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THE ECONOMIC AND HEALTH ASPECTS OF PARASITIC DISEASES

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The necessity to control epidemic diseases has never been questioned up to the present time. However, when it comes to endemic diseases whose effects on health or economy are less obvious, it becomes increasingly difficult to establish realistic lists of priorities for disease control programmes within economic development plans and to provide convincing facts of the economic impact of those endemic diseases with less dramatic signs and symptoms.

It is proposed to review cursorily present knowledge of the economic effects of certain parasitic diseases and to indicate the reasons why it is believed that their control would contribute to accelerate economic development.

What do we know of the economic effects of certain parasitic diseases?

Mortality and morbidity figures, particularly with reference to developing countries and to parasitic diseases, admittedly do not reflect exactly the public health importance of such diseases. For most parasitic diseases accurate reporting is difficult to achieve. The cause of death due to chronic forms of parasitic diseases is often missed. Morbidity is appreciated by the numbers of cases seen in hospitals, clinics, or private practice. Occasionally, an attempt is made to relate such data to the population in the area but the sampling problems are almost always insuperable.

There are of course reasons for this state of affairs. The foremost is the fact that the diagnosis of conditions that are not solely characterized by acute readily-recognizable episodes is often difficult and time-consuming, and chronic parasitic infections are often associated with other conditions for which the true etiology is unknown. Health services in developing countries are insufficiently staffed with trained personnel, and hospitals and pathological services are insufficiently equipped.

The lack of experienced statisticians is also at the root of the serious deficiencies found in vital statistics from developing countries. For example, in one WHO publication (6) reproducing data on malaria from national statis-

tics reports for the period 1955-1964, only a single entry is given for Nigeria for the year 1957 of 80,093 cases and 97 deaths, while it is known from direct information that the number of malaria cases in that country with a population of over 55 million should be of the order of several millions. Moreover, parasitic infections in developing countries are usually associated with other infections and malnutrition, the relative importance of which is difficult to evaluate. Lastly, it is only recently that certain parasitic diseases have come to be recognized as causes of serious morbidity and mortality.

There are many vivid descriptions by laymen of the ravages caused in the past by the great epidemic scourges, such as trypanosomiasis in Africa and malaria in India. But in order to appreciate the economic effects of the chronic forms of parasitic diseases, it is necessary to have an intimate knowledge of their transmission, course of development, and pathology. In fact, it is because they possessed that knowledge that parasitologists were led to believe that the conditions they treated must have repercussions at the community level. They began to look for them, and if their studies are still made without the benefit of modern tools in health economics, they provide guidelines for future quantitative investigations of the economic consequences of parasitic diseases.

The following items are proposed for consideration: (1) cost of individual treatment and of specific control programmes; (2) mortality and reduced life-expectancy; (3) the incapacitating diseases; (4) diseases directly affecting agriculture and animal production;* and (5) diseases with socio-economic effects.

Cost of individual treatment and

of specific control programmes

Except for occupational health, which is practised to a limited extent mostly in large mining companies or plantations, both curative and preventive medicine devolve upon governmental services in the majority of developing countries.

Allocations for parasitic disease control or eradication naturally depend on the importance assigned to each specific disease in a particular country. It has to be recognised also that many of the parasitic diseases have been accepted in the past as being part of natural life and no medical advice was therefore sought. It must be expected that this will alter with the changing social-economic pattern and education. While more treatment might already be being requested in clinics, parasitic diseases will occupy even more hospital beds in future.

Mortality and reduced life-expectancy

Quite a number of parasitic diseases, depending of course on the intensity

* This item needs to be treated in a separate article.

of infection, end in death if left unattended, particularly African trypanosomiasis, malaria, visceral leishmaniasis, and certain deep mycoses. In Chagas' Disease, approximately 10% of acute forms in children are fatal.

The economic effects of mortality and of reduced life-expectancy will depend very much on the age groups and sex most affected. From a purely economic point of view, a high mortality in young men and adults in the native population is of vital importance since these age groups are the very ones no country can afford to lose.

It now appears that schistosomiasis must be added to the diseases mentioned above. In community cross-sectional studies with modern diagnostic techniques, it was found that *Schistosoma haematobium* gave rise to hydronephrosis, ureteric lesions, or non-functioning kidneys, in more than 20% of the child population, but only in over 10% of the adults (2). Such evidence of serious lesions occurring in adolescents and children but with lesser frequency in adults suggests that schistosomiasis might be the cause of considerable mortality, unsuspected so far, in the age groups that are about to begin their productive life.

The incapacitating diseases

Of particular importance, owing to the severe irreversible pathological effects or multilations they produce, are American muco-cutaneous leishmaniasis, Chagas' Disease (cariomyopathies), some mycoses (e.g. mycetoma), and schistosomiasis. In hyperendemic areas of filariasis, 30% of the adult population may be affected by hydrocele and elephantiasis.

Onchocerciasis is certainly one of the most striking examples of an invalidating disease. Like trachoma, its most serious consequences are blindness and impaired vision. In many parts of West and Equatorial Africa more than 50% of the inhabitants are infected with *Onchocerca volvulus;* 30% of them have impaired vision; and 4-10% are blind.

Although it is difficult to appreciate the cost of loss of vision to economy, it may be said that blindness in hyperendemic areas is often already established in the 20-30-year-old age group and that its highest incidence is usually found in adult males. Also, as onchocerciasis does not shorten life, all these blind people constitute a heavy burden on the community.

Practically all parasitic diseases have debilitating effects (weakness, anaemia, loss of weight), painful episodes (e.g. malarial fever attacks, painful swelling of the lymphatic vessels and glands in filariasis), or produce discomfort (intolerable pruritis in onchocerciasis, dysentery bouts in amoebiasis).

The soil-transmitted intestinal helminths — roundworms (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), and hookworms (*Ancylostoma duodenale* and *Necator americanus*) — probably rank highest among all the helminths from the point of view of their influence on individual health and

group productivity. From the many published reports it can be estimated that 650 million people are infected with *Ascaris*; 350 million with *Trichuris*; 450 million with hookworms; 3.5 million with *Strongyloides*; and 5.5 million with *Trichostrongylus*. However impressive, the figures quoted would be meaningless if they did not bear relation to intensity of infection and morbidity. There is now general agreement that where a large number of people are infected the frequency of heavy infections can be expected to be greater on account of constant, daily exposure to reinfection. The main pathogenic efforts brought about by these groups of helminths are: (1) anaemia and oedema in hookworm infection and, to a lesser extent, in other soil-transmitted infections; (2) intestinal malfunction, especially impairment of fat and protein absorption and loss from the bowel of folic acid and vitamin B12. As so vividly expressed by van Zile Hyde (8), "Half the work of a sick peasantry goes into the cultivation of food for the worms that make them sick."

It is extremely difficult to calculate the loss due to lowered work output or man-days lost; for example, estimated economic loss due to schistosomiasis varies from US $ 3.50 in Egypt (7) to US $ 105 in Japan (4). The significance of such figures may be questioned in view of the labour conditions prevailing in most developing countries where manpower is not only in excess but also where the level of skills is very low.

Diseases with socio-economic effects

In certain developing countries tourism is an important factor in the economy and, in particular, in foreign exchange earning. In Kenya, and elsewhere in Africa, if diseases such as trypanosomiasis, schistosomiasis, or malaria spread, the tourist industry at least would be severely crippled.

These are also intangible effects of parasitic diseases which can be understood only in terms of moral and social attitudes prevailing in certain communities. *Tinea capitis*, for instance; although considered a relatively benign disease is only apparently so; Kerion celsi, severe cases of favus, generalized lesions, etc., often develop. Ringworm of the scalp is acquired almost exclusively before the age of puberty. Discrimination against children suffering from this infection is probably one of its most deeply resented effects.

The problems raised by parasitic diseases in children are particularly important from the point of view of schooling and training. Several studies show that they are a serious cause of absenteeism and that they affect mental growth and learning ability.

This factor should be taken into account when proposing methods for raising the level of skills and training in developing countries.

How do parasitic diseases affect economic development?

Today nobody can seriously deny that economy has greatly benefited from the control of major endemo-epidemic diseases. In fact, such control has often been the condition *sine qua non* for opening up large tracts of fertile land for agricultural production. Examples abound, which concern in particular former malarious areas (see Pampana, 1963) (5).

Another example is onchocerciasis, where a spectacular increase in land values — 164% over a period of 10 years — was observed in the Jinja area after *Simulium* control in the Victoria Nile.

Conversely, great benefits to health are expected from the raising of economic and social standards brought about by economic development. However, the deep socio-economic and environmental changes resulting from expansion have created a new set of health problems in certain areas. The major public works construction sites, which attract a considerable labour force, contribute to the spread of disease among the workers whose migrations are now greatly facilitated by more rapid means of communication. Over-crowding of rural settlements at the fringes of towns has had the same effect and, in certain areas, has multiplied breeding sites for vectors such as *Culex pipiens fatigans,* the principal vector of bancroftian filariassi.

Large-scale development schemes may or may not have a favourable influence on the epidemiology of certain parasitic diseases. In many tropical and sub-tropical areas, water development schemes for electricity production or irrigation purposes are the key to economic and agricultural development. Depending on whether the health hazards are heeded or not, these schemes may either reduce or increase breeding sites for vectors of such diseases as malaria, onchocerciasis, or schistosomiasis. Unfortunately, experience shows that these schemes have contributed to the spread of these infections and increased their severity during the last 30 years. Two examples will suffice to illustrate this point: in the Aswan province of Egypt the amount of *Schistosoma haematobium* infection increased from four to forty-fold within three years of the introduction of perennial irrigation to replace basin irrigation (Khalil & Azim, 1938, quoted by Blair (1);); in Southern Rhodesia the Umshandige Irrigation Scheme, costing three million pounds, had to be abandoned in 1949 ten years after its commencement, mainly because the prevalence of schistosomiasis had reached menacing proportions.

In view of the many health implications in economic programmes, it has now become a regular practice for the World Health Organization, the Food and Agriculture Organization, and the World Bank, to participate in feasibility studies and in preparatory work carried out under the United Nations Development Programme.

As can be seen, the quantitative evaluation of the economic incidence of parasitic diseases lies in : (a) the loss of potential wealth owing to death, or temporary or permanent inability to work, the extent of the loss depending on the magnitude of the disease in clinical and pathological terms, on the age and sex of the people most affected, and on the demand for labour; (b) consequential waste, such as failure to take advantage of land and natural resources; and (c) the direct costs of medical care and surveillance. The economic importance of animal disease lies in : (a) the direct loss due to death and lowered production and marketability of meat and animal products; and (b) the direct costs of veterinary care and surveillance.

The budgetary implications of health programmes, as determined by cost-analysis processes, are extremely important since governments must see to it that all the other essential requirements of the nation are met.

This basic principle of sound economy applies throughout the world. It applies, however, even more forcefully to developing countries owing to the magnitude of their needs which bear no relation, in many instances, to the means and resources available.

Disease control is not a luxury item which only prosperous countries can afford. It is an essential component of the economy. As such, it should be part of any economic development scheme and receive an adequate share of local as well as national government expenditures, depending on national priorities. Therefore, cost-benefit analysis becomes necessary.

The methodologies of rational analysis of expenditures in the public sector, generally termed cost-benefit analysis, systems analysis, cost-effectiveness, planning, programming and budgeting systems, have been developed over the past 25 years. These started with water resources and defense sectors in the USA but have now been extended to almost all sectors of public expenditure and to other countries in all stages of economic development. Although the economic, administrative and planning theory underlying the methodologies has been greatly refined, and there is an extensive and growing literature on the subject, actual application to problems of public choice and resources allocation have been more limited.

In public health, where previously decisions were made on the basis of technical judgement and on purely humanitarian grounds, it is only since about 1960 that these methodologies have been applied in the field of health services.

Up to now there has been limited use of systems analysis in health planning for two reasons. First, it may not be an unjustified belief that priorities in health services should not be determined by economic considerations. There is also a lack of consensus on how social, psychological and other benefits and losses should be measured; for example, the relief of pain, reduction of capacity to participate in social life, bereavement and premature death. Secondly, there is the difficulty of predicting in quantitative terms the bene-

fits which will flow from a particular intervention in the health field and measuring those benefits, both direct and indirect.

Measurement of the effect of diseases in lowering productivity is essential if the economic benefits of control are to be determined. However, appropriate data are non-existent in many areas and in others are almost fragmentary and incomplete.

When borrowing disciplines and techniques from other sectors of activity, it is necessary to identify similarities between the attributes of these sectors and those of the public health sector. If the public health sector is viewed as a true sector of the economy as much as other sectors, e.g. energy production, each project should then be a proven part of an optimum programme of development; each disease or category of disease is in itself a system of activities which inter-act with other systems within the public health sector and also with systems in other sectors of the economy. It would thus appear that the major need in the public health sector is the development of a methodology for calculating benefit to cost ratios so far as the economy is concerned, or substitutes for these.

It is believed that the model complex could be divided into two broad parts concerning, respectively: (1) the disease itself in human beings and its transmission aspects, i.e. epidemiological model; and (2) the cost of changing the above set of systems in one or more ways at one or more points and the consequences to the total economy, i.e. socio-economic model.

In Iran, the provision of health delivery for the entire population has been proclaimed by His Imperial Majesty the Shahanshah Aryamehr. This will undoubtedly include action against parasitic diseases as a major health problem.

In planning the realization of these issues, although the economic elements are not considered as obstacles and constraints, the application of proper tools and techniques as related to cost-benefit analysis, and more particularly to cost-effectiveness analysis, are of great importance and have to be more and more developed and worked out in the country.

It is gratifying that the studies carried out for over three decades on the epidemiology and experimental control of most of the endemic parasitic diseases of Iran, by the Institute of Public Health Research with the collaboration and support of the Ministry of Health, have furnished extensive baseline data for such analyses. Undoubtedly, complementary studies have to be carried out in this area using more sophisticated techniques to satisfy the requirements for permitting cost-benefit/effectiveness analyses; and for planning, programming, and budgeting.

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