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A Model for analyzing whether or not national health service corps physicians will remain in their assigned communities, by John E. Gerweck and Sam M. Cordes.

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Model for Analyzing Whether NHS Physicians will stay in their Assigned Communities

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INTRODUCTION

On a per capita basis the nation's most urban areas have approximately five times as many physicians as the nation's most rural areas. This maldistribution problem was largely responsible for the creation of the National Health Service Corps in 1970. The mandate of the Corps was "to improve the delivery of health services to persons living in communities and areas of the United States where health personnel and services are inadequate to meet the health needs." The program is administered by the Health Resources Administration, U.S. Department of Health and Human Services. Physicians, dentists, nurses, and other health workers who join the Corps receive a two-year assignment in a community experiencing a "critical shortage" of health manpower. For the most part, these communities are either remote rural areas or inner-city areas.

From its inception, one of the goals of the Corps has been for the physicians assigned to medically underserved communities to remain beyond their two-year obligatory periods. The purpose of the research summarized in this paper is to develop an empirical model for predicting whether or not Corps' physicians could be expected to stay in the communities to which they had been assigned. The value of such a model is obvious. If a strong predictive model can be developed, the Corps can use it to maximize the retention of physicians by (1) recruiting those most likely to stay for more than two years and (2) placing physicians in practices and communities that are conducive to the physicians likelihood of staying.

METHODS

In 1975, a consulting firm under contract with the NHSC surveyed the 105 Corps physicians who had just completed their two-year obligatory period. A comparable questionnaire was mailed by the same firm to the 108 physicians who completed their two-year assignment in 1976. Eighty-nine of the questionnaires were returned in 1975, and 91 in 1976. Hence, the response rates were high and virtually identical in both years (i.e., 85 percent and 84 percent, respectively). Subsequently, these data were made available by the Corps to researchers at The Pennsylvania State University. In addition to the questionnaire data, the Corps was able to provide information on patient revenue and cost for the practices where the 1975 group of physicians had been assigned.

The term "stayers" is used for those physicians who decided to remain in their assigned community beyond the two-year obligatory period. Those who did not stay are referred to as "leavers". Of the 90 respondents in 1975, 22 were stayers and 67 were leavers. The comparable figures for 1976 were 36 and 55, respectively.

Because the questionnaires were so lengthy (10 legal size pages in 1975 and 8 pages in 1976), criteria for selecting variables to be used in the analysis were needed. The "pure" scientific method requires that this be done on the basis of existing knowledge, i.e., theory and prior research. The antithesis of this is the "mechanistic" approach in which the researcher selects those variables which provide the "best fit" -- an approach more acceptable if the focus of the research is prediction rather than explanation.

In this study, the selection of variables represented an amalgamation of the "pure" and "mechanistic" approaches. The first round of selecting variables for possible inclusion in the analysis relied entirely on theory

and prior research. After this round of selection, the number of variables still available for inclusion, if included, would have made further analysis unwieldly. To the extent many of these variables were conceptually similar, the second round of variable selection (i.e., reduction) was mechanistic in nature.

By way of illustration, consider the concept of "leisure time". Theory and prior research suggest physicians place a value on leisure time and the array of amenities in which this leisure can be invested. The first round of variable selection included isolating this conceptual field. However, theory and prior research provide little direction as to which of the three following survey questions best measures this general conceptual field: "How would you judge the community to which you were assigned in terms of:

1) The opportunities for a stimulating social life?

2) Cultural opportunities?

3) Your overall personal and social experience?"

Whenever such a set of conceptually similar variables existed, the strength of each variable was assessed (using a simple bivariate framework) in terms of its relationship to the percent of physicians who stayed in the communities to which they had been assigned. The specific variable with the strongest relationship was then selected for further analysis.

FINDINGS

The two-stages of data reduction described in the prior section resulted in the selection of 13 variables from the questionnaire. The values associated with these variables are displayed in Table 1. The two years of data were separated for two reasons. First, some variables were available for only

one of the two years. Second, there was no apriori reason to believe the two groups, their experiences with the Corps, and the communities to which they were assigned were similar in both years. If enough similarity does not exist it has important implications for developing a predictive model with policy-level utility. Specifically, the estimated structural parameters of the model for one year will not be valid for the other year.

Physician Characteristics (See table 1)

Background and Preferences of Physicians

ELIG refers to whether or not the physician was "board eligible." In order to be board eligible a physician must have completed a residency in a specialty area. It was hypothesized that physicians who had completed their residency would be more likely to stay in their assigned community because they would not be leaving to pursue specialty training. This hypothesis was confirmed for the 1975 group, but not for the 1976 group.

PRECEP refers to whether or not the physician participated in a preceptorship program. Typically, such programs are designed for third or fourth-year medical students, and provide a short-term experience of working with a practicing physician -- usually a general practitioner in a rural area. Prior research suggests that such exposure increases the likelihood of physicians practicing in rural areas. Hence, it was hypothesized that Corps physicians who had participated in a preceptorship program would be more likely to stay in their assigned community. Data to test this hypothesis were not available for the 1975 group. In 1976, more of the stayers than leavers had participated in a perceptorship program (64% compared to 47%). However, the difference was not statistically significant.

MEDNEED refers to the importance placed on serving a medically needy area. It was hypothesized that physicians who had this type of "social consciousness" would be more likely to stay in their assigned community. This hypothesis was confirmed for the 1975 group, but not for the 1976 group.

Motives for Joining the Corps

SOCCHANG, PROGRO, and FREEBUS refer to the motives for joining the Corps. Specifically, physicians were asked how important the following reasons were for joining the Corps: Viewed Corps as a tool for social change (SOCCHANG); Felt Corps experience would be helpful for professional growth (PROGRO); Wanted to be free of business hassles (FREEBUS). It was hypothesized that physicians who viewed the Corps as a tool for social change, who did not join the Corps for their own professional growth, and who had a desire to avoid the business details of a practice would be more likely to stay in their assigned community. Each of these three hypothesis was confirmed in one of the two years, but none was confirmed for both years.

Practice and Area Characteristics (See table 1)

Noneconomic-Professional Aspects

CONSULT and HOSPRIV refer to the physicians' assessments of "access to immediate consultation" (CONSULT) and "availability of hospital privileges" (HOSPRIV). It was hypothesized that physicians located in areas where these two types of professional back-up were adequate would be more likely to stay in their assigned community. In the case of hospital privileges the hypothesis was not confirmed in either year. In the case of access to consultation, the hypothesis

was confirmed for the 1975 group, but not for the 1976 group. Indeed, in 1976, stayers were significantly less likely than leavers to view their access to consultation as "adequate".

COROBS and MANAG refer to structure and management aspects of the practice. Specifically, physicians were asked if the Corps "assistance" in the practice was obstructive (COROBS) and whether or not the physician was extensively involved in the management of the practice (MANAG). It was hypothesized that physicians who did not view the Corps as obstructive and who felt they were extensively involved in the management of the practice would be more likely to stay in their assigned community. The former hypothesis was not confirmed for either year and the latter for only the 1975 group.

Noneconomic-Personal Aspects

HILIFE refers to physicians perceptions of the opportunity to develop a satisfactory social life in the Corps community. It was hypothesized that physicians who believed such opportunities existed would be more likely to stay in their assigned community. This hypothesis was confirmed for the 1975 group, but not for the 1976 group.

Economic Aspects

PATDAY is a subjective measure by the physician of the number of patients seen daily. Because revenues are directly related to the number of patients seen the financial potential of the practice will be influenced by patient flow. Although Corps physicians are on a salary basis, most of them probably have expectations of eventually establishing their own practice. Whether to stay in their assigned community and eventually convert the Corp practice to a private practice will depend upon the financial potential of the Corps practice. Hence, it is hypothesized that physicians seeing "too few" patients

daily will be more likely to leave their assigned community. This hypothesis was supported for both years.

SSRAT refers to the practice's self-sufficiency ratio. This ratio is calculated by dividing patient revenue by total cost. This ratio was made available by the Corps as a separate data element for the 1975 group of physicians. It was hypothesized that physicians located in the more lucrative practices would be more likely to stay in their assigned communities. The logic for this hypothesis is the same as for PATDAY. The hypothesis for SSRAT was confirmed.

Perhaps the most striking result of the above-described bivariate analysis is the lack of consistency between the two years. Only the economic variables were consistently important across both years. Although economic factors would appear to be a consistent predictor of whether physicians stay in their communities, the remainder of the decision-making process appears to involve year to year variation. These variations are likely due the the lack of homogeneity from year to year in both the physicians and the communities to which they were assigned. If such variation is substantial, the structural parameters of a model estimated for one year will not be valid for some other year. In other words, a model based on data from the 1975 group of physicians may be very efficient in predicting, ex post facto, which individual physicians in the 1975 group would be expected to stay in their assigned communities and which would be expected to leave. However, the same model may be very inefficient in making similar predictions for the 1976 group of physicians.

In order to determine the extent of this difficulty, a discriminant analysis framework was developed. Discriminant analysis is simply a statistical technique for assigning observations (in this case physicians) to two or more mutually exclusive groups (in this case "stayers" or "leavers"). The

efficacy of this assignment procedure is determined by the predictive power of the variables included in discriminant function. The variables included were 11 of the 13 shown in Table 1. PRECEP and SSRAT were excluded because data were available for only one of the two years.

Classification function coefficients were then estimated for each of the two years. The coefficients derived from the 1975 data were used to classify both the 1975 and 1976 groups of physicians. Similarly, the classification function coefficients derived from the 1976 data were used to classify both the 1975 and 1976 groups of physicians. Results are shown in Table 2.

When 1975 coefficients were used to classify the observations, the predictive accuracy was considerably higher for the 1975 group than for the 1976 group. Specifically, 84 percent of the 1975 observations were classified correctly, but only 62 percent of the 1976 observations were classified correctly. Of those predicted to stay, 68 percent of the 1975 groups were correct predictions, but only 55 percent of the 1976 group were also correct. The predictive accuracy for leavers was also lower for the 1976 group than for the 1975 group (67 percent compared to 90 percent).

When 1976 coefficients were used to classify observations the reverse situation held, i.e., predictive accuracy was higher for the 1976 group. Specifically, 79 percent of the 1976 observations were classified correctly, but only 50 percent of the 1975 observations were classified correctly. In the case of stayers, predictive accuracy dropped all the way from 75 percent for the 1976 group to 17 percent for the 1975 group. Of those predicted to leave, 82 percent of the 1976 group were correct predictions, but only 68 percent of the 1975 group were also correct.

The above-described variation in the predictive power of the model confirms the suspicions based on the simple bivariate analysis of the data.

These suspicions were that the relative strengths of the variables influencing whether or not the physicians stayed in their assigned communities had changed between the two years. In order to gain a better understanding of these changes, standardized discriminant coefficients were calculated for each of the two years. These coefficients are useful in determining which variables are most important in the model's ability to discriminate between stayers and leavers. For the 1975 group the most important variables were ELIG, FREEBUS, and PATDAY. Specifically, physicians in the 1975 group were likely to stay in their communities if they were board certified (ELIG), had an aversion to handling the business details of the practice (FREEBUS), and were seeing some minimal number of patients (PATDAY). These latter two reasons were also important influences for the 1976 group; but two additional reasons were also strongly associated (in 1976) with staying in the assigned community: not simply using the Corps as a vehicle for one's own professional development (PROGRO), and not viewing the Corps "assistance" as bothersome (COROBS).

CONCLUSIONS

The purpose of this research was to develop a model capable of predicting whether or not Corps physicians could be expected to stay in the communities to which they had been assigned. In developing the model, several general insights were gleaned regarding the physicians' decisions to stay or leave their assigned communities. Economic potential of the practice (as reflected in the size of the patient flow) appears to be a consistently important factor. Contrary to established doctrine, the availability of back-up medical resources and social amenities were not consistently associated with the decision to stay or leave. In sum, it appears physicians are willing to practice in rural underserved areas if they can expect to earn an acceptable

income. Unfortunately, these general ex post facto insights or "explanations" do not translate into a model with strong predictive power. This is because the estimated coefficients for the model's specific structural parameters are not stable between years. Before a strong predictive model can be developed, the data base needs to expand to include additional groups of Corps physicians; and more precision must be developed in measuring specific concepts.

Table 1. Physician and Practice/Area Characteristics in Relation to Whether Corps Physicians Stayed or Left Their Assigned Communities

Characteristics of Physicians and Practice/Area	1975			1976		
	Stayers[a]		Leavers[b]	Stayers[c]		Leavers[d]
Physician Characteristics						
A. Background and Preferences						
Percent board eligible (ELIG)	54%	***	14%	24%		30%
Percent participating in preceptorship (PRECEP)		NA		64%		47%
Percent desiring to serve medically needy (MEDNEED)	91%	*	70%	80%		93%
B. Motives for Joining Corps						
Percent viewing Corps as tool for social change (SOCCHANG)	50%	*	27%	33%		47%
Percent not using Corps for professional development (PROGRO)	36%		53%	75%	**	45%
Percent using Corps to avoid business hassles (FREEBUS)	18%		15%	44%	**	19%
Practice and Area Characteristics						
A. Noneconomic-Professional Aspects						
Percent with adequate access to consultation (CONSULT)	96%	**	34%	72%	*	87%
Percent with readily available hospital privileges (HOSPRIV)	68%		45%	64%		56%
Percent not viewing Corps assistance as obstructive (COROBS)	80%		92%	97%		78%
Percent extensively involved in management (MANAG)	82%	**	52%	69%		57%
B. Noneconomic-Personal Aspects						
Percent seeing opportunity for satisfactory social life (HILIFE)	82%	**	48%	67%		45%
C. Economic Aspects						
Percent feeling number of patients seen daily was too few (PATDAY)	14%	**	48%	20%	**	42%
Average self-sufficiency ratio (SSRAT)	.81	***	.54		NA	

a. Number of responses for stayers ranged from 20 to 22.
b. Number of responses for leavers ranged from 61 to 66.
c. Number of responses for stayers ranged from 35 to 36.
d. Number of responses for leavers ranged from 51 to 55.

* Significant difference detected at .10.
** Significant difference detected at .05.
*** Significant difference detected at .001.

Table 2. Predictive Accuracy of Discriminant Analysis Model

Description of Prediction	Percent of Predictions Correct When Predictions Were Based On -	
	1975 Coefficients	1976 Coefficients
Physicians predicted as stayers who were stayers:		
1975 group	68%	17%
1976 group	55%	75%
Physicians predicted as leavers who were leavers:		
1975 group	90%	68%
1976 group	67%	82%
Predictive accuracy for all physicians:		
1975 group	84%	50%
1976 group	62%	79%