Quality of Life and Pharmacoeconomics in Clinical Trials, Second Edition, edited by B. Spilker.
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CHAPTER 32

The General Health Policy Model: An Integrated Approach

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INTRODUCTION

Quality of life data are becoming increasingly important for evaluating the cost-utility and cost-effectiveness of health care programs. Such analyses require the evaluation of very different types of health care interventions using the same outcome unit. This chapter highlights some of the strengths and weaknesses of general health outcome measures. The value of general versus disease-specific measures within clinical populations is also addressed. In addition, we consider the boundaries of the quality of life concept.

QUALITY OF LIFE MEASUREMENT

Why Measure Quality of Life?

The conceptualization and measurement of health status has interested scholars for many decades. Following the Eisenhower administration, the President's Commission on National Goals identified health status measurement as an important objective. In *The Affluent Society*, Galbraith described the need to measure the effect of the health care system on "quality of life." Within the last two decades, many groups have attempted to define and measure health status (1–3). Before considering any specific approach, it is worth noting that traditional indicators of "health" have well-identified problems that need to be addressed before they can be considered part of an adequate measure of quality of life.

Mortality

Mortality remains the major outcome measure in many epidemiologic studies and some clinical trials. Typically, mortality is expressed in a unit of time and the rates are often age-adjusted. Case fatality rates express the proportion of persons who died of a particular disease divided by the total number with the disease (including those who die and those who live). Mortality rates have many benefits as health outcome measures. They are "hard" data, despite some misclassification bias (4), and the meaning of the outcome is not difficult to comprehend. Despite their many advantages, mortality outcomes have some obvious limitations. Mortality rates consider only the dead and ignore the living. Many important treatments or programs might have little or no impact

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on mortality rates and many frequently occurring illnesses, such as arthritis, have relatively little impact on mortality. Thus, there has been an incentive to define and measure nonfatal outcomes.

Morbidity

The most common approach to health status assessment is to measure morbidity in terms of function or role performance. For example, morbidity estimates often include workdays missed or bed-disability days. Many different approaches to health status assessment using morbidity indicators have been introduced. These include, for example, the Sickness Impact Profile (5), which represents the effect of disease or disability on a variety of categories of behavioral function, and the Medical Outcomes Study measures, which have separate categories for the effects of disease or health states on physical function, social function, and mental function (3). These measures are important quantitative expressions of health outcome. However, they do not integrate morbidity and mortality, although as each birth cohort ages, mortality cases accrue.

Death is a health outcome, and it is important that this outcome not be excluded from any expression of health status. For example, suppose we are evaluating the effect of program A, which integrates support and treatment, for randomly assigned groups of very ill, elderly, nursing home residents against the effect of program B, which offers no support or treatment. Let us suppose that program A maintains patients at a very low level of function throughout the year, but that in the comparison group (program B), the sickest 10% died. Looking just at the living in the follow-up, one finds program B patients to be healthier, since the sickest have been removed by death. By this standard, the program of no supportive treatment might be put forth as the better alternative. With a measure that combines morbidity and mortality the outcome will be very different, because mortality effects will reduce the overall health of program B to a very low level.

Behavioral Dysfunction

When Sullivan (6) reviewed the literature on health measurement nearly 30 years ago, he emphasized the importance of behavioral outcomes. Behavioral indicators such as absenteeism, bed-disability days, and institutional confinement were identified as the most important consequences of disease and disability. Ability to perform activities at different ages could be compared with societal standards for these behaviors. Restrictions in usual activity were seen as *prima facie* evidence of deviation from well-being. Many other investigators have focused on point-in-time measures of dysfunction as measures of health (3,7,8).

Prognosis

The problem with measures of behavioral dysfunction is that they often neglect what will happen in the future. The spectrum of medical care ranges from primary prevention to rehabilitation. Many programs affect the probability of occurrence of future dysfunction (e.g., vaccines), rather than alter present functional status. In many aspects of preventive care, for example, the benefit of the treatment cannot be seen until many years after the intervention. A supportive family that instills proper health habits in its children, for example, may also promote better health in the future, yet the benefit may not be realized for years. The concept of health must consider not only the present ability to function, but also the probability of future changes in function. A person who is functional and asymptomatic today may harbor a disease with a poor prognosis. Thus, many individuals are at high risk of dying from heart disease even though they are perfectly functional today. Should we call them "healthy"? We hold that the term *severity of illness* should take into consideration both dysfunction and prognosis (or probability of future dysfunction and mortality).

Many medical treatments may cause near-term dysfunction to prevent future dysfunction. For example, coronary artery bypass surgery causes severe dysfunction for a short period of time, yet the surgery is presumed to enhance function or decrease mortality at a later time. Patients may be incapacitated and restricted to coronary care units following myocardial infarction. Yet, the treatment is designed to help them achieve better future outcomes. Pap smears and hysterectomies are performed in order to decrease the probability of future deaths due to cancer. Much of health care involves looking into the future to enhance outcomes over the life span. Therefore, it is essential to divide health into current and future components. We prefer the term *prognosis* to describe the probability of transition among health states over the course of time (9).

IS QUALITY OF LIFE DIFFERENT FROM HEALTH STATUS?

In the preceding section, we have described some common elements in existing measures of health status. However, there is considerable variability in the definition of quality of life. Some authors define quality of life as health outcomes that are different from traditional health outcomes. Using these definitions, quality of life measures are typically limited to psychological and social attributes (10). By contrast, our definition of health-related quality of life focuses on the qualitative dimension of functioning. It also incorporates duration of stay in various health states. We will return to this definition later in the chapter; in this section, however, we review the value dimension, which is an important aspect of quality of life.

The Value Dimension

Scholars have debated the components of "health" for many centuries (11). Most concepts of morbidity involve three types of evidence: clinical, subjective, and behavioral (6). *Clinical* outcomes include clinical judgment, physical findings, laboratory tests, or results of invasive procedures. Clinical evidence is valuable if, and only if, it is clearly related to well-defined behavioral health outcomes. For example, significant abnormalities in certain blood proteins are of concern only if these deviations correlate with morbidity or early mortality. The burden of proof is on the scientist to demonstrate these associations.

Subjective evidence includes symptoms and complaints that are also very important in health care. Symptoms are a major correlate of health care utilization, but not all symptoms should be given equal weight because neither the type nor the number of symptoms necessarily depicts the severity of disease. For example, an adult with an acute 24-hour flu may have an enormous number of symptoms. Although these can include nausea, headache, cough, sneezing, aches and pains, vomiting, and diarrhea, it is not clear that this condition is more severe than the single symptom of a very severe headache.

Several factors need to be considered. First, we must determine the degree to which the symptoms limit functioning. Consider an individual with five symptoms—an itchy eye, runny nose, coughing, fatigue, and headache—but who still feels well enough to work and to perform all usual activities. Another person with the single symptom of a severe headache may be limited to bed. Would we want to call the person with five symptoms less well? Another dimension is the duration of the symptoms. A year in pain is certainly worse than a day in pain. The final, and perhaps the most often neglected, factor is the value or preference associated with different types of dysfunction.

Biomedical investigators often avoid reference to values or preferences because these constructs are not considered "scientific." However, the value dimension in health status is inescapable. Fishburn (11) defined value as the quantification of the concept of worth, importance, or desirability. Ultimately, our judgments of the value of health states, and whether one level of functioning is "better" than another level of functioning, depend on subjective evaluations. If we advise individuals to change their diet to avoid heart disease, we inherently assume that the reduced probability of heart disease later in life is valued more than the immediate but enduring mild displeasure of dietary change. The phrase *quality of life* necessarily presumes a qualitative judgment.

As noted earlier, Sullivan (6) emphasized *behavioral dysfunction* as the third type of evidence for morbidity. Behavioral dysfunction includes disruption in role performance, confinement to hospitals, or work loss.

SHOULD QUALITY OF LIFE BE LIMITED TO PSYCHOLOGICAL AND SOCIAL ATTRIBUTES?

Some authors use the term *quality of life* as a limited descriptor of psychological and social health (10). We believe that most psychological and social dimensions can be incorporated into a general health status measure. However, some concepts of social health are correlates of health outcomes rather than outcomes themselves. We have addressed these issues elsewhere (12–14) but will summarize them here.

Social Health

For nearly 35 years, physicians, psychologists, sociologists, and epidemiologists have been attempting to include social support and social function in a definition of health status. Despite relentless efforts, it has been difficult to meaningfully define social support as a component of health. The term *social health* was included in the World Health Organization definition of health that accompanied their charter document in 1948 (15). They defined health as "a state of complete physical, mental, and social well-being and not merely the absence of infirmity." In identifying the dimensions of health, the World Health Organization neglected to provide any operational definitions. Thus, different investigators have taken different approaches in their attempts to capture physical, mental, and social dimensions. Since the publication of the World Health Organization statement, many investigators have tried to develop measures to operationalize the three components of health status. With surprising consistency, authors quote the World Health Organization definition and then present their methods for measuring the three components. So prevalent is the notion that health status must include these three components that many reviews now negatively evaluate any measure that does not conform to the World Health Organization definition. For example, Meenan (16) disapproved of several health measures because, "these approaches fall short of conceptualizing or measuring health in the World Health Organization sense of a physical, psychological, and social state."

With the command of the World Health Organization so plainly set forth, many investigators have struggled to develop their measures of social health. Yet there have been consistent problems. For example, Kane and Kane (17) devoted a substantial section of their monograph to describing problems in the quantification of social health. These problems included vague concepts, lack of norms, the interactive nature of variables, difficulty in construction of a continuum, and the subjective nature of social health.

Only Ware and colleagues (18,19) have begun to question the meaning of social health. In one paper, Ware and Donald (19) reviewed 70 studies relevant to social health. From these they selected 11 studies for more detailed analysis. The great majority of these studies focused on what we now call social support. Yet there were at least two separate components being assessed by the many investigators contributing to this literature. One component is social contacts, or the performance of social role. The other component is social resources, which is more analogous to the concept of social support. This distinction is very important. Social contacts might include participation in work, attendance at school, and other aspects of functioning. Social resources are relevant to social life, friendships, and family relationships.

In a series of analyses, it has been demonstrated that social support may be a predictor for health outcomes (13,19), but the direction is not always clear. For example, Heitzmann and Kaplan (20) have demonstrated that social support may predict positive outcomes for women but negative outcomes for men. Social support is not an outcome that can serve as the target of health care. On the other hand, social functioning is a component of health status. Diseases and disabilities affect social function. Social function is a central component in the concept of quality of life (21). Optimizing social health raises issues of social control and public policy. Considering the example of function, there is strong consensus that function is desirable. Thus, it seems reasonable to devote public resources to maximize the level of function and quality of life within a community.

Optimized health status might be considered a common goal, as is national defense, a strong educational system, and so on. Many current methods of health measurement do include a social functioning component. On the other hand, including social support in the definition of health status would imply that community resources should be used to obtain some defined level of social support. We might expect considerable public disagreement about what the social support objective might be. For example, would we want to develop a public policy that requires people to have friends?

Excluding social support from the definition of health makes policy analysis relatively straightforward. There is little disagreement about what levels of functioning are desirable (22). When people agree on what is desirable, the objective of health care can be directed toward achieving the desired states. A major issue is in defining a mix of programs that most efficiently and effectively achieve these objectives. Programs that enhance social support might be considered in this mix, but we believe that including social support in the definition of health only confuses the definition of these objectives.

Mental Health

The separate category for mental health in the World Health Organization definition prompted many investigators to develop separate measures of mental health functioning. Perhaps the best known effort in this area is the work by Ware and his associates (23). These investigators adapted Dupuy's (24) General Well-Being Index and administered it to large numbers of people as part of the RAND Health Insurance Experiment. Ware et al. (25) argue that the correlation between psychological distress and physical functioning is only .25 and suggested that this confirmed that mental health was a separate dimension. In addition, they offered comparisons between those with no physical limitations but with differences on items about psychological distress. For this high physically functioning group, those with higher scores on mental distress used three times as many mental health services as those low in distress.

The separate measurement of mental health remains a major issue in the conceptualization of general health status. Although our position is against the norm, we believe mental health can be conceptualized as a portion of general health status and that there is considerable disadvantage to attempting separate measurement and specification of mental function. We do understand that some investigators are interested in specific subcomponents of mental health, such as cognitive functioning. In these cases, more detailed measures might be considered additions to (but not replacements for) the general measures. We will return to this argument later.

We argue that the World Health Organization conceptualization of health status promotes an artificial dichotomy between mental and physical function. To understand this argument, it is important to think about the impact of mental illness, anxiety, or poor social adjustment on functioning. Mental health affects longevity (26) and quality of life. In other words, the impact of mental health on general health status is expressed through its impact on life expectancy, functioning, and symptoms. However, many individuals with perfect physical functioning experience symptoms. For example, an individual experiencing anxiety at work might report a symptom describing anxiety. This anxiety might effect quality of life in a manner similar to a physical symptom such as shortness of breath. Severe anxieties, such as phobias, may disrupt role performance. Thus, individuals may be limited to their homes because they are afraid to go outside. Many individuals experience symptomatic depression that does not disrupt their activities of daily living. At the other extreme, anxiety and depression can be so severe that they result in hospitalization. Thus, the impact of the condition on functioning is very much the same as the impact of a physical malady.

As in physical health, the duration of mental health conditions must also be considered. For example, depression may last 3 days, 3 weeks, or 1 year. The total impact needs to be expressed as a function of its duration. More importantly, mental health status may effect differential transition among functional states over the course of time. The term *positive health* is used typically to describe some aspect of lifestyle or mental outlook that is associated with better future health. Or people with positive health have lower probabilities of transition to poor health over the course of time. An individual who can cope with stress may seem no different from individuals without such coping skills. However, given certain epidemiologic linkages, they may have a higher probability of better functioning at future points in time.

Much of the confusion about mental health has been generated by a very refined technology for assessing mental states. Often, detailed questionnaire methods have been factor analyzed to describe different dimensions of mental health. Nevertheless, these very different levels of functioning may ultimately have impact on the general well-being. This may be analogous to the many available measures of blood chemistry. For example, indicators of kidney function (creatinine, BUN, and so on) may be identified as separate factors, yet the importance of these measures is their relationship to longevity and to function at particular points in time. We might not be concerned about elevated creatinine, for example, if these blood levels were not correlated with death or dysfunction due to kidney disease.

There are some justifications for not separating mental and physical function. The growing literature on psychoneuroimmunology (27) clearly demonstrates the intertwining nature of physical and mental health outcomes. In addition, experiments have demonstrated that general health status can be improved in medical patients even though physical functioning is unaffected. For example, patients with chronic obstructive pulmonary disease do not achieve changes in lung function following rehabilitation. However, they may reach higher levels of activity and reduced symptoms (28). The rehabilitation programs are not necessarily medical and may depend on physical or respiratory therapists. Indeed, the changes in outcome may result from improved attitude or from the enhanced ability to cope with symptoms. Ultimately, we are interested in patient function and quality of life. It may not matter if this is achieved through enhanced lung function or improved coping skills. The most important point is that all providers in health care are attempting to improve quality of life and extend the duration of life. It may be worthwhile to allow mental health providers and physical health providers to compare the benefits of their services using a common unit.

Health-Related Quality of Life

The objectives of health care are twofold. First, health care and health policy should increase life expectancy. Second, the health care system should improve the quality of life during the years that people are alive. It is instructive to consider various measures in health care in light of these two objectives. Traditional biomedical indicators and diagnoses are important to us because they may be related to mortality or to quality of life. We prefer the term *health-related quality of life* to refer to the impact of health conditions on function. Thus, health-related quality of life may be independent of quality of life relevant to work setting, housing, air pollution, or similar factors (29).

Numerous quality of life measurement systems have evolved during the last 30 years. These systems are based primarily on two different conceptual approaches. The first approach grows out of the tradition of health status measurement. In the late 1960s and early 1970s, the National Center for Health Services Research funded several major projects to develop general measures of health status. Those projects resulted in the Sickness Impact Profile (5), the Quality of Well-Being Scale (30,31), and the General Health Rating Index. The latter measure, originally developed at Southern Illinois University, was adapted by the RAND Corporation under Health and Human Service grants and has become known as the RAND Health Status Measure (8). This measure evolved into the SF-36. These efforts usually involved extensive multidisciplinary collaboration between behavioral scientists and physicians. Most of the measures are focused on the impact of disease and disability on function and observable behaviors, such as performance of social role, ability to get around the community, and physical functioning. Some systems include separate components for the measurement of social and mental health. All were guided by the World Health Organization's above-mentioned definition of health status.

The second conceptual approach is based on quality of life as something independent of health status. Some investigators now use traditional psychological measures and call them quality of life outcomes. For instance, Follick et al. (10) suggest that quality of life represents psychological status in addition to symptoms and mortality. Croog et al. (32) used a wide variety of outcome measures and collectively referred to them as "quality of life." These measures included the patients' subjective evaluation of well-being, physical symptoms, sexual function, work performance and satisfaction, emotional status, cognitive function, social participation, and life satisfaction. Yet mortality is not part of the concept. Other investigators, including Hunt and McEwen (33), regard quality of life as subjective appraisals of life satisfaction. In summary, a wide variety of different dimensions have all been described as quality of life. Although agreement is lacking on which dimensions should be considered the standard for assessing quality of life in research studies, recurrent themes in the methodological literature can assist in the evaluation of existing instruments. As will be shown, our approach to quality of life measurement focuses on health-related outcomes of mortality, morbidity, symptoms, and prognosis. We believe that many definitions of quality of life are poorly operationalized. Before addressing our definition of health-related quality of life, it is also important to clarify some economic terms that are often used in the literature.

Cost-Utility versus Cost-Benefit

The terms *cost-utility, cost-effectiveness,* and *cost-benefit* are used inconsistently in the medical literature (34). Some economists have favored the assessment of cost-benefit. These approaches measure both program costs and treatment outcomes in dollar units. For example, treatment outcomes are evaluated in relation to changes in use of medical services and economic productivity. Treatments are cost-beneficial if the economic return exceeds treatment costs. Diabetic patients who are aggressively treated, for example, may need fewer medical services. The savings associated with decreased services might exceed treatment costs. As Kaplan and Davis (35) have argued, there is relatively little strong empirical evidence that patient education or behavioral treatments are actually cost-beneficial. In addition, as suggested by Russell (36), the requirement that health care treatments reduce costs may be unrealistic. Patients are willing to pay for improvements in health status just as they are willing to pay for other desirable goods and services. We do not treat cancer in order to save money. Instead, treatments are given in order to achieve better health outcomes.

Cost-effectiveness is an alternative approach in which the unit of outcome is a reflection of treatment effect. In recent years, cost-effectiveness has gained considerable attention. Some approaches emphasize simple, treatment-specific outcomes. For example, the cost per pound lost has been used as a measure of cost-effectiveness of weight loss programs (37). Public competitions, for example, achieve a lower cost-per-pound loss ratio than do traditional clinical interventions. The major difficulty with cost-effectiveness methodologies is that they do not allow for comparison across very different treatment interventions. For example, health care administrators often need to choose between investments in very different alternatives. They may need to decide between supporting liver transplantation for a few patients versus prenatal counseling for a large number of patients. For the same cost, they may achieve a large effect for a few people or a small effect for a large number of people. The treatment-specific outcomes used in cost-effectiveness studies do not permit these comparisons.

Cost-utility approaches use the expressed preference or utility of a treatment effect as the unit of outcome. As noted in World Health Organization documents (38), the goals of health care are to add years to life and to add life to years. In other words, health care is designed to make people live longer (increase the life expectancy) and to live a higher quality of life in the years prior to death. Cost-utility studies use outcome measures that combine mortality outcomes with quality of life measurements. The utilities are the expressed preferences for observable states of function on a continuum bounded by 0 for death to 1.0 for optimum function (39–41). In the next section, we outline a model that combines utilities with measures of mortality, morbidity, symptoms, and prognosis. The system can be used as either a health-related quality of life measure or an instrument in cost-utility analysis.

A COMPREHENSIVE SYSTEM—THE GENERAL HEALTH POLICY MODEL

Our approach is to express the benefits of medical care, behavioral intervention, or preventive programs in terms of well-years. Others have chosen to describe the same outcome as quality-adjusted life-years (42). Well-years integrate mortality and morbidity to express health status in terms of equivalents of well-years of life. If a cigarette smoker died of heart disease at age 50 and we would have expected him to live to age 75, it might be concluded that the disease cost him 25 life-years. If 100 cigarette smokers died at age 50 (and also had life expectancies of 75 years), we might conclude that 2,500 (100 people × 25 years) life-years had been lost.

Death is not the only outcome of concern in heart disease. Many adults suffer myocardial infarctions that leave them somewhat disabled over a longer period of time. Although they are still alive, the quality of their lives has diminished. Our model permits all degrees of disability to be compared with one another. A disease that reduces the quality of life by one-half will take away 0.5 well-years over the course of 1 year. If it effects two people, it will take away 1.0 well-year (equal to 2 × 0.5) over a 1-year period. A medical treatment that improves the quality of life by 0.2 for each of five individuals will result in a production of 1 well-year if the benefit is maintained over a 1-year period. Using this system, it is possible to express the benefits of various programs by showing how many equivalents of well-years they produce (39–41). Yet not all programs have equivalent costs. In periods of scarce resources, it is necessary to find the most efficient use of limited funds. Our approach provides a framework within which to make policy decisions that require selection from competing alternatives. Preventive services may in this way compete with traditional medical services for the scarce health care dollar. Performing such comparisons requires the use of a general health decision model. In the next section the general model of health status assessment and benefit-cost-utility analysis is presented.

The General Model

Building a Health Decision Model

The Health Decision Model grew out of substantive theories in economics, psychology, medicine, and public health. These theoretical linkages have been presented in several previous papers (43–45). Building a health decision model requires at least five distinct steps.

Step 1: Define a Function Status Classification

During the early phases of our work, a set of mutually exclusive and collectively exhaustive levels of functioning were defined. After an extensive, specialty-by-specialty review of medical reference works, we listed all of the ways that disease and injuries can affect behavior and role performance. Without considering etiology, it was possible to match a finite number of conditions to items appearing on standard health surveys, such as the Health Interview Survey (National Center for Health Statistics), the Survey of the

Disabled (Social Security Administration), and several rehabilitation scales and ongoing community surveys. These items fit conceptually into three scales representing related but distinct aspects of daily functioning: Mobility, Physical Activity, and Social Activity. The Mobility and Physical Activity scales have three levels, whereas Social Activity has five distinct levels. Table 1 shows the steps from the three scales. Several investigators have used this function status classification (or a modified version of it) as an outcome measure for health program evaluation (46,47). However, the development of a truly comprehensive health status indicator requires several more steps.

Step 2: Classify Symptoms and Problems

There are many reasons a person may not be functioning at the optimum level. Subjective complaints are an important component of a general health measure because they relate dysfunction to a specific problem. Thus, in addition to function level classifications, an exhaustive list of symptoms and problems has been generated. Included in the list are 25 complexes of symptoms and problems representing all of the possible symptomatic complaints that might inhibit function. These symptoms and problems are shown in Table 2.

Step 3: Preference Weights to Integrate the Quality of Well-Being Scale

We now have described the three scales of function and 25 symptom/problem complexes. With these, all we can do is compare populations in terms of frequencies of each scale step (and, if necessary, Symptom/Problem Complex). Although comparisons of frequencies are common in health services research, our system offers a strategy for integrating the frequencies into a single comprehensive expression. If our intent is to say which of these distributions is "better off" and which "worse," simple frequency distributions may not be able to help much. For example, is a group with 80 people able to travel but limited in their mobility and 5 restricted to their homes worse off than a group in which 85 can travel freely, but 10 are restricted to their homes? Obviously comparing frequency distributions is complex. Further, the example involves frequencies for only one scale. How can one make decisions when there are three scales and Symptom/Problem Complexes to consider?

Another step is necessary to integrate the three scales and the Symptom/Problem Complexes in a manner that will allow a single numerical expression to represent each combination of steps on the scales and Symptom/Problem Complexes. The empirical means of accomplishing this is measured preferences for the health states. These might be regarded as "quality" judgments. As we noted earlier, the General Health Policy Model includes the impact of health conditions on the quality of life. This requires that the desirability of health situations be evaluated on a continuum from

TABLE 1. *Quality of Well-Being/General Health Policy Model: elements and calculating formulas (function scales, with step definitions and calculating weights)*

Step no.	Step definition	Weight
	Mobility Scale (MOB)	
5	No limitations for health reasons	−.000
4	Did not drive a car, health related; did not ride in a car as usual for age (younger than 15 yr), health related, and/or did not use public transportation, health related; or had or would have used more help than usual for age to use public transportation, health related	−.062
2	In hospital, health related	−.090
	Physical Activity Scale (PAC)	
4	No limitations for health reasons	−.000
3	In wheelchair, moved or controlled movement of wheelchair without help from someone else; or had trouble or did no try to lift, stoop, bend over, or use stairs or inclines, health related; and/or limped, used a cane, crutches, or walker, health related; and/or had any other physical limitation in walking, or did not try to walk as far or as fast as other the same age are able, health related	−.060
1	In wheelchair, did not move or control the movement of wheelchair without help from someone else, or in bed, chair, or couch for most or all of the day, health related	−.077
	Social Activity Scale (SAC)	
5	No limitations for health reasons	−.000
4	Limited in other (e.g., recreational) role activity, health related	−.061
3	Limited in major (primary) role activity, health related	−.061
2	Performed no major role activity, health related, but did perform self-care activities	−.061
1	Performed no major role activity, health related, and did not perform or had more help than usual in performance of one or more self-care activities, health related	−.106
	Calculating formulas	
	Formula 1. Point-in-time well-being score for an individual (W): $W = 1 + (\mathrm{CPX}wt) + (\mathrm{MOB}wt) + (\mathrm{PAC}wt) + (\mathrm{SAC}wt)$ where wt is the preference-weighted measure for each factor and CPX is symptom/problem complex. For example, the W score for a person with the following description profile may be calculated for one day as:	
CPX-11	Cough, wheezing, or shortness of breath, with or without fever, chills, or aching all over	−.257
MOB-5	No limitations	−.000

TABLE 1. *(Continued)*

Step no.	Step definition	Weight
PAC-1	In bed, chair, or couch for most or all of the day, health related	−.077
SAC-2	Performed no major role activity, health related, but did perform self-care	−.061
	$W = 1 + (-.257) + (-.000) + (-.077) + (-.061) = .605$	
	Formula 2. Well-years (WY) as an output measure:	
	$WY = [\text{No. of persons} \times (\text{CPX}wt + \text{MOB}wt + \text{PAC}wt + \text{SAC}wt) \times \text{Time}]$	

death to completely well. An evaluation such as this is a matter of utility or preference; thus, combinations of behavioral dysfunction and symptom/problem complexes are scaled to represent degrees of relative importance.

Human judgment studies are used to determine weights for the different states. We have asked random samples of citizens from the community to evaluate the relative desirability of a good number of health conditions. Random sample surveys were conducted in the San Diego community during 2 consecutive years. The probability sample included 866 respondents ethnically representative of the population. When necessary, interviews were conducted in Spanish. From a listing of all possible combinations of the scale (Mobility, Physical Activity, Social Activity, and Symptom/Problem Complexes), we drew a stratified random sample of 343 case descriptions (items) and divided them into eight sets of computer-generated booklets. All respondents were assigned randomly to one of the eight booklets, creating eight subgroups of approximately 100 respondents each. In a series of studies, a mathematical model was developed to describe the consumer decision process. The validity of the model has been cross validated with an r of .94 (10). These weights, then, describe the relative desirability of all of the function states on a scale from 0 (for death) to 1.0 (for asymptomatic optimum function). Thus, a state with a weight of .50 is viewed by the members of the community as being about one-half as desirable as optimum function or about halfway between optimum function and death.

Some critics have expressed concern that community, rather than specific population weights are used. The advantage of community weights is that they are general (like the model) and do not bias policy analysis toward any interest group. More important, however, is that empirical studies consistently fail to show systematic differences between demographic groups (21), providers, students and administrators (20), and Americans versus British (48). Relevant to the general versus disease-specific issue, Balaban and colleagues (49) found that weights provided by rheumatoid arthritis patients are remarkably similar to those we obtained from members of the general population.

TABLE 2. *Quality of Well-Being/General Health Policy Model: symptom/problem complexes (CPX) with calculating weights*

CPX no.	CPX description	Weights
1	Death (not on respondent's card)	−.727
2	Loss of consciousness such as seizure (fits), fainting, or coma (out cold or knocked out)	−.407
3	Burn over large areas of face, body, arms, or legs	−.387
4	Pain, bleeding, itching, or discharge (drainage) from sexual organs—does not include normal menstrual (monthly) bleeding	−.349
5	Trouble learning, remembering, or thinking clearly	−.340
6	Any combination of one or more hands, feet, arms, or legs either missing, deformed (crooked), paralyzed (unable to move), or broken—includes wearing artificial limbs or braces	−.333
7	Pain, stiffness, weakness, numbness, or other discomfort in chest, stomach (including hernia or rupture), side, neck, back, hips, or any joints or hands, feet, arms, or legs	−.299
8	Pain, burning, bleeding, itching, or other difficulty with rectum, bowel movements, or urination (passing water)	−.292
9	Sick or upset stomach, vomiting or loose bowel movement, with or without chills, or aching all over	−.290
10	General tiredness, weakness, or weight loss	−.259
11	Cough, wheezing, or shortness of breath, with or without fever, chills, or aching all over	−.257
12	Spells of feeling, upset, being depressed, or of crying	−.257
13	Headache, or dizziness, or ringing in ears, or spells of feeling hot, nervous, or shaky	−.244
14	Burning or itching rash on large areas of face, body, arms, or legs	−.240
15	Trouble talking, such as lisp, stuttering, hoarseness, or being unable to speak	−.237
16	Pain or discomfort in one or both eyes (such as burning or itching) or any trouble seeing after correction	−.230
17	Overweight for age and height or skin defect of face, body, arms, or legs, such as scars, pimples, warts, bruises, or changes in color	−.188
18	Pain in ear, tooth, jaw, throat, lips, tongue; several missing or crooked permanent teeth—includes wearing bridges or false teeth; stuffy, runny nose; or any trouble hearing—includes wearing a hearing aid	−.170
19	Taking medication or staying on a prescribed diet for health reasons	−.144
20	Wore eyeglasses or contact lenses	−.101
21	Breathing smog or unpleasant air	−.101
22	No symptoms or problem (not on respondent's card)	−.000
23	Standard symptom/problem	−.257
X24	Trouble sleeping	−.257
X25	Intoxication	−.257
X26	Problems with sexual interest or performance	−.257
X27	Excessive worry or anxiety	−.257

Note: x indicates that a standardized weight is used.

Using preference weights, one component of the general model of health is defined. This is the Quality of Well-Being Scale, which is the point-in-time component of the General Health Policy Model (50,51). The quality of well-being score for any individual can be obtained from preferences or "quality" judgments associated with his/her function level, adjusted for symptom or problem.

The example in Table 1 describes a person classified on the three scales of observable function and on a symptom/problem. The table shows the adjustments for each of these components. Using these, a weight of .605 is obtained. By including symptom/problem adjustments, the index becomes very sensitive to minor "top end" variations in health status. The adjustments for particular symptom/problems are shown in Table 2. For example, there are Symptom/Problem complexes for wearing eyeglasses, having a runny nose, or breathing polluted air. These symptom adjustments apply even if a person is in the top step in the other three scales. For example, a person with a runny nose receives a score of .83 on the Quality of Well-Being Scale when he is at the highest level of behavioral function (i.e., the top step on each scale shown in Table 1). Thus, the index can make fine as well as gross distinctions.

Step 4: Estimate Transitions among Health States

The Quality of Well-Being (QWB) Scale is the point-in-time component of the model. A comprehensive measure of health status also requires an expression of prognosis or the probability of moving between health states over time. People who are well now want to remain well. Those who are at suboptimal levels want to become well, or at least not get worse. A general health policy model must consider both current functioning and probability of transition to other function levels over the course of time. When transition is considered and documented in empirical studies, the consideration of a particular diagnosis is no longer needed. We fear diseases because they affect our current functioning or the probability that there will be a limitation in our functioning some time in the future. A person at high risk for heart disease may be functioning very well at present, but may have a high probability of transition to a lower level (or death) in the future. Cancer would not be a concern if the disease did not affect current functioning or the probability that functioning would be affected at some future time.

When weights have been properly determined, health status can be expressed precisely as the expected value (product) of the preferences associated with the states of function at a point in time and the probabilities of transition to other states over the remainder of the life expectancy. Quality of Well-being (W) is a static or time-specific measure of function, whereas the well-life expectancy (E) also includes the dynamic or prognostic dimension. The well-life expectancy is the product of quality of well-being times the expected duration of stay in each function level over a standard life period. The equation for the well-life expectancy is

$$E = \Sigma\, W_K Y_K$$

where E is the symptom-standardized well-life expectancy in equivalents of completely well-years, W_K is the Quality of Well-Being score, and Y_K is the expected duration of stay in each function level or case type estimated with an appropriate statistical (preferably stochastic) model.

A sample computation of the well-life expectancy is shown in Table 3. Suppose that a group of individuals was in a well state for 65.2 years, in a state of non-bed disability for 4.5 years and in a state of bed disability for 1.9 years before their deaths at the average age of 71.6 calendar years. To make adjustments for the diminished quality of life they suffered in the disability states, the duration of stay in each state is multiplied by the preference associated with the state. Thus, the 4.5 years of non-bed disability become 2.7 equivalents of well-years when we adjust for the preferences associated with inhabiting that state. Overall, the well-life expectancy for this group is 68.5 years. In other words, disability has reduced the quality of their lives by an estimated 3.1 years.

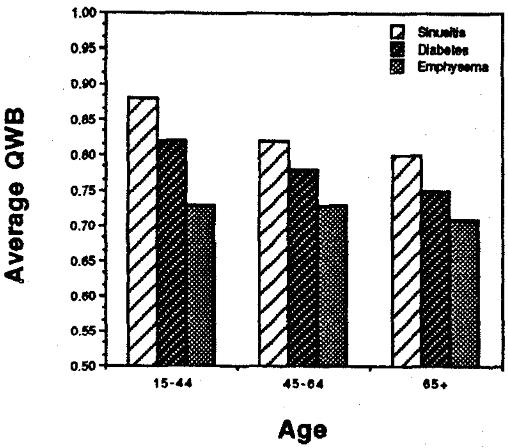
Step 5: Estimating the Benefit-Cost/Utility Ratio

The San Diego Group has shown in a variety of publications how the concept of a well or weighted life expectancy can be used to evaluate the effectiveness of programs and health interventions. The output of a program has been described in a variety of publications as quality-adjusted life-years (43,52,53), well-years, equivalents of well-years, or discounted well-years (20,51,54). Weinstein et al. (55,56) call the same output quality-adjusted life-years (QALYs), and this has been adopted by the Congressional Office of Technology Assessment (57). It is worth noting that the quality-adjusted life-years terminology was originally introduced by Bush et al. (43), but later abandoned because it has surplus meaning. The term *wellness* or *well-years* implies a more direct linkage to health conditions. Whatever the term, the number shows the output of a program in years of life adjusted by the quality of life that has been lost because of diseases or disability.

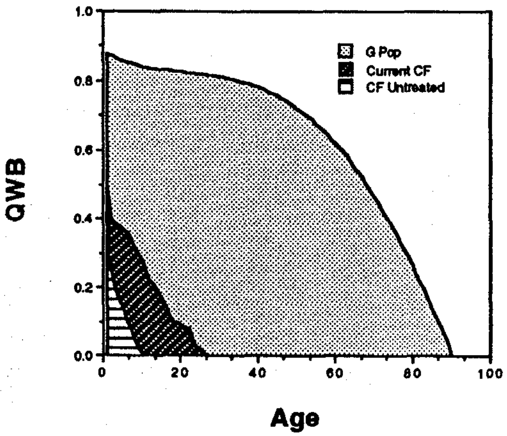
TABLE 3. *Illustrative computation of the well-life expectancy*

State	k	Y_k	W	WY_k
Well	A	65.2	1.00	65.2
Non-bed disability	B	4.5	.59	2.7
Bed disability	C	1.9	.34	.6
Total		71.6		68.5

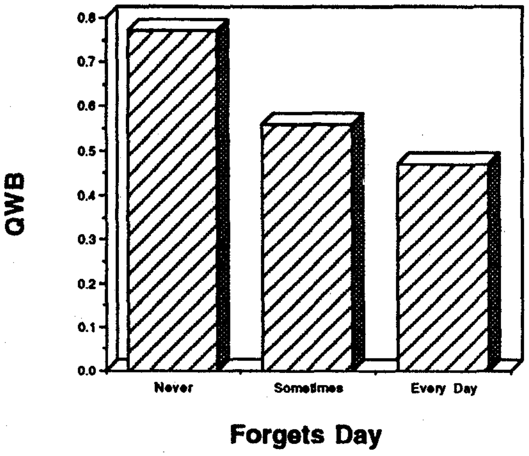
Current life expectancy ΣY_k: 71.6 life-years.
Well-life expectancy ΣWY_k: 68.5 well-years.
From ref. 51.



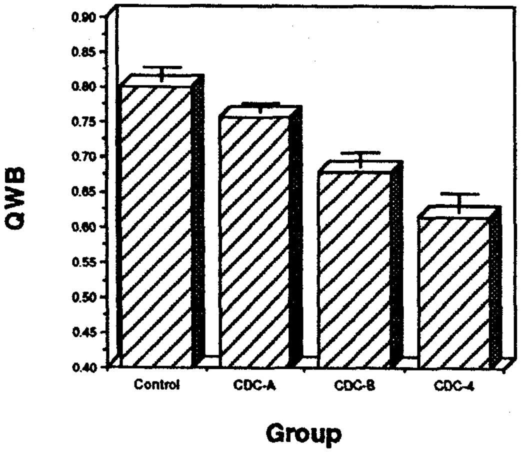
Comparison of Sinusitis, Diabetes, and Emphysema in NHIS



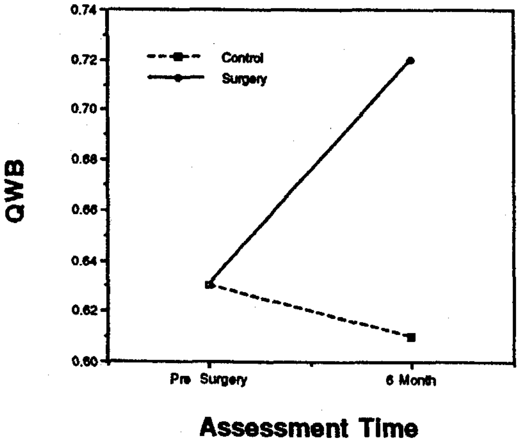
Estimated CF Treatment Benefit



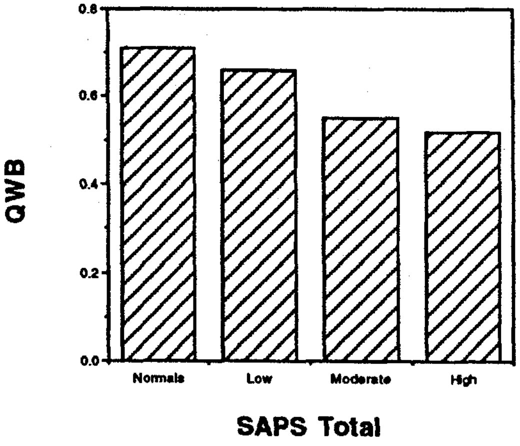
QWB by Cognitive Function In Alzheimers Disease



Mean QWB by CDC Groups In HIV



QWB Before and After Sinus Surgery



QWB and Scale for the Assessment of Positive Symptoms

Validity of the Quality of Well-Being Scale

The QWB has now been used in a wide variety of different studies. The validity evidence will be reviewed briefly and the reader is referred to the specific papers. The upper left panel of Fig. 1 summarizes QWB scores, estimated from the U.S. National Health Interview Survey, in relation to three problems: sinusitis, diabetes, and chronic lung disease. In each of three age groups, sinus disease is shown to be a less serious problem than diabetes, which, in turn, has less impact than emphysema (58). The upper center panel of Fig. 1 shows how the method might be used to estimate the impact of an illness such as cystic fibrosis. According to this analysis, cystic fibrosis causes the loss of about 52 QALYs each year. The total area under the curve shows estimates of the total QALYs for the U.S. population. The area under the second curve shows life expectancy for people with cystic fibrosis. The third curve shows the quality-adjusted life expectancy for people with cystic fibrosis 25 years ago. The area between the second and third curves shows the advances in cystic fibrosis treatment within the last quarter century. The area between the first and second curves describes the distance we must travel in order to reduce the impact of this disease (59).

The upper right panel of Fig. 1 summarizes the relationship between the QWB and measures of cognitive impairment for patients with Alzheimer's disease. Patients at the San Diego Alzheimer's Disease Research Center were evaluated and classified according to whether they forget what day it is every day, sometimes, or never. These cognitive impairments were systematically related to QWB scores (60). The lower left panel summarizes the relationships between the QWB and stage of human immunodeficiency virus (HIV) disease. The Centers for Disease Control (CDC) IV group (full AIDS) was significantly lower (.661) than the CDC II/III groups (asymptomatic HIV infected) (.755) and a control group matched for age, sex, and lifestyle (.802) (61).

The General Health Policy Model has been used in a wide variety of population studies (58–62). In addition, the methods have been used in clinical trials and studies to evaluate therapeutic interventions in a wide range of medical and surgical conditions. These include chronic obstructive pulmonary disease (63), AIDS (64), cystic fibrosis (65), diabetes mellitus (66), atrial fibrillation (67), kidney disease (39), lung transplantation (68), arthritis (69), cancer (70), and several other conditions (71). The lower middle section of Figure 1 shows how the measure defects change in a clinical trial of sinus surgery (72). Further, the method has been used for health resource allocation modeling and has served as the basis for an innovative experiment on rationing of health care by the state of Oregon (73,74).

Studies have also demonstrated that the QWB is responsive to clinical change in a variety of conditions. The lower center section of Fig. 1 compares QWB scores for patients undergoing sinus surgery with those for a control group that did not receive surgery. Patients who undergo this difficult surgery achieve significant QWB benefits (72). The QWB also has shown small but significant improvements for patients using a new drug (auranofin) for the treatment of rheumatoid arthritis (75) and has been shown to be responsive to changes resulting from use of zidovudine for AIDS (64).

Despite widespread interest in the model among practitioners in many different specialties, the concept of a quality-adjusted life-year has received very little attention in the mental health fields. In several studies we have shown that the QWB is indeed related to measures of mental health status. One of these studies is summarized in the lower right panel of Fig. 1. The QWB was shown to be systematically related to level of the Assessment of Positive Symptoms for adults with schizophrenia (SAPS) (76). In summary, we believe that the QWB has validity for measuring a wide variety of health outcomes.

CONCLUSIONS

The term *quality of life* has been used inconsistently in the health services research literature. The definitions range from descriptions of functioning, to qualitative judgments of functioning, to measures typically unrelated to traditional health outcomes. Several dimensions of quality of life emerge across different discussions. These include mortality, functioning and role performance, symptoms, prognosis, and preference weights. We have proposed a system that combines these dimensions into a single number.

The objectives of health care include the extension of the life expectancy and the maximization of quality of life during years people are alive. In other words, health care should add years to life and also add life to years. All activities in the system should be evaluated by estimating their contribution toward these goals. The General Health Policy Model attempts to quantify the contributions from various providers

FIG. 1. *Top left:* Comparison of estimated QWB for patients with sinusitis, diabetes mellitus, and emphysema at different ages. (Data from the National Health Interview Survey, adapted from ref. 58.) *Top center:* Area under curve in cystic fibrosis. Top curve is the estimated U.S. quality adjusted life expectancy. Middle curve is the estimate for patients with cystic fibrosis. The bottom curve is the estimate for cystic fibrosis 25 years age. (Adapted from ref. 59.) *Top right:* QWB scores by levels of cognitive impairment for patients with Alzheimer's disease. (From ref. 60.) *Bottom left:* Comparison of mean QWB by CDC class in HIV disease. (From ref. 61.) *Bottom center:* QWB scores for those undergoing sinus surgery in comparison to controls. (Adapted from ref. 74.) *Bottom right:* QWB scores for schizophrenic patients rated on the scale for the assessment of positive symptoms as normal, low impairment, moderate impairment, an high impairment. (From ref. 76.)

and interventions so that the outcomes can be compared across very different interventions. These broad comparisons require an aggregate measure of health outcome. Profiles that have different dimensions for different components of outcome have little value for these comparisons. For example, many investigators suggest mental health outcomes cannot be evaluated using the same systems as used to measure physical health outcomes. However, we ultimately must make decisions about the comparative value of programs aimed at mental or physical health problems. Further, we must evaluate products that may have some benefits in one domain and side effects in another. A comprehensive system is required for these evaluations.

The General Health Policy Model has been used to evaluate outcomes in a variety of settings. Although we cannot review each of these applications in detail, different investigators have estimated the expected well-year benefits of competing interventions. Table 4 summarizes many of these studies with adjustments to 1993 dollars. As the table suggests, some interventions, such as aerosolized pentamidine for prophylaxis of *Pneumocystis carinii* pneumonia in HIV disease, cost nearly one-half million dollars to produce the equivalent of a life-year. Traditional medical interventions in prevention, such as cholesterol and blood pressure reduction, may be much less expensive to produce the equivalent of a year of life. However, some nontraditional interventions including programs of smoking cessation counseling are even more cost-effective. Interestingly, our estimate suggests that the most cost-effective program has nothing to do with traditional health care: it involves passing laws that require the use of seat belts.

The use of the General Health Policy Model requires many heroic assumptions. The data for Table 4 come from a variety of different studies. In many of these cases, the

TABLE 4. *Summary of cost/well-year estimates for selected medical, surgical, and preventive interventions*[a]

Program	Reference	Cost/well-year
Seat belt laws	Kaplan (1988)	0
Antepartum and anti-D injection[b]	Torrance and Zipursky (1984)	1,543
Pneumonococcal vaccine for the elderly	OTA (1979)	1,765
Postpartum and anti-D injection[b]	Torrance and Zipursky (1977)	2,109
Coronary artery bypass surgery for left main coronary	Weinstein (1982)	4,922
Neonatal intensive care, 1,000–14,999 g	Boyle et al. (1983)	5,473
Smoking cessation counseling	Shulman (1991)	6,463
T4 (thyroid) screening	Epstein et al. (1981)	7,595
PKU screening	Bush et al. (1973)	8,498
Treatment of severe hypertension (diastolic > 105 mm Hg) in males age 40	Stason and Weinstein (1977)	10,896
Oral gold in rheumatoid arthritis	Thompson et al. (1987)	12,059
Dapsone for prophylaxis for PCP pneumonia	Freedberg (1991)	13,400
Treatment of mild hypertension (diastolic 95–104 mm Hg) in males age 40	Weinstein and Stason (1976)	22,197
Oat bran for high cholesterol	Kinosian et al. (1988)	22,910
Rehabilitation in COPD	Toevs et al. (1984)	28,320
Estrogen therapy for postmenopausal symptoms in women without a prior hysterectomy	Weinstein (1980)	32,057
Neonatal intensive care, 500–999 g	Boyle et al. (1983)	38,531
CABG (surgery) 2-vessel disease	Weinstein and Stason (1982)	39,770
Hospital hemodialysis	Churchill et al. (1984)	40,200
Coronary artery bypass surgery for single-vessel disease with moderately severe occlusion	Weinstein (1981)	42,195
School tuberculin testing program	Bush et al. (1972)	43,250
Continuous ambulatory peritoneal dialysis	Churchill et al. (1984)	54,460
Cholestipol for high cholesterol	Kinosian et al. (1988)	92,467
Cholestyramine for high cholesterol	Kinosian et al. (1988)	153,105
Screening mammography	Eddy (1990)	167,850
Total hip replacement	Liang (1987)	293,029
CABG (surgery) 1-vessel heart disease	Weinstein and Stason (1982)	662,835
Aerosolized pentamidine for prophylaxis of PCP pneumonia	Freedberg (1991)	756,000

[a] All estimates adjusted to 1993 U.S. dollars.

[b] Treatment for Rh immunization.

PKU, phenylketonuria; PCP, Pneumocystis carinii pneumonia; COPD, chronic obstructive pulmonary disease; CABG, coronary artery bypass graft.

health benefits were estimated using expert judgment. The accuracy of many of these estimates is unknown because they are based on judgments and not empirical studies. Furthermore, there are important assumptions in the application of the model that include the discount rate and the reliability of the estimate of treatment effectiveness. Despite these limitations, we believe the General Health Policy Model provides a unique new way of thinking about alternatives in health care. We hope to see more systematic experimental trials that employ structured measures such as the Quality of Well-Being Scale. As more data accumulate, we hope to provide a stronger data base for comparing different alternatives in health care.

ACKNOWLEDGMENT

This work was supported in part by grant PO 1-AR-40423 from the National Institute of Arthritis, Musculoskeletal, and Skin Disorders of the National Institutes of Health.

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