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INTRODUCTION

Research into the factors attracting physicians to practice in a given community has increased in volume in recent years. This interest is the result of a growing awareness of a number of things. Some are: (1) the importance of health in determining an individual's ability to function on a day-to-day basis; (2) the key role played by the physician in any individual's access to basic medical services; (3) the lack of access to basic medical services suffered by an ever increasing portion of the population as the result of the concentration of physicians in large urban centers. This study was the result of an attempt to re-examine the factors influencing the location decisions of physicians from a slightly different standpoint. Its objectives were: (1) to determine those factors which attract a physician to a given community; (2) to determine whether or not the factors which attract a physician to a community differ with the type of physician; (3) to examine the policy implications of the results for the study area, Oklahoma, and other states with similar distributions of physicians.

Previous research on physician location factors comes from a variety of fields including medical education, public health, economics, sociology and geography. Two basic approaches have been used. The first approach, which may be called 'urban-rural', viewed the location decision made by a physician

as a choice between either an urban or rural practice. These studies asked sample populations of physicians what factors had influenced them to locate where they did, then examined their answers in light of personal background characteristics. (See Dinkel, 1946; Fein, 1954; Liccione and McAlester, 1974; Parker and Tuxill, 1967; Taylor et.al., 1973) The second approach, labeled 'community-constraint',has been somewhat less individualistic in nature. Researchers saw the physician as an entrepreneur seeking to locate so as to maximize income. As such, the decisions of physicians to locate in a given community were seen to be constrained by the socio-economic characteristics of that community, especially as those characteristics influenced the community's ability to support an additional physician. Studies utilizing this approach attempted to statistically explain the number of physicians within an area in terms of that area's population, income, racial composition, etc. (Marden, 1966; Rimlinger and Steele, 1963; Rushing and Wade, 1973; Lankford, 1974).

Although this paper draws most heavily on the community-constraint literature in approach and methodology, it differs from previous research efforts in three ways. First, rather than viewing the location decision entirely or solely as an attempt to maximize income, it was hypothesized that income was only a very general constraint. Given the subset of environments which meet minimum expectations of potential income, the physician located in that community which came closest to his mental picture of the ideal personal and professional environment. Total environment, rather than income alone, was maximized. As a result of this basic assumption, the distribution of physicians was viewed as the result of individual decisions made on the basis of personal characteristics interacting with community characteristics. In order to more accurately describe this distribution, the rather impersonal community constraint model was expanded to include measures of physician attraction to a community based on personal background characteristics of the locating physician.

Second, rather than trying to explain the spatial distribution of physicians in 1973 in terms of 1973 values of the explanatory variables, it was hypothesized that the decision of each physician was made on the basis of values of explanatory variables existing when the actual location decision was made. In other words, the physician who located in Tulsa, Oklahoma in 1940 did so on the basis of his knowledge of the environment which existed there in 1940 rather than 1973. As such, it was felt that the most appropriate values of explanatory variables that could be used to describe the location decision were those that existed in 1940. The third and final difference between this research effort and the others lies in the definition of the term "physician". Rather than examining the location decisions of all licensed physicians, "physician" was defined as only those practitioners with M.D. degrees involved in active, private direct patient care. This definition excluded interns, residents, medical researchers, full-time hospital staff, educators, administrators and osteopaths.

THE GENERAL FACTOR MODEL

In the hypothesized model of factors influencing physician location decisions, the view taken was that physicians, lacking strong income and institutional constraints, were attracted to those environments which 1) were familiar to them, 2) offered numerous opportunities for familiar recreational/leisure activities, 3) offered opportunities to make friends with similar professional backgrounds, 4) had sufficient demand for medical services so as to support an additional physician and 5) were easily accessible to supportive medical facilities.

That familiar environments would be attractive to the physician makes intuitive sense. Gould and White's study (1968) of perceptions of residential desirability has shown that most people had a preference for the local area that they knew best. This phenomenon can be seen as the result of what Hoover

called man's attempt to "minimize the uncertainties of moving" by choosing places about which "they have information, and where they will find relatives, friends, and others" (1975:179). For the physician, the two environments which seemed to best fit these conditions were those areas within which they grew up and those where they underwent medical training.

Two other personal environmental factors cited by physicians in the urban-rural literature as having attracted them to their places of practice were opportunities provided by a community for familiar leisure activities and the opportunity to make friends with individuals of similar professional background. It was hypothesized that the community which came closest to fulfilling the familiar leisure needs of the physician was an urban one, which by virtue of its population concentration, could support a wider range of opportunities for activities and thus increase the chances that suitable activities could be found than might be the case in a rural community. And since most medical schools are located in urban areas, even the rural-born physician has had the opportunity to become accustomed to the amenities of urban living. The opportunity to make friends of similar professional background was considered to be greatest in a community with a large professional population. On these bases, it seemed logical to hypothesize that both areas with sizeable urban and professional populations would be attractive to locating physicians.

Turning to professional considerations, it seemed logical that a physician would consider a community's demand for an additional or marginal physician. After all, physicians while not purely economic beings, do have at least as much concern for their economic well-being as other professionals. It seemed unlikely that a physician would locate in a community where the ratio of population to already established physicians was low enough to raise serious doubts about his ability to attract a clientele. For this reason, communities with high levels of demand, i.e. high population to established physician ratios, were hypothesized to be more attractive to a physician than those communities with lower ratios.

That access to supportive medical facilities, i.e. both local hospitals and regional medical centers, would be an attractive factor is understandable when the changes that have occurred in the medical field are considered. Since the turn of the century, research and the resulting developments in medical techniques have increased the physician's dependency upon hospitals and the special equipment and personnel that such institutions provide.

In summary, the operational model tested was of the form

$$NOPHY_{it} = f(MHOM_{it}, MMSC_{it}, PURB_{it}, PPROF_{it}, PPR_{it}, MHOS_{it}, MMMC_{it})$$

where

$NOPHY_{it}$ = the number of physicians who located in county i in decade t;

$MHOM_{it}$ = the average number of miles from place of practice in county i to hometowns for physicians locating there in decade t;

$MMSC_{it}$ = the average number of miles from place of practice in county i to place of training for physicians locating there in decade t;

$PURB_{it}$ = the percent of the population living in urban areas in county i in decade t;

$PPROF_{it}$ = the percent of the population engaged in professional occupations in county i in decade t;

PPR_{it} = the population to established physician ratio of county i in decade t;

$MHOS_{it}$ = the average number of miles from place of practice in county i to the closest hospital for physicians locating in decade t;

$MMMC_{it}$ = the average number of miles from place of practice in county i to the nearest major medical center for physicians locating in decade t.

The attractiveness of an area, therefore, was measured by the number of physicians who located in that area in a given period and was hypothesized to be a function of the above listed factors.

THE STUDY AREA

In order to test the hypothesized model, the state of Oklahoma along with its 1973 population physicians were chosen as the study area and study population, respectively. Data on physicians and their practices were gathered from the American Medical Directory (1910-1973) and the records of the Oklahoma Board of Medical Examiners. Data on practice locations were taken from the appropriate Census reports.

THE RESULTS

The General Factor Model. The model was tested using a multiple regression framework. The results are summarized in Table 1. Of the seven hypothesized relationships tested, only three failed to be supported.

Contrary to the hypothesized positive relationship where an increase in the population/physician ratio was expected to result in an increase in the number of physicians, physicians tended to avoid locating in communities where the demand ratio was high. One possible explanation of this tendency could have been a desire on the part of physicians to avoid those areas where demand would have been high enough to limit the amount of leisure time available to them. Faced with a decision between a higher potential income coupled with long hours or a lesser potential income and more leisure time, the physician seemed to have opted for more leisure time. This finding would seem to cast some doubt on the "physician as income-maximizer" hypothesis of earlier research efforts.

The second hypothesis questioned by the analysis was the positive relationship between degree of urbanization and the number of physicians who located in an area. The sign and magnitude of the beta coefficient indicated that urbanization had a small and negative influence on the number of physicians who located

in an area. Given the low significance level of the beta coefficient, a second analysis of the data set was made regressing the urbanization variable against the number of physicians who located. In this case, a positive and significant relationship was revealed (Table 2).

The final hypothesized relationship rejected by the analysis was the importance of access to hometown as an attracting factor. The positive beta coefficient of the variable indicated that as the average number of miles between place of practice and hometowns increased, the number of physicians who located there also increased. It should be noted, however, that those physicians practicing in Oklahoma who were also born in Oklahoma were practicing within an average of 50 miles of their hometowns.

Overall, the model explained 48 percent of the variations of the dependent variable about the mean. While not an overwhelming statistic, it was of respectable magnitude vis-a-vis previous research models. That 52 percent of the variations remained unexplained gave credance to the argument made in the more general migration literature (Salkin, 1973) that available social indicators fail to measure the intangible or psychic considerations inherent in a location decision.

The Difference Model. The second objective of this study was to determine whether or not the factors affecting location decisions of different types of physicians differed significantly. Had specialists located in significantly different types of environments than had non-specialists? Had the non-Oklahoma trained physician favored a specific type of environment? In order to answer these types of questions, chi-square analysis was used to examine the relationship between physician type as defined by type of practice, state of birth, state of training, age and date of location and the type of environment chosen. Table 3 summarizes the results of this analysis.

In general, non-specialists, Oklahoma-born and Oklahoma-trained physicians all tended to locate in larger numbers than expected in the same type of

environments. These groups of physicians tended to favor locations characterized by high demand ratios of populations to physicians, with largely rural populations, with easy access to familiar hometown and medical school environments and lacking immediate access to either types of considered hospital facilities. The professional make-up of a county's population was related only to type of practice where non-specialists showed a greater than expected willingness to locate in counties with largely non-professional populations.

The state's practicing specialists and both those physicians born or trained out-of-state, on the other hand, favored a different sort of location. These types of physicians located in larger numbers than expected in those locations with the lowest demand ratios, with largely urban populations, lacking access to familiar environments and with immediate access to both types of considered hospital facilities. Specialists, alone, tended to locate in larger than expected numbers in the state's more professionally-oriented counties.

When the relationship between type of location and age of the physicians at the time of the location decision was examined, no significant relationship was found to exist between age and a location's demand ratio, level of urbanization or access to either medical school or major medical center facilities. It was found, however, that the younger physicians unexpectedly tended to locate in counties with largely non-professional populations and with easy access to both local hospital facilities and hometowns. The older physicians showed a tendency to locate in counties with professional populations and at farther distances from hometowns and local hospital facilities than expected.

The type of locations favored by physicians has changed over the years as the analysis of location year and type of location indicated. The trend has been in favor of the lower demand locations with largely urban, professional

populations at the expense of the areas with larger demands for physician services and rural, non-professional populations. When access to medical facilities was considered, locations with local hospitals had begun to attract a larger than expected proportion of the total physician population. The same was true of those locations with easy access to one of the state's two major medical centers. There was no relationship between year of location and access to either hometowns or medical schools.

IMPLICATIONS

Given these results, the next question asked was, What are the implications of these findings for Oklahoma and other states with similar patterns of physician location? What might the distribution of physicians look like if revealed trends continue? What sorts of programs might bring about a more equitable distribution of physicians?

Physicians in Oklahoma have become increasingly concentrated in the state's more urban counties over the year. The results of the chi-square analysis of type of locations favored over the years seem to indicate that if present trends continue, physicians will continue to become more areally concentrated. Physicians were shown to be increasingly attracted to those locations with low demand ratios, high levels of urbanization and largely professional populations. Since rural Oklahoma counties are by definition characterized by low levels of urbanization and can be shown to be high demand areas with small professional populations, the failure of rural counties to attract physicians seems bound to continue unless measures are taken to make rural practice more attractive.

Two characteristics of rural practice which did not attract physicians were the high demand ratios and lack of access to major medical centers. Before rural areas can attract physicians, demand ratios must be lowered so that

assurances can be made that a new physician will have adequate leisure time. One way to provide such assurances would be for rural communities to recruit teams of physicians interested in group practice and/or guarantee to provide full-time physicians' assistants to a locating physician. Either scheme might reduce the perceived demand on a physician's time enough to induce a physician to locate in a rural community.

In order to increase access to major medical centers and alievate what feelings of professional isolation a rural practice might generate, the establishment of formal ties between the state's major medical centers and rural centers might be considered. Examples of the types of ties to be considered might include formal consultation arrangements with center specialists, use of center facilities or use of talk-back video hook-ups such as those used in test programs to provide health services to isolated parts of the Southwest.

Previous researchers have argued that physicians have avoided rural areas because of a lack of familiarity with rural living and a misunderstanding of the nature of a rural practice. This study indicated that access to familiar environments was a factor in the location decisions of some physicians. On this basis, it could be argued that programs aimed at increasing the physician population's familiarity with rural environments and rural practice might be an effective means of increasing rural physician numbers.

The most direct type of program would be for areas lacking a physician to encourage local residents with an interest in medicine to attend medical school and return to the area to practice. Perhaps the most direct and proven effective means of encouragement that could be offered the potential medical student would be financial support and differential medical school admission requirements. Given the increasing cost of a medical education, community scholarship programs, when tied to local service committments, would provide

rural areas with a sure means of securing the physicians they need. A second means of increasing the number of physicians from and in rural areas would be for the state supported medical schools to admit students committed to practice in rural areas even though their academic credentials might be slightly less than those of students normally admitted. An evaluation of a differential admissions policy of this sort in effect in Illinois since 1948 showed it to be an effective and successful means of increasing the number of physicians practicing in rural areas (Mattson, et.al., 1973).

Familiarizing the physician with an urban background with the nature of rural practice could be the aim of another sort of program. Programs which might accomplish this end could include the establishment of formal internships and/or residencies with rural hospitals or programs of the sort used by the University of Minnesota's Medical School to introduce students to rural/small community practice. In their Rural Physicians' Associate program, fourth year medical students spend one year with practicing rural physicians in the state. For their year effort, they receive both payment and academic credit (Verby and Connolly, 1972).

Perhaps the best contribution of this study, however, lies not in the impact of factor manipulation on physician numbers but rather in the analysis of the types of locations chosen by types of physicians. Besides adding to the understanding of the dynamics of physician location decisions, knowing what sort of physician was most attracted to a given type of environment would be most important to those communities who, lacking physicians, are attempting to recruit doctors. With the knowledge of what sort of physician has tended to locate in communities of a certain size and character, recruitment efforts of a given community might be directed at the specific physician population most likely to locate there. In this way, the community's chances of recruitment success might be increased.

In general, the need for more physicians exists in the rural counties of Oklahoma and many other states. Results indicate that these areas would do well to look for young state-born and trained physicians whose practices fall into the non-specialist category.

By working with the existing trends perhaps the lack of physical access to physician services which characterizes much of Oklahoma might become less of a problem.

TABLE 1

FACTORS INFLUENCING PHYSICIAN LOCATION DECISIONS[a/]

Variable	(i)
Constant	1.177 (2.37)*
Population/Physician Ratio (PPR)	-0.123 (-1.90)**
Percent Urban Population (PURB)	-0.009 (-0.46)
Percent Professional (PPROF)	0.615 (7.29)*
Average No. Miles Home (MHOM)	0.042 (2.63)*
Average No. Miles to Medical School (MMSC)	-0.030 (-1.59)***
Average No. Miles to Hospital (MHOS)	-0.015 (-0.48)
Average No. Miles to Major Medical Center (MMMC)	-0.319 (-14.64)*
R^2	.48
DF	571
F	75.76
d	1.35

Note: The values in parentheses below the predicted coefficients of the independent variables are the computed t-values for each variable.

a/ All variables have been transformed to logarithmic form.
* Significantly different from zero at the 1% level.
** Significantly different from zero at the 5% level.
*** Significantly different from zero at the 11% level.

TABLE 2

RESULTS OF THE SIMPLE REGRESSION MODEL UTILIZING ONLY PURB[a/]

Variable	(2)
Constant	-0.004 (-0.052)
Percent Urban Population (PURB)	0.159 (7.003)*
R^2	.078
DF	577
F	49.05
d	.85

Note: The value in parentheses below the predicted coefficient of the independent variable is the computed t-value for the variable.

a/ The variable was transformed to logarithmic form.

* Significantly different from zero at the 1% level.

Table 3

CHI-SQUARE RESULTS[a]

Type of Physician	Type of Environment
Non-Specialist Oklahoma-born Oklahoma trained	High Demand Rations, Rural Populations, Easy Hometown Access, Easy Med School Access, Lacking Hospital Access, Lacking Reg. Center Access
Specialist Born out-of-state Trained out-of-state	Low Demand Ratios, Urban Populations, Lacking Hometown Access, Lacking Med. School Access, Easy Hospital Access, Easy Reg. Center Access
Younger Physicians	Non-Professional Populations, Easy Hometown Access, Easy Hospital Access
Older Physicians	Professional Populations, Lacking Hometown Access, Lacking Hospital Access
Early Locaters (Pre-1940)	Low Demand Ratios, Rural Populations, Non-Professional Populations, Lacking Hospital Access, Lacking Reg. Center Access
Recent Locators (1960-1973)	Low Demand Ratios, Urban Populations, Professional Populations, Easy Hospital Access, Easy Reg. Center Access

[a]Specific chi-square results were too lengthy to present; specifics available from the author on request.

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