A Health Needs Index Based On the Health Goals Model

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SYNOPSIS

A new quantitative index is proposed to measure the degree to which the health care needs of a population are met. It is based on the health goals model of Lester Breslow and A. R. Somers, who listed the kinds and frequencies of health services appropriate for each of 10 developmental and maturational stages of life. The population is further divided into the sick and well segments of each of the 10 groups; the sick need treatment and the well and asymptomatic need preventive care.

The index is the geometric mean of the proportions of the people in the stages whose utilization experiences conform to the services and goals appropriate for their respective group. The counting system requires the minimum information as to whether the person has received the necessary treatment for his condition if he is sick or made the requisite number of professional visits for preventive care if he is well. The index is best considered a heuristic tool for understanding a complex problem.

MEASURING THE NEEDS OF A POPULATION for health services remains a problem despite the availability of a number of measurement models (*1–3*). A major difficulty lies in the definition of need, particularly need as objectively determined in contrast to need as subjectively perceived. Without a clear, operational definition of need, it is impossible to design a measurement model that is realistic and practicable.

In the literature, objective need is usually defined in terms of use or nonuse of services by people who, in the judgment of medical experts, need such services. This definition is used in at least two indices (*4, 5*). Although this is certainly a valid definition, its usefulness is limited to the segment of the population with known medical conditions or signs and symptoms. Because the definition is inapplicable to the larger segment of the population that is asymptomatic, the model proposed by Breslow and Somers (*6*) is more encompassing.

The contribution of the Breslow and Somers model is significant in view of emerging opinions about preventive medicine among health care scholars. For example, the value of the annual checkup that included multiphasic screening for the general population, which was once hailed as a sound preventive measure, has been questioned by several medical experts (*7, 8*). Charap (*9*), tracing the history of the periodic health examination, asserts that we know no more about the benefits of such examinations today than we did 60 years ago, when the idea was first introduced.

Termed the "Lifetime Health-Monitoring Program" (LHMP), the Breslow and Somers model differs from the concept of the health examination at fixed intervals in that it is geared to the maintenance of specific health goals for specific sex-age groups within the framework of regular physician-patient relationships. This is not the only model that emphasizes preventive packages designed to promote or maintain the health of sex-age groups. Models by Frame and Carlson (*10*) and the Canadian Task Force on Periodic Health Examinations (*11*) stress the prevention of preventable conditions afflicting specific population groups by applying carefully organized packages of services and procedures. These three models and the American Cancer Society model are summarized in the guide for

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Figure 1. Schematic representation of the 20 population groups

Category i	Stage of life j[1]					
	1	2	3	4	.....	10
Well (1)	$N_{(1)1}$	$N_{(1)2}$	$N_{(1)3}$	$N_{(1)4}$	....	$N_{(1)10}$
Sick (2)	$N_{(2)1}$	$N_{(2)2}$	$N_{(2)3}$	$N_{(2)4}$	....	$N_{(2)10}$

[1] The 10 stages in the Breslow-Somers model follow:
1. Pregnancy and perinatal
2. Infancy (first year)
3. Preschool child (1 to 5 years)
4. School child (6 to 11 years)
5. Adolescence (12 to 17 years)
6. Young adulthood (18 to 24 years)
7. Young middle age (25 to 39 years)
8. Older middle age (40 to 59 years)
9. The elderly (60 to 74 years)
10. Old age (75 years and older)

preventive medicine of the American College of Physicians (*12*).

Nonetheless, the Breslow and Somers model is the most comprehensive in that it covers the entire life from the perinatal period to old age and uses 8 epidemiologic and clinical criteria to select procedures for inclusion in the packages for each of 10 maturational and developmental periods or stages. Although some concerns have been voiced about the inclusion or exclusion of certain procedures in some packages (*13*, *14*) and about the criterion of cost effectiveness (*15*), these criticisms detract little from the utility of the model as the framework on which to build a sound preventive program for persons of all ages. Breslow and Somers stated clearly that their model is meant to be tentative and to be improved when new scientific evidence about the health effectiveness of certain procedures becomes available. Their model meets the requirement of my index because the lists of types and frequencies of services for each package are useful as norms against which the actual use of services by people in a particular stage can be assessed. When new or more valid lists are available, they will serve as the basis of new norms.

A New Index Proposed

To make the index applicable to the entire population, the population is first divided into two broad categories: the well and the sick. The sick need treatment, and the well and asymptomatic need preventive care. Then each broad category is further divided into the 10 stages according to the Breslow and Somers scheme. Overall, there are 20 population groups, each group with its own health goals and list of services required to attain them. The population groups are shown schematically in figure 1.

'Just as a thermometer cannot tell why a patient has a fever, so the index cannot tell why a population has a high or low degree of met health needs.'

In figure 1, $N_{(1)1}$ is the size of the well population group in developmental stage 1, which includes the newborn. $N_{(1)4}$ represents the size of the well group of adults aged 25 to 39 years. $N_{(2)1}$ is the size of the sick population in developmental stage 1, including the newborn. The other cells can be similarly interpreted.

As an example of health goals and the services required to attain these goals, young middle-aged adults in cell $N_{(1)4}$, who are well and asymptomatic, should aim to (*a*) prolong the period of maximum physical energy and develop their full mental, emotional, and social potential and (*b*) anticipate and guard against the onset of chronic diseases. To attain these goals, healthy members of this group should make two professional visits, at about ages 30 and 35 years, to receive a battery of tests for hypertension and anemia; women should also be checked for breast cancer and other conditions. At these visits they should receive counseling regarding nutrition, exercise, and other health-related behavior. Furthermore, they should have a dental examination and prophylaxis every 2 years.

I have described elsewhere (*4*) the rationale and methodology of an index of met health needs applicable to the sick segment of the population. I have also demonstrated the practicability of the index for an adult population (*16*). Briefly, the index is premised on the thesis that, in the absence of a better criterion, prevailing medical opinion should be the basis for deciding if a person with certain signs and symptoms should visit a physician. A person's need is considered met if his signs and symptoms call for a visit to the physician and the visit is made. His need is not met if the visit is not made. The index is simply the proportion of people with signs and symptoms who justifiably receive medical attention for their problems.

For example, in a test of the index's feasibility, 366 subjects reported having frequent leg cramps, and 220, or 60 percent, visited a physician for their condition. Of the 456 subjects who reported having frequent headaches, 315, or 69 percent, visited a physician for their condition. These are the data that can be used to estimate the proportions of peo-

ple in certain developmental stages of the sick category who needs are met.

Given the lists of requisite preventive services for the well groups and treatment requirements for the sick groups, it is possible to ascertain the proportions of people in each of the 20 population groups who met the requirements. As an example, if there are 100 healthy young middle-age adults in cell (2)4 and 57 of them made the necessary visits, then the proportion of this group meeting the requirements would be $p = .57$. Similarly, if there are 100 sick newborns in cell (2)1 who required treatment and 85 of them received the treatment, $p = .85$ of this group met its requirements. Figure 2 represents hypothetical proportions of all 20 population groups that met their requirements.

In the previous paragraph, the criterion of meeting the requirements is made categorical for the sake of convenience: in counting the proportions, either a person has met his requirements or he has not. If a more refined measure is required, the criterion can be modified to include people whose needs are partly met. For example, if a healthy young adult in cell (2)4 made one of two requisite professional visits at either age 30 or age 35 but not at both, then he had .5 of his requirements met, and he is counted .5 in computing the proportion for his group. Or, if this adult made the requisite two professional visits but did not have the dental prophylaxis every 2 years, he could be counted .75 or .80, depending on the investigator's perception of the importance of oral health. The subjectivity of the counting method does not affect the index so long as the criterion or criteria are explicitly stated and the counting system is uniformly applied to the population whose health care needs are being assessed.

Each proportion in figure 2 ranges in value from 1 for the best case, in which all members of the group had their needs met, to zero for the worst case, in which no one in that group had his needs met. Logically, then, the index for the total population should be some kind of average of these p values. That is exactly what the index is: the geometric mean of the ps. Symbolically, the index is

$$G = \left(\prod_{i=1}^{2} \prod_{j=1}^{10} p_{ij} \right)^{\frac{1}{20}} \qquad (1)$$

where i goes to 2 categories (well and sick) and j goes to the 10 stages.

Since the geometric mean is zero if any of the ps is zero, it is suggested that the quantity .5 be added to each of the numerator values before computing the proportions. This procedure, customary in the analysis of contingency tables, not only eliminates the possibility of G being zero, but improves the sample estimates of the variances of the ps (*17*).

For ease of computation, equation 1 can be transformed into log form:

$$\text{Log } G = \frac{1}{20} \left(\sum_{i=1}^{2} \sum_{j=1}^{10} \log p_{ij} \right) \qquad (2)$$

The antilog of log G is, of course, the geometric mean or G. For purposes of research, it is desirable to use log G rather than G because the formula for estimating the variance of G is rather cumbersome. The variance of log G, however, can be conveniently estimated by

$$\hat{\text{V}}\text{ar } (\log G) = \frac{1}{400} \left(\sum_{i=1}^{2} \sum_{j=1}^{10} \frac{1}{n_{ij} + .5} + \sum_{i=1}^{2} \sum_{j=1}^{10} \frac{1}{N_{ij}} \right) \qquad (3)$$

where n_{ij} is the number of people in the ith category (well or sick) and jth stage whose needs are met, and N_{ij} the population size of that group.

Equation 3 may look formidable but, in reality, it is simple. It is simply the sum of the reciprocals of all the n_{ij}s + .5 and the N_{ij}s divided by 400.

Discussion

An index, which is the geometric mean of the proportions of people in 20 population groups whose needs for health services are considered met, has been presented for research and planning purposes. It should be noted that the index is a measure of the status of met health needs of a population or community—nothing more. Just as a thermometer cannot tell why a patient has a fever, so the index cannot tell why a population has a high or low degree of met health needs. And just as a fever should alert the physician to the possibility of a serious underlying cause or causes, so a low index value should warn the health planner of the possible presence of severe inadequacies, such as incon-

Figure 2. Proportion of met needs for 20 population groups

Category i	Stage of life j					
	1	2	3	4	.....	10
Well (1)	$p_{(1)1}$	$p_{(1)2}$	$p_{(1)3}$	$p_{(1)4}$	....	$p_{(1)10}$
Sick (2)	$p_{(2)1}$	$p_{(2)2}$	$p_{(2)3}$	$p_{(2)4}$	....	$p_{(2)10}$

venient locations of health facilities or an inadequate supply of primary care physicians.

For the index to be practical, the requisite data must be available or collectible at reasonable cost. As previously stated, the numerators of the proportions of n_i's need not be positive whole numbers (before adding .5) that must result if the categorical counting system of yes or no is adopted. It should be noted, however, that this counting system requires the minimum amount of information as to whether an individual in 1 of the 20 population groups has received the necessary treatment for his condition if he is in the sick category or made the requisite number of professional visits for preventive care if he is in the well category.

Since Breslow and Somers clearly stated that their LHMP is not a finished product, but rather "an exploratory proposal to be reviewed and refined by health professionals and knowledgeable consumers," it would be premature to field test my index based on this model at this time. The field test will be undertaken when, through further research and consensus of scientific opinion, the preventive packages for the stages are in their final form. Until then, the index is best considered a heuristic tool for a better understanding of the rather complex problem of attempting to assess, in an objective manner, the degree to which human needs are met in the health care sector.

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Designing Primary Health Care Teams for Developing Countries

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SYNOPSIS

A time-honored industrial engineering technique, job evaluation, which was developed to set rates for manual labor, was used in the design of new teams for delivering primary health care in Latin America. The technique was used both in writing job descriptions for new allied health personnel and in designing the curriculums needed to train the personnel.