The Semantic Differential for Health

A TECHNIQUE FOR MEASURING

Beliefs About Diseases

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WHAT the public thinks and feels about any disease is a strong determinant of its response to preventive, casefinding, and therapeutic programs. In order to make health programs more effective in reaching the public, health agencies need to plan their educational and promotional efforts and the style of their services to take account of the conscious and unconscious meanings various high-risk subgroups in the community have applied to the disease being attacked.

It is generally acknowledged that diseases are perceived as different in many respects. It is also apparent that various diseases arouse feelings having different qualities and intensities (gnawing worry, sudden panic, embarrassment, guilt, distaste). What is needed, then, is an interviewing and rating technique that will capture these ideas and feelings and represent them objectively.

Past approaches to this research problem have been largely of two general types: survey-type, multiple-choice questions and projective techniques. The multiple-choice questions have often produced results that were highly influenced by what the respondents believed were the socially desirable answers rather than what they truly believed about the subject. The use of projective techniques overcomes this objection, but this is an expensive procedure whose reliability is greatly influenced by the level of skill and the uniformity of approach of the field interviewers.

A newer method for the study of beliefs and feelings is the semantic differential developed by Osgood and associates (*1*). To date, this technique has been used most conspicuously in studies of linguistics, communication, and personality. The semantic differential aims at elucidating the connotations and latent meanings of words and concepts by mathematical measurement of their correlations with networks of other concepts and dimensions of meaning (*1a*). The semantic differential does not prestructure a subject's response to the same degree as a multiple-choice question in that the subject is not limited to a few categories of response but may place his response anywhere along a broad continuum.

The Osgood method was altered slightly by Maclay and Ware in their study of three American Indian tribes (*2*). Their modified semantic

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Dr. Travis J. Northcutt, formerly of the Florida State Board of Health, supervised the field interviewers. Dr. John S. Neill, director of the Hillsborough County (Florida) Health Department, and Dr. James O. Bond, formerly assistant State health officer in charge of research, Florida State Board of Health, were administrative officers of the larger program of which this study was a part.

differential was suitable for use with nonliterate subjects and discriminated validly between the constellations of meaning found in three different tribal languages (Hopi, Zuni, and Navajo). The technique was further modified for the study reported here by the development of scales directly pertinent to health-related behavior and by certain technical additions, such as the use of verbal labels at several points along the scale in addition to words expressing extremes at the ends of the scale.

Some scales were intended to measure beliefs about susceptibility to disease, several aspects of the severity of a disease, and its prominence in public thought and discussion. Rosenstock and associates (*3*) have shown the relevance of these variables. In collaboration with Ralph C. Patrick and A. L. Johnson, still further scales were introduced to test additional facets of thought and feeling about disease. We call this technique the semantic differential for health (SDH).

This paper describes use of the SDH to obtain quantitative estimates of health-relevant perceptions whose quality and intensity are often difficult for respondents to verbalize. It reports the findings obtained from the application of the technique in one large urban county. It then discusses the implications of these findings as they support certain commonsense assumptions of health workers, cast doubt on other commonsense assumptions, and bring into focus new hypotheses about ways to increase public response to health programs.

Sample and Method

The semantic differential for health (SDH) was administered as part of a larger study in 1962 to a probability sample of 436 persons, aged 20–39 years, in a large urban county of Florida. As shown in the table, the age-sex-race composition of the sample closely approximated that of the county in 1960, within these age limits.

The sample was composed of 202 men and 234 women. The racial-ethnic distribution was 12 percent Negro; 12 percent Spanish-speaking white; and 76 percent English-speaking white. Their educational levels were 14 percent elementary school only, 27 percent some high school, 43 percent high school graduates, and 16 percent at least some college.

Public health workers experienced in interviewing techniques interviewed the subjects in their homes. After background data were gathered and rapport established, the interviewer introduced the SDH by a simple example and then supervised the respondent in marking three practice scales. This minimized the chance of later responses being invalid because the respondent did not comprehend the task.

The scales used in the study are shown in figure 1. Each scale was read to each respondent and his response elicited in the following manner: (scale A) "This line says—Many people get it. Some people get it. A few people get it. Almost nobody gets it.—Where on this line would you put tuberculosis?" The respondent then marked his reply by placing a check at whatever position on the continuum he felt best represented his view. Each person responded to identical sets of the 16 scales shown in the figure for each of the four diseases: tuberculosis, poliomyelitis, cancer, and mental illness.

Inasmuch as the same sample of persons gave the responses for all four diseases studied, the differences in beliefs and feelings observed between the diseases cannot be attributed to differences in characteristics of respondents, such as age, sex, social position, or education.

The responses to each scale were converted to a cumulative frequency distribution for each disease. The significance of the difference between distributions (the likelihood that the observed distributions of perceptions might be random samples of some larger hypothetical set

Distribution of sample in 1962 and county population [1] in 1960, by sex, age, and race

Sex, age group (years), and race	Percentage	
	County (N=103,706)	Sample (N=436)
Men:		
20–29	22.9	20.9
30–39	25.5	25.4
Women:		
20–29	24.0	22.7
30–39	27.6	31.0
Race:		
White	85.7	87.6
Nonwhite	14.3	12.4

[1] 1960 census.

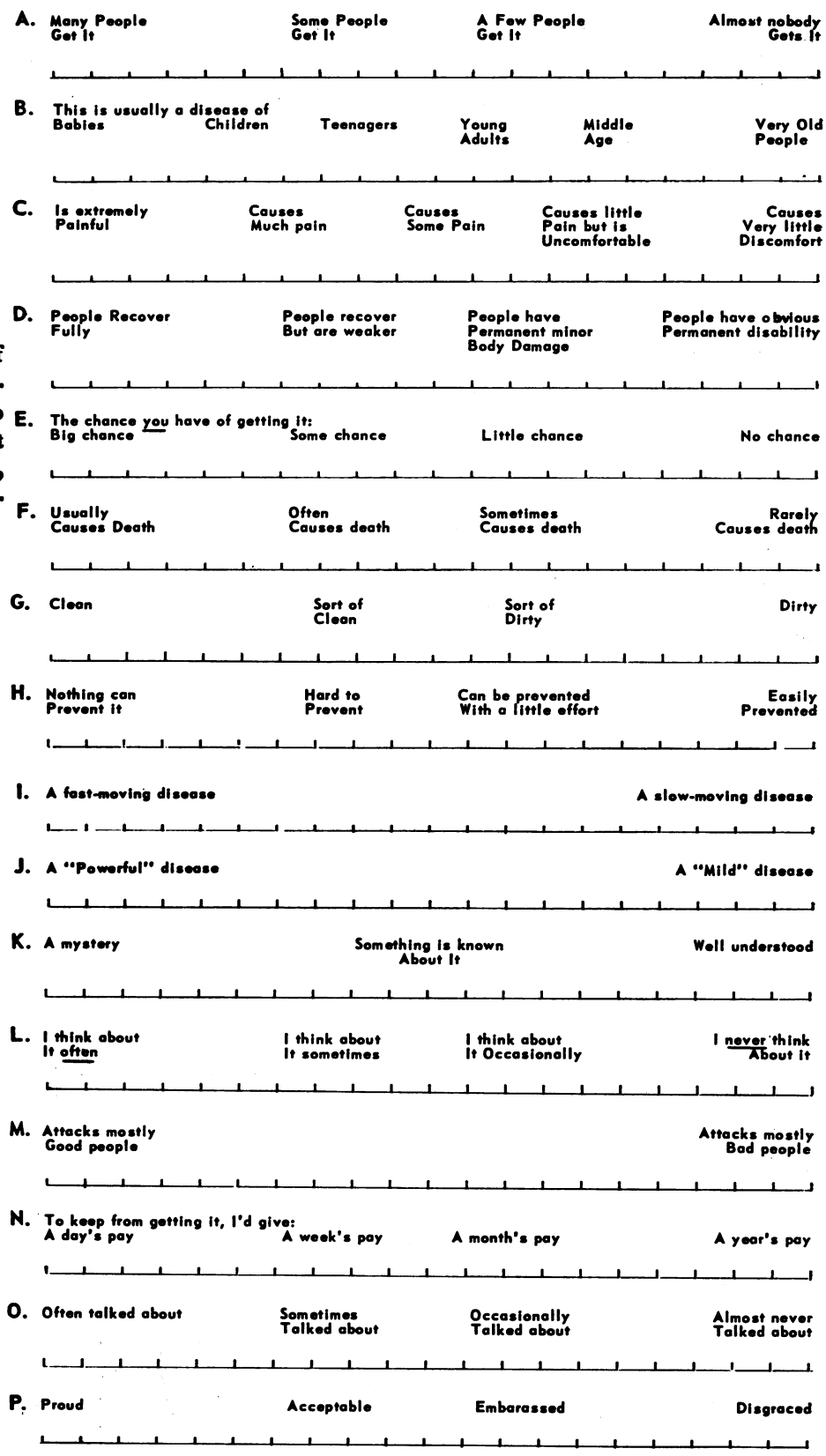


Figure 1. Scales of the semantic differential for health used to measure beliefs about cancer, poliomyelitis, tuberculosis, and mental illness

of perceptions about the same or equivalent conditions) was computed using the Kolmogorov-Smirnoff two-sample test for cumulative frequency distributions (*4*). With four diseases compared two at a time (six possible pairings) for each of 16 scales, 96 comparisons of distributions were made. Sixty-one of these comparisons yielded differences between diseases at the 0.01 level of statistical significance. This finding emphasizes the multiplicity of ways in which the sample perceived these diseases to differ from one another. It also suggests that the SDH is sensitive to these differences in perception.

The semantic differential and the SDH do not assume that the verbal labels have the same meaning or implications for all respondents. In fact, this is one of the questions the SDH seeks to answer. Verbal labels or entire scales which are ambiguous or have a heterogeneity of meanings will elicit a helter-skelter of responses not systematically different when applied to different concepts (in this case, diseases). Only to the extent that there was popular consensus in this sample about both the meaning of the scales and the characteristics of the diseases could significant differences between distributions of responses arise. The SDH, like most semantic differential research, does not assign an a priori definition to words, but rather defines them a posteriori in terms of the way persons respond to them. The interrelations of these responses to one another have been examined by factor analysis, and they will be presented in another report.

Findings

Analysis of the responses to the SDH suggested that (*a*) diseases are perceived in systematically different ways, (*b*) the SDH is sensitive to these differences, and (*c*) certain new dimensions tapped by the SDH add useful components to the knowledge about the way diseases are viewed.

The difference in perceptions of any one disease between subgroups within the sample have been reviewed previously (*5*). The scales which yielded data having more direct implications for public health practice are grouped by topic and discussed subsequently.

How many people does each disease attack? How many people get it? (scale A). Of the 436 respondents, 49 percent thought that cancer has the highest attack rate; 35 percent, tuberculosis; 29 percent, mental illness; and 28 percent, poliomyelitis. These responses correlated with the responses to "The chance *you* have of getting it" (scale E). More people thought they had a big chance or some chance of getting cancer than any of the other three diseases. Interestingly, the respondents felt that the likelihood of their being stricken by tuberculosis or poliomyelitis was equal. Half as many thought they had a big chance of getting poliomyelitis (16 percent) or tuberculosis (16 percent) as those who suspected a big chance of getting cancer (33 percent). Only 12 percent believed they had a big chance of getting mental illness. Cumulative frequency analyses showed that this rank ordering was maintained for well over half of the 40-point scale. Despite the wide variety of mental illnesses and the presupposition that different persons may view them from different premises, the heterogeneous sample of respondents made a consistent set of comparisons between mental illness and the other three diseases. This consistency is brought out in the following sections.

What kind of people does each disease attack? The respondents distinctly associated certain diseases with certain ages (scale B). The distribution of responses for each disease was significantly different from those for each of the other three diseases (at the 0.01 level). Poliomyelitis was seen as a disease of pre-adolescent children. The implications of the name "infantile paralysis" may still guide people's thinking about the disease; however, only 1 percent felt that it is primarily a disease of babies. Tuberculosis was seen as attacking mostly young adults, but about 30 percent of the respondents associated it with middle age. Mental illness was seen more as a disease of middle age, although there was considerable overlap in the perception of age of occurrence of mental illness and tuberculosis. Cancer was perceived quite differently from the other diseases, being associated with late middle age and old age.

Most of the respondents believed that any of the four diseases strikes without regard to whether the victims are "good people" or "bad

people" (scale M). Generally, they did not feel that the diseases occur as a punishment for moral inadequacy or as special misfortunes of particularly upright people. Preliminary data from other analyses suggest that persons of lower educational levels associate illness with "goodness and badness" more often than the highly educated do. In the general population sample reported here, however, there was a slight trend toward the belief that diseases strike very good people rather than very bad people. This may be a "halo effect" of the commonly felt pity for persons having serious diseases. Among the minority of respondents who felt that any of the diseases attack bad people more frequently, the most often mentioned disease was tuberculosis. On this scale, however, none of the differences among the diseases was statistically significant.

How severe is this disease? Attitudes and feelings about the relative severity of diseases were investigated as to amount of pain (scale C), degree of recovery possible (scale D), and chance of dying from the disease (scale F).

The disease most often marked "usually causes death" was cancer. Tuberculosis and poliomyelitis were rated far behind cancer in terms of mortality potential; the rating most frequently applied to them was "sometimes causes death." This modal rating is about 20 points removed on the scales from the modal response to cancer. Mental illness, again standing apart from the other three diseases, was most commonly seen as rarely causing death.

Full recovery was most often associated with mental illness and tuberculosis. One explanation for this association may be that on scale D the alternative to full recovery was probably perceived as physical disability, which of course is not generally a residual of mental illness. The respondents were somewhat more optimistic about recovering from cancer without residual disability than from poliomyelitis. The poliomyelitis publicity showing children in braces and with other obvious permanent disabilities may well be reflected in the responses to this scale.

All four of the diseases were perceived as being significantly different from each other in terms of the amount of pain they cause, and all four maintained the same rank relative to each other at all points in scale C (fig. 2). Cumulative frequency curves are shown because they display more adequately the accumulation of consistent trends. Such trends are often obscured in the more commonly used bar graphs, particularly where a large number of intervals are concerned. The cumulative frequency curve gives the percentage of responses for a given disease at or to the left of the X-axis location.

Cancer was seen as by far the most painful of these illnesses. More than half the sample rated it at the far edge of the "extremely painful" end of the scale. Only 37 percent rated poliomyelitis this extremely; 7 percent gave tuberculosis and 3 percent gave mental illness this rating. Poliomyelitis was seen as second most painful of the diseases. Only half the sample felt that tuberculosis caused more than "some" pain, whereas only one-fourth said this for mental illness. Twenty percent said mental illness causes "very little discomfort." In general, mental illness was seen as a painless disease; about half the respondents believed it was painless and caused only varying degrees of discomfort.

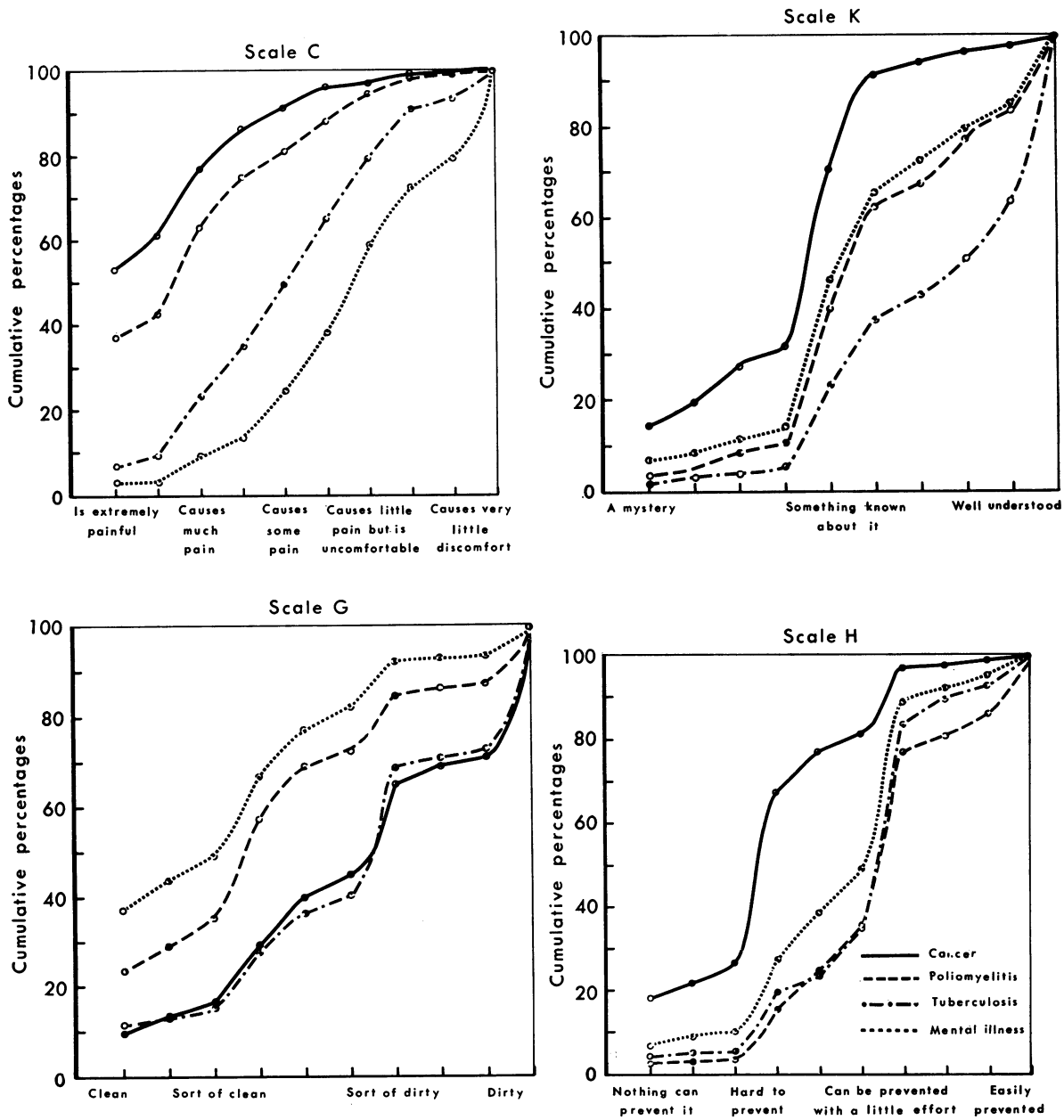
Computing the correlations between the scales revealed for most diseases a substantial association between powerful-mild (scale J), fast moving-slow moving (scale I), and extremely painful-little discomfort (scale C). Because of this association, these scales were included as indices of perceived severity. The responses to the fast moving-slow moving scale showed poliomyelitis, cancer, tuberculosis, and mental illness to rank in that order of speed of activity. This ordering reflects the relative speed of onset and the emergence of severe symptoms of typical cases of the four illnesses. In terms of potency, cancer was considered the most powerful more often than poliomyelitis; tuberculosis, moderately powerful; and mental illness, the least powerful by far.

If these dimensions, related to likelihood of getting a disease and to its severity and life-threatening characteristics, are adequate indices of fear, cancer is the most feared of the four diseases studied. All five scales relating to these areas of belief and feeling consistently showed that the population studied accorded cancer the most threatening position.

How prominent is each disease in public

thinking? Two scales refer to how prominently diseases figure in public and private thinking. Scale O, running from "often talked about" to "almost never talked about," and scale L, whose extremes were "I think about it often" and "I never think about it," showed similar responses in regard to each of the diseases, despite being placed several positions apart in the series of scales. Cancer was the disease reputed to be most talked about by others and also most thought about by respondents. Poliomyelitis occupied the second most popular position in the public interest. Tuberculosis and mental illness lagged considerably behind, to the extent of being classifiable as diseases the public does not like to think about or talk about.

Figure 2. Perceptions of 436 persons about cancer, poliomyelitis, tuberculosis, and mental illness according to selected scales from the semantic differential for health



How do the diseases rank in social acceptability? Why are mental illness and tuberculosis so seldom thought about and discussed? This may be explained by two factors. First, these diseases do not appear to the public to be as prevalent or as threatening when they attack. They are seen as less powerful than cancer and poliomyelitis. Second, these diseases have somewhat more of a cloak of shame about them, as revealed by scale P, whose guide points are "proud, acceptable, embarrassed, disgraced." While most respondents indicated that all four diseases were in the "acceptable" range, the use of a 40-point scale spread the responses enough to reveal that a sizable minority associated the term "embarrassed" with some illnesses—particularly mental illness. Significantly more embarrassment was attached to mental illness than cancer or poliomyelitis. Tuberculosis was in the second most embarrassing position, but not statistically different from mental illness.

Another approach to the rating of the social acceptability of the different diseases is scale G, with the end points of "clean–dirty" (fig. 2). The ranking of the diseases here was different from scale P, the "proud–disgraced" dimension, and the difference was surprising. Cancer and tuberculosis were perceived quite similarly: both were rated far more dirty than mental illness and poliomyelitis. Although they considered it the most embarrassing disease, mental illness was rated the cleanest by the bulk of the 436 respondents. Poliomyelitis appeared more frequently on the "dirty" end of the continuum, perhaps because it is an infectious disease. But this hypothesis does not account for the extreme ratings given cancer. Perhaps the physical deterioration observed in some terminal-cancer patients influenced these ratings.

The exact meaning of these findings is not clear as yet. Study of the relation of scale G to the other scales and to health-related behavior may shed further light on its latent implications.

Can man understand and master these diseases? Does the public believe these diseases can be effectively prevented? Two scales (K and H) deal with whether man can master nature or must remain subservient to it. Scale K concerns perception of man's mental mastery (fig. 2). The continuum runs: "a mystery, something is known about it, well understood." Few people considered any of the diseases a complete mystery. A sizable number (32 percent) placed cancer to the more mysterious side of the midpoint of the scale. Very few felt that it was more than "half-way along" to being well understood. Mental illness ranked as the second most mysterious of the diseases. Poliomyelitis was considered slightly better understood. Tuberculosis was considered by far the best comprehended of the four diseases. About half the respondents considered it "well understood." All differences were statistically significant except for the difference between poliomyelitis and mental illness. Surprisingly, the sample felt that the level of scientific understanding of mental illness approaches that for poliomyelitis. The emphasis on the need for cancer research, as contrasted with the emphasis on providing services which is found in publicity for mental health programs, may have had some influence on the respondents' belief that sizable differences exist in available knowledge about these diseases.

The preventability of diseases was measured on scale H (fig. 2). Poliomyelitis was considered the easiest disease to prevent. Yet only 14 percent of the respondents marked it at the far right of the scale (easily prevented). Tuberculosis was considered almost as preventable as poliomyelitis by these lay respondents. Mental illness was seen as more difficult to prevent than tuberculosis and poliomyelitis by significantly more people. Two-thirds of the respondents felt that cancer was difficult or impossible to prevent. The respondents revealed a far more fatalistic, helpless attitude toward cancer than toward any of the other three diseases.

Implications

It should be emphasized that the percentages of respondents in the sample having specific perceptions about a given disease may not be representative of the outlook in other counties, or even in the same county 5 years hence. The stronger any given trend or the greater the difference observed between perceptions, however, the more confidence one may have that the rela-

tionship may have general validity in other communities, particularly if they are demographically and socially similar to the one sampled. Keeping these limitations in mind, what may be the implications of these findings for understanding response to public health programs? What specific research questions are set before us as a next step?

Despite a high estimate of the pain caused by cancer, its potential for mortality, and the belief that older adults have greater chances of contracting it, these fear-provoking perceptions do not seem so threatening that persons (at least those under age 40) are afraid to think about or talk about this disease. This may be an encouraging sign for preventive health efforts directed toward cancer. Behavioral science theory suggests that when a condition can be discussed openly, people will be more likely to respond rationally to control programs. Further research is needed to determine whether health programs have greater difficulty in situations where thoughtful consideration and discussion of the disease in question is repressed.

The response to cancer detection programs, however, has not been as extensive as desired. It could be hypothesized that many persons do not come to screening clinics because they have a helpless, fatalistic attitude toward cancer. Such persons may need assurance that incipient cancer can be treated successfully. This hypothesis requires a definitive test. The data also suggest that the public should be further apprised of the fact that cancer strikes not only during old age but that it occurs with sufficient frequency among younger and middle-aged adults to warrant their participation in screening programs.

Tuberculosis was seen as quite prevalent and yet seldom talked about. Perhaps an aura of embarrassment is attached by many persons to this disease, and these people rate their own susceptibility as less than that of the general public of their own age. Tuberculosis needs to be presented more effectively as a disease which need not be hidden, but for which diagnosis and treatment can be sought as openly as for any other disease. The perceived slowness and lack of severity of tuberculosis also reduce the level of concern about this disease. It is suspected that all these factors may contribute to the problems of casefinding and treatment for tuberculosis. The content of beliefs and strength of feelings about tuberculosis have been observed to differ markedly among ethnic groups and, to a lesser extent, between socioeconomic classes. Even the basic dimensions of meaning (factor structure of SDH scales) differ among ethnic groups. These findings have been reported elsewhere (*6*).

Many qualities were attributed to poliomyelitis which seem to make it a relatively easy disease for eliciting public response to preventive programs. It was seen as disabling and rapid in its attack, and its prevalence tended to be overestimated. Yet it was not considered so overpowering as to immobilize appropriate health behavior; it had high social acceptability among the respondents.

Poliomyelitis was considered the easiest of the four diseases to prevent. Yet some persons in the sample were rather skeptical about the ease of preventing any disease. Despite all the recent publicity that with present vaccines poliomyelitis is almost completely preventable, 15 percent of the respondents felt it was hard to prevent and only 14 percent rated it at or adjacent to the "easily prevented" extreme of the rating scale. Replies to direct questions suggested that the sample overwhelmingly endorsed the efficacy of poliomyelitis vaccines. The responses to this scale, however, suggest that this "faith" could be largely a reaction to a pointed question and may not reflect many persons' spontaneous thoughts. It appears that more education is necessary to convince the public of the extreme ease with which poliomyelitis can be prevented with available vaccines. However, these data were gathered in 1962. Since then, an educational campaign was undertaken preceding the feeding of live-virus oral vaccine in this county. A social and psychological analysis of the high rate of public response to this program as well as discussions of its administrative aspects and health education programing are presented in a monograph by Neill and Bond (*7*).

The perception of mental illness as weak, slow, unlikely to lead to disability or death, and least likely to attack oneself, may partially account for the lack of general public enthusiasm, arousal, or concern for mental health activ-

ities. The widespread idea that mental illness is painless, even relatively free of discomfort, is a finding of great interest. Perhaps the respondents were focusing on "physical pain" when reacting to this scale. If this were the case, it reveals lack of awareness of the pain of a subjectively severe intensity which some mentally ill persons report. If nothing else, the finding points to an unawareness of the fact that mental anguish can cause suffering equal to physical pain.

In most of the scales of the SDH, mental illness was perceived in a distinctly separate manner from the three "physical diseases"—cancer, poliomyelitis, and tuberculosis. Mental illness ranked lowest of the four diseases in social acceptability. It was also seen as mysterious and not preventable.

The greater dispersion of ratings for mental illness on the scales suggests that there was considerable disagreement about this disease in the minds of the respondents. Again, however, different respondents may have had different specific diagnoses in mind when responding to the overly broad term "mental illness." These factors may compound the difficulty of mobilizing public support for local mental health programs.

The above inferences were drawn from the measured perceptions interpreted in the light of behavioral science theory. The empirical relationships between the SDH scales and health-related action, such as obtaining vaccines, X-rays, and medical examinations, need further controlled study. This was the initial large-scale field usage of the SDH. Subsequent experience has led to recommendations for replacement or modification of a few of the original scales (*5a*).

Data-gathering instruments such as the SDH offer a useful addition to the techniques of the health educator, health administrator, and behavioral scientist. For example, they can be applied in the following circumstances: (*a*) when a health educator wishes to evaluate the effect of his program on changing beliefs and feelings about a disease, apart from the communication of factual knowledge; (*b*) when a public health administrator wishes to know the current "public image" of a disease in his area so that he can more effectively plan a new preventive or casefinding program; and (*c*) when a voluntary health agency receives good response to its programs from one community and poor response from another, the SDH can be used as part of a survey to determine a community's image of the agency as well as the community's beliefs and feelings about the target disease.

It should be emphasized that beliefs and feelings about a disease are but one of many factors influencing whether or not persons will participate in health programs. Additional factors promoting participation include interaction with groups of people where good health practices are habitual, feelings that omitting such health actions is socially disapproved, belief that the health act is really effective and without undesirable side-effects, ability to conceptualize future health goals, cultural values consistent with those of health professionals, and convenience of participation in the health program.

The study of beliefs and feelings about disease is a necessary component, however, to the better understanding of why many persons still fail to accept proved preventive health measures. The techniques used in this study offer one useful approach to this larger task.

Summary

The semantic differential for health, a technique for ascertaining beliefs about diseases, has the basic format of the standard semantic differential but its content derives from theories of the dynamics of health-related behavior. The technique was administered to a sample of 436 persons, aged 20–39 years, in an urban county in Florida. All of these persons recorded their beliefs and feelings about tuberculosis, poliomyelitis, cancer, and mental illness on duplicate scales.

Analysis of the responses indicated that (*a*) diseases are perceived in systematically different ways, (*b*) the semantic differential for health is sensitive to these differences, and (*c*) certain new dimensions tapped by the semantic differential for health add useful components to the knowledge about the way diseases are viewed.

The findings suggested possible reasons for difficulties in obtaining participation in preventive and casefinding programs for certain diseases. Application of a technique such as

this in operational studies by public health administrators, health educators, and voluntary health agencies may yield insights as to reasons behind some of these difficulties.

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Mechanism of Penicillin Explained

How does penicillin kill bacteria which invade the body without killing normal cells? The mechanism by which penicillin kills bacterial cells has been of interest since the discovery of the drug in 1929, according to Dr. Jack L. Strominger, professor and chairman of the department of pharmacology, University of Wisconsin Medical School.

The work of Strominger and associates indicates that penicillin stops invading bacteria from building their own cell walls. The wall is necessary for the bacterial cell to maintain its stability.

Human and other animal cells do not have a wall, but a limiting membrane which has a fragile construction. Penicillin does not harm human and animal cells, and, therefore, people who take penicillin usually are not harmed by it. Bacteria have a membrane also, but it is not strong enough to prevent their destruction once penicillin prevents synthesis of the bacteria's cell wall.

According to Strominger, the bacterial cell wall can be imagined as a set of ropes which are tied together to make a kind of fishnet around the bacterial cell. Bacteria use about 30 steps to make cell walls and devote at least one-fourth of their available energy to build them.

Penicillin, a small organic molecule isolated from a fungus, prevents the last step in this wall building, the cross-linking reaction, thus stopping formation of the wall. Some other antibacterial agents which the researchers have studied—such as bacitracin, often used on cuts and burns—stop the bacterial cell-wall ropes from being made by interfering at an earlier stage in their construction.