

The Advanced Medical Science and Technology: A Challenge to The Higher Education in Developing Countries¹

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ABSTRACT Indonesia's second stage of the National Long-Term Development Plan is a determinant factor for the shape of the country by the year 2020. A new era of development in the next 25 years will be of an unprecedented magnitude and far reaching significance for the future of the country as well as for South East Asia. Health development as one of the essential components, will play a significant role as it is the foundation for the well-being of the society without which development and progress will not be accomplished. On the other hand, a promising health development will depend on the availability of the human resources with a proper scientific background in the field of medical sciences. Therefore, health research is an effective way to solve many health problems encountered in the country. This condition in turn depends on on the advancement of the higher education to participate in the development. The WHO strategy for HFA by the Year 2000 specifically states that health research and development policies are the essential components of national health. An effective mechanism, coordination of research activities, the use and dissemination of its results should be established. The unique situation in Indonesia is described, in regard to geographical position, multiethnic, sociocultural traditional beliefs, health situation and services available. Facing two patterns of diseases, the commonly established infectious diseases and the new emerging diseases as a consequence of industrialization, the access to the advanced medical science and technology that develop rapidly are the challenge to the higher education to solve those problems effectively and efficiently in the years to come. [Paediatr Indones 1996; 36:127-136]

Introduction

Indonesia, an archipelago of around 17,000 islands with the total land area of 1,920,000 sq. km is situated across the equator between the Indian and Pacific

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Oceans and between Asia and Australia. The size of the islands ranges from subcontinents (Kalimantan and Sumatra) to small coral atolls that stretch from east to west over more than 5,000 km. The diversity of climates in consequence of varying effects of prevailing winds, monsoons and ocean currents make this tropical area into a condition with a high endemism on the islands with all its cost. It has a rich inexhaustible natural resources of spices, hardwood and minerals. Moreover, around 70% are maritime area that covered the eastern part of Indonesia has abundant unexplored natural resources that become primadona as the new strategy for the next national development plan.

Indonesia's population of 195 million ranks 4th in the world and 1st in South East Asia, is rapidly-growing (2.1% per annum) scattered in 27 provinces and concentrated mainly on the "inner islands" (Java, Madura, and Bali) with 500-800 peoples compared to the eastern part with only 17 peoples / sq. km because of the young rich soils that made intensive agriculture possible and enable to support the high population density.¹ The country consists of 27 provinces with diversity in ethnic groups, religion, socio-economic and cultural beliefs with different educational levels among the population that makes especially health services very difficult to accomplish.

The triad of health problems, namely the rapid population growth, nutritional problem and the high morbidity and mortality in the community are our main concern at this stage. Moreover, the impact of the long colonialization era as appeared in the low awareness of the people on personal and environmental hygiene; the low educational level and the old traditional beliefs among the society are predominant factors to be considered in the national health development.

The higher education that develop rapidly in the country since the independence as seen among others is the existence of not less than 30 medical schools (state as well as private) that provide 2,000 graduates per year. At present there are around 28,000 physicians in the country. Every graduates from the medical schools is obliged to serve the country from 3 to 5 years in remote areas all over the country.

The Health Situation

If in 1980 the *total population* was 147.33 million, it grew to 179.33 million in 1990 and more than 190 million in 1994 and at present becomes 195 million. The crude birth rate (CBR) is declining with a rate of 11.8% during the period of 1985-1990 and 1990-1995 with a total fertility rate (TFR) ranging from less than 3% to more than 5% in Java and Maluku islands and in Irian respectively. See Table 1. The crude death rate (CDR) is however 5.06% contribute to natural increase (RNI) of 14.42%.²

Nutritional status of the people is the basic important issue in health development of the country. Indonesia has experienced in the management of severe malnutrition among children in many areas in the country in the past. Two decades ago, in one

area close to Yogyakarta (in a lime stone) hill zone along the south coast), severe malnutrition was very common among population. The condition that stays because of an ecological disaster brought about by the authorities for many years during the colonial time. Malnutrition was also identified as the result of the unequal distribution of land and income among the community. By concrete efforts of the government together with the people in the last decade, several initiatives were made with great success involving scientists from the higher education to improve the situation.³

Table 1. Population growth rate in 27 provinces

RATE	FROM 27 PROVINCES
2.0 or less	8
2.01 - 3.0	10
3.01 - 4.0	6
over 4.0	3

However, national figures still shows at present, 40% of the under-fives are in *adequate or moderate nutrition*, while the rest are still suffering from malnutrition, a condition vulnerable to infection and aggravate diseases they might encounter. It is mostly found in the eastern part of Indonesia, a relatively not well developed area. *Severe malnutrition* could still be seen in 1.4% among the under-fives in the country. Clinically, *vitamin A deficiency* (1.04%) has been significantly suppressed in most part of the country because of intensive Vitamin A program since 1978/1979. However, in two provinces, North Sumatra and Maluku islands, 20 per 1,000 children still suffer from xerophthalmia (X1B). Subclinical vitamin A deficiency is however still around 50% in the country. *Anemia*, which is nutritional in origin, is frequently found in low income people, 60% of the pregnant women and 55% of the under-fives *Iodine deficiency*, manifested in goiter and cretinism becomes a public health problem to the country as they will suffer of permanent mental disorder in their further life.

Low birth weight infant or small for date babies demonstrates the very early malnutrition in their life that reflects the poor nutrition of the pregnant mothers. Various studies done in Indonesia and official data show that the national figure of LBW infants are between 11-17% (Table 2). It differs between urban and rural data and varies from one area to the other. Growth faltering in infants at the early age is partly predominant due to undernutrition of the mothers during pregnancy and lactation. There is relation between low birth weight babies and mortality mentioning that if the cut-off point of LBW infants is 2500 grams, the relative risk of dying in the period of 0-12 months was twice as high for LBW than normal infants and about ten times higher in the neonatal period of LBW infants if the cut-off point is 2200 grams.¹

Table 2. LBW Infants in South East Asia Countries⁵

COUNTRY	% LBW
Indonesia	11 - 17
Philippines	15
Thailand	13
Malaysia	10
Singapore	7

Infant Mortality (IMR)

The under-fives mortality (U5MR) and the maternal mortality rate (MMR) in Indonesia as markers to the advancement of a national health were still unsatisfactory as they are the worst seen in ASEAN countries (Table 3). However, encouraging figures could be noticed in the last decade. A rapid decline of the IMR could be observed, from 142 in 1971 that went down to 112 in 1980, 71 in 1985 and 54 per 1000 livebirth in 1990 ! It is the hope that at the end of second 25 years national development plan that will end in the year 2020 the IMR will reach to 20 per 1000 livebirth.

Infectious diseases with poor nutrition as background are responsible for the high IMR, U5MR and MMR. Recent data mentioned that *neonatal tetanus (19.3%), perinatal complications (18.4%) and other infectious but preventable diseases like diphtheria, pertussis and measles (9.4%)* are the responsible causes of the high mortalities (MOH).

Table 3. IMR in South East Asia countries⁵

COUNTRY	IMR (PER 1000 LIVEBIRTH)
Indonesia	54
Philippines	46
Thailand	27
Malaysia	14
Singapore	7

Encouraging figures that declines significantly during the last decade is also shown in the under-fives mortality rate, reflects a better nutritional status, better educational level of the community, particularly in women and also a better health service in the community.

The high maternal mortality rate of 420 per 100,000 pregnancy remains a difficult question to be answered, very complicated situation, not only due to infection resulting from TBA's practices (70% of all deliveries in the country), but also due to many other factors: nutrition, access to inadequate health service for geographical reason, and various old traditional belief that still exist in the society. Table 4 below shows us the situation of MMR in SE Asia region.

Table 4. MMR in South East Asian Countries⁵

COUNTRY	MMR (PER 100,000)
Indonesia	420
Philippines	100
Thailand	50
Malaysia	59
Singapore	5

A unique situation happens in many developing countries including Indonesia, that in the era of rapidly growing science and technology, an overlap of infectious diseases occur in the same time with new emerging diseases as a result of industrialization with its consequences (urbanization, new settlements, overcrowded traffic in cities and new life style in the society). Add to the above mentioned issues is the modern technology practices in agriculture and forestry with not well equipped preparatory measures. Those negative health hazards that arise together with the old established infectious diseases despite measures taken to eradicate it will surely need more efforts in the following years of the national development plans. Moreover, HIV positive and cases of AIDS are constantly knocking at our door harder and harder. The latest information have warned us that hundreds of people are HIV positive in the country and 52 of them died because of AIDS. Unless effective and efficient measures taken by the government, health related organization as NGO's including the medical associations, it is predicted that around 2.5 million positive HIV cases will show up in the year 2,000 that will disturb the national economy and further development plans.

Health development is therefore a strategic issue in the national development plan as one of the efforts to create productive human resources to participate in the long term national development plan.

From Household Surveys done recently (MOH, 1992) the pattern of the underlying cause of death is still predominant of infectious disease (46.8%), followed by features of cardiovascular, degenerative and malignancies (31.2%) and finally also due to accidental injuries and poisoning (22.0%).⁶

Malaria that fluctuate during the year has always become a serious problem in the

country, especially in the eastern part of the country. In transmigrating area and remote areas in Indonesia, cases of malaria could be found between 0.99 to 238.38 per 1000 population. Efforts towards the eradication of malaria has been intensively conducted since many years involving various sectors including universities existed in the area. Diarrhoeal diseases, that varies from 19 to 26 per 1,000 population with seasonal flare ups could be seen continuously during the year in more or less throughout the country.

High incidence rate could be observed in some crowded and in a not well developed areas that reach 33.7 to 49.4 per 1,000 population as it is in East Java and East Timor respectively. However, case fatality rate has been considerably decreased as a result of the better management and the use of appropriate technology e.g. the widely used Oral Rehydration Solution and adequate monitoring by health cadres in the society. It is also demonstrated that diarrhoeal disease specific death rate infants had declined from 20% in 1970 to 14% of all infant deaths in 1992 and childhood was 33% in 1970 and 27% of childhood deaths in 1992.⁷ Dengue hemorrhagic fever, first recognized in Surabaya in 1968 with only 58 cases has been widely spread throughout the country with an increase rate from 0.14 to 6.09 per 100,000 population in 1989 with total cases 10,362. The fatality rate which was very high has been successfully suppressed from 41.4% in 1968 to 4.4% in 1989. Hepatitis B become very popular among the community in the last decade. From official data observed it is stated that Indonesia is an intermediate to high endemic area with a prevalence of as high as 6-17%! Many people died because of liver cirrhosis or liver cancer that frightened the people. Immunization against hepatitis B is however still a luxury and regarded as too expensive to the vast majority of the people.

Other communicable diseases like diphtheria, tetanus, pertussis, typhoid fever, tuberculosis, measles are still very popular among the community, although Extended Program on Immunization (EPI) has been widely practiced in Indonesia and recently also with the first national mass immunization against polio launched in the whole country in the attempt to eradicate polio early next century.

The Higher Education and Its Deliberations

We are facing two patterns of health that challenge us how to set up an effective solution towards a better quality of the people in the near future. First pattern includes diseases that exist mostly in every developing countries due to communicable diseases that give a high morbidity and mortality among the people, impaired nutritional status of the people that goes to a vulnerable human being against many disease resulting in a poor growth and development of the children. Moreover, this condition will be aggravated by the unfavorable environmental condition. This situation could be observed particularly in societies with minimal understanding on how to live healthily as a results of the low education as well as socio-economic level. In many places negative

impact of the long lasting colonialization in the past could still be as one negative factor in the society.

The second pattern are disease that used to be found in industrialized countries such as degenerative diseases, malignancies, mental disorders and accidental injuries and poisoning. This newly developed pattern of diseases occur not only among the well to do urban community but also in the rural areas where agriculture and piantation are the main living practices.

In the era of the rapidly growing medical science and technology those situation became a challenge to scientists and researchers available in universities for to conduct more effective and efficient solutions within a reasonable time in the near future. This should be purposed by the higher education that exist widely in Indonesia.

Research activities and continuous effort through scientific meetings on various health problems in the country should go to a more effective outcomes in its objectives. Every results should be carefully studied and implemented to the relevant situation in the country. To accomplish this ambitious goal, the higher education, in particular the medical schools and other relevant institutions such as the National Research Council, National Institute of Health Research and Development Board, and other supporting facilities such as laboratories, basic as well as clinical and pharmaceutical agencies available should work collaboratively.

There are at present not less than 30 medical schools in the country, state and private, produced annually around 2,000 physicians who are compulsory serve for the country for 3 to 5 years in remote areas straight from their graduation day. For this reason the medical curriculum is designed to graduate physicians that should be well equipped with appropriate medical and surgical knowledge and experience in various emergency procedures with a broad view in community health. At present, 28,000 physicians are serving the community and 70% are in rural areas facing diseases still popular in the society such tuberculosis, typhoid fever, malaria, diarrheal diseases, dengue hemorrhagic fever and frequently flare ups of communicable diseases like measles, diphtheria and tetanus. This of course will hamper the national development program.

However, entering upon the second 25 years national development plan, we need appropriate health technologies coping with various infectious diseases and in the same time the new emerging diseases. In accordance, a change in strategy has been in progress in the medical education in regard to the access of advanced science and technology that developed globally. This depends on the national capabilities how to absorb and implement the rapid development of medical science and technology in the attempt to improve the very complicated health situation of the country related to the National development plan.

The trend towards modern medicine in the future, medical curriculum should be modified to the community in improving their health and quality of life. Some portion of the medical education should be stressed on how to serve the community profes-

sionally and some other portion of students to become researchers using modern medical science and technology.

Biomedical sciences should be allocated more in the curriculum to encourage young students for doing research and through good scouting, the best benefit of the institution to conduct research in a larger scale for a more effective and efficient health service in due time. The discovery of DNA structure as revolutionary advancement in molecular biology for instance and the application on DNA recombinant, hibridoma technology for antibody monoclonal development will become a daily discussion topics among the staffs and students in medical schools.

Latest development in cell, membrane and molecular biology, together with biochemical sciences that will enhance modern immunology related to communicable diseases and immunodeficiency disease is one step ahead in medicine. It is also true about the development of neurochemistry and neurobiology in the pathogenesis and pathology of various degenerative diseases. Physics as basic science in medicine comes to radiology techniques, such as ultra sound scanning, magnetic resonance imaging (RMI) and positron emission tomography (PET), laser technics in surgery and other science and technologies in the field of human reproduction.⁸

In number, there are very few researchers in the country and if research activities were conducted an overlap of topics could happen easily resulting in duplication of activities due to lack of communication as well as poor coordination. Moreover, it is believed that research activities could be well organized through more efforts in coordination, supervision and to make available the facilities for research that could be used efficient and effectively throughout the country.

Three Inter University Center's (IUC) has been developed since 1985 to increase the quality of scientist through Masters and Ph.D's programs. Biotechnology was mainly organized in those IUC's to develop clusters of scientists in that field which is essential in the national health development. A Center of Excellence in Biotechnology (1990) and Microbiology (1994) as been developed later at the University of Indonesia together with the establishment of a Biomolecular Laboratories in Indonesia to enhance researchers in solving various health problems toward better health and welfare of the people.

The National Research Council of Indonesia (NRCI) has designed an effective system for selecting research proposals competitively from all institutions or universities and as research allocation budget of the government is increasing year by year, selected research topics will be financed by the government. The objective is not only as regard to efficiency of financing, but also to encourage to conduct research in a team from various institutions or universities and or disciplines and later on also to encourage industries to work together with universities in their respective fields.⁹

In this context, the more privilege countries could contribute in the national development plan of the developing countries through collaborative activities in research, scientific meeting and training to young scientists and researchers. A good example is

the approach of The Japan Society for the Promotion of Science (JSPS) toward this problem. Since 1978 a Memorandum of Understanding (MOU) was signed between JSPS and The Directorate General of the Higher Education (DGHE) of Indonesia for conducting collaborative activities between the two countries in various fields. The fields of medicine, agriculture, science, engineering and social & humanities were the main topics for collaborative works. Total number of exchange scientists within the last three years (1991, 1992, 1993) and PhD of various disciplines since the commencement of JSPS-DGHE Program are shown in the tables below.¹⁰

Table 5. Number of scientists exchange for Indonesia through JSPS-DGHE Program in the Fiscal Years 1992, 1993, 1994

Indonesia to Japan	Japan to Indonesia
143	180

Table 6. The number of PhD awardees to Indonesia under Ronpaku Program (FY 1978-1993)

Medicine	Agriculture	Science	Engineering	Social Sciences / Humanities
22	17	10	5	3

Through similar programs by the developed countries like Japan, it can surely be of significant support to enhance and increase the quality of researchers in the higher education from the developing countries that will in turn develop a better health and quality of life of the people. To Indonesia, it will enhance the 2nd 25 years long-term development plan that commenced in 1994.

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