A critical review of priority setting in the health sector: the methodology of the 1993 World Development Report

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The 1993 World Development Report, Investing in Health, suggests policies to assist governments of developing countries in improving the health of their populations. A new methodology to improve government spending is introduced. Epidemiological and economic analyses form the basis for a global priority setting exercise, leading to a recommended essential public health and clinical services package for low- and middle-income countries. Ministries of Health in many countries have expressed an interest in designing a national package of essential health services, using the methodology. Given the apparent importance attached to the study and its far reaching potential consequences, this article provides an overview of the method, the main issues and problems in estimating the burden of disease as well as the cost-effectiveness of interventions. Strengths and weaknesses in the databases, value judgements and assumptions are identified, leading to a critical analysis of the validity of the priority setting exercise on the global level.

Introduction

The 1993 World Development Report (WDR or the Report) is devoted to health (World Bank 1993). Its main stated objective is to assist governments of developing countries to improve the health of their populations. The Report identifies as important problems in the health sector: escalation of costs, misallocation of public funds and their inefficient and inequitable use. Suggested policies to improve the situation include (pages 1–6):

a) fostering an environment that enables households to improve health;

b) promoting diversity and competition in the provision of health care services;

c) improving government spending on health.

This article, in line with the report, focuses on the last policy: improving government spending on health. Technological limitations and scarcity of resources mean that not all health needs can be accommodated. Consequently priorities for health services need to be set. The WDR introduces a new method using epidemiological and economic analysis to establish a league table of priority health interventions, cardinally ranked by health gain per dollar spent. Use of this league table is expected to improve efficiency of public health expenditure.

This paper is a critical review of the methodological basis on which the WDR rests. The purpose of the review is to alert readers of the WDR to the many problems associated with the methodology of arriving at the basic packages, and thus the implications of attempting to implement suggested priorities in specific settings.

The article is organised in six sections. After the introduction, an outline of the WDR methodology sets the basis for the examination of the technical issues regarding calculation of the global burden of disease, estimating the cost-effectiveness of interventions and setting priorities. Within each of these sections a summary of the WDR approach is given followed by discussion of issues and criticisms. In the final section some concluding remarks on the overall WDR exercise are made.

The WDR methodology and its conceptual context

In order to have a good understanding of the technical issues it is necessary to have a general overview of
the methodology the WDR used to reach its recommendations, and of the conceptual context in which the methodology is used.

In simplified terms, the methodology outlined in the WDR for improving government spending on health consists of estimating the extent to which populations suffer from diseases (the burden of disease) and the costs and effectiveness of curative and preventive health interventions known to reduce this burden. The burden of disease is estimated in terms of disability adjusted life years (DALYs) lost, and the cost-effectiveness of interventions in cost per DALY gained. These are combined to assess the burden of disease that can be averted if the interventions were implemented. Only when the burden of disease is large and the cost-effectiveness of interventions high, is the intervention considered a priority (World Bank 1993: 63). In this way a number of clinical and public health interventions are identified as ‘good buys’ for governments. The framework for this global priority setting exercise is illustrated in Figure 1.

Details of the methodology used in the Global Burden of Disease study, sponsored jointly by the World Bank and the World Health Organisation, are reported separately from the WDR in a WHO publication, edited by Murray and Lopez (1994a). Similarly, the cost-effectiveness information, developed through the World Bank Health Sector Priorities Review, was reported in another separate volume, edited by Jamison et al. (1993). These two volumes can be considered the basic background documents to the WDR. Conceptual criticism and discussion on the methodology can be found here and in other published reactions (SCF 1993; Zwi and Mills 1995a; Lancet 1993; Laurell et al. 1996).

Conceptual context of the report

Three fundamental choices influence the whole methodology and eventually the priority setting in the report. They relate to the limited health perspective of the report, to setting global versus national priorities, and to the concept of equity.

- Different definitions of health have implications for policy, because the definition determines the range of conditions and factors included in measuring health (Zwi and Mills 1995b; Murray 1990). In the WDR ‘investing in health’ refers mainly to ‘investing in the health care services’. Thus the report reflects a limited health perspective, concerned with (re)allocating (public) health resources more efficiently in order to maximize DALYs saved or averted. Therefore priority setting is reduced to choosing between health interventions to control diseases in a cost-effective manner. This precludes the inclusion of other sector interventions, which are known to impact on health, such as girls’ schooling, water supply and sanitation, and increased food consumption. Similarly, some health interventions, such as family planning, have welfare impacts other than health. Except for girls’ schooling (advocated in another part of the report) the costs for these interventions are not sufficiently low to make them attractive on health grounds alone (World Bank 1993: 64–65). However, in terms of total welfare they may be very cost-effective.

- Since the WDR hopes to assist governments of developing countries in improving the health of their populations, one can question the usefulness of a global exercise in the context of national priority setting. The burden of disease differs greatly across countries and even within countries. Costs and effectiveness of interventions also vary across countries because epidemiology, delivery

![Figure 1. Methodology for setting priorities in the WDR](image-url)
systems, interventions and penetration of the intervention into the population are different. Moreover, cultural, economic, political, environmental, infrastructural and behavioural differences will all impact on the package finally chosen. Thus results of any priority-setting exercise are location, time and group specific (Murray 1990: 304).

Some even argue that priorities should not be set at the global level at all (Mooney and Creese 1993).

- Although the WDR states that ‘government spending on health should be redirected to more cost-effective programs that do more to help the poor’ (page 3), poverty is not explicitly considered in the methodology. Equity seems to only be considered in terms of applying a consistently high life expectancy for all countries, although many other aspects of the calculations can have specific implications for disadvantaged groups. Cost-effectiveness analysis only assists in examining issues of equity if information used is disaggregated relevant to disadvantaged groups, and this was not done in the WDR. In particular the additional burden and costs in a context of poverty are totally disregarded. Can the results then be seriously expected to impact on the health status of the poor?*

**Estimating the global burden of disease – data, values and DALYs**

The DALY, as used in the WDR to calculate the burden of disease, attempts to capture in a single time-based indicator the impact of both premature mortality (quantity of life) and morbidity (quality of life). Non-fatal diseases and conditions are responsible for a great number of healthy life years lost due to disability, estimated at 34% of the global burden of disease (calculated from Table B.5. World Bank 1993).

The WDR calculations of DALYs are complex. The duration of time lost to premature mortality was assessed by age group and sex, for eight world regions, using life expectancies at birth of 82.5 for females and 80 for males. Disability was considered in six broad classes, each with a severity weight between 0 and 1, representing reduction in functional capacity. Assessed time lived in each disability class was multiplied by the severity weight in an attempt to make it comparable with years lost due to premature mortality. Time lived at different ages was valued differently, giving greater importance to ‘productive’ years. Future life saved or improved by health interventions was valued at a discounted rate of 3% per year (Murray 1994; Murray and Lopez 1994b, 1994c).

Criticisms related to the DALY approach as used in the WDR to calculate the burden of disease have been presented by several authors (Anand and Hanson 1995; Barker and Green 1996; Barendregt et al. 1996; Evans and Hurley 1995; Ugalde and Jackson 1995). In this section we discuss:

- the data on which the calculations are based
- the value judgments made
- sensitivity analysis.

**Data**

The significance that can be attached to the results of any study ultimately depends on the quality of the inputs. Given the scope, pretensions and the widely perceived authority of the WDR, assessing the accuracy of the input data becomes of tantamount importance. We discuss the range and quality of information used to calculate the global burden of disease, as published in the WDR. However, the Global Burden of Disease Study by the World Bank and WHO is an ongoing exercise, and data are improving as time goes by.*

For the WDR, global and regional cause-specific mortality by age and sex was estimated for about 120 diseases or injuries for 1990, coded according to the ninth revision of the International Classification of Diseases (Murray and Lopez 1994b: 21/23). Disability estimates were reviewed for over 100 diseases (Murray and Lopez 1994c: 56). The WDR states that this relatively limited number of conditions accounts for about 90% of the total global burden of disease.

The 120 diseases are listed in three broad groups, each with subdivisions of more specific causes. The availability or lack of data made it necessary to use different sources of mortality and morbidity in different regions. Thus estimates of cause-specific **mortality** can be based on vital registration data (where available), on epidemiological transition modelling for the broad groups, or on epidemiological estimates by disease experts for the specific causes. For some regions cause-specific mortality rates had to be proportionally reduced, in order for the sum of them to accord with total national mortality (Murray and Lopez 1994b: 23–25).
For assessment of the total time lived with a disability the WDR used estimates of disease incidence, proportion becoming disabled, average age of onset, duration and severity of disability. In regions where this information was not available rates were imputed from other regions. All information was critically reviewed and checked for internal consistency, using the Harvard incidence-prevalence model, described in detail by Murray and Lopez (1994a: 56–58; Murray 1994: 5–6).

Our concerns about this overall process include the following:

- Data on mortality and morbidity in developing countries are generally weak (Jamison and Jardel 1994). Most of the estimates are uncertain, and the authors cannot provide confidence intervals. The degree of uncertainty varies from disease to disease, across age groups, and between regions. It is regrettable that data are not presented with their upper and lower limits as was the case in earlier editions about the global burden of tuberculosis (Murray 1990).
- The burden of disease is defined in normative terms with the emphasis on mortality and morbidity and excludes socioeconomic and environmental factors which may influence the actual burden experienced by an individual, household and community.
- The unmet health needs of populations are very difficult to estimate, but they do contribute to the burden of disease. The Global Burden of Disease study does not take unmet health needs into account. Therefore the basis of the statement that the study covers 90% of the burden of disease is unclear and the true percentage is likely to be lower.
- Murray and Lopez (1994a: 65) have raised the possibilities of under- and over-estimating the years lived with disability. The former by omission of diseases and idiopathic disabilities, and the latter by the existence of co-morbidity (two or more disabling conditions in one person are counted separately) and the interdependence of disability probabilities (e.g. diabetes as a risk factor to become blind).
- The level of disease aggregation will affect the calculation of disease burden and comparability to other less or non-aggregated conditions. A league table presenting conditions with different levels of disease aggregation will create difficulties for determining priority for action, e.g. more aggregated problems showing a higher burden could be interpreted as more urgent than disaggregated problems (Murray 1990; Feachem et al. 1989).

Value choices

For calculations of the DALYs four sets of value choices were made (World Bank 1993: 213–214; Murray 1994: 6):

- valuation of duration of life lost as a result of death at each age (standard life expectancy);
- valuation of a healthy year of life lived at different ages (age weighting);
- comparison of time lived with a disability with time lost due to mortality (disability grades);
- time preference (discount rate).

Details of each set of value judgements and implications for calculation of the global burden of disease are discussed below.

Standard life expectancies

To assess duration of life lost, life expectancy for all people was set at 82.5 years for women, based on the actual female life expectancy in Japan, and 80 years for men, based on projection that the ultimate gender gap, based on biological differences only (not on exposure to risk), will be between 2 and 3 years (Murray 1994: 8). Life expectancies were set to this high standard for all countries in consideration of equity of perspective ('treat like health outcomes as like') and to maintain comparability of the burden of disease across countries (Murray 1994: 5).

- Although ethically appealing and mitigated by the discounting procedure, the use of high standard life expectancies leads to very high burdens of disease in countries which presently have considerably lower life expectancies. While this is justified for international comparisons, it might be better to use realistic life expectancies when setting national priorities.
- Factors outside the health sector, such as female education, income, income distribution, safe water supply and sanitation, influence both the quality and quantity of life (McKeown 1979: 92–96; Szreter 1988; World Bank 1993: 34; Wilkinson 1990; Benzeval et al. 1995). Therefore using such high life expectancies in the global burden of disease calculations, implies advanced socioeconomic circumstances. Hence the global burden of disease not only measures the burden of disease, but also indicates a burden of 'underdevelopment' (Anand and Hanson 1995:7).
• According to Anand and Hanson the burden of disease is over-estimated for males relative to that of females due to the small gender gap used (2.5 years instead of e.g. 6 years, the latter being the real gender gap in Japan), which they consider optimistic and rather arbitrary (Anand and Hanson 1995: 8–9). Using the ultimate ‘ideal’ difference (based on biological differences) can in itself be considered consistent with using ‘ideal’ life expectancies for all countries. Due to the use of high life expectancies and the discounting procedure, the impact of the decision to use a small gender gap will be most important for women in the industrialized world. For developing countries the difference will be less prominent, but does exist.

Age weighting

In the WDR years of life lost at different ages are given different relative values, reflecting a utilitarian view of society (Murray 1990: 307). A modified Delphi approach to decision making was used with a group of public health experts to ascertain a continuous age weight function, resulting in years lost between the ages of 9–54 years being valued more than one, and years lost by children and the elderly being valued at less than one (Murray 1994: 8–10). The value of a life lost was calculated according to the weights of all the remaining years to 80 or 82.5 (World Bank 1993: 213).

• We have doubts about the consistent use of age weighting in all studies that form the foundation for the WDR. In opposition to the above, Jamison states about the World Bank Health Sector Priorities Review (HSPR): 'The approach used here explicitly values years of healthy life at all ages equally . . . this assumption can be readily relaxed, however, to give greater weight to those age groups likely, say, to have more dependants' (Jamison et al. 1993: 8). In the same chapter, Table 1A–6 gives the reader the impression that age-weighting has indeed been used (Jamison et al. 1993: 28–29). And in the chapter on HIV and STDS the authors clearly state that they used productivity weights (Over and Piot 1993: 510). It is therefore unclear whether the HSPR information was re-calculated for the WDR.

• Age weighting is neither universally accepted nor valued. The Oregon cost-effectiveness analysis chose to give greater weight to mothers and children than to adult males (Evans and Hurley 1995: 510, citing Hadorn 1991). In the WDR its use is similar to the controversial use of productivity weights in the human capital approach to value life for cost-benefit analysis. Murray (1994: 9) is inconsistent in rejecting productivity weights because of their ‘obvious inequity’, but justifying age weights on the grounds that the social value of the middle age groups is considered to be greater due to responsibility for dependants. Such values depend on context specific conceptions of human value, impossible to generalize to one functional formula. Although the WDR claims that the results of the analysis are not very sensitive to the introduction of non-uniform age weights (World Bank 1993: 213), using them can still be considered inequitable in principle.

• Using the same age-weighting equation as for the WDR, Barendregt et al. (1996) contend that using it actually enhances the importance attached to a death between 0–27 years (between 0–38 years after discounting), and not between 9–54 years. In a reaction Murray and Lopez agree, adding that the same pertains to life-long disability but noting that the incremental effect of age-weighting for short-term disability enhances the importance of morbidity of people between the ages 7–52 years (Barendregt et al. 1996). According to this work, the impact of the age-weightings used by the WDR gives more importance to child mortality and morbidity than intended.

Disability weighting

Duration of disability by cause, age and sex was assessed for all eight regions by a group of experts. Severity of a disability was estimated separately from its duration. Twenty disability outcomes of diseases were anchored on a scale from 0 to 1 (more severe conditions = higher scores) by use of personal trade-off methods. These were grouped into six classes and severity weights were attached to each class. Subsequently all other disabilities were categorized into the same six classes, which were developed and described only after the weighting procedure (T. Vos, personal communication). DALYS were calculated by multiplying the expected duration of the condition by the severity weight. Different dimensions were used in describing the disability categories: the first four were defined in terms of the ability to pursue normal activities related to recreation, education, procreation and occupation, while the two more severe categories were defined in relation to needing assistance in essential daily activities, such as meal preparation and personal hygiene (Evans and Hurley 1995: 509). An attempt was made to capture the likely
impact treatment can have on the distribution of disabilities across the six classes (Murray and Lopez 1994c: 60).

- The use of experts, rather than populations or patients, has been queried for their lack of personal experience with the disease in question. Expert opinion does not necessarily reflect how individuals or society judge the seriousness of different health conditions. On the other hand, by using experts, the methodology could be applied in a consistent manner. Another concern is the possible lack of understanding of concepts of disability in different cultures (Evans and Hurley 1995: 513). The WDR method does not allow for any differences in disability severity related to social, cultural or economic contexts. It is unclear which setting or context was used by the experts for the global exercise.

- Concerning the different dimensions used in defining the disability classes, the ability to pursue certain activities, as used in some categories, and the need for assistance, as used in other categories, are not mutually exclusive. However, it is unclear whether the assessment of disability used for the WDR reflects this. For consistency, all categories should include the same range of dimensions.

- The separation of disability duration and severity does not allow for their interaction. The DALY as used in the WDR does not capture the difference in utility loss for an individual due to a temporary or permanent functional loss. The incapacity, for example, of not being able to walk naturally for six weeks due to a broken ankle, or not being able to walk naturally for the rest of your life due to an amputated leg, bear obvious different utilities, not captured by a straight multiplication of disability weight by time. It can also be argued that some disability conditions are worse than death. The method does not allow for that.

- Because the concept of disability in the Report is limited by a strict normative and functional definition, linked to the underlying morbidity, several aspects of the real burden of disease are neglected. For instance, abilities to cope with functional limitations vary not only with personal characteristics, but also with social, cultural and economic circumstances, and the consequences of these are not reflected in the measurement by DALYs. Furthermore, by focusing on the diseases of individuals, the burdens which fall on households, and on the larger community are not included (Anand and Hanson 1995: 6).

- Some of the criticisms might have been prevented if the process by which disability weights were established had been published and openly debated. Several authors for example have remarked that pain and suffering were not considered in the weighting (Evans and Hurley 1995: 509–510; Ugalde and Jackson 1995: 532). However, in defining the disability weight for rheumatoid arthritis, pain next to the functional incapacity of the disease seems to have been considered (T. Vos, personal communication).

Discount rate

A yearly discount rate of 3% is used in the WDR DALY calculations, so that future years of healthy life are valued at progressively lower levels. The method purportedly converts future lives to their present values. The rate is based on society’s social time preference, avoiding the controversial much higher rates (8–15%) based on social opportunity costs of capital as captured by the market rate of return on (short-term) investment and being consistent with long-term yield on investments (Murray 1994: 13–14). Using a rate of 3% means, for example, that one year of healthy life is counted as approximately half a year if it occurs 22.5 years from now, and only as 3 months if it occurs some 45 years into the future.

- Using a lower rather than higher rate, increases the calculated total burden of disease, raises the importance of premature mortality over short-term disability and increases the importance of premature deaths at young ages relative to those at older ages.

- Although the low rate minimizes the discriminatory effect that discounting future benefits has on interventions for which the health effects are felt only in the long run (World Bank 1993: 61), such as many preventive efforts. discounting future lives per se does have the disadvantage that interventions which are of major concern for the lives of future generations may receive reduced priority. Murray (1990: 308) summarized the overall effect as: ‘The greater the discount rate, the shorter is our time horizon’

- Using a discount rate is said to avoid the difficulty of the time paradox and overvaluation of eradication programmes that would occur when no discount rate is used (World Bank 1993: 213–214; Murray 1994: 13–15). However, it is a matter of perspective and value as to whether an eradication programme is overvalued if a discount rate is not used. Whose perspective and values should be considered?
Sensitivity analysis

The WDR and background documents state that sensitivity analysis was done by varying the discount rate, the age weights and various combinations of these, but detailed results have not been published for independent scrutiny. The global burden of disease involves complex calculations using many sets of data and value choices. Increasing the discount rate from 0 to 10 shifted the burden of disease towards the older age groups, thereby also increasing the relative importance of non-communicable diseases over infectious diseases and of disability over mortality. Shifting to more unequal age weights had the opposite, although apparently very limited effect (Murray et al. 1994b: 101–105).

- Having used a low rather than high discount rate and sharply increasing age weights during childhood stresses the relative burden of disease of pre-health-transition countries, although in an absolute sense the combined effect of discounting and age weighting does result in a slightly lower value attached to the burden of disease in the under-10-year-olds (World Bank 1993: 26).

- Murray et al. (1994b: 105) conclude that the qualitative results of the burden of disease analysis are quite robust to the specific assumptions about time preference and age-weighting used. However, the authors do comment that 'the information requirements for determining real trends in the burden of disease are much more exacting than for estimating for an ad hoc study. Estimates of the level can be wrong by 5%–10% without affecting the interpretation of results, but changes in the burden over a 5 or 10 year period may only be of this magnitude' (page 106), implying that quantitative differences in results may be as high as 10%.

- Sensitivity analysis was apparently also performed for the disability grades, but information has not been published, and we are expected to believe the authors when they state that 'changing the specific values of the disability class weights . . . has little if any effect on the overall results as presented here' (Murray et al. 1994b: 105).

- These reassurances are not sufficient. A wide range of sensitivity analyses could be done to consider impact on the ordering of the eventual league table of priority health interventions as presented in the WDR. To ignore the impact of certain choices could be very costly. When burden of disease studies are done on the national level, it is particularly important to bring the value choices in line with national policies. Some examples of important sensitivity analyses are: more realistic life expectancies for developing countries, equal or different age weights, different weights for each of the six disability classes and allowance for disability worse than death, and no or different discount rates.

Estimating the cost-effectiveness of interventions

Once the burden of disease has been assessed the next component to investigate is the cost-effectiveness of interventions that claim to impact on the main causes of disease. The WDR used a form of economic analysis to establish the league table of cost-effective interventions. In this section we discuss:

- appropriateness of method of economic analysis;
- quality of the data base;
- estimating effectiveness;
- estimating costs;
- sensitivity analysis;
- marginal or average analysis.

Appropriateness of method of analysis

Economic evaluation, being the comparative analysis of alternative courses of action in terms of both their costs and consequences, can contribute to setting priorities (Drummond et al. 1987: 6–8). Of the different economic evaluation techniques, the method used in the WDR is cost-utility analysis, a type of cost-effectiveness analysis specifically used in the health sector. Costs are measured in dollars, and effectiveness or utilities are assessed as DALY's gained.

- Cost-utility analysis is an appropriate method as the DALY provides an outcome measure that allows comparison of cost-effectiveness across different types of health interventions. Therefore the economic evaluation in the WDR moves beyond examination of technical efficiency and attempts to assess allocative efficiency across different health interventions (Birch and Gafni 1992) by comparing costs to the service provider to achieve one additional year of healthy life.

- However, cost-utility analysis cannot establish whether an intervention is worth undertaking in an absolute sense. Nor does it permit comparison of results with interventions outside the health sector (Evans and Hurley 1995; Drummond et al. 1987). To achieve that, costs and effects would have to be measured in the same units,
i.e. assigning dollar values to outcomes, which poses the problem of putting a monetary value on life. The DALY is only able to capture or represent the impact on health of interventions such as safe water, sanitation, female education, etc.

Quality and relevance of the data base
The information in the WDR on cost-effectiveness of interventions is largely derived from the Health Sector Priorities Review (HSPR), conducted by the World Bank from 1987 to 1993. The cost-effectiveness of 50 health interventions impacting on about 25 major diseases or disease clusters in developing countries were studied, mostly by re-working available research. How and why these 50 interventions were selected, consistency of methods, and the quality of the research used as the basis for the cost-effectiveness calculations, are critical to the final league table of ‘good buys’ presented in the WDR.

- It is unclear what criteria were used for the selection of the 50 clinical and preventive procedures that were evaluated for cost-effectiveness, except for the availability of limited research on the impact of interventions and ‘the importance’ in developing countries of the diseases and conditions on which they impact (Jamison 1993: 5). This importance cannot have been derived from the Global Burden of Disease (GBD) study though, since the latter only started in 1992 (Murray et al. 1994b: 99). The few interventions for which costs per DALY gained have been assessed are a small fraction of all possible interventions. However, comparison of the lists of selected diseases for the HSPR and the GBD study shows that there is considerable overlap (Jamison 1993: 6; World Bank 1993: 216–217). Given the central importance attached to cost-effectiveness in establishing priorities in the WDR, it is all the more serious, if not unacceptable, that the reader of the WDR is left in the dark about which 50 interventions were evaluated and what their ranking was as to cost-effectiveness. Only the interventions selected for the essential package are described in the WDR with their cost per DALY and percentage of disease burden averted (World Bank 1993: 117).

- The WDR claims that the implementation of the chosen health interventions could reduce the global burden of disease by up to 50% (World Bank 1993: 60; Bobadilla et al. 1994: 171). However, only five of the top ten diseases for males aged 15–44 have been assessed (World Bank 1993: 223). Jamison acknowledges that the omission of some conditions ‘genuinely limits the scope of the review’ (1993: 4).

- Drummond et al. (1987) have outlined important features required in good quality cost-effectiveness studies. These features are not apparent in the research used to determine cost-effectiveness of the 50 interventions for the HSPR. A do-nothing alternative was considered for some diseases/clusters, as for TB (World Bank 1993: 63), however, the research methodology is not consistent, making interpretations across interventions problematic. Jamison et al. (1993: 6) acknowledge that there is no consistent approach in the research used. It was done at different times, in different contexts, with different perspectives and purposes, making comparability and meta-analysis extremely difficult, if not totally inappropriate. Jamison concedes that ‘the actual cost-effectiveness of a particular intervention could easily vary by two- to tenfold or more in any given situation, depending on a host of local factors’ (Jamison and Mosley 1991).

Estimating effectiveness
In the original research used for the HSPR, DALYs were not used as the effectiveness/utility measure. Rather, DALYs were calculated during the HSPR review and re-working of the original research. In addition to the lack of comparability of the research, the critical points to be made here relate to the assumed effectiveness of interventions, the limited health perspective and the effects of the ‘ideal’ life expectancies used in the WDR.

- Evidence of programme effectiveness, defined by Bobadilla et al. (1994: 175) as a combination of efficacy, diagnostic accuracy and compliance, for interventions and their alternatives, should be explicit before undertaking cost-effectiveness analysis (Drummond et al. 1987). Although WDR estimates allow for incomplete coverage of interventions and compliance with treatment, the report optimistically assumes that medically correct procedures are followed and that reasonable care is taken as to quality (World Bank 1993: 61). Information on effectiveness is not clearly or consistently provided in the separate disease chapters in Jamison et al. (1993), nor is there any specific mention of it in the WDR.

- The effectiveness of any intervention will also depend on population coverage and utilization, which in turn depend on appropriateness, quality and
acceptance (Litvack and Bodart 1993). Such factors are context specific and not easily comparable to different settings across a large number of countries.

- Effects outside the health sector could not be taken into account, due to the use of cost-utility analysis (World Bank 1993: 64). This has the effect of reducing the overall impact of an intervention, and thus reducing the resulting cost-effectiveness ratio (Feachem et al. 1989: 176), causing disregard of interventions with effective impact spread across several sectors.

- Just as the use of ‘ideal’ standardized life expectancies inflates the burden of disease for developing countries, it also inflates the effects of interventions, even with discounting. If benefits are over-estimated, conclusions based on cost-effectiveness analysis are unfounded and governments may experience problems with choosing value for their money. To overcome this problem Murray (1994: 7–8) advises the use of cohort life expectancies at each age to estimate benefits in any national cost-effectiveness analysis.

**Estimating costs**

Little is explained in the WDR and its background documents about the way costs were estimated. Broadly, cost issues can be examined with regard to which costs were included or excluded in the calculations, and how they were calculated. Information on the procedure and discussion about the choices made can be found in the WDR itself and in the background documents (World Bank 1993: 60–65; Jamison 1993: 9; Murray et al. 1994a).

**Calculation of costs**

To facilitate global comparability, all costs that were included were assessed at market prices and considered to be the same across all countries. Although authors acknowledge that costs for building facilities and for semi-skilled labour will be lower in developing countries, no distinction was made between internationally tradable and non-tradable goods. Where interventions were provided jointly, costs (and effects) were assessed for the whole package, but in some cases an attempt was made to attribute costs to the separate intervention (Jamison 1993: 9). It is not mentioned specifically in the WDR nor in Jamison et al. (1993) whether a discount rate was applied to future costs and effects.

- Ideally cost estimates should be based on expenditures identifiable to interventions, but such information is difficult to obtain in many countries. Using budget information is also problematic because budgets are often organized by inputs, rather than programme items or interventions, requiring considerable estimation of actual costs. No costing details are provided in Jamison et al. so it is not possible to determine similarities of inclusions or costing procedures across the research for the 50 interventions. Comparability should not be assumed.
When all costs are fully valued at market prices it is likely that costs of services in developing countries, where market failings and distortions are frequent, are over-stated, lowering the cost-effectiveness ratio. Shadow pricing would be required for this.

The level of technical efficiency of service provision at the time of input measurements influences information on costs. The mix and costs of factors of production are context specific, with variations in clinical practice, availability of resources, incentives to health workers, etc., again making it difficult, if not inappropriate, to compare input costs across countries.

Difficulties in allocating overheads and joint costs can unjustifiably increase the costs allocated to interventions that are more technically efficient (Murray et al. 1994a: 183). This anomaly should be avoided where possible, but no indication is given of how this problem is dealt with for the 50 interventions in question.

Marginal or average analysis?

To determine whether the level of provision of an intervention should be increased or decreased, it is the marginal, rather than the average, costs and benefits that should be examined (Mooney and Creese 1993). This implies comparing programmes or interventions with alternatives, e.g. the existing situation, in order to answer questions related to identifying those interventions which offer best value for money or, in economic terms, maximize technical and allocative efficiency. If unit marginal costs are not possible, then incremental costs should be used.

It is not clear whether the WDR provides marginal or average information. Jamison (1993: 3) states that in the Health Sector Priorities Review ‘to the extent possible, the cost-effectiveness of intervention has been summarized by estimates of marginal cost per DALY gained’, but in an Appendix to the same volume Mooney and Creese (1993: 738) say ‘the data presented are, in all cases, estimates of the average cost per DALY gained’. Murray et al. (1994a: 183) refer to the ‘average cost-first approach used in the WDR’. In the WDR itself, Table 5.3 gives average costs but marginal benefits for the package of selected public health and clinical services, but Box 3.3 presents figures of incremental and average costs for a strategy to increase immunization coverage (World Bank 1993: 117 & 63). When asked, a World Bank representative involved in the Report, said that ‘a marginal approach was not always or even very often used’ (SM Over, personal communication). According to the Report itself, calculations of how many years of healthy life are currently saved by health systems do not exist (World Bank 1993: 65). Therefore, in the absence of a baseline, incremental analysis cannot be done.

In short, confusion abounds, while the WDR should be consistent and crystal clear in describing and explaining the use or non-use of this important economic principle. The significance lies in the limitations of using average costs for resource allocation, because they cannot be assumed to be equal to marginal costs (Mooney and Creese 1993: 738/9).

On top of this, it is unclear whether the calculated costs to implement the essential package in developing countries are meant to be total or marginal, e.g. including or excluding currently financed activities (Murray et al. 1994a: 188). The question is whether in the WDR cost-effectiveness analysis is used to inform the reallocation of resources between programmes, or in deciding how marginal increases in resources can best be allocated.

The average cost approach, as apparently used in the WDR, ignores the existing infrastructure of the health system (Murray et al. 1994a: 183). It also ignores the fact that some interventions already exist, to which other interventions could be tagged on relatively cheaply, without incurring high fixed costs related to setting up a service. Hence, a criticism of the WDR cost-effectiveness analysis, and the resulting Agenda for Action, is the lack of recognition of the importance of overall health system functioning for assessment of costs and benefits, and the implementation of the proposed minimum packages.

Sensitivity analysis

With so many estimates and uncertainties in costs and benefits, sensitivity analysis is essential to test the robustness of results. Although the Report asserts that ‘differences in cost-effectiveness between one intervention and another are often much larger than either the variation from one locale to the other or the uncertainty in the estimates’ (World Bank 1993: 62), no information is provided on sensitivity analysis for the wide range of variables that influence the calculated cost-effectiveness of the 50 interventions.

Factors that impact on the cost-effectiveness ratio are, for example, the overall level of development of a country and the state of its infrastructure
(Murray 1990), clinical factors such as treatment efficacy and case fatality rate; epidemiological factors such as prevalence and incidence of the conditions; delivery system characteristics such as utilization of services, intervention specificity, targeting and the degree of intervention penetration and population coverage; and individual characteristics such as treatment compliance, rate of self-referral, levels of risk factors (Jamison 1993: 9; Feachem et al. 1989). All of these vary widely across countries, and the absence of analysis on the sensitivity of the cost-effectiveness ratios to change, in any or combinations of these variables, is all the more serious because of the uncertainty of the data on which the calculations are based. Sensitivity analysis should also be done for accuracy and possible variation of all costs included; for example, for different levels of technical efficiency, and for different allocations of overhead and joint costs. Last but not least, some understanding of the difference in cost-effectiveness ratios should be assessed with the inclusion of private and indirect costs.

**Setting priorities**

After all these estimations, the final ratio of costs and effects is the cost per DALY gained, which forms the basis of the WDR resource allocation advice. Priority conditions are those that cause a large burden of disease and have interventions with low cost per DALY gained. Interventions for these conditions are considered most important for inclusion in an essential or minimum package of services. It will be obvious that changes in the assumptions, estimates or values brought forward in the previous sections might change the order of the league table, by affecting either the extent of the burden of disease or the cost-effectiveness ratio of the interventions, or both. However, besides these technicalities there are a number of more general issues impacting on priority setting which we will review in this section. They will be grouped in three (partly overlapping) categories:

- epidemiological issues
- economic issues
- policy issues.

**Epidemiological issues**

Epidemiological issues influencing priority setting are related to disease patterns changing over time and to the concept of risk groups.

- Once infectious diseases have been tackled to some extent, the epidemiological transition will make necessary more interventions in non-communicable diseases, which are more expensive per DALY gained. Moreover, new infectious diseases, such as HIV/AIDS, will put an extra burden on the health budget. Further improvement in the health status of the population will therefore depend on the economic feasibility and willingness to increase the health budget. Therefore, dynamic analyses that take into account the effects of epidemiological transitions are needed to enhance the value of the model.

- When disease or risk factors change rapidly, the present burden of disease is not a good indicator of the priority for their control (Bobadilla et al. 1994: 173). On this basis the necessary allocation for the prevention of AIDS, for example, would be grossly underestimated. For emerging new diseases the expected ‘future burden’ would provide a better input for priority setting.

- The method to estimate the burden of disease fails to reveal whether a disease is concentrated in certain parts of the population. This has led some authors to question whether it is appropriate to seek to prioritize health care interventions rather than population groups. It is argued that most mortality and morbidity is experienced by a relatively small minority of people. Identifying these individuals/groups and determining risk factors and outcomes is likely to lead to a different set of research priorities and intervention strategies (Feachem et al. 1989; Murray 1990). Analysis by risk factor would give a better guide to primary prevention (Murray et al. 1994b).

**Economic issues**

Economic issues influencing priority setting are related to the use of cost-effectiveness studies on a system level, to the tension between efficiency and equity goals, and to lack of clarity concerning the costs of the advocated package.

- Economists warn against feeding individual study results into generalized league tables, because the context and methods of individual studies differ (Gerard 1992; 1993). On first sight this does not seem to apply to the WDR, since it appears to be one study, but Jamison concedes that in the HSPR exercise the methods of assessing the cost and effectiveness of interventions vary for different diseases, complicating comparison (Jamison 1993: 6). Ranking the results of cost-effectiveness
analyses should also be treated with extreme caution due to wide and unknown confidence intervals of the data used (Drummond et al. 1995).

- The validity of using a micro-economic technique, cost-effectiveness analysis, to influence priorities at a system level has been questioned (Zwi and Mills 1995b: 316). Is it proper that the WDR methodology should allow economic studies to dominate allocative decisions where so many other legitimate factors are at play? One can think of political factors, such as the wish to provide relatively expensive services to the poor or disadvantaged, or the wish to include the priorities as perceived by the population into the decision making process. An obvious factor to take into consideration is the status quo and the vested interests of health workers, institutes and administrators. One cannot change a health system overnight.

- Although the WDR calls provision of cost-effective health services to the poor an effective and socially acceptable approach to poverty reduction and mentions that most countries view access to health care as a basic right (World Bank 1993: 5), it uses economic evaluation to set priorities, which, as a technique, focuses on efficiency. It does not necessarily allow for equity goals to be met. The fact that the most efficient interventions identified in the WDR tend to specifically benefit the poor is more a result of coincidence than of principle.

- Once the most cost-effective interventions are in place the burden of disease is expected to decrease. But health care would become relatively more costly after the cheap DALYs have been gained, because the cost per DALY gained of existing interventions will increase when yield decreases.

Policy issues

Policy issues influencing priority setting are related to whose priorities should shape decisions, to who profits from DALYs gained or averted, to political barriers to reallocation of money, to the concern that the WDR methodology is not in the spirit of the PHC approach, and to the costs of the priority setting exercise per se.

- One could also argue that people should have a say in decision making about priorities, which might well turn out to be different from those of epidemiologists and economists. In the WDR only expert opinion is used to arrive at priorities. Zwi and Mills (1995b: 317) expressed concern that the package arrived at by experts might not be acceptable to the public and hence less cost-effective in the end, if preferences of the population are not considered in the methodology. A health need inventory could supplement the technical information and provide a broader basis for priority setting.

- A DALY gained is treated as a DALY gained, regardless of who gains it. It could be argued that DALYs gained or averted among those who presently experience the lowest quality of life and life expectancy should be valued higher than DALYs gained or averted among those who are already relatively healthy. In this way countries who make an effort to enhance equity alongside efficiency would be rewarded.

- The suggested public health and essential clinical services imply re-allocation of health budgets and radical health care reforms in many countries and extra resources in others; for example, the investment in public health would need to quadruple (World Bank 1993: 11). This is far from easy, given vested interests in the present allocations, lack of incentives for providers, and lack of consumer demand for public health services. Transferring current expenditure from expensive tertiary care to focus on the minimum package for the poor is difficult with the already minimal resources available and is politically naive. The WDR offers little practical advice for Ministries of Health on how to deal with political barriers. Nor is there advice on how to effectively distinguish the poor from the non-poor.

- The limited package of advocated interventions in the WDR seems to be very much in the spirit of the selective PHC approach advocated by Walsh and Warren (1980) in the 1980s, directed at preventing or treating those few diseases responsible for the greatest mortality in less developed areas and for which interventions of proven efficacy exist. It is not in line with the Alma Ata approach to comprehensive care, which has been pushed by WHO and donors for many years now. It could imply that less cost-effective interventions should not be provided, which would be politically unacceptable (Abel-Smith 1994). The call for specific packages could lead to vertical programmes (Prost and Jancloes 1993) or governments could use the report as a justification for limiting public expenditure (Zwi and Mills 1995b). In an article reviewing 18 package-building exercises, Bobadilla and Cowley (1995) state that the
packages designed so far have been adapted to the existing health system and infrastructure at the district level and that interventions are clustered and can be delivered in an integrated way, overcoming the danger of uncoordinated vertical programmes. It remains to be seen whether and how this will work out in practice.

- However desirable to base estimates of burden of disease and cost-effectiveness of interventions on reliable and representative data, the exercise advocated by the WDR to design an essential public health and clinical package will be too expensive and time consuming for poor countries. In these countries, however, it is all the more important to prioritize health interventions and get the most value for money. It has therefore been suggested that low income countries could save costs by adopting simpler methods of package design by focusing on mortality data alone, since in many of these countries mortality makes up 75% of the burden of disease (Bobadilla and Cowley 1995).

A summary of issues raised in the previous sections on burden of disease, cost-effectiveness and priority setting can be found in Table 1.

Concluding remarks

The 1993 World Development Report documents the results of a complex set of calculations and analyses that have not previously been tackled so comprehensively. The World Bank is to be commended for this unique initiative, conducted in a self-critical spirit.

A primary purpose has been to attempt to provide a framework for objectively identifying priority health interventions, based on epidemiologic and economic calculations, which can improve allocative efficiency in the health sector. However, given the acceptance, value and validity of public policy priorities other than efficiency, the WDR’s strong reliance on intervention-based cost-effectiveness analysis as the primary basis for setting priorities is questionable.

The WDR prescriptive advice is that governments should ensure universal access to a minimum package of health services, especially for the poor. However, there cannot be one universally applicable set of priorities. Rather, political, physical, social, environmental and behavioural impacts on health are specific to different cultures and different economic circumstances, and therefore must be fully taken into account. Moreover, interventions that impact across sectors were omitted from the analyses. A critical question in this debate is whether health improvement can be achieved in the absence of social and economical development. This is particularly relevant, since implementation of the advocated good buys will most likely not result in a reduction of the burden of disease, but in the transition of disease patterns and increased health care costs. This has to be taken into account when implications for sustainable development are being discussed.

The first large exercise of its kind, the WDR purports to have applied a consistent (though highly estimated and subjective) approach to measure the global burden of disease in DALYs lost. The same ‘rigour’ was not applied to the estimation of cost-effectiveness of interventions examined, due to the Report’s reliance on non-standardized previous research. Such lack of standardization does not permit the type of comparisons made or support the league table presented in the Report.

The interventions examined may not have the large impact on the global burden of disease as claimed. The effectiveness of interventions and their alternatives is not explicit, and is influenced by many contextual factors, as well as inflated by the high life expectancies used. Costs are underestimated because private, indirect and non-specific fixed costs have been omitted. The empirical basis on which costs per DALY have been computed is too limited for any realistic debate on priorities at a global level. The result is that the advocated package of essential services is of unproven validity and creates confusion about whether the indicated costs are to be interpreted as total or marginal costs.

Nevertheless, the methodology on priority-setting as presented in the WDR, represents an important contribution to the debate of providing ‘evidence-based policy’ in the health sector. In addition to the above concerns, a major deficiency, and a recurring theme in this and other reviews of the WDR, is the limited nature of the data on which the conclusions of the Report are based. The method aims to enable interventions and overall health sector performance to be evaluated in terms of reduction or transition of the burden of disease. However, to achieve this there is a need for considerable improvement of the data base: the number of diseases has to be expanded, household surveys should be used to validate the burden of disease results, individual behaviour and
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<tr>
<th>Technical item</th>
<th>Problems/issues</th>
<th>Policy implications</th>
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<tbody>
<tr>
<td>Methodology and conceptual context</td>
<td>• Restricted definition of health</td>
<td>• Health sector separated from other sectors</td>
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<td></td>
<td>• Validity of global priority setting</td>
<td>• Global priority setting not necessarily appropriate for national choices</td>
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<td></td>
<td>• Equity barely considered</td>
<td>• Results cannot easily be expected to impact on health status of the poor</td>
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<td>Global burden of disease and DALYs</td>
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<td>-------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Data</td>
<td>• Uncertainty of estimates unknown (no confidence intervals)</td>
<td>• Decision making/priority setting less founded</td>
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<td></td>
<td>• BoD defined in normative terms</td>
<td>• BoD as experienced might be different</td>
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<td></td>
<td>• Unmet health needs not taken into account</td>
<td>• True BoD likely higher</td>
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<td></td>
<td>• Different levels of disease aggregation used</td>
<td>• Makes priority setting difficult</td>
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<tr>
<td>Life-expectancy</td>
<td>• Life expectancies of industrialized nations used globally</td>
<td>• Leads to inflated BoD in developing countries</td>
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<td></td>
<td>• Small gender gap used</td>
<td>• Shows burden of underdevelopment in addition to BoD</td>
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<td></td>
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<td>• Over-estimated BoD in males</td>
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<tr>
<td>Age weighting</td>
<td>• Lack of clarity about consistent use</td>
<td>• Lack of information for policy decision on use of age weighting</td>
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<td></td>
<td>• Social value of middle age group considered greater</td>
<td>• Inequitable in principle</td>
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<td></td>
<td>• Lack of clarity about effect</td>
<td>• Makes policy decision on age weighting difficult</td>
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<tr>
<td>Disability weighting</td>
<td>• Use of experts and normative functional definition</td>
<td>• Different social, cultural and economic contexts not considered and burden on family and community omitted</td>
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<td>Category</td>
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<td><strong>Discount rate</strong></td>
<td>• Inconsistent dimensions of measurement</td>
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<td>• Separation of severity and duration</td>
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<td>• Use of low rate (3%)</td>
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<td>• Use of discounting per se</td>
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<tr>
<td><strong>Sensitivity analysis</strong></td>
<td>• SA not done on enough options of data inaccuracies or value choices</td>
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<td><strong>Cost-effectiveness of interventions</strong></td>
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<td><strong>Method</strong></td>
<td>• Cost utility analysis permits comparison within but not across sectors</td>
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<td></td>
<td>• Limits range of interventions considered</td>
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<tr>
<td><strong>Data</strong></td>
<td>• Selection criteria for interventions not clear and few interventions studied</td>
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<td></td>
<td>• Limits basis for priority setting</td>
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<td></td>
<td>• No consistent approach to the research purpose, viewpoints or methodology</td>
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<td>• Appropriateness of combination and meta-analysis for priority setting?</td>
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<tr>
<td><strong>Effectiveness</strong></td>
<td>• Effectiveness of interventions assumed</td>
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<td>• Effectiveness assumed to be same across countries</td>
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<td>• Externalities outside health sector not taken into account</td>
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<td></td>
<td>• Use of high life expectancies inflates effects of interventions</td>
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<td>• Actual effectiveness might be lower</td>
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<td>• Results may not be generalizable to certain settings</td>
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<td>• Reduces cost-effectiveness ratio</td>
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<td>• Creates problems with choosing value for money</td>
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NB: BoD = burden of disease
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<th>Technical item</th>
<th>Problem/issues</th>
<th>Policy implications</th>
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<tr>
<td>Costs</td>
<td>• Private, indirect, non-specific fixed and intangible costs omitted&lt;br&gt;• Budget, rather than intervention specific, information used&lt;br&gt;• All costs valued at market prices&lt;br&gt;• Differences in technical efficiency not taken into account&lt;br&gt;• Problems and inconsistencies in application of overhead and joint costs</td>
<td>• Inflates the cost-effectiveness ratio flawed priority setting&lt;br&gt;• Costs are significantly estimated, and levels of inaccuracy not known&lt;br&gt;• Lowers cost-effectiveness ratio in developing countries&lt;br&gt;• Comparability across countries difficult&lt;br&gt;• Artificially increases costs of more efficient interventions</td>
</tr>
<tr>
<td>Type of analysis</td>
<td>• Lack of clarity on average or marginal analysis&lt;br&gt;• Lack of clarity on total costs for essential package being marginal or average&lt;br&gt;• If average cost approach used</td>
<td>• Confusion → difficulties in resource allocation and flawed priority setting&lt;br&gt;• Unclear how much (extra) money is necessary to implement the package&lt;br&gt;• Lack of recognition of existing health system&lt;br&gt;• Robustness of results not clear</td>
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<tr>
<td>Sensitivity analysis</td>
<td>• No information is provided</td>
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**Priority setting**  

**Epidemiological issues** | • Future interventions (injuries and non-communicable diseases) more expensive | • Health care will become more expensive |
Economic issues

- Present BoD not a good indicator for rapidly changing disease or risk factors
- Methodology prioritises interventions rather than risk groups
- Feeding individual study results into league table
- Factors other than economic ones also shape priority setting
- Cost-effectiveness analysis focuses on efficiency gains
- Marginal costs will increase as implementation of cost-effective interventions increases

Policy issues

- Priorities identified not necessarily same as those of population
- DALYs are valued the same, whoever gains them
- Suggested packages imply re-allocation of budgets and radical reforms
- Approach resembles selective PHC and vertical programme structure
- Costs of designing essential package are too high for poor countries
- Future burden needs to be estimated
- Risk group approach could lead to different priorities
- Validity of league table questionable
- Socioeconomic and political context has to be taken into account
- Methodology does not specifically focus on equity
- Health care will become more expensive
- Broader basis might be necessary
- Valuing DALYs gained by disadvantaged groups higher would encourage measures to improve equity
- Political, long-term strategy is needed
- No in line with accepted comprehensive PHC approach
- Simpler methods, based on mortality data only, might have to be used

NB: BoD = burden of disease
environmental risk factors in the causation of disease and disability have to be added to the calculations, research has to be comparable, etc. With this kind of extended data base, the model could be used to forecast the estimated future burden of disease. In addition, with intended improvements the methodology has potential at the (sub)national level, where more precise data can be collected and the local context can be taken into account. As such the methodology could (among others) be an important tool to aid health planners and decision makers, but only where the resources and skills are available to implement such a complex methodology.

Endnotes

a The Report contains the results of the third revision of the Global Burden of Disease Study (1993). The WHO publication edited by Murray and Lopez reports on the fourth iteration (1994). Currently the 5th revision is being worked on (1996-97). National studies on burden of disease are being done in many countries, which will undoubtedly improve the accuracy of future global assessments, assuming it is considered a valid exercise.

b Incidence data were estimated from prevalence data because the latter were more frequently available. The reasons given for using incidence rather than prevalence data are internal consistency between mortality and disability (death rates are incidence rates) and the higher sensitivity of incidence to epidemiological trends and evaluation of intervention effects.

c That figures on death rates can differ substantially is shown by Murray (1990). He looked at data on mortality estimates for Hepatitis B, gathered by Walsh for 1988 and by the Commission on Health Research for Development for 1990. Walsh provided a figure of 800 000 deaths, while the Commission numbers amount to between 100 000–300 000 deaths. The conflicting estimates stress the fragility of available data-bases.

d The problem of time paradox occurs when, under certain assumptions, a lower discount rate is used for benefits than for costs. This would make it economically efficient to postpone implementation of projects indefinitely, because costs will become less in present-value terms, while benefits will stay the same or decrease less than costs.

Table 1.1 on page 6 in Jamison (1993) lists 25 selected diseases and conditions, whereas Murray et al. (1994a: 181) mention 26 diseases.

e In the chapter on tuberculosis Murray et al. (1994b) estimated the marginal costs for treatment of smear-positive patients as an average of the variable cost per case.

References


Over SM. Personal communication to Maria Paalman, 12 March 1996.


Theo Vos. Personal communication to Henk Bekedam, September 1996.


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