Scalability of Health Services:
An Empirical Test

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The implementation of five programs considered to contribute to an array of comprehensive health services is investigated by Guttman scale analysis in a sample of United States hospitals and health departments to determine whether the programs are undertaken in a unidimensional or a random sequence. Evidence is presented that the mode of implementation of these programs is unidimensional in hospitals, but program implementation in health departments is found to follow a different pattern and to show no scalability. The conclusions are not changed when the data are controlled for size of facility and regional location. Implications of these findings for evaluating comprehensiveness of health services and for predicting future innovations are discussed.

As part of the research on innovation in health care organizations now being conducted at the University of North Carolina Health Services Research Center, considerable time has been devoted to the study of community and organizational factors affecting the differential implementation of selected health care programs. A continuing problem in the delivery of medical care is the comprehensiveness of health services provided by local health agencies, particularly services provided by hospitals and health departments. Although it is probable that these two types of agencies will both overlap and complement one another in certain areas, five specific types of program advocated by various health organizations were chosen as contributing to comprehensiveness in the health care services available to a community: (1) home care services, (2) family planning, (3) medical social work, (4) mental health, and (5) rehabilitation. In one form or another these programs have been the focus of several research projects as attention has been directed to assessing the determinants of their implementation [1–11].

A recurring question in this research is whether the implementation of these

five programs can in any way be considered to proceed in a systematic manner or whether they are undertaken in random or haphazard fashion by the providers of health services. The significance of this question lies in the possibility of characterizing the various stages in the provision of increasingly comprehensive services in order to evaluate accurately the level of comprehensiveness of a specific health facility and, more importantly, to predict with a high degree of accuracy the next innovations or changes in the direction of comprehensiveness that a health facility is likely to make. Most work has implicitly or explicitly presented these programs in "check list" fashion; no attention has been given to determining the empirical interrelations of these programs and whether these interrelations have any substantive meaning.

The objectives of this paper are to determine the degree to which this set of programs representing an array of comprehensive health services can be shown to have a single cumulative dimension and, where a single cumulative dimension does not exist, to assess possible sources of variation. If the data support a unidimensional model, the set of programs should vary systematically as a continuum of a single underlying dimension of comprehensiveness of health services, so that implementation of the services is undertaken in a predictable sequence. If the data do not support a unidimensional model, then no empirical basis can be provided for the typology of comprehensiveness as conceptualized and measured—it is a concept without a referent.

The question of whether the process of moving to comprehensiveness of care is a unidimensional or a random and relatively unpredictable process is of interest not only in its own right but also in the broader context of the determinants of innovation. One of the more powerful statistical techniques used in assessing the effects of organizational factors on innovation is the multiple regression model, in which multiple independent variables are assessed to explain the variation in a single dependent variable. A basic implicit assumption of the multiple regression model, however, is that the dependent variable, particularly, is measured on a unidimensionally ordered continuum. If comprehensiveness of care can be shown to lie along such a continuum, this would provide meaning to an analysis that attempts to predict levels of comprehensiveness by the use of multiple regression or similar techniques. If, on the other hand, unidimensionality cannot be shown to exist, the results of this type of analysis would be difficult to interpret, if not meaningless.

Methodology

In order to examine the question of whether implementation of the five services under study reflects an underlying unidimensional continuum, data concerning the implementation of services in hospitals and health departments were subjected to Guttman scale analysis. The Guttman scale technique [12] involves the systematic ordering of complex qualitative data. It was originally developed for the study of attitudes, where it has had its most extensive application. Guttman scaling has also been successfully adapted to the study of societal com-

plexity by Freeman and Winch [13] and by Buck and Jacobson [14]. In their studies, these authors were able to show that certain developments in society come about in a unidimensional fashion, so that knowledge of the current developmental level of a society makes it possible to predict the next developmental level it will reach. Freeman and Winch, for example, showed that societies develop according to the following pattern: (1) money economy, (2) formal punishment of crimes, (3) formal religion, (4) formal education, (5) formal governmental structure, (6) written language. Any society having a written language is also likely to have a formal government, formal educational system, and so on. Those societies having no formal religion but with formalized punishment of crimes are unlikely to have formal education but likely to have a money economy. This reflects the notion of unidimensionality upon which the Guttman technique is based, with the assumption that the scalability of the present distribution implies the order of acquisition in the past.

The specific concern of this study is whether hospitals and health departments develop programs contributing to comprehensiveness of care in a unidimensional fashion. A scale is assumed to exist if those facilities which provide the least-common service also provide all others; those which provide the second least common provide all the more common services but not the least common, and so on; and those which provide only one service provide the most common one.

In practical terms, the identification of a scale for implementation of services in hospitals and health departments would indicate that these facilities expand their services to the community according to a set and established pattern. The organization's rank or scale score indicates exactly which services it provides and allows an accurate prediction of the next service it is likely to implement.

A program developed by the University of California as part of the BMD series [15] was used for the Guttman analysis. This program will accept up to 25 variables with as many as seven categories per variable. For this analysis the variables were the five programs of interest, and each variable was treated simply as a "yes" or "no" alternative.

The hospitals and health departments selected for analysis represent respondents to questionnaires sent to a stratified sample of all such facilities in the United States [6,7]. The sample represented 10 percent of U.S. hospitals and 20 percent of U.S. health departments; 480 hospitals (77 percent of the sample) and 205 health departments (72 percent) returned usable responses. Stratification variables and characteristics of nonrespondents have been discussed by Kaluzny et al. [7]; for the purposes of this report it is sufficient to note that on variables of interest there is no consistent difference between respondents and a random subsample of nonrespondents contacted by telephone. Thus it is assumed that the results of the analysis will have applicability beyond the limits of the hospitals and health departments actually studied.

The questionnaire items of interest to this analysis asked, for each of the five services, whether the hospital or health department was currently providing that service. (A sixth service, chronic disease screening, was asked about in the ini-

Table 1.   Hospitals and Health Departments Providing Specified Services

Service	Hospitals		Health departments	
	Number	Percent	Number	Percent
Rehabilitation	344	71.7	123	60.0
Mental health	231	48.1	120	58.5
Medical social work	222	46.2	78	38.0
Family planning	125	26.0	135	65.8
Home care	100	20.8	144	70.2

tial study, but the implementation and nature of this service were found to be so different from the other five services that it was not included in this analysis.)

Findings

It is immediately apparent from the results that if there is a unidimensional continuum of implementation for these five services within hospitals and health departments, it is not the same continuum for both types of facility. As Table 1 shows, the most common program within hospitals is rehabilitation, with 344 of the 480 hospitals reporting that they had such a program, while for health departments the most common program is home care services, with 144 of the 205 departments having this service. The least frequent service in hospitals is home care (100 hospitals); the least frequent in health departments is medical social work (78 departments).

Hospitals and health departments have traditionally been oriented toward basically different types of health concerns, so it is little wonder that they do not concentrate their efforts in the same areas. The Guttman analysis was therefore done separately for the two types of facility. Table 2 shows the results for services of the 480 hospitals.

Since scalability was not perfect, the error was evaluated by computing Guttman's coefficient of reproducibility (total errors/total responses) and Menzel's coefficient of scalability [16]. The Guttman coefficient was found to be .91, compared with Guttman's suggested minimum value of .90; the Menzel coefficient was .63, against a suggested minimum of .60. This suggests that hospitals do implement these services in accordance with the underlying unidimensional continuum described. Moreover, as Table 2 shows, the majority of the hospitals in the sample (nearly 70 percent) represent perfect scale types. Thus there is basis to expect the implementation of these five services in hospitals generally to proceed and to be characterized by unidimensional progression from rehabilitation services to mental health services to medical social services to family planning services and finally to home care services. It is highly unlikely that hospitals will implement home care services before medical social services or family planning.

Table 2.   Scale and Nonscale Types for Hospital Services

Type	Services					Hospitals providing	
	Home care	Family planning	Medical social work	Mental health	Rehabil- itation	Number	Percent*
All types						480	100.0
Perfect scale types:							
Five services	X	X	X	X	X	35	7.3
Four services		X	X	X	X	45	9.4
Three services			X	X	X	46	9.6
Two services				X	X	47	9.8
One service					X	67	14.0
No services						92	19.2
						332	69.2
Nonscale types:							
Four services	X		X	X	X	24	5.0
Three services		X		X	X	14	2.9
Two services			X		X	26	5.4
Other						84	17.5
						148	30.8

* Percentages do not add to 100 because of rounding.

The separate Guttman analysis for health departments, however, shows quite a different pattern (Table 3). While 69 percent of the hospitals manifest the characteristics of a scale type, only 49 percent of the health departments do so. Moreover, Guttman's and Menzel's coefficients fail to reach the suggested minimum values: the Guttman coefficient of reproducibility is .87 and Menzels' co-efficient of scalability is .42. While the Guttman coefficient is fairly close to the minimum level, the Menzel coefficient is only about two-thirds of the suggested minimum value. Thus it must be concluded that implementation of the five programs in health departments does not tend to follow a single unitary continuum.

Because of this indication of nonlinearity, two possible sources of variation in health department sequences of implementation were investigated—regional differences and institutional size differences. A parallel examination was conducted within the sample of hospitals for purposes of comparison.

Regional Variations among Health Departments

Health departments historically have not enjoyed the amount of political autonomy accorded to hospitals. Subject as they are to policy directives and financial sanctions from local and state legislative bodies and a conservative orientation by state and local medical societies, health departments have less independence than hospitals in planning for new services.

In the knowledge that different regions of the United States have differing social, political, and financial motivations and capabilities, the investigators

Table 3. Scale and Nonscale Types for Health Department Services

Type	Services					Health departments providing	
	Medical social work	Mental health	Rehabil- itation	Family planning	Home care	Number	Percent*
All types						205	100.0
Perfect scale types:							
Five services	X	X	X	X	X	38	18.5
Four services		X	X	X	X	21	10.2
Three services			X	X	X	10	4.9
Two services				X	X	6	2.9
One service					X	9	4.4
No services						17	8.3
						101	49.3
Nonscale types:							
Four services	X		X	X	X	10	4.9
Three services		X		X	X	9	4.4
Two services		X		X		9	4.4
One service				X		6	2.9
Other						70	34.3
						134	50.9

* Percentages do not add to 100 because of rounding.

divided the national samples of health departments and hospitals into four regions (Northeast, North Central, South, and West) and applied Guttman scale analysis within each region. It was assumed that similarity in implementation of programs would be higher within regional units than it is nationally, and that when the data were controlled for regional variations in the social, political, and financial climate, unidimensional scales might emerge for health departments. Because hospitals have a greater degree of autonomy, it was expected that they might not show similar differentiation on this basis.

Table 4 shows, for both hospitals and health departments, the order in which the five programs are most commonly provided within the four regions. Examination of the rankings corroborates not only the previously noted difference between hospitals and health departments in the sequence of provision but also the predicted relative uniformity of rankings across regions for hospitals, in contrast to the greater disparity of rank orderings across regions for health departments. Kendall's coefficient of concordance [17,18] was used to verify the degree of uniformity of rankings across regions. The statistic W, which varies between 0 (no uniformity) and 1 (complete concordance of rankings), shows significant agreement (.91; $p < .01$) for hospitals and only medium agreement (.5; n.s.) for health departments.

The moderate level of concordance found for health departments verifies the

Table 4. Ranking of Programs Implemented by Hospitals and Health Departments, by Region

(1 = highest frequency, 5 = lowest frequency)

Region	Programs					Guttman coefficient	N
	Home care	Family planning	Rehabil- itation	Mental health	Medical social work		
	HOSPITALS*						
Northeast	5	4	1	3	2	.90	77
North Central	4	5	1	2	3	.90	144
South	5	4	1	3	2	.93	182
West	5	4	1	2	3	.92	77
	HEALTH DEPARTMENTS†						
Northeast	1	4	2	5	3	.89	41
North Central	1	4	2	3	5	.86	59
South	2	1	4	3	5	.90	74
West	2	1	4	3	5	.88	31

* $S = 146$ ($p < .01$); $W = .91$.
† $S = 80$ (n.s.); $W = .50$.

evidence of Table 4 that health departments vary considerably more by region than hospitals in terms of which programs are most commonly found. Further examination of health department results in Table 4 shows quite similar rankings for the Northeast and North Central regions and identical rankings for the South and West. The major difference between the two groups lies in the priority of implementation of family planning, which is the most widely provided of the programs in the South and West but fourth of the five in the northern regions. This finding would appear to substantiate the proposition that health departments are more subject than hospitals to regional political variations. Heavily Catholic areas of the Northeast, for example, have been slow to legislate for contraceptive education, let alone advocate policies of population planning. The implications of political advocacy for inhibition of particular types of health services deserve a much more pointed and thorough analysis.

Examination of the Guttman coefficients of reproducibility for each region, however, does not suggest any greater degree of unidimensionality in implementation of health department services than was found for the United States as a whole. Only in the South does the coefficient of reproducibility rise to a minimally acceptable level (.90), and even this, like the scores for the other regions, is close to the combined coefficients yielded by the national sample (.87). As expected, coefficients for hospitals by region do not differ substantially from the combined score. It is interesting to note that it is in the South that hospitals too have the most uniform pattern of program prevalence.

In sum, there is still no strong evidence for an underlying order of program implementation within health departments, even when the data are controlled

Table 5. Ranking of Programs Implemented by Hospitals
and Health Departments, by Size

(1 = highest frequency, 5 = lowest frequency)

| Size | Programs | | | | | Guttman coefficient | N |
	Home care	Family planning	Rehabil- itation	Mental health	Medical social work		
	HOSPITALS*						
Number of beds:							
<100	3	5	1	2	4	.95	113
100–249	4	5	1	3	2	.87	161
250–499	5	4	1	2	3	.91	147
500+	5	4	1	3	2	.96	69
	HEALTH DEPARTMENTS†						
Population of jurisdiction:							
<25 000‡	1	2	3	4	5	.85	53
25 000–<50 000	1	2	3	4	5	.88	43
50 000–<180 000 ...	1	3	2	4	5	.87	54
180 000+	2	3	4	1	5	.83	55

* $S = 130$ ($p < .01$); $W = .91$.
† $S = 118$ ($p < .01$); $W = .74$.
‡ Jurisdictions of under 25 000 population that fall in a Standard Metropolitan Statistical Area are included in the next larger category because of their nonrural nature.

for regional variations. The basic differences between rankings in the northern regions and in the South and West suggest a more fruitful investigation of area political differences, using more politically sensitive units. Unfortunately, the size of the present sample precludes pursuing this type of analysis with the data at hand.

Institutional Size Differences

One other possible source of variance in the frequency of the five services is the size of the health agency itself. In another analysis (Kaluzny et al. [7]), the size of hospitals, measured by number of beds, and the size of health departments, measured by the population of the jurisdiction served, were found to be significantly associated with implementation of new programs. A ranking analysis parallel to that conducted for regional variations was therefore carried out for size differences among hospitals and health departments (Table 5).

Measures of concordance indicate that the uniformity of the order of the services was significant among all sizes of both types of health facility. In other words, the program most common in health departments serving one size of jurisdiction will probably be most common in the other size groups. As in the regional breakdown, hospitals vary less than health departments across groupings.

The Guttman coefficients reveal that the control for size has no impact on health department scalability except for those health departments with the

largest jurisdictions, where scalability is decreased to a notable extent (to .83). Both lowest and highest scores of hospitals show increased within-category unidimensionality when size is controlled; but since hospitals as a whole had already been shown to conform to a unidimensional mode, this subanalysis does not contribute much additional knowledge. The effects of institutional size do not appear to be strong in relation to the sequence in which programs are introduced.

Conclusions

The programs chosen for analysis in the hospital population reflect a unitary pattern of implementation and constitute a scale, suggesting that the implementation of these five health services in hospitals can be presented as a unidimensional concept with a specific set of referents. Moreover, the existence of this pattern suggests a sequence of development common to hospitals. Generally, hospitals having the least-comprehensive services provide rehabilitation services. As comprehensiveness increases, rehabilitation is followed by mental health, medical social work, family planning, and finally home care services.

In practical terms this implies that if an external agency wishes to increase the comprehensiveness of services offered in a community, it might be wise or even necessary to promote the more common services first, paving the way for later provision of less common and possibly more complex services. An alternative approach would be to focus efforts on organizations already providing the more customary services.

Health departments present a different pattern. Here the data indicate that the programs do not represent a scale and that it is impossible to ascribe a unidimensional character to them. The implementation pattern of health departments fails to reflect any predictable manner of development, although analyses controlling for regional differences indicate some differences in program priority between the northern regions and the South and West, mainly centering around the comparative emphasis placed on family planning in the latter two regions. By and large, however, controls for regional and size differences did little to augment the indication of unidimensionality within control categories; alterations in Guttman scale coefficients among health departments were inconsequential. It can only be concluded that the controls chosen—gross regional categories and institutional size differences—were either not significantly related to the order in which health care services are provided to health department constituents (and that perhaps other factors play on this sequence) or that the measures used were not valid indicators of regional or size variations.

This article has attempted to demonstrate the applicability of a technique traditionally used in the study of attitudes to a problem of organizational development. An additional implication of the findings is that, since the concept of comprehensive health services is cumulative and not random in hospitals, ranking of organizations becomes possible. Organizations manifesting a given scale type can easily be compared with organizations of another scale type on basic

organizational and administrative factors, thus providing an efficient means of analyzing factors associated with program implementation. Moreover, the fact that unidimensionality has been shown increases the probability that such analytical tools as multiple regression would yield meaningful results when independent variables such as hospital size, location, and administrator characteristics are used to predict or explain the level of comprehensiveness of care.

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