CHAPTER 2

REVIEW OF RELATED LITERATURE

Malaria Control Programme

Malaria varies throughout the world, hence no single prescription can be made for the malaria control. There are four basic technical elements of malaria control strategy, i.e. (a) to provide early diagnosis and prompt treatment; (b) to plan and implement selective and sustainable preventive measures including vector control; (c) to detect early epidemics, contain or prevent them; and (d) to strengthen local capacities in basic and applied research to permit and promote the regular assessment of a county's malaria situation, in particular the ecological, social, and economic determinants of the disease (WHO, 1993).

In Indonesia, the goal of the malaria control programme is to reduce the prevalence of malaria up to a certain level where malaria is not a public health problem. To achieve this goal, the strategy of the malaria control program is divided into two operational regions, i.e. a) Java-Bali, by controlling malaria in the focal areas; and b) Outer Islands, by suppressing malaria prevalence in priority areas such as : transmigration areas, socio-economic development areas and international border line areas; and to control epidemics or unusual events of malaria. The objectives of the malaria control programme in the Outer Island Region such as South-east Sulawesi Province are : a) to reduce the prevalence of malaria to be < 4% in priority areas; and b) to reduce the level of slide positivity rate (SPR) to be < 20% in non-priority areas. The main method of control is vector control measures which is supported by case finding and treatment (MOH-Indonesia, 1993).

The World Health Organization (1987) has identified the major constraints on the application of malaria control measures as :

(a). the cost and ecological unacceptability, in certain areas, of environmental measures (like clearance of marshland);
(b). vector resistance to insecticides, the cost and toxicity of alternative insecticides and the exophily (outdoor) behavior of certain vector species, which makes indoor spraying ineffective;
(c). the cost and limited applicability of larvacidal chemicals (although biological control agents currently being developed offer hope of more effective larval control);
(d). parasite resistance to and the rising cost of anti-malarial drugs;
(e). inaccessibility of large population groups (for reasons of climate, geography or civil unrest);
(f). population movements;
(g). people's inadequate knowledge about health and disease;

(h). the overall cost, and in some areas logistic impracticability, of control activities;
(i). inadequate epidemiological information about the disease, vector biology and behavior, and related social and economic factors;
(j). in many developing countries, low priority is accorded to health in general and malaria in particular in national resource allocation, with a consequent paucity of basic health facilities and well-trained health service staff.

Increasing resistance of vectors to insecticides and of parasites to drugs coupled with reduction in the allocated resources in many countries resulted in a dramatic increase in annual parasite incidence (API) in many countries (Kaewsonthi et al. 1989). When resources - funds, manpower, equipment, facilities, time and knowledge - are scarce, the choices must and will be made in a decision to commit resources to one use instead of another. This is true for at least three reasons : (a) without systematic analysis it is difficult to clearly identify the relevant alternative; (b) the viewpoint assumed in an analysis is important; and (c) without some attempt at measurement, the uncertainty surrounding orders of magnitude can be critical (Drummond and others, 1989). In each of these situations, an economic evaluation of alternative services should be considered.

Vector Control Measures

Control of the mosquito vectors of malaria with chemical insecticides and larvicides, larvivorous fish and biological control agents and through environmental measures aimed at eliminating mosquito breeding sites is theoretically the most effective way of controlling the disease. In practice, though, effective application of these methods has been compromised by inadequate knowledge of local malaria epidemiology. Vector control efforts are further complicated by the emergence and spread of mosquitoes that are resistant to or avoid contact with insecticides, as well as the high cost of chemical insecticides (TDR, 1987).

Vector control measures by indoor residual spraying with insecticide for long term application have encountered a number of very serious problems. Curtis (1990) reported that there is a tendency of insects not to rest for long enough on spayed surfaces to pick up a lethal dose because of either (a) the excito-repellent effect of insecticides such as DDT, (b) the evolution of a change in behavior as a result of the exposure of many generations to sprayed houses, or (c) a preexisting tendency of some species to exit from houses soon after blood feeding.

Thomson (1947) and Davidson (1953) have described changes in *An. gambiae* after spraying to the extent that the mosquitoes are irritated by short contacts with DDT sprayed surfaces, that they do not pick up a lethal dose of the insecticides, that they continue to bite man and transmit malaria and the utility of DDT in controlling transmission is thus very largely restricted (cited in Sundararaman, 1958). Sundararaman found that after four years of spraying, with abundant *An. sundaicus* in the act of biting man at night, very few resting on walls at night and practically none by day. The degree of exophily is increased after DDT spraying and probably associated with it there is also a slight increased exophagy. He showed that DDT spray failed in its objective as spleen rates went up, new infections continued to occur in infants after one, two, or even three years of application of DDT and mosquito infections were met with after spraying for two or three years. He believed the failure of DDT to be result of an altered behavioristic manifestation in *An. sundaicus*. But he was still hesitant that this change is specifically induced by the application of insecticide *(ibid.)*. There was no study about the effect of insecticides in relation to the behavior of *An. barbirostris* and *An. subpictus* as well as *An. flavirostris*.

Atmosoedjono and others (1992) reported that *An. sundaicus* still exists along the south coast of Java despite massive efforts to achieve eradication. Its success presumably stems from the combined effects of physiological resistance to dieldrin, behavioral resistance to DDT, and insurmounttable environmental conditions that foster prolific larval breeding, then malaria outbreaks still occur along the southern coast. WHO (1993) reported that *An. barbirostris* has exhibited resistance to DDT in India, Indonesia, Myanmar and Sri Lanka, and to malathion in Sri Lanka, while *An. subpictus* resistant to DDT occurs in Afghanistan, Bangladesh, India, Indonesia, Myanmar, Nepal, Pakistan, Sri Lanka and Viet Nam. In India, *An. subpictus* also showed resistance to malathion and fenthion, whilst in Sri Lanka they are also resistant to malathion, fenithrothion and chlorphoxim. In Southeast Sulawesi, Bahang and others (1984) reported that *An. barbirostris* was still susceptible to DDT. But, since 1985 *An. barbirostris* became tolerant to DDT after two years of DDT application. There is no information about the susceptibility of *An. subpictus* as well as *An. flavirostris* to insecticides in South-east Sulawesi.

Economic Evaluation

Economic evaluation has been formally defined as quantitative analysis of the relative desirability of investing in alternative projects (Mills, 1987). It can and frequently does support decision making in engineering, development projects and environmental analysis. Such evaluation could, in principle, also support decision making at a variety of levels in malaria control (Kaewsonthi and Harding 1986): a) deciding which disease to control; b) deciding on the principle strategy; c) deciding which type or mix of interventions is best within the selected control strategy; and d) deciding among processes in a specific intervention. Despite the fact that economic evaluation may often be ignored when making judgments about past or future programmes, economic analysis can, and does offer the disease control manager real opportunities to improve effectiveness and efficiency in an ongoing control programme (Kaewsonthi and Harding 1991).

In evaluating the economics of malaria control, Mills concentrates on the following five areas of concern : (1) the determinants of malaria transmission; (2) the resource costs of malaria; (3) the demand for malaria treatment and prevention; (4)

the characteristics of the supply of malaria control; and (5) economics evaluation which includes cost analysis, cost-effectiveness analysis, cost utility analysis and cost benefit analysis (Onori, 1973 quoted in Gilles and Warell, 1973).

The most common forms of economic evaluation are cost analysis, cost-effectiveness analysis, cost-utility analysis and cost-benefit analysis (Mills, 1991). Kamol-ratanakul and others (1993) has used cost-effectiveness analysis to compare three short-course anti-tuberculosis management methods with a standard regimen in Thailand, and to evaluate the effectiveness of impregnated nets among migrant workers in eastern Thailand. The similar study has also done in Indonesia by Tjiptoherijanto and Joesoef (1988). These methods can be applied to the analysis of other diseases also.

Cost-effectiveness analysis (CEA) is one form of full economic evaluation, where both costs and consequences of health programmes or treatments are examined (Drummond and others, 1989). It can produce a cost per health effect (e.g. case prevented) for the entire programme which can the be compared with ratios from other health programmes to help decide which are worthwhile (Jamison and Mosley, 1990 cited by Mills, 1991). The main disadvantage of this approach is that when there is as yet no satisfactory common measure of health effects (the strongest contender is 'discounted days of healthy life gained') and little attention is paid to the efficient mix of strategies within the programme (Mills, 1991).

WHO (1993) described that cost-effectiveness analysis is designed to identify efficient courses of action, and to analyze operational efficiency, i.e. to identify the most cost-effective way of performing a particular activity. It can be applied at different points within the planning cycle.