechanical control including cost effectiveness of cotton net sweepers in removing *Aedes aegypti* larvae was reported.

The efficacy and feasibility of some biological control methods were demonstrated in the field including use of dragon fly nymphs, mosquito fish, and others. Basic research on the vector mosquitoes were carried out including vector ecology and bionomics, biting habits, development and survival.

### **(4) Virology and pathology of DF/ DHF**

Methods for the determination of Dengue serotypes were established and innovative techniques for early isolation and detection of dengue virus were developed at DMR in previous decades. New and emerging diagnostic methods were recently established in the 1990's including Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR). Collaborative research has been carried out between Virologists at DMR and counterparts in USA, Australia and Japan. Some of the commercially available test systems such as ICT and Dengue blot test, etc. have been evaluated and used to investigate dengue outbreaks.

Biological difference between mild and severe dengue cases have been observed in preliminary studies with far reaching implications and needs confirmation. Recent studies show that the commonest circulating Dengue serotype in the community has changed from Dengue 2 to Dengue 1 which was the prevailing serotype during the biggest Dengue outbreak in 2001 and may be its leading cause.

Regarding the pathogenesis of Dengue infection, risk factors such as virulence, temperature sensitivity of the Dengue virus and the influence of immune enhancing antibodies, small intestinal permeability, FDP and various others factors were studied.

### **(5) Diagnosis and Clinical management**

Study of factors that will predict development of shock identified pulse rate > 120/min, platelets <50,000/cu.mm and PCV>42% as principal risk factors. It was shown that bacterial translocation could lead to septicemia which justifies use of antibiotics in DSS cases. Studies which Indicate need for administration of platelets, blood products and plasma expanders, and choice of intravenous fluids were carried out. It was shown that steroids have no role in the treatment of DSS.

### **(6) Basic research on DF/DHF**

Some of the researches on DF/DHF which are of fundamental scientific significance and which also indicate the level of science and competency attained by scientists, research, academic and health service institutions in Myanmar have been further elaborated hereunder.

*Research studies on the genetic diversity of dengue viruses*

Dengue viruses, being RNA viruses are genetically diverse. Studies on genetic diversity of Myanmar dengue viruses were done in the Virology Research Division, DMR (LM) in collaboration with the WHO Collaborating Centre for Arbovirus Reference and Research, Brisbane, Australia. Genetic variation was explored between virus populations by directly sequencing the virus isolates and variation within virus populations were studied by cloning and sequencing of the clones. Envelope protein genes sampled from populations of Myanmar dengue 2 (DEN-2) viruses in individual *Aedes aegypti* mosquitoes and sera from dengue patients were cloned and sequenced. In a single mosquito host, two sets of clones represented each parent and one clone was identified as a recombinant genome composed of portions of two parental genotypes. This was the first report of recombinant and parental dengue viruses in a single host.

Also for the first time in dengue virus populations in humans and mosquitoes, a stop-codon mutation was found on the surface of the envelope protein representing a defective lineage of dengue 1 (DEN-1) from Myanmar and within a year, this mutation had spread to all populations sampled. It was proposed that this long-term transmission of defective RNA viruses in nature indicated complementation by co-infection of host cells with functional viruses.

Molecular epidemiology studies were undertaken and phylogenetic trees drawn with the DNA sequences of dengue viruses to identify the emergence of new viral strains and establish the relationships between Myanmar dengue strains and global strains. Analyses of dengue 1 viruses isolated from one of the largest outbreaks of dengue in Myanmar (95% of viruses being isolated were dengue 1), revealed that the lineage that had been circulating for the past 25 years had become extinct and two new lineages of dengue 1 (DEN-1) had emerged. Further studies indicated that this emergence was due to a stochastic event attributable to the low rate of virus transmission in an inter-epidemic period. Virological surveillance detecting diversity in dengue viruses and new strain emergence has important implications for the formulation of an effective dengue vaccine as well as timely implementation of control measures in preventing DHF outbreaks.

*Risk factors in Dengue Shock Syndrome*

A five year prospective clinical, epidemiological and virological study was undertaken in two townships of Yangon (during 1984 to 1988), to determine risk factors (epidemiological and virological) in dengue shock syndrome (DSS). The study revealed that the risk of developing DSS is 81.6 to 103.3 times higher in secondary dengue infections compared to primary dengue infections. Moreover, the risk of developing DSS is 15.2 times higher if the second infecting dengue virus is serotype 2 if compared to other serotypes (1). This study confirmed the findings of the earlier prospective study in Thailand (2). This is the only study (apart from earlier Thai study) up to then, that provided valid scientific evidence that risk of developing DSS is significantly higher in secondary dengue infections, particularly with dengue serotype 2. The findings have profound implications in the rationale of dengue vaccine development. A dengue vaccine administered to a child should provide solid immunity to all of the four dengue serotypes. If the vaccine provide only partial immunity to any of the dengue serotypes, that child may be at risk of developing DSS if infected (naturally) by that partially protected dengue serotype.

*Study on Patho-immunology of Dengue Hemorrhagic Fever*

An understanding of the mechanisms that produce symptoms of disease and the fatal vascular permeability, hepatic damage and metabolic acidosis rests ultimately with gaining definitive understanding of dengue virus-host cell interactions during infections. To achieve

this goal, a comprehensive study of tissues obtained from human autopsy and a modern study of the histology of DHF/DSS needs to be performed with particular emphasis on immune-pathologic responses.

Only a few histo-pathologic studies have been published that described the cellular and organ damage caused by dengue viruses and the accompanying host tissue responses that characterize dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS). Conventional studies on dengue pathology have been supplemented at Immunology department of DMR (LM) by efforts to isolate and localize dengue virus and also viral antigens in peripheral blood and organs by using immunohistochemistry, in situ hybridization and electron microscopy in collaboration with Pediatric Dengue Vaccine Initiative/International Vaccine Institute. These studies raise questions concerning the sites of infection during human dengue infection.

*Bionomics of vector mosquitoes and innovative studies of Artemisia annua extracts on Aedes aegypti*

Basic research on the vector mosquitoes were carried out including vector ecology and bionomics, biting habits, development and survival. Apart from extensive studies on the prevalence of *Aedes aegypti* in many localities and region throughout Myanmar, of particular significance were the studies on seasonal prevalence and variations in different localities and the determinants because this may lead to possible more effective seasonal preventive measures.

Some innovative research were the studies on the effect on *Aedes aegypti* of extracts from *Artemisia annua*, the plant basis of the Artemesinine drugs known to be effective on human Dengue infection.

## Section 7.4

### Gastrointestinal Diseases (1996-2010)

by Myo Khin, Yi Yi Kyaw & Aung Than Batu

*(extracted from Annotated Bibliography of Studies on Gastro-intestinal diseases in Myanmar by Myo Khin and Yi Yi Kyaw, published by DMR (LM)*

#### Gastrointestinal Diseases Studied

The scientific study of gastro-intestinal diseases in Myanmar began early in the colonial regime.

Epidemics of cholera were rampant in the Kingdom of Myanmar since the 18<sup>th</sup> century and global pandemics of cholera invaded the Kingdom of Myanmar and also British Burma from time to time, the 6<sup>th</sup> pandemic reaching Myanmar in 1901. They were a threat to the health of the colonial army, the administrators, their families and the European community which followed the British flag into Myanmar, as well as to the proper conduct of administration and trade. Cholera therefore was the GI disease first taken up by the colonial medical administration for public health action and study and continued to be kept under surveillance and studied till the end of colonial rule. By the time Myanmar Kingdom was annexed to the British Empire in 1886, the cholera vibrio had already been discovered by Koch in 1883 and the water borne nature of the disease was known. The classic studies of Snow in London in 1855 and others in India had shown that it is possible to prevent cholera by providing clean water.

After Independence in 1948, the Myanmar health authorities continued to focus attention on and study different aspects of cholera, according to need and opportunity.

Diarrhoea (non-choleric or non-specified diarrhoea) became gradually recognized as a highly prevalent and important cause of mortality and morbidity in Myanmar, especially in children including neonates and was listed among the top priority diseases in successive National Health Plans. Although people in the community and general practitioners would have always been aware of its pervasiveness and health impact, it was only from around the 1960's that the focus of attention of the health authorities shifted from cholera to diarrhoea and it became the subject of intense scientific study in scope and depth, from the medical as well as socio-economic aspects, throughout the later decades.

Intestinal helminthic infections are easily recognized and known to be highly prevalent in children in Myanmar and like diarrhoea, they have been the subject of intense scientific study from about the 1950's onwards.

Dysentery is also easily recognized, very common and has been scientifically studied to some extent and depth from about the 1950's onwards

Other common GI diseases and disorders, medical and surgical, must have been diagnosed and treated in hospitals and by general practitioners throughout the colonial period but were not particularly studied or reported.

After Independence, from 1950's onwards, common GI diseases studied (other than cholera, diarrhoea, dysentery and intestinal helminthiasis) were medical diseases including peptic ulcer, tropical sprue and intestinal tuberculosis; and surgical diseases/conditions including acute abdominal emergencies and non-acute conditions such as piles, cancer stomach and a variety of others. Although numerically large in total, none or very few of these individual GI diseases were investigated in broad scope, depth and continuity as in the case of diarrhoea and intestinal helminthiasis. The exception was Peptic ulcer, where the new

concept regarding etiology (*Helicobacter pylori* infection) gave the stimulus and theme for a series of in-depth studies.

### **Overall View**

The gastrointestinal studies undertaken throughout the years were on:

#### **Cholera**

- epidemiology and bacteriology. Identification of classical Inaba and Ogawa strains of cholera vibrio initially and then of *Vibrio non-01* strains in Myanmar.
- Introduction of cholera vaccination during early colonial period and its efficacy.

#### **Diarrhoea**

- extensive research was carried out on the epidemiology and etiology of acute diarrhoea in urban and rural communities.
- seasonal and geographical variations in incidence were investigated'. Personal hygienic practices that affect diarrhea incidence were studied – in particularly home and hand contamination in relation to diarrhoea and demonstration that hand washing with soap and water after defecation and before meals reduced diarrhoea incidence; the role of fomites such as paper currency notes in the person to person transmission of diarrhoeas was investigated.
- apart from well known EPEC strains other important etiological agents, hitherto not known to be present in Myanmar were identified including Enterotoxigenic *E. coli* (ETEC, both heat labile and heat stable strains) and *Campylobacter jejuni*. Rotaviruses as etiological agent of diarrhoea in children was studied for the first time in Myanmar and found to be prevalent during the cold season. Rotavirus surveillance was carried out in Children's hospital as part of Asian Rotavirus Surveillance project. The relative frequency of these etiological agents for diarrhoea was studied in children including neonates.
- the biological properties of these pathogens were studied such as invasiveness and adherence and the effect of their toxins were also studied such as intestinal secretory response to ETEC, effect of cholera toxin on cyclic AMP and on amino-acid uptake, using radio-labeled tracers.
- the effect of diarrhoea on gut function, bio-availability and pharmacokinetics of drugs was studied.
- an important shift in the focus of diarrhoea research took place - from etiological agents to treatment modalities - when oral rehydration therapy (ORT) emerged in the 1970's as effective treatment of diarrhoea, as a result of crucial discoveries in basic research and clinical demonstration of efficacy at top research centers abroad. Trials were undertaken to test the operational feasibility and acceptability of ORT under local conditions in the villages, communities and at home in Myanmar. Studies ranged from whether village mother could properly measure water and prepare acceptable concentrations of oral rehydration solution (ORS) to tests of cheaper substitutes for home use and investigations into suitable foods to be given during diarrhoea including breast milk and rice gruel. Also, clinical trials were done of traditional herbal remedies like berberine and commonly used home remedies like alum and activated charcoal for the treatment of diarrhoea
- the socio-economic aspect of acute diarrhoea was studied:- such as cost analysis and cost comparison of patient hospitalized for acute diarrhoea; role of general practitioners in diarrhoea management was described; characteristics and health related behaviour of diarrhoea patients seeking hospital admission through different services was compared; maternal knowledge, attitude and practice in relation to severity of diarrhoea was document.
- patho-physiological mechanism related to gut function and food absorption were carried out in the laboratory, hospital and in the field. The breath-hydrogen test was set up

and used to determine rice carbohydrate (CHO) absorption in normal village children. CHO absorption and malabsorption in relation to growth in children was studied.

### **Dysentery**

Studies of dysentery were few. *Shigella shiga* outbreak was recorded and efficacy of traditional medicine on acute amoebiasis including Let-Htoke-kyi was tested.

### **Intestinal Helminthiasis**

- An Expert Technical Committee for the Study of Intestinal Helminthic Infection in Burma was appointed by the Burma Medical Research Council in 1968. Although there have been several previous prevalence studies of intestinal helminths in Myanmar this Technical Committee conducted the first systemic attempt to review the situation and assess the health impact of intestinal helminthiasis in Myanmar. Its Report provided the framework and guidance for further research on the subject for many years to come. Descriptive epidemiological studies of intestinal helminthiasis were carried out in different urban and rural communities especially among school children. These studies and many more in the following decades provided base-line data on the extent of intestinal helminthiasis in the country.

- Later, the epidemiology of Ascariasis as well as the biology of *Ascaris lumbricoides* were studied in depth. Cross-sectional and longitudinal surveys were carried out in villages to determine distribution of worm load, the basic reproductive rate and transmission dynamics. Epidemiological models of *Ascaris* infection and theoretical simulation of the effect of mass chemotherapy were done, followed by a pilot experiment to examine the possibility of reducing *Ascaris* transmission to insignificant level by mass chemotherapy. The impact of periodic age-targeted mass chemotherapy on prevalence, intensity and morbidity due to Ascariasis was studied in village children. The impact of regular de-worming on nutrition and growth of school children was studied in a large experiment covering 21 villages.

- Result of these studies helped to fill the gap in contemporary scientific knowledge about the interrelationship between *Ascaris* infection and nutrition and provided information helpful in choosing between various public health options for preventing and controlling *Ascaris* infection in the community in Myanmar.

- The important role of *Ascaris lumbricoides* infection in the pathogenesis of bile duct stones became apparent when analysis of bile duct stones showed the presence of *Ascaris* ova in their core.

### **Anatomical Studies**

- Which were done as part of academic studies beginning with gross structure of the gut including vascular supply and innervation and later extended to include small intestine mucosal pattern, dissecting microscopic appearance and histological features of the small intestine

### **Specific Gastrointestinal Diseases**

- Which were frequently encountered in hospital practice began to be studied systematically from different aspects according to scientific importance, interest and opportunity:-

- **Peptic ulcer**- epidemiology, comparison of surgical treatment, peptic ulcer and gastritis were studied for the first time in Myanmar from the new perspective of *H.pylori* infection as a possible etiology factor; a variety of surgical conditions were studied to record experience in a local setting -acute pancreatitis, acute appendicitis, intestinal perforation, anal and peri-anal infections, gastro-duodenal hemorrhage, tuberculous abdomen, prolapsed rectum.

- Infection with *Helicobacter pylori* as the etiology agent responsible for peptic ulcer has emerged as a refreshing new concept in recent years and was the subject of many studies in Myanmar during this period leading to better understanding, diagnosis and treatment of gastric and duodenal ulcers and non-specific gastritis. The current status of *Helicobacter pylori* in Myanmar was presented at the Symposium on “ Updates in Internal Medicine UK and Myanmar Perspectives” held in collaboration with the Royal College of Physicians (London) and Internal Medicine Society, Myanmar at UM1, Yangon on 29-4-2013.

- **Clinical and epidemiological surveys of some other GI diseases** include typhoid, shigella dysentery, abdominal tuberculosis

- **A variety of surgical conditions** were studied to record experience in a local setting -acute pancreatitis, acute appendicitis, intestinal perforation, anal and peri-anal infections, gastro-duodenal hemorrhage, tuberculous abdomen, prolapsed rectum.

- The study of recurrent cholangitis showed the importance of bile duct stone, as distinct from gall stone, as a cause of obstructive jaundice in Myanmar. Previous studies in the 1970's have shown the importance of ascaris infection as etiology of bile duct stones. Previous reports have also mentioned that Ascaris adult worms may sometimes be found in the common bile duct. Diagnostic methods for obstructive jaundice were evaluated - endoscopic retrograde cholangiography features were correlated with ultrasonography in obstructive jaundice due to stones

- Recently acquired technology was used to diagnose and treat surgical conditions – such as use of ultrasonography to diagnose appendicitis and to stage oesophageal cancer; endoscopic sclerotherapy to treat oesophageal varices; other studies such as clinico-pathological study and operative staging of cancer stomach; clinical study of colostomy, study of G.I motility in emergency appendectomy, etc.

### **Microbial Genetics**

Plasmid profile analysis was introduced and Polymerase chain reaction (PCR) and Southern Blot analysis of microbial gene was studied for the first time in Myanmar opening up a new field of microbial genetics and DNA analysis. Reverse transcription Polymerase Chain Reaction was used to characterize and genotype Rotavirus isolated from Yangon Children Hospital.

### **Application of newly introduced diagnostic methods and new technology**

- The utility under local conditions of endoscopy of the stomach and gut and ultrasonography of the hepato-biliary system; and the experience from the performance of large series of such investigations were reported.

- A few other diagnostic tests were evaluated as they were introduced or modified including tetracycline fluorescent test for diagnosis of cancer stomach.

### *Aim of the GI studies*

The aims of the GI studies undertaken were one or more of the following:-

- to describe and characterize them
- to describe how they were being diagnosed, treated, prevented and to improve such measures
- to understand better their nature, their etiology, their causation and origin
- to understand and describe their pathogenetic mechanism
- to describe their effect on the patient and community

### **Types of Study and Methods**

The types of study and the methods used to study and achieve the intended aims were:-

- clinical
- epidemiological
- laboratory – microbiological, biochemical , pathological,
- imaging and visualization – by radiology, ultrasonography, endoscopy
- genetic
- socio-economic

**Clinical methods** used and described were routine, simple and qualitative in most of the studies. However, quantitative methods were added later, such as assignment of scores and weightage to GI clinical signs and symptoms.

**Epidemiological methods** were at first elementary and descriptive but soon progressed to analytical epidemiological methods to find causal relationships, like between intestinal helminthiasis and nutrition, diarrhoea and climate. Epidemiological modeling methods were used to predict and confirm the results of public health interventions such as mass chemotherapy on intestinal helminthiasis.

**Microbiological methods** used and studied progressed from routine methods available in hospital diagnostic laboratory to special, newly acquired technology to determine etiological agents - such as cell culture assay systems including Chinese Ovarian Cell and HEP 2 cell culture to isolate ETEC and Shigella, ELISA to identify EPEC, and EIA to detect rotavirus.

Special techniques were used to investigate the action of microbial toxins - such as invasiveness, adherence and intestinal secretory response. Radio-labeled tracers were used to investigate the effect of cholera toxin on cyclic AMP and on amino-acid uptake.

A big step forward was the introduction and use of genetic methods like plasmid profile analysis and gene probes and PCR to identify and characterize DNA of micro-organisms such as Rota virus.

**Biochemical and physiological methods** advanced from those routinely available in hospital and medical college laboratories to new methods for the study of intestinal carbohydrate absorption and malabsorption including xylose absorption test, lactose tolerance test and breath hydrogen test. New microbiological assay systems were used to investigate folic acid absorption. Novel methods were introduced to investigate food iron absorption:- such as radioactive labeling of rice grown by hydroponic culture, double radio-labeled iron tracers to measure rice iron absorption and quantification of intestinal mucosal iron content. Radio-active tracers were used to investigate biochemical activity in intestinal mucosal cells such as effect of cholera toxin on amino-acid uptake by the gut.

**Anatomical methods-** for study of gross and microscopic gut structure for academic purposes were those routinely available in college anatomy departments.

**Pathological methods** ranged from routine histological methods to hitherto unused approaches like dissecting microscopy of intestinal villi obtained by Crosby intestinal capsule; and special histological stains to detect and measure intestinal mucosal cell contents like lactase enzyme.

**Imaging and endoscopy of the gut-** A major advance in the diagnosis and treatment of GI diseases was the introduction of endoscopy to visualize and access the gut lumen and bile duct, and ultrasonography to reveal the gross and detailed structure of solid internal organs related to the gut like the liver and pancreas.

**Genetic studies** of the microorganism responsible for GI disease started with plasmid profile and later progressed to more advanced methods including gene probes, PCR, and reverse PCR to characterize and genotype microorganism particularly rotavirus.

**Socio-economic methods** were used to show the influence of social and economic factors and human behavior on GI diseases and vice versa - such as effect of cost on hospitalization.

### **Conclusion – A glimpse Backward and Forward**

The **GI diseases** studied and reported during the period 1960 to 2007 were mostly *communicable infective diseases* of high national priority, viz. cholera, diarrhoea, dysentery and intestinal helminthiasis including a few studies of intestinal tuberculosis. *Peptic ulcer* was the only non-infective medical condition which was studied in some detail. Many of these studies were within the framework of a common theme and some were conducted in accordance with a well planned, coordinated, continuous program. It is unlikely that new forms of GI bacterial infections will be found in future but more viruses may be discovered as etiological agents of GI diseases. Rotavirus gut infections may need more in depth studies. *Common acute and non-acute surgical conditions* have also been studied but there was no planned program or connecting theme or continuity. Future surgical studies may need to have consistency and continuity in order to have better impact. With better control of GI infection, gut cancers may account for an increasing proportion of GI disease especially gastric cancer which is prominent in some Asian countries and may merit more attention here. Key-hole surgery has now started in Myanmar and may need to be compared with conventional surgery regarding usefulness and safety in the local setting.

Apart from definitive and serious GI diseases like the above, there are many GI disorders in Myanmar which cause no mortality or serious illness but are very common and pervasive and cause considerable distress in the daily lives of the vast majority of people - such as non-specific gastritis, irritable bowel syndrome, indigestion and flatulence, especially in children and functional GI disorders. They are now being dealt with by folk medicine and empirical treatment and merit more attention and scientific study. Digestive disorders and food digestion, especially of particular Myanmar foods and meals, such as being undertaken in Thailand, is also a relatively unexplored area for study.

Regarding **methodology** – *descriptive epidemiological method* was easily acquired by many and most frequently used yielding extensive data; *analytical epidemiological methods* were also employed and gave useful information about causal relationships ;but more sophisticated methods like *epidemiological model* construction was used only sometimes by very few. Some of the studies have become repetitive and redundant in later years such as the clinical and epidemiological descriptions of intestinal helminthiasis and diarrhoea in different localities and settings, and need no longer be pursued unless a new finding is likely or a new hypothesis is being explored.

Routine *clinical, radiological and clinical laboratory methods* were used at first but gradually large numbers of specific techniques required for special purposes were employed as new, up-to-date technology was acquired in many pre-clinical and clinical disciplines.

Quantitative methods have now been added to qualitative clinical methods used in some GI diseases/disorders; this is an area that may be expanded in future to include decision analysis and development of more and better algorithms to diagnose and manage GI diseases in different local settings.

Introduction of *ultrasound imaging* to visualize the gross and detailed structure of solid organs related to the gut such as liver and pancreas; and *endoscopy* to visualize gut lumen and biliary tree, had tremendous impact on diagnosis and treatment of GI diseases. The

future may bring more advanced and revealing imaging technologies. *Gut function* studies such as measurement of *intestinal absorption* and *malabsorption* were done; but *motility studies* were few and limited to radiological contrast studies.

Studies in some areas have reached the stage of diminishing returns with respect to practical application and use - such as clinical and epidemiological descriptive studies of intestinal helminthiasis and diarrhoea, while some others like epidemiology of dysentery and in-depth investigation of its etiological agents may need more emphasis and acquisition of new up-to-date technology.

Gut function studies may need to be expanded. Methods for the study of food digestion and digestive disorders may need to be introduced. Even simple measurements of gastric and pancreatic enzyme secretions are not easily available here.

While the upper and lower gut can now be visualized and accessed by endoscopy, the small intestine in between still remains out of vision and un-accessible in Myanmar, except with the *Crosby capsule for biopsy* of the proximal ileum. Intestinal capsules that transmit pictures of the gut lumen and other information such as pressure waves are now being used to aid diagnosis in other countries and may be introduced here if financial resources are available. Similarly, expanded studies of normal and abnormal gut motility using electrophysiological measurements and radio capsules are exciting possibilities.

The genomes of many pathogenic micro-organism are being unraveled one by one at an increasing pace in the scientific world, including those causing GI diseases, leading to better understanding of their pathogenetic mechanism as well as opening new approaches to treatment. Efforts will need to be made to acquire appropriate technology and keep pace with the rapidly increasing developments in genetics and seize the opportunity to pursue new avenues and strategic approaches in the diagnosis and treatment of GI infections.



## **Section 7.5**

### **Viral Hepatitis**

**by Khin Pyone Kyi**

*(The researches on Viral Hepatitis included hereunder may be mostly found in " Bibliography of Research Findings on Liver Diseases in Myanmar " and in Review articles in DMR Bulletin published by DMR)*

#### **Previous Studies**

Clinicians in Myanmar have recognized and treated patients with acute hepatitis, serum hepatitis and cirrhosis of the liver since the introduction of Western medicine into Myanmar but it was only when the International Committee on Nutrition for National Defense/Myanmar Survey 1962 showed the prevalence of liver diseases in Myanmar and the opportunity for studies became recognized that systematic research on liver diseases were started.

BMRI, later re-designated as DMR (LM), initiated the Liver Diseases Research Project in 1965 and built up the infrastructure to continue and expand the research works on various aspects of viral hepatitis and its complications. Laboratory methods to determine the serological markers of HAV and HBV infection were set up at DMR and liver function tests became generally available. DMR and teaching Departments of Institutes of Medicine undertook many clinical studies in depth of viral hepatitis – Hepatitis B and especially Non-A Non-B Hepatitis -and complications, particularly viral hepatitis in pregnancy at Mandalay. Other liver diseases such as amoebic hepatitis, cirrhosis and cancer liver were also studied to some extent. DMR and DOH undertook many epidemiological studies of viral hepatitis, when epidemics of viral hepatitis broke out in various parts of Myanmar in the 1970's and some early trials of Hepatitis B vaccines were began. Postgraduate students from Institutes of Medicine participated in these research projects when postgraduate courses were opened in the 1970's.

#### **Research from Early 1990's Onwards**

Innovative studies carried out from early 1990's to date included the molecular biology, immunology, genetics and genetic variants of hepatitis viruses. Clinical and sero-epidemiological feature of viral hepatitis were described and new treatment modalities for chronically infected patients which are appropriate for developing countries were tried. Local immunodiagnostic test kits and Hepatitis B vaccines were developed and studies on the prevention of hepatitis infection by vaccination were carried out. Most of the basic laboratory research and particularly studies on development of diagnostic kits and hepatitis vaccines were done principally at DMR (LM) with participation of postgraduates and teachers from Institutes/Universities of Medicine and clinical units of teaching hospitals.

The noteworthy achievement of DMR (LM) during this period was the successful technology transfer and development of Hepatitis B vaccines. Some of the basic researches were collaborative projects between Myanmar medical scientists and scientists from abroad. Epidemiological studies were carried out by all Departments at many health facilities.

## **1. Epidemiology of Viral Hepatitis**

Hospital and community based studies verified the evidence of new hepatitis viruses in patients with liver diseases- prevalence of different types of markers (viral genome) were approximately HBV 17 %- 30 %, HCV 19 % - 27 %, GVB-C/HGV 8-11 %, TTV 3 % and the rest dual or combined viral hepatitis cases. In healthy subjects, HBV was present in 8 %, HCV in 2 % and GVB – C/HGV in 11% .The most common genotype was also type C for HBV, type 3b for HCV and type 2 of GVB-C/HGV.

Research studies on enterically transmitted hepatitis viruses also highlighted the fact that Anti-HAV IgG was positive in 52 % of children at the age of 5 years and 100 % at 13 years, thus confirming their immunity to hepatitis A virus infection at an early age. The prevalence of hepatitis A and hepatitis B infections were also noted to be higher in lower socio-economic status. Hepatitis E infection was also recorded to be very low in under-10 years of age. Other studies showed that HEV IgG was 3 % in subjects below 20 years of age and 30 % or more in subjects 20 years of age or older.

## **2. Hepatitis A**

Detailed clinical studies were done on Icteric Viral hepatitis Type A at the Mandalay General Hospital.

## **3. Hepatitis B**

Hepatitis B is a priority public health problem as shown by the prevalence of HBsAg in 9-12% and detection rate of hepatitis B markers in 35% of the general population in Myanmar. Recent studies in the border areas have shown that the prevalence of HBsAg is 3.8 -7.1 % at the Myanmar-Thailand border, 13.2 % at the Myanmar-China border and 4.9% at the Myanmar-India border.

Studies were done to demonstrate the trans-placental, vertical and horizontal transmission and carriage of HBV in various groups of subjects. Experimental studies of duck hepatitis B virus were undertaken in collaboration with scientists abroad and using Pekin duck as model horizontal transmission by oral route and prevention by duck hepatitis B vaccine was demonstrated. Also, HBV replication and its prevention by anti-viral drugs were investigated experimentally. Test systems were developed to detect antibodies against Hepatitis B surface antigen and used to study its prevalence. Treatment of Hepatitis B by traditional medicine and several other measures were tried.

## **4. Hepatitis C**

Researchers have also emphasized the emerging danger of Hepatitis C infection in Myanmar, which has been tested positive in 2.5% of the general population and 25% of patients with liver diseases. Retrospective studies in hepatocellular carcinoma patients revealed that 60% were positive for HBsAg and 35% were infected with HCV. Myanmar scientists participated in studies by Japanese scientists which analyzed HCV genotypes and showed the existence of new HCV subgroups in Myanmar.

## **5. Non-A Non-B Hepatitis (NANB)**

NANB Hepatitis was first diagnosed in Myanmar by researchers in 1976 on the basis of sero-negativity to HAV and HAB as well by epidemiological criteria. Myanmar was among the Asian countries which were the earliest to recognize and report on NANB hepatitis. This enteric transmitted virus was prevalent both in epidemic and endemic forms in Myanmar with high fatality in pregnant women. Putative virus- like- particles were identified

in stools by immune electron microscopy and animal transmission studies were begun. Animal model of enteric transmitted NANB was established and histological, patho-genetic, immunological and molecular studies were done in collaboration with scientists abroad. Later the enteric transmitted NANB virus was recognized as a separate entity and designated Hepatitis virus E (HEV)

#### **6. Hepatitis E (HEV)**

The prevalence of viral hepatitis E infection in Myanmar studied in 2003 showed that Anti-HEV IgG sero-positivity in adult population in Yangon was 28.57% when tested by ELISA method.

Myanmar researchers participated in basic experiments by Japanese scientists on the molecular biology of HEV from patients in Myanmar. The DNA was partially sequenced and further studies provided information which led to the development of molecular assay systems for HEV.

#### **7. Development of Immunodiagnostic Test Kits**

In collaboration with WHO, UNDP, IAEA and JICA, Myanmar scientists has developed several immunodiagnostic test kits which have been used for routine screening, diagnostic and confirmatory purposes as well as for sero-epidemiological surveys. These are RPHA and ELISA and RIA test Kits for hepatitis B, micro PA test and ELISA test kits for hepatitis C, ELISA tests for hepatitis A, hepatitis E and alfa fetoprotein and test systems to detect antibodies against Hepatitis B surface antigen.

#### **8. Development of Hepatitis B Vaccine**

The noteworthy achievement during this period was the successful development of Hepatitis B vaccines. Small scale production of plasma-derived Hepatitis B vaccine was developed in collaboration with WHO and UNDP, and has been used all over Myanmar since 1997. Later the development of recombinant hepatitis B vaccine was carried out at the WHO/ GMP standard Hepatitis B Vaccine Plant with assistance by the EDCF loan from Republic of Korea in 2004. Many studies were done by DMR scientists to find the optimal local conditions for the various steps in the production of the vaccines and for quality control. Clinical trials in 2006-2007 confirmed the safety, immunogenicity and efficacy of both of the vaccines in newborns, 90% for plasma-derived hepatitis B vaccine and 100% for recombinant hepatitis B vaccine. The local development of effective vaccines will play a key role in the control of viral hepatitis in Myanmar.

#### **9. Molecular and Genetic Research**

Another important leap ahead is the successful setup of the molecular biology laboratories at DMR to carry out the molecular and genetic research on hepatitis viruses. Studies showed that in the majority of HBsAg seropositive children, although the HBcAg positivity rate is low, the HBV DNA positivity is high with potential of transmitting the disease and the most common was genotype C. Also, when molecular characterization was done and the HBV DNA positive PCR products were further analyzed for genotypes by use of Restriction Fragment Length Polymorphs (RFLP) assay, based on S region, it was shown that the majority, more than 80%, were of genotype C and the remainder were of genotypes B and D in the border areas.

Molecular assays are applied in the management of viral hepatitis patients-to confirm the serological diagnosis, to monitor the disease progression and to formulate and select appropriate anti-viral therapy in selected chronic viral hepatitis patients in Myanmar.

However because of high cost of molecular assays and anti-viral agents, the numbers of patients who can afford the standard treatment are limited, and can be applied mainly to patients attending private clinics and hospitals.

Molecular research on Anti-HCV positive blood donors revealed that HCV-RNA was positive in 62% of blood samples by Reverse Transcription (RT) and Polymerase Chain Reaction (PCR). Determination of HCV types and subtypes by RT PCR amplification and nucleic acid sequencing showed that 47% were of genotype 3, 32% of genotype 1 and 21% were of type 6 variants. Further phylogenetic analysis of these type 6 variants revealed that 3 new type 6 subgroups exist in Myanmar

#### **10. Chronic Hepatitis**

Clinical and biochemical studies of cirrhosis and hepatic encephalopathy and outcome as related to infection with HBV and HCV were done. Several studies have been carried out in collaboration with Okayama University, Japan for the management of chronic hepatitis. A variety of agents have been employed in the treatment of chronic hepatitis, and interferon; either alone or in combination with antiviral drugs has been found promising. Modern therapy such as oral antioxidant bio factor (AOB) and fekalin 80 (heat-treated enterococci) have also been applied in the management of chronic hepatitis C infection. These agents act as immunomodulators and clinical improvement is seen in the patients but they are expensive and hard to obtain so an affordable and effective treatment regimen is required. Since hepatic iron overload is attributable to liver injury of chronic liver diseases, the role of iron reduction therapy by phlebotomy in the management of chronic hepatitis B and hepatitis C patients was studied.

## Section 7.6

### Tuberculosis

by Khin Ti Ti

#### Previous Research

Research on tuberculosis was carried out in Myanmar since the colonial period (as described in Volume 1, G&D Med. Res. In Myanmar) and continued during the period under review. Most of the studies done between 1910 and 2006 are included in the "*Annotated Bibliography of Research Findings on Tuberculosis in Myanmar*" published by DMR (LM) in 2008. *Situation analysis of Tuberculosis in Myanmar- magnitude, trends and problems* was reported by Program Manager, National Tuberculosis Program (NTP), DOH, and published in the Report of the Symposium, Myanmar Health Research Congress (2010) held in 2011. A Review of *Progress in Tuberculosis Control*, Myanmar was prepared by Dr. Thandar Lwin, Win Maung (Program Manager, National Tuberculosis Program, DOH, and Dr. Ti Ti, Senior Consultant Microbiologist (Retd) National Tuberculosis Reference Laboratory, DOH.

#### Research from 1990's Onwards

Based mostly on the above sources -new and noteworthy studies conducted during the period under review have been selected and given below.

##### (1) Diagnosis of Tuberculosis (TB)

Existing methods of diagnosis were re-evaluated from different aspects from time to time and new methods were tested when they became available and introduced into Myanmar. The NTP started to develop the framework for the quality assessment activities since 1999. It reviewed and revised the system and developed the National Guidelines on External Quality Assessment for *microscopic examination of sputum for Acid Fast Bacilli (AFB)*. This was introduced all over the country in 2009. The National TB Reference Laboratory (NTRL) and Regional TB Laboratory situated at Upper Myanmar TB Centre, Mandalay are the only 2 places where culture using solid culture media and drug sensitivity test for first-line anti-TB drugs (Streptomycin, Isoniazid, Rifampicin and Ethambutol) can be done. In 2010, the above two laboratories-NTRL Yangon and Regional TB Laboratory, Mandalay were upgraded and strengthened to become the certified bio-safety level-3 laboratories able to diagnose Multi-Drug Resistant Tuberculosis (MDR-TB) using liquid culture and drug susceptibility testing, rapid species identification and the line probe assay (LPA). With these new technologies diagnosis for tuberculosis is shortened to 3 weeks with liquid culture and as early as 3 days with LPA.

The *Glutaraldehyde gellification* test was investigated for use as a screening method. The *EnzymeLinked Immunosorbent Assay (ELISA)* for detection of infection with *Mycobacterium Tuberculosis*, as done in Myanmar, was evaluated for usefulness. It was studied in relation to Chest Xray, tuberculin test, and sputum smear results. The sensitivity and specificity, odds ratio and predictive value under specified conditions were studied. The DNA structure of *Mycobacterium tuberculosis* had become known and the technology for *Polymerase Chain Reaction* had been obtained in Myanmar. Therefore, *molecular method* for the diagnosis of infection with *Mycobacterium tuberculosis* became available. DNA of *Mycobacterium tuberculosis* was identified in CSF to diagnose TB meningitis and shown to be a very much more sensitive diagnostic method than conventional methods. Diagnosis of

TB infection in different organs and organ systems by conventional methods were evaluated for usefulness under different local conditions such as Chest Xray for pulmonary TB, Xray for spinal TB, needle biopsy and histology of cervical glands for diagnosis of tuberculous adenitis, and pleural biopsy and histology and biochemical examination of pleural fluid for diagnosis of tuberculous pleurisy. More recent methods including *ultrasonography and computed tomographic scanning (CT scan)* to diagnose TB of various organs were similarly tested.

## **(2) Microbiology of *Mycobacterium tuberculosis*; Pathology and Immunology of TB Infection**

A study was undertaken at the National Tuberculosis Reference Center, Yangon to determine prevalence of Mycobacteria other than *Mycobacteria tuberculosis* in Myanmar (isolates from 30 townships). Species identification was based on WHO guidelines such as biological characteristics (growth rate, growth temperature, pigment production, etc.) and biochemical characteristics (oxygen production, nitratase activity, etc.) All isolates were of the *Mycobacterium tuberculosis* complex the dominant variant being the Asian human variant (94%) and the rest being *Mycobacterium africanus* II variant (4%) and Classical human variant (2%) PCR based Spoligotyping of *Mycobacterium tuberculosis* was done. Humoral and cellular immunity in TB patients was correlated with clinical features, bacterial load. Hypersensitivity reaction to tuberculin (PPD-S) and to a sensitin prepared from *M. intracellulare* (PPD-B) tested in subjects from Mandalay district. It was shown that sensitivity to non-mammalian sensitin was prevalent in the area and confirmed previous findings of low grade tuberculin sensitivity in Myanmar. CD4+ T cell count was evaluated in TB patients as a supportive indicator reflecting immune status.

## **(3) Clinical Features**

The clinical manifestations of TB infection in various organs and organ systems were described. Case series of TB nervous system particularly TB meningitis, TB of skin, cervical lymph nodes, eye, intestine, spine and skeletal system were reported including diagnostic methods used for each.

## **(4) Drug Resistant Tuberculosis**

A large cross sectional study of drug resistant TB was done at Union Tuberculosis Institute, Yangon. Multi-drug resistance and resistance to any first line ant-TB drugs were determined. Multiple logistic regression analysis was done to find associated factors. It was found that history of previous drug usage was the strongest associated factor. It was also associated with low sputum conversion and cure rates; patient non-compliance to drug treatment being the most important cause of this. Drug regimes which may lead to drug resistance were identified. The role of traditional medicine in the management of drug resistant TB was investigated. Drug resistant pattern in a military hospital and its relation to possible factors was investigated.

## **(5) Epidemiology of Tuberculosis**

The magnitude of Tuberculosis in Myanmar was described. Trend analyses were done and trends during the period 1990 to 2006 were described (some according to states and divisions) regarding: prevalence, incidence, notification, mortality, age specific mortality, sputum smear positive and negative rates, case detection, treatment success and failure rates, defaulter, case fatality rates etc. Country-wide tuberculin surveys, annual risk of TB infection surveys and nationwide drug resistant surveys were carried out. (*See Figure*)

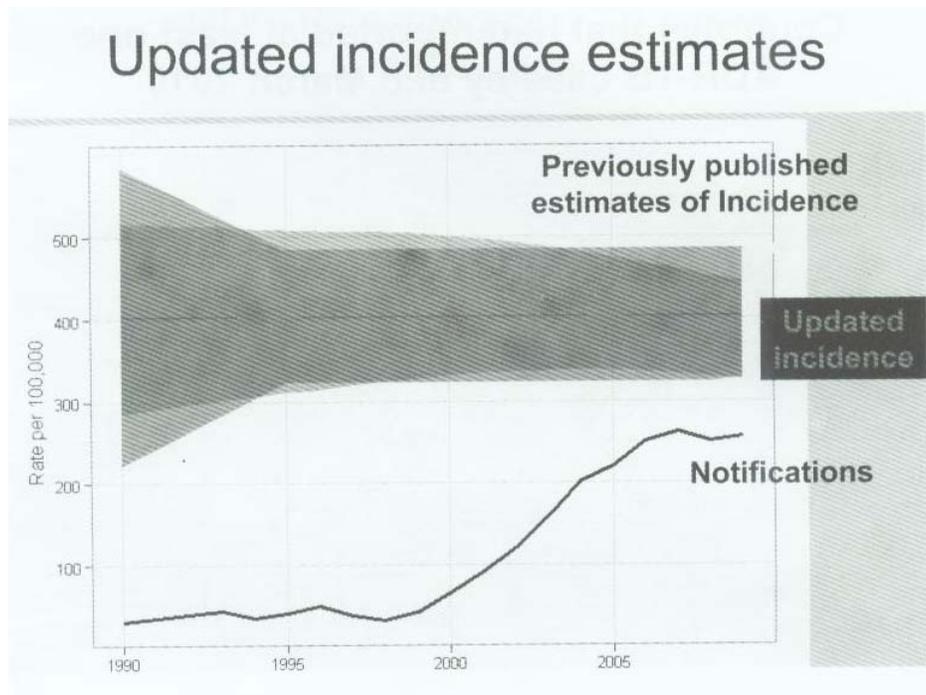
**(6) Treatment of Tuberculosis**

Myanmar traditional medicines were investigated for reputed anti TB activities and chemical properties. The role of some Myanmar traditional medicines in the treatment of multi-drug resistant pulmonary TB was studied and found to be potentially valuable. Directly Observed Treatment Strategy (DOTS) was studied for its efficacy and influence on patients using quantitative and qualitative methods including Knowledge-Attitude-Practice (KAP) techniques and in-depth interviews. Treatment outcome including treatment success, failure, and default rates were measured and factors influencing outcome were determined.

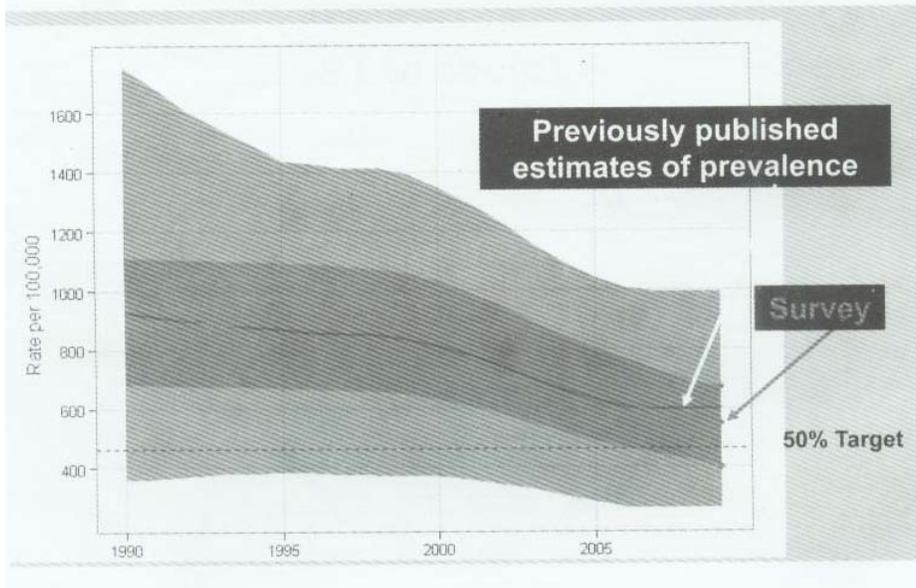
**(7) Socio-medical Studies**

Phenomenological study was done to show lived experience of patients regarding health seeking behavior; physical , psychological and social experience; their ability to cope with illness; their knowledge about prevention and transmission of TB; attitude towards health care personnel; opinion regarding traditional medicine versus medicine, etc .KAP studies were done regarding level of knowledge and attitude towards DOTS treatment. A study was done to find out the current practice of General Practitioners regarding diagnosis and treatment; and knowledge and conformity with National Tuberculosis Program guidelines. Strategies to promote private-public partnership between GP's and basic health service staff and TB service personnel as a means of improving TB control in the country were studied. The burden of TB including social, psychological and financial burden of TB patients and families was investigated.

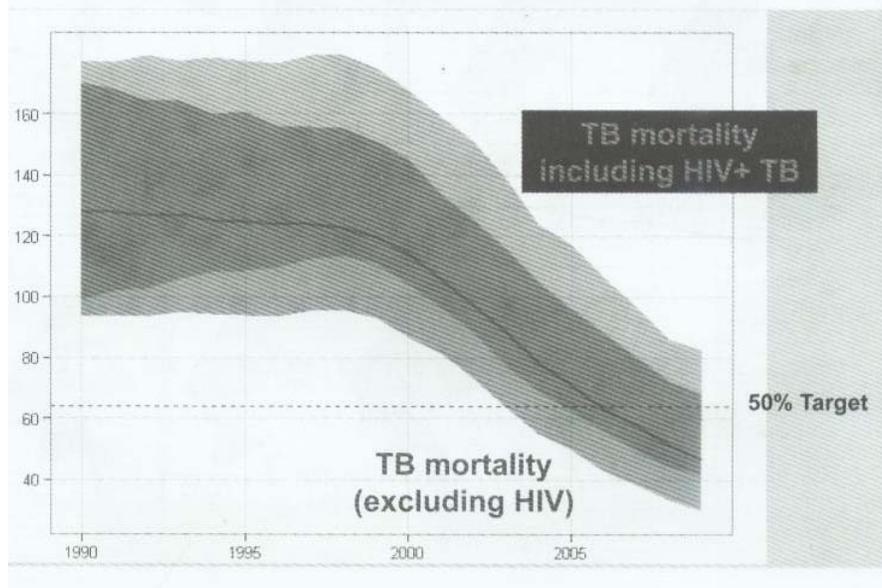
**(8) Diagrams showing Updates of Prevalence, Incidence and Mortality**



## Updated prevalence estimates



## Decline in TB mortality



## **Section 7.7**

### **Leprosy**

**by Kyaw Lwin**

The control and elimination of Leprosy as a public health problem in Myanmar is one outstanding example of how research could be well integrated and merged into the health service program of DOH and contribute towards achieving its public health goal.

Research activities on Leprosy up to 1973 and the research findings are given in "Conquest of Scourges in Myanmar: an Update (Myanmar Academy of Medical Science, 2005). Subsequent research activities until elimination and during the post-elimination phase are also described.

The chief components of the research were firstly, the early epidemiological surveys to assess the situation of leprosy in the country; secondly, trials of the various mono-therapy drug regimes including dapsone and rifampicin, and then trials of BCG and of multidrug regimes; and thirdly and importantly the various integration trials of leprosy services into the basic health services.

The integration trials were important in showing that specialized services like leprosy could, under favorable circumstances, be integrated into basic health services and achieve its objectives.

Health System Research activities were mostly embedded in the service program and played an important role in Leprosy Control by providing solutions to solve practical operational programs, addressing priority problems identified by managers and involving managers throughout the research process thus ensuring the utilization of research results. Research during the post elimination mopping up period included Disability surveys and detection of residual cases using the mouse foot pad inoculation method done by DMR (LM).

New initiatives were taken for Leprosy Research Capacity Strengthening in 1999. A Technical Core Group for Leprosy Research was formed in 1999 and research areas were identified and several studies conducted.

More studies were conducted in 2003-2004 under the financial support of IMCJ of Japan which included forward looking topics such as 'Re-establishment of the Mouse foot-pad laboratory for characterization, identification and study of the Genome of *Mycobacterium Leprae* from relapse suspected resistance and new cases from special skin clinics'.



## Section 7.8

### Situation Analysis of HIV/AIDS in Myanmar

by Khin Ohnmar San

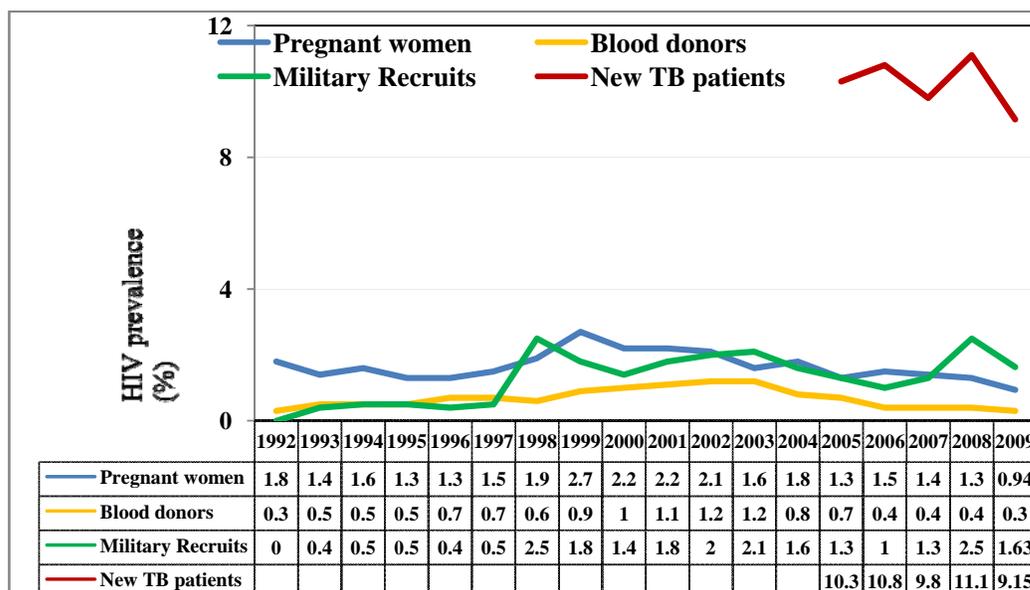
#### 1. Epidemiology

The first case of HIV infection in Myanmar was detected in 1988, and the first AIDS case in 1991. The two-decade old HIV epidemic is largely concentrated among population sub groups with high-risk behaviours. The majority of the HIV/AIDS cases are reported from large urban areas and from the northern and north-eastern parts of the country. While the overall HIV prevalence in Myanmar is estimated to be below 1%, there is a sizeable most-at risk population (female sex workers and their clients, men who have sex with men and injecting drug users). These populations are disproportionately affected by HIV.

Systematic surveillance is carried out among key population groups in selected geographical areas since 1991. Target groups included are pregnant women attending ANC clinics, Male STI patients, new TB patients, female sex workers, injecting drug users, men who have sex with men, new military recruits and blood donor units. In 2009, the prevalence of HIV was estimated at 11.2% (range 9.2-13.6%; CI 95%) for female sex workers (FSW), at 34.6% (range 31.6-37.7%; CI 95%) for injecting drug users (IDU) and at 22.3% (range 18.2-26.4%; CI 95%) for men who have sex with men (MSM)<sup>1</sup>.

Trends analysis of the HIV sentinel surveillance data revealed that HIV prevalence levels among low risk populations in 2009 show continuation of the general decline observed since their peak in the late 1990s; however, a slight rise was observed among new military recruits in 2008.

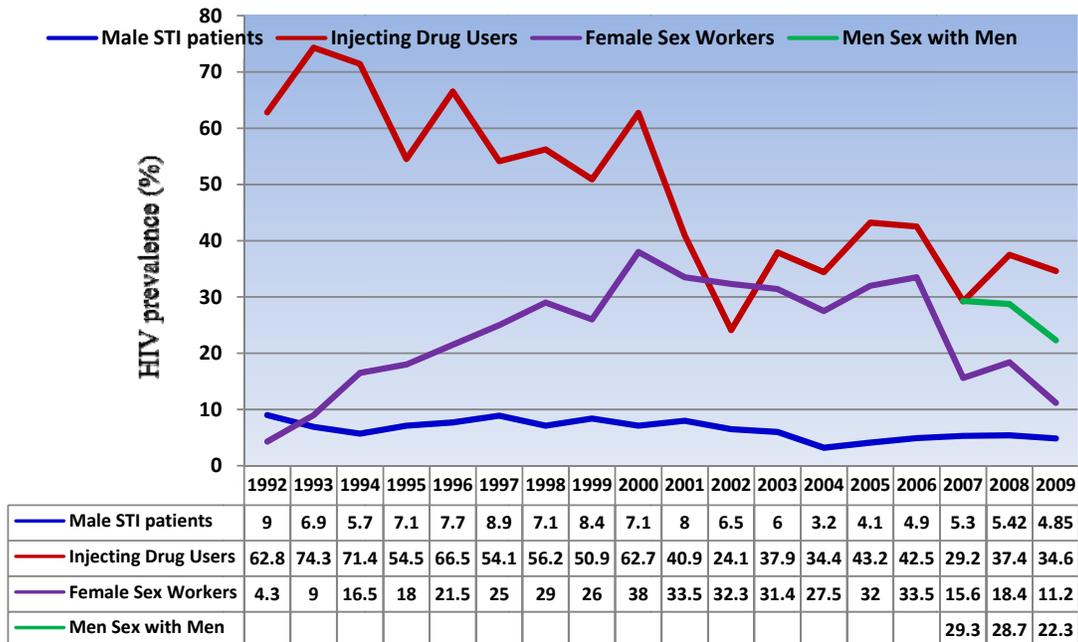
**Figure 1. Trends of HIV prevalence among low risk population (1992-2009)**



Notably, HIV prevalence is decreasing among all high-risk behaviour groups; due to the limited number of data points, a large degree of uncertainty persists for MSM.

<sup>1</sup> National AIDS Programme, Report of the HIV Sentinel Sero-Surveillance Survey 2009, Myanmar

**Figure 2. Trends of HIV prevalence among most at risk population (1992-2009)**

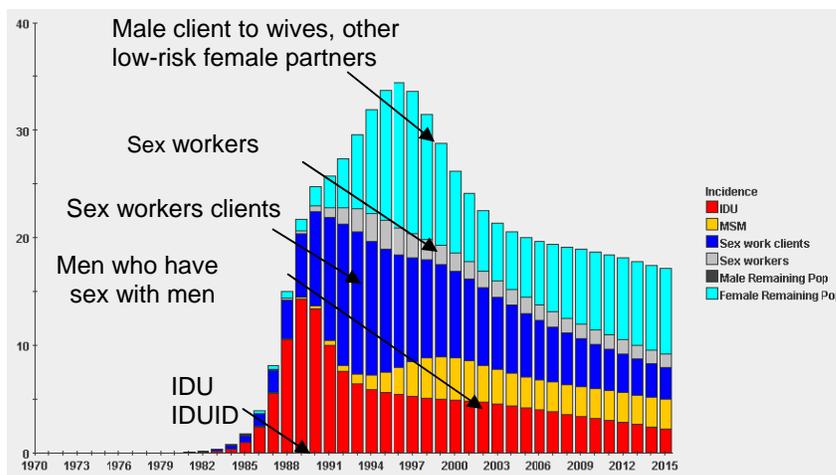


The HIV epidemic in Myanmar has been mostly concentrated in men with the male to female ratio declining from 8 to 1 in 1993 to 1.9 to 1 in 2009. By 2015, it is projected that the male to female ratio will be 1.6:1. These women are largely the sexual partners of current and former FSW clients, IDU, and MSM.

## 2. HIV Incidence

Figure 3 shows trends in distribution of new HIV infections by subpopulation group. Like in other Asian countries, IDU was the first group to be affected. HIV incidence in IDU peaked in the early 1990s. The IDU epidemic was followed by increase in cases among FSW and their clients. Finally, following the infection of a large number of male clients of FSW, HIV incidence reached a peak in the so-called “low-risk” female population due to transmission from male clients to their low-risk female partners.

**Figure 3. Trends in the distribution of new HIV infections by population subgroup<sup>2</sup>**



<sup>2</sup> National AIDS Programme, HIV Estimates and Projections, Myanmar 2008-2015, Myanmar 2010

### 3. Impact Results

The results from the Estimation and Projection of HIV/AIDS (2009) revealed that approximately 238,000 adults and children are living with HIV in 2009. An estimated adult HIV prevalence among 15 to 49 years age group is 0.61%. The adult HIV prevalence peaked around 2000-2001 and since then there is a steady decline (Figure 4).

**Figure 4. Trends in adult HIV prevalence (15-49 years)<sup>3</sup>**

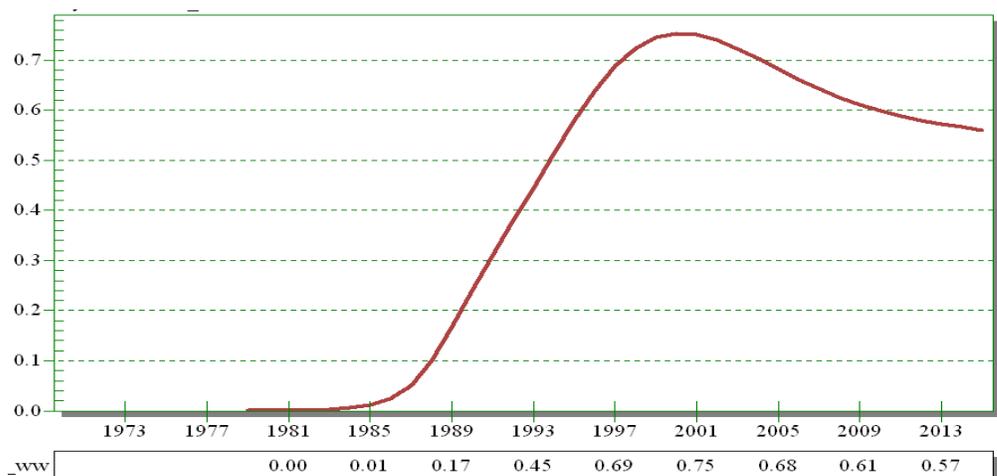
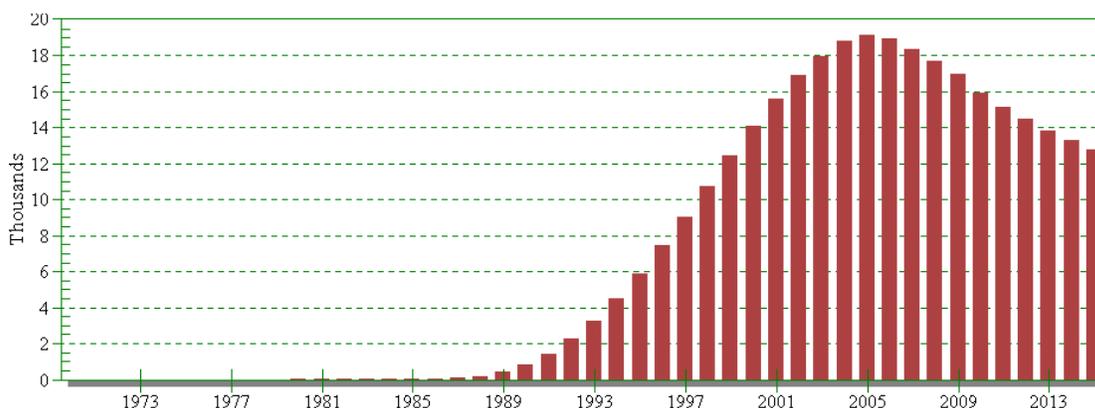


Figure 5 shows that the burden of HIV related deaths after peaking at 19,000 in 2005, has begun to come down. The decrease corresponds with increased access to ART since 2005 in the public and NGO sectors.

**Figure 5. Annual AIDS deaths among adult population (aged >15 years)<sup>4</sup>**



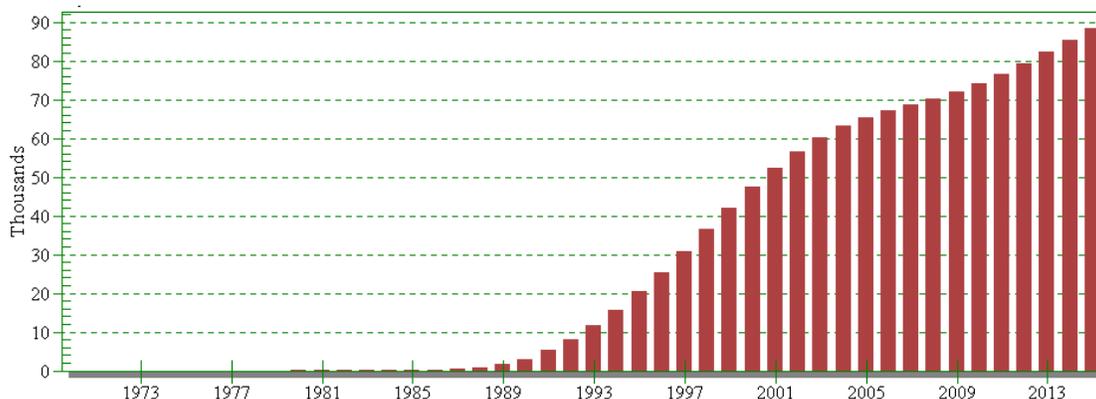
In Myanmar, ART is provided by the NAP, international and local NGOs. As of the end of 2009, approximately 21,000 adults and children are on treatment. Estimates of the number of people needing ARV in a given year are based on the NAP ART guideline recommendations from 2006. According to the national ART guidelines, patients with CD4 <200 should receive ART and those with CD4 200-350 can be considered for treatment. Using a threshold of CD4 <200, approximately 74,000 adults needed ART in 2009. However, as more people needing treatment start to receive it, the need for ART will increase as more

<sup>3</sup> National AIDS Programme, HIV Estimates and Projections, Myanmar 2008-2015, Myanmar 2010

<sup>4</sup> National AIDS Programme, HIV Estimates and Projections, Myanmar 2008-2015, Myanmar 2010

people will survive longer (Figure 6). When the national guidelines are revised to reflect the recommended change to start treatment at CD4 <350, then adult ART needs will increase accordingly.

**Figure 6. Number of adults with advanced HIV infection in need of antiretroviral<sup>5</sup> treatment**



*Footnote by Editor:*

*The National Aids and Sexually Transmitted Diseases Control Project of the National Health Plan (2006-2011) include the following planned operational research activities-study on incidence of HIV infection; ARV drug resistance survey; KAP about AID among young people, STI prevalence survey. Basic research on AIDS/HIV by DMR (LM) includes a study of molecular diversity of HIV-1 infection using RT-PCR; study of immunosuppression and plasma viral load;*

*(The Annotated Bibliography of Research Findings on HIV/AIDS in Myanmar – published by DMR (LM) in 2008, is an important source of information)*

<sup>5</sup> National AIDS Programme, HIV Estimates and Projections, Myanmar 2008-2015, Myanmar 2010

## Section 7.9

### Nutritional Disorders

by Thyra Po, Aye Aye Thaw & Aung Than Batu

*(Based largely on the book "Nutrition- Golden Jubilee (1954-2004)" by Dr Thyra Po, Retired Deputy Director (Nutrition) of Department of Health and on DMR Bulletins (Volume 2 No.2 & 4, vol 6 No.1 & 3)*

#### 1. Nutrition Research and Studies by Nutrition Project/Section/National Nutrition Centre (Nut P/S/NNC) of DOH

The development of the Nutritional services provided by the Department of Health (DOH) and its predecessor Directorates of the government- from the time a Nutrition section was started in the office of the Director of Public Health in 1930, through the establishment of the Nutrition Project in 1954, to its present re-organized status as the Nutrition Section of the Public Health Division of DOH or the National Nutrition Centre (as it is commonly known after it moved into its own building in Yangon, 1989) – is comprehensively described in the recently published book "Nutrition- Golden Jubilee (1954-2004)" by Dr Thyra Po, Retired Deputy Director (Nutrition) of DOH.

The Nutrition services provided as part of general health services of DOH has expanded greatly in scope and depth and in scientific content during the 50 years of development and its many programs and activities also include *Nutrition Research* which is described in some sections of the book.

In order for the Nutrition Project and the Nutrition Section or National Nutrition Centre (Nut P/S/NNC) of DOH to provide nutritional services that are comprehensive in coverage so as to reach peripheral levels and important sections of the population, especially vulnerable groups such as mothers and children, and sufficient to meet important nutritional needs and eliminate or reduce gross nutritional deficiencies - scientifically valid information regarding the nutritional status and dietary intake of the population is required; and this was obtained by the Nutrition P/S /NNC through surveys and studies carried out periodically and ad-hoc, from time to time, at different places throughout the country.

Based on the available scientifically valid evidence from its own research as well as research conducted by other organizations, especially DMR/BMRI and the Institutes/ Universities of Medicine and allied institutions, and also drawing lessons from the experience of other countries, the Nutrition Project/Section /NNC of DOH planned, organized, acquired resources and implemented a series of Nutrition Programs in successive People Health Plans. As a consequence it was able to successfully attain the desired targets in some areas and substantial measurable progress in others. Thus, to give a few examples: Iodine deficiency and Goitre; Thiamine deficiency and Beri-beri are no longer public health problems of significance. In recognition of the outstanding achievements in the field of nutrition for child health the Joint Nutrition Support Program (JNSP) in Myanmar, implemented principally by NNC/DOH was awarded the prestigious "Liguria" International Technology for Development Prize in 1991 by the Italian government.

The studies carried out by Nutrition P/S/NNC have been mentioned in the Golden Jubilee book as follows:

- (1) Surveys and studies carried out (1954-64)
- (2) Studies carried out to collect epidemiological data (1964-2004)
- (3) Operational research and surveys done (1980-2004)

(4) A comprehensive situation analysis of the content and implementation of the nutrition component of primary health care (1982)

(5) Food and Nutrition Surveillance System systematically set up by the Joint Nutrition Support Program (JNSP) after 1984, prior to which there had been only aggregated routine reporting supplemented by ad hoc surveys

In addition, although not specifically mentioned as research the following activities carried out by Nutrition P/S may be regarded as nutritional research activities:

(6) Development and testing the acceptance and usefulness of the Growth Chart

(7) Development and testing of a weaning diet suitable and affordable for children in Myanmar

(8) Development and testing of nutrition education for different client population groups,

(9) Development and testing of methods for nutrition training of all categories of health personnel such as medical officers, pediatricians and basic health staff such as mid-wives, etc,

(10) Ad hoc Operation research to assess the feasibility and practicality of newly introduced nutrition programs such as Hospital Nutrition Unit, Nutrition Rehabilitation Center, Community Nutrition Center, Domiciliary feeding and nutrition promotion program, School meal program, etc.

(11) Analyses and determination of the nutritional values (calorie, carbohydrate, protein content, etc) of many items of Burmese foods including snacks etc, and publication in book form.

## **2. Nutrition Research by National Health Laboratory, Food and Nutrition Division**

The National Health Laboratory, at its Food and Drug Division has been monitoring the safety and conformity to reference standards of articles of food manufactured by the indigenous food industry and sold in the market and such activities may be regarded as a form of nutrition research.

## **3. Nutrition Research by the Department of Medical Research/Burma Medical Research Institute (DMR/BMRI)**

Since it was established in 1963, the Burma Medical Research Institute (BMRI) and its successor- the Department of Medical Research (DMR) subsequently re-named Department of Medical Research (Lower Myanmar) (DMR/LM) – has included the following among its missions - '*to investigate nutritional factors affecting national health*' and '*to investigate nutrition-infection interaction*'. DMR/BMRI have therefore carried out a systematic, integrated and continuing program of *Nutrition Research* which includes field studies in the community, clinical research in hospitals, as well as experimental research supported by well- equipped laboratories with advanced medical technologies such as radio-active tracer techniques and microbiological assay system, and ancillary support such as epidemiological and bio-statistical services and computers.

Such research has been extensive in scope and depth and those carried out up to 1986 have been fully described in "The Growth and Development of Medical Research in Myanmar (1886 to 1986) published by Myanmar Academy of Medical Science in 2003. Subsequent nutrition research has continued on similar themes but with a new focus on diabetic diets and food habits of diabetics in Myanmar.

#### **4. Nutrition Research by the Institutes of Medicine and Successor Universities of Medicine and Other Allied Institutes/Universities**

The Institutes /Universities of Medicine undertake the training of postgraduate students to be qualified for postgraduate Master and Doctorate degrees, which includes as part requirement the completion of a research project and defense of a Thesis. Some of the postgraduates, especially for the degrees of M.Med Sc /Dr Med Sc (Pediatric or Internal Medicine) and M.Sc/PhD (Physiology, Biochemistry) take up a Nutrition Research topic as a research project. Most such research is done in hospitals or in DMR/BMRI or sometimes in collaboration with the Nut P/S of DOH. They may be found as published Thesis in the respective Institutes/Universities or sometimes as published papers in national or international journals or in the published Proceedings/Abstracts, if read at national research congresses and scientific meetings.

#### **5. Nutrition Research and Food Research by Other Institutions and Organizations**

The earliest research on the composition of Ngapi- the quintessentially Burmese article of diet- was done at the Harcourt Butler Institute of public Health in 1927. The Union of Burma Applied Research Institute (UBARI) renamed the Central Research Organization (CRO) undertook some research in the 1970/80's on food technology to enable better food preservation and food processing of local food items and the industrial production of foods items of nutritive value such as soya milk. Similar research probably continues. Recently the Agricultural Research Institute has been conducting research on genetic strains of rice with high nutritive value.

The FDA of the NHL has been monitoring foods items manufactured by the local food industry to determine their safety and conformity with reference standards and this may be regarded as a form of nutrition research or food research.

#### **6. Nutrition Research Programs**

##### **(1) Research on Protein Energy Malnutrition (PEM)**

In Myanmar the prevalence of PEM is similar to the figures shown by other countries in South East Asia; the majority of the cases are of moderate form. It was decided to explore the possibility of extension of management of PEM by treating moderate cases of PEM outside the hospital thereby preventing the progress to severe conditions. Nutrition Rehabilitation was started as a pilot program in 1971 at the beginning of the joint WHO/UNICEF five-year program

The Myanmar National Strategy for Infant and Young Child Feeding Practices (based on the regional strategy) was adopted by the NNC and provided a framework for its action cum research activities.

Nutrition promotion programs and nutrition rehabilitation centers were initiated one by one, at different places and different times, some overlapping with each other, from 1970 onwards as given hereunder:

Some also overlapped and were integrated with other programs where a nutrition element was also present such as Diarrhoea control and MCH programs. All these activities contained both a service component and a research component (especially in the initial phases). At the same time as nutrition services in various forms were being provided, the operational feasibility of carrying out these nutritional activities in collaboration with the community, with national NGO's like MMCWA and international NGO's like HHO, UNICEF was being studied, adjustment according to local situations and availability of resources were made and managerial decision were made for replication to other places and

phasing of activities. In the later stages as nutritional data, nutritional information and operational experience accumulated, the research component yielded diminishing returns and was discontinued at different places and periods.

The Nutrition promotion programs and nutrition rehabilitation centers that were initiated include the following: -

1. Establishment of Nutrition Rehabilitation centers in Yangon - to study the operational feasibility and serve as a prototype for replication to other townships.
2. A pilot study for the establishment of village Nutrition promotion centre in Yankin village, Hlegu Township
3. Urban nutrition activities- including Hospital Nutrition Units and Community Nutrition Centers (from 1973 onwards) throughout the country
4. Rural Nutrition activities- including Growth Monitoring and Counseling (since 1976 together with the start of Primary Health program); Nutrition and Diarrhoea Surveillance in sentinel townships; Village Food Banks(to treat and rehabilitate severely malnourished children in remote villages)

In Myanmar the prevalence of PEM at present is 28%

## **(2) Research on Nutritional Anemia**

Research on Nutritional Anemia was first undertaken systematically in Myanmar by the BMRI (predecessor of DMR) when it initiated the Anemia Research Project in 1963 soon after BMRI was established. A comprehensive review of research on Nutritional Anemia in Myanmar carried out from the colonial period up to 1988, mostly by BMRI/DMR, has been published in DMR Bulletin (1988 ).A series of pioneering studies were carried out by BMRI on dietary iron intake, food iron absorption, iron storage and iron balance in the Myanmar population. Studies of the folate content of Myanmar food, its availability and its absorption were carried out. Folate deficient megaloblastic anemia in pregnant women was investigated in depth for the first time. It was found that the major determinant of nutritional anemia, especially in women and pregnant mothers is iron deficiency. Dietary iron intake was found to be adequate, yet iron deficiency occurred because of the low availability of iron in the rice based diet low in animal proteins. Investigation in sample population and in pregnant women showed that folate deficiency was present in varying degrees but was not responsible for anemia in the general population or in pregnant women in general. However, it caused severe megaloblastic anemia in about 2% of pregnant women who may also be iron deficient but not deficient with respect to vitamin B<sub>12</sub>. Further studies demonstrated the efficacy of iron and folate supplementation in preventing nutritional anemia during pregnancy. It had been well known before that Vitamin C and acidic foods will enhance and that tannins such as tea will inhibit elemental iron absorption. Experiments by BMRI in human subjects demonstrated the enhancing and inhibitory effects of certain other food items on iron absorption; thus 40 grams of fish protein was sufficient to enhance iron absorption considerably, whereas coconut milk inhibited iron absorption.

### *Community Haemoglobin surveys (2001-2003) by DOH/NIN*

DOH (Nutrition section/NIN) continued further studies on nutritional anemia in the community. In 2001-2003, cross-sectional Haemoglobin surveys were conducted in the community with the objective of determining the haemoglobin status among different age groups and to explore the dietary habit concerning intake of iron. According to the studies conducted by the National Nutrition Centre anemia was present at all ages- higher in pregnant women and children under five years of age exceeding 70%; and lower in adolescent and non pregnant women.

Anemia prevalence- stratified according to hilly, plain, coastal, and delta regions of the country; according non-pregnant, pregnant and adolescent status of women; and children according to age under five – was found to be as follows: for people from the delta anemia prevalence was 79.2% for pregnant women, 79.5% for under fives; for coastal region it was 83.5% for pregnant women and 87.8% for under fives; thus indicating a higher prevalence of anemia in these areas than in other areas.

The main causes for anemia in Myanmar were inadequate intake of heme iron from meat, main source of dietary iron being from vegetables; poor personal hygiene and poor habit of taking iron supplementation regularly. It was highlighted that taking iron absorption inhibitors foods particularly tea and tea leaves are major contributors in Myanmar. Another contributor is worm infestation which is more prevalent in data where most of household were using surface latrine.

#### *Operational research by NIN*

The main strategy for control of iron deficiency anemia is supplementation with iron folate tablets. They are among the drugs supplied to the MCH centers and Urban and Rural Health Centers or women and children.

Since the beginning of Primary Health Care in 1978, the strategy of anemia control was targeted at pregnant mothers, to ensure that every pregnant woman in the villages receive iron and folate supplementation. Previous research has determined the dose of iron and folic acid required to prevent anemia during pregnancy but it was uncertain whether adequate quantities were being distributed and received by pregnant women during pregnancy. This problem was investigated as an operational research project. Among townships which had received substantial quotas of iron sulphate tablets those with a resident midwife and those without were compared with respect to amount of iron tablets received by pregnant women. It was found in both these types of townships –whether or not there was a resident midwife - pregnant women did not receive adequate amounts of iron-folate tablets; the main complaint was irregular, delayed and insufficient supply. As mentioned above most of the knowledge and technology to achieve reduction of iron deficiency anemia are already available but developing countries including Myanmar could not put this into practice – perhaps possible only in limited areas and not on a country wide scale. Further operational research studies are needed to find out ways and means of ensuring that ferrous sulfate with folic acid reach the pregnant mothers so that anemia may be prevented especially during pregnancy.

### **(3) Research on Vitamin A Deficiency**

Research on vitamin A status of Myanmar population has been carried out as early as 1961 but till 1970s the most vulnerable group, the preschool children were not included in the studies. In the 1970s and 1980s some studies revealed more than 0.5% of XIB prevalence among the children of age less than 5 years, Studies by Trachoma Control and Prevention of Blindness Program (TCPB) of DOH among the general population revealed prevalence of Bitots spot to range between 0.61 % to 3.3 % in 6 townships of the Dry Zone in central Myanmar; and further studies in 3 more townships of the Dry Zone during 1990 showed prevalence rates to be between 0.5 % to 1.62 %. At first these figures it did not attract any attention of the health authorities as it was mostly far less than the criterion then defined by WHO which was 2% XIB.(Bitots spot)

But from 1982 onwards when the WHO criterion changed from 2% to 0.5% among 6 months to 6 years old children, studies conducted by Trachoma Control and Prevention of Blindness Program, the Department of Medical Research, Yangon Children's Hospital, the National Nutrition Centre and other individual investigators reported the prevalence of XIB

to be between 0.5% to 3.3% and quite above WHO's revised criteria of Vitamin A deficiency. From research conducted during 1987, 1988 and 1989 on a sample of 1862 children between 2 and 14 years from townships in the dry zone, in the hilly region and the delta region the investigators concluded that both clinical and biochemical findings indicated that vitamin A deficiency has become a public health problem in all the areas surveyed and that the problem appeared to be more serious in the dry zone of the country. Liver stores of vitamin A were also found to be significantly lower in children aged 1-6 years than in the other older children, teenagers and adults, very low in the children with severe PEM and in children of low socioeconomic group. Thus vitamin A deficiency was identified as a public health problem in various areas to the country especially in the dry zone from 1982 onwards.

As a result of various measures taken by the NNC of DOH including nutrition education, nutrition promotion campaigns, targeted distribution and supplement of high potency Vitamin A capsules followed by the universal retinol distribution program – Vitamin A deficiency is now found to be below 0.5% in children of 6 months to 6 years, and no longer a public health problem.

#### **(4) Research on Iodine Deficiency Disorders (IDD)**

*(This account is based largely on relevant chapters in:- (i) Nutrition-Golden Jubilee-1954-2004(ii) Conquest of Scourges in Myanmar(iii) Conquest of Scourges in Myanmar: Update (iv)Growth and Development of Medical Research in Myanma, 1886 to 1986)*

Iodine deficiency disorders (IDD) were one of the major health scourges that afflicted Myanmar. IDD was reported to be present in the hilly regions of Myanmar since early colonial times. Later it became known that IDD was prevalent throughout the country including the lowlands and delta regions. It was recognized as a public health problem and health authorities and successive governments made various policy decisions and took a series of measures, firstly to control IDD, and eventually to eliminate IDD as a public health problem. This was finally achieved.

The measures taken to control/eliminate IDD may be viewed in five phases:

- (a) Iodinated salt distribution to selected endemic areas
- (b) Iodized oil injection program
- (c) Iodized oil capsule program
- (d) Revitalization of iodized salt program
- (e) Universal salt iodization program

Research in support of IDD control and elimination-such research may be considered under the following categories

1. Research to provide valid scientific information and evidence that supports health policy and program decisions concerning IDD. Such research led to recognition of IDD as a public health problem and to health policy decisions and initiation of programs to control and eventually eliminate IDD as a public health problem from Myanmar. *(see 1.1 below)*
2. Research to know and understand the underlying causes of IDD prevalence in Myanmar: the bio-medical and ecological as well as the socio-economic determinants of IDD prevalence in Myanmar *(see 1.2 below)*
3. Research to determine the most appropriate, practical and cost-effective measures to control IDD, according to place and time; and eventually to eliminate IDD as a public health problem in the whole country

4. Operational research to determine the feasibility and replicability of the IDD control measures taken from time to time, place by place; and to measure progress of the program towards elimination as a public health problem; and its sustainability.

#### 1.1 *Research to produce valid scientific information and evidence for national and health policy decisions and programs concerning IDD*

A series of descriptive epidemiological studies were carried out over the decades, starting from the colonial period up to and beyond 2000, to provide information regarding the prevalence, severity and distribution of iodine deficiency and IDD among various population groups in different geographical regions of the country. These were at first crude prevalence studies, limited in time and place, and based on clinical features alone. Later, the studies became progressively more accurate and valid, based additionally on biochemical measurements in population groups and the environment; and using proper statistical design and analyses.

Important studies including landmark studies are given below:

- (a) Report in the Chin Hill Gazetteer in 1896 showing the high prevalence of goiter and cretins in the hill tribe areas of the northern state
- (b) Report of the Interdepartmental Committee on Nutrition for National Defense (ICNND) (1962) on the results of a nutritional survey in various parts of the country showing some high goiter prevalence rates
- (c) Pilot study by BMRI in 1972 demonstrating that distribution of iodized salt in selected areas of the Chin Hills brought the Crude Goiter rate down spectacularly after 3 years from 91% to 21 % in 1972.
- (d) Report by BMRI that after decontrol of the salt trade and discontinuation of the salt iodization program in 1983 the goiter rate in one of the places of the pilot area had risen from 20% to 76%.
- (e) Report by DMR in 1984 that goiter was prevalent in the plains, delta and coastal regions of Myanmar.
- (f) Nation-wide goiter surveys in the 1990's by NIN of DOH covering all states and divisions using Visual Goiter rate (VGR) as indicator of IDD. It was shown that the whole country including coastal regions was not free from iodine deficiency. VGR in states/divisions was classified as 30% or more, 20 to 29%, 5 to 19% and less than 5%. Only Taninthayi Division had less than 5%. The prevalence of VGR among 6 -11 years old children in this first nation- wide survey done in 1994 showed that 9 of 15 states/divisions had prevalence rates higher than 30%.

#### 1.2 *Research to know and understand the underlying causes of IDD prevalence in Myanmar*

There was adequate scientific evidence in the medical literature that the etiology of endemic goiter in mountainous regions of the world was due to iodine deficiency and low environmental iodine, and it was accepted that it would be the same for the hilly regions of Myanmar. However, when endemic goiter was found by DMR to be prevalent in the plains, coastal region and the delta, DMR conducted research to find out the determinants of goiter in these areas. In depth studies were carried out in an indicator village which included clinical, dietary and biochemical studies. Biochemical assessment of thyroid status was carried out on patients including measurement of serum thyroid hormone levels and urinary iodine excretion. Chemical analysis of water and soil was done. There were no excessive goitrogens in the diet. It was concluded that drinking of water with low iodine content and consumption of diet from food grown locally in soil with low iodine content were the principal factors responsible and that the underlying etiology was environmental iodine deficiency probably due to leaching of iodine from the soil due to floods and rains.

Iodine induced hyperthyroidism (IIH) or Joss-Base Dow disease:- Around 1990's clinical reports began to be produced to show apparent increase in number of cases of hyperthyroidism in hospitals; and the Department of Nuclear Medicine in Yangon reported increasing number of cases in 1995-97 . Many clinicians were of the opinion that this is causally linked to the iodized oil injection and iodized salt distribution program. A study on hyperthyroidism was carried out at Pathein Hospital in 1999 which showed that out of 106 patients 18 % were iodized salt users and 40% were non-iodized salt users which did not support the hypothesis of a causal link between distribution of iodized salt and apparent increase of IIH .This issue was taken up by the health authorities. It was well known previously that increased iodine intake may occasionally induce hyperthyroidism but consumption of iodized salt, at the concentrations being distributed, was unlikely to cause IIT of considerable magnitude and that the benefits of salt iodization far outweigh the small incidence of side effects.

### 1.3 *Research to determine the most appropriate, practical and cost-effective measures to control IDD in Myanmar*

It was well known from world wide experience that distribution of iodized salt was effective, economical and cost effective for the control of IDD. Pilot scale studies in Myanmar confirmed its efficacy and practicality as well as the need for sustainability. Universal salt iodization (USI) was the ultimate aim of the IDD control program but this required national level policy decisions, inter-ministerial agreement, coordination resources as well as participation of the community. So, while USI was being gradually developed a series of interim measures were taken. Studies were carried out to test these measures for efficacy, feasibility and replicability as given below:

- (a) Pilot study was carried out in northern Chin Hills in 1972 by BMRI to show the efficacy and practicality of iodized salt distribution to control IDD. Previous studies by Nutrition section of DOH had found out the mean and range of salt consumption in Myanmar and it had been decided to iodize solar salt crystals so as to contain 80 parts per million and this was used in the pilot trial. A spectacular decline in total goiter rate was observed and confirmed the efficacy and practicality of iodized salt distribution to control IDD. It was further shown in 1983 that discontinuation will produce a dramatic, large rebound increase in the prevalence of IDD.
- (b) Studies by DMR in 1982-86 showed that iodized oil injection to targeted groups including 1-14 age group children and reproductive age women was effective in reducing crude goiter rate in those who received the injection and a rise of the rate who those who did not.
- (c) Studies were also carried out by DMR in 1969 and 1982 which showed the efficacy of iodized oil capsules in reducing crude goiter rates which were confirmed by urinary iodine excretion and thyroid function measurements.
- (d) A feasibility study of iodated salt distribution was carried out in 1986 by NIN of DOH in several townships of Chin and Shan states as preparation to revitalize the iodized salt distribution program and also as preparation for eventual Universal Salt Iodization. Flaws and weaknesses in the program were seen and remedial measures decided.

### 1.4. *Operational research to determine the feasibility and replicability of the IDD control measures*

Such operational research or action-cum research was carried out by Nutrition section/NIN of DOH for all its IDD control programs in different places and periods according to operational requirements. Some of the important ones are given below:

- (a) Operational research to determine the practicality and replicability of the water iodization program at primary schools during 1995-96.
- (b) Operational research to determine the practicability and replicability of USI programs which include:
  - (i) Monitoring iodine content of salt at factory level
  - (ii) Monitoring iodine content of salt at distribution level
  - (iii) Monitoring iodine content of salt at house-hold level using proper sampling method (Lot Quality Assurance Sample)
- (c) Measuring progress of IDD control towards elimination.

National goiter surveys were conducted by NIN every three years since 1994 using standardized methods and sampling techniques till elimination of IDD as a public health problem was achieved in 2004. Urinary excretion of iodine (UIE) was monitored on random samples from 1999 onwards. Iodated salt consumption was also regularly monitored.

#### **(5) Research on Growth in Relation to Nutrition and Infection**

Growth and growth rate in the general population is the resultant of many factors including genetics, infection as well as nutrition. A comprehensive Review of Growth (height and weight) in the general population of Myanmar by Myo Khin has been published in DMR Bulletin (1992 July). The review covered Anthropometric surveys of different population groups (including Nutrition Assessment Standards Project); Dietary and nutritional surveys during different periods (1939-45, 1947-1966, 1967-1986); Nutrition situation surveys; and Intervention studies to promote growth during health and disease. The relationship of nutrition to growth and growth rates in different population groups, especially children; and the influence of infection, especially diarrhea and intestinal helminthiasis in children were investigated extensively and in depth in many of these studies. These studies brought up the complex interrelationship between growth, nutrition and infection in Myanmar especially among children.

Research on Nutrition Assessment Standards and studies of Energy intake, energy expenditure and balance are also related to Growth and Nutrition and were described in part 4 of G & D of Med. Res. in Myanmar.

#### **(6) Research on Breast Feeding and Weaning Diet**

Breast feeding practice and weaning diets are crucial elements of nutrition in children and research on this subject come within the scope of Nutrition research. Such research in Myanmar has been comprehensively reviewed by Khin Maung Naing in DMR Bulletin (1992 January) The review covers surveys by DMR of both breast feeding and weaning practices in urban as well as rural populations of various townships during the 1970's-80's; and similar surveys by Nutrition Division of DOH in different states and divisions throughout the country. Weaning practices alone have been studied by Nutrition section of DOH since 1957 and continued also by DMR and the Department of Child Health, IM1 during the 1970's-80's. Later studies on PEM by all these institutions mentioned in the Golden Jubilee Book inevitably include research on breast feeding and weaning. The result of these studies provided valid essential scientific information which formed the basis of the effective nutrition programs, especially those related to PEM, delivered to hospitals, clinics and the community by DOH and by other health providers then and now.

Recently, the Food Technology Research Department of MSTRD has been conducting a comprehensive program on Weaning Foods including Instant weaning Food (*see Chapter 5 Section 5.6*)

**(7) Research on Food and Nutrition**

A National Plan of Action for Food and Nutrition (NPAFN) was drawn up in 1994 by a multi sector working group comprising experts from the Ministries of Health, Agriculture, Livestock and Fisheries, National Planning and Economic Development and coordinated by the National Nutrition Center and presented at a National Seminar. In accordance with the NPAFN a Central Board for Food and Nutrition was formed by the National Health Committee in 1995 comprising Director-Generals, Department of Planning, Ministry of Planning and Economic Development (MNPE), Central Statistic Organization (CSO) MNPE, Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Department of Planning, Ministry of Livestock and Fishery, Department of General Administration and Department of Border Areas and National races, Ministry of Home Affairs and chaired by the Minister of Health. Among the various activities undertaken by the Board was the formulation of the Household Food Security and Nutrition Program and one of the strategies adopted by the Board in 1996 was to Assess, analyze and monitor the nutrition situation in the country. This required research and one of the research programs undertaken was the Household Food Security Survey conducted in 1996.

*Household Food Security Survey*

Objective -to explore household and intra-household food supply, food acquisition and intra household care and linkages that influence the nutritional status of the vulnerable family members and children under- five years age, in rural and urban settings.

It was a cross-sectional study both quantitative and qualitative. Information on nutritional status in urban and rural area of Yangon Division was collected from a randomly selected sample of 300 household.

The type of information obtained may be concisely stated as follows:

- (1) Household roles- the roles of different members of the household
- (2) Health and Nutrition information- sources of information
- (3) Household expenditure-
- (4) Social Networks and social organization-in which the family participates
- (5) Food practice- food preferences and beliefs of vulnerable groups such as mothers during pregnancy and puerperium
- (6) Food consumption –types of food, seasonal differences, calorie intake at household level, intra household calorie distribution, child care and child feeding practices.

The findings were disseminated at a workshop in 2001 on Multi-sectoral study for improving household food security for the Vulnerable groups.

## **Section 7.10**

### **Reproductive Health in Myanmar Including Diseases of Pregnancy and Child Birth**

**by Than Than Tin**

#### **Previous Research and Previous Reviews of Research on Reproductive Health in Myanmar**

Previous research up to 1996 have been concisely reviewed in DMR Bulletin 1996 and outlined in G&D of Medical Research in Myanmar. The present Review as given hereunder overlaps with the previous reviews and extends coverage up to date as well as makes more detailed description and analysis of the research.

#### **Research on Reproductive Health in Myanmar (up to 2011)**

According to the WHO's definition of "Reproductive health" the issues of pregnancy and childbirth come under its umbrella.

As regards the existing studies carried out in Myanmar mostly individual ones published as dissertations for the Masters degree as well as theses for the Doctorate degree and a number of large scale sub-national projects carried out with the aid of national and international non governmental agencies.

This review on "Reproductive Health" research in Myanmar will be categorized according to the "womb to the tomb" sequence namely:

- Abortion
- Adolescent health
- Maternal morbidity
- Maternal mortality
- Gynaecological cancers
- Family Planning

#### **1. Abortion**

There were 31 studies published, of which most of them were on septic abortion. Majority of the studies were hospital based.

As regards the methodology - 24 were descriptive, 3 were qualitative and 3 were reviews.

Outcomes assessed were as follows:-

1. Abortion-delivery ratio of the hospital ranged from 1:13 (CWH,1992) 1:2.4(CWH,1990) to 1:2.65.(NOGH,1994)
2. Duration of pregnancy ranged from 6 to 24 weeks, where about half of the abortion occurred at 6 to 12 weeks.
3. Induced abortion ranged from 56.6% to 72.0%
4. Common age for septic abortion ranged from 18 to 35 years, mean age varied from 27.4 yrs to 31.8 yrs.
5. More than 90% of the septic abortion cases were married and multiparous with the mean parity ranged from 2.3 to 3.6.
6. About 80% of the septic abortion cases were of low socioeconomic class, educational level varied from illiterate to graduates.

7. Prime reason for induced abortion was unwanted, unplanned pregnancy.
8. About 70% of the induced abortion was done by lethe.
9. Contraceptive prevalence among septic abortion had risen from 11.9% (1981) to 47.0% (1991)
10. Contraception practice rose from 21% (1980) to 70% (1994)
11. Lack of knowledge of contraception declined from 30% (1980) to 17.9% (1994) to 5.7% (1998)
12. Morbidity of abortion increased with delay in hospitalization especially when it was induced.
13. Average delay of stay before hospitalization is 6.7 days.
14. Maternal mortality due to abortion constituted half of maternal deaths due to direct obstetric cause.
15. Intraperitoneal abscess diagnosed by USG in septic abortion cases was confirmed during laparotomy in 85.4% of the cases
16. Sensitivity of USG in diagnosis of cause of first trimester bleeding ranged from 93.35% for missed abortion to 100% for threatened abortion.
17. Commonest pathogen was found to be *E.coli* followed by *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus pyogenes* which were sensitive to ciprofloxacin and gentamycin.

## Conclusion

This review has the following implications:

- Abortion is still a major problem.
- Prevention of unwanted pregnancy/ unplanned pregnancy should be done by giving more supportive measures on contraception rather than giving educational talks, thus reducing the incidence of septic abortion which in turn will reduce the abortion-delivery ratio of the hospital. Skill (how to take the pills) rather than awareness is required by the people.
- Male participation in family spacing and family planning should be encouraged so as to reduce the unplanned pregnancy, thus induced abortion.

Early detection and diagnosis of causes of bleeding in first trimester (e.g. ectopic pregnancy, threatened abortion, and H. mole) and diagnosis of intraperitoneal abscess in septic abortion by ultrasonogram is found to be invaluable. Ultrasonogram is found to be an essential and invaluable equipment in reducing the maternal morbidity and mortality.

On further analysing certainly induced abortion patients, unplanned pregnancy was the main reason for interference. These patients had a mean hospital stay of a week and required either major or minor surgery for treatment of abortion and its complications. Continuous antibiotic usage was required in two thirds. The costs of abortion comprised one third to one fourth of the total family income.

It is evident that abortion continues to be a major health problem with health and economic implications for the patient and the family.

## 2. Adolescent Health in Myanmar

Studies related to adolescents (direct studies or adolescent data incorporated in other studies) were compiled and reviewed. A total of (22) studies were included in this review. Majority of the studies was observed to be cross-sectional studies. Stratified random sampling method was utilized in selecting subjects in (4) studies; one study covered the whole population living in the study area, whereas convenient sampling method was

performed in others because of limited time and resources. Two hospital based case-control studies were also included.

Recommendations based on the above studies were as follows:

Children should be taught Myanmar culture and traditional values from the very young. Support to the families should be encouraged to prevent early school dropouts. The adolescents should be informed of the physiology of puberty, the risks of pregnancy and also about sexually transmitted diseases. They should also be taught healthy life style and risk behaviours that are detrimental to health. Various models should be developed (age specific education programs) to provide reproductive health education and services to adolescents. Adolescents should be involved in these programmes. Knowledge, attitude/ behaviour and practice of adolescents should also be explored from time to time on a larger scale so as to modify and implement appropriate intervention program. Education programs for parents on the adolescent behaviour should be organised so that they could prevent their daughters from early marriage and pregnancy.

Formation of Youth's organizations in social work should be promoted so that youths will be occupied during the leisure hours. Sports activities should also be promoted.

Physical growth of adolescents should be monitored regularly at schools so as to observe the trend of physical growth of Myanmar adolescents. Age of onset of menarche should also be included.

In collaboration and coordination with the non governmental organisation groups, focus on adolescent health is increasing and encouraging.

### **3. Female Genital Cancer**

There are 33 studies, comprising of 5 reports, 16 papers, 6 thesis and 12 dissertations: For carcinoma cervix, there were 16 studies consisting of one thesis, five dissertations and ten published papers. One study was on epidemiology of carcinoma cervix, three studies were on screening of CIN by cytology, five studies were on screening of CIN by cytology, colposcopy and colposcopy directed biopsy, two studies were on screening of CIN by speculscopy in addition to cytology and colposcopy, one on human papilloma virus screening two studies were on treatment of CIN, and three studies were on clinical profile, treatment and follow up of invasive carcinoma cervix.

There were six studies on malignant ovarian tumour: 4 dissertations, one thesis and one published paper.

There were two studies on malignant trophoblastic disease: One thesis and one dissertation.

Regarding carcinoma vulva, there were three studies, one dissertation and two published papers.

The prevalence of disease was shown as crude incidence rate, and rate in proportion among the various genital cancers. For CIN screening, the pick-up rate in percentage, sensitivity, specificity, positive predictive value, negative predictive value and accuracy rate were calculated. For scoring system, the cut-off points were computed using ROC curve, having optimum sensitivity and specificity. For descriptive studies, the proportions in percentage were shown to illustrate the distribution of the disease in the individual reproductive variable.

The following conclusions were drawn:

- The prevalence of genital cancer in Central Women Hospital ranged from 1.5% to 9.4% of total gynaecological admission. The prevalence in North Okkalapa General Hospital was 9.4% and 16.8% to 36.6% of total gynaecological admissions in Mandalay General Hospital.

- Among the female genital tract cancers in Myanmar, carcinoma cervix was the commonest (42%-52% of total genital cancer in Central Women Hospital, 64.4% in North Okkalapa General Hospital, 41%-48% in Mandalay General Hospital), and malignant ovarian tumours ranked second in frequency of occurrence (31%-39% in Central Women Hospital, 23% in North Okkalapa General Hospital, 19%-22% in Mandalay General Hospital). The two diseases together accounted for more than 75% of all genital cancers (73%-88% in Central Women Hospital, 87.5% in North Okkalapa General Hospital, 67%-99% in Mandalay General Hospital). Malignant trophoblastic disease, Carcinoma Vulva and Endometrial Carcinoma were the other three common genital cancers.
- Cytology (Pap smear) yielded a pick up rate of 2.4% to 12% for CIN and 0.67% to 3% for malignancy.
- Colposcopy and Colposcopy directed Biopsy combined with cytology was definitely beneficial. It increased the detection rate for CIN and invasive carcinoma (studies gave detection rate for CIN and Malignancy as ranging from 5.3% to 36.7%), and helped in pinpointing the diseased area for biopsy and creating an opportunity for local treatment as well. The sensitivity, specificity and accuracy were also enhanced.
- As for Ovarian Cancer, although later studies showed much earlier cases of the disease (borderline cases and stage I cases), the vast majority continued to be late and advanced at the time of diagnosis. As for malignant trophoblastic tumour, the studies revealed that 57%-69% of choriocarcinoma were antedated by history of H.Mole, stressing the need for effective and efficient follow up of every treated H.Mole cases with proper monitoring by history, pelvic examination, tumour marker - HCG, and other necessary investigation. Chemotherapy remains the main treatment of choriocarcinoma, giving the hope for permanent remission of the disease.

Carcinoma vulva seemed to have higher prevalence in upper Myanmar, as the annual intake of carcinoma vulva in Mandalay General Hospital was higher than that of Central Women Hospital.

In the present situation, the health authorities have gone in for full scale prevention and early detection of cancer cervix, the commonest female genital cancer with provision of cytology services by collaborating with the national NGOs. In addition, provision of vaccination against oncogenic HPV virus from the private sector at reduced cost is now available.

#### **4. Maternal Mortality Studies**

In 1987, the first International Safe Motherhood Conference took place in Nairobi and the goal of a 50% reduction of the existing 1999 levels of maternal mortality by the year 2000 formulated. This goal was later adopted by National Governments and by other International Conferences, including the World Summit for Children in New York in 1990, the International Conference on Population and Development in Cairo in 1994 and the Fourth World Conference on women in Beijing in 1995. Myanmar also joined hands with the rest of the world. The Maternal Mortality in Myanmar has shown a declining trend over the past 35-40 years.

The studies carried out so far involved isolated as well as collaborative analytical/descriptive studies (10) which looked for the causes of maternal deaths when such deaths occurred, both hospital as well as community based. Prospective longitudinal studies were also carried out on pregnancy complications which are well documented to be the major causes of maternal mortality.

There was one multi-centre collaborated study on maternal mortality in 1989-90, conducted at 4 teaching University Hospitals and 14 Divisional level Hospitals.

There were (2) community based cross-sectional in depth interview studies, but the facts collected were retrospective and obtained from relatives and neighbours. Collaborated multi-centre study on causes of maternal mortality was carried out in 1990 at 18 teaching hospitals where Obstetric and Gynaecological specialists were based which was organised by Obstetric and Gynaecological Section, Myanmar Medical Association (MMA). Regional differences were observed, as sepsis due to abortion constituted 2/3 of causes at Central Women Hospital and haemorrhage and pregnancy induced hypertension (PIH) were more common at Mandalay General Hospital and deaths due to abortion, haemorrhage and pre-eclampsia were common at the Divisional Hospitals. There were (9) longitudinal prospective descriptive studies on eclampsia, PIH, 3<sup>rd</sup> stage complications, viral hepatitis with pregnancy, rupture uterus, heart disease with pregnancy and ectopic gestation.

According to these studies, maternal deaths were related to 3<sup>rd</sup> stage complications, (4 cases). Abruptio placental (1 case) and PIH (4 cases) one death occurred in study of heart disease (Eisenmenger Complex) and no death occurred in the study of viral hepatitis complicating pregnancy.

#### Methodology

- 10 were cross-sectional descriptive, retrospective studies
- 2 were community based with IDI
- 7 were prospective case control studies
- 13 were M.Med.Sc (O&G) Dissertations

Outcomes were percent distribution for descriptive studies in relation to age, parity, complications of pregnancy (18) cases. Three studies discussed on accoucher and conditions at home deliveries. Four studies discussed on pitfalls in referral system, transportation, Late arrivals to hospital were main cause of delay in emergency measures provided to patients. Three studies were analytical of note.

Conclusion and Recommendations mentioned by various authors were as follows:

- (1) There should be trained medical personnel in attendance at every maternity shelter.
- (2) Clinical audit should be practised for review of each maternal death.
- (3) Confidential enquiry of each maternal death at the hospital, at home or at a private institution should be carried out.
- (4) Protocol should be provided for midwives conducting domiciliary deliveries.
- (5) Use of partogram by field workers should be encouraged for timely referral.
- (6) Emergency Obstetric Centres should be set up.
- (7) Arrangement for effective transport system is required and may be solved by community participation.
- (8) Post-mortum examination is mandatory to every maternal deaths, to diagnose cause of maternal mortality.

#### **5. Maternal Morbidity**

This review mainly covers morbidity occurring in hospitals during late pregnancy, labour, puerperium and morbidity due to ectopic pregnancy. The incidence varied with different studies. It ranged from 4% to 32%, the lowest in tertiary hospital (C.W.H) and the highest in Upper Myanmar (Seminar on M. morbidity, 1992). The common maternal morbidity following caesarean section were puerperal pyrexia, abdominal wound sepsis, paralytic ileus, caesarean hysterectomy, primary as well as secondary postpartum

haemorrhage and injury to near by structure. Like all other major surgery, morbidity due to anaesthesia should be considered such, as spinal shock, spinal headache, Mandelson's syndrome and meningitis. Instrumental delivery is known to be associated with increased maternal morbidity. Commonest maternal morbidity was maternal injury like vaginal tear, cervical tear, uterine tear and extension of episiotomy wound. The maternal injury occurred more in forceps delivery (18 to 31%) than ventouse delivery (8 to 11%) Complication of episiotomy wound, puerperal pyrexia and postpartum haemorrhage followed next .The rest were retained placenta, urinary retention, haematoma and symphysis pubis separation. In general, ventouse delivery was less traumatic than forceps delivery.

In general maternal morbidity was found to be lowest among mothers who delivered babies weighing 2500-4000 G, and highest in mothers who delivered more than 4000 G, up to 50% in Upper Myanmar.

In multi-centre study, among the complications during pregnancy, pre-eclampsia was found to be the commonest complication in most centre ranging from 1 to 9% except for Mandalay where anaemia was on top of the list (14.98%). Premature rupture of the membrane was also common with highest rate in Mandalay. Haemorrhage occurred less frequently ranging from 0% to 5.8%. The rest were infections, medical diseases, surgical diseases, and uterovaginal prolapse (Seminar on M. morbidity,1992).

Anaemia in pregnancy was a very common problem. It was frequently severe and contributed significantly to maternal morbidity and reproductive health morbidity. Malaria infection during pregnancy was one of the important medical problems in malaria endemic area. Women demonstrated an increased prevalence and severity of malaria infection during pregnancy. Antepartum haemorrhage also contributed to increased morbidity.

Premature rupture of the membrane was one of the common complications during pregnancy. (0.43% - 10% of all deliveries)

#### *First stage complications*

The presence of hypertensive disease of pregnancy was the most frequently encountered morbidity in the first stage labour followed by antepartum haemorrhage and history of PROM. Eclampsia in labour was found in all centers (Seminar on M. morbidity, 1992).

#### *Second stage complications*

Here again hypertension and haemorrhage occurred as major causes of morbidity. Eclampsia also contributed to increased morbidity. Ruptured uterus caused not only increased morbidity but also caused mortality. In the study of obstetric uterine rupture in MGH, the incidence was 2.8 per 1000 live births. Third stage complications

Postpartum haemorrhage was at the top of the list followed by maternal injuries and retained placenta. In multi-centre study the incidence of PPH was only 1.85%. The main third stage complication occurred outside the tertiary centre was retained placenta with or without PPH.

#### *Maternal morbidity after child birth*

There was one study which explored maternal morbidity after child birth in late puerperium. The commonly perceived problems were bowel problems, backache, cough and cold, urinary problems, constantly reliving baby's birth, painful perineum and clinically detected anaemia.

The prevalence rate of emotional health problems was 3.1% of post partum mothers. Age group (20-30 years) and primiparae are most frequent vulnerable groups and more than half of those women had undergone emergency lower segment caesarean section.

This study highlighted that we need to give attention on maternal morbidity beyond immediate post partum and hospital stay

*Reproductive Morbidity beyond child birth*

There was a study on genital prolapse as a reproductive morbidity in MGH (1993-1994).

*Maternal morbidity due to ectopic pregnancy*

Among early pregnancy complications, ectopic pregnancy is one of the common clinical problems which can cause not only morbidity but also mortality. Nowadays, mortality due to ectopic pregnancy is declining with energetic treatment and blood transfusion. The incidence is about 7.5/1000 – 9.2/1000 hospital deliveries

Hospital statistics also plays important role in reviewing maternal morbidity. Detailed and proper medical records and registration of any morbidity that occur in hospital, antenatal and postnatal clinics are extremely important. Computer recording of hospital statistics have been established in major hospitals.

## **6. Women's Health after Menopause in Myanmar**

In Myanmar, there was also a group of vague illnesses around the menopausal period, called menopausal syndrome. But as a Buddhist, they accepted these as unavoidable part of senility and tried to avoid these illness by following cultural belief and custom; such as taking one viss of milk on the 40<sup>th</sup> birthday at one sitting to replace the effect of maternal breast milk that has run out by that time. Some took indigenous medicine or honey daily. Regarding urogenital symptom of oestrogen deficiency, they may not be troublesome until women were so old that their relation to menopause was forgotten. Myanmar elderly women may be reluctant to express the problem of dyspareunia or may not be problem for her because of infrequent sex in older age. But urinary symptoms, such as frequency, urgency, incontinence and dysuria may be distressing problems for elderly women that could be greatly helped by treatment with topical or systemic oestrogen.

Regarding osteoporosis, kyphosis and spine problems were accepted as sign of senility and they did not bother about them. Fracture neck of femur may be a terminal event for elderly women, making her bed-ridden for a long time before she dies. Other chronic diseases, such as ischaemic heart diseases, osteoporosis, reproductive tract cancer, most notably endometrial and breast cancers are also related to postmenopausal women.

It is important to provide the optimal health care services to the post menopausal Myanmar women who have become a larger proportion of the total population and who have to spend about one third of their lives in post menopausal state, to improve their quality of life and to prevent them from possible chronic health problems associated with menopause.

In Myanmar, there were only a few studies in this area. It is a topic rarely publicised and menopausal clinics are non existent.

There are eight isolated studies: five dissertations, one journal publication and two thesis. Only one study was community based. In three studies, the type of interventions was investigations including histopathological study to identify the cause of postmenopausal bleeding. Two studies dealt with face-to-face interview of the postmenopausal women regarding their experiences of menopausal symptoms using preformed, pretested questionnaire. One study involved systemic and local form of oestrogen to postmenopausal women with atrophic vaginitis. One study dealt with tibolone therapy. In one study, clinical risk factors for bony fracture in postmenopausal women was analysed with multiple logistic regression analysis.

Provision of health care centers with well trained medical staff and doctors for dealing of the post-menopausal women's problems is necessary. Guide lines and management protocol regarding HRT should be developed and provided to these health centers. Information, health education and counselling before prescribing the optimum method of HRT with informed choice for each individual woman are important to provide optimal expectation of life (and quality of life) in our aging women society.

**This area of Reproductive Health needs further coverage with health care programs.**

## **7. Reproductive Tract Infections in Myanmar**

There were 10 studies from dissertations, proceedings of Myanmar Medical Conferences and Myanmar research congress. The individual studies carried out so far dealt with Focus Group Discussions, Interviews, History taking & Physical examinations (General & Local) and Investigations - such as Endocervical swab for Gram stain, Posterior vaginal wall smear for Gram stain and Saline test, Vaginal pH measurement, Blood tests for Chlamydial antigen assay, VDRL, TPHA (in syphilis).

Participants included were women with pelvic inflammatory disease, husbands of women with pelvic inflammatory disease, women with vaginal discharge, ectopic pregnancy cases, Preterm Premature Rupture of Membrane cases (PPROM), outpatient clinic attendees of Obstetric and Gynaecological Department, men, women and service providers of Pyay and Kalaw Townships.

Outcomes assessed were prevalence of clinically diagnosed pelvic Infection, Microbiological evidence of RTI such as Bacterial infection, Gonococcal infection, Bacterial vaginosis, Trichomoniasis, Candidiasis, Seropositivity of Chlamydial antigen, Seropositivity (Syphilis)

Available studies were mostly clinic or hospital based, therefore data could not reflect the prevalence of RTIs in the country.

A community based study concerning any RTI is required.

Broader category of RTIs/ STD should be considered.

Data on pelvic infection following gynaecological surgery, puerperal and post-abortal condition were also required.

Further research areas should include

- confirmation of aetiology,
- interventions for treatment,
- interventions aimed at decreasing transmission,
- partner notification and
- morbidity and mortality.

## **8. Family Planning**

There were 12 - isolated studies published (1 thesis and 11 dissertations) and 11 project studies at community levels involving large number of participants , quantitative as well as qualitative One interesting dissertation included cost effectiveness analysis of contraceptive options.

There were (3) studies from the providers' aspect. Most papers or studies were presented in descriptive forms except for (3) studies which attempted to take all confounding variables into consideration by means of logistic regression analyses. These studies were;

1. Studies on Contraceptive acceptability (94/ PO 1 DOH /DMR /UNFPA 1998)
2. Base-line data in twenty townships (1993)
3. Studies on ontraception in Taik-Kyi (DMR/ DOH/ WHO, 1992)

As regards study designs, (15) were cross-sectional, (3) were longitudinal, (2) prospective and (1) retrospective.

Most were quantitative studies whereas (3) were qualitative using FGD and IDI. Data collection methods used were pre-tested structured questionnaires. The variables included in the questionnaire for the Myanmar Population Changes and Fertility Survey (PCFS) were similar to those of international Demographic and Health Surveys (DHS), but adopted to suit the country's requirements as well as the customs and culture. Qualitative techniques, such as focus group discussion among separate groups of wives and husbands were also employed in the study in rural Yangon. All the data were collected by qualified trained personnel, and analyzed by computer.

#### *Validity of studies*

Each study seemed to have their own yardstick and validity of interviewing techniques vary from study to study. Large projects have their own built-in epidemiological validity checks.

#### *Inclusion criteria*

Inclusion of subjects was based on hospital population (4) studies, community in (14) studies. All seemed to observe the universal ethical criteria of informed consent. For operational researches informed choice and consent was carefully observed.

Numbers included ranged from (40) to (6675). Recommendations for future research are made as follows:

- (1) Audit on birth spacing services; e.g. clients' satisfaction with method and delivery, quality of counseling services.
- (2) Introduction of newer methods and their acceptance; e.g. Progestogen implants
- (3) Female barrier methods especially in relation to sexually transmitted diseases.
- (4) Operational research on door-step services for those home-bound clients in poorly communicable areas.
- (5) Integrated approach for birth spacing for families; e.g. mother and adolescent daughter IEC
- (6) Expanding family planning options; natural methods as well as newer methods
- (7) Dissemination of information; Workshops for improving communication skills

Subsequent to the above studies, a tri-institutional translation of WHO "Decision Making Tool for family planning clinic attenders and providers" was produced, distributed and used at community levels, since 2006.

From the above review of existing literature, it is evident that planning of research in the field of Reproductive Health needs to consider the priority issues of the country with the ultimate objective of utilization of research findings apart from dissemination and advocacy.



## **Section 7.11**

### **Snake Bite (Part A)**

**by Tun Pe, Aye Aye Myint & Aung Than Batu**

#### **Previous Studies**

Previous studies in the 1970's up to 1986 were very well reviewed in DMR Bulletin (1986) and G&D, Med.Res.Myanmar.

Pioneering research on snakes and snake bites in Myanmar was done. These studies described the epidemiological features including time, place of bite and body part bitten; clinical features of snake bites, especially bites by Russell' viper (*Daboia siamensis*); pattern of changes in blood coagulation factors, renal functions, and pathological and histological findings at autopsy in cases of Russell's Viper bites. Experimental animal studies were done to study changes in renal tubules in Russell's viper envenoming using light, electron and immune-fluorescent microscopy and micro-dissection. ELISA to detect Russell's viper venom in blood was developed and used to confirm cases of Russell's viper bite.

Increased capillary permeability leading to hypotension, clotting defects leading to spontaneous internal and external hemorrhage and DIC causing acute renal failure were the prominent clinical and patho-physiological features found. The clinical and laboratory features - including venom levels, clotting factors and renal functions –in cases with different degrees of envenoming, leading to acute renal failure and death in severe cases, were described.

The pharmacokinetics of Russell's Viper venom and anti-venom in blood measured by ELISA or RIA was studied experimentally in animals and human subjects. The maximum amount of venom that can be milked from Russell's vipers was measured and experiments were done to determine the amount of venom injected at first bite and correlated with length of snake. This was more than 80 mg of venom previously accepted as the maximum injected. Study was done of correlation between length, age (young /old), previous feeding of snake and local and systemic features of envenoming.

The clinical outcome of different doses of BPI/ASV administered at different time intervals after bite, as well as the efficacy of other therapeutic measures such as plasma expanders and corticosteroids were described and analyzed. Pituitary hemorrhage at autopsy and clinical observation of panhypopituitarism in some cases was reported. The feasibility and outcome of peritoneal dialysis in a township hospital, and results of hemodialysis at RGH were reported.

Preventive measures such as First aid using tourniquet was found ineffective. Russell's Viper Venom Toxoid or Venoid (RVVT) was developed for the first time and demonstrated to have protective effect against lethal doses of sufficient anti-venom viper venom in small and large animals; and shown to produce antibody titre levels for six months in human volunteers. This was reported for the first time in the world medical literature.

#### **Snake Bite Research in the 1980's and 1990's**

Snake bite research during 1980's and 1990's up to 1995 was comprehensively reviewed in DMR Bulletin 1995. This Review has been condensed and excerpts have been taken as given hereunder.

#### *Clinical and therapeutic studies*

Further studies were done to clarify and determine the optimum dose of ASV and the maximum time interval after bite that could elapse to prevent severe complications and death. Sheehan's syndrome was described as sequel of Russell's Viper bites in a series of cases, confirming and extending previous occasional observations. A study of pattern of acute renal failure in Russell's viper bites showed the relation between clinical features and oliguria. A clinical trial of heparin therapy for DIC in Russell's viper bite was done with equivocal results.

#### *Blood coagulation studies*

Coagulation abnormalities in viper bites were continued and extended. It was determined that the whole blood clotting time of 20 minutes should be used as the gold standard for diagnosis and blood FDP levels for monitoring of systemic envenoming in Russell's viper bites. A new and easier test (staphylococcal clumping test) for detecting and measuring blood FDP was developed.

#### *Studies of renal function and biochemical disturbances*

Two patterns of acute renal failure (oliguric and non-oliguric) were observed and clinical features, outcome, blood and urine biochemistry including fractional sodium excretion and response to frusemide therapy were compared. Urinary NAG (N-acetyl-B-D-glucosaminidase) activity was found to be the earliest predictor of renal damage. Other indicators of renal damage were also studied.

Mechanism of renal damage in Russell's viper bites were further studied to confirm and extend previous observations that both ischemic and nephrotoxic damage could be induced by RVV. In-vivo and in vitro experiments showed that the predominant renal lesion was proximal tubular degeneration and necrosis and that glomerular changes were minimal. Renal ischaemia, transient glomerular leak, and acute renal damage was found in patients envenomed by Russell's viper. Plasma concentration of active rennin was very high, suggesting that renal ischaemia, associated with activation of the rennin-angiotensin system, was involved in the development of renal dysfunction.

#### *Studies on Russell's viper venom and its components*

The biological property, activity and mode of action of various components of Russell's viper venom from Myanmar were investigated. It was found that the biological properties of RVV from various parts of Myanmar varied. Also that it varied between juvenile and adult Russell's vipers. Such geographical variation could be responsible for differences in the clinical picture and the variable performance of anti-venom.

#### *Potency assays of anti-venom*

Potency assay of mono-specific Russell's viper anti-venom (ASV) manufactured by MPF was carried out using rodent assay system recommended by WHO. It was found that there were large variations in the amount of ASV required to neutralize different biological activities of RVV from different localities in the country. The neutralizing activity of Indian polyvalent anti-venom was also compared and found to be poorly effective.

#### *Studies on Immune response following Russell's viper bite*

A prospective study of the development, intensity and protective ability of the antibody response to Russell's viper bite and its relation to severity of envenoming was done and showed persistence of antibody from 1 week to 15 years after bite.

### *Studies on prophylaxis*

The efficacy of local compression immobilization technique was demonstrated unequivocally in experiments on monkeys using radio-labeled RVV and in human volunteers using mock venom and subsequently confirmed in prospective cases.

The administration of intramuscular ASV was found to be effective as a first aid measure prior to IV therapy on admission to hospital. Protective boots as a preventive measure were being tried.

Earlier work on development of venom toxoid was extended in order to improve its quality.

### **Snake bite research from 1995 and after**

*"Bibliography of Research Findings on Snakebites in Myanmar (1967-2010)* include studies between 1995 and 2010 (as well as those prior to 1995). Those done after 1995 have been summarized hereunder. Many of these studies were continuation and extension of previous studies and many were similar and overlap with each other with respect to method and content.

### *Clinical, epidemiological and HSR studies*

Previous clinical and epidemiological studies were extended to include townships from various parts of Myanmar and many more similar studies in different hospitals and settings including major hospitals like YGH and MGH. Data from six townships were consolidated, compared and contrasted.

In addition to Sheehan's syndrome previously reported, adverse effects on reproductive function and low levels of reproductive hormones were found in Russell's viper bite victims 4 to 21 years after viper bites. Cranial diabetes insipidus developed in a case of Russell's viper bite 4 weeks after bite and recovered from it after 28 weeks. Knowledge-attitude-practice studies of patients and family were done regarding beliefs and treatment seeking behavior and of medical workers like nurses regarding knowledge about how to do clotting tests and snake identification.

### *First aid*

Previous research on compression/immobilization techniques was continued and extended.

### *Immunodiagnosis*

A rapid dipstick dot blot enzyme labeled immunoassay for detection of Russell's viper venom was developed which was simple, sensitive and specific and suitable for use in district laboratories. This was further improved using colloidal dye instead of labeled enzyme and reading time was shortened to 20 minutes. It is simple, specific, sensitive, inexpensive, rapid and robust and may be used for rapid identification of snake species in the field.

### *Immunology*

Previously developed RVV Toxoid was further studied. Its stability when stored at 4C and pattern of antibody response according to immunization schedule were studied in experimental animals.

The cellular and humoral response in Russell's viper bite victims and reptile keepers and venom handlers from MPF; and humoral response following traditional active immunization were studied. Development of natural antibodies after Green pit viper bite and King cobra bites were also studied.

### *Management of snake bite*

Many studies of various aspects of snake bite management had been carried out in previous decades and some were continued further. The place of low dose dopamine and high dose frusemide regime in averting and treating acute renal failure due to Russell's viper bites was investigated. Results of peritoneal dialysis at MGH were reported. There was 16 % incidence of complications due to peritoneal dialysis. Results of peritoneal and intermittent hemodialysis in Russell's viper bites were compared.

### *Pathophysiology*

Trans-capillary escape rate, capillary permeability and escape of protein from intravascular to extravascular compartment were found to be increased in cases of Russell's viper bite.

Pathological studies of regional lymph nodes on the limb bitten by vipers showed excessive sinus hyperplasia and localization of viper venom by immune-peroxidase staining.

### *Prophylaxis*

Locally available rubber boots are being worn as protection from snake bite by 88% of farmers but these will not protect against penetration by Russell's viper fangs. Fang proof Rubber boots have been developed, tested and are being sold. Their acceptability and affordability by farmers at subsidized prices is 99%.

### *Snakes and snake bites other than by Russell's viper*

Bites by other poisonous snakes have occurred in Myanmar, although much less frequently, including other vipers, cobras, krait and sea snakes. The taxonomy of snakes, first studied in the 1970's, has been more thoroughly studied again and reported.. Some of these other poisonous snake bites have been investigated in some detail but non-poisonous snake bites are seldom reported and not studied.

Green pit viper bites are not uncommon and clinical manifestations and laboratory findings due to envenoming were described.

Cobra bites (due to *Naja kaouthia*) are the second most common poisonous snake bites in Myanmar (less than 10%) and may cause neurotoxicity. Clinical features, and response to treatment with antivenom, assisted respiration and other measures were described.

A few cases of bites by King Cobra (*Ophiophagus hannah*) in snake charmers are also described. Spitting cobra has been observed in Myanmar but its bite not reported. A few cases of Malayan pit viper (*Calloselasma rhodostoma*) bites, diagnosed retrospectively, were reported.

The prevalence, (yearly prevalence 27 to 158/100,000), case fatality rate (18%), and treatment seeking behavior of sea snake bite victims were studied in Letkokekone, Yangon Division. Clinical features observed at YGH on two patients included paresis and renal insufficiency and effective treatment being unavailable both died following renal shutdown. A few cases of bites due to Banded krait (*Bungarus fasciatus*) and Chinese krait (*Bungurus multicinctus*) were reported including clinical features and results of mechanical respiratory support

### *Venom*

Characterization of the biological and biomedical properties of venom from different localities in Myanmar (townships in Ayeyarwaddy, Bago, Magway, Mandalay, Sagaing and Yangon Divisions); from snakes of different lengths and ages, at different seasons and different color was done and analyzed. The biological properties include lethality, coagulant, necrotic, hemorrhagic, defibrinogenating and capillary permeability increasing ability. It was

found that venoms from Lower Myanmar were generally more potent than from Upper Myanmar and there were qualitative and quantitative variations of individual properties and activities between localities and seasons and similarities between juvenile and adult snakes. Venom was fractionated and biological activity of each fraction was characterized. Each of the different types of biological properties like capillary permeability or nephrotoxicity and each of the major biochemical components like phosphomonoesterase or Factor X was purified and further characterized and studied. Kinetic studies of the radio labeled venom were done and the distribution in various organs was studied in experimental animals. Differences in response to ASV therapy were probably due to these observed differences in venom and it was recommended that pooled venom should be used to produce anti-venom for common use.

The kinetics of venom and anti-venom in experimental animals and in human cases was studied.

#### *Antivenom*

The ability of mono-specific liquid anti-sera to neutralize venom of Russell's vipers from different localities in Myanmar was found to be variable and was probably due to differences in biological properties and toxicity of the venom. The efficacy and practicality of different total dose, bolus dose, frequency and optimum lapsed time after snake bite continued to be studied. Among other findings it was shown that the usual bolus dose of 40 mls was not sufficient to prevent serious complications in systemic envenomation. The potency and ability to neutralize biological properties of Russell's viper venom from Myanmar was compared between MPF, Thai Red Cross and Indian anti-venom; it was found that MPF anti-venom was far more superior. The stability of MPF mono-specific liquid anti-sera during various storage conditions was investigated.

*Anti-venom raised against Russell's viper venom from sources other than horse*  
This new line of developmental research initiated and carried out by DMR (LM) is innovative as well as the most potentially useful area of snake bite research during this period. The only medically proven treatment against snake envenoming is the equine antiserum. The production of anti-sera involves the immunization of the horse by injecting snake venom and subsequently collecting blood from the horse. Enzyme digested antisera contain some quantities of non-specific serum proteins that could elicit clinical side effects which may sometimes be severe. In addition maintenance and production of ASV from horses is laborious and expensive.

The above drawbacks have prompted scientists to search for an alternative animal model for the production of a pharmaceutically safe and cost effective antidote for snake bite. Towards this end, since about the early 1990's, chicken egg as an antibody source has attracted investigators through-out the world. Researchers discovered that avian antibodies against antigens like Hepatitis B- surface-antigen or snake venom can be obtained from chicken eggs and may be used instead of mammalian antibodies from rabbits or horses. Transfer of the maternal antibody to the progeny in chickens is through the egg yolk; the antibody crosses the oviduct barrier and is termed IgY which accumulates in the yolk sac. The advantages offered by avian Igy antibody (IgY) over mammalian antibody production are well documented. Collection of a large volume of blood from a large animal could be replaced by antibody isolation and extraction from egg yolk. Researchers have produced antivenom in chicken eggs against some snake venoms since about 2005 but not yet against Russell's viper (*Daboia siamensis*) venom. In Myanmar we faced the same difficulties as others elsewhere in having to produce adequate quantities of equine ASV against Russell's viper. So, when DMR (LM) became aware from the medical literature about the possibility of producing avian ASV in hen eggs it realized the potential benefit of this method for

overcoming our difficulties in producing sufficient ASV for treatment of Russell's Viper bites in Myanmar.

Since about 2002, the Immunology Research Division of DMR (LM) has taken on the task of setting up this method in its laboratory. Most of the necessary immunological technology were already available in house but it took several years of meticulous laboratory work in the Immunology Research laboratory to adapt, test and set up the necessary procedures; and cooperation with commercial producers of chicken eggs in order to be able to keep chickens in chicken farms, immunize the chickens, collect eggs and transport sufficient eggs back to the laboratory for extraction of ASV. Finally Immunology Research Division of DMR (LM) succeeded in producing a monovalent avian ASV in chicken eggs against Russell's viper venom in 2007.

Russell's viper anti-venom was raised in laying hens and extracted from egg yolk, (checked by immune-diffusion and assayed by ELISA). Antibody could be detected at two weeks after initial immunization and maintained good levels up to 20 weeks. Pooled IgY (anti-venom) was tested for, ED50, and neutralization against lethality, coagulant, hemorrhagic, necrotic, defibrinogenating, and capillary permeability increasing activities. It was found that this Avian ASV has comparable efficacy to equine MPF Russell's viper anti-venom and possesses neutralizing ability against the biological properties of the venom and it could be used for treating Russell's viper bite cases in Myanmar. 1.86gms of IgY antibody was obtained per month from 4 laying hens (22 eggs/month) which is equivalent to a yield of total of IgG antibody from 8 rabbits (250grm/50ml/month/rabbit) and that of 2 goats (1gm/200ml/month /goat) per month. The major advantages of the avian anti-venom are that the eggs from immunized hens provide a continual source of antibody, inexpensive to keep the hens, and required only minute amounts of the venom

To our knowledge this is the first time anyone anywhere has produced Russell's viper venom ASV in chicken eggs and it was reported in Myanmar Health Science Research Journal. Clinical trials have now been carried out. This is a big achievement for DMR (LM) and for Myanmar medical scientists. Later, in 2010 Indian researchers have also produced Avian ASV against cobra, Russell's viper and krait from chicken eggs, in the laboratory.

## **Snake Bite (Part B)**

**by Aung Than Batu**

### **A. Missed Opportunity**

#### ***To protect from the devastating consequences of viper bites***

Despite about 40 years of research since the first systematic study at Insein Hospital in 1972, viper bites are still a major health problem, especially to farmers-the economically very important occupational group in Myanmar. The Burma Pharmaceutical Industry (BPI) and successor Myanmar Pharmaceutical Factory (MPF) is capable of producing a highly potent, safe, effective mono-specific antiserum against viper toxin but production is inadequate for the country's needs and sufficient production is unaffordable. The National Health Plan 2006-2011 states that in 2002 there were 7682 poisonous snake bites in Myanmar with a 7.5 % mortality, which is unacceptable high, and that the specific objective was to reduce mortality following poisonous snake bites by *1 percent!!*

Research over the decades has provided enough scientific technical information for health professionals to do what is necessary to prevent death due to viper bites, but this

requires sufficient antiserum to be available at the right place at the right time and this is yet unaffordable.

(1) However, it should be demonstrated that the mix of interventions already available but fragmented (antiserum, protective devices like boots, first aid with compression bandage, health education, community participation and back-up secondary and tertiary medical care), when all applied together, can prevent death due to poisonous snakes particularly Vipers.; the mortality can be zero. Demonstration as a pilot research project in a model township can be replicated elsewhere and also serve as strong advocacy for increased resources for snake bite control and snake bite research. This has not yet been done.

(2) Alternative strategies- The burden of health due to the snake bite problem may be avoidable with the existing mix of interventions but un-affordable mainly due to the cost of viper anti-venom. This calls for biomedical research and development to reduce costs or to create new interventions and this has been done with variable results.

(a) Viper Venom Toxoid- Failure or inability of medical researchers to develop an effective, stable Viper Venom Toxoid that could be used to prevent the devastating consequences of viper bites to farmers and others was a missed opportunity or a failure.

Research in 1986 seems to have demonstrated that an effective and practically usable viper venom toxoid had been produced on a laboratory scale and only needed large scale manufacture by industry and further field trials on large population groups. But there were doubts about its long term immunogenicity and stability and although research was pursued from the 1990's onwards clear cut results were not obtained and a viper venom toxoid that is effective, stable and practical for field use by the target farmer population during their most vulnerable working period was not successfully produced up to now.

(b) Viper anti-venom from chicken eggs- as an alternative, more affordable source is being developed since 2007 at DMR (LM) and demonstrated to be immunogenic, safe and effective in experimental animals and human subjects by clinical trials. Further research is being pursued to produce it on a larger scale. This could turn out to be a success story for medical/health research in Myanmar and for DMR (LM). However resources are limited and more support and resources could accelerate the venture. Inability to provide all out support in time may make this a missed opportunity.



## **Section 7.12**

### **Hematological Disorders**

**by Aung Than Batu**

Previous studies on hematological disorders, particularly nutritional anemias and red cell disorders including hemoglobinopathies and thalasseemias have been well described in G&D Med.Res. Also in DMR Bulletins Vol.2.No.4, Jan 1988.

Research on hematological disorders expanded and took on new direction when the new National Blood Research Centre was opened at DMR (LM) in 2002 and the Clinical Research Unit on Haematology at Yangon Children's Hospital. Research on nutritional anemias decreased and some research on Thalassemia continued, particularly with respect to genetic and molecular aspects, but research expanded into other areas. The Blood Research Division of this Centre is primarily involved in research on red cell disorders; it also studies hemostasis and coagulation disorders and common hematological malignancies. Whereas, previously, DMR had done extensive research on coagulation defects in Viper bites only, it now also studies the relation between changes in the coagulation mechanism and diseases in various organ systems such acute ischaemic stroke and gynaecological tumors. Research on leukemias is also undertaken. RT-PCR was established to investigate genetic mechanism in acute leukemias and monitor response to targeted therapy in chronic leukemias.

Extensive research on the Thalasseemias and Hemoglobinopathies is also done at the Clinical Hematology Department of the Yangon General Hospital and the North Okkalapa General Hospital especially on the molecular and genetic aspects, some of it in collaboration with Japanese scientists. A rare super-unstable Hemoglobin variant, Hb. Monroe, was detected in Myanmar children. Growth and development of Thallasemia children continued to be studied especially at the Department of Child Health of the University of Medicine 1, Yangon .More studies of the adverse effects of iron overload due to blood transfusion and clinical trials of the efficacy and cost effectiveness of iron chelating agents under local conditions was done. Close collaboration takes place in research on thalasseemias between the Clinical Hematology Departments of the Yangon General Hospital, North Okkalapa General Hospital, Mandalay General Hospital, Yangon Children's Hospital, Child Health Department of the University of Medicine 1, and Pathology Division of DMR (LM) and the work done was presented and discussed at the Panel Discussion on "Toward Better Care of Thalassemia" held in Yangon in May 2006.

Acute leukemias, their genetic basis, and management under local socio-economic conditions were investigated at the Clinical Hematology Department of North Okkalapa General Hospital.



## **Section 7.13**

### **Environmental Health**

**by Aung Than Batu**

The Environmental Health Program of the National Health Plan (2006-2011) includes: (a) Environmental Health Risk Assessment and Control Project (b) Occupational Health and Safety (c) Prevention and control of Agricultural Hazards (d) Air and Water Pollution Control Project (e) Community Water Supply and Sanitation (f) Healthy City Project. The Program aims to systematically explore the environmental related causes which are adverse to community health and to prevent hazards.

Each of these service projects has embedded Operational Research activities to be undertaken by DOH, such as surveys, monitoring, assessment to obtain necessary information for management and planning. Data collection on chemical and pesticide poisoning will be through record of cases admitted to civil hospitals. Also, air and water pollution trends will be studied based on rapid assessment and emission inventory. Water quality Surveillance and Monitoring will be done throughout the country

Research on Environmental Health was greatly boosted by the opening of the new Poison Control Centre at DMR (LM) in 2003 with 4 Toxicology Divisions: Pharmaceutical Toxicology, Chemical Toxicology, Biological Toxicology, Radiation Toxicology. The Centre supplements and strengthens the Environmental Health Program of Ministry of Health by providing service as well as conducting research. It adds a strong research capability to the inbuilt OR being carried out by DOH. Its recent research activities include: Assessment of pesticide residues in the ecosystem around Inlay Lake; survey of street vendors to detect biological toxins in grilled meat samples; study of poisoning cases at YGH and other hospitals to find out type of poisoning and preparedness with respect to antidotes, etc.



## **Section 7.14**

### **Mental Health**

by **Zaw Sein Lwin**

#### **1. Development of Mental Health Care in Myanmar**

The Lunacy Act was promulgated in 1912 following which the Lunatic Asylum was built at Tadagale, Yangon, in 1918 and used mainly for custodial care. In 1948 the Lunatic Asylum was re-named the Tadagale Mental Hospital in recognition of its function as an institution for the diagnosis and treatment of mental disorders. Later it became the State Mental Hospital (1962) and then the specialty Yangon Psychiatric Hospital (1967).

Mental hospitals were also established gradually in other States and Divisions. Mental health care became a component of Primary Health Care package from 1990 onwards.

Regarding the problem of Substance Abuse, opium addiction was early recognized as a important mental health problem and an Opium treatment Centre was first opened at the Tadagale Mental hospital and then in 1950 at Myitkyina and Putao hospitals. In 1974 the Anti-narcotic Law was passed to deal with all types of Substance Abuse and the Drug Detoxification and Treatment Centre and Research Unit was (DDTC&RU) established at Yangon Psychiatric Hospital. Later (6) Major Drug treatment Centers and (22) Minor Drug Treatment Centers were opened throughout the country. Drug Rehabilitation Centers /Youth Nurturing Centers were also established in Wet-hti-gan (Pyay) and Ka-the-kwin (Shan State) The Tadagale Mental Hospital has functioned as a teaching and training institution for mental diseases to medical students and other health professionals. The upgraded Psychiatric Hospital s in Yangon, Mandalay also became University Teaching hospitals and participated in the training of postgraduates for M.Med Sc (Psychiatric Medicine) and Diploma in Mental Health (DPM).

#### **2. Mental Health Research**

##### **2.1 The Drug Detoxification and Treatment Centre and Research Unit**

It is one of the few Research Unit established on its own by a DOH Hospital. It undertook research on the efficacy and applicability of various detoxification regimes in Myanmar

##### **2.2 Development of Standardized Questionnaires for use in Myanmar**

There is a need to develop standardized questionnaires, appropriate to the social, cultural and economic conditions in Myanmar, which will enable proper assessment of mental health of the community and psychological makeup and measurement of intelligence level (Intelligence quotient-IQ) of individuals in Myanmar. This is being done by various investigators/experts and expert groups for different purposes. These activities include the following:-

- (a) Myanmar Personality Inventory by Dr Sein Tu and others
- (b) Intelligence quotient (IQ) of Myanmar children by Psychologists of the Psychology Dept. of Yangon and Mandalay Universities.
- (c) Personality traits by Psychologists of Yangon and Mandalay Universities and Experts from the Officer Selection/Testing Team of the Defense Services
- (d) Myanmar Psychological Interview Schedule (MPIS) by Dr U Ne Win, Dr Yin Yin, Dr Thuta and Captain Ohn Hlaing
- (e) General Mental Health Questionnaire by Dr Ne Win and Professor U Thein Htay Pe

- (f) Check list for Specific Diseases – including Anxiety, Depression, Drug Dependence, Schizophrenia, Ah Narhmu (အားနာမှု) syndrome, Yaung Tat Te' (ယောင်တတ်တယ်), etc.
- (g) Psychiatric Nursing Assessment –including Psychiatric Nursing check list, Suicidal check list, Quality of life scale, etc.

**2.3 Community Surveys on Mental Health** – at Hlegu (1976), Sein Pan Myaing (1981), Dawpon (2004)

**2.4 Clinical Trials of Treatment Regimes** – including Dexamethasone suppression test in Depression, etc.

**2.5 Clinical Studies** – including Relation between Anxiety and Meditation, Stress management, etc.

**2.6 Descriptive Studies of Cases** – from the perspective of outcome, criminality, perception, treatment compliance, etc; in relation to HIV, AIDS, Tuberculosis; at Drug treatment Centers and elsewhere.

**2.7 Health Impact Studies** – to provide basic data for health planning – from community surveys and other studies including results of standard treatment for opiate dependence, alcohol dependence,

## **Section 7.15**

### **Vaccine Preventable Children Diseases & Other Diseases**

by **Aung Than Batu**

#### **A. Vaccine Preventable Children Diseases**

Much research has been done in past decades and already applied in ongoing health service program. Very little more research needed to be done.

#### **B. Other Diseases**

The DMR's, DOH, other Departments, and individuals undertake research projects ad hoc on various subjects.

As mentioned elsewhere DOH may carry out investigations and collect data as integral part of its many service programs, which when accumulated and analyzed become important new information for use in planning and evaluating the service programs. Some of these embedded research activities are given below.

#### **Cancer**

The Hospital Care Program includes research as one of the activities of the Cancer Control Project. A Cancer Registry has been established. It will carry out epidemiological research and plans to study the changing pattern of Cancer in Myanmar.

#### **Cardiovascular Diseases**

The Cardiovascular Diseases Control Project of the Hospital Care Program has conducted "NCD Risk Factor Survey in the Myanmar Population" in 2005, in Yangon in 2003, and among myocardial infarct cases in coronary care unit of hospital in 2003. It found that the average daily salt intake in Myanmar is still above the WHO recommended intake of 6 grams/day. A KAP study showed the community awareness of this to be 98%. A study in 2004 among urban and semi-urban school children revealed that 1:1000 had rheumatic heart disease and has shown a declining trend over past 5 years. It was found that penicillin prophylaxis was taken only by 50% for average of 7-10 months by those affected.

#### **Diabetes Mellitus**

In 2003-2004, the Prevention and Control of Diabetes mellitus Project of the Hospital Care Program of DOH undertook a survey on prevalence of Diabetes mellitus and prevalence of risk factors for major non-communicable diseases in rural and urban areas of Yangon, It was a collaborative effort between the Project and Nutrition Research Division of DMR (LM) using the WHO STEP approach. Over 4000 subjects aged 25-74 years were recruited for the study and using the standard oral glucose tolerance test it was found that the prevalence of Diabetes mellitus was 11.68 % in men and 12.81 % in women. More detailed studies of the prevalence were also carried out subsequently using various diagnostic procedures. Relative urban and rural prevalence and risk factors were also studied.

### **Accident Prevention Project**

The earliest epidemiological studies on road accidents and other accidents were done by BMRI in the 1960's and marked an important point in the development of epidemiological research in Myanmar- a new focus on non-communicable health problems in addition to traditional research on communicable diseases and nutrition. Although accidents and injuries ranked only 20 in the priority diseases listed in the National Health Plan 2006-2011, accidents, especially road accidents, drew the attention of many investigators and is the topic of study by post graduate students and the Departments of Surgery and Orthopedics. The Accident Prevention Project of DOH planned a national survey in 2007 and aims to study the accident pattern that varies from place to place and to develop new methods of accident prevention.

## Section 7.16

### Overview

by Aung Than Batu

#### (A) Evaluation of the Research Directed at Health Problems and Diseases

Research done on each of the major diseases/health problems was evaluated according to the criteria/characteristics given below:

##### 1. Type of research

**1.1 Biomedical research** – research using the principles and methods of the basic medical sciences such as biochemistry, microbiology, genetics, pharmacology, pathology, etc, to obtain new knowledge about causal factors, etiology and pathogenetic mechanism

**1.2 Clinical research** – research to obtain new knowledge about personal health when affected by disease - clinical features, diagnostic criteria, treatment effects; clinical studies, clinical surveys, clinical trials

**1.3 Public health research/Health systems research** – research to obtain new knowledge about the health of communities/ groups when affected by disease-about epidemiological, socio-economic and behavioral aspects; epidemiological surveys describing prevalence, incidence, time and place of occurrence, trends; effect of public health interventions.

##### 2. Level of research

Research to obtain new knowledge that will change or significantly influence decisions, action or practice at different management levels

**2.1 Strategic level** - research to generate knowledge that changes the direction of national health policy or national health program or strategy concerning the disease. See Tables [(a)(b)(c)(d)(e)] below for national health strategies against some of the principal diseases and health problems. Strategies for other diseases can be seen in National Health Plan (2006-2011).

**2.2 Operational level** - research to improve or change practice at operational level: to create or assess products (drugs, vaccines, diagnostics, devices, equipment including tools for public health, prosthetics, etc.) and interventions that cure or ameliorate the disease, reduce risk, duration or severity of an adverse health condition:-

- Public health intervention
- Personal health interventions

**3. Fundamental Research** - to generate knowledge of scientific significance about the disease

**4. Output** - knowledge contained in publications, reports, presentations  
- evidence-based health service programs and projects

**5. Outcome** - health impact  
- mortality, morbidity, prevalence, incidence, trends  
- change in clinical, public health, laboratory practice

## Evaluation 1

A score of (+) to (+++++) was given *arbitrarily*, according to the criteria/ characteristics of the research, for the quantity and quality of research done on each of the major disease (*see Table 1*)

*Biomedical research* – the scope and volume of biomedical research done on DHF and viral hepatitis was large and of high quality, using advanced molecular and genetic methods and techniques such as genetic sequencing and cloning of the virus. Some biomedical studies were done on malaria and gastrointestinal diseases (GI), Reproductive health, snake bite, hematological disorders, and some other diseases but none on leprosy, tuberculosis, nutrition and environmental health (Env Hlth) and accidents (Accid).

*Clinical research* – the scope and volume of clinical research ranged from large to small for most of the diseases and problems; none was done for leprosy.

*Public health research/HSR*- the scope, volume of public health research/HSR was large for many of the diseases and health problems and relatively smaller for AIDS, hematological disorders, leprosy and cancer.

*Strategic research* – the research done was not at the strategic level for many of the diseases and health problems - even though research may have been extensive. This is because strategic decisions and actions have already been taken which are based on general public health principles and practice as well as on scientific evidence provided by past research. This is the case for control strategies in diarrhea, goiter, tuberculosis, reproductive health, hematological disorders; or because the disease may no longer be of public health concern due to eradication activities and no longer require strategic decisions, as in the case of leprosy and Iodine deficiency disorders (IDD).

Research of strategic importance was done with respect to malaria, viral hepatitis and snakebite.

With respect to *malaria*, considerable research on drug resistant malaria and Artemisinin combination therapy (ACT) influenced national drug policy; and research on Insecticide treated bed-nets influenced overall strategy for malaria control.

National policy with respect to *HBV vaccination* was influenced by technology transfer and developmental research leading to production of Hepatitis B vaccine on a commercial scale in Myanmar.

Developmental research on production of effective *antiserum against viper venom (ASV)* in goats and in chicken eggs influenced changes in the manufacture of anti-serum against viper venom by the pharmaceutical industry in Myanmar.

*Operational research* – a large volume of research to improve or change practice and create or assess products and interventions was done for most of the diseases and health problems but only to a small extent in leprosy which was already eliminated as a public health problem.

*Fundamental research* – Some of the research about genetic diversity of Dengue virus. Hepatitis C virus and mechanism of Chloroquine resistance by *P. falciparum* may be regarded as fundamental research. (*see Chapter 7 section 7.1, 7.3 and 7.5*)

*Output* – was large to small for most of the diseases and health problems.

*Outcome*- the impact of knowledge and evidence from research cannot be separated from other factors such as provision of adequate resources, transfer of technology, etc. Nevertheless reduction of disease burden –in some indicators such as mortality, morbidity, prevalence, incidence, case-fatality rates – can be seen in malaria, diarrhea, nutritional disorders, reproductive health, snake bite and part of this may be contributed by research. Leprosy is already eliminated as a public health concern.

Improvements or change of clinical, public health and laboratory practice can be seen in most of the diseases and part of this may be attributable to research. Such effects are large in malaria and nutrition. Recent availability of new technology such as endoscopy and ultrasound stimulated new research which led to changes in clinical practice.

## **Evaluation 2**

A score of (+) to (+++++) was given *arbitrarily*, according to the criteria/ characteristics of the research, for the quantity and quality of research done by *different organizations* doing health research alone or in various combinations – research institutions (the DMR's), academic institutions (the Universities of Medicine and other Universities), service organizations (DOH and others), research organizations related to Industry (MSTRD, CRDC/DCPT) (*see Table 2*)

*Biomedical research* – was done mostly by the DMR's

*Clinical research* – was done by all health organizations but not by industrial research organizations.

*Public health research/HSR* – was mostly done by the health organization but not by industrial research organizations. Such research was done extensively by DOH alone or together with DMR's. Some were also done by other Government departments

*Strategic research* – some strategic level research was done by DMR alone and together with DOH. The strategic research detailed in Evaluation 1 above was done by DMR with DOH.

*Operational research* – many such research were done by all organizations, mostly by DOH and DMR's. MSTRD and CRDC also did considerable amount of developmental research concerning traditional medicinal herbs and food technology research.

*Fundamental research* – there were only a few instances and these were done by DMR. (*see Evaluation 1*)

*Output* – The output was large; the number of publications by all organization was many times more than during previous decades.

*Outcome* – the impact of research on disease burden as shown by mortality and morbidity data is attributable partly to collaborative research by DOH and DMR (see Evaluation 1) Research by others may of course indirectly influence these indicators. The outcome of research by organizations with different missions such as Sports and Fitness will be shown by different indicators. Changes in clinical, public health and laboratory practice are partly attributable to research done by all organization but principally to collaborative research between DOH & DMR's and DOH & Academic institutions.

*(It should be noted that the evaluation and scoring used is subjective and arbitrary but based on the authors review of the publications cited in this section and in other chapters and also on personal knowledge of past and present research in Myanmar; other knowledgeable persons may perhaps differ)*

*[Research Output-'To measure quantitatively the output of the research effort, especially in the medical field, is extremely difficult since they cannot be evaluated by the market mechanism. Many people have measured the scientific output by the output of papers, by means of citation analysis. But here, there is the obvious difficulty of differences in the quality of papers. Some aver that the output of sciences is knowledge but economists would have it that the yield of a unit of money spent in scientific research depends to a large extent on the effectiveness with which it output is used. Most medical research however is goal oriented. It should produce results providing better understanding of pathophysiological*

*processes; improved diagnostic techniques, more effective therapy and better prophylactic measures. We should therefore measure the effectiveness of our output by these criteria.]*

*(Extract from "The climate of medical research in Burma today" by Mya Tu in Union of Burma Journal of .Life Science 1973; 6:13-25)*

**Table (a) Malaria Control Strategy**

1.	Information, Education & Communication regarding malaria down to grass root level
2.	Prevention, mainly emphasize on personal protection & environmental measures including selective spraying
3.	Prevention, early detection and control of epidemics
4.	Early diagnosis and appropriate treatment
5.	Intersectoral collaboration
6.	Community involvement
7.	Capability strengthening of Health staff
8.	Operational research

*(From National Health Plan 2006-2011, National Malaria Control Project)*

**Table (b) AIDS Control Strategies**

*(From NHP 2006-2011 National AIDS and STD Control Project)*

1.	Advocacy to various authorities, partners and groups
2.	HIV and STD prevention education
3.	Targeted interventions-reducing HIV-related risk, vulnerability and impact among various population groups
4.	Care and treatment of STD patients and People Living with HIV/AIDS (PLWHA)
5.	Program management and support including monitoring and supervision
6.	Capacity building including Health system development

**Table (c) National Tuberculosis Control Strategies**

*(From NHP 2006-2011 National Tuberculosis Project)*

1.	Intensification of health educational activities including multimedia to increase community awareness about TB
2.	BCG immunization to all under one year children
3.	Early case detection through direct sputum microscopy of chest symptomatic patients attending health services and also contact tracing
4.	Implementing Directly Observed Treatment (DOT) down to grass root level
5.	Regular supervision and monitoring of NTP activities at all levels

**Table (d) Nutrition Development Strategies**

1.	Community involvement in nutrition activities
2.	Nutrient supplementation-vitamin A, iron
3.	Food fortification-iodized salt. Research to fortify food with Iron and vitamin A will be done
4.	Nutrition education
5.	Integrated de-worming
6.	Vitamin B1 Surveillance System
7.	Supervision and Monitoring
8.	Intersectoral co-operation
9.	Collaboration with UN Agencies, INGO's, NGO's-WHO, UNICEF, ICCIDD.

*(From NHP 2006-2011 Nutrition Development Project)*

**Table (e) Snake bite Control Strategies**

*(From NHP 2006-2011 Snake bite control project)*

1.	Health education, training for first aid
2.	Selective destruction of poisonous snakes without upsetting ecology
3.	Ensuring adequate and improved supply of anti-venom
4.	Making peritoneal dialysis available in township hospitals in epidemic areas
5.	ensure adequate distribution of anti-venom

**(B) Analyzing the burden of the health problems to identify research needs**

*(from Investing in Health Research & Development, WHO, 1996)*

Diseases /health problems and research needs in Myanmar may be classified according to the following scheme:

1. Averted/avoided by current mix of interventions and population coverage  
***May require advocacy by the health professionals for policy decisions to implement***
2. Avertable/avoidable by current mix of interventions with improved efficiency  
***Requires research on health systems and policies***
3. Avertable/avoidable by existing but non-cost-effective interventions  
**Requires biomedical research and development to reduce the cost of existing interventions**  
***(OR)***  
***Identify new cost effective interventions***
4. Unavertable/unavoidable with existing interventions  
***Requires biomedical research and development to identify new interventions***

*(Interventions mean combination of products, algorithms, information or policies that reduce the risk, duration or severity of an adverse health condition)*

*(Products mean drugs, vaccines, equipment, including tools for public health, prosthesis and diagnostics)*

**Analysis (see Table 3)**

*Analysis was done subjectively on the basis of priority ranking in National Health Plan and on the subjective perception of whether the disease or health problem persists because of (a) lack of knowledge about the disease and its determinants (b) lack tools (c) failure to use the existing tools efficiently (d) because the available tools are unaffordable or not cost effective.*

It is concluded that the burden of the major national health problems and diseases –

- (1) Can be averted/avoided by existing but non-cost-effective or unaffordable interventions in some diseases -which are:-

Malaria, Dengue hemorrhagic fever, Viral hepatitis B, Tuberculosis, Diarrhoea/ Dysentery, some Vaccine preventable diseases, Malnutrition, Diseases of Pregnancy and Childbirth, Snake bite, some cancers such as liver cancer due to persistent Hepatitis B infection and cancer cervix due to oncogenic HPV virus infection.

The *research required* would be health policy research to generate ideas for policy changes that would bring more resources for the existing interventions; or socio-economic research which would generate schemes that would bring more resources for the interventions; research on health systems (HSR) to reduce the cost of existing interventions; or biomedical research to identify, create and assess likely cost effective interventions

- (2) Cannot be averted/avoided by existing interventions- (even if affordable) in some diseases, as in the case of most cancers in Myanmar ,inherited red cell disorders and other genetic diseases, and some environmental health problems.

The *research required* is biomedical research and development to identify new interventions or research in other scientific fields.

**(C) Achievements and Missed Opportunities in Research Directed at Health Problems**

- What had medical/health research achieved during the last two decades?
- The output was large but what is the outcome?
- What opportunities were missed - missed opportunities that would have added more to the outcome if instead they had been carried out?
- What would be the health situation now if no health research had been done in Myanmar during the last two decades?
- What changes in the health situation had taken place and how much of this could be attributed to health research in Myanmar?
- What would have happened or not happened with respect to the people's health if no research had been done?

The following are some achievements and non-achievements:

**Malaria** – mortality and morbidity rates reported by DOH have decreased and show a downward trend and part of this is attributable to malaria research.

Recent research did not change the malaria control strategy which had been developed during the past years. However, some of the strategies for Malaria Control (according to NHP 2006-2011) would have been difficult, delayed or not possible without the recent and continuing research on malaria.

One of the main malaria control strategies is '*Early detection and appropriate treatment*' and supportive research includes (a) extensive studies of drug resistance such as

monitoring the spread and degree of resistance to various drugs including Artemisinin derivatives and combinations; clinical efficacy studies and clinical trials of various drug regimes (b) Case management studies such as trials of various anti-malarial drugs and treatment regimes for severe complicated malaria (c ) Studies of Immuno-chromatographic tests(ICT) for rapid diagnosis of malaria.

With respect to the strategy of '*Prevention –personal and environmental* ' the major component was (d) use of Insecticide treated bed nets (ITN) and a controlled trial of this was conducted which gave important results for malaria control.

Regarding the strategy of '*Information, education and communication regarding malaria to grass root levels*' (e) socioeconomic and behavioral aspects of malaria were studied using quantitative and qualitative methods as well as participatory action methods. (see section 7.2)

**Dengue Hemorrhagic Fever--**Much of the research which influenced clinical and public health practice regarding DHF was done in the 1970's and 1980's decades.

A very important study of scientific and practical significance was the five year prospective clinical, epidemiological and virological study which was undertaken in two townships of Yangon (during 1984 to 1988), to determine risk factors (epidemiological and virological) in dengue shock syndrome (DSS). This is the only study up to then (apart from earlier Thai study), that provided valid scientific evidence that risk of developing DSS is significantly higher in secondary dengue infections, particularly with dengue serotype 2. Recent research (of the past two decades) did not add significant improvements to clinical and public health practice. Most of the recent research only produced further evidence supporting current practice.

Molecular epidemiology studies in recent years have implications for future development of dengue vaccines but does not affect current practice.(see section 7.3)

**Viral Hepatitis** - ranks 8<sup>th</sup> in priority in the National Health Plan 2006- 2011. The implied strategy for control, past and present, is prevention of horizontal and vertical transmission. Recent research does not substantially change this strategy but adds another virus, Hepatitis C virus (HCV) as etiological agent of chronic liver disease that could lead to cancer liver (hepatoma).

**Leprosy** – was eliminated as a public health problem in 2003 and all the contributions by research to this success were made many years ago in the 1980's and research during recent years did not add much.

**Snake Bite** - snake bite control strategy includes ensuring adequate, improved supply and distribution of anti-venom; this strategy will become more feasible because of recent research on production of viper anti venom from chicken eggs. The strategy of health education and training for first aid is strengthened by recent research and demonstration of the pressure-immobilization technique of bandaging the snake bite site as first aid measure.

Missed Opportunity- is the failure to generate intervention that protect from the devastating consequences of viper bites and other snake bites at affordable cost.

Although it is difficult in many cases to separate the lapses on the part of medical/health research from policy lapses and managerial and resource inadequacies, the following may be regarded as a failure and missed opportunity by medical/health research:

The missed opportunity regarding snakebite research is described fully in Chapter 7, Section 7.11 (Part B)

- (a) It is the failure to do a Demonstration & Pilot study of Snake bite control in a Model township to show that if all mix of interventions already available but fragmented (antiserum, protective devices like boots, first aid with compression bandage, health education, community participation and back-up secondary and tertiary medical care) are all applied together, death due to Viper bites can be prevented. Such demonstration in a model township can later be replicated elsewhere and also serve as strong advocacy for increased resources for snake bite control and snake bite research.
- (b) Viper Venom Toxoid - Failure or inability of medical researchers to develop an effective, stable Viper Venom Toxoid was a missed opportunity or a failure.
- (c) Viper anti-venom from chicken eggs - as an alternative, more affordable source is being developed since 2007 at DMR (LM) and demonstrated to be immunogenic, safe and effective in experimental animals and human subjects by clinical trials. Further research is being pursued to produce it on a larger scale. Resources are limited and inability to provide all out support in time may become a missed opportunity.

CHAPTER 7 RESEARCH AREAS AND PROGRAMS DIRECTED AT HEALTH PROBLEMS AND DISEASES

**Table – 1 Evaluation of Research**

Criteria/ Characteristic	Malaria	AIDS	TB	DHF	VH	GI	Lepro- sy	Vaccine Preven- table diseases	Nutri- tion	Repro- ductive Health	Snake bite	Hemat	Accid	Env Hlth	Can- cer	All
1. Types of Research																
1.1 <u>Biomedical Research</u>	++	+	-	+++	+++	++	-	+	-	++	++	++	-	-	-	++
1.2 <u>Clinical</u>	+++ ++	+	+++	++ ++	++ ++	++	-	++	++	+++	+++	+++	+	+	++	+++
1.3 <u>Public Health Research</u>	+++ ++	++	+++	++ ++	++ ++	+++	++	+++	+++ +	+++	+++	+++	+	++	+	+++ ++
1.3 <u>Health Systems Research</u>																
2. Level																
2.1 <u>Strategic Level</u>	++	-	-	-	+	+	-		-	-	+	-	-	-	-	+
2.2 <u>Operational Level</u>	+++ ++	++	+++	++ ++	+++	+++	-	++	+++	+++	+++	+++	++	++	++	+++ ++
3. <u>Fundamental Research</u>	+	-	-	+	+	-	-		-	-	-	-	-	-	-	+
4. Output	+++ ++	++	+++	++ ++	+++	++	++	++	++ ++	+++	++ ++	+++	++	-	-	++ ++
5. Outcome																
<u>Burden of disease indicators</u>	+++	+	+	+	+	++	-	++	+++	++	+	+	-	-	-	++
<u>Change clinical, public health, laboratory practice</u>																

CHAPTER 7 RESEARCH AREAS AND PROGRAMS DIRECTED AT HEALTH PROBLEMS  
AND DISEASES

**Table – 2 Evaluation of Research**

	Res Insti DMR	Acad Insti UM+others	Ser Dept DOH+ others	Industry health related research	Combinatons		
					Res+Ser	Acad+Ser	Res+Acad
1. Types of Research							
1.1 <u>Biomedical Research</u>	+++	+	+	-	+	+	+
1.2 <u>Clinical</u>	++	++	++	-	+++	+++	+++
1.3 <u>Public Health Research</u>							
<u>Health Systems Research</u>	++	++	+++++	-	+++++	+++	+++
2. Level							
2.1 <u>Strategic Level</u>	+	-		-	++		
2.2 <u>Operational Level</u>	+++	++	++	+	++++	++	-
3. Fundamental Research	+	-	-	-	-	-	-
4. <u>Output</u>	++++	++++	++++	+	++++	++++	++++
5. Outcome							
5.1 <u>Burden of disease indicators</u>	-	-	-	-	++	+	-
5.2 <u>Change clinical, public health, laboratory practice</u>	++	++	++	-	+++	++	++

**Table – 3 Analyzing to burden of a health problem to identify research needs (from investing in health research and development. WHO 1996)**

**Analysis according to priority health problem in Myanmar**

	Ma-laria	AIDS	TB	DHF	VH	GI	Lepro-sy	Vaccine Preventable diseases	Nutrition	Repro-ductive Hlth	Snake bite	Hemat	Accid	Env Hlth	Cancer	All
1. Averted with current mix of interventions and population coverage  (effective-no research required) Advocacy	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
2. Avertable with improved efficiency  (Research on health systems and policy)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
3. Avertable with existing but non-cost- effective interventions)  (Biomedical research and development to reduce the cost of existing interventions)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	
4. Unavertable with existing interventions.  (Biomedical research and development to identify new interventions)	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	

Y= Yes, N=No



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## Section 8.1

### Developments in Clinical Research

by Aung Than Batu

Clinical research done in Myanmar falls under several categories –

1. Firstly – clinical research done as research projects required for academic degrees/diplomas conferred by Universities of Medicine and other Health Universities and undertaken as part of post-graduate teaching programs.
2. Secondly – clinical research done by Departments of Medical Research (DMR's) as part of their research programs on a number of priority diseases.
3. Thirdly – clinical research done as integral component of service programs of Department of Health (DOH), Ministry of Health and Directorate of Medical Services (DMS), Ministry of Defence .
4. Lastly – clinical research done ad-hoc by Non-governmental organizations (NGO's) and individual clinicians on diverse clinical problems

#### 1. **Clinical research as component of post-graduate teaching programs of Universities of Medicine and other Health Universities**

Clinical research is done as requirement for many academic degrees/diplomas in medicine or nursing (masters and doctorates). Such research is about clinical and laboratory features of disease, diagnostic methods treatment modalities, causal factors, disease mechanism - which although mostly known elsewhere before, are nevertheless studied when they became known or introduced and made available in the country- in order to find out their applicability and usefulness under local conditions and to acquire experience in their use. (*see also G&D Med. Res., pages 210, 228*)

The volume and variety of the research topics have multiplied many times because of the opening up of many new postgraduate courses in the increasing number of Universities of Medicine (formerly Institutes of Medicine), the University of Nursing and University of Public Health and other health related Universities, attracting many more post-graduate students to do clinical research., which is done at the many Teaching Hospitals which now exist – in general wards and out patients clinics as well as in the many different specialty and subspecialty units opened since the 1990's. Some may be done elsewhere in peripheral hospitals and clinics and a few in private hospitals and clinics.

During the decades since 1986 large advances in medical technology, diagnostic methods and treatment modalities became available for clinical use and clinical research in the Teaching Hospitals of the Universities. (*see Category 3, Clinical research as component of service programs of DOH and DMS below*)

The range of research subjects is wide reflecting the diverse clinical problems being encountered in the teaching hospitals and the interest of the teachers and postgraduate students.

Many research projects are problem-orientated and ad-hoc:- seeking to describe clinical conditions in the local setting, understand underlying causes and find solutions to common clinical problems like abortion, surgical wound infection, aplastic anaemia, non-alcoholic liver disease, hepatocellular carcinoma, neonatal hypothyroidism, etc.

Many research projects are technology-driven:- undertaken when a new technology, method, or test is introduced or becomes available, leading to a series of interlinked studies about its applicability, usefulness, reliability and sometimes sensitivity, specificity, cost-

effectiveness, in different diseases in different clinical situations. Examples are: CT scan and MRI of different organs to detect disease and abnormalities; monitoring of fetal condition by cardiotocography (CTG) in different obstetrical situations; measurement of fibrin-degradation-products (FDP) in different pediatric conditions like nephrotic syndrome, DHF, Meningitis; fine needle aspiration cytology (FNAC) for breast lumps, goiter, and renal masses etc. (*see Category 3, Clinical research as component of service programs of DOH, DMS below*).

About 500 titles of research projects carried out at Universities of Medicine 1, 2 (Yangon) and University of Medicine (Mandalay) and published as MSc and DrMedSc Thesis (2002-2011) were collected, scrutinized and classified according to the scheme used by the School of Public Health, University of Michigan, 1991. The distribution of these various Types of Clinical Research according to clinical disciplines (Medicine, Obst & Gynae, Pediatrics, Surgery) and according to the 3 Universities (UM1, Um2 UMM) and for all 500 titles is shown in Tables 1, 2, and 3. For comparison research projects done by DMR (2002-2011) were also similarly classified and shown in Table 1.

It may be seen that approximately 20% to 30% of the MSc and DrMedSc theses were about clinical features, treatment effects and clinical trials; 6% about hypothesis generation, 5 % about causal factors in disease, and 1% was about other categories of research such as cost benefit, definition of disease, etc. The distribution of the different Types of Clinical Research as seen in Tables 1,2,3 is generally similar in the 3 Universities and in DMR but there were some differences between the different disciplines, Surgery doing more studies of treatment effects than the others.

Table 1. Types of Clinical Research

Type of clinical research	MMEDSC. Thesis (2002-2011)§ (n = 1296)		DRMEDSC Thesis (2002-2011) § (n = 235)		Research papers (DMR scientists) (n = 133)	
	No.	%	No.	%	No.	%
1. Clinical studies; clinical investigations, clinical surveys concerning						
1.1 Clinical and laboratory features of disease; natural history of disease	475	36.7	25	10.6	49	36.8
1.2 Causal factors in disease	63	4.9	9	3.8	5	3.8
1.3 Treatment effects	276	21.3	75	31.9	21	15.8
1.4 Definition of disease syndrome/entity, case definition	9	0.7	1	0.4	2	1.5
1.5 Diagnostic criteria and methods	157	12.1	29	12.3	13	9.8
1.6 Distribution of syndrome or entity in time, place, person	17	1.3	1	0.4	17	12.8
1.7 Hypothesis generation about etiology or new therapy	74	5.7	23	9.8	1	.8
2. Clinical trials-comparison of treatment modality to establish efficacy, dose level, side effects	207	16.0	71	30.2	22	16.5
3. Institutional epidemiology; post marketing surveillance	-	-	-	-	-	-
4. Cost benefit analysis:technology assessment to determine efficiency, secondary impact on health care, manpower, financing, institution	1	0.1	-	-	3	2.3
5. Biomathematical modeling			-	-	-	-
6. Disease burden & quality of life	17	1.3	1	0.4	-	-

§ 2011 data not available from University of Medicine (Mandalay)

[\*From List of MSc and Dr Med Sc Thesis of Clinical Disciplines, University of Medicine 1 and 2, Yangon and University of Medicine Mandalay (Source: Libraries of Universities of Medicine 1 and 2 (Ygn) and Mandalay) .# List of research papers by DMR scientists (Source: Program and Abstracts of Health Research Congress -2002 to 2011) Titles of papers were scrutinized and classified by Khin Thet Wai, Director, DMR (LM)]

Table 2 &amp; 3

Type	CATEGORY								Total	
	MEDICINE		OBGYN		PAEDIATRICS		SURGERY		No.	%
	No.	%	No.	%	No.	%	No.	%		
Features & natural history	191	37.2%	29	17.9%	90	54.2%	190	27.6%	500	32.7%
Causal factors	26	5.1%	14	8.6%	11	6.6%	21	3.0%	72	4.7%
Treatment effects	96	18.7%	31	19.1%	15	9.0%	209	30.3%	351	22.9%
Def disease syndrome	5	1.0%	2	1.2%	3	1.8%	0	0.0%	10	0.7%
Diagnostic	77	15.0%	26	16.0%	30	18.1%	53	7.7%	186	12.1%
Distribution syndrome	11	2.1%	2	1.2%	2	1.2%	3	0.4%	18	1.2%
Hypothesis generation	48	9.3%	20	12.3%	11	6.6%	18	2.6%	97	6.3%
Clinical trials	42	8.2%	38	23.5%	4	2.4%	194	28.2%	278	18.2%
Cost benefit	0	0.0%	0	0.0%	0	0.0%	1	0.1%	1	0.1%
Burden & QOL	18	3.5%	0	0.0%	0	0.0%	0	0.0%	18	1.2%
Total	514	100.0%	162	100.0%	166	100.0%	689	100.0%	1531	100.0%

Type	UNIVERSITY						Total	
	UM1		UM2		UMM		No.	%
	No.	%	No.	%	No.	%		
Features & natural history	276	32.4%	135	37.1%	89	28.3%	500	32.7%
Causal factors	37	4.3%	13	3.6%	22	7.0%	72	4.7%
Treatment effects	219	25.7%	63	17.3%	69	21.9%	351	22.9%
Def disease syndrome	3	0.4%	3	0.8%	4	1.3%	10	0.7%
Diagnostic	81	9.5%	56	15.4%	49	15.6%	186	12.1%
Distribution syndrome	12	1.4%	2	0.5%	4	1.3%	18	1.2%
Hypothesis generation	47	5.5%	28	7.7%	22	7.0%	97	6.3%
Clinical trials	161	18.9%	62	17.0%	55	17.5%	278	18.2%
Cost benefit	0	0.0%	1	0.3%	0	0.0%	1	0.1%
Burden & QOL	16	1.9%	1	0.3%	1	0.3%	18	1.2%
Total	852	100.0%	364	100.0%	315	100.0%	1531	100.0%

[From List of MSc and Dr Med Sc Thesis of Clinical Disciplines, University of Medicine 1 and 2, Yangon and University of Medicine Mandalay (Source: Library of Universities of Medicine 1 and 2 and University of Medicine, Mandalay) Titles of papers were scrutinized and classified by Khin Thet Wai, Director, DMR(LM)]

## 2. Clinical Research at Departments of Medical Research

The next category of clinical research is that undertaken by research institutions – The Departments of Medical Research, (Lower, Upper and Central Myanmar). They carry out research programs on priority health problems included in the Health Research Program of successive National Health Plans.

Most of this is done in teaching hospitals and clinics, some in the Clinical Research Units set up by DMR (LM) and a few others elsewhere in peripheral hospitals, private hospitals and clinics. .

These researches are also about clinical and laboratory features of diseases, diagnostic methods, treatment modalities, causal factors, and disease mechanism but with more emphasis on causal factors, disease mechanism and clinical trials and are carried out at teaching hospitals, state/division hospitals, township hospitals or field clinics. (*See Table 1*)

The research projects are problem-oriented, coordinated, cohesive, and many are part of long standing research programs such as on snake-bite, DHF; new programs have been added including research on tuberculosis and AIDS, etc. The research projects are backed up by the excellent research facilities of DMR including good research infrastructure, know-how and advanced technologies available at basic biomedical research divisions like Immunology, Pathology, Parasitology, etc.

Such advanced technologies included PCR, etc. .

Some of the research projects by postgraduates attached to DMR's become part of the priority health research programs of DMR's

## 3. Clinical research as component of service programs of Department of Health (Ministry of Health) and Directorate of Medical Services (Defence Ministry)

The DOH executes a large number of service programs and projects as included in successive National Health Plans many of which explicitly mention the research component such as:-

Community Health Care Program, Disease Control Program, Health System Development Program, Development of Myanmar Traditional Medicine Program. In many others the research component is implicit in the service projects of Programs and although the research component is usually public health research or health system research it may include a clinical research element as well such as in Snake-bite control project and the DHF control project of the Hospital Care Program..

During the decades since 1986 large advances in medical technology, diagnostic methods and treatment modalities became available for clinical use and clinical research in the Teaching Hospitals of the Universities. Large resources have been put into the Teaching hospitals by DOH under the Hospital Care Program of DOH which has benefitted service and teaching as well as clinical research in the clinical departments of the teaching hospitals. Also, twinning arrangements between some clinical units and Universities abroad have brought in many advanced technologies and enhanced knowledge and skills in specialized fields. Examples are: twinning between Orthopedic Hospital in Yangon (Kyeemyin daing) and the University of France; twinning between the Neurology Unit and University of Edinburgh. Clinical research projects by postgraduates under the teaching programs of the Universities were able to make use of these advanced clinical facilities for their research projects.

A broad outline of the advances are as follows: -

- (a) imaging techniques such as ultrasonography, computerized tomography (CT.Scan), magnetic resonance imaging (MRI), contrast studies of various organs including the vasculature.
- (b) such as better methods of visualizing internal organs with endoscopy, with miniature video-cameras, of the gastro-intestinal tract including the biliary system (ERCP); urogenital system including bladder, ureters, kidney pelvis; uterus, salphinx tubes; nasopharynx; bronchial tree.
- (c) better assessment of organ function – of the heart, such as by echocardiography, coronary angiography, early detection and measurement of cardiac enzymes; of the kidney function such as by measurement of glomerular filtration rate (GFR), micro-albuminuria; of endocrine glands by chemical assay, and radioimmunoassay of hormone levels; monitoring of respiratory function during sleep apnoea; monitoring of fetal function during childbirth by, cardiotocography (CTG), etc
- (d) better methods of disease classification, staging, indexing based on clinical histological or other findings.
- (e) replacement or repair of organ or organ parts such as eye lens, joints, kidney, liver , bone-marrow ,hands, coronary arteries, other parts of the vasculature, bone-marrow.
- (f) substitution or supplementation of defective organ functions by methods such as hemodialysis, peritoneal dialysis, cardiac pacemakers.
- (g) a continuous stream of new drugs, drug-combinations and vaccines for prophylaxis or treatment.

The DMS (Defence Minsitry) also undertake a large volume of well organized clinical research programs relevant to the service needs of DMS, particular with respect to malaria, which is carried out at Clinical Research Units at DSGH and 2(MH) in parallel and in co-ordination with epidemiological research. Other lesser clinical research projects concerning communicable disease such as scrub typhus are also being undertaken. All these researches are carried out at the Teaching hospitals of the Defense Academy of Medicine:- Defense Services General Hospital (DSGH), Mingaladon, No 2 Military Hospital (2MH)Yangon and at other principal service hospitals at Pyin Oo Lwin, etc. Resource inputs has enhanced the clinical capabilities of DSGH and 2 MH with opening of new clinical units like Cardiology and large increases in human resources with high qualification. Twinning arrangements between DSGH and the University of Singapore have added to the clinical expertise and skills at DSGH particularly in Cardiology and Cardiac Surgery .Being also teaching hospitals of the Defense Academy of Medicine they were made use of for clinical research projects under the postgraduate teaching programs.

The volume of such research during the 1990's onwards, in continuation of those done in the 1970's, 1980's, is very large. The utility, relevance and scientific value of these researches on malaria at DMS is noteworthy and mentioned also elsewhere under different headings.

#### **4. Clinical Research Elsewhere by Non-governmental Organizations and Individuals**

The Myanmar Medical Association (MMA) ,the Myanmar Nursing Association (MNA) and other NGO's – undertake several research programs and projects independently on diseases and health conditions of national importance such as malaria, AIDS, etc most of which are HSR but sometimes include a clinical research element.

Some individual TMO's, General Practitioners and Specialists sometimes investigate and report cases of rare diseases or unusual manifestation of common diseases, useful

adaptation of standard procedures, operative techniques and operational research regarding current clinical practice. They are useful for other clinicians or for health managers even though done under routine service, practical conditions with limited resources. Some of the adaptations are very useful and cost effective like the intermediate technologies reported from Jivitadana Sangha Hospital such as nebulizer pump made from local material at low cost.

## 5. The Organization of Clinical Research

Clinical research is loosely organized at the different institutions.

At the DMR's – which are small organizations, clinical research as such is organized and coordinated loosely in a system of research groups/committee, mostly at scientist level and serves the purpose.

One mechanism by means of which DMR carries out its mission of promoting research is by setting up Research Units elsewhere and Clinical Research Units at Hospitals (*see page 102 G&D Med.Res.Volume 1*) which DMR has done since the 1970's (*see page 224 G&D Med.Res. Volume 1*).

There are now eight Clinical Research Units (CRU) and one Research Unit already established :

- (1) CRU for Malaria at DSGH - established since the 1970's
- (2) CRU for Malaria at 2 (M.H.) - established since the 1970's
- (3) CRU for Malaria at NOGH
- (4) CRU for snake bite - established since the 1970's in Tharawaddy Township hospital and now relocated at YGH
- (5) CRU for Traditional Medicine - established since the 1970's within DMR and now relocated at Trad. Med Hosp
- (6) CRU for Blood Diseases at Children's Hospital, Ygn
- (7) CRU for HIV at Wai-bagi Hospital
- (8) CRU for Cancer at YGH
- (9) Research Unit at University of Medicine 2

CRU's in Teaching Hospitals as above are well organized with a research agenda and a minimal budget in Kyats provided by DMR .They have visibility and recognition as CRU of DMR and may, if necessary, desirous and competent, procure additional support as Research Grants, Research Training Fellowships, or even long term Institutional Grants of their own, by open competition, from international agencies like WHO, TDR, UNDP, CIDA, etc. CRU at DSGH has done this but very few others have done likewise.

According to DMR's institutional policy of promoting research elsewhere it may be possible, if resources are available, for more Research Units and Clinical Research Units to be designated and set up, especially at pre-clinical teaching departments of Universities of Medicine where research infrastructure , particularly laboratory facilities, is weak and needs strengthening, provided of course that they are willing and able to satisfy DMR's pre-requisite for establishment of a Research Unit/ Clinical Research Unit - such as a coherent, sustainable research agenda and plan.

Clinical research (other than at CRU's) at clinical teaching departments of Teaching hospitals of the University/DOH is organized ad-hoc. Arrangement for collaboration and support are improvised and short term. Some clinical units ( although not designated CRU's of DMR) such as the Clinical Hematology Unit of YGH or the Drug Dependency Treatment and Research Unit of the Mental Hospital (Yangon) may nevertheless have a short or medium term research agenda, but many others have no such cohesive plan of research.

### Relevance and Utility

All clinical research done appears to be relevant to health problems in the country, some directly and many indirectly and remotely. In fact, it is difficult to find one which is not relevant. Clinical research that is designed to contribute towards theoretical knowledge of a subject is rare. One at least was found pertaining to hypothesis-generation. The study of “Risk factors in Dengue Shock Syndrome”, 1997 at the Children’s, Hospital, Yangon confirmed independently and importantly the hypothesis formulated elsewhere that DSS was caused by sequential infection, still controversial then, and that the risk of developing DSS was highest in those experiencing an anamnestic infection particularly if the most recent infection is due to Dengue 2.

A large number of clinical studies were directly useful to clinical practice in priority health problems – particularly on drug-resistant malaria, snake-bite, DHF, and a few in surgery such on injuries and trauma, particularly traffic related injuries. Examples are the demonstration that artesunate combination with quinine is more effective than either alone; the demonstration that the Dengue blot test has sensitivity of 96% specificity of 83%; the “Evaluation of predictors of shock DHF cases” at IM 1 and DMR showing by discriminant-analysis the high predictive value of certain clinical features and laboratory tests; “Role of early intravenous anti-venom in Management and outcome of Russell’s viper bite case” in 1997 by DMR, “Biliary colic in association with round worms” in 1999 at YGN and NYGH surgical wards.

Many however are not useful or of local restricted utility only and merely describe the clinical experience of the investigator in a limited situation and are either well known elsewhere before or not applicable. Random examples are: “Clinical study of Parkinsonism”, and “The study of infection in empyema thoracis”.

Most of the problem-oriented clinical research projects are directly useful to some extent in clinical practice or for health managers; whereas, as expected, a high proportion of the ad-hoc research projects have limited utility elsewhere but provides good clinical experience in the use of new technology and new tools and research training to the investigator, which also is an important aim of the postgraduate research training program.

### Clinical Research in the Specialties and Sub-Specialties

The above account is about Clinical Research from a broad perspective and generally applicable also to most specialties and subspecialties but with some difference in the emphasis given to types and methods of research according to the special aims and methods used in the particular specialty. (See Table 2)

*Clinical Research in Surgery-* Surgical research deals less or very little with top national medical problems which are communicable diseases like malaria, diarrhea and dysentery, leprosy, tuberculosis. Trauma and injury is one national health problem about which surgical research is being done. Cancer as an emerging national problem is of course within the scope of surgical research. Apart from clinical research interests common to all specialties like prevalence of disease and causation, pathogenesis and others, the type of clinical research which is special to surgical research (and Ob&Gyn) is the development and modifications of operative surgical techniques. More details about surgical research is given in Section 8.2

*Clinical Research in Pediatrics-* There is much commonalty between the subject/topics dealt with in pediatric and medical clinical research. The top priority national health problems such as malaria, diarrhoea, and tuberculosis, including the vaccine preventable diseases as well as red cell genetic disorders like thalassemia - are of common

research interest to Internal Medicine and Pediatrics. Etiology, genetics and pathogenetic mechanism of these diseases are investigated by both specialties. Neonatal clinical research may require more special techniques and technology as well as more emphasis on genetics and relationship to intrauterine and birth conditions.

*Clinical Research in Obstetrics & Gynecology* - A review of research in Reproductive Health was done in 1996. (see "Research in human reproductive health in Myanmar " in *DMR Bulletin Vol.10, No.2, April 1996*). Relevant portions on research in Obstetrics & Gynecology were extracted and included in G &D Med. Res). They are hospital based as well as community studies. The subjects and topics are similar to clinical research in Internal Medicine-such as infections (like malaria) and diseases of various organ systems (like hypertension, anemia, nephritis, peripheral neuropathy) during pregnancy. There is similarity with surgical research when studying child birth and obstetrical procedures. However there are also differences. The availability of special techniques, methods and introduction of new technology such as ultrasound for studying intra-abdominal and intrauterine conditions and for monitoring of fetal conditions such as by cardiotocography (CTG) have stimulated and enabled clinical research of a type which may be regarded as special to O&G.

*Clinical Research in the Subspecialties of Ophthalmology, Otorhinology, Radiology, Anaesthesiology* - Clinical research in these subspecialties are similar to research done in the Specialties and includes new operative techniques and newly introduced technology and devices such as lens, hearing devices, monitoring devices during anesthesia.



## Section 8.2

### (a) Surgical Research

by Maung Maung Sein

We have taken a sample from the Membership [Master of Medical Science (Surgery)] and Doctorate [Doctor of Med Science (Surgery)] dissertation/thesis as a representative segment of research during the period 1997-2005. A total of 122 papers during that period were sampled. These papers could be presented as:

A. around 1997	- total number of papers	26
B. around 1999-2000	- total number of papers	38
C. around 2003	- total number of papers	27
D. around 2005	- total number of papers	31
	<u>Total</u>	<u>122</u>

These papers have again been categorized in the following divisions for analytical purposes:

1. Clinical studies.....	56.56%
2. Diagnostics .....	15.57%
3. Treatment .....	25.41%
4. Instrument/Appliance .....	2.46%

It will be noticed that the way research being carried out in relation to medical problems met with in hospitals is distinctive from pure Basic Medical Science Research. In a way, it takes form as a short term investigation into finding answers for our daily clinical care problems.

Table. Showing data for analysis:

Period	Clinical study	Diagnosis	Treatment	Instrument appliances	Total
A 1997	16 M.Med Sc	3 M.Med Sc	6 MMed Sc	1 MMedSc	26
B 1999-2000	19 MMed Sc	11 MMed Sc	8 MMed Sc	0	38
C 2003	16 M 1DrMedSc	5 M	3 M 1 DrMedSc	1 MMedSc	27
D 2005	16 M 1DrMedSc	0	6 M 7 DrMedSc	1 MMedSc	31
Total	69 67 MMedSc 2 DrMedSc	19 19 M	31 23 MMedSc 8 DrMedSc	3 3 MMedSc	122 112 MMedSc 10 DrMedSc
Percentage	56.56%	15.57%	25.41%	2.46%	100%

Of a total of 122 papers sampled, there were 112 Mastership Dissertation and 10 Doctorate Thesis. The Masterships courses were opened in 1971 & the Doctorate courses began around 2003. The Master dissertation suffered a number of constraints of having to

finish the investigation in twelve months time; the next problem is the choice of the problem. A clinical study provided problems met with in the wards - a good source of material for record and study especially when other requirements like special chemical/drugs & appliance are not required. All of this has resulted in the number of clinical studies which amounted to 56.56 % of the total number of papers sampled. Similar reasons can be given to the study of treatment aspects (25.41%). Other constraints such as support of an animal house, a good supporting biochemical laboratory, provision for funds - are grey areas which need to be strengthened. The total number of candidates being taken in annually has been increasing. This is also an important point which should be considered with respect to our resources & the quality of our postgraduates.

In spite of these constraints it should be commented that some investigators were resourceful. We saw their use of bodies left over at forensic post mortems, the comparative study of different new surgical procedures on wound healings, the diagnostic reliability of results obtained from non-invasive applications and the utilization of private clinics in the clinical studies. In the diagnostic segments, the relation of our investigative piece of work to new instrument or appliances can be seen - as with the use of arthroscopy and magnetic resonance imaging techniques, etc.

In view of the unavailable constraints and our available limited resources, the amount of investigation work that has taken place, in our own small way, gives us some answers to our practical problems. This is something to be very proud of.

## **(b) Research in Surgery**

**by Ye Myint**

The need for research in surgery was well recognized by heads and professors of surgery as early as 1960. Under the guidance of Prof. U Kyi Paw, there were plans to set up an experimental surgery unit in RGH at some time in 1970 with an independent, motivated and capable surgeon as head of the unit. An animal lab was necessary to carry out experimental surgery. Though plans were laid and budgets allocated under the Institute of Medicine 1, there were difficulties in setting up an animal lab and hence this project did not materialize.

At this time two notable internationally recognized clinical researches were established. Firstly, Dr. U San Baw, well renowned orthopaedic surgeon from Mandalay General Hospital was studying on the use of Ivory Prosthesis in the treatment of Fracture neck of Femur in 1960s. His study was found to be useful and highly successful for the treatment and internationally recognized. He studied all aspects of ivory as an implant and presented his experience to UK, USA and Asia-Pacific region. Only because of the limited availability of Ivory and readily available commercially produced metallic implants limited the use of Ivory. Secondly, Prof. U MaungMaungSein during a research for his M.Ch degree, carried out a research on lympho-venous shunt in the treatment of intractable ascites in Liverpool. Intractable ascites is a common problem in Myanmar and hence his study was well recognized and appreciated.

As experimental surgery could not be performed, research in surgery was mainly on clinical research. It was carried out at surgical units of all medical institutes and their results published and presented at medical and surgical conferences. Later when post-graduate master courses started, research became part of the course. Research methodology training courses are given at the beginning of the course. Each student had to present a protocol, scrutinized by the academic board and the study was done for 1 – 1<sup>1/2</sup> years under a supervisor. Later when doctorate courses were started, a well prepared thesis was necessary

for final evaluation. The researches were mainly clinically oriented on common problems in surgery like surgical infections and wound infections, microbiology and antibiotic use, various aspects of surgical trauma and comparison of various surgical treatments. Various aspects of common surgical diseases like tuberculosis, cholelithiasis and cholangitis and malignant surgical diseases in general surgery as well as speciality surgeries. These studies were made with the help of other paraclinical departments as well as from medical research department. *(These books can be studied at the library of the respective medical institutes.)*

As the candidates already had experience in research methodology (during his M.Med.Sc training), their research quality improved, research facilities increased with abundant clinical materials and time, the output (thesis) is of acceptable standard. They will also be useful for patients care.

***Editorial Footnote***

***Clinical research in Surgery-*** *Surgical research deals less or very little with top national medical problems which are communicable diseases like malaria, diarrhea and dysentery, leprosy, tuberculosis. Trauma and injury is one national health problem about which surgical research is being done. Cancer as an emerging national problem is of course within the scope of surgical research. Apart from clinical research interests common to all specialties like prevalence of disease and causation, pathogenesis and others, the type of clinical research which is special to surgical research (and Ob&Gyn) is the development and modifications of operative surgical techniques.*



## **Section 8.3**

### **Clinical Research in Obstetrics and Gynaecology**

**by Katherine Ba Thike**

*(Acknowledgements: Prof Nan Oo and Prof Yin Yin Soe for their inputs)*

#### **National and International Context**

Obstetricians and gynecologists in Myanmar have carried out research on important and common issues in Obstetrics and Gynaecology since the days when clinical practice started in the earlier part of the twentieth century. The first reported study from those days is on amoebic vaginitis. However, subsequent clinical research studies were few and far between.

Obstetricians and gynaecologists (ob-gyns) continued to conduct hospital-based research on conditions that are commonly encountered in daily practice. The outcomes of the clinical investigations were presented at the annual conferences of the Department of Medical Research and Myanmar Medical Association. Some findings were published in the Burma Medical Journal.

The Obstetrics and Gynaecological Society co-ordinated the conduct of multi-centre studies in the nineteen-eighties. Data on maternal mortality and perinatal mortality was collected from all tertiary and teaching hospitals and Divisional Hospitals. The annual Obstetric and Gynaecological Society meetings provided an additional forum for presentation of hospital-based research findings.

The initiation of courses to confer the Masters degree in Obstetrics and Gynaecology (Ob Gyn) in 1972 led to an impetus to conduct research as a dissertation is required for partial fulfillment of the degree. The commencement of doctor programmes in 1997 increased the scope and magnitude of clinical research.

The Ministry of Health and the Department of Ob Gyn of the Institutes of Medicine have a long-lasting collaboration with the Royal College of Obstetricians and Gynaecologists which influenced the choice of topics.

The Ob & Gyn. Society is a member of the International Federation of Obstetrics and Gynaecology and the Asia Oceania Federation of Obstetrics and Gynaecology. These two bodies have provided young gynaecologist awards which provide additional fora for presentation of research findings.

The UNDP, UNFPA, World Bank and WHO co-sponsored Special Programme of Research, Development and Research Training in Human Reproduction (HRP) awarded a Long-term Institutional Development (LID) grant to the Department of Medical Research in 1992. DMR in collaboration with the Department of Obstetrics and Gynaecology (Ob Gyn) of the Institutes of Medicine 1, 2 and Mandalay conducted community-based studies on reproductive health with the support of HRP.

#### **Scope of Clinical Research in Obstetrics and Gynaecology**

From the outset, hospital-based studies were conducted on common topics such as maternal mortality, hypertensive diseases in pregnancy, postpartum haemorrhage, abortion and gestational trophoblastic diseases.

The Ministry of Health and the Department of Ob & Gyn. of the Institutes of Medicine have a long-lasting collaboration with the Royal College of Obstetricians and

Gynaecologist. Several of the clinical research topics fall under the sub-specialties of foeto-maternal medicine, reproductive medicine, gynaecological oncology and urogynaecology.

The collaboration with HPR influenced the selection of topics which included the core elements of reproductive health highlighted in the WHO Global Reproductive Health Strategy. These are:

- Improve antenatal/delivery/postpartum/newborn care
- Provide high quality family planning services
- Eliminate unsafe abortion
- Combat STI/RTIs including HIV, cervical cancer and other morbidities
- Promote sexual health (includes adolescent reproductive health)

As partial fulfillment for the Master's degree in Ob & Gyn. hospital-based research in teaching hospitals was conducted on common disorders in Obstetrics. These included: clinical presentations and management of hypertensive diseases in pregnancy, ante-and post-partum haemorrhage, postmaturity, complications of abortion, among others. The scope in gynaecology covered screening, manifestations and management of malignancies of the genital tract; gynaecological morbidity (utero-vaginal prolapse); birth spacing/family planning; abnormal uterine haemorrhage and infertility.

Clinical research was conducted using diagnostic and therapeutic technology/procedures which were innovative for those times: amniocentesis; ultrasonography in obstetrics and gynaecology: cardiotocography for fetal monitoring and assessment of fetal well-being (performing biophysical profile); manual vacuum aspiration; colposcopy and visual inspection with acetic acid and cryotherapy for cervical cancer screening and management; laparoscopy; hysteroscopy; etc.

In recent years, research has been conducted on antepartum haemorrhage (placenta praevia) and early pregnancy bleeding with transvaginal ultrasonography and management of intra-uterine growth retardation using colour Doppler ultrasound. These have been carried out on laparoscopic assisted vaginal hysterectomy, management of benign ovarian tumours and ovarian drilling for polycystic ovaries. When the Royal College of Obstetricians and Gynaecologists or the International Federation of Obstetrics and Gynaecology or WHO, introduced new management protocols; studies to assess these protocols were conducted, albeit on a small scale.

Doctoral theses elaborated on the above-mentioned topics. Furthermore, specialist Ob& Gyn. pursued their research interests in these areas. Issues more relevant for a developing country such as referral for obstetric emergencies, obstetric fistula, utero-vaginal prolapsed, etc. was also addressed.

### **Public Health Approach on Clinical Research in Obstetrics and Gynaecology**

The Special Programme of Research, Development and Research Training in Human Reproduction (HRP) initially supported community studies on maternal mortality, birth spacing/family planning, post-abortion complications. Later on the studies supported by HRP and the Population Council included traditional practices in maternal and child health, determinants of antenatal care, reproductive health of adolescents and young people, reproductive tract infection s/sexually transmitted infections (RTI/STI), training and supervision to improve detection of pre-eclampsia, to name a few. The Department of Medical Research has also provided small grants for hospital-based studies conducted jointly between DMR and the Institutes of Medicine.

## **Challenges and the way forward**

The interest and conduct of research in Obstetrics and Gynaecology over the years is encouraging. However, Investigators face the following challenges in conducting clinical research in Myanmar.

- An enabling environment for more original research
- Easy access to international literature
- Resource constraints, both technological and financial
- Limited experience in scientific writing to obtain peer-reviewed international publications

A thorough literature search and systematic reviews on a particular topic will assist in generation of a hypothesis for original research. Laboratory facilities for detailed investigations such as markers, receptors, onco-genes are lacking in most hospitals in Myanmar. While some private laboratories can perform more sophisticated investigations, the costs can be exorbitant for a researcher.

Dr. Mahmoud Fathalla, former Director of HRP has stated that "There is only one type of research; good research". The understanding, knowledge and skills of researchers to undertake different types of research need to be strengthened. This ranges from framing the research question and managing data to writing skills for publication. Sexual and reproductive health issues are sensitive and investigators must be conscious of the ethical implications of their proposed questions and study methods. They have an obligation to adhere to ethical principles and maintaining ethical standards to ensure that research participants' rights are preserved, protected, and respected.

Well-designed and ethically sound research should contribute to the formulation of policies and the development and strengthening of programmes for improving the sexual and reproductive health and well-being of communities. Partnerships will need to be enhanced with reproductive health programmes for research that will contribute to reducing child mortality and improving maternal and newborn health.

With the passage of time, there are new and emerging health problems which lead to changes in priorities for programmes and research. The Millennium Development Goals (MDGs) and the Global Strategy for Women's and Children's Health led by the United Nations, endorsed by countries and development partners, has emphasized on universal access to health and quality of care. The critical role of social determinants in health promotion and health-seeking behaviour will need to be determined and considered in designing community-responsive programmes. Clinical research in Myanmar will need to respond to changing priorities in the country and conducted on the basis of sound research methods to ensure the use of research findings for policy making and programme development to meet the health needs of the population.



## Section 8.4

### Developments in Public Health Research

by Aung Than Batu

There was considerable expansion in scope and large increase in the volume of public health research during this period. This large increase was mostly due to the research done by public health specialists with postgraduate qualifications and also because health professionals – doctors, nurses and others, specialists and non-specialist - were more often taking up studies concerning public health. Although the bulk of the studies were part of academic courses leading to postgraduate degrees, many other studies were also undertaken during everyday professional activities.

The scope of public health research expanded. The subjects included the description of communicable and non-communicable diseases, especially newly emerging and re-emerging diseases: and widened to also include many descriptions of socio-economic conditions and human behavior linked to health and disease.

The type of studies ranged from descriptive to comparative, analytical studies and included high level quasi-experimental and experimental studies. The studies were mostly aimed at understanding or ameliorating or solving practical public health problems of national importance. There were only a few purely academic, theoretical explorations of new public health concepts or novel public health approaches or experimental modeling.

There were increased human resources for public health research, as indicated by the number of public health specialists with postgraduate diplomas and degrees.

About 100 public health studies undertaken during this period may arbitrarily be classified according to purpose, type and method of study. This is shown in the Table 1 which was constructed on the basis of samples of public health studies derived from several sources. [from UM (Mdy), DMR (Upper and Central), DOHP, and UOPH]

Although the data is not truly representative or complete it gives a general idea of the relative proportion of the purpose, type and methods of study employed by the institutions included.

Thus, it may be seen from the Table that about (48 %) of the studies were descriptions of health problems/conditions or health behavior/practices in the community. They were cross-sectional surveys of prevalence and occurrence by time, place, person or case studies or knowledge/attitude/practice studies.

About (37%) were descriptions of health institutions, health service operations, health personnel and their work including time utilization. About (10%) were analytical studies to determine causal factors or contributory factors concerned with health problems or conditions. They were comparative, retrospective or case- control studies.

Experimental studies were done to develop and test health indicators and community diagnostic methods/ criteria and to select and test public health interventions; Prophylactic, therapeutic trials or prospective/cohort studies were carried out in the field or communities. They comprised about (2%) and (0.8%) respectively of the total. Costing and cost effective/benefit studies were also done and comprise (1%)

Evaluation of health programs may be regarded as a form of public health research or as health systems research. They were undertaken as part of the formulation of National Health Plans or sometimes as part of Departmental annual reviews or as review by donor agencies, using case studies or quasi-experimental methods as required. Studies to generate new hypotheses or to develop models, including epidemiological models, were very seldom undertaken.

Table 4.7 Classification of Public Health Studies

Purpose	Type of Study	Method	UMMDY		DMR		DHP	UPH	Total
			M.Sc (PH)	Ph.D	Central	Upper			
			n=27	n=4	n=7	n=27			
1 Describe and characterize health problem, health condition in the community or Health behaviour / practice	Descriptive	Cross sectional surveys of prevalence, occurrence by time, place, person, or Case study KAP study	16 (60%)	1 (25%)	2 (29%)	10 (37%)	8 (40%)	18 (60%)	55 (48%)
2 To Describe health service operation, personnel.	Descriptive	Survey of health institution, health service operation, health, personnel and their work including time utilization	5 (19%)		5 (71%)	12 (46%)	12 (60%)	8 (27%)	42 (37%)
3 To determine causal factor or contributory factors concerning health problem or condition	Analytical	Comparative, Retrospective, or Case-control studies	6 (22%)	1 (25%)		3 (11%)		2 (6%)	12 (10%)
4 Development/test health indicator, community diagnostic methods/criteria	Experimental	Field trial		1 (25%)				1 (3%)	2 (1%)
5 Test/select health intervention	Experimental	Prophylactic trial Therapeutic trial prospective / cohort				1 (3%)			1 (0.8%)
6 Evaluate health program	Quasi-Experimental or Experimental	Case study Quasi experimental or experimental							
7 Cost-effect Costing	Cost effect costing	Costing		1 (25%)		1 (3%)		1 (3%)	3 (2%)
8 Generate hypothesis	Modelling	epidemiological model							
<b>Total</b>			<b>27(100%)</b>	<b>4(100%)</b>	<b>7(100%)</b>	<b>27(100%)</b>	<b>20(100%)</b>	<b>30(100%)</b>	<b>115(100%)</b>

A similar classification of over 250 public health studies done during the period 1973 to 1987 showed about 50 % descriptive studies ,about 16 % analytical, and 16% experimental including prophylactic and therapeutic trials .Thus, there seems to be much more descriptive (85%), less analytical (10%) and much less experimental studies studies(3%) during this period. However, the sample sizes are not large and too much significance should not be given to the comparison although it may be concluded that in public health research overall, descriptive studies are large (over 50%) and analytical and experimental studies relatively smaller, which is to be expected.

The above Table 1 does not include public health studies from DMR (LM), UM1 or from DOH. Much of the public health research by DOH is arbitrarily classified as HSR and even if this, as well as data from DMR (LM) and UM1, are included for consideration the pattern of research will be similar and it is unlikely to change the above conclusion that in public health research overall, as done in Myanmar, descriptive studies are large and analytical and experimental studies relatively smaller.(See also section 8.5)

With regard to the quality of research the remarks previously made in the first volume are still appropriate (see “*Growth and Development of Medical Research In Myanmar (1886 to 1986)*”, pages 219-223)

*“Most of the public health studies were the usual, common-place type carried out to procure information necessary to plan, organize and deliver more effective, efficient health services.*

*Many of the disease/health determinants were already known before or elsewhere and investigated for confirmation under local conditions and not necessarily to add new knowledge; some were therefore redundant and a rigorous scientific analysis was not usually attempted. They just served to inform health managers of the general weight-age to be given to these factors during planning and organizing health services.*

*However many field trials of prophylactic agents or alternative therapeutic agents were carried out with scientific rigor and provided conclusive evidence regarding efficacy and utility.*

*The evaluative studies were case-studies using before/after quasi-experimental design and provided decision-making support for planning health services.*

*Many of the aforesaid public health studies may be regarded as Health Services Research and Health Behavior Research”(see also under Health Systems Research Part 4, Chapter 11 )*

With the large increase in number of academically qualified public specialists in academic and research institutions and also in service departments, and because health professionals were now more familiar with epidemiological methods and HSR, many more of the studies during this period, compared to previous years, were properly designed and scientifically rigorous; some were of high quality comparable to those in scientifically developed countries.

Public health research played an important part in national health development by providing timely, scientifically valid information to health providers, planners. It contributed significantly to the control of previously well-known diseases such as malaria, viral hepatitis, diarrhea, acute respiratory infections, tuberculosis, diabetes, hypertension, CVA, snake-bite, etc. and also to the containment and control of emerging diseases and new threats to national health like HIV/AIDS, Avian Influenza, and SARS. It played a major role in the eradication (or reduction to a level where they are no longer public health problems) of the major scourges of national health, viz. Leprosy, Trachoma, Polio and Goiter during the last decade.



## Section 8.5

### Health Systems Research

by Aung Than Batu

Many of the activities identifiable as HSR are indistinguishable from either public health research or management practice; most of HSR done by Universities of Medicine and health related Universities is included under public health research. A HSR Unit was established in the DOH in 1970 and functioned for about 4 years till about 1974 when it was transferred under the Department of Health Planning where it later became defunct. The DOH no longer has a separate HSR Unit but carries on HSR in its service programs/projects as required. The bulk of HSR done by DOH is embedded among other health activities. Some recent

*Reviews* of activities identified as Health Systems Research that was carried out in various Departments, institutions and health organizations are given hereunder:-

#### Subsection 8.5.1

#### Health Systems Research by Socio-Medical Research Division of Department of Medical Research (Lower Myanmar) (1986-2009)

by Than Tun Sein, Le Le Win, Saw Saw & San Shwe

##### (a) Background

Previously, Epidemiology Research Division of the Department of Medical Research-Lower Myanmar (DMR-LM) conducted epidemiological studies and a few social science researches and Medical Statistics Division assisted with statistical analysis. In May 1990, Health Systems Research (HSR) Division was formed. Epidemiology Research Division, Medical Statistics Division and HSR Division were collectively referred to as Socio-medical Research Centre under the management of one Director (Socio-medical Research).

Training of Trainers in HSR methodology was undertaken in collaboration with HSR Unit of the Department of Health (DOH) in 1990 with World Health Organization (WHO) support. HSR modules developed by International Development Research Centre (IDRC), Canada, were used. HSR proposal development workshop followed soon where five HSR proposals were developed through collaboration between service managers from DOH and researchers from DMR-LM.

These developments — establishment of HSR division in DMR-LM, keeping Epidemiology, Medical Statistics and HSR Divisions under the technical leadership of one Director, capacity strengthening in HSR methods among Public Health researchers of DMR-LM — engineered new strategic approaches in research by Public Health researchers at DMR-LM. The two key strategic approaches were:

- researchers of Epidemiology, Medical Statistics and HSR divisions became more involved in HSR of a social science nature (not excluding health economics research and human resources for health research) and the Socio-medical Research Centre began to function as one research division; and
- there was more extensive and intensive collaboration with service managers, especially from the DOH, (because concepts of HSR encompasses collaboration with service managers and involvement in their priority problems so that utilization of research results is ensured)

The two key strategic approaches of Socio-medical Research Division shaped the public health research scenario of DMR-LM for the next two decades, beginning from 1990, and probably beyond.

Reproductive Health research, TB research, Leprosy research and Malaria research were the main facets of the new approach developed in the new scenario of public health (health systems) research undertaken by DMR-LM. (These will be further elaborated in the sub-sections to be followed).

Year 2000 could be considered an entry into a newer era for public health researchers of DMR-LM. After receiving Long-term Institutional Development (LID) grant for Reproductive Health research in 1993, qualitative research methods were strengthened among public health researchers of DMR-LM. Public health researchers of DMR-LM began to realize their need for development of facilitation skills.

A striking shift towards a researcher holding the dual roles of being a “researcher” as well as a “facilitator” took place in the year 2000 with the undertaking of the community-based study: “Participatory action research on detecting and solving social group health differences in a selected *urban* area<sup>1</sup> in Taik-kyi township, Yangon Division, Myanmar, 2000-2002”. In this study researchers not only developed training modules but also participated as facilitators in the participatory learning and action (PLA) approaches to formulate and implement project activities. This study was undertaken in collaboration with service managers of the DOH. Above all, this was the first equity-oriented community-based research to be undertaken in the Ministry of Health. The experiences of the PLA approaches and equity-oriented research approaches were incorporated into the Master of Public Health training curricula of University of Public Health as well as that of Defence Services Medical Academy.

#### **(b) Socio-medical Related Reproductive Health Research**

Reproductive Health Research (RHR) was first recognized in the field of Socio-medical research in August 1990. This was established through a series of workshops □ National Workshop on Assessment of Research Needs in Human Reproduction in August 1990, Workshop on Development of Research Proposals in February 1991, held in DMR-LM. In April 1992, Long-term Institutional Development Grant-LID was awarded to DMR-LM covering the period 1993-1997. During these years, RHR was carried out together with DOH and Department of Medical Science (DMS), especially with the Obstetricians and Gynecologists, in reproductive health epidemiology and social science studies regarding contraception, abortion, maternal mortality and survivorship of low birth weight babies. Second LID was awarded for the years 1998–2002. This enhanced RHR in various forms especially the capabilities in performing qualitative research methods. Qualitative methods are now widely used, not only in RHR, but also in other research areas like malaria, TB, leprosy, etc. The LID award enabled the researchers from DMR-LM to conduct a series of collaborative studies on RH/HIV/AIDS/STI involving epidemiologists, social scientists and clinicians from DOH, Department of Medical Research – Upper Myanmar (DMR-UM) and DMS.

Some outputs of the RH research contributed to the development of the training modules- for instance, training modules for emergency obstetric care, and formulation of RH strategies for HIV positive women.

Recently, RH hotline was established on 23<sup>rd</sup> March 2009 with the objective of testing the feasibility of improving knowledge or RH among general public, especially adolescents and youths, by answering questions from the public through modern communication technology.

HIV/AIDS Annotated bibliography was compiled. DMR-LM also wrote RH Annotated Bibliography with DMR-UM. These documentations were of immense value for researchers, teachers and service managers.

**(c) Socio-medical Related Malaria Research**

Funding of Socio-medical related Malaria by TDR started in 1993. Regional Linkage Grant, RLG, was awarded for research and training in tropical diseases with effect from 1<sup>st</sup> July 1993. This was a joint program of DMR-LM, Centre for Health Economics, Chulalongkorn University and Malaria Research Unit, Faculty of Medicine, University of Colombo, Sri Lanka. The objective of this program was to provide multidisciplinary postgraduate research training in tropical diseases within two or more of the three Faculties of the Linkage program having complementary skills and expertise.

This program accelerated collaborative studies between DMR-LM and DOH. Since then, a number of joint programs - based malaria projects have been carried out, which aim to utilize the findings for control activities. Some of the projects were focused on control of malaria through active community participation, drug compliance, source reduction of well breeding *Anopheles dirus*, and impact of insecticide-treated bed nets on malaria morbidity.

**(d) Socio-medical Related TB Research**

Institutional Research Capacity Strengthening (RCS) grant from WHO/TDR was obtained in 2002 and aimed at strengthening research capability on tuberculosis research in Myanmar. The project is a collaborative effort aimed at upgrading of research skills and facilities, promoting network among all departments participating in tuberculosis control research, establishing mechanism that facilitates the utilization of research results, with National Tuberculosis Program (NTP), Department of Health. Four research proposals were funded and the principal investigators and co-investigators are from DMR-LM and National TB Program. Proposals included public health research and laboratory research. Moreover, the following activities were carried out to strengthen TB research and to promote the networking among participating centers under the leadership of DMR-LM. Meetings with National Tuberculosis Program-managers, training officers and personnel in 2003 and with scientific group on TB research in 2003 to present and discuss research activities, generate research proposals, and promote awareness of TB research ; and workshop on HSR methodology in 2004 at which scientists from various academic departments participated. As output of TDR/RCS grant- there was an increase in number of TB research projects , more collaboration of service managers and researchers was ensured, research capacity was strengthened, linkage established with NTP ,other Institutions, local NGOs and International Institutions like University of Malaysia.

Socio-Medical Research Division, DMR (LM) conducted a series of training workshops in 2005,2007,2008, on both qualitative and quantitative research methodology, in collaboration with NTP, Myanmar Medical Association (MMA), Japanese International Cooperation Agency (JICA) and WHO. The workshops strengthened the research capacity of NTP, and strengthened research capability of TB control managers. The underlying aim was to develop research infrastructure of the partners and enhance their ability to utilize research findings.

An annotated bibliography of research findings on TB in Myanmar was developed by professionals from Socio-Medical Research Division in collaboration with Central Bio-medical Library. The purpose of this bibliography was to inform policy makers, program managers and researchers about previous research on TB and document the research findings on TB covering the period 1910 - 2006. This will enhance utilization of research and

facilitate evidence-based decision making for TB control. Moreover, it will provide a comprehensive reference for prioritizing and identifying future research for effective TB control in Myanmar.

**(e) Socio-medical Related Leprosy Research**

Prior to 1990, leprosy research was done jointly by the researcher and program manager, but it was mainly laboratory-based research. Working as a team of researcher and program manager research which emphasized the social science aspect expanded in early 1990s. Since the service providers were involved in such research from the beginning, the program utilized the findings for the program improvement. Examples are: upgrading the Central Special Skin Clinic (CSSC) into teaching and referral centre, integrating urban leprosy control program into basic health service, acceleration of Leprosy Elimination Campaign (LEC) activities through training to basic health staff and community awareness. To strengthen the leprosy research capacity, Technical Core Group for leprosy research was formed in 1999, where the members were from DOH, DMR-LM, DMS and Psychological Department of Rangoon University.

The following workshops were conducted with the aim of strengthening the research capacity of researchers and service managers.

- HSR methodology workshop in August 2000 for the State and Divisional level service managers. IDRC module was applied and a total of five proposals had developed.
- Data analysis workshop in May 2001, which was focused on the above five proposals

Consequently, a new pattern of leprosy research has developed in which the leading role in conducting the research has shifted from academic institutions to service managers, and which was more focused on action-cum research. The success of this coordination and cooperation contributed to the declaration of Leprosy Elimination in Myanmar in January 2003. In the post elimination era, collaborative studies have been conducted with the aim of utilizing research results to provide better care for the ‘person affected by leprosy’ (PAL). Some examples of the application of such research results are: developing self-care teaching manual, training of trainer on self-care for basic health staff, teaching about self-care to PAL, modifying techniques for disability assessment, improving the detection of delayed cases . To sustain the achievements up to now, research-cum-action programs are being carried out by service managers in collaboration with researchers from the academic institutions.

**(f) Elderly Health Research**

Last but not least, research relating to elderly health will be highlighted. A series of studies have been undertaken on the elderly population in Myanmar .A multi country study on health care of elderly supported by WHO was undertaken from 1989 till 1992 in Yangon, Mandalay and Ayeyarwady divisions by researchers from DMR-LM. Based on the findings of above study, health care for elderly program was included in National Health Plan (1996 to 2001). Since 1994 health care for elderly people activities have been launched in Kyauktan, Hlegu, Taikkyi, Kyopinkauk, Nyaunglaybin and Nyaungtone townships. The targets aimed for the project were baseline elderly register collection, development of elderly clubs in towns, training of medical staff related to care of elderly, production of modules related to elderly care for medical staff.

**(g) Training and International Degrees Received by Public Health Researchers of DMR-LM**

During 1986 and 2009, a number of researchers from DMR (LM) received further international training and degrees in various academic fields namely: MSc (Health Economics), MSc (Epidemiology and Biostatistics), Master of Public Health (Epidemiology and Biostatistics), MA (Population and Social Research), Master of Clinical Tropical Medicine, Master of International Research Biostatistics, PhD in Health Care Management, PhD in Social Science, PhD in Health Economics, PhD (Epidemiology and Biostatistics).

**(h) Outstanding Research/Academic Achievements by Social Scientists of DMR (LM)**

It has been internationally recognized their leader the Director, Socio-medical Research Center, was awarded the Leon Bernard Foundation Prize in 2007 at the World Health Assembly for outstanding services in the field of social medicine in Myanmar. He is considered a pioneer in the development of research methodology in equity and gender. The Senior Scientist, HSR Dept. was recognized for outstanding achievements in TB research and received in 2008 the Melbourne School of Population Health's "Head of School Award for Excellence in Knowledge Transfer in Doctoral Research".

In order to be considered for the award, the researcher must demonstrate that their work will change health outcomes, policy or professional practice; that it represents a novel approach or major discovery; and that it embodies excellence in conceptualization, development, execution and application of innovative high quality knowledge transfer methods. Through her PhD work, she examined the role of public-private partnership in controlling TB in vulnerable low-income populations in Myanmar. Her research findings touched on several knowledge transfer issues, including use of referral letters by general practitioners and establishing link between all GPs and Township Health Department.

**Subsection 8.5.2****Health Systems Research at the Department of Health Planning.**

**by Aung Kyaing**

Although the DOHP is a service department of the Ministry of Health it also participates in some of the research activities undertaken by the other Departments of the Ministry of Health. In recent years it has also initiated activities that inform and support the health planning process of the Ministry of Health and the health planning of Departments under the Ministry of Health as well as undertake its own program of Health Systems Research including health planning research, measurement of population health, and assessment of health system performance. It has organized a series of Workshop on Health Planning Research aimed to promote the effectiveness and efficiency of health systems through the support of reliable information in health project and program management. The topics included scientific measurements of population health and Burden of Disease and assessment of the various aspects of health systems performance.

*(a) Department of Health Planning, Research and Development Division, Research Workshop and Research Report (2004-2005)*

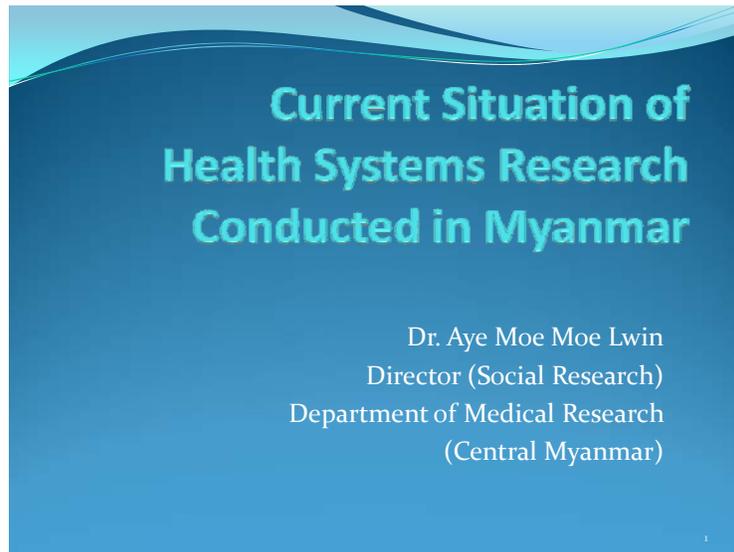
Contents

1. National Workshop on Burden of Disease Methods
2. Assessment of Health Inequalities Based on Household Consumption Expenditures in Yangon Division
3. Assessment of Health Systems Responsiveness to Patients Attending Some Health Facilities in Yangon Division
4. Assessment of Road Traffic Injury Reporting System in Myanmar
5. Sustainability Analysis of Sanitary Latrine Use in a Selected Township in Yangon Division
6. Acceptability of condom among target groups (sex workers and clients) in selected Townships implementing 100% TCP program

*Research and Workshop Report (2006-2007)*

Contents

1. Quality Assessment on Care of Sexually Transmitted Diseases at the District Level
2. Community Injury Survey in Pyinmanar Township
3. Hospital Based Verification of Causes of Death in Pyinmanar Township
4. Community Based Verification Causes of Death in Pyinmanar Township
5. Workshops on Burden of Diseases Method
6. Workshops on Health Systems Research Methodology for Post-Graduate Students from the Universities of Medicine
7. Workshops on Health Systems Research Methodology for health staff working in the States and Divisions
8. Status of Mortality Statistics in Myanmar
9. Current situation of International Statistical Classification of Diseases and Related Health Problems (ICD) in Myanmar

**Subsection 8.5.3****HSR Review done by Department of Medical Research (Central Myanmar)****Objectives of developing background paper on Situation of HSR**

- To know the current situation of HSR studies conducted
- To identify the list of HSR studies conducted under six main building blocks of health systems with scopes covered
- To get the information on weaken research area of health system for setting priority research areas in the development of National HPSR Agenda.

**Steps for developing background paper on Situation of HSR conducted in Myanmar**

1. Focal person was assigned for collecting and compiling HSR studies conducted by their departments during last decade
2. Consultative meeting was conducted in UPH
  - Clarified the concepts and defining criteria for HPSR, definition and categorizing criteria for HS BB and scopes
  - Presentation, discussion and getting group consensus were done for categorization of HSR/HPSR studies
  - Reviewed and categorized 436 HSR studies under six main building blocks and 19 scopes of the studies

**Method for assessment**

1. “Topic classification of Health System publications in Medline data based” mentioned in “Policy practice research, Strengthening health systems: the role and promise of policy and system research” published by Alliance HPSR in 2004 was used as reference for categorizing HSR studies
2. 12 public health specialists participated in assessment
3. 436 HSR papers sent by the departments were assessed and data was compiled in a table with column title of “topic of the study, department carried out the study, place of the study, year, field of the study, relevant building block of HSR and relevant scope of HSR, summary, dissemination, utilization and comments.
4. Data was analyzed by using excel spreadsheets and SPSS software.

## Findings

1. Numbers of studies sent by the departments
2. HSR studies under six building blocks
3. Scopes covered
4. Uncovered scopes under each building block
5. Themes of studies under each scope
6. Fields of the studies
7. HSR studies by year
8. Dissemination and utilization
9. Limitations of the study

**Number and percent of HSR studies sent by the departments for assessment**

S.N.	Departments	Number	Percentage
1	DOH	86	19.7
2	DHP	20	4.6
3	DMR-UM	27	6.2
4	DMR-CM	7	1.6
5	DMR-LM	130	29.8
6	UOPH	29	6.7
7	UM-1	71	16.3
8	UM-2	66	15.1
	Total	436	100.0

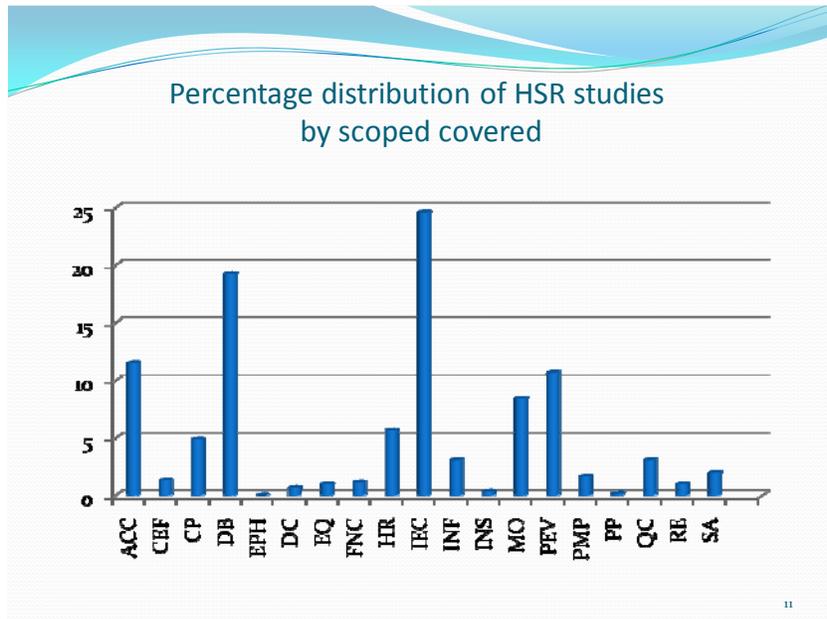
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## Building blocks and scoped covered by HSR studies

- Number of studies addressing more than one building block (Maximun-3) is 26 (5.9%)
- Number of studies addressing more than one scope (Maximun-3) is 45 (10.3%)

**Number and percentage distribution of HSR studies by health system building blocks**

S.N.	Building blocks	Number	Percentage
1	Service delivery	159	31.4
2	Information and evidence	283	55.9
3	Medical products and technologies	26	5.1
4	Health workforce	17	3.4
5	Health financing	14	2.8
6	Leadership and governance	7	1.4
	Total	506	100.0



*Scopes uncovered by each main Building Block*

Uncovered scope of studies under each health system building block

Building block	Uncovered scopes of study
Service delivery	1. Economic policy and health
	2. Financing
	3. Pharmaceutical policy
	4. Policy process
Information and Evidence	1. Decentralization/local health system
	2. Economic policy and health
	3. Pharmaceutical policy
	4. Policy process

Uncovered scope of studies under each health system building block (Contd.)

Building block	Uncovered scopes of study
Medical Products and Technologies	1. Costing and cost effectiveness
	2. Community participation
	3. Economic policy and health
	4. Equity
	5. Financing
	6. Human resources
	7. Information, education and communication
	8. Information system
	9. Insurance
	10. Research to evidence

Uncovered scope of studies under each health system building block (Contd.)

Building block	Uncovered scopes of study
Health Workforce	1. Costing and cost effectiveness
	2. Economic policy and health
	3. Disease burden
	4. Decentralization/local health system
	5. Equity
	6. Financing
	7. Insurance
	8. Pharmaceutical policy
	9. Policy process
	10. Research to evidence
	11. Sector analysis

## Uncovered scope of studies under each health system building block (Contd.)

Building block	Uncovered scopes of study
Health Financing	2. Accessibility
	3. Community participation
	4. Disease burden
	5. Decentralization/local health system
	6. Economic policy and health
	7. Equity
	8. Human resources
	9. Information, education and communication
	10. Information system
	11. Management and organization
	12. Pharmaceutical policy
	13. Policy process
	14. Quality of care
	15. Research to evidence
	16. Sector analysis

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## Uncovered scope of studies under each health system building block (Contd.)

Building block	Uncovered scopes of study
Leadership and governance	1. Accessibility
	2. Costing and cost effectiveness
	3. Community participation
	4. Disease burden
	5. Decentralization/local health system
	6. Economic policy and health
	7. Financing
	8. Human resources
	9. Insurance
	10. Program evaluation
	11. Policy process
	12. Quality of care
	13. Sector analysis

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### 1. Themes of HSR studies under scope of Accessibility

Scope	Themes of the conducted studies	Themes not covered
Accessibility (Number of studies = 71)	- Health seeking behavior	- Willingness and capacity to pay
	- Determinants of utilization, coverage, referral, barriers to care	- price regulation, prices
	- cost-sharing	- equity in access
	- Demand for health services	- Outreach service

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### 2. Themes of HSR studies under scope of Community Participation

Scope	Themes of the conducted studies	Themes not covered
Community Participation (Number of studies = 30)	- Community-based strategies	
	- Participation in governance, empowerment, school health, family health strategies	
	- Social support networks	

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### 3. Themes of HSR studies under scope of Costing and cost effectiveness

Scope	Themes of the conducted studies	Themes not covered
Costing and cost effectiveness (Number of studies = 8)	- Determination and evaluation of costs	
	- Cost analysis	
	- Cost effectiveness of resource allocation	
	- Cost benefit services	

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### 4. Themes of HSR studies under scope of Decentralization/Local health system

Scope	Themes of the conducted studies	Themes not covered
Decentralization/local health system (Number of studies = 4)	- Decentralization of services	- Decentralization policy and process
	- District/Township health system development	- impact of decentralization on services and health outcomes
	- community participation in local health services (GP)	- local government, devolution
	- healthy cities	- municipal health services

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### 5. Themes of HSR studies under scope of Disease Burden

Scope	Themes of the conducted studies	Themes not covered
Disease Burden (Number of studies = 119)	- Prevalence and incidence of diseases, health status, health needs	
	- Burden of disease studies, risk factors, determinants of health and diseases other than economic and social policy	
	- Morbidity, mortality, disease profiles	
	- Epidemiology and survival of AIDS patients	

23

### 6. Themes of HSR studies under scope of Economic Policy and Health

Scope	Themes of the conducted studies	Themes not covered
Economic Policy and Health (Number of studies = 0)		- Macro and global levels to include the relationships between health and free trade agreements, TRIPS and health
		- Economic crisis and health, the impact of poverty reduction and adjustment policies on health, debt reduction and health
		- Social policy and health, social assistance and health issues, intersectoral coordination, the impact of employment, labor policy and health

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## 7. Themes of HSR studies under scope of Equity

Scope	Themes of the conducted studies	Themes not covered
Equity (Number of studies = 6)	- Assessment of inequality in health seeking behavior according to HH economic status	- Equity of health system
	- Develop a methodology to monitor equity in health care utilization in Townships	- Impact of health reform on equity
	- Role of gender in rural community, KAP on gender issue	- Equity and poverty
	- Factors contribution towards risk classification of pregnant women attending ANC	- Poverty targeting, poverty and health, exclusion

## 8. Themes of HSR studies under scope of Financing

Scope	Themes of the conducted studies	Themes not covered
Financing (Number of studies = 7)	- Community health financing and financing of specific health programs	- Resource mobilization, allocation
	- National health accounts	- Financial equity
		- Financing policies

### 9. Themes of HSR studies under scope of Human Resources

Scope	Themes of the conducted studies	Themes not covered
Human Resources (Number of studies = 35)	- Personal management, deployment	- Migration
	- KAP of health personnel	- Traditional healers
	- Satisfaction and quality of life, motivation	- Medical education and curriculum assessment
	- Assessment of HR performance	- Evaluation of medical and nursing teaching programs
	- Training and education of human resources	- Human resource policy and demography

### 10. Themes of HSR studies under scope of Information, Education and Communication

Scope	Themes of the conducted studies	Themes not covered
IEC (Number of studies = 152)	- Wide range of health promotion activities such as health education strategies	- HE strategies and impacts
	- Information and communication for general public	- impact assessment of KAP
	- Assessment of KAP	

### 11. Themes of HSR studies under scope of Information systems

Scope	Themes of the conducted studies	Themes not covered
Information systems (Number of studies = 19)	- Information needs, surveillance mechanisms and systems	- Establishment of public domain database
	- Strengthening of information systems, health monitoring systems	- Informatics
	- Development of indicators for service management and policy	- Development of indicators for policy

### 12. Themes of HSR studies under scope of Insurance

Scope	Themes of the conducted studies	Themes not covered
Insurance (Number of studies = 2)	- Risk and benefits covered by insurance schemes	- Impact of insurance on health and service outcomes
		- Community-based health insurance
		- Options for health insurance and insurance reform

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### 13. Themes of HSR studies under scope of Management and Organization

Scope	Themes of the conducted studies	Themes not covered
Management and Organization (Number of studies = 52)	- Assessment of performance of health service providers	- Contracting and provider payment mechanism
	- Delivery of services	- Effect of privatization on specific services
	- Administration, service management strengthening	- Performance agreement and effect of hospital autonomy on service delivery
	- Community participation and management	- Stakeholders in unit management

31

### 14. Themes of HSR studies under scope of Pharmaceutical Policy

Scope	Themes of the conducted studies	Themes not covered
Pharmaceutical Policy (Number of studies = 10)	- Rational use of drugs	- Cross-cutting priority focusing on specific resource
	- Dispensing practice	- Procurement, logistics, herbal medicine, pharmaceutical regulation, national drug policy and the formulation of essential lists

32

## 15. Themes of HSR studies under scope of Policy Process

Scope	Themes of the conducted studies	Themes not covered
Policy Process (Number of studies = 1)	- Factors influencing the policy process (Complementary of national research area of different institutions in context with National Health Policy and National Health Research Policy conducted by DMR-LM)	- Stake holder analysis - Roles and relationships of actors in the formulation and implementation of policy - Role of government agencies in policy formulation, role of community and NGOs in policy formulation - Perceptions of policy, decision making process, policy negotiation

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## 16. Themes of HSR studies under scope of Program Evaluation

Scope	Theme of the conducted studies	Theme not covered
Program Evaluation (Number of studies = 66)	- Evaluation and assessment of impact of programs on specific diseases or services	- Evaluation and assessment of impact of policies on specific diseases or services

34

### 17. Themes of HSR studies under scope of Quality of Care

Scope	Themes of the conducted studies	Themes not covered
Quality of Care (Number of studies = 19)	- Clinical practice guidelines, evidence-based medicine	
	- Quality assurance and patient satisfaction	

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### 18. Themes of HSR studies under scope of Research to Evidence

Scope	Themes of the conducted studies	Themes not covered
Research to Evidence (Number of studies = 6)	- Health systems research training, research methods	- Outcomes of research, research impact, policy utilization and impact of research
	- Priority setting of health research	- Creation of national HSR database,
	- Research ethics and dissemination of research	- Essential national health research

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### 19. Themes of HSR studies under scope of Sector Analysis

Scope	Themes of the conducted studies	Themes not covered
Sector Analysis (Number of studies = 12)	- Health system development	- Understanding of health sector reforms and their implications across the whole health system
	- Public/private mix health care	- Private health service development, intersectoral collaboration and coordination, health care organizations
		- Sector-wide and system-wide analysis of performance
		- Regulation, policy formulation on specific diseases, on programs or on aspect of health system

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### Fields of HSR study

S.N.	Field of study	Number	Percentage
1	Tuberculosis TB	76	17.43
2	HIV/AIDS and STD (HIV/AIDS)	54	12.39
3	Maternal health	52	11.93
4	Health system issues	48	11.01
5	Non-communicable diseases	40	9.17
6	Malaria	32	7.34
7	Leprosy	27	6.19
8	Child health	23	5.28
9	Environmental health	15	3.44
10	Dengue Haemorrhagic Fever	12	2.75

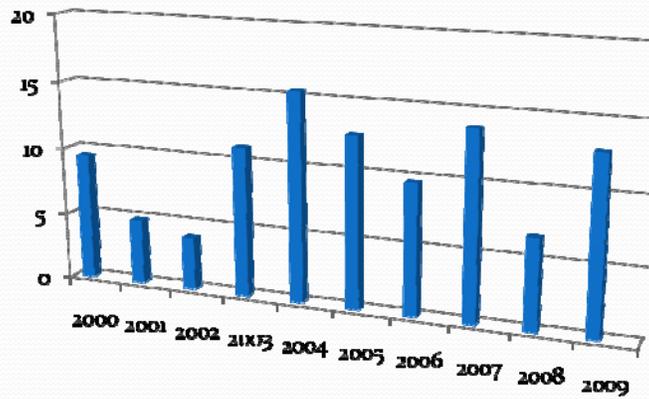
39

### Fields of HSR study (Contd.)

S.N.	Field of study	Number	Percentage
11	Risk factors for health	12	2.75
12	Other communicable diseases	11	2.52
13	Nutrition and food safety	10	2.29
14	Socio-economic determinant of health	9	2.06
15	Others	8	1.83
16	Emergency preparedness	4	0.92
17	Elderly health	2	0.46
18	Pharmaceutical technologies	1	0.23
	Total	436	100.00

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### Percentage distribution of HSR studies by Year



42

## Dissemination

- Out of 436 HSR assessed, 31.6% disseminate their results
- Dissemination was done in
  - Myanmar Health Research Congress, other conferences, seminars and workshops
  - Local publications
  - International publications
  - SSB
  - Sports and Physical Education Department
  - Fliers

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## Dissemination (Contd.)

- Dissemination was done to
  - Project managers from DOH (NAP, NTP, Nutrition, Leprosy, Malaria, RH, Basic Health)
  - Report to WHO
  - Report to Population Council
  - GAVI Board
  - UN agencies

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## Utilization

- Utilization -3.3 % of total study
- Ways for utilization
  - Collaborative study between DOH and DMR- LM
  - Academic/further study/published articles
  - Counseling training for BHS
  - Maternal and child health development
  - Internal project design modification
  - Public-private mix DOTs
  - NAP Program documents
  - GAVI
  - Community based health activities

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## Limitation of the assessment

- All studies cannot be accessible due to limited time period
- Some institutions left to request for their HSR studies i.e University of Nursing, University of Community Health (Magwe), Department of Traditional Medicine and Defense Service Medical Academy
- No time for compiling HSR studies from IM-Mandalay as it received very late (through UPH internet)
- Detailed information about publication and utilization cannot be ensured due to limited time (Need to contact PI for how they disseminate and utilized their studies )

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**Subsection 8.5.4**

**Synthesis of Health Systems Research under the Framework of Health Research Program: A Decade Work of Department of Medical Research, Lower Myanmar (2000-2009)**

by Le Le Win , Saw Saw, Yin Thet Nu Oo, Khine Sandar Oo, Myo Khin, Thandar Min & Soe Moe Myat

Prime purpose of HSR is to help improve health of people through improvement not only of conventional health services but also of other services that have a bearing on health. Accordingly, divisions within the Department of Medical Research (Lower Myanmar) (DMR-LM) have been conducting HSR-related projects since 1986. More or less, these researches were related to 7 projects under Health Research Programme (HRP) of National Health Plan (NHP) 2006-2011, namely, communicable diseases (CD), non-communicable diseases (NCD), health systems, environmental health (EH), traditional medicine, academic and technology development and capacity strengthening. However, there are limited information on the linkage between these research projects and HRP and their utilization. With this aim, this review study was conducted to determine types of HSR-related projects under the framework of HRP conducted by divisions within DMR-LM from 2000 to 2009 and the degree of research utility.

**Materials and Methods**

For consistency of source of information, Annual Reports of DMR-LM from 2000 to 2009 were used [5]. All HSR-related projects in these reports were analyzed. Based on the year of reporting the research findings, the summaries of the research findings were reviewed and categorized into seven projects under HRP of NHP using content analysis. Regarding the situation of utilization of research findings, scientists from the respective divisions of DMR-LM were requested to fill in a form on research utilization.

**Results and Discussion**

During a 10-year period, 16 of 22 research divisions and one of seven research units of DMR-LM conducted 160 HSR-related projects.

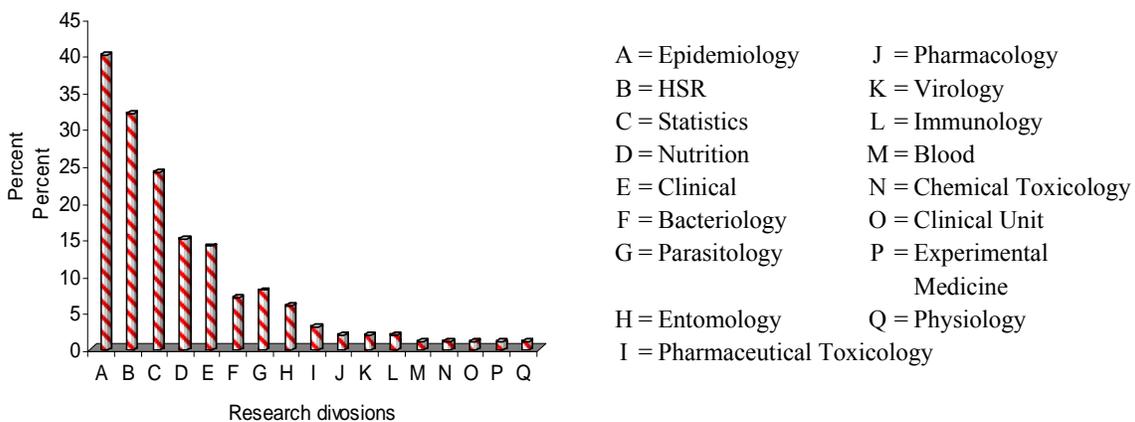


Figure 1. HSR-related projects conducted at DMR-LM during 2000-2009 by research divisions

Social science-related research divisions (i.e., Epidemiology, Health Systems Research and Medical Statistics research divisions) conducted 60.6% of the projects and clinical and laboratory-based research divisions conducted 39.4% of the projects, respectively (Fig. 1).

#### *Yearly HSR-related projects conducted by divisions*

During the study period, while number of projects conducted over the years had increased, number of projects conducted by social science-related divisions had decreased between 2001 and 2006, particularly in 2004. It could be due to increased involvement of clinical and laboratory-based research divisions in HSR projects, more collaboration among divisions with different disciplines of DMR-LM and most researchers from social science-related research divisions were out of office for further studies during 2001 and 2006 (Fig. 2).

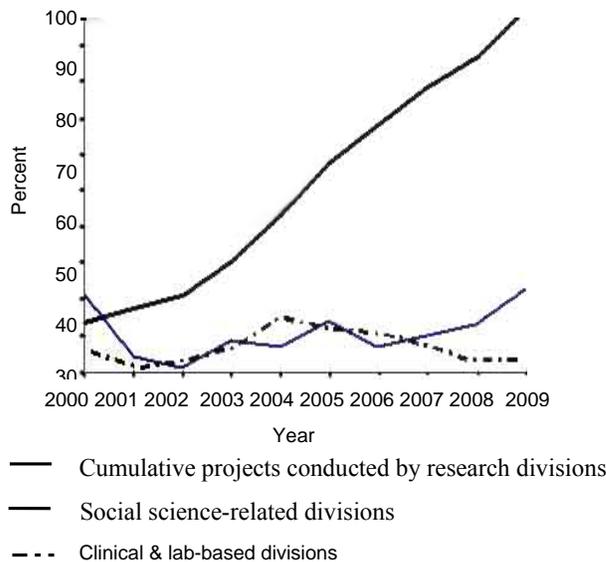


Figure 2. Yearly HSR-related projects conducted by divisions from 2000 to 2009

#### *Types of HSR-related researches conducted by divisions*

During this decade, social science-related research divisions conducted 97 projects (60.6%) and clinical and laboratory-based research divisions conducted 63 projects (39.4%), respectively (Table 1).

By type of disease-related research, about half (50.6%) were communicable diseases including AIDS, TB, malaria, leprosy, ARI, DHF and HCV. Next came reproductive health (15.6%) followed by non-communicable diseases (6.3%) and environmental health (3.8%). About one-fourth were other research areas such as smoking practice, elderly, research implementation, cost study, snake bite, minor ailments, vital statistics, dietary pattern, food behaviour, iron status, health information, etc. Both social science-related research divisions and clinical and laboratory-based divisions focused more on communicable diseases ( $53/97=54.6\%$  and  $28/63=44.4\%$ , respectively).

With respect to the projects under HRP, the majority of researches were concerned with health systems (83.8%), and these were relating to treatment seeking behaviours, establishment of community-based surveillance system for women cancer, intervention studies for sustainable dengue control and malaria prevention. Of which, 67.9% were done by social science-related research divisions. Clinical and laboratory-based research divisions also emphasized on NCD, communicable diseases and environmental health relating to HRP.

Environmental health-related studies were done by Pharmaceutical Toxicology, Chemical Toxicology, Entomology and Pharmacology research divisions.

Table 1. Type of disease-related projects by Health Research Programme conducted by research divisions

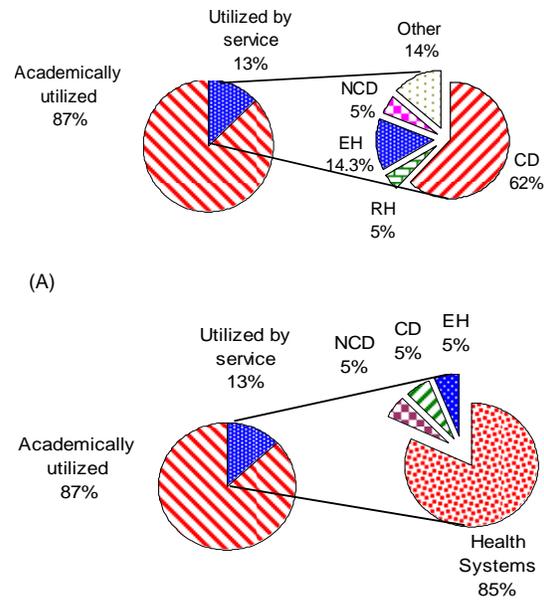
Project under Health Research Programme	Type of disease	Research Division		
		Social science-related divisions	Clinical & lab-based divisions	Total no. (%)*
Health systems	Communicable diseases	51	21	72
	Reproductive health	23	1	24
	NCD	0	3	3
	Environmental health	0	2	3
	Other	16	16	32
Sub total		91	43	134(83.8)
Non-communicable disease	Non-communicable diseases	1	6	7
	Reproductive health	0	1	1
	Other	2	3	5
Sub total		2	10	13(8.1)
Communicable disease	Communicable diseases	2	7	9
Sub total		2	7	9(5.6)
Environmental health	Environmental health	0	3	3
Sub total		0	3	3(1.9)
Other	Other	1	0	1
Sub total		1	0	1(0.6)
Total (%)**		97 (60.6)	63 (39.4)	160

\*Column percent \*\*Row percent

#### *Utilization of research findings*

Collectively, most findings were academically utilized by either one of the following channels (n=137, 85.6%): presentation at Myanmar Health Research Congress, reporting to Department of Health and international agencies, dissemination at seminars, thesis and publications in local and international journals. Of which, reporting and presentation at the congress were the commonest. The situation of result finding of 2 researches was not known. About 13% of the research findings were utilized by project managers (n=21) as a citation or reference, guidance for patient treatment and guidelines for health providers of the respective programme and general practitioners. Among them, 11 and 10 researches were conducted by social science-related research divisions and clinical and laboratory-based research divisions, respectively. Since the findings were based on the personal contact of the respective divisions of DMR-LM, we could not know the real utilization status from the service department's aspect. It is assumed to be larger than this extent.

It was observed that most of the research results utilized by the service managers were communicable diseases (62%), which were among the priority diseases ranked in NHP 2006-2011 such as TB, malaria and leprosy (Fig. 3). In addition, with regards to HRP, while research findings relating to health systems were mostly used by the service departments, other types such as communicable diseases, non-communicable diseases and environmental health were the least (5% each). Through personal communication, it was also noted that service managers participated in those researches from the beginning of protocol development.



(B)  
 CD = Communicable Diseases  
 NC = Non-communicable Diseases  
 EH = Environmental Health  
 RH = Reproductive Health

Figure 3. Situation of research findings utilization by (A) type of disease-related projects and (B) Health Research Program

### Conclusion

During the 10-year study period, 160 HSR-related projects were conducted by more than half of the research divisions of DMR-LM. However, some of the research findings of ongoing projects were not documented in Annual Reports; in reality, number of the projects could be larger than this. However, it was observed that by effective collaboration among divisions of DMR-LM, HSR-related projects of DMR-LM contributed to health development of the country. However, it still needs to promote research areas relating to Environmental Health. It was noted that both types of research divisions of DMR-LM conducted the research, of which the results were used by the service departments. The research findings were used by the service departments for various purposes. However, the extent of result utilization was not fully satisfactory. The situation inclines to the view of Remme and his group [2] that recognition of role of research in improving health system and health care delivery had increased and concurrently, result utility which is useful and serviceable, should also be taken into consideration.

Although the real situation of research utilization was not known, the findings indicate that there is still a need to promote result utilization by service departments. Thus, not only the researchers need to be encouraged to involve service managers in implementation of research but also the service managers need to be encouraged to seek information for utilization through various channels. To achieve this, the following ways and means could be helpful to enhance the utilization of research findings:

- (a) Preparing research findings in brief or executive summary for the service managers
- (b) Making this summary reach to service managers, and
- (c) Creating a situation for sharing the findings among researchers and the service managers

**References:**

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**Section 8.5.5****Situational Analysis of Utilization of Basic Health Staff**

**by Nilar Tin & Mar Mar Aung**

A note worthy meta-analytical study carried out recently by DOH which may be regarded as HSR is the "Situational Analysis of Utilization of Basic Health Staff ".All studies on basic health staff (BHS) previously carried out were systematically and comprehensively reviewed. It was concluded that the extent of involvement by BHS in service delivery was high. Findings revealed that BHS was involved in all elements of PHC, that many studies concern disease control especially leprosy and MCH but no studies on BHC involvement in Non-communicable disease control (NCD) such as mental health, occupational health adolescent health were found. This study was of great practical use to public health workers and researchers and shows the capability of DOH in doing scientifically sound and relevant HSR studies.

**Section 8.5.6****Summing up**

**by Aung Than Batu**

The development of Health Systems Research in Myanmar up to the 1980's has been comprehensively reviewed in G&D Med. Res. Vol 1. (*see chapter 11, part 4, pages 230-244*)

HSR has been variously defined. According to one definition it - "includes all types of research that contributes to improving the functioning of the health system through providing new information for decision-making in the health system or providing information to support advocacy for change in the system or through contributing to the body of knowledge relating to theories, concepts and methods that is required for generating such information." It encompasses health services research, health policy research, health behavior research and others. Like public health research HSR includes:- descriptive studies of health problems/ conditions or health behavior/practices in the community; descriptive studies of health institutions, health service operations, health personnel and their work; analytical studies to determine causal factors or contributory factors concerned with health problems or condition; experimental studies to develop and test health indicators and community diagnostic methods/ criteria and to select and test public health interventions; and evaluation of health programs.

The Scope and Depth of HSR Studies have Increased Enormously in Myanmar

One of the reviews above has identified 436 HSR studies done in Myanmar between the years 2000 and 2009. Nineteen (19) health subjects were studied ranging from service delivery, human work force, leadership, governance to disease burden; and 51 topics were covered ranging from accessibility, clinical practice, quality assurance to research ethics, on 18 different diseases, health and service conditions, health determinants and health technology. Fifty four (54) subjects and 49 topics not covered were also pointed out. According to the meaning presumably given to HSR in the review, HSR appears to deal with enquiries about almost all health activities.

Since about the beginning of the 1990's HSR has become accepted in Myanmar as a necessary type of research for the support of rational decision-making in health management. The formulation of National Health Plans at Ministry of Health level and Departmental programs and projects at central and peripheral levels as well as effective and efficient implementation of the plans, programs and projects created a demand for HSR. HSR has become institutionalized in all Departments under the Ministry of Health and all types and classes of health professionals –doctors, nurses, technicians and health managers- have become more familiar with HSR and are using the concepts and methods of HSR to enable more effective and efficient delivery of health care. Although there is a difference between public health research and HSR at the extreme ends of a continuous range of research activities dealing with health conditions in the community, the health care system of the community and the deliverers of health care to the community- there is a large overlap in the middle. Much of what is being done as public health research in Myanmar may be regarded as HSR and vice-versa. Although there is a distinct academic discipline of public health and designated public health specialists with public health degrees, no academic discipline designated as HSR exists; and there is no professional category designated as HSR specialist.

Whatever the label (HSR or public health research or operational research)and whoever and why it is done, so long as systemic enquiries are being made about health conditions and the health care system; and practical answers are being sought to correct identified deficiencies and make improvements – it cannot but be beneficial to the health of the people of Myanmar.

## Section 8.6

### Basic Biomedical Research

by Aung Than Batu

#### Developments in Basic Biomedical Research

Basic biomedical research is undertaken to increase knowledge about the basic structure and function of living cells, about how living things work (living things ranging from simple cellular and sub-cellular entities to large complexly organized human beings); it is the quest for more knowledge about how organisms function at cellular and sub-cellular level, at the level of organ system, and at the level of whole individuals.

Insight can be gained into fundamental biomedical processes by observing the alterations that take place in biomedical processes during disease. Disease may be regarded as Nature's experiment and its consequences. It may be stated, therefore, that "the wards are the greatest of research laboratories". Thus, studies of anemic patients with sickle shaped red blood cells (or sickle cell anemia) led to the discovery of Hemoglobin S and opened up new knowledge of Abnormal Haemoglobins and molecular diseases or diseases due to critical changes in molecular structure of proteins.

Many of the basic biomedical research in the past and up to now in Myanmar are done by using known principles and methods to make observations on Myanmar subjects and populations under different local conditions and during diseased states. They attempt to measure variations in physiological and biochemical parameters in various populations and to explore the short term and long term pathophysiological responses to infection with microorganism or to environmental conditions. The results usually give a good description of the biomedical processes in such conditions, using the latest available methods. Such descriptions under similar circumstances may have been made before and elsewhere and the observations made here are expected or predictable and did not add to new knowledge. Or the observations may be small variants of what has been described before and elsewhere and may have added to knowledge in a small way without being significant enough to provide new original insight into fundamental mechanisms.

Thus, for example, "A comparative study of the Physical Working Capacity (PWC) of rural and urban women " (a postgraduate research thesis) would have yielded factual data on the differences in PWC between rural and urban adult women in Myanmar but may not yield quantitative and qualitative differences which are physiologically significant and gives fresh insight into the factors which influence PWC in human subjects. Similarly, a study of "Biochemical changes in protein calorie malnutrition" would have yielded data, newly obtained in Myanmar but well known before and elsewhere, but which does not give more insight into the fundamental biochemical processes that take during carbohydrate and protein metabolism. More such examples are "Cardiovascular reflex activities in iron overloaded Thalassaemic patients", "Effects of oral vitamin C supplementation on oxidant status and semen quality" and "Plasma malondialdehyde level and red cell deformability in normal and pre-eclamptic pregnant women".

However, it is in the study of a disease (Dengue , DHF, DSS) caused by the Dengue virus that some new observations were made which provided new insight into basic biological processes. Genetic variation was explored between virus populations by directly sequencing the virus isolates and variations within virus populations were studied by cloning and sequencing the clones. Results indicated that parental and recombinant viruses can exist in a single host mosquito, thus adding new knowledge about the nature of dengue virus infection in the mosquito host. Also, for the first time, in dengue virus populations in humans

and mosquitoes, a stop-codon mutation was found on the surface of the envelope protein representing a defective lineage of dengue 1 (DEN-1) from Myanmar and within a year, this mutation had spread to all populations sampled. It was proposed that this long-term transmission of defective RNA viruses in nature indicated complementation by co-infection of host cells with functional viruses<sup>2</sup>. Molecular epidemiology studies were undertaken and phylogenetic trees drawn with the DNA sequences of dengue viruses to identify the emergence of new viral strains and establish the relationships between Myanmar dengue strains and global strains. Analyses of dengue 1 viruses isolated from one of the largest outbreaks of dengue in Myanmar (95% of viruses being isolated were dengue 1), revealed that the lineage that had been circulating for the past 25 years had become extinct and two new lineages of dengue 1 (DEN-1) had emerged<sup>3</sup>. Further studies indicated that this emergence was due to a stochastic event attributable to the low rate of virus transmission in an inter-epidemic period.

Virological surveillance detecting diversity in dengue viruses and new strain emergence has important implications for the formulation of an effective dengue vaccine as well as timely implementation of control measures in preventing DHF outbreaks. Studies of the risk factors in Dengue Shock Syndrome provided valid scientific evidence about the immunological nature of the dengue shock syndrome. A five year prospective clinical, epidemiological and virological study was undertaken in two townships of Yangon (during 1984 to 1988), to determine risk factors (epidemiological and virological) in dengue shock syndrome (DSS). The study revealed that the risk of developing DSS is 81.6 to 103.3 times higher in secondary dengue infections compared to primary dengue infections. Moreover, the risk of developing DSS is 15.2 times higher if the second infecting dengue virus is serotype 2 if compared to other serotypes. This study confirmed the findings of the earlier prospective study in Thailand. This is the only study (apart from earlier Thai study) up to then, that provided valid scientific evidence that risk of developing DSS is significantly higher in secondary dengue infections, particularly with dengue serotype 2. The findings have profound implications in the rationale of dengue vaccine development. (*see Chapter 7 Section 7.3*)

## **Section 8.7**

### **Medical Technology Development Research**

**by Hlaing Myat Thu, Kyaw Moe, Thaw Zin & Aung Than Batu**

#### **Subsection 8.7.1**

##### **Developments in Biomedical Technology that led to Advances in Medical Research**

**by Aung Than Batu**

Human beings are forever inventing things or finding out new ways of doing things. The underlying motive is "How to do things better – easier, cheaper, more useful for its purpose. A scientist (Leuwenhoek) invented the microscope, based on the light refractory property of the lens, to enable small things to be seen clearer and larger. This was improved step by step by others till we now have the modern binocular microscope capable of magnifying things 100 times or more. Different stains and processes were invented to make particular components in the material become more visible. Based on the same principle as the light microscope but using different electromagnetic waves, scientists invented the electron microscope which could magnify images many thousand times. All this may be regarded as technological research.

New technology is used directly to improve health and the way we live- like spectacles, intraocular lens, dentures, hearing aids, coronary stents, etc, etc. New technology is also used by scientists to discover new facts about the natural world. After inventing a new technology, like the microscope, it is then used to discover new facts, to obtain new information about the natural world. Leuwenhoek, after inventing the microscope, saw for the first time small living things in a drop of water, in cheese- he discovered microorganism.

Perhaps the most frequent stimulus for doing research and the most common source from which new research ideas and topics are derived – is the availability of a new method of observation, of doing things, new technology, new instruments, new techniques. Investigators are stimulated to use these new methods to observe, describe or measure previously known medical conditions, known diseases, known health conditions so that new facts are discovered and new relationships are found. Also, new technology in one science may open up new fields of research in another.

Many research projects are technology-driven:- undertaken when a new technology, method, or test is introduced or becomes available, leading to a series of interlinked studies about its applicability, usefulness, reliability and sometimes sensitivity, specificity, cost-effectiveness, in different diseases in different clinical situations.

A very common stimulus for new research ideas and topics is the introduction of a new diagnostic method or a new therapeutic and prophylactic regimen, new drugs for known diseases and conditions.

There have been large and rapid advances in biomedical technology in recent years in Myanmar. In scrutinizing the list of medical technologies that are reported as available at the research institutions and service laboratories in Myanmar, it needs to be considered whether and how they are being used.

In reviewing them we have to consider:-

- (a) whether new technology has been invented here or newly modified such as the dipstick developed by DMR to detect Viper venom

- (b) whether the new technology was imported and then directly used, in previously known ways, routinely, to do things better – like using ultrasonography of the abdomen to more easily detect an enlarged liver or spleen(which, by itself, does not add to new knowledge)
- (c) whether the new technology was imported and then used to discover previously unknown, unreported facts – such as electrophoresis to make the first discovery of the existence of HB H and therefore alpha thalassemais in Myanmar; and such as the first observation that in Myanmar, an enlarged liver, fever and jaundice suspected to be due to leptospirosis may in fact be due to a hidden liver abscess (amoebic) detected only by ultrasonography.

The advances in biomedical technology that have taken place in Myanmar include the following:

Easier and clearer imaging techniques like CT Scan, MRI, ultrasonography; better methods of visualizing internal organs like endoscopy; improved methods of visualizing intracellular and ultracellular structures such as electron microscopy, fluorescent microscopy; improved methods of studying function of organs and biochemical processes within organs, tissues, cells and intracellular structures such as cardiac and liver enzymes ; improved methods of detecting and identifying immunological reactions such as Western Blot; better methods to separate biological particles such as immune-electrophoresis, two dimensional paper chromatography, Sephadex column chromatography, ultracentrifugation; parasite culture, cell culture, virus culture; molecular methods to identify DNA such as PCR and reverse PCR.

Some of these advances like PCR are first introduced into laboratories such as in the DMR's where they are accessible to others for teaching and research; some like endoscopy for visualizing internal organs of human subjects and imaging techniques like CT scan and MRI are first introduced into teaching hospitals for diagnostic and treatment purposes where they are also used for teaching and research. Some medical technologies are useful and affordable at both research and clinical institutions. Clearly, in Myanmar, some of the recent technologies are too expensive to be set up both at research/academic institutions as well as at medical care institutions like teaching hospitals. A choice is implicitly made according to the source of the funds provided. This also leads to a division of the types of research that are pursued at research institutions and at medical care institutions respectively. This is not only because of a difference in research aims and problems of interest but also because of feasibility and availability of the medical technology required. Thus the technology available influences the type of research done.

The advances in medical technology described below in (2) and (3) are those at the DMR (LM); but many of them are also becoming available at DMR (UM) and DMR (CM) and some also at the Common Laboratories at UM 2 (Ygn) and UMM and also at NHL and some private laboratories. As mentioned above advances in imaging techniques and endoscopies for visualizing internal organs in humans are available only at clinical care institutions including teaching hospitals and some private clinics.

It needs to be strongly emphasized that the availability of a new technology, however sophisticated, does not necessarily lead to its use for research, for obtaining new knowledge, for advancing knowledge. The new technology may provide the stimulus to seek new information but it may not be taken up because of hindrance by other factors such as unavailability of time, or resources, funds, etc. The new technology may be used just for routine purposes, repeating what others had already done, and not to gain new knowledge. Such routine use may be beneficial and help in diagnosis or treatment but it may not add new

knowledge. There are instances in the past where a new technology is imported but never used for research, for obtaining new knowledge. The electron microscope was procured for DMR in the 1970's but it was never used for research, for discovering new facts, and not a single research report ensued. A considerable number of the published papers and academic theses in Myanmar merely show that a newly introduced technology can be used here in the same way that it has been used elsewhere before by others; the reports just show that we have the knowledge and skills to use the new technology effectively here in Myanmar just as others do elsewhere. Thus, one report shows that PCR can more sensitively and accurately detect *Mycobacterium tuberculosis* in CSF of suspected cases of TB meningitis when compared to microscopy for AFB. This is well known elsewhere but may not have been reported yet in Myanmar. The report confirms that PCR is useful and more sensitive to diagnose TB meningitis but does not add new knowledge and is not original research. (*see chapter 7 section 7.3*)

### **Subsection 8.7.2**

#### **Advances in Biomedical Research**

**by Hlaing Myat Thu & Kyaw Moe**

##### **(a) Molecular Techniques**

In the past two decades, molecular techniques have been established and utilized in the Departments of Medical Research. Based on a novel technique, polymerase chain reaction, many molecular techniques have been developed to detect and identify a variety of disease states and pathogenetic mechanisms. Reverse transcriptase multiplex polymerase chain reaction (Multiplex RT-PCR) using multiple specific primers is one of the techniques used for detecting and genotyping of various RNA viruses like rotavirus, dengue virus and hepatitis C virus. PCR has also been used to detect antimicrobial resistance in bacteria like *Mycobacteria* and protozoa like *Plasmodia*. A heteroduplex mobility assay (HMA) is also an innovative technique initiated for subtyping HIV. PCR coupled with restriction fragment length polymorphism (RFLP) is set up for identifying the globin gene mutation analysis for epigenetics of thalassemia and for genotyping of human papilloma virus (HPV). *In situ* hybridization using specific DNA probes labeled with enzymes is a modern tool for revealing and localization of microbial nucleic acid inside cells. A molecular method called TUNEL has been introduced to determine the apoptosis index of normal and diseased cells.

Real Time RT-PCR technique was established for the diagnosis of Pandemic H1N1 influenza virus since 2009 at the National Health Laboratory. This technique can not only detect the presence of the virus but can also quantify the number of viral copies, that is, determine the viral load and can be used for a number of viruses. Viral load quantification of HIV, Hepatitis B and Hepatitis C viruses by real time PCR technique has been established. Reverse transcriptase polymerase chain reaction (RT-PCR) technique for the diagnosis of dengue and Chikungunya viruses has also been utilized. Human identity testing, "Y" gene detection and gender verification has also been done by using the polymerase chain reaction technique. Single Strand DNA Conformation Polymorphism (SSCP) is used to detect P53 gene mutations in cancers of the lung and stomach. Microsatellite instability and loss of heterozygosity have been detected in cancer breast patients. Haplotype analysis of MDR1 genes using restriction enzyme digestion have also been used. ARMS-PCR for detection of mutations in Beta-thalassemias, multiplex-PCR for detection of mutations in Alpha-

thalassemias and GAP-PCR technique for detection of globin gene mutations has also been utilized.

**(b) Immunological Techniques**

Immunological techniques have advanced from the simple agglutination tests to the highly advanced methods like immunohistochemistry to detect tumour markers, protein immunoexpression, cell proliferation markers and oncoproteins in cells. The Western blot technique for separating and detecting the presence of multiple antibodies, combining polyacrylamide gel electrophoresis, transblotting and enzyme immunoassay, is a valuable confirmatory technique for viral infections.

**(c) Electrophoretic, Chromatographic and Spectrophotometric Techniques**

Cellulose acetate electrophoresis has been enhanced by iso electric focusing (IEF) to differentiate different types of normal and abnormal haemoglobins. Polyacrylamide and agarose gel electrophoretic methods are available to separate proteins and nucleic acids to be stained for visualizing of the separated fragments.

Chromatography has progressed from paper chromatography to the highly sophisticated high performance liquid chromatography (HPLC) set up to quantify all types of hemoglobin including A<sub>1</sub>C, F, E and A<sub>2</sub> and to identify and determine drugs and toxin levels in body fluids and environmental samples.

Ultraviolet (UV) and atomic absorption (AA) have revolutionized spectrophotometry utilized for detecting and quantitating nucleic acids and trace elements.

**(d) Chromosomal Techniques**

Karyotyping after lymphocyte culture has divulged autosomal and chromosomal abnormalities.

**Subsection 8.7.3**

**Advances in Analytical Methods of Biomedical Research**

**by Thaw Zin**

Advances in analytical methods at the DMR (LM) include the use of ultra-modern sophisticated equipment which, although utilizing the basic principles of sample preparation and analysis, has advantage in accuracy, precision, specificity, sensitivity and stability, balanced on time, labor and cost. This is also made possible by the use of computer-assisted programs, software and databases used for data handling, analysis and interpretation, and through research and development programs carried out at the National Poison Control Centre, DMR (LM).

**(a) Spectrophotometry**

Principles of instruments utilizing light source for analysis is based on relationship between fraction of incident light absorbed and concentration of the solute (Beer-Lambert's Law) for quantitation of compound in a given sample. Since the methods are non-specific, interfering compounds have to be first removed by some form of sample purification, such as solvent extraction, or microdiffusion.

1. *UV/Vis Spectrophotometry*

Spectrophotometry is used for primary identification and quantification of compounds having absorption in UV/Vis region (180-900nm). Advances include computer-assisted spectral analysis for identification and quantification of drugs and poisons.

2. *Fluorescent Spectrophotometry*

Fluorescent Spectrophotometry is used for primary identification and microquantification of compounds or their derivatives having fluorescent properties in different environmental and biological samples. Advanced kinetic studies with increased sensitivity are performed by optimizing excitation and emission wavelength through computer assisted wavelength scan and analysis.

3. *Fourier Transform Infra-red Spectrophotometry (FT-IR)*

FT-IR measures an infra-red spectrum by fourier-transform of an interferogram and is used for both qualitative (spectral search, structure drawing, identifying functional groups) and quantitative (multi-linear regression) analysis of known and unknown compounds in acute poisoning, impurities and adulterations in pharmaceuticals and traditional medicines. Its advantage includes higher sensitivity, speed of measurement, accuracy in spectrum subtraction and the ability to analyze small samples, low in transmittance. Advances include matching and confirmation of the spectra and functional groups by library search through computer databases.

4. *Atomic Absorption Spectrophotometer (AAS)*

AAS is one of the most extensively employed techniques for determination of inorganic metals and trace elements in environmental, biological, food samples and indigenous medicines. Non-volatile metals (viz. Pb, Fe, Zn, Cu, Ca etc.) are analyzed in flame system while volatile metals (Hg, As, Se etc.) are measured using vapor hydride generation. Advances include enhanced analytical sensitivity by graphite tube atomization.

**(b) Chromatography**

Chromatography is used for separation of organic compounds by means of distribution of components between a (solid or liquid) stationary phase and a (liquid or inert gas) mobile phase on the basis of partition coefficient of the compounds. They are then measured by different detectors depending upon the physico-chemical properties of the compounds. Advances in these systems include the use of autosamplers, computer-assisted programmable units for temperature control, injection data handling, analysis and reporting .

1. *Gas Chromatography (GC)*

GC is used for analysis of volatile and semi-volatile organic pollutants (viz. pesticides) present in different environmental and biological samples. It is highly specific, selective and sensitive (from ppb to ppm levels) depending upon the compound and detectors used. Advances include the use of head-space samplers for high-sample throughput.

2. *High Performance Liquid Chromatography (HPLC)*

HPLC is specially used for detection and quantification of a wide variety of drugs (e.g. antibiotics, anticancer and antimalarials like artemesinin derivatives;) and organic toxicants, which are non-volatile and thermal unstable (e.g. caffeine, cotinine, aflatoxins;). Its advantages over gas chromatography are; use of a short column, different detectors (UV, fluorometry, electro-chemical), quicker equilibration times (using gradient instead of isocratic solvent delivery system) and the use of polar organic; aqueous phase systems where

most substances are soluble. On-line degassers to remove dissolved gases had also reduces time and labor needed for analysis.

3. *Gas Chromatography- Mass Spectrophotometry (GC-MS)*

GC-MS is used for identification, confirmation and quantification of volatile and semi-volatile pollutants (viz. pesticides, phthalates, phenols etc.) present in different environmental (air, water, soil etc) and biological samples. Advances include facilities to get critical mass spectra using electron and chemical ionization modes and confirmation of the spectra by library search through computer. Molecular weights can also be obtained by using positive or negative chemical ionization mode in mass. Sensitivity from ppb to ppm levels depending upon the compound and samples measured.

4. *Capillary Electrophoresis Micro-drug Analyzer (P/ACE MDQ)*

Capillary electrophoresis (CE) differs from HPLC in that it utilizes narrow-bore fused silica capillaries instead of silica-packed columns to separate different molecules based on differences in charge, size and hydrophobicity. Depending on the type of capillaries and buffers, CE has been made to meet different requirements in qualitative and quantitative analysis, method development and quality control of drugs and chemicals. Identification and quantification of drug and drug-related impurities is currently the principle role, and its potential benefits over HPLC include speed, simplicity and cost of operation, reduction in use and disposal of large amount of organic solvents, increased automation and improved data quality.

(c) **Microwave-assisted digestion and solvent extraction.**

As stated above, chemical methods are non-specific, and interfering compounds have to be first removed by some form of sample digestion and purification steps, such as solvent extraction, or microdiffusion. Advances have been made by the use of advanced microwave technology for analytical and organic chemistry applications which has dramatically reduced the sample preparation time from hours to minutes for GC, GC-MS, HPLC, AAS and IR applications through microwave assisted sample preparation. This also reduces the cost of labor and reagents used. It avoids loss of volatile elements, leak of acid fumes into laboratory environment, and sample contamination. Closed vessel technology permits higher temperature while using the same solvents and conventional extraction methods can be easily converted to microwave methods without changes in solvent composition. This method has been used in environmental assessment using non-biological (e.g. soil, water etc.) and biological (blood, hair, nails and plant parts) samples for further analysis by above methods.

**Subsection 8.7.4**

**Developments of New Devices, Appliances, Medical Supplies**

**by Hlaing Myat Thu**

(a) DMR developed a dipstick to detect Russell's viper venom in blood/serum of snake bite victims, thus enabling early, specific diagnosis of Viper venom poisoning and early specific treatment. It can be produced now on a laboratory scale at DMR and used for research purposes. It should be possible to upscale production, firstly for distribution to hospitals and clinics and later on a commercial scale for public use. More developmental research in technology may be needed.

- (b) With the aim to conduct Research and Development of new vaccines, biological products and diagnostic test devices by using advanced technology, the Vaccine Research Centre was established at DMR (LM) in April 2012. The Technology Development Division of the Centre is currently engaged in development of a test kit for screening of infections such as HIV, HBV and HCV in donor blood. This is a collaboration between DMR(LM) and Olipro Biotechnology Company from Malaysia. Two types of test kits are being developed. One is for use at blood banks and requires microchips and computer; another for use as dipstick at the periphery.
- (c) The common gum boot used for the protection of the feet from obstacles and dirt was modified to protect against penetration by Viper fangs and is now being produced commercially by DMR for common use.
- (d) DMR (LM) has made a very important and significant innovation in medical technology at the Venom Research Laboratory. It has successfully produced Russell's viper antitoxin in chicken eggs by adapting a previous method of producing antibody in chicken eggs against other antigens. After laboratory scale production and clinical trials it is now producing avian anti-venom on a large scale for eventual commercial production and distribution.
- (e) Development of a prosthetic femoral head made of ivory at Mandalay General Hospital Orthopedic department was one of the technological innovations during the 1970's (and mentioned in G&D Med Res Vol 1.MMR)
- (f) Detection of fecal contamination of wells from nearby latrines by pouring some kerosene oil into the latrines and detecting it by smell in the well water.
- (g) Removing toxic gases at bottom of wells by lowering an open upturned umbrella with a rope and vigorously moving it up and down to mix the heavy toxic gases at the bottom with fresh air from above.
- (h) Detecting the presence of excess iron in drinking water by boiling tea leaves in it and noting the change of color to dark brown.
- (i) There may be many other small innovations in medical technology clinical methods and procedures known and used only locally on a small scale which could be used more widely if known. Serial accounts of such innovations and devices are published in the Myanmar Journal of Current Medical Practice such as modification of the urinary catheter and its uses; economical local made mucus suction pump and nebulizer pump for inhalation of asthma medications, etc.



## Section 8.8

### Pharmaceutical Research

by Aung Than Batu

A brief account of pharmaceutical research was given in G&D Med.Res. By the 1970's a systemic sequence of research on medicinal plants –from botanical identification, taxonomy, chemical analysis, in-vitro pharmacological testing, safety screening to clinical trials – had taken place in Myanmar and is now scientifically well established as can be seen from the account of pharmaceutical research at MSTRD (*see Chapter 5, section 5.6*)

BMRI was investigating the pharmacological properties of indigenous medicinal plants since 1963 and DMR, its successor, continues a systematic study of traditional drug formulations, the ingredients of which are mostly herbs from local or foreign sources. A research program for the standardization, pharmacological and toxicological evaluation of traditional drugs and herbal medicines was started by DMR in the 1970's and continues.

The Developmental Centre for Pharmaceutical Technology (now renamed the Central Research and Development Centre) was established in the 1980's to undertake developmental research in pharmaceuticals. Its major achievement in recent years was the development of methods for the production of Artemisinin compounds from *Artemisia annua* grown locally (*see Chapter 5 section 5.6*).

The BPI and its successor MPF have been doing research in conjunction with CRDC/DCPT to develop new and suitable pharmaceuticals for the country, including biological products and vaccines and to improve and test their efficacy. It pioneered the production of highly potent mono-specific anti-snake serum. DMR pioneered the production of Anti-Viper Toxoid and Hepatitis B vaccine. Recently it has been able to successfully produce viper anti-toxin from chicken eggs (*see Chapter 3, section 3.1 and section 3.4*)

Myanmar Scientific and Technological Research Department (MSTRD) of the Ministry of Industry, previously known as Central Research Organization (CRO) and Union of Burma Applied Research Institute (UBARI) has been engaged in health related research including pharmaceutical research since its beginnings.

The Pharmaceutical Research Division (PRD) of MSTRD is now continuing a strong and systematic program of research on indigenous medicinal plants which is broad in scope and considerable in depth.

The Department of Traditional Medicine, Ministry of Health, also carried out research on pharmaceuticals in addition to its service function. Private pharmaceutical enterprises play a relatively small but significant part in research on pharmaceuticals especially in recent years by one enterprising pharmaceutical company.

Tremendous technological advances that have taken place as a result of developments in molecular biology have had great impact on the development of diagnostic reagents. Most of the methods of producing biological pharmaceutical agents like vaccines and anti-sera are still according to conventional methods, using living creatures, animals, organs or tissues, plants. Sooner or later in the near future, advances in molecular biology and biotechnology will enable such vaccines and anti-sera to be built up from organic compounds like amino acids making use of bacteria and other micro-organisms and Myanmar will have to be ready for such technology transfer in the field of pharmaceutical research.



## **Section 8.9**

### **Medical Education Research**

**by Aung Than Batu**

An informal Medical Education Group was formed by interested teachers at the Institute of Medicine 1 in 1979 which later became established as a Medical Education Unit. It functioned intermittently and produced some research papers one of which is on 'Learning Module on Educational Science for teachers of health personnel' in 1985. At present Medical Education Units have been established in the University of Medicine 1 and 2 (Yangon) and in the University of Medicine (Mandalay). In addition to their main function of providing support for teaching activities and helping to make improvements in all aspects of teaching, the Units also aim to undertake medical education research. The UM2 (Ygn) Unit has a separate Research and Development section and the UM (Mdy) Unit has a Library and Research section. The Units may be doing some supportive research but such activities and publications are not very visible now. However a number of studies by Faculty members have been occasionally published. Research by the Psychology Department of Yangon and Mandalay Universities on the Intelligence Quotient (IQ) of Myanmar children, Myanmar Personality Inventory, and Myanmar Personality Traits would be of relevance to Medical Education.

The Department of Medical Science produced an 'Educational Handbook for Trainers of Health Professionals' in 2004 which included a chapter on Educational Research. It provided detailed methodology and tools for educational research.



## Section 8.10

### Health Research by Private Enterprise

by Aung Than Batu

Adoption of the market system in the national economy in recent years has resulted in rapid, vigorous growth of the private health sector. Private enterprises have not only upgraded medical facilities from small individual clinics to the level of large collective medical centers and hospitals and diagnostic facilities/laboratories but have ventured into production and manufacture of medical goods, especially traditional medicines, on a large industrial scale. Development of the health industry in this way creates new necessities and opportunities for the private component of health research to expand but it is not yet very large.

#### 1. Research into Traditional Medicinal Herbs and Remedies

*(based on personal communication with Dr Khin Mg Lwin of FAME Pharmaceuticals)*

Private enterprises have been commercially producing traditional medical drugs [such as Yogi-thway-se (ယောဂီထွေးဆေး) or [Yet-sar (ဇရုတ်ဆေး)] since the colonial period, mostly on a household scale or as cottage industry. In recent years one such private enterprise has emerged which manufactures traditional medical drugs systematically, on a fairly large industrial scale, according to international standards, good manufacturing practices and WHO guidelines, with good quality control and assurance. The traditional drugs manufactured are mostly derived from indigenous herbs with reputed medical properties; that is, herbs for which Myanmar and Ayurvedic systems of medicine have claimed efficacy for the treatment or relief of certain diseases and ailments. Some of them have been subjected to scientific studies in Myanmar and India with varying results and this is well documented. This private health enterprise is, so far, the only private health enterprise which is committed to research as an essential component of its manufacturing activity. A systematic botanical and taxonomic study of the medicinal plants in Myanmar was done. Furthermore there is ongoing built-in research cum quality control procedures on the formulation of the drugs, such as their solubility, availability, pharmacokinetics, etc. Also there is post-marketing research on acceptability, side effects improvement of quality of life (QUALY), etc. There are plans for and some initial ventures into systematic research on the efficacy of a few reputed indigenous herbal plants. With further opening up of the economy and release of market forces, this encouraging example of commitment to research by private enterprise could lead in future to a mutually beneficial marriage between universities, research institutions and private industries in Myanmar.

#### 2. Research into Medical Devices, Appliances and Supplies

Medical appliances such as crutches, wheel chairs have been locally manufactured for many years. There is a need for industrial scale production of locally important diagnostic test strips such as to detect Viper poisons (developed by DMR). Also, for cheap weighing machines to be used at village level for growth monitoring; cheap test strips and devices for detecting significant anemia; cheap sphygmomanometers, etc. There is a need and opportunity for much applied health research by private enterprises in these areas but the potential is not yet exploited.



## Section 8.11

### Overview

by Aung Than Batu

An overview of the different types of research being carried out in Myanmar from the perspective of their place and interrelationship in the health research system is given briefly in Chapter 1 'Development of the health research system in Myanmar' and each of them as done in Myanmar has been fully described in each section of this Chapter.

Clinical research methods and approaches are similar in the different clinical disciplines but their special characteristics have been given separately.

Basic Research and Medical Technology Development Research tends to be confused and an explanation of the similarities and differences has been attempted. Much of the research activities termed Basic Research in Myanmar are research activities which use the principles and methods of the basic scientific disciplines to study applied research problems such as the etiology and pathogenesis of diseases and are not research activities aimed at investigating the basic structure and function of living cells.

Each of the basic scientific disciplines has not been described. Only Pharmaceutical research has been described because much work has been done in this area by the medical as well as industrial research institutions.

Traditional Medicine Research as carried out in Myanmar does not study the principles and practice of Traditional Medicine (which is mostly based on Ayurvedic Medicine from India and perhaps also on the Unani system of Medicine). It mostly studies traditional herbal remedies and formulations used in Myanmar.

Medical Education Research is the type of research which bridges medical/health research and research in the social sciences and is relevant because of its study of the teaching methods and tools in medicine as well as the production, deployment and management of the human resources for health.

Health Systems Research (HSR) is the type of research about which there are differences in understanding by health professionals, between health professional as well as between health administrators. The concept of Health Systems Research is relatively new. Its similarity and differences with public health research is not clear to many. The section on HSR and Public Health Research has attempted to clarify what is being done under the different terms in Myanmar. Whatever the label (HSR or public health research or operational research) and whoever and why it is done, so long as systemic enquiries are being made about health conditions and the health care system; and practical answers are being sought to correct identified deficiencies and make improvements – it cannot but be beneficial to the health of the people of Myanmar.

Research by Private enterprise is not a different type of research but mentioned separately because of its different and increasing role in the health research system of the country

### Choice/No Choice and High tech/Low tech

Past experience shows that the type of interventions that had produced the greatest health impact in Myanmar was public health, low technology, community based, public health interventions that produced sure and steady results incrementally over a period of years culminating in a major success. The type of research which produced these successful public health interventions are the health service cum research activities exemplified by the quasi experimental studies that resulted in the elimination of trachoma as a public health

problem; and the integration trials from vertical to horizontal health programs that resulted in the elimination of leprosy as a public health problem.

Recent Biomedical research in Myanmar has not affected health strategy at national level. Biomedical research emphasized more on advancement of knowledge and less on changing practice whereas public health research and HSR changes practice with little advancement of knowledge. Biomedical, high technology research in Myanmar in recent decades has not generated interventions which had major impact on disease/health problems. The impact was largely due to imported high technology for use as tools in clinical management programs and clinical research confirming the suitability of the tools for use under local conditions and modifying their use as necessary. Biomedical snake bite research may become the exception if research on production of antiserum against viper venom from chicken eggs becomes successful on a commercial scale and results in a drastic change of national strategy for snake bite control.

Biomedical research, however, has advanced our knowledge and understanding of patho-physiological mechanism in DHF, malaria, diarrhea, viral hepatitis. Biomedical research at operational level has produced and assessed tools and devices that improved clinical and laboratory practice and supports disease control strategies. Thus, in malaria and snake bite, biomedical research has produced or assessed diagnostic tests/kits and contributed towards implementing the strategy of early diagnosis and appropriate treatment.

Much of high technology biomedical research in Myanmar is not sustainable on our own and needs partnership and collaboration with research and academic institutions from abroad with whom we have common research interests. Myanmar cannot follow the high technology road alone. There is no choice but collaboration with foreign scientific institution for biomedical research in Myanmar to sustain itself and to progress. Much of the high technology biomedical research required to solve some of the major health problems and disease in Myanmar like malaria, AIDS, tuberculosis, DHF are also of interest world-wide and Myanmar could access the knowledge generated by the scientific community and import, transfer the technology produced through collaborative research programs and projects - which it is doing now and should continue doing so in future. The DMR's, especially DMR (LM), has strong and continuing collaborative research programs. The Universities of Medicine has started such programs as exemplified by collaborative research program on Thalassemia between the Department of Medicine, University of Mandalay and Mahidol University. Such ventures should also be taken up by other Departments of the Universities of Medicine including the pre-clinical Departments.

The choice should not be "either or" between biomedical research and public health research but a judicious balance of both depending upon the research problem of interest and the academic discipline.

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- Analysis of the burden of disease to identify research needs
  - Further conclusions
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## Chapter 9

### General Overview

#### Medical and Health Research in Myanmar

by Aung Than Batu

#### A. Evaluation of research directed at national priority health problems and diseases during the period under review (1987-2011)

An evaluation of the research directed at health problems and diseases was done in Chapter 7, section 7.16 (A).

This evaluation came to the **Conclusion** that

- (1) Most of the research done was public health research or HSR and clinical research
- (2) Substantial and advanced biomedical research was done mainly for malaria, dengue hemorrhagic fever, viral hepatitis; some for snake bite, diarrhea and inherited red cell disorders; and little for the others; and that most of such biomedical research was done by DMR's and some by Universities of Medicine
- (3) Of importance is that strategic level research that influenced national health policy and service programs was done for malaria, viral hepatitis and snake bite; but little or none was done for the other diseases. Such strategic level research was done by research and service institutions combined.
- (4) Operational level research was varied and large in number for all diseases/health problems and was done by all institutions.
- (5) Fundamental research was limited and done by the DMR's and some academic departments of Universities of Medicine.
- (6) Research output was very large compared to the past.
- (7) Research outcome-
  - (a) There was reduction in mortality, morbidity and declining trends in malaria and some other diseases, part of which may be attributable to research done.
  - (b) There were many improvements in clinical, public health and laboratory practice for most of the diseases and health problems, part of which may be attributable to the large volume of operational level research done.

#### Further Conclusions

The Conclusions made lead to Further conclusions that:

1. Biomedical research at Universities should be promoted and supported
2. Strategic research should be done as and when the need and opportunity arises. Need and opportunity should be actively sought.
3. The desirability of enabling some fundamental research at Universities of Medicine and other health related Universities should not be overlooked, as the function of Universities is to generate knowledge as well as to transfer knowledge, with emphasis on the latter in the case of Universities in Myanmar.

#### B. Analysis of the burden of disease to identify research needs

This analysis was done in Chapter 7, section 7.16 (B) and came to the **Conclusion** that:-

- (1) Many of the major priority diseases and health problems can be averted/avoided by the existing mix of interventions but at high cost and therefore not yet affordable. Research required to avert/avoid them is Health Systems Research or Socio-economic or Biomedical research.
- (2) Some diseases/problems are not avertable/avoidable at all with the existing interventions. Research required is biomedical research or research in other sciences.

### Further Conclusions

The Conclusions made lead to the further conclusions that:

1. Biomedical research is needed to generate affordable and effective interventions that will reduce or eliminate the health problems.
2. Advanced biomedical research may not yet be possible, affordable, or sustainable at most institutions in Myanmar. The overall strategy would be for more partnership with scientific institutions abroad, to import technology and develop the capacity to absorb such technology. Such ventures should be done by research institutions which already have the required absorptive capacity; Universities of Medicine should be helped to also acquire such absorptive capacities.
3. Meanwhile and equally important or even more important - to continue with public health research/HSR and operational level research that will create products such as drugs, devices and interventions which would make current health service strategies more effective, more economical and so that the burden of diseases that are unavoidable would be lessened and mitigated.
4. Also, innovative Public Health Research or Health Systems Research may be able to generate public health interventions (using simple technology) which could solve or reduce some of the persisting health problems [*See also (C) below*].

### C. The Challenge

1. The challenge to the Health Research System is to be able to perform its five essential functions of stewardship, capacity development, knowledge generation, knowledge utilization and resource mobilization, with excellence, in this time of large and rapid changes in Myanmar. (*see chapter 1- development of the health research system in Myanmar*)

It is especially important for the leadership to have the strategic vision so that research develops in the right direction, with the right balance, and generate the right kind of knowledge to improve the health of the people primarily, and to also advance medical knowledge in the country.

(What are the knowledge needs of the health system in Myanmar? What mechanism does exist for finding this out? How is this need, when known, becomes transmitted to the decision makers responsible for development of the health research system in Myanmar?)

Strategic research should be done as and when the need and opportunity arises. Need and opportunity should be actively sought. Many of the national strategies for control of the principal diseases/health problems of national importance are derived from global strategies arrived at by international scientific bodies based on world-wide research and experience but are not conceived or arise nationally. The suitability of these scientifically excellent global strategies for adoption and adaption under conditions in Myanmar should be the objective of strategic research in the country. Identification of the need (for which disease/health problem, when and how) requires strategic vision of the leaders in health research.

**D. QUESTIONS to provoke strategic thinking:**

\* What would be the health situation now if no health research had been done in Myanmar (i) during the last two decades or (ii) during the past many decades?

\* What changes in the health situation had taken place and how much of this could be attributed to health research in Myanmar?

\* What would have happened or not happened with respect to the people's health if no research had been done?

\* What changes in clinical, public health and laboratory practice has resulted from the research done?

Such questions are often overlooked. These questions could make researchers, especially research leaders in academic, service and research institutions realize the-

(i) Level of research being undertaken, whether strategic or operational?

(ii) Significance of the research being done- whether there is health impact and/or scientific significance?

(iii) Purpose of the research done –to advance knowledge and/or change practice?



## General Overview

### Health and Research Development in Myanmar and the International Community

by **Ko Ko**

#### 1. Health consequences of the 1988 Uprising

Prof Aung Than Batu's second book on the Further Development of Medical Research in Myanmar, covers the period 1987 to 2011 and it covers the most disturbing decades following the 1988 Uprising and its Consequences. This reminds me of a Public Health Text Book, published in America, towards the end of the 19<sup>th</sup> Century, soon after the conclusion of the American Civil War 1861-1865. The Chief Editor of the Text Book noted in his Introduction to the Book that Public Health has roots in the peace of the country and without peace there can be no health. Even though the 1988 Uprising in Myanmar is not as devastating to the country as the Civil War of America, the aftermath of the 1988 Uprising with the subsequent negative reaction and pressure of foreign countries, especially those of the Big Powers, very much upset the general development in Myanmar and the social sector suffered the most.

It should be understood that the 1988 Uprising did not come out of the blue; it has roots in the 1962 military take-over by the Revolutionary Council, the subsequent Myanmar Socialist Program Party and the ensuing Government; the 1974 Constitution and the political and socio-economic dissatisfaction thereafter. The 1988 Uprising (8 August 1988) saw the self-abdication of U Ne Win from BSPP presidency, followed by fast, successive changes of the Presidents of the country-U Aye Ko, U Sein Lwin and Dr Maung Maung.

General Saw Maung took over power as Chairman of SLORC (State Law & Order Restoration Committee) on 18 Sept 1988 and slowly the 1988 Uprising was controlled and Government Departments and staff returned to work.

A National Health Committee was formed in 1990 (reorganized in 1998); National Health Plans were drawn for 1991-92, for 1993-96, for 1996 to 2001 and so on. The National Health Committee formulated the National Health Policy, 1993. Regarding Health Research, the National Health Policy designated as follows: "To encourage the conduct of medical research, not only on prevailing health problems, but also giving due attention in conducting Health System Research"

National Health Budget in all low and middle income countries are generally very small and such funds allocated to Health Research in these countries are much smaller. In Myanmar external resources for Health Research are always limited. Soon after the 1988 Uprising, the diplomatic relationship with some major powers was strained, leading to curtailing of financial support from them as well as from some UN agencies like UNDP. After the 1988 Uprising UNDP suspended all its financial support to Myanmar. UNDP even stopped a major Hepatitis B plasma- derived vaccine production project to DMR, co-financed by WHO and CDC Atlanta. With great efforts by Govt. and WHO, the Hepatitis B vaccine project got extended and completed by 1994. The DMR continued epidemiological research on Hepatitis B infection in Yangon. It extended work on vaccine development and went on to produce Recombinant DNA Hepatitis B vaccine with the support of Republic of Korea.

Regarding suspension of support after 1988, along with UNDP, World Bank, International Monetary Fund and Asia Development Bank, discontinued their respective support. However, UN specialized Agencies WHO and FAO, along with UNICEF, UNDCP and UNAIDS and some big NGO's, continued with work in Myanmar. EURO which has just began operations in Myanmar, terminated operations after 1988. USA, both USAIDS and US

Peace Corps, never existed in Myanmar. Though selective in their support with limitations in programs, British ODA, Japanese ODA and AUS-AID, continued their support. Many INGOS, especially major ones such as GAVI, JICA, PSI, MSF, Save the Children, World Vision International, were there in the country. UN Global Fund/ A.T.M initiated support in Myanmar in the beginning of 21<sup>st</sup> century for 3 or 4 years, then withdrew the operations, presumably under political pressure; into the vacuum, British, Australia, EURO led Three Diseases Fund came in. However, it must be well understood that most of these support are meant for humanitarian assistance, where health sector is also included, but as usual, funds for health research would be negligible.

## **2. Health Care Programs and Research Programs- Influence of Funds from International Sources**

Global Forum for Health Research in 1998 estimated, generalizing globally, that 2.7% of total Health Budget is spent on Health Research and Development. For 2 years in 1997 and 1998, Global Forum had studied in 3 Asian countries and the most advanced country, Thailand spent about US\$ 30 Million in Health R&D, mainly supported from national Government budget. Even in normal politico socio-economic situation, R&D Health Budget in Myanmar would be much lower than in Thailand. With negative political pressure by Big Powers, with all kinds of sanctions after 1988, R&D Budget in Health in the country would be almost non-existent.

For nearly two decades since 1988, Research in Health in Myanmar is supported by national budget with small token support from UN specialized Agencies, from INGOS and exceptionally friendly countries on subjects of interest to them. Again, these are mostly on Research cum Action Projects such as on Disease control campaigns: - Leprosy, malaria, TB and new global activities like in Poliomyelitis, measles, Neonatal and AN Tetanus control.

Meanwhile, Ministry of Health organized projects on Health of the Elderly and initiated activities to study and control Non-communicable Diseases. When in the middle of 1<sup>st</sup> decade of 21<sup>st</sup> century (2004-2005) new viral diseases threatened the world-SARS, H5N1 Avian Influenza and later Swine flu, considerable international resources were made available to Myanmar.

With the kind technical and material support of concerned UN agencies, especially WHO, FAO, UNICEF, UNDP as well as friendly neighbors like Thailand, China and Japan, health and veterinary departments accelerated epidemiological, virological and control activities against these new viral diseases.

Almost at the same time, more funds were made available for CD programs, to study and extend work on MDR and XDR in pulmonary TB, and to study and contain ACT resistance in Malaria, Myanmar responded energetically with good results.

As regards Centres of Excellence, University of Nursing was recognized by WHO as a Collaborative Centre for Nursing, Midwifery Training & Education; Dept of Medical Research (LM) was recognized as a WHO Collaborative Centre for Research Training in Malaria; and University of Public Health received attention as a Centre of Excellence in teaching of Post Graduate Public Health.

The Three Departments of Medical Research received sizable amount of Research Budget from WHO (especially Tropical Diseases Research), American Leprosy Association; Republic of Korea for CD programs, and from Japanese Universities to support joint collaborative activities.

Myanmar Medical Association presents scientific papers at its Annual Conferences yearly on varying subjects- clinical subjects, basic sciences, PSM, microbiology and pathology, etc. Majority of those papers are basic or analytical reports from studies all over the world, summarizing the findings.

### **3. New Political Changes and Financial Implications for Health**

The year 2008, two decades after the 1988 uprising is the land mark year for opening up of Myanmar among nations. Cyclone Nargis attacked lower Myanmar on 1 March 2008, affecting most of Yangon Division and 4 townships of coastal area of Ayeyarwadi Division, leaving more than one and a half lakh casualties with great devastation to the entire area. The country and the Government were heavily criticized for negligence and non cooperation in refusing external relief work and assistance. Govt. was accused by Big powers severely for conducting the Referendum for National Constitution, only 2 months later. In the year 2010 the general election to the Parliament was held, which again was criticized for callousness by many countries. ASEAN and neighbors cautiously welcomed the General Election.

President U Thein Sein led the new democratic Govt. in March 2011, and gradually built up his credibility, proactive leadership role with strong capabilities. In a 2012 Bye-election Daw Aung San Suu Kyi was elected into the Parliament with a NLD majority and U Thein Sein and Daw Aung San Suu Kyi proved their sincerity and joint leadership roles.

Though reluctantly supporting the new Govt. in 2008 the International Big Powers gradually showed their confidence and began to talk about relaxation of the Political and Socio Economic Sanctions.

From USA, Foreign Secretary Hilary Clinton visited Myanmar first, followed soon on 19 Nov 2012 by President Obama. Other Big Powers followed suit. Heads of Govt. of UK, Germany, Canada, EURO Council, neighbors like India, China and ASEAN countries visited Myanmar.

Regarding general assistance and support, US Govt. initiated action to release Politico-economic Sanctions with implications for health sector as well. With the general support of U.S.A, the Economic and financial institutions like World Bank, IMF and ADB began showing positive interests in Myanmar. From USA itself, they indicated active support through USAID and Peace Corps. US AIDS is showing interest in Parliamentary matters and community support through Microfinancing. In practice ADB had been supporting Myanmar through Greater Mekong Community. US University Consortium, Harvard, Johns Hopkins are approaching Myanmar authorities for collaborative support. Some interest is being shown by Euro, Australia, UK and Japan. One important international activity is the resumption of support to Myanmar by UN Global Fund for HIV, TB & Malaria, with the agreement of the Three Diseases Funds, to take up M.D.G instead of focus on the three Diseases.

Of course one has to understand that the opening up with financial assistance to Health budget will indirectly and partly go to Research budget in Health Sector

While welcoming the general opening up accompanied by flow of resources including funds, Myanmar President U Thein Sein had warned all parties concerned that these additional resources must benefit the people generally and serve them effectively and efficiently, and to convince the donors that funds and resources are managed well.

### **4. National preparedness for global partnership and national capacity build-up to enable informed choice for the country's best benefit**

We therefore have to prepare ourselves for broader & wider global partnership: -

1. To improve national capacity building and management capabilities;
2. To choose systematically and wisely in prioritization and selection of activities;
3. To accept and follow international standards and norms and management principles
4. To prove our capabilities, honesty and transparency
5. To convince international donors that inputs in Myanmar are productive, cost effective and with evidence-based result oriented.



**CHAPTER 10**

**CONCLUSION**

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## **Chapter 10**

### **CONCLUSION**

**by Aung Than Batu**

This account of medical research in Myanmar from 1987 to 2011 starts arbitrarily in 1987 and ends when the Myanmar government changed in March 2011. It covers the period during which much political and socio-economic changes took place in Myanmar and still continues. This volume and the previous volume "Growth and Development of Medical research In Myanmar (1886-1986), of which this volume is the sequel, together gives the definitive history of medical research development in Myanmar from the earliest colonial times (1886) to the end of the last administration (2011), a span of approximately one and a quarter century.

It is written by knowledgeable persons involved in executing research or managing research during the decades following 1986 and a few of the older generation who still continue to be involved in medical research, in one capacity or another, and whose knowledge, experience and vision would help to make the story to be told now richer and more meaningful.

This volume has turned out to be not just descriptive but also analytical and critical in parts. The contributions from the authors are factual- describing what was done, by whom, when and where; and also explanatory- telling how things were done and sometimes why and why not.

The Overviews by the Editor are analytical and sometimes critical. The two General Overviews are written by Dr Aung Than Batu and Dr Ko Ko, two senior persons of great experience in managing medical research both nationally and internationally and with continuing interest in the development of medical research In Myanmar. Dr Aung Than Batu has summed up his reviews of the purpose, content and type of research done in Myanmar in the past and in the recent two and half decades and given his viewpoint of future medical research development in Myanmar. Dr Ko Ko has described the interrelationship between health and health research development in Myanmar and the international community.

Both strongly state that the health leadership in Myanmar would need broad strategic vision in responding to the changes taking place nationally and internationally in matters concerning health and health research development, so that there will be the greatest benefit to Myanmar.



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