PHYSICIAN LOCATION DECISIONS IN OKLAHOMA:

A STUDY IN MEDICAL GEOGRAPHY

By

MARCIA HUDDLESTON SALKIN

Bachelor of Arts

University of California-Davis

Davis, California

1973

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
December, 1976

PHYSICIAN LOCATION DECISIONS IN OKLAHOMA:

A STUDY IN MEDICAL GEOGRAPHY

Thesis Approved:

K. D. Harries

Robert E. Norris

Richard D. Heaton

Norman N Durham

Dean of Graduate College

PREFACE

This study dealt with the location decisions of Oklahoma physicians. Its primary objective was to determine those factors which influenced physicians to locate their practices where they did and to explore the nature of the relationships between those factors and the attractiveness of a location to different types of physicians.

I want to thank my major adviser, Dr. Keith D. Harris, for his guidance and assistance throughout the duration of this project despite a hectic schedule and a sometimes incoherent advisee. Appreciation is also due to another committee member, Dr. Robert E. Norris. His helpful suggestions on content and willingness to bear with my split infinitives and embedded clauses made this study a better product. For the early guidance of Dr. Richard Hecock, I am also grateful.

The methodological problems of a thesis can be many and this thesis had its share. A special thanks is due to Miss Betty J. Rogers and the staff of the Oklahoma State Board of Medical Examiners. Their willingness to let me work with their records was invaluable. Without their cooperation, this thesis would not have been possible. Dr. Paul Hagle and Dr. Richard E. Just also helped with methodological questions and problems which arose. To each of them, I extend my thanks.

Thanks are also due to Mrs. Marilyn Wheeler for her assistance in typing this final copy.

I want to also thank my parents, Harry and Donna Huddleston, and my friends who kept asking when the thesis was going to be done. Their encouragement kept me going. Finally, I want to thank my best friend, my husband, Michael. He talked me out of fits of despair and kept me going with patience and encouragement. To Michael, I say thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Background

Perhaps one of the most persistent concerns of humans has been the state of their health. Not only does people's health influence how they physically feel but it also effects how well they are able to function within a societal framework. Health influences their ability to interact with others and consequently their employability, income, satisfaction with life, etc. Given the tremendous influence that health has on all other aspects of life, concern is obviously justifiable. It was out of this concern that the medical profession as we know it today evolved.

Americans have traditionally considered themselves to be one of the best medically cared-for populations in the world, and they have been willing to pay for that care. Expenditures for health care and related functions have grown each year such that in 1972 the United States spent some $70 billion with $22 billion (31%) of that total coming from the federal budget (Kennedy, 1972). Expenditures were estimated to continue to grow until in 1975 the total national expenditure for health care was expected to reach some $100 billion (Kennedy, 1972).

Yet, despite tremendous investment, it became apparent during the 1960's that in terms of the available measures, (e.g., mortality rates,

live birth rates, disease rate, etc.), the United States lagged behind many less economically and technologically advanced countries who spend less for health care both in absolute terms and as a percent of gross national product (U. S. Department of Health, Education and Welfare, 1967; Kennedy, 1972). When these measures were calculated for various subpopulations, especially the rural and/or poor populations, the comparison with other nations was even less favorable (U. S. Department of Health, Education and Welfare, 1967; Doherty, 1970).

At the same time that the public was becoming aware of this lag, consumer dissatisfaction with the health care delivery system was growing as each individual was finding it increasingly difficult to obtain personal health care. This difficulty was the result of numerous conditions. Skyrocketing health care costs were rapidly putting care beyond the financial reach of an ever increasing portion of the population. Increased specialization within the medical profession made it increasingly difficult to know who to go to for care or to find a physician whose practice was aimed at primary care and who would accept new patients. Rural communities found it impossible at times to attract physicians to replace retiring practitioners; residents, as a result of this decreased physical accessibility, were forced to either forego care or travel long distances for care.

In addition to, or perhaps as the result of, growing dissatisfaction there was the changing philosophy of the medical profession in the 1960's that stressed comprehensive care as opposed to the symptomatic care common to the American health care system. In comprehensive care, the stress was on

> . . . the total care given to the patients as a person within his family and community; it recommended the unity of preventive and curative care, rendered by the same practitioner and at the same location; and it advised due attention to physical as well as emotional problems that affect the well-being of patients. . . (Robertson et al., 1974, p. 13).

In short, it was becoming readily apparent that given new philosophies of health care and existing conditions within the delivery system, an ever-increasing portion of the population was losing access to necessary medical care. Given that access is both of a financial and physical nature, the populations suffering the most from decreasing access were the poor and the rural dwellers (Shannon and Dever, 1974, pp. 52-59). The poor lacked the financial resources to seek needed medical care. Rural-dwellers began to discover that their small communities could no longer successfully compete with urban centers for the services of new physicians; as a result, their physical access was declining as they had to travel to larger centers for needed attention.

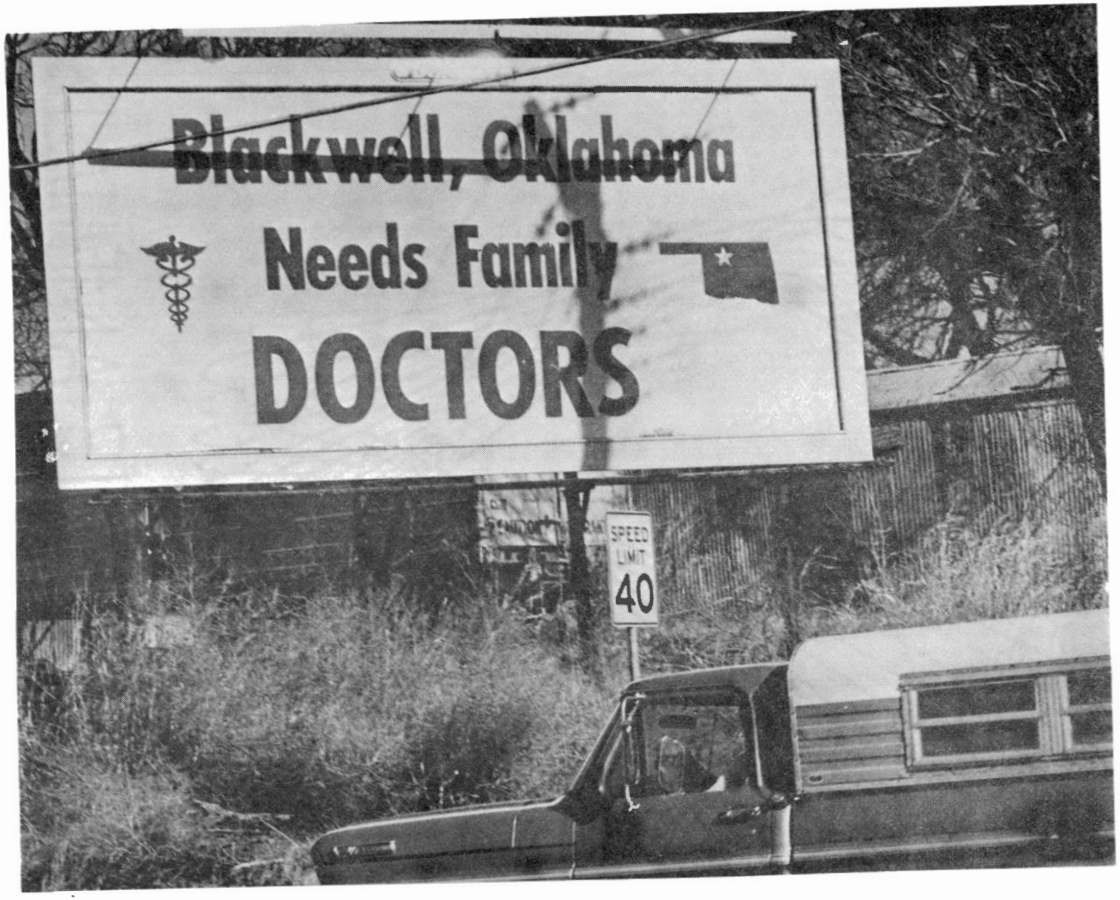
Statement of the General Problem Area

As a result of growing concern over the relatively poor showing of the United States in world-wide health status measures and decreasing public access to services necessary to good health, new and existing social legislation--the Hill-Burton Act, the amended Federal Social Security Act, the Economic Opportunity Act--was looked to as a possible solution. Programs like Medicaid, Medicare, Medical, etc. were designed to increase accessibility to health care services by providing those segments of the population without the financial means to obtain medical attention with the care they might otherwise

be unable to afford. But while these programs did increase people's potential financial accessibility to medical services, they neglected a key consideration. Careful consideration showed financial access to be only one aspect of the accessibility problem. Whether or not an individual can afford to pay for necessary care is of small importance if the individual does not have physical access to the necessary professionals and facilities. Lack of physical access can also increase the cost of medical attention in terms of time and travel needed to obtain attention. This increased cost can conceivably put medical care outside the reach of even those individuals who, if better located, could afford care.

That lack of physical access was a real problem was not readily recognized by the general public. In fact, until a number of small rural communities, hard hit by the maldistribution of medical services, began to advertise their needs in the media (Figure 1), the situation had received little attention outside the professional literature.

While medical care is provided by numerous professions within a varied institutional framework, concern for improving an individual's physical access to medical services has prompted research primarily into factors which prompt physicians to locate as they do. Physician location decisions are key considerations in the accessibility question because of the major role which the physician plays in any individual's attempt at gaining access to the whole range of medical services. Doctors are the primary source of medical care today and will continue to be so in the foreseeable future (Glasser, 1972, p. 33). It is from physicians that professional medical advice is first sought; it is through them that hospital admission and further care is possible.



Copyright, 1976, The Oklahoma Publishing Co., January 15, Oklahoma City Times.

Figure 1. A Need to Advertise

This key role played by physicians, therefore, makes them the natural focus of studies concerned with physical access to medical services and care. If it is somehow possible to alter the distribution of primary care physicans relative to those areas which lack them (i.e., rural communities), physical access will improve and perhaps with it the nation's health status.

But before we can expect to develop programs which will successfully deal with improving people's physical accessibility through encouraging physicians to locate where they are most needed, we must first understand what factors influence their decisions to locate their practices. What community characteristics are attractive to new physicians? What do they look for in a community? It is these questions that this study tries to answer. For once we understand their motivation, only then can we design legislation capable of improving the nation's health status through a redistribution of physician services.

Literature Review

The literature dealing with physician location decisions comes from a number of fields--economics, sociology, medical education, public health, geography--and covers a broad time span, the earliest work having been done in the thirties. There have been two basic approaches. The first examines the physician's decision in choosing a small town-rural practice as opposed to an urban practice. The second approach considers the location decision from the standpoint of community characteristics acting as constraints on the distribution of physicians. Within both approaches, three types of factors

affecting location decisions have been identified; they are: (1) physician background, (2) professional considerations, and (3) community characteristics.

The "Rural-Urban" Decision Literature

Researchers involved in work using the first approach have focused on the physician as an individual with a location decision to make and a set of expectations to be met. They have tended to deal with the location decision as a choice between either a small town-rural practice or an urban one. What is it that influences a doctor to choose one type of location over the other? In seeking the answer to this question, the method commonly used has been to survey by mailed questionnaires a sample population of physicians in order to ascertain what factors had most influenced each of them in locating their practices. In his early work, Dinkel (1946), a sociologist, departed somewhat from popular thinking of the time by recognizing the importance of social factors as well as economic factors in a physician's decision to locate. As the result of his questionnaire of a random sample of 375 practicing physicians in Indiana, Dinkel was able to show that both urban and rural physicians were drawn to attractive towns with good hospital facilities, good churches and good schools. The rural physicians, however, also cited the lack of doctors and moderate pace of life which characterized their selected communities as key attracting factors. The urban physician, on the other hand, was influenced by friends and relatives, the presence of an older physician to join in practice and the chance to set up practice in

his hometown. Dinkel concluded, therefore, that rural communities anxious to attract physicians should encourage local students to enter medical school, obtain or improve hospital facilities, health programs and specialty clinics and stress the environmental amenities of the community in its recruitment efforts.

While some research on physician location decisions continued to be done during the forties, fifties and early sixties (Nelson, 1942; Terris, 1956; Fahs and Peterson, 1968), none utilized the physician-oriented approach. It wasn't until the late sixties and early seventies that the methodology was again successfully used. By this time, the question of whether there was a shortage of physicians or whether the apparent shortage was a matter of distribution was of considerable importance especially as it pertained to rural areas. Despite the relative need of rural populations for medical attention (Shannon and Dever, 1974), rural areas were finding it increasingly difficult to attract physicians to replace retiring prcctitioners; as a result, the population to physician ratio was increasing and concern was growing as to the possible impact this increase might have on future rural health status (Parker and Tuxill, 1967, p. 327). Research into factors affecting the decision to locate in rural areas by doctors had become crucial again.

One of the first pieces to appear was a paper by Parker and Tuxill (1967), both health care professionals. In "The Attitude of Physicians Toward Small-Community Practice", a stratified random sample of physicians within an eleven county area of western New York state was mailed a questionnaire designed to determine their attitudes towards small community practice and the factors motivating them to be

for or against it. Each doctor was asked to rate the importance of listed factors influencing or deterring physicians, in general, to locate in small communities. Each was then asked to rate the importance of listed factors in influencing him to locate.

Parker and Tuxill were able to show that both the urban and rural physicians agreed on the three most important factors influencing physicians, in general, to choose small town practice; those factors were: (1) the ideal of small community living, (2) the prospect of building a busy practice early and (3) the influence of spouse. The factor considered the key deterrent in general by urban physicians was a preference for large community living, while the rural physician felt that a lack of understanding of the nature of small community practice was a major deterrent.

When asked what had strongly influenced their own location decisions, the factor which influenced the largest percentage of urban physicians was the idea of living in a large community followed by the influence of community of origin, the desire to be in a specialty generally considered incompatible with small town practice and the availability of clinical support from a large medical center. The factors seen as actually influencing the rural physician were two: (1) the idea of small town living and (2) the possibility of developing a busy practice early.

Parker and Tuxill concluded that the location decision of the urban physician was a positive one; that is, his decision was a decision for urban practice rather than one against rural practice. They also commented on the implied importance of the size of the community of origin as a determinant in the decision to locate in either a

small town or urban community noting that 60.4 percent of small town practitioners came from small towns and 73 percent of the urban physicians came from larger communities.

Two later studies (Taylor et al., 1973; Liccione and McAlister, 1974) also utilized the questionnaire approach but rather than questioning established physicians, these studies focused on medical student attitudes as a "monitor of changing perspectives of rural health care" (Taylor et al., 1973, p. 886). The earlier study by Taylor et al. surveyed some two hundred medical students and their wives from predominantly rural states and attempted to show the importance of two personal background factors and one professional consideration factor. In terms of physician background factors, the student's community of origin was once again shown to correlate with location plans (i.e., students with rural backgrounds tended to choose rural practice more often then urban-based students). The authors also noted that the "effect of his wife's background was particularly evident among those students planning to locate in rural communities; this influence was not salient among those planning on urban practices" (Taylor et al., 1973, p. 885). The second background factor considered--medical school curriculum exposure to family medicine--was not found to be a significant influence in the decision for rural practice. The final factor considered what the effect plans for specialization might have on location; a strong relationship was found to exist between interest in family practice and plans for a rural practice.

Noting the role attributed to hometown influences in a variety of issues, Liccione and McAllister (1974) attempted to substantiate its influence on the attitude of first year medical students towards

rural practice. They, however, went one step further than previous studies in that they attempted to measure the mean ego involvement in the decision of both those respondents in favor and opposed to rural practice. They, too, found that students from rural backgrounds were significantly more likely to take a position pro-rural medical practice, as compared to students from urban areas. In addition, they found no significant difference in their mean ego involvement scores which in all cases were very low. They concluded:

> . . . from a career choice point of view, the extremely low ego involvement in the medical practice issue displayed by rural and urban students may be the most significant finding. Their differences not withstanding, the students' low ego involvement indicates their attitudes on the medical practice issue are all relatively unimportant in their scheme of things and . . . extremely susceptible to change during their medical education. . . (Liccione and McAllister, 1974, p. 450).

In summary, these studies have all tended to stress the influence of personal background and professional consideration factors rather than community characteristics in the location decision. In light of this, perhaps it is not too surprising that the authors came to some common conclusions despite slightly different methodologies. First, all cite the tendency for rural doctors to have grown up in rural communities just as most urban physicians had grown up in urban communities. It was concluded that community of origin was a key factor in the physician location decision. Two, the importance of the physician's chosen specialty was also noted for the limitations that it placed on possible practice sites. The more specialized the specialty the more likely the decision for urban practice.

Unlike the literature utilizing the community constraint approach to be discussed next, the physician portrayed here was not

the purely economic man who seeks first to maximize income. Rather he was an individual with a mental image of the type of environment within which he wished to live and work. This mental image was the result of past experiences and it would seem reasonable to hypothesize that this image was similar to what the physician was already familiar with given the general tendency of humans to avoid the unknown. He was not oblivious, however, to the economic consideration of living as indicated by the importance attached to choice of specialty (Taylor et al., 1973; Parker and Tuxill, 1967), ability to join an established practice (Dinkel, 1946), and the ability to build a busy practice early (Parker and Tuxill, 1967).

The Community Constraint Literature

At the same time that research was being done on the choice between urban and rural practice, research on physician location models was also being done utilizing a second approach. This work considered the location decision from the standpoint of community characteristics as constraints on the distribution of physicians. The argument advanced was that in order for a community to be able to support a physician and/or attract one, it must have certain economic and demographic characteristics. Out of this approach two schools of thought evolved. An earlier theory contended that an area's income level was the single most important factor in predicting the number of physicians serving that area's population; later works argued that population size was the most important variable. A survey of the major works utilizing this approach will illustrate both arguments.

Despite earlier works which cited population and percent of the population with taxable income (Leland, 1936) and median family incomes (Fein, 1954) as key factors in the decision to locate, the work done in the early and mid-sixties by Rimlinger and Steele (1963, 1965) would appear to be the first to rigorously deal with the question of why physicians locate where they do. In their early work these two economists argued that a physician, like any other individual, would locate in such a way as to maximize income. Given the desire to maximize income, the authors hypothesized that doctors would locate in those areas with higher incomes. Higher income areas were seen as being able to support a larger number of doctors than might be expected since: (1) the demand for medical services increases with income; and (2) the fees charged by physicians vary with the patients ability to pay.

Rimlinger and Steele were able to present data from the 1950-1959 period supporting their contentions. They concluded by pointing out that policies aimed at increasing the supply of physicians as a means of achieving a more equal distribution would be an ineffective solution since higher income areas would continue to absorb more than their fair share of physicians.

Two years later, the same authors (Steele and Rimlinger, 1965) examined the dynamics of physician location decisions by developing a regression model which attempted to explain changes in the number of physicians in terms of the average rate of population change and average rate of change of per capita incomes. Developing their theoretical model in much the same way as they had in their earlier

work, Steele and Rimlinger proposed that increases in both an area's income and population would trigger an increase in the number of physicians. Once again using 1950-1959 data for the United States, they found population change to have the greatest effect on the change in the number of physicians with income a less important variable than expected.

Marden (1966), a sociologist, used multiple correlation analysis to look at the number of physicians in metropolitan areas in relation to the areas' population, population composition and range of available medical facilities. Under the heading of population composition were included age, education and race variables.

Looking at both the total number of physicians and the number of specialists alone for the nation, Marden was able to conclude that:

(1) the relationship bewteen the number of physicians and population was "a perfect linear relationship" (Marden, 1966 , p. 295);

(2) the number of general practitioners was more closely associated with age and race variables than was the number of specialists;

(3) the number of specialists was best explained by the education and facility variables.

Perhaps the classic example of the community constraint literature is a paper by Rushing and Wade (1973). In "Community-Structure Constraints on Distribution of Physicians", the authors used regression analysis to compare the county distribution of physicians in the United States with that of other professionals and technicians including

dentists, lawyers, architects, veterinarians, etc. They argued that the external economies that attract the type of organization that employs many professionals were also influential in the location decisions of independent professionals including doctors. Given a striking resemblance between the simple regression lines of physicians and other professionals, Rushing and Wade concluded that the "maldistribution" of physicians "appears to be part of a more general process that influences the distribution of professionally and technically trained persons in general and not just physicians" (Rushing and Wade, 1973, p. 286). In light of their findings, it was proposed that programs aimed at modifying this distribution by increasing the number of physicians were unlikely to affect existing trends in that the programs failed to focus on the community structures underlying the distribution. It was the opinion of the authors that organizational changes in the medical delivery system based on the establishment of intercommunity networks through which citizens in "low-manpower communities could be referred to appropriate physicians in high-manpower communities on a systematic basis" would have the greatest chance of modifying the maldistribution of physicians (Rushing and Wade, 1973, p. 297).

Most recently, physician location models have been the subject of a paper by geographer Philip Lankford (1974). Arguing that previous work done had failed to seriously consider the inherent spatial aspect of the topic, he presented the results of a number of simple regression models. Lankford, like Marden, was able to conclude that population was the single most important explanatory variable of physician location while race, age and income were only minor factors.

To date most of the work done on physician location decisions utilizing the community constraint approach has made use of state or regional level data and/or relatively simple methodology. With the exception of Rushing and Wade (1974) and Lankford (1974), no authors have attempted to develop a model utilizing smaller geographical data units. With the exception of Steele and Rimlinger's (1965) work, no attempts have been made to develop something more sophisticated than a one variable model of physician location factors.

Despite these shortcomings, the authors who have utilized this approach have managed to point out the important role that community characteristics appear to play in the location decisions of physicians. They have shown that the physician like any other professional or organization that employs professionals, was attracted to those communities which offer the physician certain external economies (i. e., population, income, urban amenities) that assured them of a need for their services and the environment within which to enjoy what leisure time they might have. Within the total set of communities, therefore, there existed only a subset of communities which met all needs. In this way, community structure acted as a constraint within the location decision.

Problem Specification and Justification

With this background in mind, this thesis was designed to re-examine the factors affecting physician location from a slightly different viewpoint. First, rather than viewing the location decision mainly as an attempt to maximize income, it was hypothesized that income acts only as a constraint. Given the subset of environments

which meet minimum expectations of potential income, it was hypothesized that physicians located in communities which came closest to their mental pictures of the ideal community within which to work and live. Thus, they maximized environments rather than income. Second, unlike previous work which tended to stress either individual physican characteristics and motivations or community characteristics, this study attempted to examine location decisions within a behavioral framework. Location decisions were viewed as individual decisions made on the basis of personal characteristics interacting with potential community characteristics. As such, the possibility that different types of physicians were attracted to different types of locations as the result of differing professional and personal needs was acknowledged. Third, rather than trying to describe the pattern of physicians in 1970 in terms of 1970 explanatory variables, it was hypothesized that the decision of each physician was made on the basis of values existing when the actual location decision was made. In other words, the physician who located in Pawhuska, Oklahoma, in 1940 did so on the basis of his knowledge of demand and environment which existed in 1940.

Because of its inherently spatial nature, the problem of developing a working model of physician location factors is a natural area for geographers. But a quick review of the literature showed that the field has been dominated by health care professionals, sociologists, and economists. Research outside geography has been basically aspatial in nature or has ignored the spatial implications.

It was not until the late sixties and early seventies and the work of Morrill and Earickson (1966), Pyle (1971), de Vise (1972; 1973),

Lankford (1974) and Shannon and Dever (1974) that geographers became interested in the spatial aspects of health care planning, and specifically, physician location decisions. This work has, for the most part, been qualitative in nature. It was the aim of this thesis to develop a more theoretically sophisticated geographical model of physician location factors.

Objectives and Procedures

The overall objective of this thesis was to analyze the location decisions of physicians involved in direct patient care in Oklahoma. Specifically, the objectives were: (1) to determine those factors which influenced physicians, in general, to locate their practices where they did; (2) to examine the possibility that the types of locations selected by different types of physicians differed significantly; and (3) to examine the impact and policy implications of the results for Oklahoma.

The following procedure was used to achieve the above objectives. Chapter II is composed of two sections. The first section outlines the hypothesized model of factors affecting the location decisions of physicians. The rationale behind the selection of each factor is presented and the nature of the relationship of each factor to location attractiveness specified. The second section of the chapter outlines the methodology used in the analysis of the data.

Chapter III documents the problem of decreasing physical access to medical services in the study area. It provides a description of historical and present day distributions of physicians in Oklahoma.

Chapter IV presents the results of the tests of the validity of the hypothesized location factors.

Chapter V presents the results of the analysis of the relationships that exist between types of physicians and types of locations selected.

Chapter VI summarizes the results of the study and discusses the implications of those results for Oklahoma. Suggestions for further research are also outlined.

CHAPTER II

A MODEL OF PHYSICIAN LOCATION DECISIONS

Theoretical Considerations

Model Development

Physicians, like all other individuals, have either conscious or unconscious mental images of the types of environments within which they would most like to live and work. It is from these mental images that sets of minimum location criteria are derived. It is these sets of criteria which the physicians then try to maximize in the selection of places to live. When it comes time to initially locate or to relocate a practice, it follows that the setting which comes closest to fulfilling the ideal environment based on the criteria will be the chosen location. The important question then is what factors make up that set of minimum criteria?

For purposes of this paper, it was assumed that an area's income and therefore the physician's potential income, rather than being the major determining location factor as has traditionally been assumed (Steele and Rimlinger, 1965; Elesh and Schollaert, 1972) was only a very general consideration in the location decision. Unlike other professionals (e.g. dentists, lawyers, accountants, etc.) and even services not so specialized which require threshold populations of anywhere from 425 to 1300 individuals in order to be economically

feasible, the general practitioner's population threshold was estimated to be as low as 380 people (Berry and Garrison, 1958). Given the uneven spatial distribution of physicians and the fact that most county populations today exceed 380, the adequacy of income as an explanatory variable seemed questionable. In fact, some of the very studies that have claimed income as a key factor in the location decisions have had to conclude that it was of very little or no importance (Steele and Rimlinger, 1965; Elesh and Schollaert, 1972). Their results led Elesh and Schollaert to conclude that a physician really had no economic location constraints. Given the ubiquitous nature of the demand for basic medical services and the lack of institutional constraints for all but the specialist, it could be argued that physicians could eke out a living in all but the most sparsely populated areas. In order for them to do so, however, they might have to work more hours and travel more often than their cohorts in more densely populated areas. With this basic assumption, the location decision then became one of maximizing personal and professional location criteria.

Considering the personal environmental factors which influenced the physician, the task of choosing those factors which might be attractive was difficult because it dealt with individual preferences which were unlikely to uniform throughout the physician population. It seemed reasonable, however, to hypothesize that physicians would tend to favor areas which (1) were similar to those with which they were familiar, and (2) offered opportunities for companionship entertainment, and leisure activities of the type to which they were accustomed.

That familiar environments would be attractive to the new physician not only made intuitive sense but has been documented in the literature. Gould and White (1968) have shown that people's perceptions of residential desirability were composed of two parts, a national viewpoint shared by most people in the country and a local "dome" of preference indicating that many people preferred the local area that they knew best and within which they felt most comfortable. This phenomenon was probably the result of what Hoover called man's attempt to "minimize the incertainties and risks" of moving by "choosing places about which they have ... information and where they will find relatives, friends and others who will help them get a foothold" (1975, p.179).

Since familiar environments for physicians were either the areas within which they grew up or where they underwent medical training, it was hypothesized that physicians would tend to locate in or near either their hometowns or places of advanced training. This tendency has been noted previously in the research done by the medical educators (Parker and Tuxill, 1967; Liccione and McAllister, 1974; Fein, 1954).

Besides assuming that physicians were drawn to familiar environments, it was also hypothesized that they also considered the opportunities offered by a community for (1) the cultural and recreational activities to which they have become accustomed, and (2) making friends with people of similar professional background. The environment which would come closest to fulfilling these leisure needs for most physicians would have been an urban community. An urban community by virtue of its population concentration could support a

larger range of services and facilities than smaller rural communities. As such, it offered its residents a wider range of opportunities for leisure activities. Since most medical schools are located in urban communities, even the rural-born physician had had the opportunity to become accustomed to the amenities of urban living. At the same time, given the tendency for organizations that employ many professionals to be located in urban centers (Rushing and Wade, 1973), the chances that companionship needs would be met in an urban environment would also be high. This, however, was not to imply that only in urban areas could opportunities for companionship be found, as examples of non-urban environments with high professional population percentages do exist (e.g. Los Alamos, New Mexico). In light of this discussion and evidence of the apparent avoidance of rural practice by recent medical school graduates in favor of urban location (Shannon and Dever, 1973, p. 54), it seemed logical to hypothesize that urban environments and sizeable professional populations were attractive factors to physicians.

Turning to professional location decisions, it will be recalled from Chapter I that previous research has considered two general types of professional location factors: (1) perceived demand for medical services (e.g. population, area income, etc.); and (2) accessibility to other supportive medical facilities (e.g. hospitals, consultants, etc.). For purposes of this research, perceived demand and access were accepted as legitimate considerations. After all, physicians while not purely economic men do have some concern for their economic well-being. However, as a measure of demand, it was hypothesized that a physician considered not only the population size

of a community but also the number of physicians already practicing in the community. Obviously, new physicians would not locate in a community where the population to physician ratio was already low enough to raise serious doubts as to their ability to attract a clientele.

In the case of accessibility to supportive facilities, the attraction of hospital facilities was considered. It was hypothesized that the existence of local hospital facilities and the accessibility of a community to a major medical center were positive location factors. The attraction that hospitals have for physicians has been well documented (Williams and Uzzell, 1969; Hambleton, 1971). This attraction is understandable when the changes that have occurred in medical knowledge in recent year are considered. Since the turn of the century, research and the resulting advances in medical science have increased the physicians dependence upon hospitals and the special equipment and personnel that such institutions provide.

Finally, as was mentioned previously, rather than trying to describe the pattern of physicians that existed in 1973 in terms of 1973 values of explanatory variables as had been the typical approach in previous research, it was hypothesized that the decision of each physician was made on the basis of values existing when the actual location decision was made. Since physicians who located their practices in the early fifties, for example, had no exact knowledge of what their respective communities would be like in the future, their decisions to locate there were made on the basis of conditions existing when they located and their intuitions of what the future might hold for that community.

The Model

In summary, the view of the location decision was taken that the physician, lacking strong income and institutional constraints, located in order to satisfy both professional and environmental considerations. Specifically, physicians tended to locate:

1) in areas with high demand for physician services;
2) in urban environments which provided numerous recreational and leisure activities;
3) in communities which offered opportunities to make friends with people of similar professional backgrounds;
4) in or near their hometowns or places of medical training; and
5) in communities readily accessible to local hospitals and major medical centers.

As a result, it was hypothesized that the attractiveness of an area, as indicated by the number of physicians who located in that area, was a function of these factors. More formally stated:

$$NOPHY_{it} = f(A_{it}, B_{it}, C_{it}, D_{it}, E_{it}) \qquad (2.1)$$

Where: $NOPHY_{it}$ = the number of physicians who located in area i during time period t;

A_{it} = the degree of demand for physician services in area i during time period t;

B_{it} = the degree of urbanization as an indicator of the opportunity in area i for recreational activities during time period t;

C_{it} = the opportunities in time period t to make friends of similar professional background in area i;

D_{it} = the proximity of that area i to the locating physician's hometown and/or place of medical training;

E_{it} = the proximity of the area to local hospitals and major medical centers as they existed in time period t.

Furthermore, the possibility that the importance of each of these location factors varied with respect to the type of physician (e.g. specialty, age, etc.) considered was also acknowledged. It was hypothesized that although physicians, in general, were influenced in their location decisions by the same set of hypothesized factors, communities characterized by different degrees of demand, urban amenities, companionship opportunities, etc. might have attracted different types of physicians because of differing professional needs and/or personal preferences.

Methodology

The Study Area

In order to test the hypothesized model, the state of Oklahoma along with its 1973 population of physicians was chosen as the study area and study population, respectively. Oklahoma provided a good base for this type of study for two reasons. First, being a relatively small state with excellent records on physicians practicing in the state, it was possible to collect a fairly complete data set. Second, Oklahoma was and still is a predominantly rural, agricultural state. Almost half of the state's population in 1970 were rural dwellers. As such, it seemed appropriate that a study aimed at helping to maintain or

improve the physical access of rural dwellers to basic medical services make use of the state as a study area.

The Basic Data Set

For purposes of this study, a physician was defined as a licensed practicing holder of an M.D. degree whose practice involved direct patient care as defined and indicated in the American Medical Association's American Medical Directory. Not included were those physicians who were inactive (ie. retired, permanently disabled, temporarily not in practice or not active for other reasons), full-time hospital staff members, interns, residents, or those physicians whose time was primarily devoted to administration, medical teaching, medical research or other non-patient care (law, journalism, sales, insurance). From the 1973 American Medical Directory's listing of Oklahoma physicians, a listing of physicians meeting these specifications was compiled. For each of these physicians, the following information was assembled:

Type of Practice. Three types of practice were defined. They are nonspecialists, practicing specialists and board certified specialists. Nonspecialists were those physicians whose practices were limited to general practice, family practice, internal medicine, obstetrics, gynecology, pediatrics or general surgery. Practicing specialists were defined as those physicians who limited their practices to more specialized types of practice (See Table VIII in the Appendix for a complete listing of specialties included in this category). Board certified specialists were those physicians who had undergone

additional years of training and testing and who were certified as competent in specialized medical subfields by the appropriate American Specialty Board.

Place of Practice. The place of practice for any physician was that city indicated as the location of practice by that physician in the 1973 AMA American Medical Directory.

Date of Location in 1973 Place of Practice. The date at which a physician established his practice at its 1973 location was the year indicated in the Oklahoma State Board of Medical Examiners' records as the time of location in that community.

Place of Medical Training. The place of medical training was that city within which the physician indicated he or she attended medical school as listed in the 1973 American Medical Directory.

Year of Graduation From Medical School. The year of graduation from medical school was that year indicated in the physician's entry in the 1973 American Medical Directory.

Hometown. For lack of a better definition, hometown was defined as the city indicated by the physician as place of birth on his or her application for state licensing.

Date of Birth. The year of birth indicated by the physician in the 1973 American Medical Directory was defined as date of birth.

Location of the Nearest Hospital at Time of Location. A hospital was defined as any hospital listed and/or accreditied by the American Medical Association or the American Hospital Association

in their periodic listings of U.S. hospitals. The nearest hospital location was that city closest to the place of practice that had a hospital meeting this definition in the year indicated as the date of location.

Location of the Nearest Instate Major Medical Center. A major medical center was defined as any city within which a hospital or group of hospitals provided the most up-to-date facilities, equipment and personnel within the study area. In the case of Oklahoma, Oklahoma City and Tulsa were determined to be the only two cities which met this requirement.

It was on the basis of this data set that all further analysis proceeded.

Definition and Justification of Variables

Moving from the level of theoretical model considerations to the operational definition of locational factors, the problem of providing the best measure of each of the factors under consideration arose. Basically, for each physician practicing in 1973, two type of measures were needed: 1) measures of the place of practice characteristics and 2) measures of the type of physician involved.

While comparison of individual physician characteristics from different time periods presented no problems, the necessity of comparing values of locational characteristics from widely disparate time periods compounded definitional difficulties. For example, how does one compare the impact of the urban population of a town in a 1930 location decision to the impact of urban population in a 1970 decision when growth or decline has changed the magnitude of the

figures and distorted any basis of comparison? For this reason, relative percentage values rather than absolute values of variables were used when appropriate.

Since any measure of a demographic variable, including population, urbanization, etc., was associated by definition with an areal unit, it was first necessary to specify the areal scale of any intended measure. It would have been best to use the community as the areal unit of observation for any and all demographic variables since it was the character of the community which attracted the physician. However, demographic data were unavailable for some communities and some dates of location. Since the county was the smallest areal unit for which measures were available for all factors and all time periods, county level data were used as surrogates for all community demographic variables in this effort.

At the same time, in order to associate demographic data for census years with the normally non-census year location decisions, it was necessary to use census data of the year closest to the date of the location decision. In other words, it was assumed that the best estimate of the 1936 population of a given county was that county's population as reported in the 1940 census. Likewise, the best available estimate of a county population in 1935 was the population of that county reported in the 1930 census.

The following measures of locational characteristics were calculated for each physician in the study population.

Demand. A physician's perception of demand was seen as a function of both the population of an area and the number of physicians

already in practice in that area. The obvious measure of this variable, therefore, was the ratio of county population to the number of physicians in practice in the county at the time the location decision was made. County populations were taken from the appropriate census publications while the number of physicians in practice was calculated from the American Medical Directory for the appropriate census year.

Urban Environment. At the county level, two measure of urbanization were available; these were percent of the population living in urban environments and percent of the total area in urban land uses as defined by the Census Bureau. For this study, percent of the population living in urban environments was chosen for this measure for two reasons. One, unlike percent of land in urban uses, percent of the population living in urban environments gave some indication of the degree of population concentration, a factor important in determining what urban functions may exist. Two, also unlike percent of land in urban uses, the percent of population living in urban environments was readily available at the county level for periods prior to the 1970 Census.

Opportunities for Companionship. In order to measure the opportunites for physicians to make friends of similar professional background, the Census Bureau's figures for total county population engaged in professions was utilized. Once again, a percentage figure was used in order to allow comparison of values for widely seperated time periods. The assumption inherent here was that as the percent of the population engaged in professions increased, the likelihood of meeting professionals in social situations also increased.

Proximity to Hometown and Place of Medical Training. Since it was argued that physicians tended to locate in or near their hometowns and/or place of advanced training as the result of familiarity, the straight line distance between location of practice and hometown and between practice and place of training was calculated for each physician. The rationale behind the selection of this measure was that since contact with areas surrounding one's center of activity decreases as the distance from that center increases, one's familiarity with or knowledge of surrounding areas was also a function of distance.

Access to Medical Facilities. Since access to medical facilities was hypothesized to be an important factor in physicians' location decisions, three possible measure of accessibility were considered: They were straight line distance, road mileage and travel time. Straight line distance between place of practice and nearest hospital facilites and between place of practice and nearest major medical center were chosen as the only feasible measures.

Straight line distance was chosen over road distance and travel time for a number of reasons. Road distance presented measurement problems. Given additions to the state's road system made throughout the years and the lack of adequate documentation of these additions, the problem of determining the mileage between the numerous pairs of cities necessary was unmanageable. Travel time, while perhaps the best indicator of accessibility, also presented problems. In order to calculate the average travel time between two communities, the road distance seperating them must be known and assumptions made about the average speeds possible to travel over them. The problems of determining road distance have been pointed out. Determining

average travel speeds at which travel over different roads at different points of time was possible would have been an even more complex and problem ridden task. For these reasons, straight line distance provided the only manageable measure of access for all time periods.

Testing the Location Decision Factors Model

In order to test the importance and validity of the hypothesized location factors, an ordinary least squares multiple regression model was used. Regression was chosen as the appropriate technique since it was desirable to (1) be able to establish a causal relationship between the hypothesized factors and the attractiveness of a location as indicated by the number of physicians who located there, (2) indicate the overall ability of the hypothesized factors to explain the variation of the data and (3) measure the importance of each of the factors in the location decision.

Both multiple and simple regression models have been used in the community constraint literature on physician location decisions (Steele and Rimlinger, 1965; Rushing and Wade, 1974; Lankford, 1974). The approach utilized has been to define the number of physicians in an area (e.g. county, state, region) as the dependent variable while using the values of various socio-economic area characteristics at that same point in time as independent, explanatory variables.

In this case, although it would have been optimal to make use of the data on the individual physicians as the level of observation, some aggregation was necessary if the appropriate dependent variable was to be defined. As a result, the individual observations were aggregated on the basis of county, decade of location, type of

practice (nonspecialists v.s. practicing specialists), state of birth (Oklahoma-born v.s. non-Oklahoma born) and state of training (Oklahoma trained v.s. those trained out-of-state). This rather involved means of aggregation was chosen so as to retain as much of the information contained in the original observations as possible and avoid the tendency of aggregated and averaged data to bear little resemblance to the original observations.

In light of this discussion and the definition of measures for each of the location factors, the general model (2.1) presented earlier could more precisely be defined as follows:

$$NOPHY_{it} = f(PPR_{it}, PURB_{it}, PPROF_{it}, MHOM_{it}, MMSC_{it}, MHOS_{it}, MMMC_{it}) \quad (2.2)$$

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

PPR_{it} = the population to physician ratio of county i 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 employed in professional occupations 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;

$MHOS_{it}$ = 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.

Testing for Differences in Locations by Types of Physicians

The second technique was chosen to fulfill the second stated objective of this study; that is, to study the nature of the relationship between different types of physicians and the pertinent location factors. Given the nominal nature of some of the categories of physicians of interest, chi-square analysis was the method of analysis chosen. Although none of the location decision literature reviewed made use of the technique, chi-square analysis was a frequently used tool in the social science literature. In this case, by comparing the observed and expected frequencies of types of physicians crosstabulated with the types of environments within which they located as defined by levels of hypothesized location factors, conclusions could be made as to the existence and direction of a relationship between type of physician and type of location. Chi-square analysis had the additional advantage of allowing the original data set of individual physician observations to be used without preliminary aggregation.

Although knowing what sort of physician would be most attracted to a given type of location would add to the understanding of the dynamics of physician location decisions, this knowledge would perhaps

be most helpful to those communities which are attempting to recruit new physicians. With the knowledge of what type of physician has tended to locate in communities of comparable size, degree of demand, etc., recruitment efforts of a given community might be aimed at the specific physician population most likely to locate there. In this way, the efficiency of recruitment efforts might be increased.

With the physician/community profile idea in mind, the types of physicians to be considered became somewhat easier to define. The following types of physicians were considered:

Type of Practice. Because type of practice engaged in by area physicians influenced the type of physician services available to area residents, the differences between physician location decision for specialists and nonspecialists were examined. The nonspecialist/practicing specialist dicotomy defined earlier in the chapter was used to classify individual physicians by type of practice.

State of Birth. Because an individual's perception of an area varies with that individual's knowledge of the area, two types of physicians were defined in terms of place of birth. The location decisions of native Oklahoma physicians practicing in the state was compared to those of the practicing Oklahoma physicians born outside of the state.

State of Training. Since the majority of location decisions made each year were made by recent medical school graduates and the medical schools were the logical places to recruit new physicians, the obvious question to ask was How do the locations of physicians trained

in different medical schools differ? For purposes of this study, the physician population was subdivided into those physicians trained in Oklahoma and those physicians trained out-of-state.

Age at the Time of Location. The possibility that type of community selected was influenced by the age of the physician at the time of the location decision was explored. The question to be answered was whether or not younger physicians differed significantly from older physicians in the types of communities within which they located. The age categories used were:

(1) Young Physicians: Location Age <36 Years;

(2) Mature Physicians: 36 Years$\leq$Location Age<56 Years;

(3) Older Physicians: Location Age$\geq$56 Years.

Year of the Location Decision. So that trends in the type of locations favored by physicians through time could be examined, physicians were categorized by year of the decisions in the following manner:

(1) Pre-1940 Decisions: Location Year$\leq$1939;

(2) 1940-1959 Decisions: 1939<Location Year$\leq$1959;

(3) 1960-1973 Decisions: 1959<Location Year$\leq$1973.

If the physician/community profile approach was to be used, it was also necessary to define types of locations. Using the measures of location characteristics hypothesized and used in the regression analysis as factors in physician location decisions, the following types of locations were defined:

Demand (PPR).

(1) Low Demand Counties: PPR≤1000 People/Physician;

(2) Medium Demand Counties: 1000<PPR≤1500 People/Physician;

(3) High Demand Counties: PPR>1500 People/Physician.

Urban Amenities (PURB).

(1) Rural Counties: PURB<50%;

(2) Developing Urban Counties : 50%≤PURB<80%;

(3) Metropolitan Counties: PURB≥80%.

Opportunities for Companionship (PPROF).

(1) Nonprofessional Counties: PPROF≤10%;

(2) Semiprofessional Counties: 10%<PPROF≤15%;

(3) Professional Counties: PPROF>15%.

Access to Hometown (MHOM).

(1) Easy Hometown Access: MHOM≤50 Mi.;

(2) Medium Hometown Access: 50 Mi.<MHOM≤200 Mi.;

(3) Low Hometown Access: MHOM>200 Mi.

Access to Medical School (MMSC).

(1) Easy Medical School Access: MMSC≤200 Mi.;

(2) Medium Medical School Access: 200 Mi.<MMSC≤600 Mi.;

(3) Low Medical School Access; MMSC>600 Mi.

Access to Hospital Facilities (MHOS).

(1) Direct Hospital Access: MHOM = 1 Mi.;

(2) Lack of Hospital Access: MHOS ≠ 1 Mi.

Access to Major Medical Centers (MMMC).

(1) Immediate Access: MMMC = 1 Mi.;

(2) Easy Access: 1 Mi.<MMMC≤50 Mi.;

(3) Limited Access: 50 Mi.<MMMC≤100 Mi.;

(4) Extremely Limited Access: MMMC>100 Mi.

CHAPTER III

THE DISTRIBUTION OF PHYSICIANS IN OKLAHOMA

In order to best understand and document the problem of decreasing access to physician services and the role of physician location decisions in the process, this chapter provides a description of historical and present day distributions of physicians in Oklahoma. Oklahoma provided a good base for this sort of discussion, in that, an overview of the evolution of the patterns of physician distributions was obtainable because of the state's relative youth, having been first settled in the late 1800's and early 1900's.

Historical Trends

Table I provides a summary of physician distributions in Oklahoma for the period beginning shortly after statehood in 1907 to 1973. The period was one of growth with the population of the state increasing from approximately one and a half million in 1910 to over two and a half million in 1973. Only during the years from 1930 to 1950 did the state's population not grow. During the 66 year period from 1907 to 1973, however, the number of physicians involved in direct patient care practicing in the state decreased. In 1910, some 2637 physicians were practicing in the state; in 1973, the number stood at 2094. The decline in the number of physicians was continuous until 1960 when the total number began to increase rather than decrease. As would be

TABLE I

HISTORICAL STATE TRENDS

	1910	1920	1930	1940	1950	1960	1970	1973
State Population	1657155	2028282	2396040	2336434	2233351	2328284	2559463	2663000
Percent Change		+22.4	+18.1	-2.5	-4.4	+4.2	+9.9	+4.0
Number of Physicians	2637	2414	2241	2000	1733	1731	1963	2094
Percent Change		- 8.5	- 7.2	-10.8	-13.3	-0.1	+13.4	+6.6
Number of Towns W/Physicians	769	610	427	385	284	187	160	154
Percent Change		-20.7	-30.0	- 9.8	-26.2	-34.2	-15.0	-3.8
Population/ Physician Ratio	628	840	1069	1168	1288	1345	1303	1272
Percent Change		+33.8	+27.3	+ 9.3	+10.3	+ 4.4	- 3.1	- 2.4
Coefficient of Localization	0.12	0.23	0.13	0.15	0.14	0.18	0.21	0.25

Source: American Medical Directory (1916-1973); Oklahoma Population Estimates (1973); U.S. Census of the Population (1910-1970).

expected, the population to physician ratio grew larger during this period, going from 628 in 1910 to 1271 in 1973. Despite the sizeable increase in the number of physicians between 1960 and 1973, the population to physician ratio during the same period decreased by only 5.4%. For purposes of comparison, it should be noted that, in 1973, the national population to physician ratio was 653, half of the Oklahoma ratio (Profile of Regional Health Variables, 1974, p. 41).

As indicated by the 769 towns having at least one resident physician in 1910, physicians were initially widely distributed throughout the state's communities. Through the years, however, physicians began to centralize their practices in the larger towns and cities until in 1973 only 154 communities had practicing physicians. The result of this process was that small rural communities of a few hundred people or less began to find themselves without the services of a physician that they had once enjoyed.

Realizing, however, that the population of the state also was becoming somewhat more concentrated, it was necessary to examine the concentration of physicians within the context of an increasingly agglomerated population. In order to measure the degree of concentration of physicians vis-a-vis population distribution through time, coefficients of localization for the state's physicians of each decade were calculated. A coefficient of localization, one of the family of Gini coefficients familiar to economic geography literature, measures "the extent to which the activity is concentrated areally by comparison with some other distribution" (Smith, 1975, p. 201). Values of the coefficients range from zero to one with zero indicating no

concentration and one indicating extreme concentration. In this case, the distribution of direct patient care physicians was compared to the general population distribution.

Historically, the degree of concentration of physicians was not great as indicated by the coefficients of localization in Table I. Not until the late 1960's could the coefficients even be regarded as moderate. But, when viewed as indicators of a trend the coefficients assumed more significance. Through the 1950's, the coefficients changed very little but the changes that occurred were positive. Slowly, physicians were becoming somewhat more concentrated than the population. With the 1960's, the rate of increase picked up and, in the three year period from 1970-73, the coefficients increased as much or more than they had in most of the previous decades.

In summary, while the period from 1910 to 1973 was one of population growth for the state, the number of physicians involved in direct patient care decreased. Consequently, the population to physicians ratio increased. Hardest hit as far as lack of physician services were the more rural areas as physicians tended to locate their practices in the larger towns and cities. The trend towards increased concentration which had traditionally been a slow one had in recent years begun to accelerate.

Current Patterns

Total Physician Distribution

In 1973, the number of surveyed physicians engaged in direct patient care totaled 1996 and their coefficient of localization (0.250)

showed a moderate degree of concentration[1]. Figure 2 shows the number of physicians practicing in each county. The distribution shown was one of extremes. As was the case with so many service functions, Oklahoma and Tulsa counties dominated the pattern, having 1149 or 57.4% of the state's physician population. At the other extreme, two western Oklahoma counties, Dewey and Roger Mills, had no physicians to serve their combined population of slightly over 10,000 people.

In terms of the spatial distribution, the central and more urban counties were also those with the largest number of physicians. A comparison of Figure 2, the distribution of physicians, and Figure 3, those counties with cities of 10,000 people or more, showed the high degree of association between the number of physicians and urban population centers. In the more rural, agricultural counties of western Oklahoma and the rugged, rural southeastern counties, the physician count per county was at its lowest.

The Distribution of Physicians By Type of Practice

Because the types of practices engaged in by an area's physicians influenced the types of physician services available to area residents, this section considers the distribution of physicians involved in direct patient care by type of practice. The three categories of practice considered were nonspecialists, practicing specialists and board certified specialists. As indicated earlier, nonspecialists

---

[1] Because of incomplete information on 98 physicians, the following analysis was based on the remaining 1996 physicians for whom complete information was available.

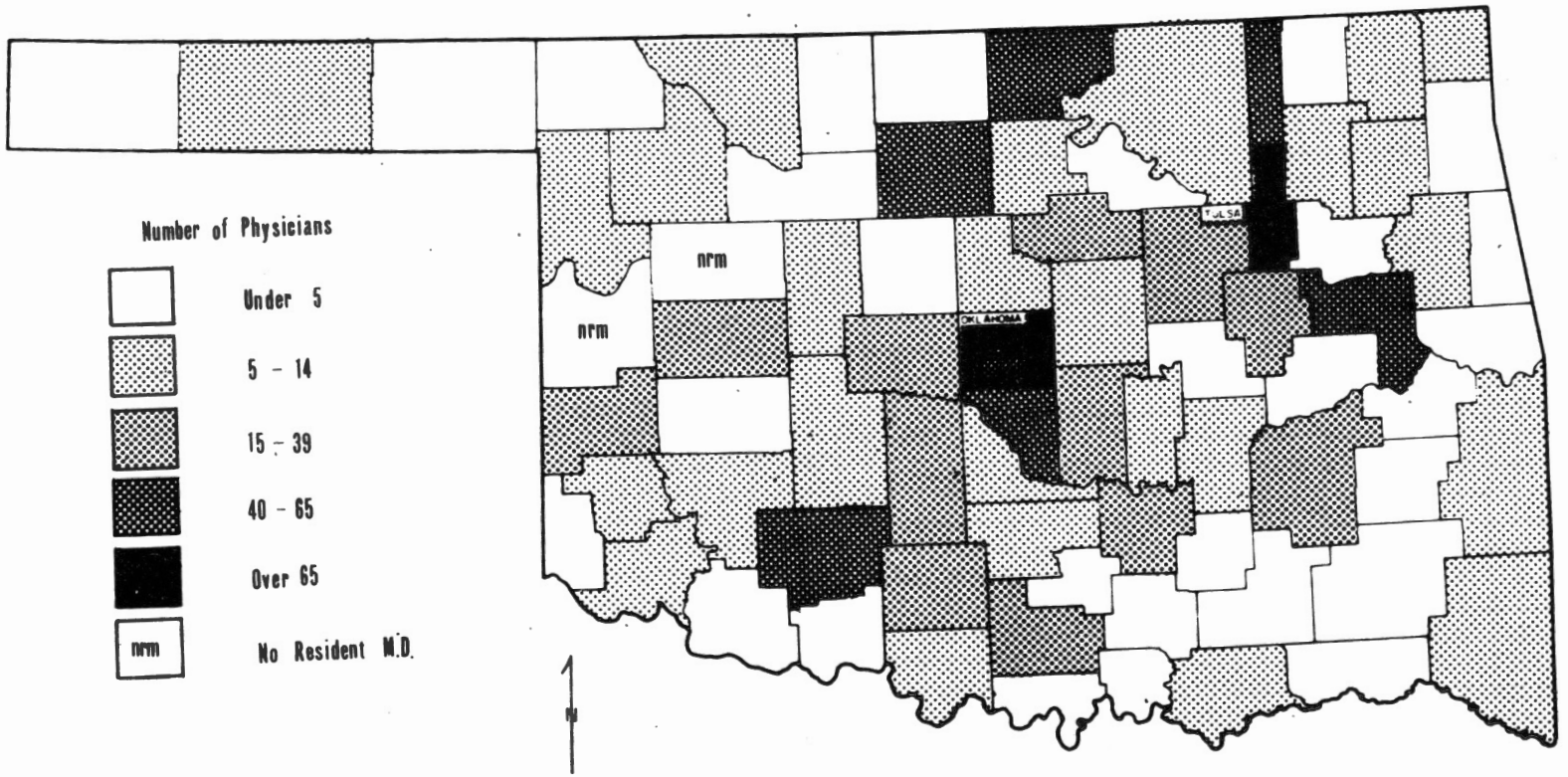
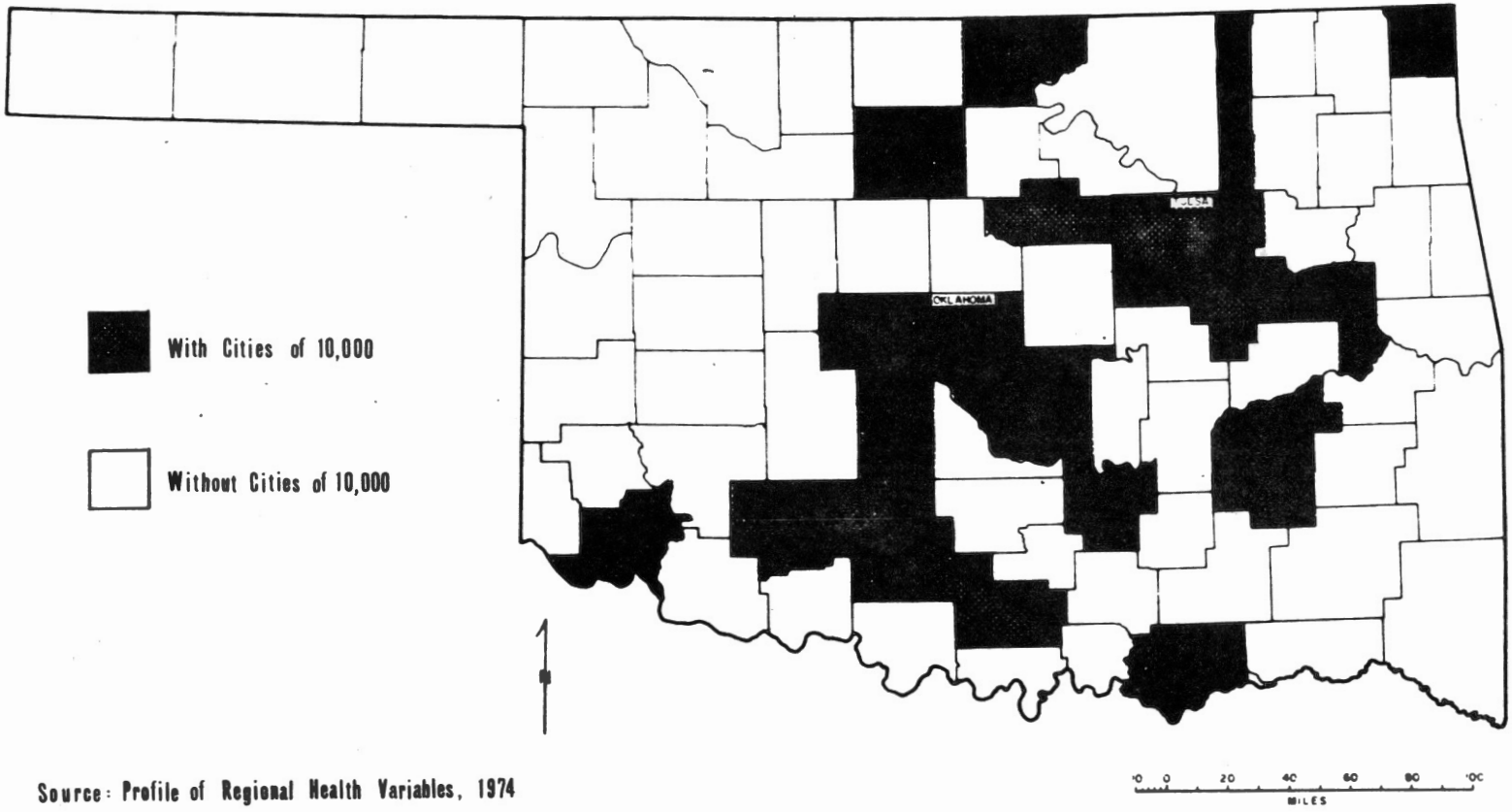


Figure 2. Practicing Physicians in Oklahoma, by County, 1973.



Source: Profile of Regional Health Variables, 1974

Figure 3. Oklahoma Counties With Cities of 10,000 Inhabitants or More, 1973.

were defined as those physicians whose practices were limited to general practice, family practice, internal medicine, obstetrics, gynecology, pediatrics or general surgery. It was from these types of physicians that most people first sought care. Practicing specialists, it will be recalled from Chapter II, were defined as those physicians who limited their practices to the more specialized types of practice. (Table VIII in the Appendix lists the precise specialties involved.) Board certified specialists were those physicians who had undergone additional years of training and testing and who were certified as competent in specialized medical subfields by the appropriate American Specialty Board.

TABLE II

NUMBER OF OKLAHOMA PHYSICIANS BY TYPE OF PRACTICE, 1973

	Nonspecialists	Practicing Specialists	Board Certified Specialists	Total
The State	1304	692	948	1996
Oklahoma County	371	306	388	677
Tulsa County	275	197	297	472
Oklahoma/Tulsa Counties	646	503	675	1149
Percent of State Total	49.4%	72.4%	70.1%	

Source: American Medical Directory (1973).

Table II presents the number of physicians involved in each type of practice for the state and Oklahoma and Tulsa counties. As was the case with the distribution of all physicians, Oklahoma and Tulsa counties dominated the distribution having attracted the majority of nonspecialist, practicing specialists and board certified specialists. Figures 4-6 summarize the distribution of physicians in each type of practice by county.

When compared, the similarities became apparent between the distribution of all physicians (Figure 2) and the distributions of each type of practice considered (Figures 4-6). Again the central, urban counties had attracted the majority of both types of specialists and the nonspecialists. In order to better compare the distributions of each type of practice to the distribution of all physicians, coefficients of localization were calculated and the results presented in Table III.

As the maps seemed to indicate, each of the three categories were shown by the localization coefficients to be somewhat more concentrated than the total physician distribution. As expected, the nonspecialist physicians were the least concentrated of the different types of practices with their distribution varying only slightly from that of all physicians. The practicing specialists and board certified specialists were more concentrated than the total physician population as indicated by localization coefficients of 0.174 and 0.162 respectively. In general, though, the areal distribution of nonspecialist, practicing specialists and board certified specialists corresponded closely to the distribution of all physicians.

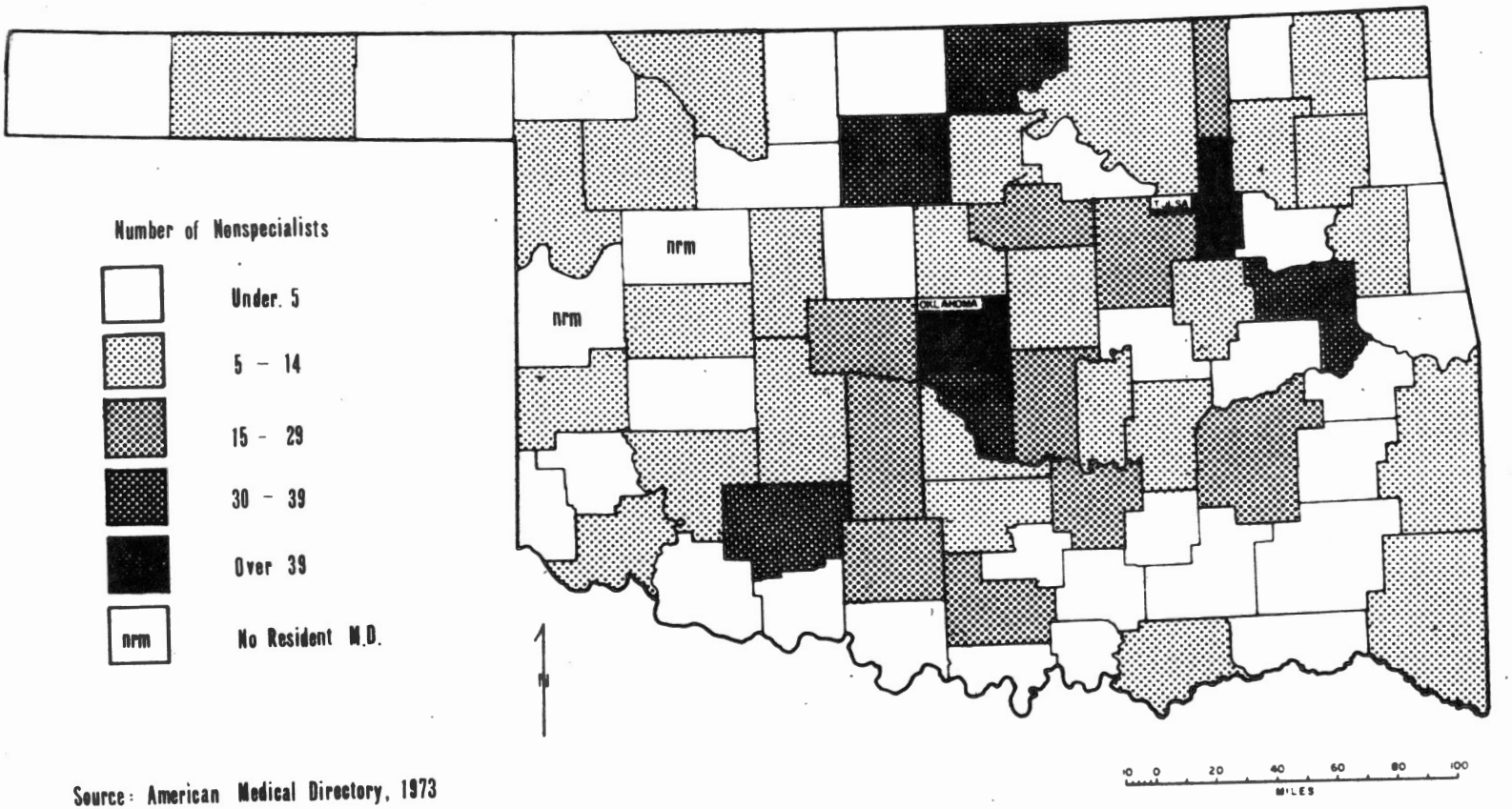
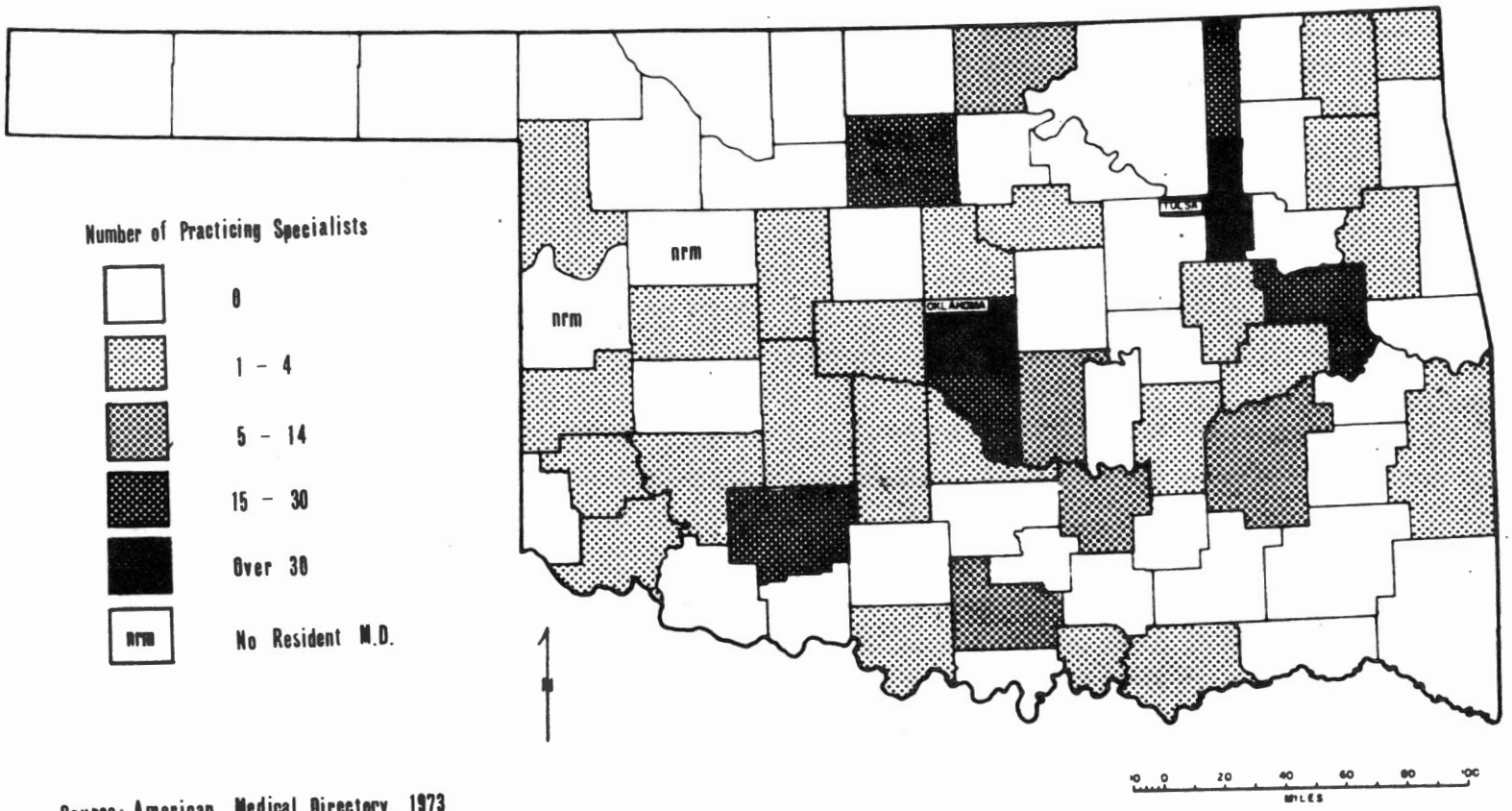


Figure 4. Nonspecialized Physicians in Oklahoma, by County, 1973.



Source: American Medical Directory, 1973

Figure 5. Practicing Specialists in Oklahoma, by County, 1973.

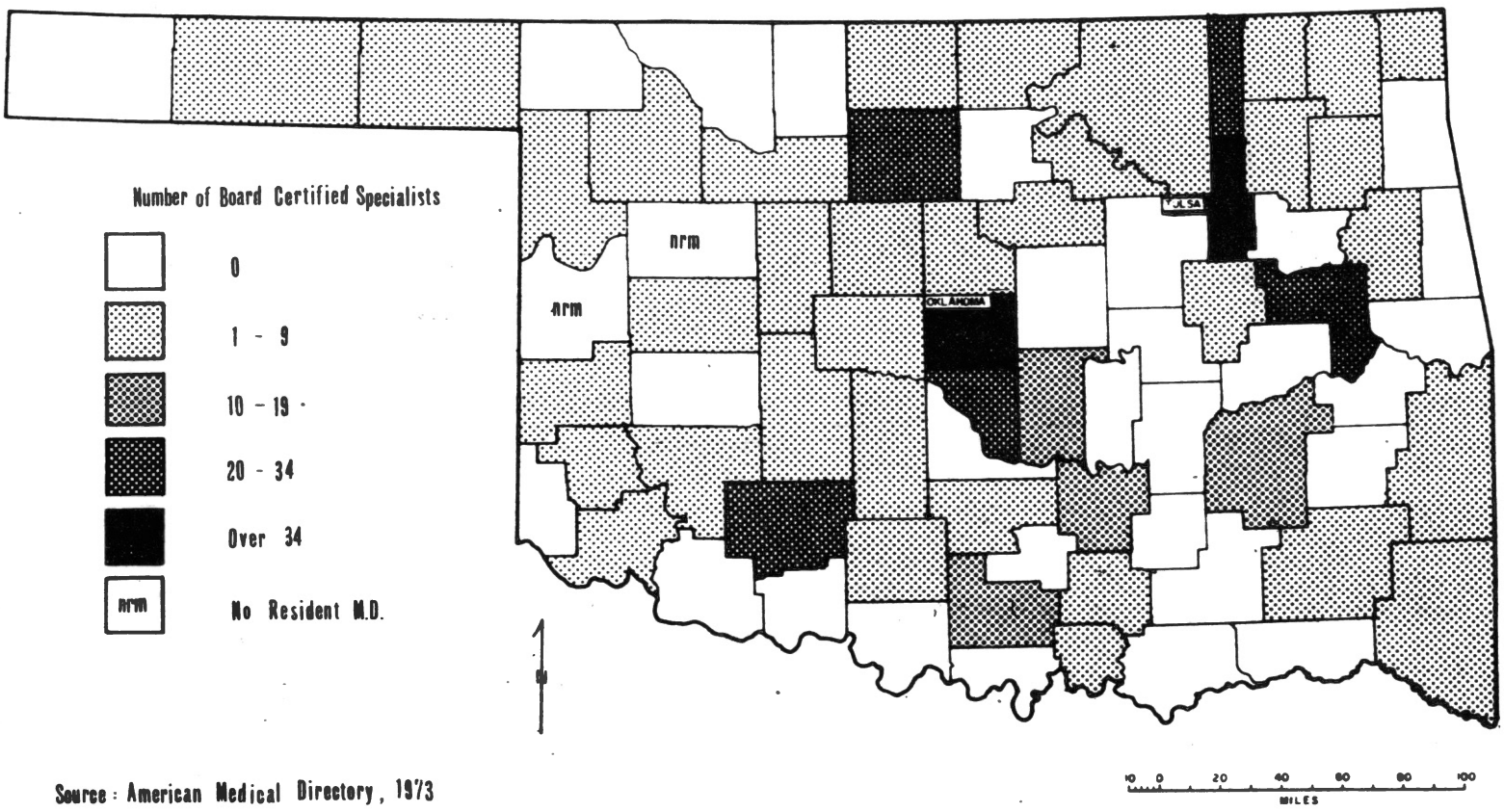


Figure 6. Board Certified Specialists in Oklahoma, by County, 1973.

TABLE III

COEFFICIENTS OF LOCALIZATION FOR PHYSICIANS BY TYPE OF PRACTICE WHEN COMPARED TO ALL OKLAHOMA PHYSICIANS AND THE TOTAL STATE POPULATION, 1973

	Nonspecialists	Practicing Specialists	Board Certified Specialists
All Physicians	.092	.174	.162
Total State Population	.178	.406	.395

Source: Author's calculations

When the distribution of physicians in each type of practice was compared to the distribution of the total population, however, a more concentrated pattern emerged as reported in Table III. Physicians involved in nonspecialized practices continued to be the least concentrated of the types of physicians considered as indicated by a slight coefficient of localization of 0.178 as opposed to 0.406 for practicing specialists and 0.395 for board certified specialists. The larger coefficients for both types of specialists would seem to indicate a degree of concentration in the larger urban counties unwarrented by population size.

The Distribution of Physicians By Place of Birth

Given the purported importance of community of origin in the location decision literature, this section outlines the distribution of

physicians by place of birth. Of the 1996 physicians considered who were engaged in direct patient care in the state, 989 or 49.5% were born in Oklahoma, 932 or 46.7% were born in one of the 49 other states, and 75 or 3.8% were born outside of the United States. The number of physicians born in each of the states, is mapped in figure 7, Table IV lists the number born outside of the U.S. by region, and Table IX in the Appendix provides a more precise breakdown of the total by country.

As shown in Figure 7, the great majority of the total physician population (80.2%) was born in the 23 states classified as Central or Middle Atlantic by the U.S. Bureau of the Census. A tendency for physicians to locate in the general area of their birth became apparent when the number of physicians born in those six state bordering on Oklahoma -- Kansas, Missouri, Arkansas, Texas, New Mexico and Colorado -- were considered along with those born in Oklahoma. This region accounted for 69.9% of the total Oklahoma physician population. The Northeast, South Atlantic, Mountain and Pacific states, on the other hand, accounted for only 6.2% of all physicians in Oklahoma.

The foreign countries contribution to the state's physician population was small as indicated in Table IV. Latin American born physicians accounted for the greatest percentage of those born abroad with 22 doctors or 29.3% of the foreign born.

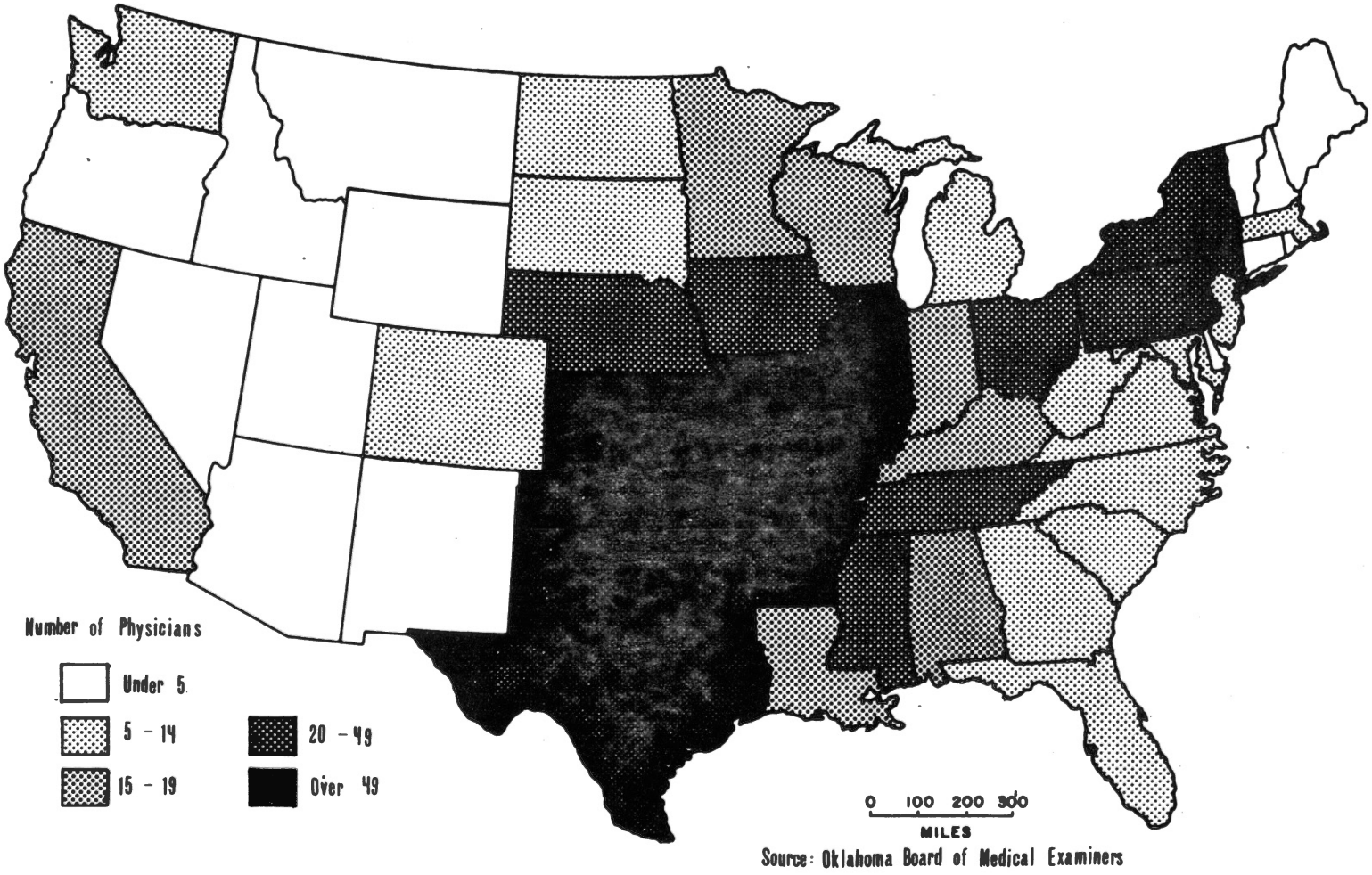


Figure 7. State of Birth for Practicing Oklahoma Physicians, 1973.

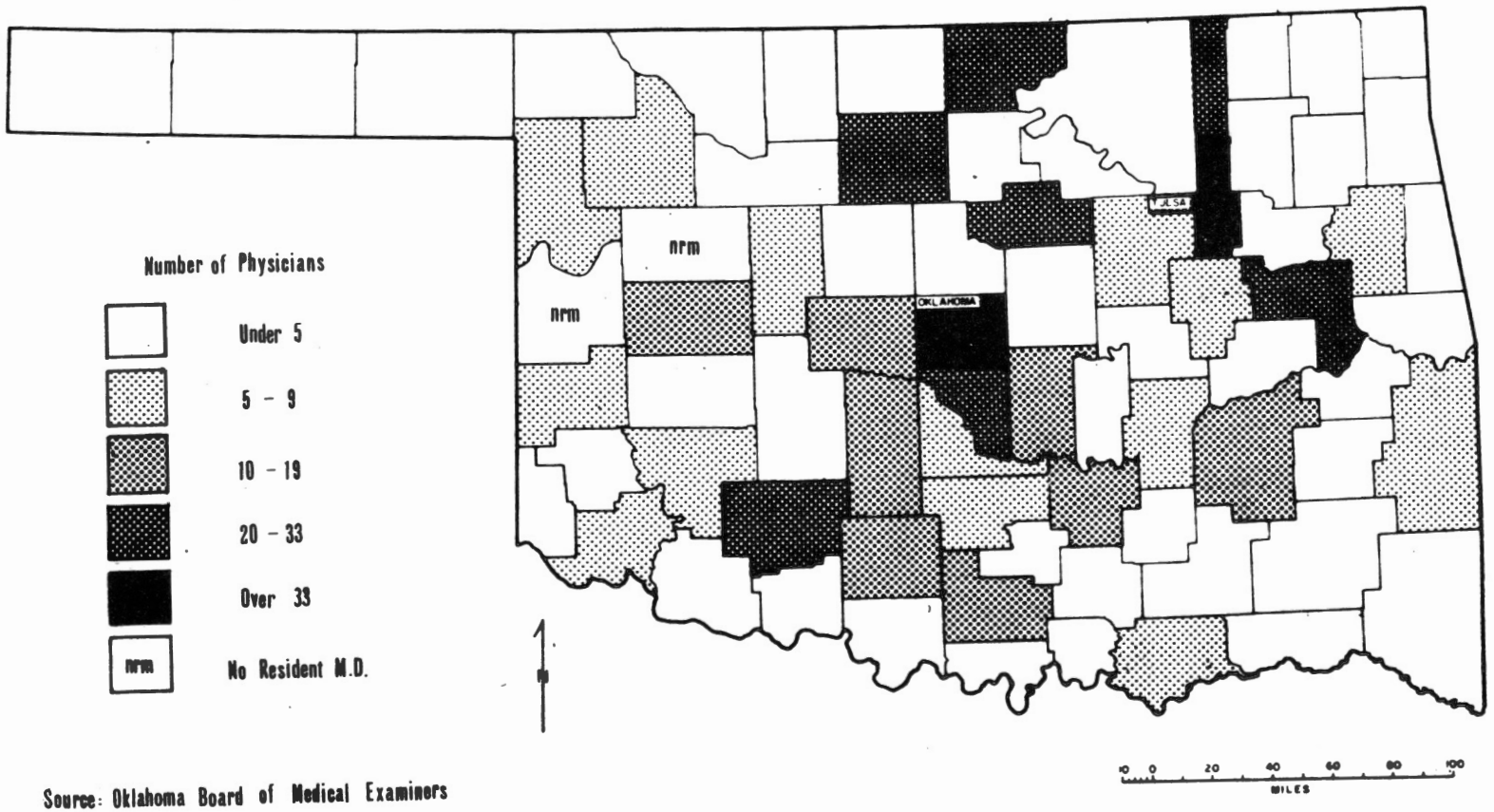
TABLE IV

NUMBER OF OKLAHOMA PHYSICIANS BORN OUTSIDE OF THE UNITED STATES BY REGION, 1973

Region	Number	Percent of Foreign Born	Region	Number	Percent of Foreign Born
Latin America	22	29.3%	Middle East	6	8.0%
Asia	15	20.0%	Eastern Europe	5	6.6%
Europe	13	17.3%	Africa	3	4.0%
Canada	11	14.7%	Total	75	100.0%

Source: American Medical Directory, (1973).

The number of Oklahoma-born physicians practicing in each county is mapped in Figure 8. As was the case with the specialists, the distribution of Oklahoma-born physicians mirrored the distribution of all physicians with the central, urban counties dominating the pattern. Evidence of the similarities between the two distributions was given by a very slight coefficient of localization of 0.076. When the distribution of Oklahoma-born physicians was compared to the distribution of the population of the state, a coefficient of 0.214 indicated a degree of concentration though not one as large as the degree of concentration between population and total physician population (0.250) or either type of specialist (0.406, 0.395) previously considered.



Source: Oklahoma Board of Medical Examiners

Figure 8. County Physicians Born in Oklahoma, 1973.

The Distribution of Physicians By Place of Training

Another consideration of importance in a discussion of physician characteristics was the source of medical training for a state's physician population. Of the 1996 physicians practicing in the state, in 1973 1105 or 55.4% were trained in Oklahoma, 846 or 42.4% were trained in one of the 44 other states with medical schools and 45 or 2.3% were trained outside of the U.S. Figure 8 shows the number of Oklahoma physicians involved in direct patient care trained in each state, Table V lists the number trained outside of the U.S. by region and Table X in the Appendix provides a more precise count by country of training.

Thirteen states proved to be the major sources of medical training for Oklahoma physicians. The seven states in category one as mapped in Figure 9 provided medical training for 78.0% of the state's physicians while these states in category two trained an additional 13.1%. The states other than Oklahoma involved can be classified in one of two ways: 1) states in relative proximity to Oklahoma, e.g. Kansas, Texas, etc., or 2) states that have traditionally trained the largest proportion of the nation's physicians e.g. Illinois, Pennsylvania, etc. The remaining states, those largely in the Northeast, South Atlantic, Mountain and Pacific regions, accounted for another 7.7% of physicians in Oklahoma.

The number of physicians trained in foreign medical schools was small. Table V summarizes the sources of training for these physicians by region.

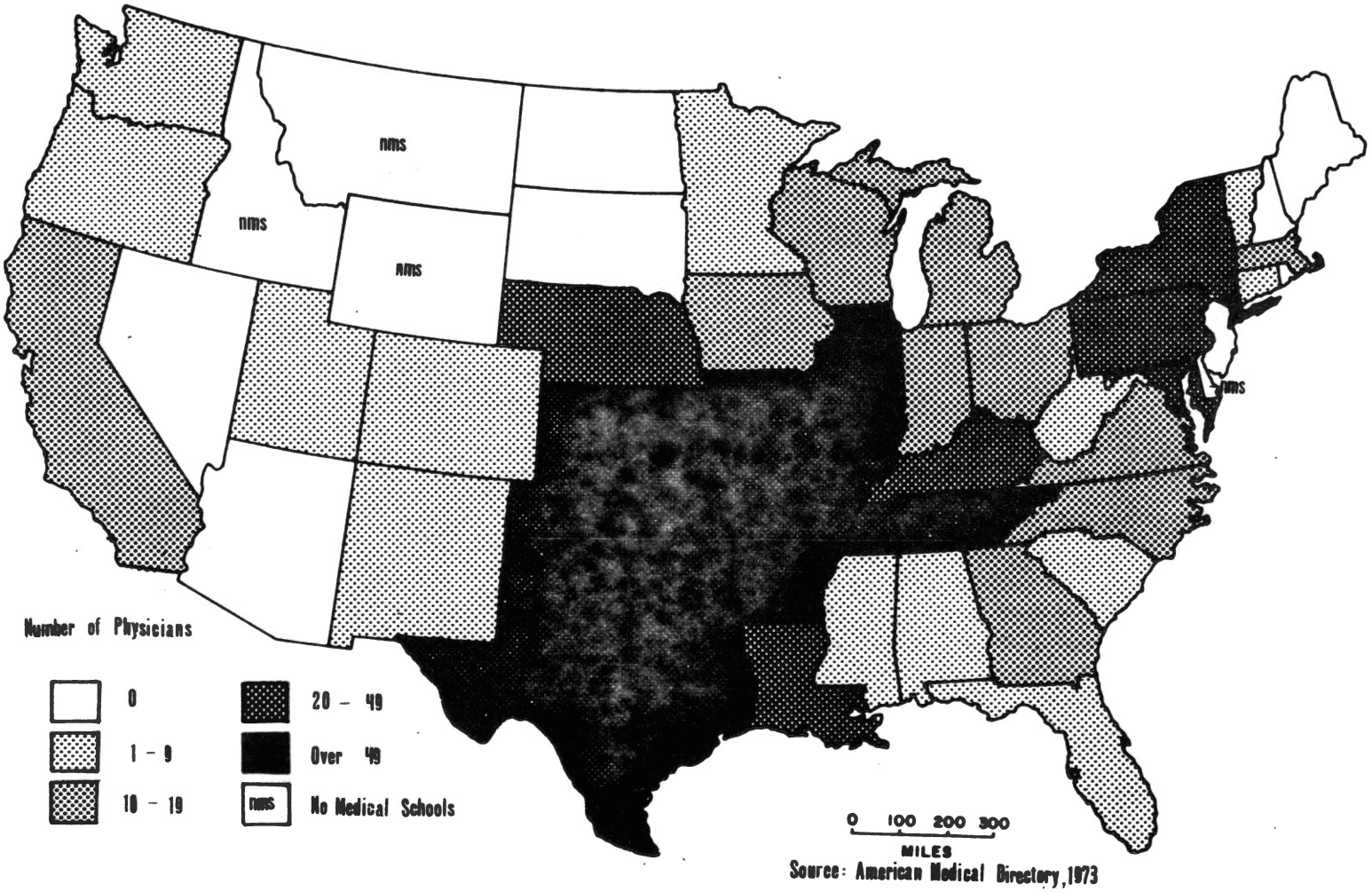


Figure 9. State of Training for Practicing Oklahoma Physicians, 1973.

TABLE V

NUMBER OF OKLAHOMA PHYSICIANS TRAINED OUTSIDE OF THE UNITED STATES BY REGION, 1973

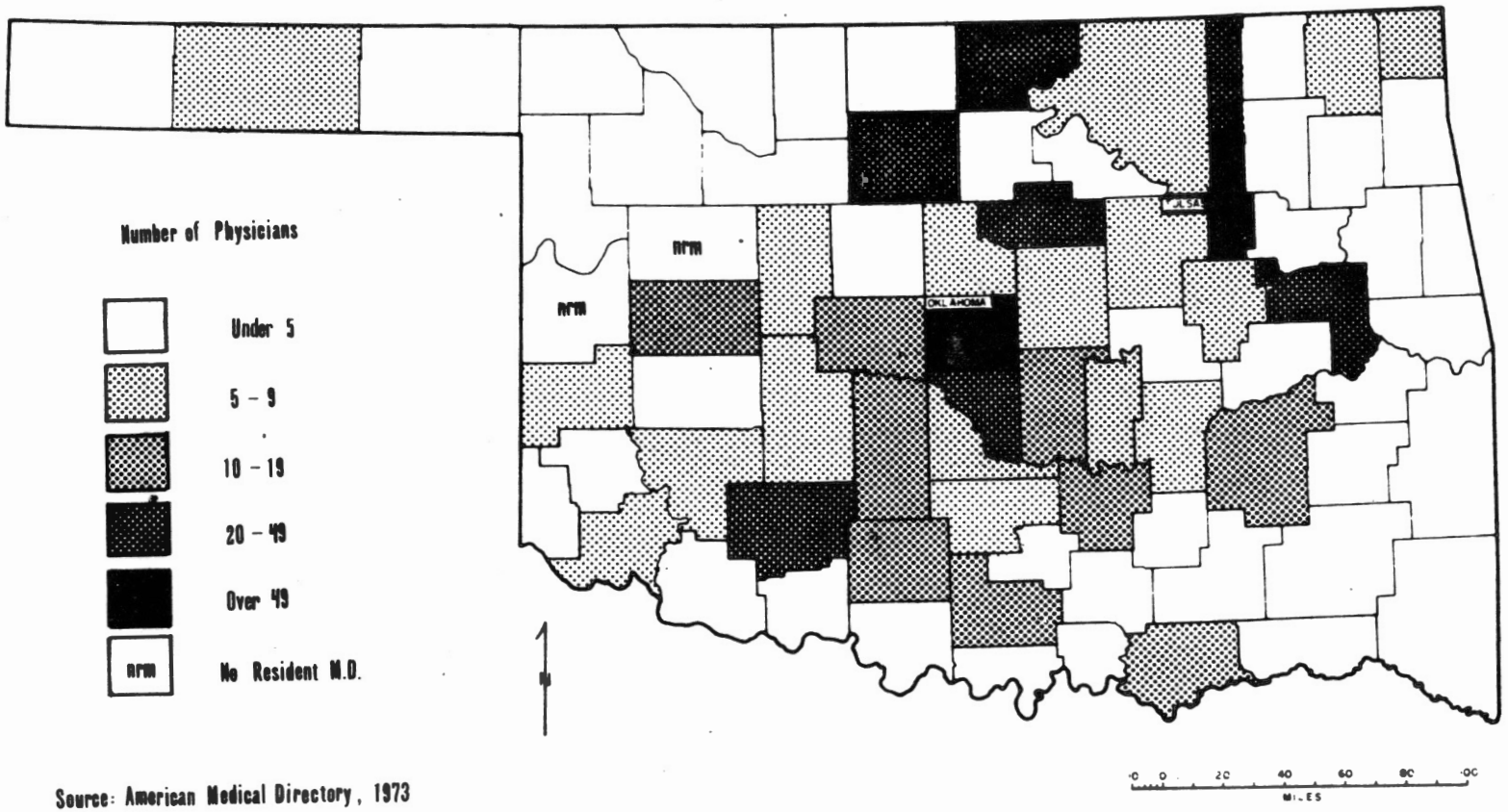
Region	Number	Percent of foreign trained	Region	Number	Percent of foreign trained
Latin America	11	24.4%	Middle East	6	13.3%
Asia	11	24.4%	Eastern Europe	2	4.4%
Canada	9	20.0%			
Europe	6	13.3%	Total	45	100.0%

Source: American Medical Directory, (1973).

Figure 10 maps the distribution of those physicians trained in Oklahoma by county of practice. Again, the distribution closely resembled that of all physicians as indicated by a localization coefficient of 0.114 and was only slightly concentrated with respect to the distribution of total population as indicated by a coefficient of 0.205.

The Distribution of Physicians By Age

The final characteristic of the Oklahoma physician population considered was its age structure. While unimportant in itself, age was considered worth examining because of its usefulness as an indicator of what areas would be most likely to lose physician services through retirement. For the state as a whole, the average age of practicing physicians was 48.7 years of age; of the 1996 physicians surveyed,



Source: American Medical Directory, 1973

Figure 10. County Physicians Trained in Oklahoma, 1973.

199 or 5.0% were over 65 years of age. Figure 11 maps the average age of physicians by county while Figure 12 show what percent of the total county physician population was over 65 years of age.

As Figure 11 indicates, the average age of physicians in the great majority of the counties ranged between 40 and 59 years with only three counties averaging between 30 and 39 years and three others between 60 and 69 years. Of the three counties averaging greater than 60 years, two counties, Coal and Love, with 100% of their physicians over 65 years of age were in danger of losing all available physicians through retirement.

For the most part, the physicians most likely to retire were fairly well dispersed throughout the state with respect to the distribution of all physicians and to the distribution of state population as indicated by localization coefficients of 0.230 and 0.254 respectively. With the exception of those cases already mentioned, what concentration of older physicians did exist seemed to be centered on Oklahoma and Tulsa counties with 85 or 42.7% of all physicians over 65 years of age. If any area of the state could be said to be able to afford to lose physicians, these two counties would probably have been the best equipped to handle the loss.

Summary

The distribution of physician in Oklahoma in 1973 could be characterized as follows:

1) In general, physicians tend to be fairly evenly distributed throughout the state with respect to total state population. What concentration did occur centered on the more central,

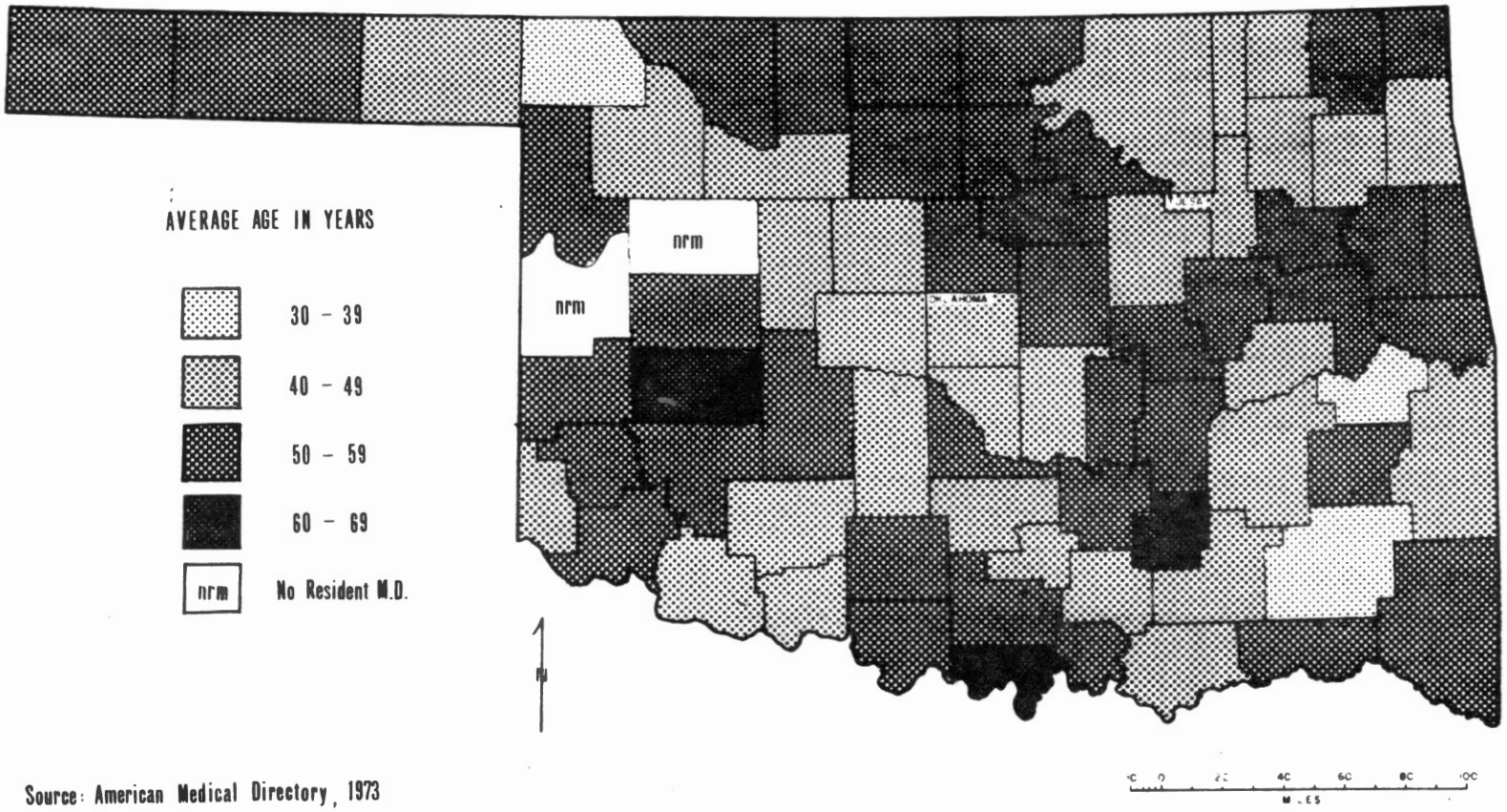


Figure 11. Average Age of Practicing Oklahoma Physicians, by County, 1973.

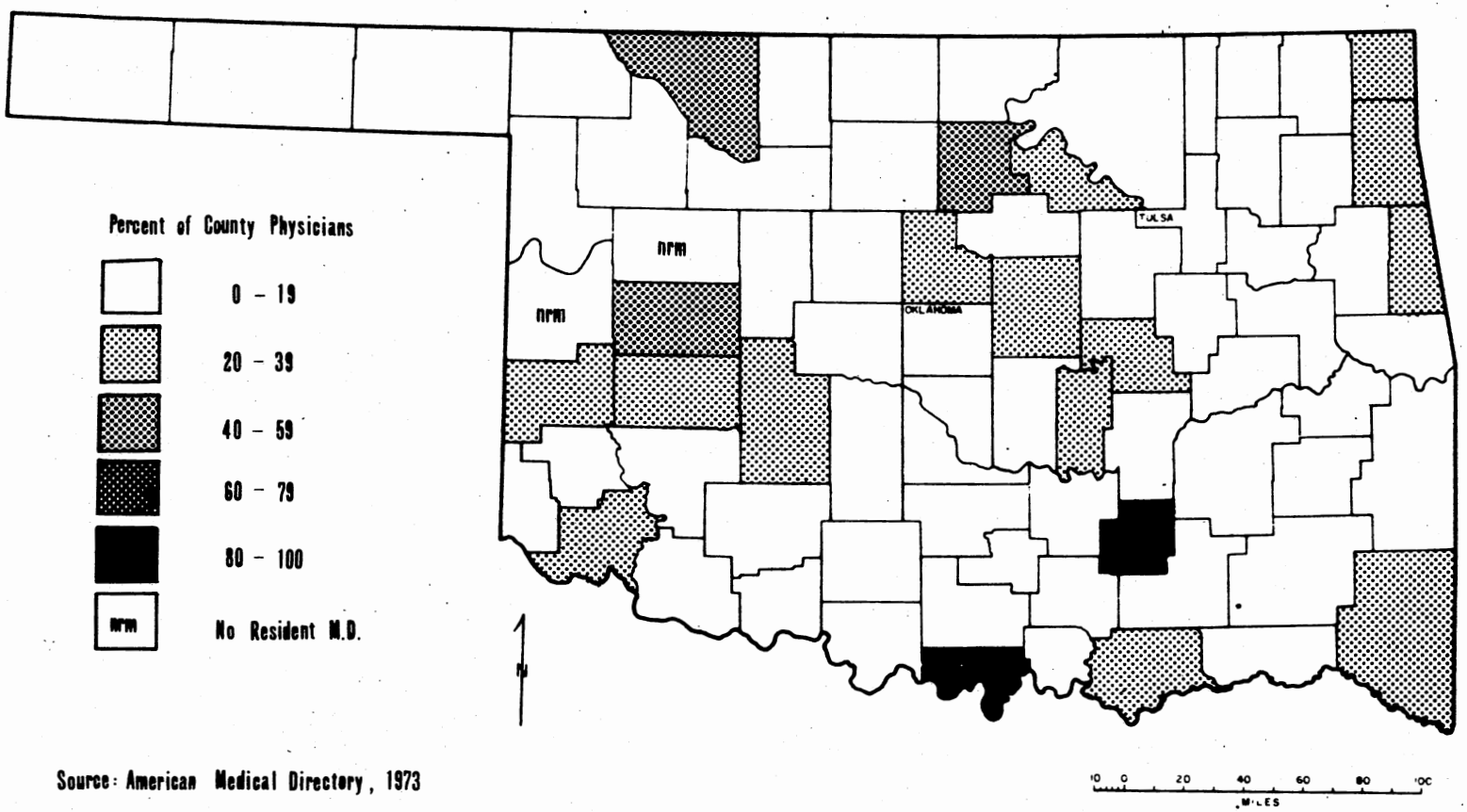


Figure 12. Practicing Oklahoma Physicians Over the Age of 65 Years, by County, 1973.

urban counties, especially Oklahoma and Tulsa counties, at the expense of some of the more rural counties.

2) When physicians were categorized by type of practice, place of birth, place of medical training, and age, the areal distribution revealed corresponded closely to that of all physicians with localization coefficients ranging from 0.076 to 0.230. Those physicians over 65 years of age tended to be the most concentrated with respect to the distribution of all physicians followed in descending order of concentration by practicing specialists, board certified specialists, Oklahoma trained physicians, nonspecialists and Oklahoma born physicians.

3) When each of the distribution of each of the categories of physicians were compared with the distribution of state population in moderate degree of concentration was encountered. Each category tended to be more concentrated than population alone would account for. Practicing specialists were the most concentrated category followed in descending order by board certified specialists, those physicians over 65 years of age, Oklahoma born physicians, Oklahoma trained physicians and non-specialists.

CHAPTER IV

RESULTS OF THE LOCATION DECISION MODEL

The Model

As indicated previously, an ordinary least squares multiple regression model of the form

$$NOPHY_{it} = f(PPR_{it}, PURB_{it}, PPROF_{it}, MHOM_{it}, MMSC_{it}, MHOS_{it}, MMMC_{it}) \quad (4.1)$$

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

PPR_{it} = the percent of the population living in urban areas in county i 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 employed in professional occupations 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;

$MHOS_{it}$ = the average number of miles from place of practice in county i to 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;

was used to test the importance and validity of the hypothesized factors in the physician location decision. A log transformation model was used to take into account prior evidence which indicated that the relationship was not a linear one. The appropriate statistics are reported in Table VI.

General Predictive Ability

As indicated by the coefficient of determination (R^2) of 0.48, the hypothesized variables accounted for 48 percent of the variation about the mean of the dependent variable, the number of physicians who located in a given county in any given decade. While not an overwhelming statistic, it was of respectable magnitude and, in fact, the hypothesized model explained more of the variation about the mean than any of the models proposed by Rushing and Wade (1973), and most of those considered by Steele and Rimlinger (1965) or Lankford (1974), each which were tested with considerably larger and more aggregated data sets. That 52 percent of the variation remained unexplained lent credance to the arguments made in the more general migration literature (Salkin, 1973) that available social indicators fail to measure the intangible or psychic considerations inherent in location decisions.

TABLE VI

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.

The Importance of Individual Variables

Demand (PPR). It was hypothesized that physicians, with an eye to guaranteeing themselves satisfactory incomes, would have tended to locate in communities with high demands for their services. Demand, in this case, was measured by the county population to physician ratio; the higher the ratio, the higher the demand for a physician's services and the more attractive the county would have been to a physician looking to establish a practice.

In actuality, the beta coefficient of the demand variable, PPR, was shown to be significantly different from zero. However, the sign of the calculated beta coefficient, being negative, ran counter to the hypothesized positive relationship. The calculated coefficient of -0.123 indicated that a 10 percent increase in the population to physician ratio brought about a 1.2 percent decrease in the number of physicians who located in the county[1]. Therefore, it seemed that physicians rather than seeking out high demand environments tended to avoid them despite possibilities of higher incomes.

One possible explanation of this tendency would be a desire to avoid those areas where demand would have been high enough to limit the amount of available leisure time. Faced with a decision between (1) a high potential income coupled with long hours, or (2) a lesser

---

[1]See Goldberg's (1964, pp. 215-218) discussion of the doublelog functional form and Leftwich's (1966, pp. 33) discussion of elasticities for a justification of this interpretation of beta coefficients.

potential income and more leisure time, the physician seemed to have opted for more leisure time. This would seem to contradict Rimlinger and Steel's (1963) view of physicians as predominantly income maximizers in their location decisions.

Urban Amenities (PURB). The hypothesized relationship between a desire for the amenities provided by an urban community (i.e. the cultural and recreational leisure activities) and that community's attractiveness to physicians was one where an increase in the level of urbanization, as measured by percent of the population living in an urban environment, would bring about an increase in the number of physicians who located in the community. The hypothesis when tested within the multiple regression framework, was not supported by the data. Instead, the sign and magnitude of the beta coefficient (-0.009) indicated that urbanization had a very small and negative influence in attracting physicians. For example, a 100 percent increase in the percent of a county's population living in urban areas effected only a 0.9 percent decrease in the number of physicians who located in the county. In addition, the t-statistic for the PURB variable was significant only at the 0.65 level; this, needless to say, left some doubt as to whether or not the beta coefficient was significantly different from zero and , in fact, had any effect on the dependent variable. On the basis of (1) previous analysis of the data set, and (2) a suspicion of problems of multicollinearity in the independent variable matrix, leading to downwardly biased t-statistics for the regression beta coefficients, a second analysis was made using a simple regression model. The form of the model was as follows:

$$NOPHY_{it} = f(PURB_{it}) \qquad (4.2)$$

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

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

The results are reported in Table VII.

TABLE VII

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.

The relationship revealed by the simple regression analysis between the dependent and independent variables was both positive and significant at the 0.01 level. An increase of 10 percent in the percent of the county population living in urban areas resulted in an attendant 1.59 percent increase in the number of physicians who located in the county. Additional evidence of a positive relationship between NOPHY and PURB was provided by a scattergram of the two variables (Figure 13) and a positive simple correlation coefficient (r) of 0.44 for the nontransformed values of the variables and of 0.28 for the transformed values (Tables XI and XII in the Appendix). Despite the differences in the testing mechanisms, on the basis of the evidence presented, it did seem reasonable to conclude that as measured by the surrogate variable, the percent of the county population living in urban areas, urbanization did have a positive impact of uncertain magnitude on the number of physicians who located within a given county.

Opportunities for Companionship (PPROF). In order to quantify the opportunity that a county offered a physician to make friends of similar professional background, the percent of the population engaged in professional occupations in a county was chosen as a surrogate measure. The hypothesized relationship was such that as the percent of the county population engaged in professions increased, the number of physicians attracted to the county also would increase.

As Table VI indicates, the hypothesized relationship did exist. The beta coefficient of +0.615 for the variable, PPROF, was not only significantly different from zero but also had the largest impact

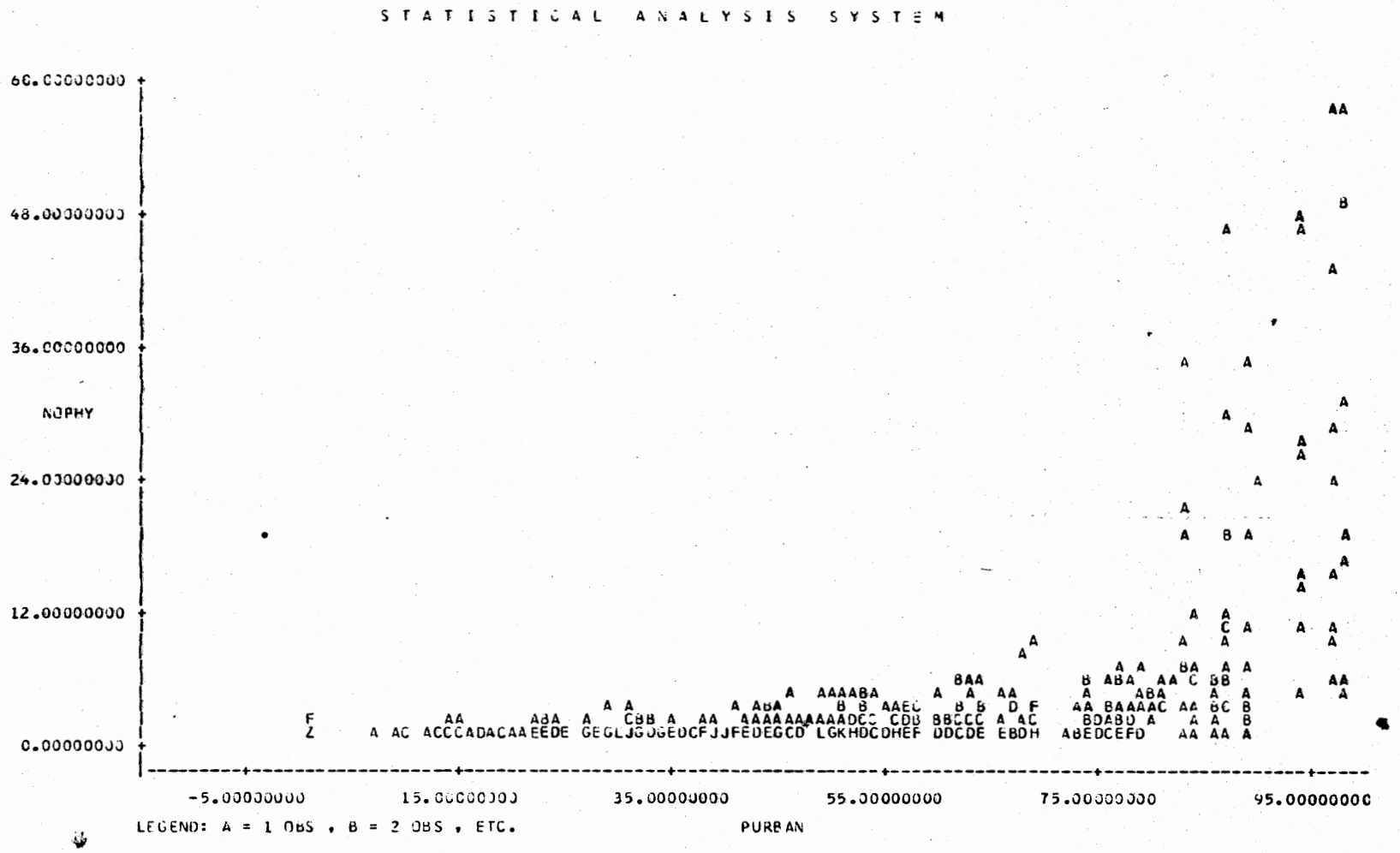


Figure 13. Number of County Physicians By Percent of the County Population Living in Urban Areas, Oklahoma, 1973.

on the magnitude of the dependent variable. For every 10 percent increase in PPROF, an approximate 6 percent increase in the number of locating physicians resulted. It could not be denied that a largely professional county population was attractive to physicians.

Familiar Environments (MHOM, MMSC). In Chapter II, it was hypothesized that the physician, in an attempt to locate in a familiar environment, would have tended to locate in or near either his hometown or place of medical training. The results of the tests of this hypothesis were somewhat mixed in that while both of the measures considered proved to be significant influences in the location decision only proximity to place of medical training (MMSC) had the hypothesized negative influence while proximity to hometown proved to have a positive beta coefficient. This meant that as proximity of a place of practice to hometowns decreased (i.e. as the average number of miles between place of practice and hometowns of locating physicians increased), the number of physicians who located there increased. On the other hand, as the proximity of a place of practice to place of medical training decreased (i.e. as the average number of miles between place of practice and place of medical training increased), the number of physicians who located there decreased. The magnitudes of the beta coefficients were such that an increase of 10 percent in the variable MHOM, resulted in 0.4 percent increase in the number of physicians who located in the county. A 10 percent increase in values of the variable MMSC, resulted in a 0.3 percent decrease in the number of physicians.

Physicians, therefore, tended not to locate in or near their hometowns but rather favored locations near their places of training.

The departure of the MHOM coefficient from the expected sign could be explained in two ways: (1) misspecification of the explanatory variable, and (2) the nature of the aggregated data set.

First of all, perhaps place of birth was not the best operational definition of each physician's "hometown" (i.e. the environment with which the physician is most familiar). Given the high degree of mobility of the U.S. population, it is unlikely that for most people, place of birth and hometown could ever be consistantly and successfully defined.

A second consideration lies in the nature of the data set itself. The counties associated with those observations with the largest values of the dependent variable were almost exclusively Oklahoma and Tulsa. These two counties also contained the largest number of those physicians practicing in the state who were born out-of-state. The large number of physicians born out-of-state tended to produce high average number of miles from home figures which were in turn associated with the largest of the dependent variables. As a result, in the case of the general physician location model, proximity to hometown could not be shown to be a positive influence.

Access to Medical Facilities (MHOS, MMMC). Two measures of a county's access to medical facilities were considered in the model -- the average number of miles to the nearest hospital and the average number of miles to a major medical facility. The hypotheses tested were that as county access to either type of facility was increased

(i.e. as the number of miles between place of practice and either type of facility decreased), the number of physicians who located in that county also increased.

In the case of the variable MMMC, the associated beta coefficient (-0.319) was proven to be both significant and of the hypothesized sign. The results indicated that physicians did tend to consider the accessibility of a community to one of the two major medical centers of Oklahoma City and Tulsa. As indicated by the beta coefficient, an increase of 10 percent in the number of miles from the nearest of these two centers resulted in a 3.1 percent decline in the number of physicians who located there.

The variable MHOS performed somewhat as expected. The negative sign of the beta coefficient (-0.015) corresponded to and supported the hypothesized relationship. Physicians tended to locate in or near those communities with hospital facilities. The rather low t-statistic associated with the coefficient did cast some doubt as to the significance of the coefficient. In light of the fact, however, that only 111 (5.8 percent) out of the total 1919 physicians considered did not locate in a community with a hospital and that these 111 doctors located, on the average, within 16 miles of a community with a hospital, the importance of the variable seemed hard to ignore.

Summary

The model proposed withstood the rigors of hypothesis testing quite well. Of the seven relationships examined, five conformed with the hypotheses presented. Three of these five hypotheses dealing with the variables PPROF, MMSC and MMMC were accepted without question

while the remaining two dealing with the variables PURB and MHOS were accepted on the basis of other supportive evidence. The remaining two hypotheses, dealing with PPR and MHOM, were rejected as the result of the hypothesized sign of the beta coefficient not conforming to the sign of the actual calculated beta coefficient and alternative explanations were presented. In general, physicians tended to be most attracted to those counties with (1) a high percent of the population engaged in professions, (2) easy physical access to a major medical center, and (3) a low population to physician ratio. The rationale of each of these variables was apparent when viewed as surrogate measures of opportunites for companionship of similar professional background, a desire for access to the latest in equipment, facilities and backup personnel and a demand for physician services high enough to insure a respectable income but low enough so as not to place overwhelming demands on leisure time. At the same time, seperate evidence was presented to support the hypothesis that the percent of the population living in urban areas also exerted a moderate amount of positive impact on the attractiveness of a community despite a questionable showing within the multiple regression testing framework.

Other county characteristics attractive to the physician to a lesser degree were easy access to local hospital facilities and some degree of familiarity with the environment as indicated by relative close proximity to place of medical training. Finally and somewhat theoretically unexplainable, the analysis also seemed to indicate that the farther a potential place of practice was from the physician's hometown, the more attractive that place was.

CHAPTER V

RESULTS OF THE CHI-SQUARE ANALYSIS

It will be recalled that the second stated objective of this study was to examine the possibility of different types of physicians being influenced to different degrees by the hypothesized location factors. The reasoning was that although physicians may have been influenced by the same general set of location considerations, some specific types of physicians may have been more strongly attracted to very specific types of environments either as the result of different professional needs or different personal preferences. 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 knowlege of what sort of physician has tended to locate in communities of a certain size, with a certain degree of demand etc., recruitment efforts of a given community might be aimed at the specific physician population most likely to locate there. In this way, the community's chances of recruitment success might be increased. Chi-square analysis was used to test for the existence and nature of the relationships between types of physicians and types of environments. The procedure was discussed and outlined in Chapter II.

The Results

Type of Practice

As Tables XIII through XIX in the Appendix indicate, there was a relationship between the type of medical practice and the type of location the physician preferred. In general, practicing specialists tended to favor those locations in low demand, metropolitan counties with large (by Oklahoma standards) professional populations as indicated by the underestimation of specialist in each of these categories. In terms of the accessibility of their locations to medical facilities, the specialists overwhelmingly favored those sites with direct access to local hospital facilities. Only 8 out of 660 specialists located in communities lacking hospitals. This attractiveness was also characteristic of those locations with immediate access to a major medical center. On the other hand, the specialist tended to locate farther from the familiar environments of their hometowns and medical schools than was expected.

The nonspecialists were found to locate in those counties with high demands for physician services and those with largely rural and nonprofessional populations. Unlike the specialists, the nonspecialists showed a willingness to locate in communities without direct access to local hospital facilities and at larger distances from the state's major medical centers. They also tended to locate more in communities with medium and easy access to hometowns and easy access to medical schools.

State of Training

When the distribution of Oklahoma-trained physicians was compared to that of physicians trained out-of-state in terms of types of favored environments, a pattern of the relationship between state of training and type of location emerged. Only one of the location characteristics considered, the percent of the population engaged in professions, failed to significantly relate to place of medical training. The types of environments favored by Oklahoma-trained physicians did differ significantly from those favored by physicians trained out-of-state. The specific results of the chi-square analysis are presented in Tables XX through XXVI in the Appendix.

Summarizing, the physicians trained out-of-state tended to locate their practices more often than expected in those counties with a low demand for physician services and of a metropolitan nature. Their locations gave them direct access to local hospitals and, in general, immediate access to the facilities of one of the two major medical centers. However, their decisions to locate in Oklahoma limited their access to the more familiar environments of hometowns and medical schools.

The Oklahoma-trained physicians, unlike the out-of-state trained physicians showed a tendency to favor the rural counties with a high demand for physician services. Like the nonspecialists, the Oklahoma-trained physicians were more willing to locate in communities lacking local hospital facilities and at greater distances from the medical centers than would be expected. In terms of access to familiar environments, the Oklahoma-trained physicians tended to locate closer

to hometowns and, of course, medical schools than did the non-Oklahoma trained physicians.

State of Birth

The possibility that the type of environment favored by Oklahoma-born doctors differed significantly from that favored by physicians born out-of-state was tested and the results are presented in Tables XXVII through XXXIII in the Appendix. Of all the location characteristics considered, only the percent of the population engaged in professions, failed to relate to place of birth.

The low demand and metropolitan counties of Oklahoma attracted more of the physicians born out-of-state than expected. With respect to the access of locations to hospital facilities, the number of physicians born out-of-state was underestimated in those communities with local hospitals and in those with immediate access to the major medical centers. This seemed to indicate an unwillingness to locate in communities without local hospitals, and indeed, outside of the major centers of Oklahoma City and Tulsa. When access to familiar environment measures were considered, non-Oklahoma born physicians tended to favor communities farther away from their medical schools, and, of course, hometowns than would be expected given the make-up of the entire data set.

On the other hand, Oklahoma-born physicians tended to locate in rural and high demand counties in numbers larger than expected. These physicians also seemed to be more willing than the physicians born out-of-state to locate in communities without local hospital facilities and at greater distances from the major medical centers. As would be

expected, they tended to locate near their hometowns and their medical schools.

Age at the Time of Location

The question to be answered here was whether or not the types of locations selected by physicians were related to their ages at the time the location decisions were made. As indicated in Tables XXXIV through XL in the Appendix, no significant relationships were found between the type of locations selected on the basis of demand, urban amenities, access to a major medical center or medical school and the ages of the physicians at the time the moves were made. Physicians, regardless of age, tended to locate in the expected proportions in each type of location. It was found, however, that the older physicians were underestimated in (1) the counties with the largest professional populations, (2) communities without hospitals facilities and (3) communities with low hometown access. Concurrently, the number of younger physicians was underestimated in (1) the counties with small professional populations, (2) communities with local hospitals, and (3) communities closest to their hometowns.

The above results indicate that location preferences did change as the physicians grew older. As new young doctors, the physicians were drawn to the more familiar hometown environments where the support of family and friends was readily available. As they grew older, this local support did not appear to be as important a consideration as it had been. The older physician showed a willingness to move farther away from his hometown than expected. Perhaps related to this tendency of older physicians to locate farther from home was the move

from communities with small professional populations to the more professionally oriented communities. Once the need for family support was no longer necessary, a desire to insure oneself of opportunities for companionship in other communities seems to have become a more important consideration. Finally, the older physician was less dependent than the younger physician on the services provided by the local hospital facilities. This was perhaps the result of either greater self-confidence or a willingness to do without hospital facilities because of an intention of slow down the practice in anticipation of retirement. This second tentative explanation implies that the location was chosen for its qualities as a retirement community rather than a place of practice.

Year of the Location Decision

The distribution of physicians by time of the location decision was examined in order to determine what, if any, trends in the type of locations favored by physicians have evolved over the years. As Tables XLI through XLVII indicate, no significant relationship was found to exist between time of location decision and location with respect to access to hometown and medical school. The location of practices has not changed significantly over the years in terms of distance to (1) place of birth and (2) medical training for the physician population under consideration.

The physician who located prior to 1940 tended to favor locations in counties with low demand for physicians services and rural, non-professional populations, an apt description of all of Oklahoma counties

during that period. In larger numbers than expected, the communities they selected had no local hospital facilities and had somewhat limited access to the state's major medical centers.

The group of physicians who located between 1940 and 1959, on the other hand, tended to locate in counties with medium or high demands for medical services and developing urban, professional populations. By this time, the distribution of locations between communities with and without hospital facilities was as expected given the make-up of the entire data set. A tendency to locate away from the major medical centers was still apparent given the unexpected number of physicians whose locations were classified as having limited and extremely limited medical center access.

The largest number of physicians considered had located in the 1960 to 1973 period. These physicians were underestimated in both those counties with low and high demand for physician services. This possibly indicates a beginning awareness of the need for physicians in some long neglected areas of Oklahoma. The number of physicians in the metropolitan and professional counties was also underestimated indicating a tendency to favor locations in these counties. Unlike their predecessors, these doctors were unwilling to locate in communities without local hospital facilities as illustrated by the underestimation of physician numbers in those communities. In terms of their access to the major medical centers, these physicians favored locations with immediate or easy access at the expense of the more distant locations.

In general, the type of locations favored by physicians has changed over the years. The trend has been in favor of the lower demand counties with largely urban, professional populations at the expense of the areas with larger demand for physician services and/or rural, nonprofessional populations. When it came to consideration of a site in terms of access to medical facilities, communities with local hospitals attracted a larger than expected proportion of the total physician population; the same was true of communities with immediate or easy access to one of the state's two major medical centers of Oklahoma City and Tulsa.

Summary

As a result of the chi-square analysis, it was found that although physicians were influenced by the same general set of hypothesized location factors, different types of physicians did tend to locate in different types of environments. In other words, communities characterized by different levels of demand, urbanization, etc. attracted different types of physicians.

The nonspecialist physician, the Oklahoma-trained physician and the native Oklahoma physician were similar in their location decisions in that each were more willing than expected to locate in counties with high demands for physician services and those with largely rural, nonprofessional populations. These same types of physicians also showed an unexpected tendency to locate in communities without local hospital facilities and lacking easy access to the state's major medical centers. In terms of the access to hometowns and medical schools,

a larger number of the nonspecialists, Oklahoma-trained physician and native Oklahoman types located closer to places of birth and training than expected.

On the other hand, the specialist, non-Oklahoma trained physician, and non-native physician populations' locations were at the other end of the spectrum of environments. Unexpectedly, these types seemed to favor locations in counties with low demands for physician services and largely urban populations. The professional make-up of a county was shown to be of importance in the decisions of specialists only. Each of these physician types were underestimated in those communities with easy access to both local and major medical facilities. This would seem to indicate an unwillingness by these physicians to do without the back-up provided by these facilities. Also, these physicians tended to locate farther away from hometowns and medical schools than expected.

When the relatioships between the age of the physician at the time of the location decision and the type of environment was explored, it was found that only in terms of opportunities for companionship as measured by professional population and access to local hospital facilities and hometowns did the type of location vary with age. The younger physicians were attracted in unexpected numbers to locations in counties with small professional populations, easy access to the familiar environments of hometowns and direct access to local hospital facilities. The older physicians were attracted to the opposite types of environments.

The type of location favored by physicians has changed over time. The trend has been in favor of lower demand counties and those with largely urban and/or professional populations. In terms of access to medical facilities, communities with local hospitals have begun to attract an unexpected proportion of the physician population as have those communities with easy access to Oklahoma City and Tulsa. There was no significant differences over time in the types of environments chosen in terms of access to hometowns and medical schools.

CHAPTER VI

SUMMARY, IMPLICATIONS AND FURTHER RESEARCH

Summary

The major objective of this study were two-fold. First, the factors which influenced the location decisions of physicians involved in primary care were to be examined. Second, although it was hypothesized that physicians in general were influenced by the same set of factors, the possibility that different types of environments attracted different types of physicians, was to be tested. The state of Oklahoma was chosen as the study area and the state's 1973 population of practicing direct patient care physicians as the study population. Information on 1996 physicians was gathered by the author from the American Medical Directory (1973) and the records of the Oklahoma State Board of Medical Examiners.

Historical Trends in the Distribution of Physicians

Evidence was presented in Chapter III to show that while Oklahoma's population has increased and become areally concentrated over the years since statehood, the physician population has increased

at a slower rate and has become even more aggregated. This concentration of physicians has occurred in the state's more urban counties at the expense of the more isolated rural counties.

The Location Decision Factors Model

On the basis of previous research results and intuitive arguments as to what factors would seem to be key considerations to the relocating physician, a model of physician location factors was developed. It was hypothesized that physicians located so as to maximize their personal and professional environments, instead of their incomes, as had traditionally been assumed. As a result of this environment maximizing argument, it was hypothesized that physicians located in places which had a high demand for their services, opportunities for recreational and leisure activities provided by an urban environment, opportunities to make friends of similar professional backgrounds, access to the familiar environments of hometown and medical school and, finally, access to medical facilities at both the local and major medical center levels.

In order to operationalize the model and test its validity within an ordinary least squares multiple regression format, the following surrogate measures of the hypothesized factors were used: (1) the population to physician ratio of the location county (PPR), (2) the percent of the county population living in urban areas (PURB), (3) the percent of the county population involved in professions (PPROF), and the number of miles between place of practice and (4) place of birth (MHOM), (5) place of medical training (MMSC), (6) the

closest hospital facilities (MHOS) and (7) the nearest major medical center (MMMC).

Results indicated that contrary to the hypothesized relationship, as the the population to physician ratio increased for a location, the number of physicians who located there decreased. Physicians seemed to avoid those locations with a high demand for physician services. Perhaps they did so as to avoid excessive demands on their leisure time. If demand can be viewed as positively related to potential income, this result supported the argument advanced that physicians were not income maximizers but rather were more concerned with environment. The magnitude of the multiple regression beta coefficient of the demand ratio (-0.123) indicated that demand had a larger impact on physician numbers than all but two of the other hypothesized location factors.

The relationship between urbanization level of a county and physician numbers was somewhat less clear. Within the multiple regression framework, the percent of the population living in urban areas failed to be shown a significant factor. On the other hand, when regressed against physician numbers in a simple regression format, the variable was a significant positive factor of relatively large magnitude as indicated by a simple regression beta coefficient of 0.159. On the basis of this result and other supporting evidence (i.e. scattergram and simple correlation coefficients), the variable, PURB, was accepted as a significant factor in the location decision. Physicians were attracted in greater numbers to those locations which offered a high level of urban amenties.

The percent of the population engaged in professional occupations (PPROF) proved to be not only a significant factor in physician location decisions but also to have the largest impact on the number of physicians who located as indicated by the multiple regression beta coefficient of 0.615. Increases in a location's professional population seemed to be the most effective way of attracting more physicians.

In terms of the two measures of access to familiar environments, the number of miles between place of practice and birthplace (MHOM) was shown to be a significant, positive factor in the location decisions of physicians while the number of miles between place of practice and place of medical training (MMSC) was also a significant factor but of a negative influence. However, the magnitude of the regression beta coefficients of both of these variables left some doubt as to the power of either factor as a means of attracting new physicians.

The final set of factors considered were the two measures of access to medical facilities (MHOS and MMMMC). Both variables performed as expected with negative beta coefficients indicating that for the data examined as the number of miles between (1) place of practice and local hospital facilities and (2) place of practice and major medical centers decreased, the number of physicians who located increased. The magnitude of the medical center access variable beta coefficient (-0.319) made it the second most effective factor in attracting physicians.

In total, the model accounted for 48 percent of the variation about the mean of the dependent variable, a respectable explanatory level vis-a-vis previous research results.

The Differences Test

In order to test the possibility that different types of locations were attractive to specific types of physicians, chi-square analysis of physician versus location types was used. It was found that different types of physician did tend to locate in different types of environments. In summary, the following observations were made:

(1) The state's nonspecialists, Oklahoma born physicians and Oklahoma trained physicians were all attracted to similar types of environments. These physician types were attracted in larger numbers than expected to locations characterized by high demands for physician services (high PPR), largely rural population (low PURB), easy access to familiar environments (low MHOM and MMSC) and lacking immediate access to back-up medical facilities (high MHOS and MMMC). In addition, the professional orientation of an area's population was related only to type of practice where nonspecialists showed a willingness to locate in larger numbers than expected in areas with largely non-professional populations.

(2) On the other hand, the state's practicing specialists, those physicians born out-of-state and those trained outside of Oklahoma also were attracted to similar types of locations. These types of physicians favored locations characterized by low levels of demand for physician services (low PPR), largely urban environments (high PURB), lacking access to familiar environments (high MHOM and MMSC) and with immediate access to both local and major medical centers (low MHOS and MMMC). Again, the professional orientation of an area was related only

to type of practice where the specialist tended to favor areas with strong professional orientations by Oklahoma standards.

(3) When the relationship between type of location and age of the physician at the time of the location decision was examined, no significant relationship was found between age and a location's demand, level of urbanization and access to either medical school or major medical centers. It was found, however, that the younger physicians unexpectedly tended to locate in places with largely non-professional populations (low PPROF), and with easy access to local hospital facilities and to their hometowns (low MHOS and MHOM). The older physicians showed a tendency to locate in areas with professional populations (high PPROF) and at farther distances from hometowns and hospital facilities than expected (high MHOM and MHOS).

(4) In general, 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 needs for physicians services and rural, non-professional populations. When it came to consideration of a site in terms of access to medical facilities, locations with local hospitals had begun to attract a larger than expected proportion of the total physician population. The same was true of locations with easy access to one of the state's two major medical centers.

Implications

Given the above results, the logical questions were: (1) What might the distribution of physicians look like if current trends continued? and (2) Given the impact of each of the location factors, what sorts of programs might through manipulation of these factors bring about positive changes in the distribution of physicians?

Future Trends

The spatial distribution of physicians has become more concentrated in the state's more urban counties over the years. The findings of this study seem to indicate that this trend of areal concentration of physicians will continue.

Physicians were shown to be attracted to those locations with low population to physicians ratios, high levels of urbanization and that have largely professional populations. Since rural counties of the state are by definition characterized by low levels of urbanization and can be shown (Table XI) to be high demand, non-professionally oriented areas, their failure to attract physicians in the past is understandable. Given the results of the chi-square analysis of trends in the types of location favored over the years which showed a definite positive relationship between year of the location and low demand ratios, high levels of urbanization and professionalism, the failure of the rural counties to attract physicians seems bound to continue.

The Impact of Factor Manipulation

The results of the location factor model indicated that the following types of programs might improve the distribution of physicians by attracting physicians to areas now lacking them (i.e. in Oklahoma, the rural counties).

In terms of the magnitude of potential impact, the percent of the population engaged in professions was the most powerful factor considered. As indicated earlier, a 10 percent increase in PPROF resulted in a 6 percent increase in the number of physicians who located. If, then, a rural county wanted to make itself more attractive to physicians, the most effective means would be to increase its professional population. In Oklahoma, where the professional populations of the rural counties are very small in number, a very small influx of professional people could result in a sizeable professional population percentage increase and possible additions to the physician population. The problem with trying to attract additional professional people or the type of business or industry which employs large numbers of professionals to a rural area is that businesses of that sort tend to be attracted to urban areas where the existing population assures the business of an appropriately trained labor force.

The second factor with a beta coefficient of sizeable magnitude was the measure of physical access to a major medical center, MMMC. Its beta coefficient of -0.319 implied that a 10 percent decrease in the number of miles between a location and a major medical center increased the number of physicians attracted to that location by

3 percent. Two means of increasing community access to major medical centers could be employed: (1) the establishment of increased ties with existing major centers, and (2) the up-grading of existing minor regional medical centers into major centers.

Although the number of physical miles between a rural community and the major hospitals in Oklahoma City or Tulsa cannot be changed, the rural physician's accessibility to the services proved by the major hospitals could be improved through arrangements which would allow the rural physician to use the available services. Examples of the types of ties considered here would be the establishment of formal consultation arrangements between rural physicians and center specialists, or the use of talk-back video hook-ups such as those used in federally subsidized test programs in the provision of health services to isolated parts of the Southwest. Perhaps knowing that formal ties exist with the specialists of the major centers would reduce the feelings of professional isolation common to a rural practice.

The second approach to increasing rural community access to major medical center facilities would be to up-grade the existing minor centers such as Enid, Woodward, Lawton, Ardmore or McAlester, so that the services now offered only in Oklahoma City and Tulsa would be more readily available statewide. This sort of program would necessitate state and/or federal support since the "natural forces" necessary do not seem to exist locally.

The impacts of the other location factors, as indicated by the magnitude of the coefficients of PPR, PURB, MHOS, MHOM, AND MMSC, were small enough to raise some questions as to the effectiveness of programs aimed at increasing physician numbers through manipulations of these factors. Used in concert with each other, however, the following types of measure might be effective:

(1) Results indicated that physicians were more attracted to areas with low demand for physician services than to those with higher demand ratios. Before the rural areas of the state with the highest demand ratios can attract physicians, demand ratios must be decreased so that assurances that a physician will have adequate leisure time can be made. Perhaps the best ways to provide these assurances would be for rural communities with high demand ratios to try to recruit teams of physicians interested in group practice situations rather than individuals and/or guarentee to provide a full-time physician's assistant to any locating physician. Either scheme might reduce the perceived demand on a physician's time enough to induce a physician to locate in rural areas now lacking physicians.

(2) Given the inverse relationship between the variable MHOS and the number of locating physicians, programs aimed at decreasing the number of miles between a possible practice location and local hospital facilities might attract more physicians to that location. The obvious solution then would be to build hospitals in those communities now lacking them. But given the small change in physician numbers affected (0.1 percent increase in physician numbers/ 10 percent decrease in MHOS), the question as to whether or not the rewards justify the financial outlay could be argued. Here again, the

increased indirect access of tie-in programs with existing hospitals is perhaps the best that could be achieved.

(3) As the beta coefficient of -0.030 indicated, a decrease in the variable MMSC brought about a positive change in physician numbers. Like hospitals, however, medical schools are not the type of facilities which are built very frequently. This,in turn, makes it difficult to improve a given community's actual physical access to medical schools. But since access to place of training was used only as a surrogate measure of a location's familiarity to the locating physician, it could be argued that programs aimed at introducing potential physicians to an area might be worthwhile. These might include the establishment of formal internships and/or residencies with local hospitals or programs of the sort used by the University of Minnesota's Medical School to introduce medical students to rural/small community practice. In this Rural Physicians' Associate program, fourth year medical students spend one year with practicing rural physicians in the state for which they receive both payment and academic credit. (See Verby and Connolly, 1972 for a more extensive discussion of this program.)

(4) Although access to hometowns, another of the considered familiarity measures, failed to be shown to be a significant location factor, it should be noted that for Oklahoma physicians born in Oklahoma, practice locations were on the average within 50 miles of hometowns. This fact leads one to suggest that those communities, agencies, etc. interested in providing physician

services to those areas of the state now lacking such services might do well in the long run to encourage area youths to enter medical school.

Perhaps the two most direct and proven effective forms of encouragement that could be offered the potential rural medical student would be financial support and differential medical school admission requirements. Given the increasing costs of a medical education, community scholarship programs when tied to local service committments could provide rural areas with a sure means of securing the services of 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 somewhat below par. 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).

(5) Given the rather ambiguous role of urbanization as a location factor, suffice it to say that any type of program aimed at regional development or growth center development, as a by-product the development of new or the growth of existing urban centers, would likely have a positive impact on the attractiveness of that area to physicians.

Different Types of Physicians and Communities

Perhaps the greatest contribution of this study lies not in the discussion of the impact of factor changes on physician numbers but

rather in the analysis of types of locations chosen by types of physicians. As pointed out previously, if a community knows what type of physicians had tended to locate in communities with similar demands for physician services, opportunities for leisure activities and companionship, et., it can re-direct its recruitment efforts and maybe increase the efficiency of those efforts leading to a better chance of success.

In general, the need for more physicians exists in the rural counties of Oklahoma. Results indicate that these areas would do well to look for Oklahoma-born and trained physicians whose practices fall into the nonspecialists category. In terms of the age categories to look at, recent medical school graduates from the needy area would be good prospects.

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.

Further Research

The location decisions of physicians have been a subject of research now for over 40 years. Because of the problems inherent in gathering information from many sources, studies which have looked at the actual location decisions of the nation's physicians, rather than at a sample of physician population's perceptions of their moves, have tended to ignore the role of individual physician background characteristics in the location decision. This study has attempted to incorporate this type of consideration but further research in the following areas would be appropriate.

(1) Given the introduction of family practice specialities into the nation's medical school curriculums in recent years and the potential impact of these specialists on the distribution of primary care physicians, inquires into the type of student attracted to this specialty field and the factors influencing their location decisions should be made.

(2) In order to better understand the impact of the location of medical training and familiar environments on a physician's location decision, studies might consider the role that the availability of internships and residencies in an area plays in determining the future number of physicians attracted to an area. Place of training is a familiar environment and is an attractive area but definition of this variable should not be limited to medical school location.

(3) The relationship between the types of communities within which the physician grew up, trained and eventually located his practice should be examined. The question to be answered here is whether or not physicians tend to select communities with characteristics similar to those within which they grew up.

In addition to this research on M.D. location decisions, the existing and potential role of the osteopathic physician (D.O.) in the provision of primary medical services especially to rural areas has for the most part been ignored but should be explored. A quick survey of the directory of Oklahoma osteopathic physicians would seem to indicate that these physicians have tended to locate for the most part in rural areas and communities ignored by the M.D. population for many years. Given the potential value of these professionals in any program aimed at improving the public's physicial access to physician

services, profile studies of the osteopath and the factors influencing his location decisions are in order.

Each of these avenues of research could contribute to the overall understanding of the factors influencing the location decisions of physicians and the eventual design of programs aimed at improving the distribution of physicians.

A SELECTED BIBLIOGRAPHY

Berry, B.J.L. and W. Garrison.

1958 "Functional Bases of the Central Place Hierarchy," Economic Geography, Vol. 34, pp. 145-154.

Corey, L., S.E. Saltman and M.F. Epstein, eds.

1972 Medicine in a Changing Society. St. Louis: C.V. Mosby Co.

de Vise, P.

1972 "The Maldistribution of Physicians," The New Physician, October, pp. 611-614.

1973 "Misused and Misplaced Hospitals and Doctors," Washington, D.C.: Commission on College Geography, Resource Paper No. 22.

Dinkel, R.M.

1946 "Factors Underlying the Location of Physicians Within Indiana,"American Sociological Review, Vol. 11, pp. 16-25.

Doherty, N.

1970 Rurality, Poverty and Health: Medical Problems in Rural Areas. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 172.

Elesh, D. and P.T. Schollaert.

1972 "Race and Urban Medicine: Factors Affecting the Distribution of Physicians in Chicago," Journal of Health and Social Behavior, Vol. 13, September, pp. 237-249.

Fahs, I.J. and O.L. Peterson.

1968 "Towns Without Physicians and Towns With Only One -- A Study of Four States in the Upper Midwest," American Journal of Public Health, Vol. 58, pp. 1200-1211.

Fein, R.

1954 "Studies on Physician Supply and Distribution," American Journal of Public Health, Vol. 44, pp. 615-624.

Glasser, M.

1972 "Consumer Expectations of Health Services," in L. Corey et al., eds. Medicine in a Changing Society. St Louis: C.V. Mosby Company, pp. 29-38.

Goldberger, A.S.

1964 Econometric Theory. New York: John Wiley and Sons, Inc.

Gould, P. and R. White.

1968 "The Mental Maps of British School Leavers," Regional Studies, November, pp. 161-182.

Hambleton, J.W.

1971 "Determinants of Geographic Differences in the Supply of Physicians Services," Ph.D. dissertation, University of Wisconsin, Department of Economics.

Hoover, Edgar M.

1975 An Introduction to Regional Economics. New York: Alfred A. Knopf.

Kennedy, E.M.

1972 "Changing the Face of American Health," in L. Corey et al., eas. Medicine in a Changing Society. St Louis: C.V. Mosby Company, pp. 105-116.

Lankford, P.M.

1974 "Physician Location Factors and Public Policy," Economic Geography, Vol. 50, pp. 244-255.

Leftwich, R.H.

1966 The Price System and Resource Allocation. New York: Holt, Rinehart and Winston.

Leland, R.G.

1936 Distribution of Physicians in the United States. Chicago: American Medical Association.

Liccione, W.J. and S. McAllister.

1974 "Attitudes of First Year Medical Students Towards Rural Medical Practice," Journal of Medical Education, Vol. 49, pp. 449-451.

Marden, P.G.

1966 "A Demographic and Ecological Analysis of the Distribution of Physicians in Metropolitan America, 1960," American Journal of Sociology, Vol. 72, pp. 290-300.

Mattson, D.E., D.E. Stehr and R.E. Will.

1973 "Evaluation of a Program Designed to Produce Rural Physicians," Journal of Medical Education, Vol. 48, pp. 323-331.

Morrill, R. and R. Earickson.

1966 Hospital, Physician and Commercial Location. Chicago: Chicago Hospital Study, Working Paper Series 1, No.7.

Nelson, L.

1942 "Distribution, Age and Mobility of Minnesota Physicians, 1912-1936," American Sociological Review, Vol. 7, pp. 792-801.

Oklahoma Population Estimates, July 1973

1974 Oklahoma Employment Security Commission. Oklahoma City, Oklahoma: State Printing Office.

Parker, R.C. Jr. and T.G. Tuxill.

1967 "Attitudes of Physicians Toward Small-Community Practice," Journal of Medical Education, Vol. 42, pp. 327-344.

Profile of Regional Health Variables.

1974 Oklahoma Health Planning Commission. Oklahoma City, Oklahoma: State Printing Office.

Pyle, G.F.

1971 "Heart Disease, Cancer and Stroke in Chicago", Chicago: University of Chicago, Department of Geography, Research Paper No. 134.

Rimlinger, G.V. and H.B. Steele.

1963 "An Economic Interpretation of the Spatial Distribution of Physicians in the United States," Southern Economic Journal, Vol. 30, pp. 1-12.

Robertson, L.S., J. Kosa, M.C. Heagarty, R.J. Haggarty and J.J. Alpert.

1974 Changing the Medical Care System. New York: Praeger Publishers.

Rushing, Wm. A. and G.T. Wade.

1973 "Community-Structure Constraints on Disturbution of Physicians," Health Services Research, Vol. 8, pp. 283-297.

Salkin, M.S.

1973 "Migration and Migration Predictions in the Western Region of the United States," Ph.D. dissertation, University of California, Department of Agricultural Economics.

Shannon, G.W. and G.E.A. Dever.

1974 Health Care Delivery, Spatial Perspectives. New York: McGraw-Hill.

Smith, D.M.

1975 Patterns in Human Geography. New York: Crane, Russak and Company, Inc.

Steele, H.B. and G.V. Rimlinger.

1965 "Income Opportunities and Physician Location Trends in the United States," Western Economic Journal, Vol. 3, pp. 183-194.

Taylor, M., W. Dickman and R. Kane.

1973 "Medical Students' Attitudes Toward Rural Practice," Journal of Medical Education, Vol. 48, pp. 885-895.

Terris, M.

1956 "Recent Trends in the Distribution of Physicians in Upstate New York", American Journal of Public Health, Vol. 46, pp. 585-591.

U.S. Department of Health, Education and Welfare.

1967 Health Characteristics by Geographic Region, Large Metropolitan Areas and Other Places of Residence - U.S., July 1963-June 1965. Washington, D.C.: National Center for Health Statistics, Series 10, No. 36.

Verby, J.E. and J.P. Connolly.

1972 "Rural Physician's Associate Program," Journal of Medical Education, Vol. 47, pp. 907-908.

Williams, R.C. and W.W. Uzzell.

1960 "Attracting Physicians to Smaller Communities," Hospitals, Vol. 34, pp. 49-51.

APPENDIX

TABLE VIII

A SPECIFIC LISTING OF TYPES OF PRACTICES INCLUDED IN NONSPECIALIST AND PRACTICING SPECIALIST CATEGORIES

Nonspecialists	
General Practice	Obstetrics and Gynecology
Family Practice	Obstetrics
Internal Medicine	Pediatrics
Gynecology	General Surgery

Practicing Specialists	
Aerospace Medicine	Pathology, Clinical
Allergy	Pathology, Forensic
Anesthesiology	Pediatrics, Allergy
Broncho-Esophagology	Pediatrics, Cardiology
Cardiovascular Diseases	Pharmacology, Clinical
Dermatology	Physical Medicine and Rehabilitation
Diabetes	Psychiatry
Endrocrinology	Psychiatry, Child
Gastroenterology	Psychoanalysis
General Preventive Medicinc	Psychosomatic Medicine
Geriatrics	Pulmonary Diseases
Hematology	Radiology
Hypnosis	Radiology, Diagnostic
Infectious Diseases	Radiology, Pediatric
Laryngology	Radiology, Therapeutic
Legal Medicine	Rheumatology

TABLE VIII (continued)

Practicing Specialists (continued)	
Neoplastic Diseases	Rhinology
Nephrology	Surgery, Abdominal
Neurology	Surgery, Cardiovascular
Neurology, Child	Surgery, Colon and Rectal
Neuropathology	Surgery, Hand
Nuclear Medicine	Surgery, Head and Neck
Nutrition	Surgery, Neurological
Occupational Medicine	Surgery, Orthopedic
Ophthalmology	Surgery, Pediatric
Otology	Surgery, Plastic
Otorhinolaryngology	Surgery, Thoracic
Pathology	Surgery, Traumatic

Source: American Medical Directory, (1973).

TABLE IX

COUNTRIES OF BIRTH FOR OKLAHOMA DIRECT PATIENT CARE PHYSICIANS

Country	Frequency	Country	Frequency
North America		Eastern Europe	
Canada	11	Latvia	1
United States	1921	Poland	1
		Romania	2
Latin America		Russia	1
Argentina	3		
Barbados	1	Middle East	
Brazil	1	Iran	1
Canal Zone	1	Israel	1
Chile	1	Lebanon	1
Cuba	7	Syria	2
El Salvador	1	Turkey	1
Mexico	1		
Panama	1	Asia	
Peru	2	Hong Kong	1
Puerto Rico	2	India	7
Trinidad	1	Indonesia	1
		Phillipines	4
Europe		Taiwan	2
England	3		
France	1		
Greece	1	Africa	
Ireland	3	Kenya	1
Italy	2	South Africa	2
Scotland	1		
West Germany	2		
		Total	1996

Source: American Medical Directory, (1973).

TABLE X

COUNTRIES OF TRAINING FOR OKLAHOMA
DIRECT PATIENT CARE PHYSICIANS

Country	Frequency	Country	Frequency
North America		Eastern Europe	
Canada	9	Romania	1
United States	1951	Yugoslavia	1
Latin America		Middle East	
Argentina	3	Iran	1
Brazil	1	Lebanon	3
Chile	1	Syria	1
Cuba	4	Turkey	1
Mexico	2		
Europe		Asia	
Great Britain	1	India	7
Ireland	2	Phillipines	3
Spain	1	Taiwan	1
Switzerland	1		
West Germany	1	Total	1996

Source: American Medical Directory, (1973).

TABLE XI

SIMPLE CORRELATION COEFFICIENTS (r) FOR NONTRANSFORMED VALUES OF LOCATION DECISION MODEL VARIABLES

	NOPHY	PPR	PURB	PPROF	MHOS	MMMC	MHOM	MMSC
NOPHY	1.000							
PPR	-.173	1.000						
PURB	.443	-.386	1.000					
PPROF	.289	-.105	.597	1.000				
MHOS	.094	-.240	-.372	-.217	1.000			
MMMC	-.350	+.254	-.524	-.303	.104	1.000		
MHOM	.068	-.554	-.051	.008	-.077	-.024	1.000	
MMSC	.022	-.133	.092	.023	-.098	.000	.359	1.000

TABLE XII

SIMPLE CORRELATION COEFFICIENTS (r) FOR TRANSFORMED VALUES OF LOCATION DECISION MODEL VARIABLES

	NOPHY	PPR	PURB	PPROF	MHOS	MMMC	MHOM	MMSC
NOPHY	1.000							
PPR	-.317	1.000						
PURB	.279	-.310	1.000					
PPROF	.416	-.104	.365	1.000				
MHOS	-.138	.236	-.268	-.249	1.000			
MMMC	-.642	.418	-.333	-.292	.085	1.000		
MHOM	.153	-.063	-.006	.088	-.086	-.094	1.000	
MMSC	-.170	.193	-.107	-.064	-.062	.217	.102	1.000

TABLE XIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY TYPE OF PRACTICE AND DEMAND (PPR)

Type of Practice	PPR≤1000 E	PPR≤1000 O	1000<PPR≤1500 E	1000<PPR≤1500 O	PPR>1500 E	PPR>1500 O	Total
Nonspecialists	652	577	409	418	197	264	1259
Specialists	342	417	215	206	104	37	660
Total	994		624		301		N=1919

Source: American Medical Directory (1916-1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 90.85 with 2 d.f., and p=.0001.

TABLE XIV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY TYPE OF PRACTICE AND URBANIZATION (PURB)

Type of Practice	PURB<50% E	PURB<50% O	50%≤PURB<80% E	50%≤PURB<80% O	PURB≥80% E	PURB≥80% O	Total
Nonspecialists	211	288	309	342	739	629	1259
Specialists	111	34	162	129	387	497	660
Total	322		471		1126		N=1919

Source: American Medican Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census, (1910-1970). Chi-square = 138.70 with 2 d.f., and p=.0001.

TABLE XV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY TYPE OF PRACTICE AND OPPORTUNITIES FOR COMPANIONSHIP (PPROF)

Type of Practice	PPROF≤10%		10%<PPROF≤15%		PPROF>15%		Total
	E	O	E	O	E	O	
Nonspecialists	347	436	451	433	461	390	1259
Specialists	182	93	236	254	242	313	660
Total	529		687		703		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 100.27, with 2 d.f., and p=0.0001.

TABLE XVI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY TYPE OF PRACTICE AND ACCESSIBILITY TO LOCAL HOSPITAL FACILITIES (MHOS)

Type of Practice	MHOS=1		MHOS>1		Total
	E	O	E	O	
Nonspecialists	1186	1156	73	103	1259
Specialists	622	652	38	8	660
Total	1808		111		N=1919

Source: American Hospital Association Guide to the Health Care Field (1972-1973), American Medical Directory (1973), Guide to Hospitals (1951-1971), Hospital Service in the United States (1921-1950), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 38.59, with 1 d.f., and p=0.0001.

TABLE XVII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICANS BY TYPE OF PRACTICE AND ACCESSIBILITY TO MAJOR MEDICAL CENTERS (MMMC)

Type of Practice	MMMC=1		1<MMMC≤50		50<MMMC≤100		MMMC>100		Total
	E	O	E	O	E	O	E	O	
Nonspecialists	676	577	270	303	243	284	69	95	1259
Specialists	355	454	142	109	128	87	36	10	660
Total	1031		412		371		105		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 102.49, with 3 d.f., and p = 0.0001.

TABLE XVIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY TYPE OF PRACTICE AND ACCESSIBILITY TO HOMETOWNS (MHOM)

Type of Practice	MHOM≤50		50<MHOM≤200		MHOM>200		Total
	E	O	E	O	E	O	
Nonspecialists	321	328	409	427	529	504	1259
Specialists	168	161	215	197	277	302	660
Total	489		624		806		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 6.05, with 2 d.f., and p = 0.0472.

TABLE XIX

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY TYPE OF PRACTICE AND ACCESSIBILITY TO MEDICAL SCHOOLS (MMSC)

	MMSC ≤ 200		200 < MMSC ≤ 600		MMSC > 600		
Type of Practice	E	O	E	O	E	O	Total
Nonspecialists	725	763	325	319	209	177	1259
Specialists	380	342	171	177	109	141	660
Total	1105		496		318		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 20.11, with 2 d.f., and p = 0.0001.

TABLE XX

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICANS BY STATE OF TRAINING AND DEMAND (PPR)

	PPR ≤ 1000		1000 < PPR ≤ 1500		PPR > 1500		
State of Training	E	O	E	O	E	O	Total
Oklahoma	566	510	355	371	171	211	1092
Other	428	484	269	253	130	90	827
Total	994		624		301		N=1919

Source: American Medical Directory (1916-1973), Oklahoma State Board of Medical Examiners' Records, U. S. Bureau of the Census (1910-1970). Chi-square = 35.72, with 2 d.f., p = 0.0001.

TABLE XXI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF TRAINING AND URBANIZATION (PURB)

	PURB < 50%		50% ≤ PURB < 80%		PURB ≥ 80%		
State of Training	E	O	E	O	E	O	Total
Oklahoma	183	217	268	259	641	616	1092
Other	139	105	203	212	485	510	827
Total	322		471		1126		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U. S. Bureau of the Census (1910-1970). Chi-square = 17.36, with 2 d.f., and p = 0.0002.

TABLE XXII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS OF STATE OF TRAINING AND OPPORTUNITIES FOR COMPANIONSHIP (PPROF)

	PPROF ≤ 10%		10% < PPROF ≤ 15%		PPROF > 15%		
State of Training	E	O	E	O	E	O	Total
Oklahoma	301	297	391	392	400	403	1092
Other	228	232	296	295	303	300	827
Total	529		687		703		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U. S. Bureau of the Census (1910-1970). Chi-square = 0.18, with 2 d.f., and p=0.9059.

TABLE XXIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF TRAINING AND ACCESSIBILITY TO LOCAL HOSPITAL FACILITIES (MHOS)

	MHOS = 1		MHOS > 1		
State of Training	E	O	E	O	Total
Oklahoma	1029	1017	63	75	1092
Other	779	791	48	36	827
Total	1808		111		N=1919

Source: American Hospital Association Guide to the Health Care Field (1972-1973), American Medical Directory (1973), Guide to Hospitals (1951-1971), Hospital Service in the United States (1921-1950), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 5.46, with 1 d.f., and p = 0.0185.

TABLE XXIV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF TRAINING AND ACCESSIBILITY TO MAJOR MEDICAL CENTERS (MMMC)

	MMMC = 1		1 < MMMC ≤ 50		50 < MMMC ≤ 100		MMMC > 100		
State of Training	E	O	E	O	E	O	E	O	Total
Oklahoma	587	527	234	264	211	231	60	70	1092
Other	444	504	178	148	160	140	45	35	827
Total	1031		412		371		105		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 31.16, with 3 d.f., and p=0.0001.

TABLE XXV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF TRAINING AND ACCESSIBILITY TO HOMETOWNS (MHOM)

	MHOM ≤ 50		50 < MHOM ≤ 200		MHOM > 200		
State of Training	E	O	E	O	E	O	Total
Oklahoma	278	362	355	491	459	239	1092
Other	211	127	269	133	347	567	827
Total	489		624		806		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 423.28, with 2 d.f., and p = 0.0001.

TABLE XXVI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF TRAINING AND ACCESSIBILITY TO MEDICAL SCHOOLS (MMSC)

	MMSC ≤ 200		200 < MMSC ≤ 600		MMSC > 600		
State of Training	E	O	E	O	E	O	Total
Oklahoma	629	1084	282	8	181	0	1092
Other	476	21	214	488	137	318	827
Total	1105		496		318		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 1802.89, with 2 d.f., and p = 0.0001.

TABLE XXVII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND DEMAND (PPR)

	PPR ≤ 1000		1000 < PPR ≤ 1500		PPR > 1500		
State of Birth	E	O	E	O	E	O	Total
Oklahoma	512	468	321	340	155	180	988
Other	482	526	303	284	146	121	931
Total	994		624		301		N=1919

Source: American Medical Directory (1916-1973), U. S. Bureau of the Census (1910-1970). Oklahoma State Board of Medical Examiners' Records. Chi-square = 18.29, with 2 d.f., and p = 0.0002.

TABLE XXVIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND URBANIZATION (PURB)

	PURB < 50%		50% ≤ PURB < 80%		PURB ≥ 80%		
State of Birth	E	O	E	O	E	O	Total
Oklahoma	166	185	243	247	580	556	988
Other	156	137	229	224	546	570	931
Total	322		471		1126		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U. S. Bureau of the Census (1910-1970). Chi-square = 6.76, with 2 d.f., and p = 0.0331.

TABLE XXIX

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND OPPORTUNITIES FOR COMPANIONSHIP (PPROF)

State of Birth	PPROF≤10% E	PPROF≤10% O	10%<PPROF≤15% E	10%<PPROF≤15% O	PPROF>15% E	PPROF>15% O	Total
Oklahoma	272	259	354	373	362	356	988
Other	257	270	333	314	341	347	931
Total	529		687		703		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 3.72, with 2 d.f., and p = 0.1531.

TABLE XXX

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND ACCESSIBILITY TO LOCAL HOSPITAL FACILITIES (MHOS)

State of Birth	MHOS=1 E	MHOS=1 O	MHOS>1 E	MHOS>1 O	Total
Oklahoma	931	922	57	66	988
Other	877	886	54	45	931
Total	1808		111		N=1919

Source: American Hospital Association Guide to the Health Care Field (1972-1973), American Medical Directory (1973), Guide to Hospitals (1951-1971), Hospital Service in the United States (1921-1950), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 2.99, with 1 d.f., and p = 0.0794.

TABLE XXXI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND ACCESSIBILITY TO MAJOR MEDICAL CENTERS (MMMC)

State of Birth	MMMC=1		1<MMMC≤50		50<MMMC≤100		MMMC>100		Total
	E	O	E	O	E	O	E	O	
Oklahoma	531	489	212	234	191	200	54	65	988
Other	500	542	200	178	180	171	51	40	931
Total	1031		412		371		105		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square=16.88, with 3 d.f., and p=0.0009.

TABLE XXXII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND ACCESSIBILITY TO HOMETOWNS (MHOM)

State of Birth	MHOM≤50		50<MHOM≤200		MHOM>200		Total
	E	O	E	O	E	O	
Oklahoma	252	463	321	495	415	30	988
Other	237	26	303	129	391	776	931
Total	489		624		806		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 1295.12, with 2 d.f., and p = 0.0001.

TABLE XXXIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY STATE OF BIRTH AND ACCESSIBILITY TO MEDICAL SCHOOLS (MMSC)

State of Birth	MMSC≤200 E	MMSC≤200 O	200<MMSC≤600 E	200<MMSC≤600 O	MMSC>600 E	MMSC>600 O	Total
Oklahoma	569	809	255	118	164	61	988
Other	536	296	241	378	154	257	931
Total	1105		496		318		N=1919

Source: American Medican Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 494.00, with 2 d.f., and p=0.0001.

TABLE XXXIV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND DEMAND (PPR)

Location Age	PPR≤1000 E	PPR≤1000 O	1000<PPR≤1500 E	1000<PPR≤1500 O	PPR>1500 E	PPR>1500 O	Total
20-35 years	730	733	458	467	221	209	1409
36-55 years	251	250	157	150	76	84	484
Over 55 years	13	11	9	7	4	8	26
Total	994		624		301		N=1919

Source: American Medical Directory (1916-1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 6.52, with 4 d.f., and p = 0.1621.

TABLE XXXV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND URBANIZATION (PURB)

Location Age	PURB<50% E	PURB<50% O	50%<PURB<80% E	50%<PURB<80% O	PURB>80% E	PURB>80% O	Total
20-35 years	237	253	346	340	827	816	1409
36-55 years	81	63	119	125	284	296	484
Over 55 years	4	6	7	6	15	14	26
Total	322		471		1126		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 7.06, with 4 d.f., and p=0.1314.

TABLE XXXVI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND OPPORTUNITIES FOR COMPANIONSHIP (PPROF)

Location Age	PPROF≤10% E	PPROF≤10% O	10%<PPROF≤15% E	10%<PPROF≤15% O	PPROF>15% E	PPROF>15% O	Total
20-35 years	388	430	505	487	516	492	1409
36-55 years	134	95	173	191	177	198	484
Over 55 years	7	4	9	9	10	13	26
Total	529		687		703		N-1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 24.16, with 4 d.f., and p=0.0001.

TABLE XXXVII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND ACCESSIBILITY TO LOCAL HOSPITAL FACILITIES (MHOS)

Location Age	MHOS=1		MHOS>1		Total
	E	O	E	O	
20 - 35 Years	1328	1331	81	78	1409
36 - 55 Years	456	457	28	27	484
Over 55 Years	25	20	2	6	26
Total	1808		111		N=1919

Source: American Hospital Association Guide to the Health Care Field (1972-1973), American Medical Directory (1973), Guide to Hospitals (1951-1971), Hospital Service in the United States (1921-1950), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 14.46, with 2 d.f., and p = 0.0009.

TABLE XXXVIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND ACCESSIBILITY TO MAJOR MEDICAL CENTERS (MMMC)

Location Age	MMMC=1		1<MMMC≤50		50<MMMC≤100		MMMC>100		Total
	E	O	E	O	E	O	E	O	
20 - 35 Years	757	779	303	283	272	271	77	76	1409
36 - 55 Years	260	242	103	121	94	94	27	27	484
Over 55 Years	14	10	6	8	5	6	1	2	26
Total	1031		412		371		105		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records.
Chi-square = 8.59, with 6 d.f., and p = 0.1969.

TABLE XXXIX

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND ACCESSIBILITY TO HOMETOWNS (MHOM)

Location Age	MHOM≤50 E	MHOM≤50 O	50<MHOM≤200 E	50<MHOM≤200 O	MHOM>200 E	MHOM>200 O	Total
20-35 Years	359	386	458	464	592	559	1409
36-55 Years	124	100	157	154	203	230	484
Over 55 Years	6	3	9	6	11	17	26
Total	489		624		806		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 17.99, with 4 d.f., and p=0.0014.

TABLE XL

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION AGE AND ACCESSIBILITY TO MEDICAL SCHOOLS (MMSC)

Location Age	MMSC≤200 E	MMSC≤200 O	200<MMSC≤600 E	200<MMSC≤600 O	MMSC>600 E	MMSC>600 O	Total
20-35 years	811	831	364	360	234	218	1409
36-55 years	279	260	125	130	80	94	484
Over 55 years	15	14	7	6	4	6	26
Total	1105		496		318		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square=6.17, with 4 d.f., and p=0.1850.

TABLE XLI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR AND DEMAND (PPR)

Location Year	PPR≤1000 E	PPR≤1000 O	1000<PPR≤1500 E	1000<PPR≤1500 O	PPR<1500 E	PPR<1500 O	Total
Before 1940	72	83	45	46	22	10	139
1940-1959	368	232	231	359	111	119	710
1960-1973	554	679	348	219	168	172	1070
Total	994		624		301		N=1919

Source: American Medical Directory (1916-1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census. Chi-square = 205.80, with 4 d.f., and p=0.0001.

TABLE XLII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR AND URBANIZATION(PURB)

Location Year	PURB<50% E	PURB<50% O	50%≤PURB<80% E	50%≤PURB<80% O	PURB≥80% E	PURB≥80% O	Total
Before 1940	23	72	34	31	82	36	139
1950-1959	119	127	174	203	417	380	710
1960-1973	180	123	263	237	627	710	1070
Total	322		471		1126		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 166.85, with 4 d.f., and p=0.0001.

TABLE XLIII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR AND OPPORTUNITIES FOR COMPANIONSHIP (PPROF)

Location Year	PPROF≤10% E	PPROF≤10% O	10%<PPROF≤15% E	10%<PPROF≤15% O	PPROF>15% E	PPROF>15% O	Total
Before 1940	38	129	50	9	51	1	139
1940 - 1959	196	268	254	261	260	181	710
1960 - 1973	295	132	383	417	392	521	1070
Total	529		687		703		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records, U.S. Bureau of the Census (1910-1970). Chi-square = 483.38, with 4 d.f., and p=0.0001.

TABLE XLIV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR AND ACCESSIBILITY TO LOCAL HOSPITAL FACILITIES (MHOS)

Location Year	MHOS=1 E	MHOS=1 O	MHOS>1 E	MHOS>1 O	Total
Before 1940	131	123	8	16	139
1940 - 1959	669	667	41	43	710
1960 - 1973	1008	1018	62	52	1070
Total	1808		111		N=1919

Source: American Hospital Association Guide to the Health Care Field (1972-1973), American Medical Directory (1973), Guide to Hospitals (1951-1971), Hospital Service in the United States (1921-1950), Oklahoma State Board of Medical Examiners' Records; Chi-square = 10.14, with 2 d.f., and p = 0.0064.

TABLE XLV

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR AND ACCESSIBILITY TO MAJOR MEDICAL CENTERS (MMMC)

Location Year	MMMC=1		1<MMMC≤50		50<MMMC≤100		MMMC>100		TOTAL
	E	O	E	O	E	O	E	O	
Before 1940	75	56	30	31	27	44	8	8	139
1940-59	381	379	152	136	137	146	39	49	710
1960-73	575	596	230	245	207	181	58	48	1070
Total	1031		412		371		105		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 27.58, with 6 d.f., and p=0.0001.

TABLE XLVI

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR YEAR AND ACCESSIBILITY TO HOMETOWNS (MHOM)

Location Year	MHOM≤50		50<MHOM≤200		MHOM>200		Total
	E	O	E	O	E	O	
Before 1940	35	38	45	35	59	66	139
1940-1959	181	179	231	235	298	296	710
1960-1973	273	272	348	354	449	444	1070
Total	489		624		806		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 3.77, with 4 d.f., and p = 0.4398.

TABLE XLVII

EXPECTED AND OBSERVED FREQUENCIES OF PHYSICIANS BY LOCATION YEAR AND ACCESSIBILITY TO MEDICAL SCHOOLS (MMSC)

Location Year	MMSC≤200 E	MMSC≤200 O	200<MMXC≤600 E	200<MMXC≤600 O	MMSC>600 E	MMSC>600 O	Total
Before 1940	80	80	36	33	23	26	139
1940-1950	409	389	183	200	118	121	710
1960-1973	616	636	277	263	177	171	1070
Total	1105		496		318		N=1919

Source: American Medical Directory (1973), Oklahoma State Board of Medical Examiners' Records. Chi-square = 4.69, with 4 d.f., and p = 0.3204.

TABLE XLVIII

DATA SOURCES

DEMOGRAPHIC INFORMATION

U.S. Bureau of the Census.

1913 U.S. Census of the Population: 1910. Vol. III, Composition and Characteristics of the Population, Oklahoma. Washington: Government Printing Office.

1923 U.S. Census of the Population: 1920. Vol. III, Composition and Characteristics of the Population, Oklahoma. Washington: Government Printing Office.

1932 U.S. Census of the Population: 1930. Vol. III, Composition and Characteristics of the Population Part 2, Oklahoma. Washington: Government Printing Office.

1943 U.S. Census of the Population: 1940. Vol. II, Characteristics of the Population, Part 5 Oklahoma, Washington: Government Printing Office.

1952 U.S. Census of the Population: 1950. Vol. II, Characteristics of the Population, Part 36, Oklahoma. Washington: Government Printing Office.

1961 U.S. Census of the Population: 1960. Vol. I, Characteristics of the Population, Part 38, Oklahoma. Washington: Government Printing Office.

1973 U.S. Census of the Population: 1970. Vol. I, Characteristics of the Population, Part 38, Oklahoma. Washington: Government Printing Office.

HOSPITAL INFORMATION

American Hospital Association.

1951-1971 "Guide to Hospitals", Hospitals, J.A.H.A., Vol. 25-45, Part 2, Guide Issue,

1972 The 1972 American Hospital Association Guide to the Health Care Field. Chicago: American Hospital Association.

TABLE XLVIII (continued)

1973 The 1973 American Hospital Association Guide to the Health Care Field. Chicago: American Hospital Association.

American Medical Association.

1921-1950 "Hospital Service in the United States", Journal of the American Medical Association, Vol. 76 - 146, Hospital Issue.

PHYSICIAN INFORMATION

American Medical Association.

1910-1973 American Medical Directory. Vol. 1-26, Chicago: American Medical Association.

Oklahoma State Board of Medical Examiners Records.

VITA

Marcia Huddleston Salkin

Candidate for the Degree of

Master of Science

Thesis: PHYSICIAN LOCATION DECISIONS IN OKLAHOMA: A STUDY IN MEDICAL GEOGRAPHY

Major Field: Geography

Biographical:

Personal Data: Born in Paradise, California, December 3, 1951, the daughter of Mr. and Mrs. Harry L. Huddleston.

Education: Graduated from Sonora Union High School, Sonora, California, in June, 1969; received the Bachelor of Arts degree from the University of California at Davis with a major in geography in June, 1973; enrolled in Masters program in urban planning at the University of North Carolina at Chapel Hill, 1973-74; completed requirements for the Master of Science degree at Oklahoma State University in December, 1976.

Professional Experience: Planning Intern, City of Davis, California Planning Department, Winter, 1972; Research Assistant, Institute of Governmental Affairs,University of California at Davis, Spring and Summer, 1973; Graduate Research and Teaching Assistant, Department of Geography, Oklahoma State University, 1974-1976; Field Supervisor, Choctaw Indian Census, Summer, 1975; Research Associate, Indian Manpower Program, Oklahoma State University, Spring, 1976.

Professional Organizations: Member of Association of American Geographers, Phi Beta Kappa, Phi Kappa Phi.