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ON AN INDEX OF THE EFFECTIVENESS OF HEALTH PROGRAMS

by

Calvin D. Siebert

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Two recent articles (3 and 9) present attempts to develop a health status index in order to measure the output or effectiveness of health programs. They agreed that such indices must include the reduction in death, disability, and debility as part of the measure. A difficulty arises, however, in choosing the appropriate weight to be assigned to each health state. The authors either state that choosing the appropriate weights is a subjective value judgment and do not go beyond an ordinal weighing scheme or formulate an arbitrary one which can be changed at will if it is not intuitively pleasing to the decision making. Such arbitrariness in an index leads to problems.

For example Packer (9, p. 237) states that an index "...composed of measurable components has proved elusive" and proposes a non-operational index himself. He proposes the following states of health impairment: 1) minor disability, 2) restricted activity, 3) limited activity, 4) limited mobility, 5) confined; and 6) death and assumes these can be ordered by individual and society in the above order; i.e. minor disability is strictly preferred to restricted activity and restricted activity is strictly preferred to limited

activity, etc. He proposes an objective function of the health care system which measures the ineffectiveness of the system. From an individual's point of view, the system's ineffectiveness is the weighted sum of his chances of being in any state of ill health for a finite time. Packer (9, p. 239) writes an individual's assessment of the system's ineffectiveness as:

$$I^p = \sum_{i=1}^m c_i t_i \quad (1)$$

where m is the number of states of health impairment, t_i is the duration of stay in state i and c_i is the weighing factor for disability state i . He states that given the restrictions he places on the ordering, it is impossible to aggregate the individual measures to obtain a measure for the community. Without making some interpersonal comparisons one cannot judge, for example, between health programs which have the same results except that one results in 1,000 man-months of reduced mobility but allows one additional month premature death.

As Arrow^{1/} as shown even if a majority rating procedure is followed it may not be possible to aggregate the different

^{1/} More precisely what Arrow proved was that, in general, a transition from any set of individual orderings of social states to a social ordering consistent with his "reasonable" condition is not possible. See K.J. Arrow, Social Choice and Individual Values (New York, Wiley, 1951).

individual's preferences for alternative health programs. A simple example with three individuals and three alternatives health program will demonstrate that a consistent aggregate or social ordering is not always possible from a majority vote. Consider three individuals X, Y, Z, and three alternative health programs A, B, C. Given their individual situations and preferences the alternative health programs are ranked by X, Y, Z as follows:

Rank	X Y Z
1	A B C
2	B C A
3	C A B

There is no majority choice in the table. If alternative C is eliminated, alternative A is preferred by X and Z, and wins. Thus, alternative A is preferred to B. When we eliminate alternative A, B is preferred by X and Y, and wins. Therefore, alternative B is preferred to C. Finally, if alternative B is eliminated, C is preferred by Y and Z, i.e. C is preferred to A. Thus we have the inconsistent ordering of A preferred to B, B preferred to C, but C preferred to A.

Not making value judgment such as interpersonal comparisons may be allowed the abstract theoretician who does not have to make decisions, but is a luxury of which the health planning or public health administrator of necessity cannot partake. He has to make decisions on which program to undertake and has evaluate them in some manner. Any decision he makes is implicitly based on interpersonal comparisons. It is better these are made explicit in order that others can see on what basis he has made his decisions.

In any case the model Packer proposes is not value free. He assume certain states of health are better than others. Most reasonable men may agree with this value judgment. But some would not agree with his individualistic philosophic position that every individual's preferences should count. An alternative approach to collective measures of alternative social states has been proposed by Alexander. Instead of attempting to aggregate individual preferences he proposes that the choices be made by reasonable and moral men with adequate information to judge among alternative states. His test would be that: "If a reasonable man completely knowledgeable of the conditions in both states is given the choice of taking a chance with equal probability of being

anyone concerned in either state A or state B and he chooses state A, we can say that state A is better than state B."^{2/}

Such a procedure may give better decisions if the judges are moral and well informed. But does not allow any way for the judges to be judged. If we are to transfer our ~~domestic~~ ^{DEMOCRATIC} right to having our preferences count, no matter how ill-informed and biased we are, to health administrators, it is necessary that the system provide some way, given human nature, to check their discretionary decisions. One way in which these decisions can be checked is to make decision-making as objective as possible.

The health status index proposed by S. Fanshel and J.W. Bush (3) also does not solve the weighting problem. They include 11 mutually exclusive states on the continuum of function/dyfunction which they claim can be given operational meaning by professional judgment. This is questionable when one considers that the descriptive names of their states include the following: dissatisfaction, discomfort and disability minor. In any event, with 11 mutually exclusive states

^{2/} Sidney S. Alexander, "Comment on Political and Economic Evaluation of Social Effects and Externalities" by Kenneth J. Arrow in The Analyses of Public Output Julius Margolis. (ed.) National Bureau of Economic Research, New York, Columbia University, 1970, p. 26.

to consider, measurement of the levels of dysfunction in the population becomes a very difficult task.

As part of their weighting scheme Fanshel and Bush state that not only each individual as be considered equal, but that all days in all lives are equal for all members of the population. In other words, a day in the dysfunctional state of death for an 85-year old person is weighted equally with a day in the dysfunctional state of death for 20-year old person.

Their proposed example of the weighting scheme illustrates the arbitrariness of allowing the health administrators to decide the appropriate weights themselves. As an illustration, they propose a weighting function such that the dysfunction of any state is weighted twice as much as that of the preceding state. After looking at their results, they decide to make intuitive adjustments in order to obtain a more satisfactory set of values. They, in fact, suggest the decision making should look at the results of an arbitrary weighting scheme and make intuitive adjustments in it. In other words, each decision maker can have his own set weights to fit his own pre-conceived notions. The set

of weights of the various decision makers need not and probably will not be consistent with each other.

In what follows three alternative weighting schemes are proposed and discussed. These are operational since the values can be calculated. In addition they are objective, in the sense that if the decision makers choose a given framework, the results of their evaluations will be the same. The first framework from which a weighting scheme can be developed is termed the productivity approach.^{3/} This approach has been applied in the benefit cost studies (4, 6, and 12) which have economically evaluated various health expenditures programs. In this approach the total costs of the disease are interpreted as the benefits to be derived from eliminating the disease. These costs include direct costs which are the actual costs of finding, training, and rehabilitating the disease's victims and the indirect costs of the disease which are the costs to the individual or society in the form of lost productivity attributable to the disease or injury. Included in indirect costs are the

^{3/} Sanders (10) has suggested a health framework similar to the productivity approach but did not allow for the discounting of the future. In his suggestion, each productive man year is weighted equally whether it occurs now or ten years from the current period.

loss of consumer benefits due to pain and the discomfort of having the disease. In addition, a measure of the sentimental and psychological costs of disease to the victim or to others can be included.

For the productivity approach the consumption parts of indirect costs are not included. The indirect costs in the form of productivity lost would be used to derive the weights for the health index. Potential productivity is lost because of premature mortality; disability, which results in lost of working time; and debility, loss of productive capacity while at work. Several levels of debility could be computed depending on the debility effects of various diseases and how fine a gradation in the health index one wished to have.

To compute the health status of a target population data, age specific mortality, disability, and debility and average earnings of various groups including imputed income for housewives could be used to compute the present value of potential productivity loss in the population due to disability, debility and premature mortality. This loss on a per capita basis can be compared with the per capita losses of other populations. Also the reduction in per capita loss

for a given expenditure for a particular program can be compared with other programs. For example, the reduction in per capita loss for a tuberculosis vaccination program of new born infants and school children can be compared with a program of case finding and treatment of tuberculosis suspects in the 20-year and older population.

Since the population is of fixed size there will be diminishing returns to applying additional resources to any of these programs. With a limited budget the rule of any health administrator should apply is to expand each program until the per capita productivity loss reduction is the same for the last dollar spend for each of the programs. In this way, he will maximize the returns from his limited health expenditure budget.

Recently, Mishan (8) has criticized using the productivity loss measure as an estimate of the value of human life in benefit cost calculations. He states that the goal of economic organization is consumer satisfaction or welfare. A project should be undertaken, he argues, if there is a potential Pareto improvement, i.e. if the compensating variations of the gainers are greater than compensating variations of

losers. The compensating variation (CV) of a gainer is the maximum amount he will pay rather than forego the project, while compensating variation of the loser is the amount he will accept to put up with the project. In order to overcome the problem that probably no amount of money is large enough to compensate a man for the loss of his life and that there is complete ignorance of the identity of the victims of projects which increase risk of death, sickness or injury, the relevant sums to be subtracted from the benefit side are those which compensate each person in the community for the additional risks to which he is to be exposed. If the projects reduces the risk of death, sickness or injury the relevant sums to be added to the benefits side are the net amounts individuals are prepared to pay for the reduced risks.

There are several problems with Mishan's approach. First, the projects to be evaluated must relatively small in order that the prices of all the nonproject goods can be taken as fixed. Otherwise, the relevant individual's compensating variations will not be uniquely determined. More importantly, changes in risk to a given population is a public or collective good. Such a good is one which cannot

be divided into units of which any single individual can be given exclusive possession and hence, each person's consumption of such a good leads to no subtraction from any other individual's consumption of that good. In other words, a decentralized market cannot operate for such goods. To attempt to determine the appropriate compensating variations by surveys based on questionnaires may also be doomed to failure since it is in the selfish interest of each individual to give false signals, to pretend to have less interest in a given risk reducing activity than he actually has. Assuming individuals can calculate their true preferences under a probabilistic setting, true preferences will only be revealed if individuals are convinced that their shares of costs of the risk reducing project will be independent of their response as to how they value the benefits from the projects.

Finally, the productivity approach is not as "economically irrelevant" as Mishan maintains. Consider his second expression L_2 , where

$$L_2 = \sum_{t=T}^{\infty} P_T^t (Y_t - C_t) (1 + r)^{-(t - T)}.$$

L_2 is the loss to the economy from the death of a person. The Y_t is the gross earnings of the person during the t th

year, exclusive of any yields from his ownership of nonhuman capital. The P_T^t is the probability in the current, or t th, year of a person being alive during the t th year, C_t is the personal expenditure of the individual during the t th period that is expected at time T , and r is the social rate of discount expected to rule during the t th year. In other words, L_2 is the present discounted value of a person's future expected labor earning net of consumption. In a society in which a person is allowed to mortgage his future earnings L_2 would be the going market price of a person's labor earnings less any planned consumption expenditures. In a slave society, L_2 would be the price of slave with C_t adjusted now to be the subsistence consumption level for the slave.

In any event an individual would value his life or good health more than society since he and his friends obtain consumption value from his being alive. Health expenditures are made partly for investment and partly for consumption motives. The productivity approach to evaluate health expenditures and formulate a health status index concentrates on the investment motive for health expenditures and judges the expenditures value in terms of their contribution to economic growth. In this framework, the goal is to increase

investment in human capital and promote the productive potential of the economy. The growth goal of such an economy would be to maximize the economy's terminal capital stock, human and non-human, at some time T. The analysis of such a goal can be found in the optimum growth literature in the study of the turnpike.^{4/} Such a growth goal may be considered for an underdeveloped country with a rapidly growing population. Such an economy has a high dependency ratio and without a substantial sacrifice by the current generation may not attain the goal of steady sustained economic growth.

For a developed or rapidly developing country, such a productivity bias is probably not warranted. In these economies the consumption motives in making health expenditures must be included in the loss computations. Included in this is the loss of consumer benefits due to pain and discomfort of having the disease and a measure of the sentimental and psychological costs of diseases to the victims or to others. An ingenious way to measure these consumer losses has been

^{4/} See Hicks, John R., Capital and Growth.

proposed and applied by Klarman in his study of syphilis control programs. (7) He employs the analogous disease approach:

Consider a disease B (with symptoms that are somewhat similar to those of disease A), for which medical care expenditure are incurred both without any prospect of a return in increased output (either because the disease is not disabling or because the patient has retired from the labor force) and without prospect of an offsetting reduction in medical care expenditures in the future (because the disease is not curable and expenditures do not close). These expenditures are incurred for consumption purposes only, and by analogy they may be held to indicate the value of the consumption benefit attached to avoiding the disease A under study (7, p. 371).

The consumer losses from ill health can be added to the productivity losses in computing the health status index. Such a framework which adds the productivity and consumption losses from ill health can be termed the productivity-consumption framework.

The productivity and productivity-consumption approaches to the development of a health status **index** implicitly make interpersonal comparisons which may not be acceptable to some health administrators. The productivity framework, in particular, since the present value of future earnings is employed in the weighting scheme, will bias the health program

toward males over females; highly educated, high earning individuals over the poor and uneducated, and those beginning their work life over the aged and very young. Such a procedure is justified only if we assume that more resources should be devoted to saving a more economically "productive" life than a less "productive" life and that those with highest earnings are to be subsidized through additional health programs aimed at reducing the incidence of diseases which more heavily affect the more "productive" individuals.

A third weighting scheme framework can be employed which would eliminate most of these biases. Under this framework, which can be termed the average income framework, the loss from a disease or ill health for any individual of given age would be weighted by the average per capita labor income of individuals of that age. To per capita labor income for individuals of a particular age can be added an allowance for the consumption value of good health. In other words, a day in the life of an individual age 20 would be weighted equally whether the individual is male or female, highly or poorly educated. The day would be weighted by the average per capita income plus consumption allowance of twenty-year olds.

This framework is probably most appropriate for developed affluent economies. In most of these economies there has been a reaction against growth for growth sake and strong public outcry against the loss of consumer satisfaction resulting from externalities of production such as air and water pollution, etc. The average income framework would weigh each individual of a given age equally and thus eliminate the productivity bias for individuals of the same age implicit in the productivity and the productivity-consumption frameworks for the measurement of health status.

The decision about which framework is to be employed will need to be made by policy making authorities at the highest level and will depend on such things as the state of development of the economy and the social setting in which the evaluations are to be made. In any event, any of the proposed health status indices have the advantage of being operational and objective. They are operational in that data needed to implement them is available and can be collected. They are objective since criteria for the weights are explicitly set forth. Any health administrator with the necessary data will obtain the same answer as any

other health administrator as to the health status of given population. More importantly, they would provide the answer to the question of which health program would improve the health status of a given population the most. Finally, the weighting schemes would not depend on the subjective or intuitive feelings of the health administrator.

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