Health Policy Approaches to Measuring and Valuing Human Life: Conceptual and Ethical Issues

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ABSTRACT

To achieve more cost-effective and equitable use of health resources, improved methods for defining disease burdens and for guiding resource allocations are needed by health care decision makers. Three approaches are discussed that use indicators that combine losses due to disability with losses due to premature mortality as a measure of disease burden. These indicators can also serve as outcome measures for health status in economic analyses. However, their use as tools for measuring and valuing human life raises important questions concerning the measurement of mortality and the multidimensions of morbidity; valuing of life, particularly regarding weighting productivity, dependency, age, and time-preference factors; and conflicts between equity and efficiency that arise in allocation decisions. Further refinement of these tools is needed to (1) incorporate national and local values into weighting; (2) elaborate methods for disaggregating calculations to assess local disease patterns and intervention packages; and (3) develop guidelines for estimating marginal effects and costs of interventions. Of utmost importance are methods that ensure equity while achieving reasonable efficiency. (*Am J Public Health.* 1995; 85:1356–1360)

Introduction

To achieve more cost-effective and equitable use of health resources, improved methods for defining disease burdens and for guiding resource allocations are needed by health care professionals and decision makers. Resource allocation decisions in sectors other than health are based on benefits obtained per dollar expended—or value for money. But in the health sector there has been an understandable reluctance to put a value on life, and until recently there has been little agreement concerning how life might be measured, let alone valued.

Over the years numerous investigators have tried to put returns on health expenditures into an economic analysis framework. In the last two decades composite indicators that combine losses due to disability and premature mortality have been developed as a measure of disease burden and as an outcome indicator for health status in economic analyses. With increasing use of these indicators, as exemplified by the influential World Bank *World Development Report, 1993: Investing in Health,*[1] it is timely to examine potential conceptual and ethical issues related to the measuring and valuing of human life.

These composite indicators have a variety of uses:

- Comparison of the relative importance of different diseases or groups of diseases within a population
- Comparison of the disease burden in different populations either in different subgroups within a country or among different countries or groups of countries
- Identification of disadvantaged and vulnerable groups
- Comparison of health benefits to be gained from different interventions or packages of interventions
- Comparison of cost-effectiveness of interventions or packages of interventions for purposes of planning and evaluation
- Identification of health research priorities

We use a public health perspective that assumes that the purpose of health-related public resource expenditures is to optimize the health status of the community's population. This perspective builds on the moral imperative of rationing in the face of scarce resources, which often is in conflict with the medical practitioner's traditional creed to do all that is possible for one's patient. Rationing requires making choices among competing values; conceptual, methodological, and ethical issues arise in relation to both measuring and valuing life.

We review three approaches—the healthy life approach of the Ghana Health Assessment Team,[2] the quality-adjusted life year approach,[3,4] and the *World Development Report* disability-adjusted life year approach.[1,5] The review covers conceptual and ethical issues generic to the use of composite indicators for measuring and valuing life, highlights special issues specific to the methods used in the *World Development Report,* and provides suggestions to refine the approach for developing tools to assist in more rational resource allocation decisions. The following

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synopsis outlines the features that differentiate these three approaches.

Distinguishing Features of the Three Approaches

The Ghana Approach: Years of Healthy Life Gained or Lost

The amount of healthy life approach was developed by the Ghana Ministry of Health Planning Unit specifically for use in resource allocation decisions. This composite indicator combines morbidity and mortality to provide quantitative measures of losses from particular diseases and gains from particular interventions.[2,6] This approach has a strong clinical orientation and focuses on knowledge of the pathogenesis and natural history of disease as the conceptual framework for assessing disability and mortality and for interpreting effects of various interventions.

The main points can be summarized as follows. The health status of a population is determined by the amount of healthy life (days, months, or years) its population achieves as a proportion of the total potential amount that people could enjoy under optimal health conditions. (A birth cohort of 1000 people with a life expectancy of 80 years has the potential for 80 000 years of healthy life. In a steady state a random sample of 1000 from such a population has the potential for 40 000 years of healthy life; each year that population would experience events leading to 1000 years of healthy life lost. Discounting future life or adding productivity, dependency, and age-weighting parameters would affect these denominator numbers, which would have to be adjusted accordingly.) The total disease burden of a population is computed by adding together the years of healthy life lost per 1000 population from disability and premature death attributable to all diseases with onset in a given time period. Similarly, the benefits to be derived from a health program can be expressed as years of healthy life gained per 1000 per year.

To aid resource-allocation decisions, additional information is needed about the effects of an intervention on incidence, case fatality, and/or disability[7]; about the costs of the intervention (including delivery costs and costs in various combinations); and about coverage of the population who would benefit from it (target population). (Details of variables and computations for measuring and for adding in discounting and other social values, as well as a spreadsheet with calculations for healthy life to be gained from various interventions, are available from the authors.)

Quality-Adjusted Life Years

The quality-adjusted life year,[3,8–12] in one formulation or another, was developed for use in health care decision-making in technically advanced countries and has focused on assessing individual preference for different nonfatal health outcomes that might result from a specific intervention. It has been especially useful in distinguishing different types and levels of disability, impairment, or handicap. Torrance provides a framework for appraisal of cost-effectiveness, cost-utility, and cost–benefit analyses.[3] The key component of health status can be measured with one of three methods: *ad hoc* scales; a willingness to pay approach; or health state utilities. Torrance favored valuing health improvement through health state utilities and, specifically, quality-adjusted life years. The use of quality-adjusted life years is exemplified in the QALY Tool Kit,[8] in which severity of illness is judged on the basis of two criteria: observed disability (loss of function, mobility) and subjective distress (pain, anguish). This system identifies 8 levels of disability and 4 of distress, giving a total of 29 disability/distress states, each of which is given a value for each subject. These values averaged give an overall measure of disability for each possible outcome from alternative treatments for the patient in question. (See the review by Murray.[5]) In developing countries, refined measures of disability are much less important because of the overwhelming importance of preventable premature death, the inadequacy of data, and the relatively high cost of studies on quality-adjusted life years.

Disability-Adjusted Life Years

The disability-adjusted life year[1,5,13] was developed primarily to compare relative burdens among different diseases and among different populations. The major difference between the healthy life year and the disability-adjusted life year is that the latter directly integrates social-preference values with the amount of healthy life. For the many comparisons in the *World Development Report,* this single formula greatly simplifies the calculations and ensures comparability. However, for health planning decisions, calculations of the effects of specific interventions on the various components of healthy life—changes in incidence, case fatality ratios, extent of disability, or coverage of the target population—will require a disaggregated approach. Such an approach would also better serve decision makers who wish to choose their own social values.

Measuring Life

Measuring the burden of disease with composite indicators should not provoke undo ethical concerns, but one must beware of underlying assumptions in combining losses from various kinds of disability with losses from premature death. The measure of loss for premature death is usually stated in terms of potential years of life lost, that is, those years that would have been expected if the person had not died of that particular cause. Potential years of life lost are calculated on the basis of the expectation of life at the age of death minus the age at death. Though this calculation is seemingly straightforward, Gardner and Sanborn[14] point out that authors use various bases for their calculations by using different life expectations and even different ages for starting (e.g., eliminating infants from consideration). The major issue centers on the choice for the basis of life expectation. Although the original work in Ghana was based on expectation-of-life tables specific for Ghana,[15] considerations of equity as well as comparability across countries make it preferable to use the best possible life expectation—80+ years at birth with suitably developed life tables for each age—as was done in the World Bank *World Development Report.* Humans can, and increasing numbers do, live to age 80 and older with little or no physical or mental deterioration.

Developing common measures of disability, in contrast to measures of mortality, poses formidable challenges. Because there are many dimensions to disability—pain, discomfort, shortness of breath, physical inabilities, emotional distress, loss of dignity, and others—obtaining agreement about what disability is and how to measure it either in individuals or in populations has been exceedingly difficult. There is extensive literature on scales of measure for the many dimensions involved in health status assessment.[3,4] Recently, Murray and Lopez[13] reviewed many of the approaches to measuring the burden of disability. In order to be combined into a single burden-of-disease indicator, a disability measure should have comparable dimensions to that for life lost due to premature

death. The Ghana Team pointed out that disability has three components: (1) case disability ratio, (2) extent of disability, and (3) duration of disability.[2] The first and the third components can be determined objectively, but the assessment of the extent of disability, which ranges from 0.00 to 1.00 (from no disability [i.e., healthy] to disability equivalent to death), often incorporates a substantial subjective component.

Some writers have serious reservations about assigning a single number to the complex multidimensional phenomena contained in composite indicators. But what is the alternative? For use as a measure of utility and effectiveness in economic analyses, outcome indicators must use unidimensional units comparable to the unidimensional monetary expenditure units for costs.

Valuing Life

In contrast to the measuring of life, the valuing of life raises a number of ethical considerations. The very notion of valuing some lives more than others is jarring. Yet such notions are often reflected in our thinking and our actions. Certainly the valuation of life is often implicit in the way resource allocation decisions are made; therefore, to the extent possible, such valuations should be explicit, transparent, and open to sensitivity testing (determining how much the result changes as a function of systematically varying one or more of the inputs in question).

The major dimensions in valuing life include the following:

1. Valuing a given duration of life
2. Valuing future life compared with present life
3. Valuing life in terms of economic or social productivity
4. Valuing equity in relation to efficiency (cost-effectiveness)

1. Valuing a Given Duration of Life

Is all life inherently valuable? Is a day of anyone's life of equal value to a day of anyone else's life? Or does the value of life vary with age, economic productivity, or social status? The Ghana Health Assessment Team[2] judged all life to be intrinsically valuable and a given duration of any life to be equal to that of any other life. As pointed out by the Ghana Team, the healthy life approach values individuals in direct proportion to their expectation of life at their current age; therefore, the loss of a healthy child is regarded as costing society more than the loss of a healthy adult. The team discussed this issue at length with many groups in Ghana, where children are very highly valued (as in most societies), and found substantial support for these assumptions. This approach is appropriate if the objective of the health system is to maximize the total amount of healthy life in the community over time. But not all agree that this objective is entirely appropriate. Even in Ghana funerals for children are generally quite simple, and newborns who die in the first week may not even be acknowledged.

A number of alternative formulations may be considered. Different weights may be given for years lived at different ages. Value may be added for economic or social productivity or subtracted for societal costs of dependents (e.g., costs for education). The healthy life of a dependent lost as a result of disability or death of a parent might better be apportioned to the parent, thus adding to the value of the life of a parent. The Ghana Team tried a number of alternative weightings. Except for extreme assumptions (such as totally disregarding the life years of those who die before the age of 15), the relative ranking of disease problems and priorities accorded to intervention programs was little affected. Adoption of a different system of weighting, as in the recent *World Development Report,* is a straightforward matter.

The *World Development Report* assigned an exponential function to provide a value for the disability-adjusted life year chosen so that life lived during ages of dependency, i.e., infants, children, and the elderly, was given less value than that of the productive years. The intrinsic value of a day of life increased from zero at birth to a maximum at the age of 25 and declined thereafter. In the disability-adjusted life year calculations, a day in the life of a 50-year-old is worth about 25% less than a day in the life of a 25-year-old—a questionable effect that does not accord well with views in most cultures. Here too, however, the use of different values for the parameters within ranges that were considered reasonable did not make much difference in the relative rankings.[5]

The *World Development Report* disability-adjusted life year approach combines measuring and valuing in a single package. The single formula simplified calculation of the great numbers of comparisons that were made, and it ensured comparability of the age weighting and the discounting for the multiple burden-of-disease comparisons across different population groups. However, for resource allocation and program decision making at country- or district-specific levels, calculations for valuing are best kept separate to permit greater transparency and to make more straightforward the sensitivity testing of the various components of valuation. In addition, separation of valuing from measuring may be important for incorporating national and local values into the calculations and for determining the effects of different interventions.

2. Valuing Future Life Compared with Present Life

A second value judgment concerns the level at which the discount rate should be set for determining the present value of future events. Social time preference takes into account the phenomenon that events in the near future are more highly valued than more distant ones (quite independent of inflation). For investments in other sectors, time preference is routinely accounted for by discounting future returns and costs with some appropriate discount rate. Discounting should be done for expenditures on health care as well, but the question has been what an appropriate discount rate for valuing human life might be. Most agree that it should be less than that used commercially—perhaps 2% or 3% per year. The *World Development Report* used 3%,[1,5] which might serve as a default rate in lieu of other information. Although sensitivity testing with a range of rates could show how specific decisions are affected, at these low rates little effect on program decisions can be expected.

On the other hand, the high discount rates in the double-digit range often found in association with commercial interest rates in developing countries would make a substantial difference when comparing disease burdens of populations with different age-related disease patterns (for example, the high burden of disease in children would receive less relative weight because the discounting of their life expectancy would be relatively greater than that for adults, who have a shorter life expectancy). Such discounting would also affect the estimated value of interventions directed at diseases prevalent at different ages.[5]

3. Valuing Life in Terms of Economic or Social Productivity

Possibly the most contentious issue has to do with whether a weight should be

added for economic or social productivity. In general, productivity may be attributed to adult groups aged 15 to 64 years, with greater value given to these ages; those below age 15 and beyond age 64 years, considered as dependents, are given less weight.[16] Many variants for differential valuing are possible, including weighting according to type of employment. People at different levels of socioeconomic development are expected to have different capacities for social and economic productivity. Yet to value life according to income level or social class can be inequitable. In many developing countries the value of (marginal) wages for subsistence farmers is negligible, but the value of their lives certainly is not. Thus, a fundamental question is whether to consider adding a productivity component to the measure of healthy life.

We believe the healthy life year should be considered as an end in itself and not as a commodity produced for some other purpose, such as economic productivity. Our starting point is that health policy and decisions about the use of health-related public resources should be based strictly on discounted years of healthy life—lost due to disease burden or gained as a result of interventions—without social or economic productivity or dependency weighting. However, if it were decided that value related to productivity should be incorporated, then it would seem preferable to add a productivity factor separately—not to incorporate it as an integral part of life lived at a particular age, as is done indirectly and implicitly by age weighting with the disability-adjusted life year.

Our discussion is based on a societal viewpoint and assumes that expenditures are those that should be made by the public in the interests of the well-being of the population. Health issues do not readily conform to simple economic models. In the health care sector, information is inadequate and misinformation is rife on the part of providers as well as the public. Externalities (costs or benefits that are imposed on others as a result of a transaction that cannot be charged or credited to the parties involved in the transaction) resulting from changes in health status are generally large. Demand for costly services is determined largely by suppliers (physicians and/or third-party insurers or agencies) rather than by consumers (patients). Competitive market forces have generally not worked well with respect to those persons in greatest need. In the private sector, demand for services is clearly related to productivity and willingness to pay; if left to market forces alone, inequitable distribution of health care services would be inevitable.

4. Valuing Equity in Relation to Efficiency (Cost-Effectiveness)

Decisions based on the healthy life year (or the disability-adjusted life year) per dollar approach may not always accord well with concerns for equity. Cost-effectiveness calculations are generally indifferent to equity; they are designed to steer interventions toward what is efficient, whatever the differential needs of the potential recipients.

In terms of social justice, equity has to do, fundamentally, with a fair distribution of benefits from social and economic development. However, there seems to be no generally accepted definition of equity in relation to health. Equity is used in different conceptual senses[17]: equal access to health services for all (opportunity equality); equal resources expended for each individual (supply equality); equal resources expended for each case of a particular condition (equality of resource use based on biological need); equal healthy life gained per dollar expended (cost-effectiveness); care according to willingness to pay (economic-demand equality, which certainly will not lead to an equitable distribution in any other sense); care according to biological or socioeconomic need; or—ultimately—equal health states for all. Though perhaps it is not literally possible, Susser[18] stated that equity in health states for all social groups should be an explicit aspiration and listed this aspiration among the four constituents of an equitably distributed health right. Some ethicists would say that the greater the need in the sense of social and economic deprivation, the greater the moral claim for responsiveness in terms of health care. (Indeed, the sense of need goes beyond concerns for disease burden alone; other forms of deprivation or vulnerability represent need that could be considered in determining priorities for resource allocation to health care.) But without the notion of effectiveness of the health intervention in relation to resource costs (i.e., disability-adjusted life year per dollar), this concept of equity based on need could translate back to doing all that one can for a particular patient regardless of cost. Robert Veatch[19] considered the use of quality-adjusted life years in guiding health care resource allocation in Oregon. He argues that the moral use of cost-effectiveness calls for adding equity criteria to determine the distribution of benefits.

In our view, equity goes beyond equality of access to health care and must entail a balance so that health system responses are in accord with equity as well as efficiency. A useful operational approach would be to assess the impact of specific health decisions to ensure that they enhance equity—or at least do not contribute to inequity. Assessment of the impact on equity should be straightforward: healthy life per dollar estimates could be used as an indicator for changes in equity by estimating the gains in healthy life as a result of each decision in each population subgroup of interest.

From the viewpoint of the health system, the principles of cost-effectiveness and equity can come into serious conflict when the provision of care for remote and deprived populations is more costly than that for more easily accessible populations. Two considerations may help to resolve the conflict. First, the full cost of reaching remote populations—the development of roads, communications, and often of increased educational efforts—should not fall solely on the health sector; such infrastructural costs should be borne in accordance to the benefits received across all sectors involved (e.g., agriculture, marketing, education, community development). Second, the unmet needs of the remote, underserved population will be greater, and therefore the potential gains in healthy life years will be more than in those populations who already have access. Consequently, a good part of the equity concerns in these circumstances are related to the scope and time frame of the factors that are considered in assigning costs and in determining healthy life gains. On balance, care directed to those in greater need often is justified on grounds of cost-effectiveness as well as equity, provided that costs of infrastructural development are appropriately attributed and that the time frame is sufficiently extended to allow that development.

How do the recommendations of the *World Development Report* relate to the issue of equity? The *World Development Report* speaks repeatedly of the importance of equity; the principles and methods it espouses are equity oriented. The report's clear intent is to use the disability-adjusted life year approach to guide allocations toward the greatest burdens of disease and the most cost-effective interventions. Generally speaking, that guid-

ance will be toward those in greatest need. To the extent that the health intervention procedures most useful in underserved populations (e.g., immunizations, maternal and child health programs, communicable disease control) are those that are most cost-effective, then decisions based on cost-effectiveness analyses should enhance equity. To implement the recommendations of the *World Development Report,* national governments should build the guidelines and methods required to ensure just distribution of health care benefits into their policy analysis and health program assessment procedures.

An additional concern is that one must go beyond simply choosing what the right things to do are (the priority setting); one must also do these right things in the right way and, as Deming noted, at the right time.[20(p66)] Hence, effective management incorporating a total quality management–continuous quality improvement approach is also needed to ensure equitable distribution of health benefits.

More Work to Be Done

It is particularly important that countries interested in working with this approach be assisted in developing the analytical capacities to obtain and use the necessary data. Health care professionals and decision makers must become fully acquainted with the healthy life per dollar framework, try it out in their information systems and decision-making bodies, and compare the conclusions with those presently being made. Only then should the decision be made to adopt this approach for assisting in policy and decision making, and only then will it become possible to incorporate appropriate national and local values into decisions as to whether and how to add in productivity, dependency, and age-weighting parameters.

Further, methods for disaggregating the calculations concerning the effects of different intervention packages (and different mixes of additions to the current intervention programs) on the various components of healthy life—changes in incidence, case fatality ratios, extent of disability, and coverage of the target population—will have to be developed to assess what additional services will be most cost-effective and equitable in order to better fit local needs.

Conclusions

Measuring and valuing human life with the use of appropriately developed composite indicators contribute importantly to understanding the burdens of disease in populations and to guiding thinking about the most appropriate ways to address those burdens with health care interventions. Such measures can steer policies toward interventions and the resource allocations to support them that are both cost-effective and sensitive to ethical dimensions of health and development.

Through the use of disability-adjusted life years, the *World Development Report* takes a constructive approach to this problem. Developed as it is, with associated tables of disability-adjusted life years relating to a wide spectrum of diseases and resource allocations in all countries at all levels of development, this approach promises to be highly useful for all parties involved in grappling with the problems of health and social development.

Examining the measures and values relating to human life inevitably raises ethical questions of considerable importance. These have been discussed, and although we differ in some ways with the specifics by which the disability-adjusted life years are formulated and applied, our differences do not amount to a serious criticism of the general principles and applications of disability-adjusted life years as put forth by the *World Development Report.* We are highly supportive of the approach, but two matters of special importance deserve emphasis: One is that we consider human life to be incommensurably valuable, and we would not put a differential value on life according to age, sex, economic productivity, or social status. The other, which has substantial operational importance, is that disability-adjusted life years should be used not only to guide allocation of resources based on cost-effectiveness criteria, but also to ensure the equitable distribution of those resources within countries so as to reach those most in need. Cost-effectiveness, by itself, does not provide sufficient guidance—equity should be an associated criterion to govern the distribution of societal benefits. □

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