A METHODOLOGY FOR SHORTAGE AREA DESIGNATION
OF PHYSICIANS: SELECTED APPLICATIONS

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by
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INTRODUCTION

A shortage is "the amount by which anything is short (not reaching or obtaining a requirement, result, or mark; inadequate); a deficiency."[1] One of the most controversial issues in medicine today revolves around the determination of the inadequacy of the supply of physicians or the supply of physician services in our medical care delivery system.

It should be unmistakably understood from the beginning of this dissertation that there is a sharp distinction between the terms 'supply of physicians' and 'supply of physician services.' While the term supply of physicians refers to a count of licensed physicians[2] at a point in time, one concept of the supply of physician services refers to the number of hours of service of patient care provided by these physicians during the year or any other designated time period. Another concept of 'supply of physician services' is an actual measure of the services delivered by physicians during the time span designated. This measure is much more difficult to obtain since it involves measuring actual performance of each physician rather than just utilizing a proxy of their productivity. Each physician must

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[1] Funk & Wagnalls Standard Dictionary, International Edition, (1971), s.v. "Shortage."

[2] Licensing data do not give an actuate picture of physicians actually providing services to the population. It includes all physicians licensed to practice and gives only one location of practice, ignoring services provided in two or more locations.

be contacted to ascertain the effectiveness with which he/she

actually serves the population. Therefore, there is no valid reason

for an a priori assumption that an increase in the number of licensed

physicians will automatically lead to an increase in the amount of

physician services being made available to the population.[1]

In the past few years, a great deal has been written about a

physician shortage in the United States. This literature offers

opinions ranging from the United States actually has a surplus of

physicians through there is a shortage but the gap between the actual

supply of physicians and an adequate supply of physicians is steadily

narrowing to there is a physician shortage and the gap between the

actual supply and an adequate supply of physicians is steadily widen-

ing.

One of the basic reasons for this wide disparity in views con-

cerning the adequacy of physician supply is that no single theoretical

framework has been developed which is universally accepted. Each

author has his or her own criteria and methods for evaluating the

adequacy of physician supply. When comparing the results obtained

by various authors, all assumptions, implicitly and explicitly stated,

must be considered as well as the theoretical framework and models

used in each.

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[1]Many factors other than just numbers of physicians must be
considered before making any inferences concerning the supply of
physician services. Several of the other factors that need to be
given careful consideration for an operationally useful supply concept
are: the productive capacity or the production function of the
physicians (the number of hours worked per unit of time, a speciality
breakdown of the physicians, the availability of supportive facilities
and the ease of accessibility of these facilities, the number and type
of supportive personnel) and various socio-economic characteristics
of the population being served.

Considering the volume of resources being utilized each year in the provision of health care services, medical research, and the education of health personnel, an acceptable method for analyzing the adequacy of the supply of physician services is urgently needed. If the measure of adequacy of physician services being used misguides policymakers and/or decisionmakers as to the magnitude of the shortage, or indicates that there is a shortage where there is actually a surplus of physicians, a serious misallocation of resources is likely to occur.

A key issue in the health care industry today is the designation of shortage areas, and related concerns for developing methods of attracting health personnel into these selected shortage areas. Such concerns led to the passage on October 27, 1972, by the 92nd Congress of Public Law 92-585. Known as the 'Emergency Health Personnel Act Amendments of 1972,' Public Law 92-585 made provisions "to amend the Public Health Service Act to improve the program of medical assistance to areas with health manpower shortages, and for other purposes."[1]

A continuation of this expressed concern for the provision of medical services to all areas of our society and for the alleviation of physician shortages in rural and inner-city areas of our country is reflected in Senate Bill 3585, 'Health Manpower Act of 1974.' Each bill contains provisions for assistance to professional schools and addresses the issues of the influx of foreign medical

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[1] Public Law 92-585, 92nd Congress, (1972), p. 1.

graduates and the specialty and geographical maldistribution of health personnel. The bills also contain modifications of the National Health Service Corps.

This dissertation is concerned with the forces leading to the passage of the legislation Public Law 92-585 and the introduction of Senate Bill 3585 and House Bill 17084, as well as the rationale behind Congress' choice of criteria for the designation of shortage areas. An attempt is made to examine the strengths and weaknesses of the various components of the allocation formula used. The sensitivity of a model is demonstrated by changing the various components utilized and by changing the weighting systems assigned to the variables included in the model.

The Federal Government has taken a series of steps during the past few years in an attempt to increase the supply of health personnel in the United States. The availability of medical services, and of physician services in particular, is a controversial topic which occupies a prominent place in any discussion concerning the current and future health of the citizens of the United States. While it is clearly understood that the physician is not the sole provider of medical services in our health care delivery system, it is recognized that due to the organizational structure of our system the other providers of health care often fall within the purview of the physician. The manner in which physician services are distributed often affects the distribution of the other suppliers of health care as well as the other medical resources of our society.

By limiting the discussion which follows to physicians only,

the complex topic of the adequacy of the supply of health personnel
is made somewhat more manageable. While many of the arguments ex-
pressed are applicable to all providers of health care, they will be
discussed in terms of physicians only.

Chapter I presents an overview of the legislative background
on a physician shortage and the attempts made by legislators to
define and remedy the situation. Chapter II reviews several of the
methodologies currently being used to determine a physician shortage
and discusses the strengths and weaknesses of each method. In
Chapter III, the Federally designated shortage areas are identified,
the criteria for their designation presented and discussed, and the
sensitivity of the methodology illustrated. A multivariate model
for the determination of a physician shortage is presented in
Chapter IV. An example of the model is given followed by an analysis
of the results. Chapter V presents an overview of recent legislation
and its impact on the future. A reiteration of the purpose and a
summary of the findings conclude the dissertation.

CHAPTER I

LEGISLATIVE BACKGROUND: AN OVERVIEW

"The problem of providing an adequate and continually growing
volume of health manpower, properly distributed both regionally and
among health occupations, has become a central concern of many policy-
makers, health professionals, and manpower researchers."[1] Prior to
1960, there was very little consistent Federal government support for
the education of health personnel. During this period, however, two
reports[2] commissioned by the Department of Health, Education, and
Welfare (DHEW) and another one commissioned by the Senate Committee
on Appropriations[3] reached the same conclusion:

> ". . . immediate steps must be taken to increase the
> nation's output of physicians. Each report demonstrated
> that the supply of physicians and other health personnel
> was not keeping up with the growth in population, and that
> without Federal assistance in constructing new facilities
> and expanding and renovating existing facilities to increase
> capacity, it appeared quite likely that a 'national health
> crisis' would be the result."[4]

Several major pieces of health manpower legislation resulted from
this concern, with the first being enacted in October, 1963. The

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[1] Irene Butter, "Health Manpower Research: A Survey," Inquiry
6 (December 1967): p. 5.

[2] H. R. 17084, 93d Congress, (1974), p. 6.

[3] Ibid., p. 7.

[4] Ibid., p. 7.

following is a chronological list of the health manpower legislation

discussed in the following pages.

1963: Health Professions Educational Assistance Act (88-129)

1965: Health Professions Educational Assistance Amendments
(89-290)

1966: Allied Health Professions Personnel Training Act (89-751)

1968: Health Manpower Act (90-490)

1970: Health Training Improvement Act (91-519)

Emergency Health Personnel Act (91-623)

1971: Comprehensive Health Manpower Training Act (92-157)

1972: Emergency Health Personnel Amendments (92-585)

1974: Senate--Health Professions Educational Assistance Act
(S-3585)

House--Health Manpower Act (H.R. 17084)

Health Professions Educational
Assistance Act of 1963

The Health Professions Educational Assistance Act of 1963

(Public Law 88-129) was the beginning of the Federal Government's

response to demands for large scale financial aid to health professions'

schools. Prior to this, Federal support was small and sporadic. This

Act provided assistance for schools in the form of subsidies for the

construction of new teaching facilities and the renovation of existing

facilities as well as student loans.

If a project involved the renovation of an existing school,

the Federal Government only made funds available for that part of the

project which was necessary to maintain the quality of training at the

present level and/or that part necessary to prevent the curtailment

of current enrollment. For the creation of a new school or for a

major expansion of an existing school, the Federal funds were avail-

able under a matching program. The Federal Government's share was not

to exceed sixty-six and two-thirds percent of the total expenditures.

Other projects involving the Federal Government restricted the Federal

share to a maximum of fifty percent.

In order for a school to receive Federal construction funds at

all, it was necessary for the school to provide 'adequate assurances'

in four areas.

> "First, the facility was to be used for teaching
> purposes for at least ten years. Second, sufficient
> funds had to be available to meet the non-Federal share
> of construction costs. Third, sufficient funds had to
> be available to operate the new facility, once constructed.
> Fourth, for construction of new schools or major expan-
> sions of existing ones, there had to be a small enrollment
> increase. The first-year enrollment for each of the
> succeeding nine school years was to exceed the highest
> first year enrollment of the five previous years (before
> application for funds was made) by five percent or five
> students (whichever greater)."[1]

Congress soon decided, however, that the provisions of the

"Health Professions Educational Assistance Act" were not sufficient

to meet the growing need for quality health manpower and so with the

official recognition that the health professions schools were ful-

filling a national need, further legislation was enacted in 1965.

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[1]Owen MacBride, An Overview of the Health Professions
Educational Assistance Act, 1963-1971, Health Manpower Policy
Discussion Paper Series, (Ann Arbor, Michigan: University of
Michigan, June 1973), pp. 1-2.

Health Professions Educational
Assistance Amendments of 1965

The enactment of the Health Professions Educational Assistance Amendments of 1965 (Public Law 89-290) initiated three new programs of financial assistance to the health professions and maintained the two programs introduced in 1963. The purpose of this Act was to "amend the Public Health Service Act to improve the educational quality of schools of medicine, dentistry, and osteopathy, to authorize grants under that Act to such schools for the awarding of scholarships to needy students and to extend expiring provisions of that Act for student loans and for aid in construction of teaching facilities for students in such schools and schools for other health professions, and for other purposes."[1]

The 1965 amendments maintained the basic provision of new funds for construction subsidies through 1969, but now required that the facilities be used for teaching for a period of 20 years instead of 10. There were also new appropriations made for student loans with the addition of a loan forgiveness program. Section 741 of the Act was amended to include the following subsection:

> "(f) Where any person who obtained one or more loans from a loan fund established under this part--
>
> 1) engages in the practice of medicine...in an area in a State determined by the appropriate State health authority, in accordance with regulations provided by the Secretary to have a shortage of and need for physicians...; and
>
> 2) the appropriate State health authority certifies to the Secretary of Health, Education, and Welfare

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[1] Public Law 89-290, 89th Congress, (1965), p. 1.

in such form and at such time as the Secretary may
prescribe that such practice helps to meet the
shortage of and need for physicians...in the area
where the practice occurs; then 10 per centum of the
total of such loans, plus accrued interest on such
amounts, which are unpaid as of the date that such
practice begins, shall be cancelled thereafter for
each year of such practice, up to a total of 50 per
centum of such total, plus accrued interest thereon."[1]

The rationale for this amendment was an attempt by Congress

to influence physicians' decisions to locate their practice in areas

of greatest need. Whether or not this loan forgiveness provision is

an effective method of persuasion is still being debated.

Under the Basic Improvement Grants section, monies were paid

to schools on the basis of the number of full-time students enrolled

in their school. The Surgeon General could make the grant only if

the school could give assurance that their enrollment could be ex-

pected to increase each year during the period covered by the grant.

This provision however, could be waived if the increase in enrollment

could only be accomplished by decreasing the quality of education

provided the students.

Under the Special Improvement Grants section, funds not used

for Basic programs were available for distribution. These funds were

available to help maintain or attain accreditation by schools and for

the provision of specialized functions which schools serve. Again,

this was available only if the schools could provide some assurance

that they would expand enrollment if granted funds.

The public was still concerned about the state of the nation's

health, bringing even more pressure on Congress for action. On

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[1]Ibid, p. 7.

November 3, 1966, still another piece of legislation dealing with

the availability of opportunities in the health field was signed

into law.

Allied Health Professions Personnel
Training Act of 1966

The Allied Health Professions Personnel Training Act of 1966

(Public Law 89-751) was passed to amend the Public Health Service Act

in order to increase the opportunities for personnel in the field of

allied health to obtain an education and to improve the training

facilities in the schools providing the education to these persons.

It also contained provisions to improve student loan programs.

Section 741(f) of the Public Service Act was amended as

follows:

> "In the case of a physician...the rate shall be 15
> per centum (rather than 10 per centum) for each year
> of such practice in an area in a State which for
> purposes of this subsection and for that year has
> been determined by the Secretary...to be a rural
> area characterized by low family income; and for
> the purpose of any cancellation pursuant to this
> sentence, an amount equal to an additional 50 per
> centum of the total amount of such loans plus
> interest may be canceled."[1]

The first Act, Public Law 89-751, provided that up to fifty

percent of a student's loan could be forgiven if the physician prac-

ticed in a shortage area. This Act increased the amount of the loan

forgiveness to eighty-five percent, but did not totally eliminate

repayment.

By 1968, the term used in describing the shortage of health

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[1]Public Law 89-751, 89th Congress, (1966), p. 9.

manpower had become 'emergency.' Again, three separate reports[1]
indicated a continuance of the 'drastic' shortage of health man-
power. Further legislation quickly followed the publication of
these reports.

Health Manpower Act of 1968

The Health Manpower Act of 1968 (Public Law 90-490) was
enacted "to amend the Public Health Service Act to extend and im-
prove the programs relating to the training of nursing and other
health professions (physicians included) and allied health professions
personnel, the program relating to student aid for such personnel, and
the program relating to health research facilities, and for other
purposes."[2]

Several major modifications and new provisions occurred with
the enactment of this legislation. There was more leniency allowed
by the Federal Government for 'multipurpose' facilities, that is,
they could be used for research and other things as well as for
teaching. The basic improvement grants, formally called institutional
grants, and special grants were now extended to schools of pharmacy
and veterinary medicine. These institutional grants provided funds
based on the number of students enrolled.

This Act also provided that funds for special grants were to
come from monies 'left over' from institutional grants. These special
grants were to be distributed for the following purposes: "1) to

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[1]H.R. 17084, 93d Congress, (1974), p. 7.

[2]Public Law 90-490, 90th Congress, (1968), p. 1.

establish new educational programs or modify old ones; 2) to effect curriculum improvements; 3) for research in education-related fields; 4) to develop training for new types of personnel; 5) to assist schools in serious financial straits to meet costs of operation or accreditation requirements; or 6) to set up experimental teaching and training facilities."[1]

Relevant considerations concerning projects for the awarding of these special grants were deemed to be 1) expanding enrollment, 2) shortening of training time, and 3) the financial status of the applying school. As broad and important as the scope of this Act appears to be, the actual "implementation of the 1968 Act involved little more than attempts to insure financial viability of health professions schools. Inflation, the need for new equipment and material due to advancements in biomedical science and accompanying technology, increasing pressures to respond to the demand for more health professionals, and the absence of a firm financial base on which to operate combined to force many schools to the edge of economic disaster."[2] This acute situation was expressed in the passage of additional legislation in 1970.

Health Training Improvement Act of 1970

Public Law 91-519 (Health Training Improvement Act of 1970) was passed on November 2, 1970, "to amend Title VII of the Public Health Service Act to establish eligibility of new schools of

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[1]MacBride, An Overview, p. 7.

[2]H.R. 17084, 93d Congress, (1974), p. 7.

medicine...for institutional grants under Section 771 thereof, to extend and improve the program relating to training of personnel in the allied health professions, and for other purposes."[1] It was hoped that the amendment of the formula for determining institutional grants to new HPEA (Health Professions Educational Assistance) schools would decrease the harsh financial burdens of these schools during their early years.

This Act also provided that special project grant funds appropriated for fiscal 1971 continue to be available in 1972 to schools in serious financial trouble to meet their operating costs. It also states that

> "The Congress finds and declares that the Nation's economy, welfare, and security are adversely affected by the acute financial crisis which threatens the survival of medical and dental schools which provide the highest quality teaching, medical and dental research, and delivery of health care for the Nation.[2] The Secretary of Health, Education, and Welfare shall determine the need for emergency financial assistance to such medical and dental schools and shall report to the Congress on or before June 30, 1971, his determinations of such need and his recommendations for such administrative and legislative action as he determines is necessary to meet such needs."[3]

This was one of two bills passed in 1970 concerning the health professions in our society. The second bill focused on the critical issue of the maldistribution of physicians.

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[1] Public Law 91-519, 91st Congress, (1970), p. 1.

[2] Hereafter referred to as Secretary.

[3] Ibid., p. 3.

Emergency Health Personnel Act of 1970

The Emergency Health Personnel Act of 1970 (Public Law 91-623)
became law on December 31, 1970, and was scheduled to expire on
June 30, 1973. This Act was the first substantial Congressional
attempt to achieve a legislative solution to the perceived maldistri-
bution of health manpower. Public Law 91-623 established a program
whereby the personnel of the Public Health Service are assigned to
practice in areas where there are inadequate supplies of health per-
sonnel. The purpose was to increase the accessibility of health
services to persons living in these areas and thereby improve the
health status of the population.

This Act stated that it would be the function of the Secretary
to

> "determine which communities or areas may receive
> assistance under this section taking into consider-
> ation--(A) the need of the community or area for
> health services provided under this section; (B)
> the willingness of the community or area and the
> appropriate governmental agencies therein to assist
> and cooperate with the Service in providing effec-
> tive health services to residents in the community
> or area; (C) the recommendations of any agency or
> organization which may be responsible for the develop-
> ment, under Section 314(b) of a comprehensive plan
> covering all or any part of the area or community
> involved; and (D) recommendations from the State
> medical, dental, and other health associations and
> from other medical personnel of the community or
> area considered for assistance under this section."[1]

Provisions were made July 9, 1971, (Public Law 92-52) to
amend the Public Health Service Act to extend student loans and
scholarships for an additional year and in 1971 an additional

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[1]Public Law 91-623, 91st Congress, (1970), p. 2.

amendment to the Act was passed.

Comprehensive Health Manpower
Training Act of 1971

The Comprehensive Health Manpower Training Act of 1971

(Public Law 92-157) amended the Public Health Service Act with a

provision for increased manpower in the field of health. The Federal

role in support of the education of health professionals was made more

explicit and coherent with this legislation.

> "In addition to continuing support for construction,
> special projects, and institutional and student assis-
> tance, this legislation made fundamental modifications
> and additions to health professions educational assis-
> tance programs. This legislation was aimed at increasing
> the supply of health professions personnel, developing
> new types of personnel and modes of practice to extend
> the capacity of existing types of personnel, and im-
> proving the distribution of health services personnel,
> while stabilizing the finances of health professions
> educational institutions."[1]

This Act added a section, Health Manpower Education Initiative

Awards, which provided that,

> "for the purpose of improving the distribution, supply,
> quality, utilization and efficiency of health personnel
> and the health services delivery system, the Secretary
> may make grants to public or nonprofit private health
> or educational entities...to encourage the establish-
> ment or maintenance of programs to alleviate shortages
> of health personnel in areas designated by the Secretary
> through training or retraining such personnel in faci-
> lities located in such areas or to otherwise improve
> the distribution of health personnel by area or by
> specialty group."[2]

Provisions were also made to give the Secretary the power to

make grants to schools to increase admissions and enrollment for

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[1]Senate Report No. 93-1133, 93d Congress, (1973), pp. 1-2.

[2]Public Law 92-157, 92d Congress, (1971), pp. 16-17.

students "whose background and interests make it reasonable to assume that they will engage in the practice of the health professions in rural or other areas having a severe shortage of personnel in such health professions."[1] The bill also provides that if the physician agrees to practice for a period of two years in an area determined to have a shortage of and a need for his professional services then the Secretary shall pay 30 per centum of the loan. They would also repay another 30 per centum at the end of the second year of his practice. If the individual completes a third year in the area then another 25 per centum of the loan would be forgiven.

The concern which prompted this type of legislation is reflected in the legislative action which followed.

Emergency Health Personnel Act Amendments of 1972

On October 27, 1972, Congress passed Public Law 92-585 (Emergency Health Personnel Act Amendments of 1972) "to amend the Public Health Service Act to improve the program of medical assistance to areas with health manpower shortages and for other purposes."[2] This Act officially established the National Health Service Corps and was designated to be used by the Secretary to improve medical services in areas having critical health manpower shortages.

"The continuing need of rural and urban communities, together with limitations discovered in existing law during the programs initial

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[1] Ibid., p. 17.

[2] Public Law 92-585, 92d Congress, (1972), p. 1.

years of operation both argue strongly for extending and perfecting

the law."[1] It is expected that as the trend toward specialization

continues and that as urban and suburban localities increase in their

appeal as a place to practice, the plight of the inner-city and the

rural areas will continue to worsen.

It was felt that the extension and modification of the exist-

ing law could "enhance the programs ability to recruit personnel, to

establish health services in shortage areas, and to identify shortage

areas and encourage them to apply for assistance under this program."[2]

The Secretary is required to conduct recruiting programs at schools

of medicine in order to provide the National Health Service Corps

with an adequate supply of physicians to meet their needs. Through

an increase in the loan forgiveness program and the provision of more

scholarship assistance to students, it was hoped that the National

Health Service Corps could be made even more attractive to young

people. This Act now provides for the forgiveness of up to 85 per-

cent of a student's debt over a period of three years.

In addition to the above, this Act requires that the Secretary

now take the initiative in

> "(A) designating those areas which he determines
> have critical health manpower shortages, (B) pro-
> viding assistance to persons seeking assignment
> of Corps personnel to such designated areas to pro-
> vide under this section health care and services
> for persons residing in such areas, and (C) conduct
> such information programs in such designated areas
> as may be necessary to inform the public and private

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[1]Senate Report No. 92-1062, 92d Congress, (1973), p. 4.

[2]Ibid., p. 5.

health entities serving those areas of the
assistance available under this section."[1]

The purpose of this part of the legislation appears to be to make

areas aware of their eligibility for assistance and to encourage

them to apply for this assistance.

With the provisions discussed above requiring the Secretary

to designate critical shortage areas,

"it is anticipated that in doing this, the
Secretary will have to develop and make public
standard criteria for determining which areas
qualify for designation under this program.
The legislation does not specify what these
criteria are to be, but they may well include
measures of an area's supply of health manpower,
population density, access to adjacent supplies
of health services, and supplies of necessary
health facilities."[2]

This Act, however, still retains the provision that before

the Secretary can assign Corps members to an area, medical societies

have to certify that the area has a need for health professionals.

The Act does provide though, that "if the Secretary finds from all

the facts presented that such certification has clearly been arbitrar-

ily and capriciously withheld, the Secretary may, after consultation

with appropriate medical...societies, assign such personnel to such

areas."[3]

The trend which has developed over the past decade or so of

increased intervention by the Federal Government in the provision of

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[1]Public Law 92-585, 92d Congress, (1972), p. 1.

[2]H.R. Report No. 92-1547, 92d Congress, (1972), p. 4.

[3]Public Law 92-585, 92d Congress, (1972), p. 1.

health services appears to be continuing. Additional legislation is now being considered designed to deal with health manpower problems.

Proposed Legislation

The Federal Government has enacted a series of laws in recent years aimed at correcting the geographic maldistribution of physicians. Attempts have been made to remedy this maldistribution through the manner in which Federal monies are made available to students and institutions. Legislation to further correct the situation is currently being considered.

Health Professions Educational
Assistance Act of 1974

The Health Professions Educational Assistance Act of 1974 (S-3585) was proposed in the Senate to further amend the Public Health Service Act. This bill contains provisions designed to insure that not only will urban and rural areas be considered in the designation of shortage areas, but that a definable population within an area may also be considered. Therefore, political boundaries need not be used to define a National Health Service Corps (NHSC) site. It is felt that these boundaries should not be allowed to interfere with the provision of health services to the population.

Along with other standards (criteria) to be taken into consideration, the Secretary shall consider the following:

"1. Ratios of available health professions personnel to the population for which the application is made.

2. Indicators of the population's access to health services.

3. Indicators of health status of the population.

4. Indicators of such population's need and demand for health services.

5. Relative levels of reimbursement under Titles XVIII and XIX of the Social Security Act (Medicare and Medicaid) with respect to such population."[1]

Under this proposed legislation, scholarships would be available to medical students if they agree to engage in primary care practice in a physician shortage area or where a substantial portion of their patients shall consist of migratory agricultural workers and members of their families. Priority in the awarding of these scholarships would be given to individuals in medical school who come from a low income background, reside in a physician shortage area, and who agree to return to such an area upon completion of their training and engage in the practice of primary care.[2] It is hoped that the repayment provision included in this bill will help deter individuals from failing to complete their required length of service.

Health Manpower Act of 1974

The House was also considering a "Health Manpower Act of 1974" (H.R. 17084), to amend the Public Health Service Act. This Act would continue, with minor modifications, loans to students of the health professions. It does phase out the unconditional scholarships previously available to students and substantially increases the

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[1] Senate Report No. 93-1133, 93d Congress, (1973), p. 172.

[2] Primary care is defined as physicians specializing in general practice, family practice, obstetrics and gynecology, internal medicine, pediatrics, and general surgery.

scholarships to the National Health Service Corps.

This proposed legislation provides that efforts should be made to encourage the NHSC personnel to remain in areas of medically underserved people upon the completion of their service commitments. Efforts would be made to match the characteristics of the individuals and their spouses to those of the community in which they will be serving.[1] It is hoped that this will increase the number of personnel remaining in underserved areas upon completion of their service period.

Provisions are included which emphasize that the NHSC should not be considered as a permanent solution to an underserved area, but only as a temporary relief mechanism.

> "It authorizes service of Corps personnel to such populations for periods up to four years and mandates evaluation of the continued need of the population for health manpower and determination of efficient operation of the practice of Corps personnel before eligibility for assignment may be extended."[2]

While this places pressure on a community to make every reasonable effort to procure the needed health professionals, populations will

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[1] One of the major reasons given by physicians for not practicing in a rural area is the dissatisfaction of the spouse with that lifestyle. They maintain their family unit is incompatible with the environment of the rural setting, supporting the assumption that the family unit is the decision maker, rather than the individual physician. By matching the background characteristics of both physician and spouse to that of the community in which they will be living, it is predicted that the compatibility which results will increase the probability of the physician remaining in that area. However, no conclusive results have been consistently obtained which either support or disprove this assumption of increasing rural physicians.

[2] H.R. 17084, 93d Congress, (1974), p. 35.

not necessarily be deprived of services if these efforts fail to secure alternative sources of manpower.

This legislation reflects the feeling that while great strides have been made in increasing the supply of manpower, greater effort must be made to affect the distribution of that manpower. This bill contains three provisions that it is hoped will result in an influx of manpower to shortage areas. First, the increased funding of the NHSC enables them to make more attractive offers. Second, it requires schools who receive capitation monies to spend at least 25 percent of it on projects to train students in clinical facilities in or near shortage areas. Third, authorization is made for funds to new Area Health Centers "to train residents in remote sites, retrain personnel living in remote areas, provide continuing education to practicing health professionals in such areas and provide education to residents of such areas on the availability and appropriate use of health services."[1]

Summary

As can be seen by the above review of a decade of health manpower legislation, efforts are continuing to rectify the physician shortage situation. Since direct Federal aid to medical schools began in 1964, approximately $1,083,740,000 have been received by medical schools. If scarce resources of this magnitude are to continue being allocated to the health area, it is becoming even more crucial that an adequate method of measuring the adequacy of the

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[1]Ibid., p. 33.

supply of physicians or physician services be devised. The previous legislation has been viewed as being inadequate. Several of the factors contributing to this determination of inadequacy are: the rapid influx of foreign medical graduates, the continued geographic maldistribution of physicians as measured by the wide span of the physician-to-population ratios among states and within states, and the perceived maldistribution of specialties within the medical profession.

The next chapter gives a review of the different methodologies currently being used in the determination of a physician shortage.

CHAPTER II

REVIEW OF CURRENT METHODS

This chapter is designed to give an overview of the most
common methodologies used in assessing the adequacy of the supply
of physicians and/or physician services. The main task of this
chapter is to develop an understanding of the strengths and weak-
nesses of the various methods used by educators, researchers, and
policymakers to make decisions concerning the allocation of resources
to and within the health care sector.

The concept of shortage means different things to different
people. In an abstract sense there is a shortage of almost all goods
and services. This definition corresponds to the concept of scarcity
as defined by economists; that is, most goods and services are not
available in sufficient quantities to satisfy all the wants and needs
of all members of society. This definition, however, is not very use-
ful when decisions must be made concerning the actual allocation of
these resources. Lack of a universal definition of shortage makes a
clear-cut empirical identification of physician shortage almost imposs-
ible to obtain. Despite this obstacle, many attempts have been made
to define the conditions under which a shortage exists and to diagnose
and measure the magnitude of this shortage.

For convenience of analyses, this chapter classifies the
methodologies currently being used for the identification of a

physician shortage into two broad definitional categories--market-
model based and needs based. The first category, market-model based,
is refined further through the use of short-run analysis and long-run
analysis.

Each of the following sections defines the concept being dis-
cussed within it, the advantages of the method under consideration,
and the shortcomings or pitfalls encountered when using that particu-
lar methodology for making judgements concerning the adequacy of the
supply of physicians.

Market-Model Based

This category receives its title because the methodologies
so classified attempt to use the market conditions of supply and
demand in their identification of a physician shortage. Supply is
defined as "the amount of a good that sellers are ready to sell at
each specified price in a given market at a given time."[1] That is,
supply is the amount of services physicians are willing to provide
at each specific price in the market at any point in time.

Demand is defined as "the amount of a good that buyers are
ready to buy at each specified price in a given market at a given
time."[2] In this section, demand is the amount of physician services
that the population is ready to utilize at each price in the market
at any given time.

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[1] Erwin Esser Nemmers, Dictionary of Economics and Business,
(Totowa, New Jersey: Littlefield, Adams & Co., Inc., 1970), p. 412.

[2] Ibid., p. 116.

Short-Run

     In this section (SR), the definition of a physician shortage is: at existing prices, the quantity demanded (Q_d) is greater than the quantity supplied (Q_s). In equation form:

$$Q_d > Q_s$$

     The evidence or methodologies cited as examples of this category are queues and waiting time. Queuing theory is the analysis of waiting time and waiting lines. Under this theory, two measurable quantities are the basis for analysis:

     1) the rate of arrival, and

     2) the rate of departure or rate of service.

Once these two quantities are known, they are converted to probability distribution, and mathematical analysis performed.

     Given the current state of the art, several questions must be answered and problems overcome before the queuing theory can be adequately applied to the health profession. The narrative which follows presents a few of these points for consideration.

     Data needed to run analysis on a queuing model are not currently available on any wide range scale. The data that are currently available in accessible form are for emergency room treatment only. It provides information on the time of arrival, the time the patient was seen by a physician, and the time the patient left the physician's office. Is it plausible to assume that this type of service is indicative of the health service system? Is the University of Missouri Medical Center Emergency Room (one of the locations of the data collection) representative of emergency room treatment or are there special

features connected with this hospital that makes it enough different

from other hospitals to bias the data?

Is there any way to allow for individual habits in the demand

for medical services? Does the length of time a patient waits before

initially contacting the physician influence the length of time that

is optimal to wait after the initial contact? Is the waiting time

for initial treatment more vital than the waiting time involved in

followup visit? Is it possible to develop an adequate weighted mea-

sure of these phenomena? Is there any way to separate these as to the

type of specialist or general practitioner visited? Is it possible to

analyze one small segment of the health services industry and then

expand the results as being representative of the entire industry?

That is, is the time element so different in the emergency room

sector that it is impossible to make this expansion? Is there any

valid way of going from minutes in the emergency room to days in the

doctors' office sector? Are they comparable in any way or do special

circumstances (and if so, what?) make the two totally incomparable?

Is there any way to account for the variation in opinions

among physicians as to just what are the medical limits of elapsed

time that should be observed in the treatment of various types of

situations (emergency or otherwise)? Do we average these opinions or

should consideration be given to the various regions where tastes,

habits, age of population, education, and income differ? If so, how

are these factors to be incorporated into the measure?

Is it possible to devise a base with which to compare current

amounts of physician's services with a desired level of physician's

services? Will the use of historical data, simulations, questionnaires

to physicians concerning their opinions on the optimal length of
waiting time, etc., give us a base with which we can work for policy
purposes?

What methods can be devised to allow for the impact of
holidays and weekends on demand? Is it possible to adjust for the
effects of seasonality in the data that are available?

How do we eliminate, or at least account for, the effects of
maldistribution of physicians rather than the effects of a shortage?
If the waiting time is longer one place than another is this just a
maldistribution problem or is it a reflection of the ability of the
physicians or their capability as perceived by the consumer? How do
we allow for the differences in the productivity and ability of phy-
sicians? Do we assume that they are homogeneous or do we try to
account for the heterogeneity of the physicians' services. (This
problem is not unique to this theory. It occurs in all which are
discussed later.)

Does travel time of the patient to the point of entry enter
into the model anywhere or is it assumed to be constant and only
waiting after arrival at the emergency room relevant to the analysis?
Is there any way to incorporate this into a queuing theory model?

Do we have to make so many assumptions because of the limi-
tations of the available data that the whole procedure becomes moot?
Does lack of data for empirical verification or rejection destroy
the practicality of the proposed solution?

What impact does the availability of insurance have on waiting
time? What proportion of people seeking care in the emergency room

have insurance and does lack of insurance increase waiting time while

the patient's ability to pay is verified? Is lack of financial status

a limiting factor as to the quality of medical care to which a person

has access to? If so, how should this be incorporated into the model?

Long-Run

Within this long run (LR) component, a shortage of physician's

services is perceived as existing if the current quantity supplied

(Q_s) is less than the long-run equilibrium supply (Q_s^{LRE}). In equation

form:

$$Q_s < Q_s^{LRE}$$

In this case, the long-run objective is to shift the short-run

supply curve until it intercepts the long-run supply curve and long-

run demand curve at the point of equilibrium.

Under these circumstances, both short-run inequalities and

long-run equalities are possible. Unless the entire picture is con-

sidered, the actions taken and policies implemented to eliminate the

short-run phenomenon may be very detrimental to the attainment of

long-run equilibrium.

The methodologies cited as evidence within this criterion

include the internal rate-of-return model and the changes in relative

income approach.

Rate-of-Return Criterion

The rate-of-return criterion is a variant of the relative income

approach. Under this criterion, if the returns to investment in medical

education are relatively greater than those experienced by other inves-

tors, then a shortage is perceived as existing. Consideration is given to both the cost dimension of career choices and the return accruing to that career choice. The internal rate-of-return is calculated which "equates the present value of the expected earnings stream to the present value of the expected outlay or cost stream."[1] Under this method, the results obtained is then compared with the rate-of-return obtained by some other alternative standard rate. If the deviation in the physicians' rate-of-return from the standard rate is negative then a surplus exists. If the deviation is positive, then a shortage is present. "Implicit in such a view is the idea that changes in the numbers of entrants into a profession will be viewed through an internal rate-of-return, rather than by changes in relative positions, as argued by Blank and Stigler, or by changes in practioner-population ratios."[2]

The rate-of-return approach is conceptually simple to understand. It is relatively easy to visualize and thus to explain. This method does allow for differences in the time value of money which is lacking in most popular theories. By comparing the physicians' rate-of-return to a predetermined standard rate-of-return, conclusions can be formed with reference to a single point in time. In evaluating the effectiveness of this method as a measure of a physician shortage, it leaves many questions unanswered concerning the field of physician manpower.

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[1]Herbert E. Klarman, The Economics of Health, (New York: Columbia University Press, 1965), p. 93.

[2]Selma J. Mushkin (ed.), The Economics of Health and Medical Care, (Ann Arbor, Michigan: The University of Michigan, 1964), p. 80.

One of the most crucial components of this criterion is the rate of discount selected. As pointed out by Porterfield[1] there may be more than one rate-of-return for some projects. More than one discount rate may equate costs and benefits for some investments while others may have no rate-of-return which is a real number.

The choice of the discount rate can markedly affect the measure of the cost of delaying receipt of the income and, therefore, affect the rate-of-return. The discount rate is especially important when the time span involved is long. A given amount of money has different values when it is spent at different times. The higher the rate of interest, the lower the present value of any given stream of income.

The calculation of the social rate of discount may vary significantly from the private rate of discount. "An individual's discount rate for the distant future is likely to be higher than that of society which has the greater regard for later generations."[2] Decisions must be made as to which rate to apply to the calculations. The magnitude of the relative difference between the two rates must be designated to indicate the presence of a shortage or surplus.

Another variation of the rate-of-return criterion is to calculate the rate-of-return to physicians over time as compared to some other professional career. This approach does not indicate the magnitude of the shortage or surplus either. This criterion may reflect

[1] James T.S. Porterfield, Investment Decisions and Capital Costs, (Englewood Cliffs: Prentice-Hall, Inc., 1965), p. 25.

[2] Klarman, Economics of Health, p. 165.

a rectification of a prior situation rather than a current shortage or surplus. It may "indicate a reduction in a supposed surplus or shortage without telling whether the surplus or shortage has been eliminated or whether it actually existed in the first place."[1]

Relative Income Criterion

When using the relative income criterion to determine whether or not a shortage of physicians exists, the incomes of physicians are studied in relation to the incomes received by professionals in alternative occupations over a period of time. According to this criterion, "a shortage exists when the quantity of physicians services supplied increases less rapidly than the quantity demanded at incomes received by physicians in the recent past. Under such conditions, the incomes of physicians relative to the incomes of others will tend to rise. As the relative income of physicians rises, there will be an attempt to substitute less costly services for the services of physicians."[2]

This method provides several advantages. For one, this method offers more objectivity in determining a physician shortage than the previous methods. There is a tendency to get away from the imposition of value judgements as to what society 'needs,' although it is not entirely eliminated. This approach also has the merit of recognizing the "operation of the market in affecting the allocation

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[1]Mushkin, The Economics of Health and Medical Care, p. 81.

[2]Elton Rayack, "The Supply of Physicians' Services," in Industrial and Labor Relations Review, 7: (January 1964): 222.

of labor services in the economy."[1] The skills required by the

person using this method as compared to some of the other more

sophisticated methods are relatively few.

There are, however, several limiting factors in the use of

this technique for estimating a physician shortage. The choice of

the base period is extremely important in this method. Different

sets of data for comparative purposes may give different results.

No rationale has been presented for the selection of a base year.

If the physicians' income at that time was unusually low for some

reason, then a misleading conclusion may result. There is no logi-

cal basis presented in this criterion for the determination of the

starting point of a shortage. However, one should be determined,

being sure to include the following in the basic decisions.

Under competitive circumstances, earnings differentials[2]

should relect the marginal revenue product (MRP) and the opportunity

costs of the various types of labor involved. These wage differentials

change as either or both the MRP's or the opportunity costs (alternative

opportunities) change. The wage differentials occurring among occu-

pations reflect compensation in line with the skill, responsibility,

and experience involved in each occupation. In order to attract a

sufficient supply of labor into the occupations requiring an investment

[1]Mushkin, The Economics of Health and Medical Care, p. 81.

[2]Abraham L. Gitlow, Labor and Manpower Economics, (Homewood, Illinois: Richard D. Irwin, Inc., 1971): pp. 176-240. For additional information see Allan M. Cartter and R. Ray Marshall, Labor Economics (Homewood, Illinois: Richard D. Irwin, Inc., 1972), and Albert Rees, The Economics of Work and Pay, (New York: Harper and Row, Publishers, 1973).

of an individual's time and money in training, such an investment
must be made to appear worthwhile by a promise of higher future
payments and prestige.

This methodology fails to take into consideration the
apparent inelasticity of demand for health services. It does not
address itself to the problem of the special nature of the market
for physicians' services. When comparisons are made between pro-
fessions, allowances are not made for the circumstances of partial
provider control over the amount of services demanded. Does the
nature of the services provided by physicians and the lack of know-
ledge of consumers mean that the services will be demanded no matter
what the price, or at least that an increase in price will not bring
about a proportionate decline in the demand for the commodity in
question?

Another possible explanation for this rise in income relative
to other occupations involves the nature of the means of entrance to
this profession and the imperfections in the market delivery system.
There are barriers[1] to control the number of people that can enter
the field of medicine. Many of these barriers are under the direct
control of the profession itself and still others are influenced by
the profession and tolerated by governmental provisions. These
barriers limit entrance to training and therefore the supply of phy-
sicians. These barriers and the resulting diminution of competitive

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[1]Some of the barriers to entry into this profession include
the restrictions on the number of qualified people admitted to medical
schools, the limitations imposed on the establishment of new schools,
the accreditation process for existing schools, the licensing require-
ments for practice, etc.

forces is thought to be largely responsible for the continued rise in physicians' income.

Further consideration needs to be given to the source(s) and adequacy of the data being used for comparative purposes. Are the data available on income for the various occupations comprehensive enough to reflect the actual situation? For example, is sufficient consideration and weight given to the presence of diverse nonpecuniary 'fringe benefits' in the different professions? Are monetary values assigned to these in the computation of incomes? If not, should they be? Are reported incomes the actual monetary incomes received in these professions or are they relatively over- or understated because of income tax considerations?

As can be seen by the above discussion, the relative income approach ignores too many alternative explanations of the continued rise in physicians' incomes to be seriously considered for policy recommendations.

<div align="center">Needs Based</div>

Need As A Measure

Another general method used to estimate the magnitude of the physician excess or shortage involves comparing (1) the available supply of physicians and (2) the number that is 'needed' or the number that society 'should have.' In the discussion which follows, the health needs of a given population are defined as:

> "That quantity of medical services which expert medical opinion believe ought to be consumed over a relevant time period in order for its members to remain or become as 'healthy' as is

permitted by existing medical knowledge."[1]

As pointed out by David Palm[2] this method eliminates some of

the problems associated with the physician/population criterion (to

be discussed in the next section) in that it does allow consideration

to be given to alternative ways of reaching the designated target.

This method places emphasis on a target to be reached and not on the

specific instruments to be used in arriving at the target. Using need

as a measure permits the disaggregation of manpower requirements into

different manpower categories; that is, allows for substitution between

these manpower categories and among alternative delivery systems. This

methodology stresses the importance of policymakers playing an active

role in the provision of health services.

A serious limitation of this method of determining a shortage

is deciding who should ascertain what 'needs' to be provided and es-

tablishing relevant and satisfactory criteria to be used in the deter-

mination of the needs of society. Careful attention must be given to

which segment of the population is determining the needs of society.

Need as defined by the general population probably differs significant-

ly from need as defined by the medical profession. The medical

professions' concept of need is generally viewed independently from

[1]James R. Jeffers, Mario F. Bognanno, and John C. Bartlett, "On the Demand versus Need for Medical Services and the Concept of 'Shortage'," American Journal of Public Health, 61: 1(January 1971): 46-47.

[2]David Palm, Approaches to the Estimation of Manpower Require-ments and Supply in Nebraska, (Nebraska State Health Department: Bureau of Comprehensive Health Planning, September 25, 1974), p. 7.

consumer ability to pay or any of the other economic considerations which play such a prominent role in consumer decisions about the amount of medical services to purchase. If only the professions' concept is examined then this 'need' will probably not be translated into effective demand.

Jeffers, Bognanno, and Bartlett[1] point out that in order to specify the medical 'needs' of a society several important facts are required. First, perfect knowledge of the state of member health is required. A second requirement is that a 'well-defined standard' of what constitutes good health must exist. Third, it is necessary that there be perfect knowledge about what modern medicine can do to improve ill (or below standard) health. Fourth, a production function for health care needs to be considered. Not only are the different personal productivity functions of physicians involved, but also differences in the availability of auxiliary personnel and facilities. These factors must be considered when determining the number of physicians needed in any situation.

The demand for medical services is defined as:

"a multivariate functional relationship between
the quantities of medical services that its members
desire to consume over a relevant time period at
given levels of prices of goods and services,
financial resources, size and psychological wants
of the population as reflected by consumer tastes
and preferences for (all) goods and services."[2]

Therefore, a relationship between an economic shortage and a needs

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[1]Jeffers, Bognanno, and Bartlett, Demand Versus Need, p. 47.

[2]Ibid., p. 49.

shortage does not necessarily exist. According to Rashi Fein[1], when discussing a shortage under the need criterion no consideration is given to the link between the amount of services needed and the amount for which the population has the ability and willingness to pay. Targets so established may, therefore, have very little relationship to the actual rate of utilization. Unless the population has the ability and willingness to purchase the desired level of services, little has been accomplished in fulfilling the medical needs of society. To meet these needs, mechanisms must be provided to remove or at least alter the economic barriers that presently exist for many members of society in the procurement of medical services.

When establishing the number of physicians or the amount of physicians' services needed, it should be recognized that some individuals, because of differing tastes, habits, income, etc., will use these services less frequently than other members of society for the same degree of health. It should also be recognized that still other members of society will reject the pursuit of the health state chosen, or the means of reaching this desired state. This again reflects back to the problem of defining what is meant by need and who should have the responsibility of determining what is adequate or desired for all members of society.

Any standard utilized in the determination of need should not be viewed as permanent. If it is to be at all effective, it must be

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[1]Rashi Fein, The Doctor Shortage: An Economic Diagnoses, (Washington, D.C.: The Brookings Institution, 1971), p. 68.

modifiable as circumstances change. At best, standards should be
used as general guidelines for decision making in the allocation of
resources. It should be recognized that the health industry is only
one of many competing sectors for the limited resources. An increase
in the amount of medical services or personnel supplied can only be
accomplished at the expense of some other sector. Medical care should
not be considered in isolation, but should be placed in a relative
position with the other sectors of the economy.

For correct utilization, this method requires extensive
investigation into the amount of services actually being provided as
compared with the amount determined to be 'needed' by society. When
performed properly this is one of the most time-consuming methods
available.

Another method closely related to this concept of 'need' is
the physician-to-population ratio criterion.

Physician-to-Population Ratio

The physician-to-population ratio method involves a comparison
of the actual ratio of physicians to population with some designated
target ratio. This target ratio is viewed as an adequate or accept-
able standard. If the current ratio is less than the selected target
ratio then a 'shortage' is said to exist. Likewise, if the selected
target ratio is less than the current physician/population ratio
then a 'surplus' is viewed as existing. Therefore, the selection of
the target ratio is crucial in this technique.

This method is the approach used most frequently to identify
a physician shortage in an area, region, or nation. One obvious

strength of this technique is that it is a simple low-cost proce-
dure. It can be used for quick comparisons of the distribution of
physicians between areas or specialties and compared with future
supplies of physicians. However, while it has the ability to 'flag'
certain potential imbalances, it has far too many limitations to be
used as the sole measure of shortage of physicians.

Many economists think that this method assumes the problem
away. Under this criterion, "a certain physician/population ratio
is assumed desirable and then the number of physicians needed to
achieve the assumed ratio is estimated on the basis of certain ex-
pected changes in the population. But what is the test for determin-
ing the desirability of the assumed ratio?"[1]

The physician/population ratio criterion "implicitly assumes
an equilibrium between the demand for and supply of physicians in the
base period, and that the relation between the criterion ratio and
future supply and demand conditions will remain unchanged. Of course,
whether or not this is the case is never analyzed."[2] The base period
selected by various individuals, groups, or agencies represents their
respective value judgements as to what constitutes an adequate supply.
As Bognanno and Jeffers[3] point out, if this value judgement is

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[1] Elton Rayack, "The Supply of Physicians' Services,"
Industrial and Labor Relations Review, Communications (July 1965):
587.

[2] Mario F. Bognanno and James R. Jeffers, Evidence on the
Physician Shortage, (University of Minnesota: Industrial Relations
Center, June 1974), p. 4.

[3] Ibid., p. 4.

accepted it may result in a serious misallocation of limited re-
sources. If their judgement is biased because of personal differ-
entiations in their utility function, or because these individuals
are unduly influenced by certain special interest groups, or because
other immaterial factors influence their decision, resources may not
be allocated in the most efficient manner.

Serious limitations exist when trying to draw inferences
about accessibility and adequacy from a physician/population ratio.
This criterion generally does not allow for consideration to be given
to the dynamic factors influencing and affecting supply, demand, and
the organizational structure of the delivery system. No allowance
is made for the interaction between an individual's demand for health
services and the supply of services available to him or her. It
implicitly assumes that every sector of the economy has the same
demand for health services and does not consider the fact that diff-
erent individuals consume differing amounts of health services for
various reasons. Because of differences in tastes, habits, customs,
education, income, traditions, and other factors, the amount of
physician services consumed in one region may vary significantly
from those consumed in another region even though the supply of
services available may be the same.

Since this criterion involves a fixed input/output ratio,
it ignores changes due to innovations in technology, variations in
the delivery system, and alternations in the production functions of
physicians. This criterion also ignores any factors which may change
the needs of the population of physicians' services. No allowance

is made for the changing age composition of the population nor for
the rising per capita income.

Since so many factors affect the demand for physician ser-
vices, there is no reason to believe that even if an adequate method
could be found to determine a proper ratio that this same ratio would
be applicable five years in the future. Factors affecting the ability
to purchase medical care--income, insurance coverage, the price of
medical care, and the price of other goods--influence the demand for
physician services. Other factors influencing consumers' tastes and
preferences--education, habits, traditions, demographic characteris-
tics, culture, social status, geographic location, and the availability
of physicians--also affect the demand for physicians.

This criterion also ignores dynamic factors affecting the
supply of physicians and physician services.

> "The supply of medical care is affected (1) by the
> state of technology and organization affecting pro-
> ductivity, (2) by the number of medical personnel
> and the capacity of facilities, (3) by the location
> of personnel and facilities relative to demand or
> need. The rate at which supply can be increased is
> influenced (1) by time lags in graduating personnel
> and building facilities, (2) by entry limitations to
> medical schools and the rate of attrition in such
> schools, (3) by licensing requirements for physicians,
> (4) by the rate of retirements and deaths in the
> profession, (5) by the returns to those supplying
> medical care, (6) by the capital market for medical
> facilities investment, (7) by locational decisions
> of physicians and auxiliary personnel, (8) by the
> existence of a vertical gap in the hierarchy of
> medical personnel, (9) by the rate of introduction
> of new technology affecting productivity of medical
> personnel and facilities, and (10) by the rate of
> improvement in the organization of the delivery of

medical care."[1]

Unless these dynamic features can in some manner be incorporated into the physician/population ratio criterion, major limitations exist in trying to use this method to project future health manpower requirements. At best, this criterion can only provide an index of potential services available; a measure of the number of licensed physicians tells us nothing of services actually performed by these physicians. To determine this, survey must be conducted to ascertain what services are actually being provided to consumers.

Concluding Remarks

The object of this chapter has been to familiarize the reader with some of the inadequacies of current method, used to identify physician shortages, in the hope that any one method would not mistakenly be used in determining a physician shortage.

The methods discussed here are methodologies which do not make provisions for changing technology, changing demand, nor changing supply. Factors affecting each of these variables are ignored. (See Table 1.)

With these limitations in mind, attention is turned to the Federal criteria for designating physician shortage areas.

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[1] Charles T. Steward, Jr., and Corazon M. Siddayao, Increasing the Supply of Medical Personnel, (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1973), p. 15.

TABLE 1

SUMMARY OF METHODOLOGIES

Method	Strengths	Weaknesses
Rate of Return	1) Conceptually simple. 2) Allows for differences in the time value of money. 3) Conclusions can be found with reference to a single point in time.	1) Selection of a rate of discount. 2) Necessary distinction between the social rate of discount and the private rate. 3) No measure of the magnitude of the shortage, only presence or absence.
Relative Income	1) Offers more objectivity. 2) Recognize the operation of the market in affecting the allocation of labor services in the economy. 3) Requires less sophisticated skills by user.	1) Importance of the base period chosen. 2) No consideration given to the apparent inelasticity of demand for health services. 3) Ignores the special nature of the market for physicians' services. 4) Inadequacy of current data.
'Need'	1) Allows consideration to be given to alternative ways of reaching designated targets. 2) Places emphasis on target not on specific instrument. 3) Permits disaggregation of manpower requirements. 4) Stresses importance of policy makers	1) Ambiguity involved in who should determine need. 2) Inability to establish relevant and satisfactory criteria for determining need. 3) Does not consider ability, nor willingness to pay. 4) Requires definition of good health.

TABLE 1--Continued

Method	Strengths	Weaknesses
		5) Lacks identification of a production function for health care needs.
		6) Requires perfect knowledge of the capabilities of modern medicine.
		7) Disregards actual rate of utilization.
Physician/ Population	1) Simple to use. 2) Low cost procedure. 3) Has ability to 'flag' certain potential imbalances. 4) Provides an index of potential services currently available.	1) Assumptions necessary for implementation are too many. 2) Lacks testability of the desirability of the assumed ratio. 3) Does not consider relationship between current and future supply and demand conditions. 4) No allowance is made for interaction between individuals' demand and the supply available. 5) Does not allow for changes in physicians' productivity. 6) Ignores dynamic factors affecting supply of physicians and physician services.

CHAPTER III

FEDERALLY DESIGNATED SHORTAGE AREAS

The purpose of this chapter is to discuss the criteria being used by different Governmental programs in determining physician shortage areas. Because of the substantial quantity[1] of society's limited resources being allocated on the basis of these designated shortage areas, it is imperative that these areas be properly identified.

The first section discusses the criteria utilized in determining shortage areas for National Health Service Corps personnel allocation. The second section outlines the criteria employed in designating physician shortage areas for Health Profession Student Loan programs. Both programs are attempts to influence the distribution of medical manpower in the United States. The third section demonstrates the effect on these designated shortage areas using the criteria mentioned but applying the most recent data available. This is another attempt to show the sensitivity of the model to changing conditions of the economy and the criteria chosen.

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[1]"Between 1963 and 1973, a total of approximately $3.4 billion was obligated for the training of health professionals." (S-3585, 93d Congress, 1974), p. 21. Another example of the large amount of resources going to the health field is the $2,460,000 contract awarded to the Western Interstate Commission for Higher Education (WICHE) for The Analysis and Planning for Improved Distribution of Nursing Personnel and Services.

Because of the complications involved in attempting to study the entire United States, the following sections will be limited to a study of Missouri only. This will allow concentration on a wider range of circumstances. It is thought that by concentrating on one State, Missouri, the model can be developed more completely and the results analyzed more comprehensively.

As can be seen in the following narrative, there is a great deal of inconsistency from one governmental program to another in defining what constitutes a shortage area. The definition, "Health service scarcity areas are defined geographic areas where health and related services in the area and contiguous areas are not available to a substantial portion of the population,"[1] is so broad and intangible as to be operationally worthless for planning purposes.

When ascertaining whether an area has a critical physician shortage with a provider/population ratio methodology, the ratio chosen is the crucial factor. The sensitivity of the model to the ratio chosen is demonstrated by a comparison of the results obtained using the National Health Service Corps criteria and the Health Profession Student Loan criteria.

National Health Service Corps

Under provisions of the Public Health Service Act as amended, the Secretary of Health, Education, and Welfare has the responsibility of designating physician shortage areas. The areas so identified

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[1] Office of Monitoring and Analysis, Background Paper: Health Service Scarcity Area Identification Program, (Washington, D.C.: Health Service Administration, August 1973), p. 10.

will be eligible for the assignment of National Health Service

Corps (NHSC) personnel to them to help alleviate this shortage.

While the Act does not list specific measures to be utilized by

the Secretary, it does state that where applicable the Secretary

should give consideration to the following factors:

> "(1) health resources statistics; (2) health
> status indicators; (3) accessibility of health
> care services in the community and the ability
> of the community to obtain those services on a
> timely basis; and (4) other socio-economic, demo-
> graphic, and environmental factors of community
> life affecting the ability to procure such
> services."[1]

The Secretary of Health, Education, and Welfare shall work

with the appropriate State agencies in determining shortage areas

for a specific State. In doing so, the Secretary issued the follow-

ing explicit measures for the area and State comprehensive health

planning agencies to follow in their selection of critical physician

shortage areas.

> "(1) If the area in question consisted of a group
> of census tracts within a city it must have

>> (i) a primary care physician-to-population
>>   ratio of less than 1 to 4,000 (primary
>>   care physicians are defined to include
>>   only those physicians in general or
>>   family practice, internal medicine,
>>   and pediatrics),
>> (ii) no neighborhood health center,
>> (iii) no organized hospital outpatient depart-
>>   ment within 10 miles of the center of
>>   the area, and
>> (iv) a general physician-to-population ratio
>>   of less than 1 to 3,000 within the entire
>>   county in which the scarcity area is

---

[1]Federal Register, 39: 206, (Wednesday, October 23, 1974):
37756.

located (general physicians are
defined to include physicians in
general or family practice, internal
medicine, pediatrics, obstetrics and
gynecology, and general surgery);

(2) If the area in question was a group of census
tracts within a county (not located in a tracted
city) it must have

(i) a primary care physician-to-population
ratio of less than 1 to 4,000,
(ii) no neighborhood health center,
(iii) no organized hospital outpatient depart-
ment within 20 miles of the center of
the area, and
(iv) a general physician-to-population ratio
of less than 1 to 3,000 within the entire
county in which the scarcity is located;

(3) If the area in question was made up of one or
more minor civil divisions or census county divisions
within an untracted county (or counties) it must have

(i) a general physician-to-population ratio
of less than 1 to 4,000 within the boun-
daries of the scarcity area itself and
(ii) a general physician-to-population ratio
of less than 1 to 3,000 within the entire
county in which the scarcity area is
located;

(4) If the area in question was an entire county it
must have a general physician-to-population ratio of
less than 1 to 4,000."[1]

The only physicians which are counted in the above ratios

are those which spend at least fifty percent of their time adminis-

tering direct patient care (DPC). Interns and residents are not

included in the ratios for analysis purposes. Also, no Federal

physicians are counted in Missouri data since Missouri has no

Indian reservations.

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[1]Ibid., p. 37756.

Applying these criteria to the State of Missouri, the following list of counties were designated as shortage areas in the Federal Register.

Clark	Mercer
Hickory	New Madrid
Knox	Platte
McDonald	Shannon

(See Map 1, page 52, for the geographic location of these counties.)

These counties are now eligible to make application for National Health Service Corps personnel to be assigned to their area. These NHSC personnel provide services for the residents of the area to which it is felt they otherwise would not have ready access.

The results obtained when the Health Profession Student Loan criteria are applied to Missouri's data are analyzed next.

Health Professions Student Loans

Under Section 741(f) of the Public Health Service Act, the Secretary of Health, Education, and Welfare has the obligation of publishing a list of shortage areas for loan forgiveness purposes. If an individual who has borrowed money to finance his professional education agrees to practice in one of these areas designated as having a shortage of and a need for his professional services for at least two consecutive years, the Secretary will repay a substantial portion of these educational loans.

The State Agency having the responsibility for the administration of the State's health plan shall be consulted in the determination of these shortage areas. Again, this legislation is aimed

MISSOURI

MAP 1

DESIGNATED SHORTAGE AREAS:
National Health Service Corps

Vertically lined areas
represent shortage areas.

Atchison
Nodaway
Worth
Gentry
Harrison
Mercer
Putnam
Schuyler
Scotland
Clark
Holt
Andrew
DeKalb
Daviess
Grundy
Sullivan
Adair
Knox
Lewis
Buchanan
Platte
Clinton
Caldwell
Livingston
Linn
Macon
Shelby
Marion
Ralls
Clay
Ray
Carroll
Chariton
Randolph
Monroe
Audrain
Pike
Lincoln
Jackson
Lafayette
Saline
Howard
Boone
Callaway
Montgomery
Warren
St. Charles
St. Louis
Cass
Johnson
Pettis
Cooper
Moniteau
Cole
Osage
Gasconade
Franklin
Jefferson
Ste. Genevieve
Bates
Henry
Benton
Morgan
Miller
Maries
Crawford
Washington
Perry
St. Clair
Hickory
Camden
Pulaski
Phelps
Dent
Iron
Madison
Bollinger
Cape Girardeau
Scott
Mississippi
Vernon
Cedar
Dallas
Laclede
Texas
Reynolds
St. Francois
Wayne
Stoddard
Barton
Dade
Polk
Greene
Webster
Wright
Shannon
Carter
Butler
New Madrid
Dunklin
Pemiscot
Jasper
Lawrence
Christian
Douglas
Howell
Oregon
Ripley
Newton
Barry
Stone
Taney
Ozark
McDonald

Source: Federal Register, Wednesday, October 23, 1974.

at redistributing the health resources of the nation to increase

the accessibility of health services to all members of society.

In developing the list of designated shortage areas for

this program, the following factors were utilized.

> "First, all areas were included in which the
> ratio of practicing health professionals...to the
> most recent available estimated population in a
> county was lower than the following ratios: phy-
> cians (M.D. or D.O.)----1:1,500.

> Second, State health authorities were asked
> to provide information on and recommend areas in
> which there were problems of inaccessibility of
> medical services to the residents of such areas
> and particular local health problems. Such con-
> sultation resulted in the designation of addi-
> tional areas based on such factors as the age
> or incapacity of health professionals serving in
> an area, the distance residents must travel to
> obtain health services, the economic or income
> levels of communities, and the availability of
> transportation."[1]

If the area designated by the Secretary as a shortage area

is also determined to be a rural area having the characteristic of

low-family income, then up to one hundred percent of the educational

loans are eligible for governmental repayment. To be classified as

a rural, low-family income area, at least fifty percent of the

total population must be rural or there can be no town of more

than 10,000 population in it, and at least thirty percent of the

population must have an income of less than 125 percent of the

poverty level.

When the above criteria were applied to Missouri, the

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[1]*Federal Register*, 39: 39, (Tuesday, February 26, 1974):
7446.

following areas were identified as having a critical shortage of

physicians and appeared in the Federal Register.

Andrew	*Douglas	*Madison	Ray
Atchison	*Dunklin	*Maries	*Reynolds
*Barry	Franklin	Miller	*Ripley
*Benton	*Gentry	Moniteau	St. Charles
*Bollinger	Grundy	Montgomery	Ste. Genevieve
*Caldwell	*Harrison	*New Madrid	*Schuyler
*Camden	*Hickory	Nodaway	*Shannon
*Carter	Howard	*Oregon	*Stoddard
Cass	*Howell	Osage	*Stone
*Cedar	*Iron	*Ozark	Sullivan
Christian	Jefferson	*Pemiscot	*Texas
Clark	Johnson	Perry	Warren
Crawford	*Laclede	Phelps	*Washington
*Dade	Lewis	Platte	*Wayne
*Dallas	Lincoln	*Polk	*Webster
DeKalb	*McDonald	Ralls	*Wright
*Dent	Kansas City--(Wayne Miner Neighborhood Health Center)		

Counties with asterisks (*) represent those counties deter-
minded to be rural areas characterized by low family income. (See
Map 2, page 55, for the geographic location of these counties.)

Physicians agreeing to practice in any of these counties are

eligible for the Federal Loan Forgiveness Programs if they meet the

other necessary criteria concerning monies received for educational

purposes. Out of a total of 114 counties and one independent city,

there are sixty-five counties plus a Neighborhood Health Center in

Kansas City designated as being areas critically short of physicians

by the Secretary of Health, Education, and Welfare.

Of the eight counties appearing on the first list, six of

these also appear among the sixty-five counties on the second list.

However, two counties (Knox and Mercer) appearing on the first list

of critical shortage areas are absent from the second list of

designated shortage areas.

MISSOURI

MAP 2

DESIGNATED SHORTAGE AREAS:
Health Professions Student Loans

Vertically lined areas
represent shortage areas.

Asterisks (*) represent
rural areas characterized
by low family income.

Atchison, Holt, Nodaway, Andrew, Buchanan, Platte, Worth, Gentry*, DeKalb, Clinton, Clay, Jackson, Harrison*, Daviess, Caldwell*, Ray, Mercer, Grundy, Livingston, Carroll, Lafayette, Putnam, Sullivan, Linn, Chariton, Saline, Scotland, Schuyler*, Adair, Macon, Randolph, Howard, Cooper, Clark, Knox, Shelby, Monroe, Audrain, Boone, Cole, Moniteau, Morgan, Miller, Lewis, Marion, Ralls, Pike, Lincoln, Warren, St. Charles, St. Louis, Montgomery, Callaway, Gasconade, Osage, Maries, Pulaski*, Johnson, Pettis, Henry, Benton*, Hickory*, Camden*, Laclede*, Cass, Bates, St. Clair, Cedar*, Polk*, Dallas*, Webster*, Greene, Vernon, Barton, Jasper, Dade*, Lawrence, Christian, Stone*, Taney, Newton, McDonald*, Barry*, Lawrence, Wright*, Douglas*, Ozark*, Texas, Howell*, Oregon*, Shannon*, Dent, Phelps, Crawford, Franklin, Jefferson, Washington*, Iron, Reynolds*, Carter*, Ripley*, St. Francois, Madison*, Wayne*, Butler, Ste. Genevieve, Perry, Bollinger*, Cape Girardeau, Stoddard*, Dunklin*, New Madrid*, Pemiscot*, Scott, Mississippi

Application of Current Data

The population data being utilized in this section are the
1970 Census of Population prepared by the Bureau of the Census in
Washington D.C. The information concerning the physicians was ob-
tained from the Office of Health Manpower Planning in Jefferson City,
Missouri, who field verified the data during January and February,
1975. These data are utilized in determining the physician-to-
population ratio found on Map 3, page 57. The upper figure is the
ratio of primary care physicians[1]-to-population while the lower figure
indicates the ratio of the total number of physicians to the popula-
tion. The upper figure is the number utilized in designating shortage
areas by the 1:4000 (25 per 100,000 population) ratio established
for the National Health Service Corps criteria.

In applying this ratio to the current data, the following list
of counties are designated as shortage areas.

Bollinger	DeKalb
Carter	Maries
Clark	Ozark
Dallas	Platte

(See Map 4, page 58, for the geographic location
of these counties.)

When compared to the list appearing in the October 24, 1974,
Federal Register, only two counties (Clark and Platte) remain on the

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[1]Primary care physicians include the specialties of: general
practice, family practice, internal medicine, obstetrics and gyneco-
logy, pediatrics, and general surgery. These are referred to as
general physicians in the National Health Service Corps legislation.
The total number of physicians are utilized in the determination of
shortage areas under the Health Professions Student Loans Forgiveness
Program.

MISSOURI

MAP 3

PHYSICIAN-TO-POPULATION RATIOS

Upper figure--number of primary care physicians per 100,000 population.

Lower figure--total number of physicians per 100,000 population.

61.95
127.77

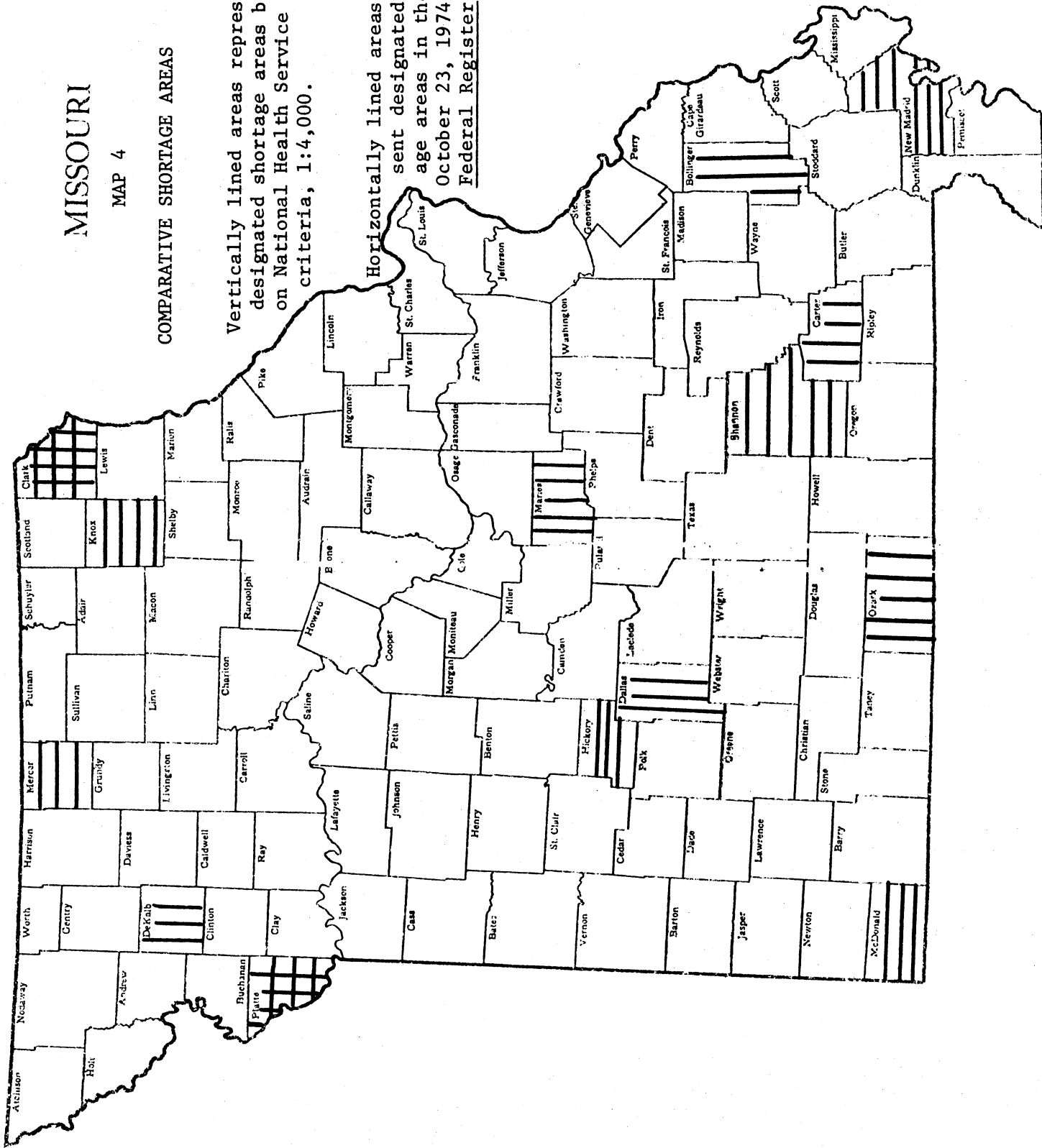| County	Primary care	Total
Atchison	59.5	59.5
Nodaway	37.8	40.1
Holt	60.1	60.1
Worth	59.5	59.5
Gentry	43.4	43.4
Harrison	46.3	46.3
Mercer	81.5	81.5
Putnam	42.3	42.3
Schuyler	64.3	64.3
Scotland	109.1	109.1
Clark	15.1	15.1
Andrew	33.6	33.6
DeKalb	13.7	13.7
Daviess	71.3	71.3
Grundy	51.0	59.5
Sullivan	33.0	33.0
Adair	166.9	203.3
Knox	70.3	70.3
Lewis	54.6	54.6
Buchanan	63.9	96.1
Clinton	68.2	76.2
Caldwell	47.3	47.3
Livingston	94.4	100.9
Linn	72.7	72.7
Macon	68.0	81.0
Shelby	63.2	63.2
Marion	76.5	102.2
Platte	24.2	24.2
Clay	64.1	85.0
Ray	31.3	31.3
Carroll	63.7	63.7
Chariton	45.1	45.1
Randolph	57.2	70.4
Monroe	36.7	36.7
Ralls	25.8	25.8
Pike	70.9	82.7
Jackson	66.4	139.3
Cass	41.2	41.2
Lafayette	64.8	65.7
Saline	44.7	44.7
Howard	37.9	47.3
Boone	76.3	159.7
Audrain	82.8	106.5
Lincoln	38.8	41.6
St. Charles	64.6	81.2
Warren	30.9	41.2
Montgomery	45.5	45.5
Johnson	46.8	58.5
Pettis	71.8	98.1
Cooper	74.7	74.7
Moniteau	60	60
Morgan	69.5	69.5
Cole	91.4	39.
Miller	53.2	53.2
Callaway	46.4	50.3
Osage	29.6	29.6
Gasconade	50.5	58.9
Franklin	52.6	57.2
St. Louis	83.85	127.77
Jefferson	25.7	27.6
St. Genevieve	42.8	42.8
Washington	33.1	33.1
Crawford	43.8	43.8
Maries	3.7	10.9
Phelps	54.3	67.8
Pulaski	37.8	37.8
Perry	55.8	55.8
Bollinger	11.3	11.3
Cape Girardeau	77.0	129.7
Madison	57.9	57.9
St. Francois	81.5	89.6
Iron	52.5	52.5
Reynolds	32.8	32.8
Wayne	38.0	38.0
Scott	72.9	95.5
Mississippi	49.6	49.6
Stoddard	58.2	60.1
New Madrid	26.7	26.7
Dunklin	26.7	26.7
Pemiscot	42.7	42.7
Butler	109.6	143.9
Carter	0.0	0.0
Ripley	30.6	30.6
Shannon	36.6	36.6
Oregon	32.7	32.7
Howell	60.6	60.6
Texas	38.2	38.2
Dent	52.4	61.1
Ozark	16.1	16.1
Douglas	32.4	32.4
Wright	43.9	43.9
Webster	45.0	45.0
Laclede	50.1	50.1
Camden	75.1	77.0
Dallas	19.9	19.9
Hickory	44.6	44.6
Benton	56.7	67.0
Henry	75.9	88.1
St. Clair	52.1	65.1
Polk	43.8	43.8
Cedar	45.1	55.7
Greene	105.4	170.3
Christian	31.4	31.4
Taney	86.4	86.4
Stone	40.3	31.4
Barry	66.3	66.3
Lawrence	36.6	40.7
Dade	36.5	36.5
Barton	76.7	76.7
Jasper	78.9	112.7
Newton	41.8	53.9
McDonald	40.5	40.5
Bates	67.9	67.9
Vernon	52.5	57.7

MISSOURI

MAP 4

COMPARATIVE SHORTAGE AREAS

Vertically lined areas represent designated shortage areas based on National Health Service Corps criteria, 1:4,000.

Horizontally lined areas represent designated short- age areas in the October 23, 1974, Federal Register.

new listing. The results obtained in the Federal Register used

1970 Census data for the population and 1972 licensed physicians.

Six counties are deleted from this list while six additional coun-

ties are selected.

The application of the Federal Health Profession Student

Loans criterion on one physician per 1,500 (66.7 per 100,000) pop-

ulation to these data produces the following list of counties. The

counties on this list are those having a ratio below the 1:1,500

(66.67 per 100,000) standard set by the Secretary of Health,

Education and Welfare for the Health Professions Student Loans.

Andrew	Franklin	Miller	Ripley
Atchison	Gasconade	Mississippi	St. Clair
Barry	Gentry	Moniteau	Ste. Genevieve
Bollinger	Grundy	Monroe	Saline
Caldwell	Harrison	Montgomery	Schuyler
Callaway	Hickory	New Madrid	Shannon
Carroll	Holt	Newton	Shelby
Carter	Howard	Nodaway	Stoddard
Cass	Howell	Oregon	Stone
Cedar	Iron	Osage	Sullivan
Chariton	Jefferson	Ozark	Texas
Christian	Johnson	Pemiscot	Vernon
Clark	Laclede	Perry	Warren
Crawford	Lafayette	Platte	Washington
Dade	Lawrence	Polk	Wayne
Dallas	Lewis	Pulaski	Webster
DeKalb	Lincoln	Putnam	Worth
Dent	McDonald	Ralls	Wright
Douglas	Madison	Ray	
Dunklin	Maries	Reynolds	

Sixty-one of the sixty-five counties designated as shortage

areas in the February 26, 1974, Federal Register remain designated

shortage areas with the application of the newer data. There are

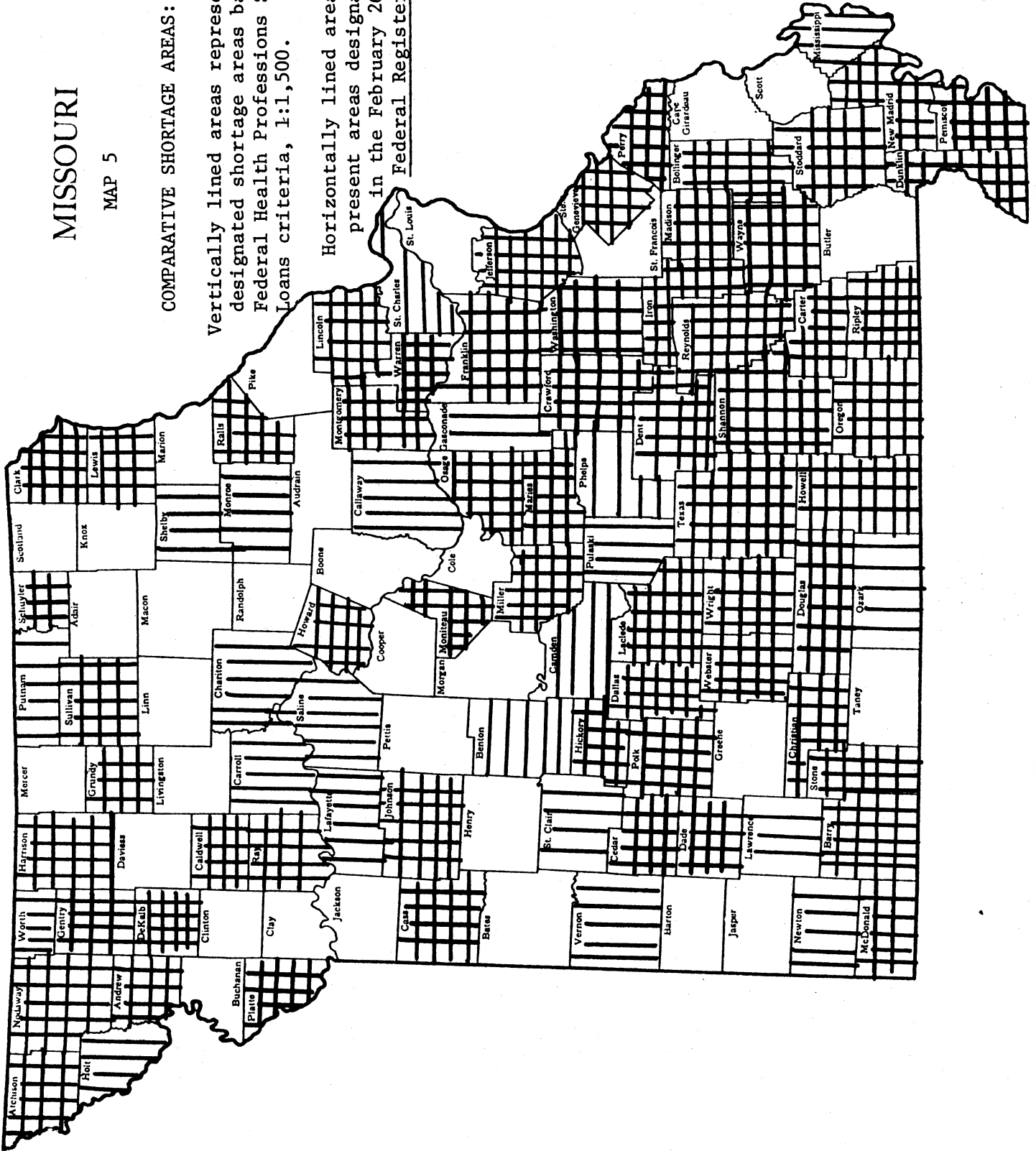four deletions and additions to the list.

MISSOURI

MAP 5

COMPARATIVE SHORTAGE AREAS:

Vertically lined areas represent designated shortage areas based on Federal Health Professions Student Loans criteria, 1:1,500.

Horizontally lined areas represent areas designated in the February 26, 1975, Federal Register.

Summary

The preceding sections provide a summary of the results obtained when the criteria and data used are varied. This shows the sensitivity of the ratio methodology to the criteria chosen for comparison purposes. In just the selection of two governmental programs, the designated shortage areas range from eight to seventy-eight.

The number of physicians needed to eliminate the shortage in the eight counties is obviously less than those needed to eliminate the shortage in the seventy-eight counties. In the case of the eight counties, it could plausibly be argued that the problem is more one of maldistribution than of an absolute shortage. This argument becomes even more plausible when the geographic region is expanded to include more than just one county.

However, when either the results of the sixty-five counties or the seventy-eight counties are viewed as being indicative of the physician shortage areas, the picture is quite different. No longer can you reasonably assert that the problem is solely one of maldistribution. Maldistribution implies that if there is a shortage in certain areas, there are surpluses in enough other areas to counterbalance these. However, there is no evidence to support this hypothesis.

The next chapter further developes the concept of the sensitivity of the results to the methodology and criteria chosen.

CHAPTER IV

DETERMINATION OF SHORTAGE AREAS

Methodology

The purpose of this chapter is to present a basic methodology
which can be utilized by various agencies in diverse areas in the
designation of physician shortage areas. Because of the versatility
of this objective, and the existing limitations on funds and manpower,
it is imperative that the method proposed be one which can be exe-
cuted accurately and rapidly. It is hoped that this methodology will
be utilized by State and Federal agencies in the allocation of
resources, providing standard criteria for evaluation of an area's
need for physicians. If a standard method can be utilized by all
concerned, much of the current ambiguity and confusion surrounding
the concept of designated shortage areas may be eliminated.

The method advanced in this chapter is an adaptation of the
evaluation methodology designed by Arthur Young and Company,
Consultants. "The core element in this methodology is a formula
which provides a means of assessing the gap between the resources
the community presently has available (as measured in terms of
physician visits provided per year) and the resources the community
needs (as measured in terms of the physician visits demanded per
resident per year) in order to reach national averages for health

personnel/consumer ratios."[1]

Basically, this methodology presents a numerical rating of the qualitative indicators of the health needs of a community. The method defines the elements involved in the assessment process and the standards to be utilized in the determination of need. Care is taken to develop a flexible model which is responsive to the specific needs of each community.

The first basic step in this evaluation methodology is the determination of the characteristics of the population and the community to be included in the analyses. The second step involves calculating the resources gap utilizing visits available and the visits required. The third step involves establishing the weights to be assigned to each variable included in the determination of other factors affecting total needs (see Table 2, page 64).

Determination of Characteristics

The broad categories of variables considered in the model are demographic characteristics, geographical characteristics, the existing health resources, the health status of the population, the economy of the region, and a catch-all category called special features of the population and/or community. The specific characteristics contained in these broad topical categories are discussed in detail in the subsequent paragraphs.

The variables included in the analyses are presently

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[1]Arthur Young and Company, Report on the Development of a Community-Health Care Delivery Matching Methodology (Unpublished Manuscript, Washington, D.C., July 1973), p. 4.

TABLE 2

NUMBERICAL NEED RATING PROCESS

Step 1

Determination of Community Characteristics

Step 2

Demography

Resource Gap
60 pts.

Existing Health Resources

Geography

Step 3

Accessibility and Availability of Primary Care Services
20 pts.

Health Status

Step 4

Health Status Indicators
10 pts.

Economy

Step 5

Demand for Services
10 pts.

Special Features

Step 6

Total Need
100 pts.
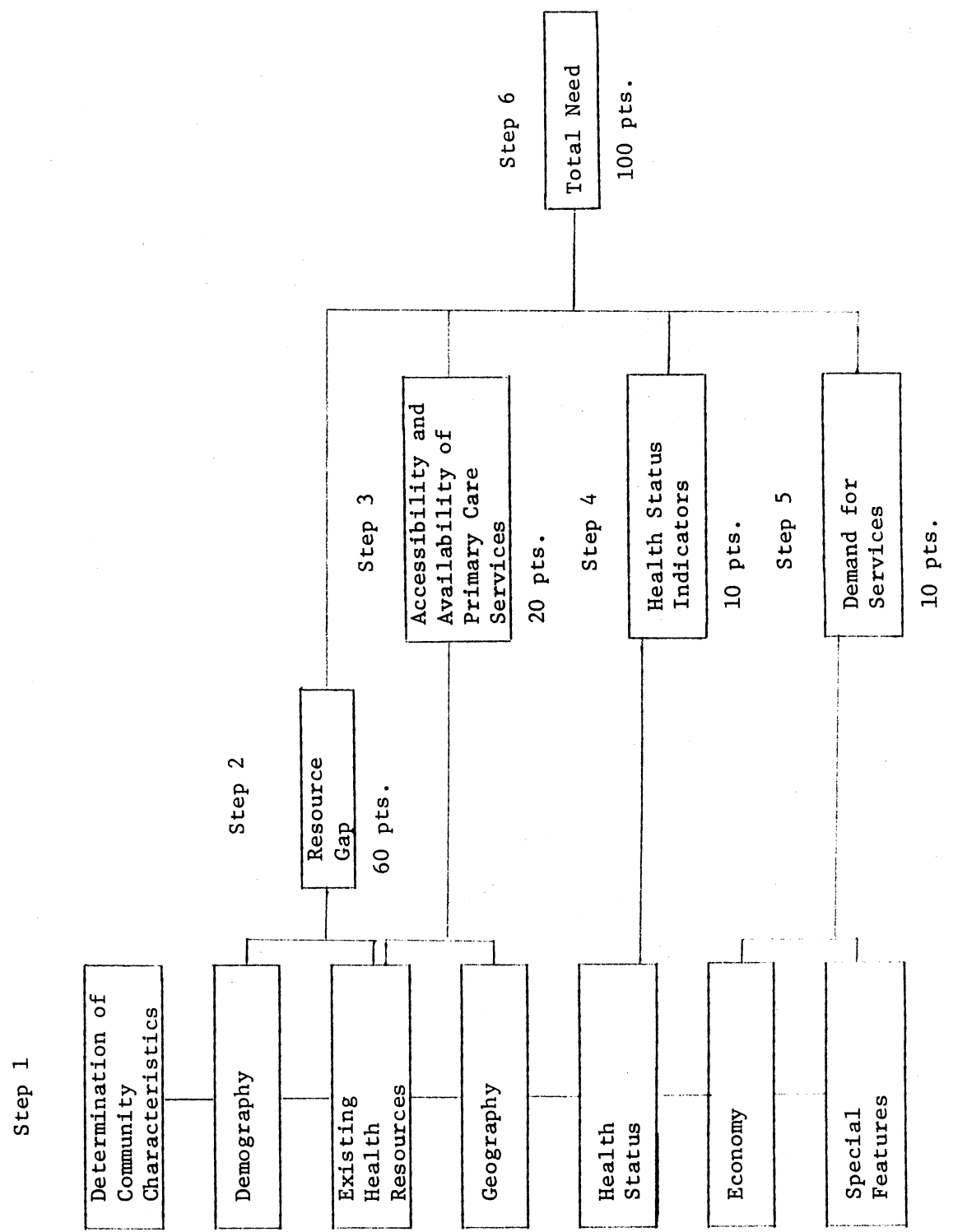
constrained somewhat by the data readily accessible. The determination of the characteristics considered essential for evaluation are, therefore, tempered by this constraint.

The specific variables listed below under these broad categories are meant to be illustrative of the type of factors to be considered. Not all of those variables will be relevant to all applications for various reasons. For example, the data may not be available, the data may not be applicable to a specific area, two or more of the variables may be so highly correlated that it is necessary to include only one, the variable may not affect all categories of health services demanded or utilized, and/or the directional impact of the variable may be indeterminate. Any one of these factors will impact on the specific variables included in any particular individual case.

Demographic Characteristics

Knowledge of the demographic characteristics of the subject population is essential if relevant assessment of the need for health services is to be made. As indicated by statistics provided by the American Medical Association (AMA)[1], the number of physician visits per person per year varies considerably between sex and among different age categories of the population.

Other factors (besides age and sex) affecting the utilization of health services included in this section are:

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[1]American Medical Association, Socioeconomic Issues of Health, (Chicago, Illinois: Center for Health Services, 1974), p. 61.

. . . race of the population

. . . education level of the population

. . . population density (urban/rural)

. . . size of the population

Geographical Characteristics

Previous research[1] appears to indicate that the geographical aspects of the area affect the need of the population for health services. These factors play a vital role in the accessibility of the currently available manpower as well as influencing the amount of manpower available in local and neighboring areas. Variables given consideration under this category are:

. . . number of registered automobiles

. . . public transportation facilities

. . . time involved in entering the medical system

. . . distance from primary care center

. . . proximity to a metropolitan area

. . . provision of alternative systems of transportation, i.e., Older Adults Transportation Systems, (OATS), Community Action Agency, (CAA), Red Cross (RC), and other agencies providing the population with means of transportation to health services.

Existing Health Resources

Before valid statements can be made concerning a physician shortage, knowledge about existing health resources is necessary.

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[1] For further information of this see Arthur Young and Company, Methodology, 1973, Victor R. Fuchs, (ed) Essays in the Economics of Health and Medical Care, (New York: National Bureau of Economic Research, 1972.

The basis for any assessment of 'needs' of a community lies in the current status of health resources. Under this topical heading, the variables included are:

. . . number of practitioners

. . . age of practitioners

. . . specialty of practitioners

. . . distribution of practitioners

. . . activity status of practitioners

. . . hospital facilities and beds

. . . nursing home facilities and beds

. . . emergency transportation facilities

. . . other medical facilities

. . . public health departments

. . . public nursing services

Health Status

"An important indicator of health care need is the general health status of the area. If the area experiences special health problems, these problems will probably be translated into increased need."[1] The variables incorporated into this category include:

. . . infant mortality rate

. . . death rate of the population

. . . fatal accident rate

. . . live birth rate

. . . premature birth rate

_____

[1] Arthur Young and Company, Methodology, p. 34.

. . . morbidity data

. . . disease specific incidence

Economy

The economic status of a community provides pertinent means of assessing the effectiveness of a proposed health care delivery system. In order for any system to be ultimately successful, the region must be capable of financially supporting the system. "During the site visits it became clear that the financial capabilities of a community act to limit or expand the number of potential models which might fit the community needs."[1] The variables included in this category are:

. . . median income of the population

. . . percent of families below poverty level

. . . type of employment of population

. . . rate of unemployment

Special Features

This category includes any other variables which may affect the utilization pattern of the subject population for health services. This allows the flexibility for specific individual problems to be incorporated into the model without changing the basic model itself. Examples of variables which may be considered under this section include:

. . . military installations

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[1]Ibid., p. 34.

. . . Indian reservations

. . . cultural differences

. . . additional community features

Concluding Remarks

The ease and accuracy with which the above information
could be collected played an important role in the decision to in-
clude it in the model. In order for the model to be widely appli-
cable, the variables included were confined to those currently
available in easily accessible form. Other variables, if readily
available for specific regions, can be incorporated with minor al-
terations into the model.

The Model

This section of Chapter IV outlines the steps involved in
the determination of the need for physicians. The model as presented
here is a model which currently does not make allowances for changing
productivity, changing institutions, changing legislation, or changing
demand.

Resource Gap Calculation

In the context of this dissertation, the term 'resource gap'
refers to "the difference between the health resources needed by the
community and the health resources possessed by the community."[1]
The first part of this step involves the calculation of the visits
required by the population.

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[1] Ibid., p. 34.

Required Visits[1]

The calculation of required visits by the population involves obtaining the utilization rate of the various sectors of the population. The AMA[2] publishes information concerning the utilization rate for an age/sex breakdown. With minor adaptations, these data are utilized in the model.

TABLE 3

NUMBER OF PHYSICIAN VISITS PER
PERSON PER YEAR[3]

Age/Sex	<20	20-24	25-44	45-64	65-74	$\geq$75
Male	3.4	3.4	3.3	4.3	5.1	6.4
Female	4.2	4.2	5.5	5.4	6.3	6.5

The demographic data on the population are similarly broken

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[1]The term required visits in this dissertation is actually a measure of services utilized by the population and is not necessarily a measure of the amount of services 'required' by the population. The measure, as presented here, does not take ability to pay into consideration. It utilizes an actual average utilization rate as a basis for further calculations in the determination of visits required by the population.

[2]American Medical Association, Socioeconomic Issues, p. 61.

[3]The AMA data on number of physician visits per person per year is adjusted by twelve percent in the calculations. The AMA data includes telephone calls made to physicians by the population. However, the AMA data on the average number of patient visits provided by physicians do not count telephone calls as a visit. Therefore, the number of visits per person per year is decreased by twelve percent. See Susan Gast and Roger N. Whiting, A Planning Study: Ohio's Requirement for Physicians. (Unpublished manuscript, June, 1973) for source of the frequency of these telephone calls.

down into the following age/sex categories: male and female in the age categories <20, 20-24, 25-44, 45-64, 65-74, and 75 and over.

The number of visits required by the subject population is obtained by multiplying the number of individuals in an age category by the corresponding number of physician visits per person per year in that age category for each age category and summing the results across all ages, i.e. Visits required = Σ (population in each age category X corresponding number of visits).

This step can be adjusted to project future requirements under status quo conditions by taking into consideration birth rates, mortality rates, and the net migration pattern of the region. The inference of this measure is that, on average, the actual number of visits by these age/sex groupings is equal to the potential number required.

Available Visits

The next part of the resource gap calculation involves determining the number of visits the current supply of physicians can provide to the subject population. This calculation requires data on the expected productivity of the physicians involved. The AMA[1] publishes a standard measure of physician productivity with which to compare existing resources.

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[1]American Medical Association, The Profile of Medical Practice, (Chicago, Illinois: Center for Health Services, 1974): p. 57, 60.

TABLE 4

AVERAGE NUMBER OF PATIENT VISITS

	General and Family Practice	Internal Medicine	Pediatrics	Obstetrics & Gynecology	General Surgery	Other Specialties
Number of Visits	10029.80	6714.76	6803.39	5516.15	7268.80	3225.86

The productivity of the physician is also related to the age of the physician. The AMA[1] indicates a significant degree of variation in the productivity of physicians depending on their age.

TABLE 5

MEASURES OF AVERAGE PHYSICIAN
PERFORMANCE

Age	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66+
Total Visits Per Year	6860	6552	7014	6757	7291	6868	6408	5836	4145
Per Cent	105	100	107	103	111	105	98	89	62

This table allows a means of adjusting the following calculation of physician production for an age factor. This variation of eleven percent above average to thirty-seven percent below average can play an important part in the amount of services provided by the

[1]American Medical Association, Profile, 1972, p. 93.

current practitioners in a given area.

So far, these data do not reflect the changes occurring in productivity when auxiliary personnel are present. Because sufficient data are currently lacking on the number and distribution of auxiliary and allied personnel, this factor is omitted for now. Once the data become available, this part of the model can be changed with little effort. In a study by Reinhardt and Yett[1], they determined that for general practitioners, the first assistant increased the physician's productivity by thirty percent, and the second through fourth assistant increased productivity by twenty percent.

The number of visits available to the population is calculated by multiplying the number of physicians in each age/specialty breakdown (see Table 6) by corresponding number of visits provided. Each age category is then summed and multiplied by the corresponding percentage of the age adjustment factor. These results are in turn summed for all age categories, i.e., Visits available = $\Sigma \left[\Sigma \right.$ (physicians/specialty/age times age adjustment factor) times number of visits provided$\left. \right]$.

Determination of A Rating Scale

"The entire resource gap formula attempts to simplify a very complex evaluation process."[2] A rating scale is devised to

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[1]Uwe E. Reinhardt and Donald E. Yett, _Physician Production Functions Under Varying Practice Arrangements_, (Los Angeles, California: University of Southern California, January 1971), p. 40.

[2]Arthur Young and Company, _Methodology_, p. 54.

TABLE 6

PHYSICIANS BY AGE BY SPECIALTY[1]

Age/Specialty	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 65	66 and over	Total
General and Family Practice										
Internal Medicine										
Pediatrics										
Obstetrics and Gynecology										
General Surgery										
Other Specialties										
Total										

assign a range of values to the individual factors considered in the model. This assignment was necessarily subjective, but was based on a perception of the priorities involved in determining a community's need for physician services. The advantage of this type of analysis lies in the fact that it permits the most important factors of all communities to be systematically evaluated.

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[1]These physicians include only those involved in direct patient care. Those in research, teaching, administration, etc., are omitted. This is also a measure of full-time equivalency based on the amount of time spent practicing direct patient care where .25 is quarter-time, .50 is half-time, and .75 is three-quarter-time with 1.00 equal to full-time.

The product of this method provides a relative ranking of a measure of the needs of the various communities for physician services. To test the sensitivity of this model to the weights assigned to each individual component in the Other Factor sector,[1] the weight assigned to each variable was increased by three, five, ten, and by twenty points, holding the points assigned to all other variables constant. If different weights are assigned to the individual components, the absolute values of the resource gap scores will change. However, once these variables were applied, a Goodman and Kruskal Coefficient of Ordinal Association[2] was computed as a test of the relative sensitivity of the model to these variations. The following table illustrates the relative robustness of the model to the variations in the weights assigned.

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[1] The assignment of additional points to the variables in the Other Factor Section automatically changes the relative weight of the sixty points assigned to the Resource Gap section. In the calculation of the composite need, this is reflected in the score received by each county.

[2] The Goodman and Kruskal Coefficient of Ordinal Association is a useful ordinal measure of association. This coefficient is called gamma, G, and explains "the degree to which an individual's relative position or rank in one ordinal scale is predictable from his rank in another." The coefficient of association, G, ranges from −1 (perfect inversion) to +1 (perfect agreement). As the G value increases from +1 or −1, increasing association between the two rankings are expressed. As can be seen by Table 7, there is a tendency toward agreement, but that the agreement is not perfect.

Goodman and Kruskal's coefficient "is a ratio of the amount of predominance of agreement or inversion between two sets of rankings to the maximum possible agreement or inversion."

$$G = \frac{\text{Number of agreements} - \text{number of inversions}}{\text{Number of agreements} + \text{number of inversions}}$$

TABLE 7

COEFFICIENT OF ORDINAL ASSOCIATION

Variable Increased	Gamma 3 points	5 points	10 points	20 points
Time and distance	.978	.966	.931	.876
Public transportation	.981	.967	.935	.871
Registered automobiles	.979	.965	.932	.888
Population density	.994	.989	.078	.966
Public health facilities	.975	.960	.908	.775
Infant mortality	.965	.946	.907	.812
Death rate	.991	.984	.971	.927
Fatal accident rate	.979	.960	.912	.824
Live birth rate	.966	.957	.923	.844
Premature birth rate	.967	.954	.901	.820
Education	.968	.958	.913	.807
Poverty level	.984	.976	.930	.914
Medial income	.964	.954	.898	.786

This general formula is presented symbolically as

$$G = \frac{fa - fi}{fa + fi}$$

where fa = the frequency of agreements, fi = the frequency of inversions.

A ratio of .978, for example, can be interpreted to mean that there is 97.8 percent greater concordance than discordance between the two rankings. Thus, "G is a coefficient of association between two sets of ordered observations based on their mutual predictability in terms of the relative number of agreements and inversions in the order of the ranking," (Linton C. Freeman, Elementary Applied Statistics, New York: John Wiley and Sons, Inc., 1968, pp. 79-88).

A test was also performed to test the correlation among variables. To do this, the weight assigned to one variable (i.e., education) was increased while the weight assigned to a second variable (i.e., income) was decreased, holding all others constant. If minor differences occurred in the rankings of the counties, then the variables were considered to be highly correlated and it would be necessary to include only one in the final calculation. The gamma calculated for increasing education and decreasing income was .992. The gamma for increasing premature birth and decreasing infant mortality was .986.

This point is mentioned here as a caution to users to become aware of the impact of the variables included in this sector and what the impact would be of including additional variables or deleting certain variables currently included. The user should be sure that the proper variables are included in the model to reflect the actual circumstances of the local areas under consideration. Otherwise, the model may be used to produce whatever results are desired.

The gamma obtained when varying each variable by three points, ranging from .964 to .994, indicate a high degree of association between rankings. This is interpreted as an indication of the insensitivity of the model to the weight assigned to any individual component. However, when the variation in weights is increased to twenty points there is a lesser degree of association between rankings. The relatively high degree of association which remains even then appears to indicate that the omission or inclusion of any single variable will not have a disproportionate effect on the results obtained.

Resource Gap

The gap is obtained by finding the difference between the number of visits available with existing resources and the number of visits required by the current population.

Gap = Visits required - Visits available

A numerical weight is calculated for this raw resource gap score with the application of the following formula:

Numerical rating = 60 - (Visits available/Visits required) X 60

The proportion of need that is met by existing resources is determined by the ratio of visits available to visits required. To determine the amount of unmet need in the community on the basis of 60, multiply the resultant figure in the previous ratio by 60. Subtract this figure "from the total available 60 points to determine the total points represented by the community's unmet need."[1] The number obtained represents the numerical rating assigned to the community. The resource gap is rated on a scale of less than or equal to zero to a maximum of sixty points. The larger the positive score obtained by this calculation, the greater the need of this community for physicians.

Other Factors

Determination of Availability and Accessibility

The following categories incorporate, to a degree, subjective assessment of the ready availability and accessibility of health services irrespective of the existing physician manpower

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[1]Arthur Young and Company, Methodology, p. 42.

resources of the community. A total of twenty points are allocated to this category and the following variables are included.

Time and Distance -- 5 points

The factors considered here are: (a) one hundred percent of the county falls within a twenty-mile radius of the primary health care center[1] as it is identified by the Office of Health Manpower Planning, Jefferson City, Missouri; (b) at least seventy-five percent of the county falls within the twenty-mile radius; and (c) less than seventy-five percent lies within the twenty-mile radius.

75 percent included . . . . 5 points

75 percent - 99 percent included . . . . . . 3 points

100 percent included . . . . 0 points

Public Transportation -- 3 points

The breakdown within this category is as follows: (a) no public transportation systems are present; (b) only a small portion[2] of the county is serviced; and (c) the public transportation tends to be centrally located within the county.

Lack of public transportation . . . . 3 points

Non-centrally located system . . . . 2 points

Centrally located system . . . . 0 points

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[1] This primary health care center is determined to be the trade center of that region, offering some degree of primary health care services. It is identified as having a relatively high population concentration for that region.

[2] The public transportation system (bus line) runs through a small portion of the county only. It is not centrally located within a county being considered.

Registered Automobiles -- 2 points

The comparison here is the number of automobiles registered in a county per 1,000 population as this ratio compares to the National average of automobiles per 1,000 population.

Less than National average . . . . 2 points

Greater than or equal to National average . . 0 points

Population Density -- 5 points

This breakdown considers the urban/rural characteristics of the population. If a community has a population of more than 15,000 then, in general, it offers more economic, social, educational, and cultural opportunities, thereby having the ability to attract more resources. According to the Bureau of the Census[1], any community having less than 2,500 population is classified as a rural community, with the area being sparsely populated. The following breakdown refers to the population of communities in a region.

Less than 2,500 population . . . . 5 points

2,500 to 15,000 population . . . . 3 points

More than 15,000 population . . . . 0 points

Public Health Facilities -- 5 points

This category takes into consideration the presence or absence of county public health departments or county public nursing services. These often times represent a point of entry into the

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[1]United States Bureau of the Census, Statistical Abstract of the United States: 1972, 93rd edition, (Washington, D.C.: Government Printing Office, 1972).

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health system and act as a partial substitute for physician ser-
vices.

No facilities . . . . 5 points

Facilities present . . . . 0 points

Total Points

The individual scores obtained above are summed for each
community to provide a single numerical value representing the
accessibility and availability of medical services in the area.
There is a maximum of twenty points to be assigned to this category,
where the higher the score, the worse off the community is relative
to other communities.

Health Status

The following variables are included in the determination of
the health status of the community. This category is assigned a
maximum possible weight of ten points.

Infant mortality rate

Population death rate

Fatal accident rate

Live birth rate

Premature birth rate

Each of the rates of the subdivisions of the subject region
is compared with a National average to determine its relative score.
Each of these components are considered separately with an equal
weight assigned to each component. The individual scores are then
summed to obtain a numerical rating for the health status of the
community.

Infant Mortality Rate -- 2 points

        Greater than 125 percent of average . . . . . . 2 points

        75 percent - 125 percent of average . . . . . . 1 point

        Less than 75 percent of average . . . . 0 points

Death Rate -- 2 points

        More than 150 percent of average . . . . 2 points

        100 percent - 150 percent of average . . . . . 1 point

        Less than average . . . . 0 points

Live Birth Rate -- 2 points

        More than average . . . . 2 points

        75 percent - 100 percent of average . . . . . . 1 point

        Less than 75 percent of average . . . . 0 points

Premature Birth Rate -- 2 points

        More than 150 percent of average . . . . 2 points

        75 percent - 150 percent of average . . . . . . 1 point

        Less than 75 percent of average . . . . 0 points

Total points

      While the above determination is again subjective, they
have a more objective element involved. The health status of the
community is compared with a national rate and their comparable
position indicates whether or not they have a greater than ordinary
need. The individual elements of this category are again summed
with the maximum number of points possible ten.

Demand For Services

"The determination of the demand for services on the part of the community involves a subjective assessment of such factors as community support, availability of facilities, motivators for change, and the ability of the community to support additional personnel."[1] This catchall category can allow for any other relevant factors to be incorporated into the model. For this category, education, median income, and the percent of families below the poverty level are analyzed and weighted in the allocation process. Again, each community is compared to a National average and points scored accordingly. There are ten points allocated to this category and the individual factors are summed to give the numerical score of the community's demand for health.

Education -- 3 points

This category looks at the percent of the population having a college education and compares it to the National average. Points are assigned on the following basis:

More than average . . . . 3 points

50 percent - 100 percent of average . . . . . . 1 point

Less than 50 percent of average . . . . 0 points

Percent Below Poverty Level -- 4 points

The percent of families residing in the community having and income below the poverty level is compared with the National

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[1] Ibid., p. 44.

average as one measure of a community's ability to support the
health delivery system. The following scale is used in the scoring
of points:

More than 150 percent . . . . 4 points

100 percent - 150 percent of average . . . . 2 points

Less than average . . . . 0 points

Income -- 3 points

Median income was the factor chosen to represent this cate-
gory. Median income is not distorted as much by extreme values on
either end as is, say, average or mean income. This again reflects
the community's ability to pay for services. In the assessment
process, points are assigned as follows:

More than average . . . . 3 points

50 percent - 100 percent of average . . . . . 1 point

Less than 50 percent of average . . . . 0 points

Total points

Each of these components are measured and scored individ-
ually and then summed to obtain the score reflecting a community's
demand for health services. The maximum number of points assigned
to this category are ten.

Composite Need

In the assessment of a community's need for physician ser-
vices, the final step involves totalling the points assigned to
each of the needs assessment areas. The resulting composite number
represents the community's need rating based on a maximum of 100 points.

Resource Gap . . . . 60 points

Accessibility and Availability . . . . 20 points

Health Status . . . . 10 points

Demand for Services . . . . 10 points

Composite Need . . . . 100 points

Summary

A negative ranking scored by this method indicates that a community has more services available than 'needed' for their population. This model as presented here, does not allow for the existing health resources to provide services for surrounding communities. Actual utilization patterns, however, could be observed and incorporated into the model without difficulty.

The larger the positive score received, the greater the composite need for medical services of the community. This, however, does not necessarily mean that more physicians are required, substitutes and complements must also be considered.

Application of Methodology

As previously stated, the reason for the model proposed in the preceding section was the creation of a basic standard model which could be utilized consistently by various governmental and/or private agencies for purposes of planning and for policy determination. In order to accomplish this, the model had to be tempered by political reality and data availability. For the model to be practical on a wide-scale basis, it had to be easily applicable, simple to interpret, and provide plausible results.

In the selection of variables to be included in this multi-variable model and the weights to be assigned to the various components, consideration was given to professional judgements and the end product was based upon the informed judgement of the Technical Advisory Group of the Office of Health Manpower Planning, the Health Manpower Planning Task Force, and the staff of the Office of Health Manpower Planning, Jefferson City, Missouri. The emphasis here is that this is an informed judgement rather than a subjective or arbitrary decision based solely on one person's opinion.

The analysis which follows was obtained by applying the Missouri physician manpower data to the Resource Gap Allocation Process model. The data utilized in the assessment of the adequacy of the supply of physician services in the State were relatively easy to obtain and are basic data generally available for other regions in the United States.

The Resource Gap Allocation Process is applied to data pertaining only to the political subdivisions of the State of Missouri. This allows attention to be given to more details than would be possible if the entire United States was analyzed. The following analysis is an attempt to ascertain whether or not an area has a critical physician shortage. In the narrative which follows, the term physician refers to a full-time equivalent physician involved in direct patient care. Unless preceded by the terms primary-, secondary-, or tertiary-care, physician refers to the total number of physicians in all specialties.

Example of Methodology

The following is an application of individual county data to the model. Two separate counties, 003 and 011, are analyzed in an attempt to illustrate the relative position of two distinctly identifiable counties with differing health services currently available.

TABLE 8

APPLICATION OF DATA

Variables	County 003 Component	Score	County 011 Component	Score
Resource Gap[1]		19.06		-32.53
Visits Available[2]	36,773.88		75,123.20	
Visits Required[3]	53,891.20		48,710.70	
Accessibility and Availability[4]		10		8
Time and Distance	3		5	
Public Transportation	0		0	
Registered Autos	2		2	
Population Density	3		3	
Public Health Facilities	5		0	
Health Status[5]		2		3
Infant mortality rate	1		1	
Population death rate	1		1	
Fatal accident rate	0		0	
Live birth rate	0		0	
Premature birth rate	0		0	
Demand[6]		4		4
Education	1		0	
Poverty level	2		4	
Median income	1		0	
Composite need[7]		38.06		-15.53

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[1]Resource Gap = 60 - (Visits available/Visits required times 60).

[2]Visits available = $\Sigma \left[\Sigma \right.$ (physicians by specialty by age times

In relation to each other, County 003 has a greater need for additional health resources than does County 011.

Analysis of Application

Applying the data for all Missouri counties to the Resource Gap Allocation Process, the following list of counties were designated as having some unmet need. (See Map 6, page 89, for the resource gap score received by each individual county.) After scoring, these counties are ranked beginning with the county having the largest score; the larger the score obtained, the greater the unmet need of that county. This list does not include those counties in the State currently having no unmet need for physician services.

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an age adjustment factor) times the number of patient visits provided].

[3]Visits required = Σ (population in each age-sex category times the corresponding number of visits).

[4]Accessibility and availability = Time and distance plus public transportation plus registered automobiles plus population density plus public health facilities.

[5]Health status = Infant mortality rate plus population death rate plus fatal accident rate plus live birth rate plus premature birth rate.

[6]Demand = Education level plus median income level plus poverty level.

[7]Composite need = Resource Gap plus Accessibility and Availability plus Health Status plus Demand.

MISSOURI

MAP 6

METHODOLOGY SCORES

Number represents score received with application of Resource Gap Allocation Process.

-13.96

County	Score
Atchison	5.00
Holt	10.01
Nodaway	28.30
Andrew	38.06
Worth	5.23
Gentry	26.71
Harrison	31.14
Mercer	-10.96
Grundy	13.78
Daviess	-10.57
DeKalb	64.11
Buchanan	-8.90
Clinton	-25.25
Caldwell	16.42
Platte	48.02
Clay	-19.90
Ray	35.40
Putnam	42.54
Sullivan	56.75
Schuyler	0.69
Adair	-147.48
Scotland	-46.46
Knox	16.62
Clark	65.17
Lewis	9.04
Linn	-10.27
Livingston	-45.49
Chariton	30.52
Macon	-12.26
Shelby	5.41
Marion	-17.62
Randolph	16.31
Monroe	38.95
Ralls	54.06
Pike	-13.85
Lincoln	35.36
Carroll	6.92
Saline	14.81
Howard	23.81
Boone	-50.18
Audrain	-24.53
Montgomery	22.90
Warren	-13.57
St. Charles	6.83
St. Louis	17.99
Ste. Genevieve	
Lafayette	-8.21
Jackson	-28.46
Cass	20.43
Johnson	19.82
Pettis	22.54
Cooper	2.78
Callaway	16.55
Osage	8.74
Gasconade	
Franklin	11.54
Jefferson	37.01
Perry	-1.10
Bates	2.34
Henry	-15.63
Benton	9.15
Morgan	0.92
Moniteau	-53.45
Cole	
Miller	5.70
Maries	70.26
Osage	
Phelps	-1.44
Crawford	17.91
Washington	39.05
St. Francois	-29.?
Madison	19.90
Bollinger	-34.88
Cape Girardeau	
Scott	-11.17
Vernon	18.72
St. Clair	25.08
Hickory	24.10
Camden	-16.92
Pulaski	34.33
Dallas	51.68
Laclede	16.06
Texas	32.74
Dent	1.68
Iron	16.62
Reynolds	38.72
Shannon	38.69
Wayne	63.90
Stoddard	4.57
Mississippi	12.59
Cedar	29.26
Dade	43.28
Polk	28.04
Greene	-71.70
Webster	22.07
Wright	24.72
Howell	-1.64
Oregon	39.90
Carter	79.00
Ripley	33.88
Butler	-70.16
New Madrid	38.19
Barton	-15.53
Jasper	-23.43
Lawrence	23.73
Christian	43.63
Douglas	44.03
Ozark	58.44
Taney	-32.25
Stone	26.21
Newton	21.48
McDonald	32.46
Barry	-9.10
Pemiscot	30.59
Dunklin	13.83
Franklin	39.19
Gasconade	39.19
Moniteau	22.54
Cole	-9.01

TABLE 9

RESOURCE GAP RANKING
(115 = worst)

County	Score	Rank	County	Score	Rank
Carter	79.00	115	Wayne	24.81	75
Maries	70.26	114	Hickory*	24.10	74
Clark	65.17	113	Howard	23.81	73
DeKalb	64.11	112	Lawrence	23.73	72
Bollinger	63.90	111	Montgomery	22.90	71
Ozark	58.44	110	Webster	22.07	70
Sullivan	56.74	109	Newton	21.48	69
Ralls	54.06	108	Cass	20.43	68
Dallas	51.68	107	Madison*	19.90	67
Platte	48.02	106	Johnson	19.82	66
Douglas	44.03	105	Vernon	18.72	65
Christian	43.63	104	Ste. Genevieve*	17.99	64
Dade	42.54	103	Crawford	17.91	63
Putnam	42.54	102	Iron*	16.62	61
Oregon	39.90	101	Knox*	16.62	61
Osage	39.19	100	Callaway	16.55	60
Washington	39.05	99	Caldwell*	16.42	59
Monroe	38.95	98	Randolph	16.31	58
Reynolds	38.72	97	Laclede	16.06	57
Shannon	38.69	96	Saline	14.81	56
New Madrid	38.19	95	Dunklin	13.83	55
Andrew	38.06	94	Grundy*	13.78	54
Jefferson	37.01	93	Mississippi*	12.59	53
Ray	35.40	92	Franklin	11.54	52
Lincoln	35.36	91	Holt*	10.01	51
Pulaski	34.33	90	Benton*	9.15	50
Warren	34.03	89	Lewis*	9.04	49
Ripley	33.88	88	Gasconade*	8.74	48
Texas	32.74	87	Carroll*	6.92	47
McDonald	32.46	86	St. Louis County	6.83	46
Harrison	31.14	85	Miller*	5.70	45
Pemiscot	30.59	84	Shelby*	5.41	44
Chariton	30.52	83	Worth*	5.23	43
Cedar	29.26	82	Atchison*	5.00	42
Nodaway	28.30	81	Stoddard*	4.57	41
Polk	28.04	80	Cooper*	2.78	40
Wright	27.72	79	Bates*	2.34	39
Gentry*	26.71	78	Dent*	1.68	38
Stone	26.21	77	Moniteau*	0.92	37
St. Clair	25.08	76	Schuyler*	0.69	36

The counties with asterisks are those counties to which the addition of one more general practitioner would decrease their resource gap score to a negative number. In other words, their present amount of unmet need is _relatively_ insignificant when compared to counties with greater unmet needs. (See Map 7, page 92, for the geographical location of these remaining counties.)

One advantage of this method is that it can be used systematically in determining a ranking of priorities for policies involving attempts to redistribute physicians by geographical location. Not only is an unmet need given a numerical value for evaluation purposes, but when mapped the proximity of a county having a high degree of unmet need to one having an adequate or surplus amount of services is easily identifiable. This is very important in the availability and accessibility of health services to the population.

If a county having some degree of unmet need is surrounded by other counties having varying degrees of unmet need, then that population will usually find it more difficult to obtain an adequate amount of care than would be the case if the county were adjacent to counties having the necessary supply of physician services. In making this assumption, geographical barriers must be taken into consideration in analyzing the accessibility of physician services. This and other additional factors can be considered with minor difficulties in the application of this model.

When considered in this framework, the following counties fall out as having the greatest 'need' for additional physician

MISSOURI

MAP 7

PHYSICIAN SHORTAGE AREAS

Vertically lined areas represent those counties remaining after elimination of counties with the addition of one physician.
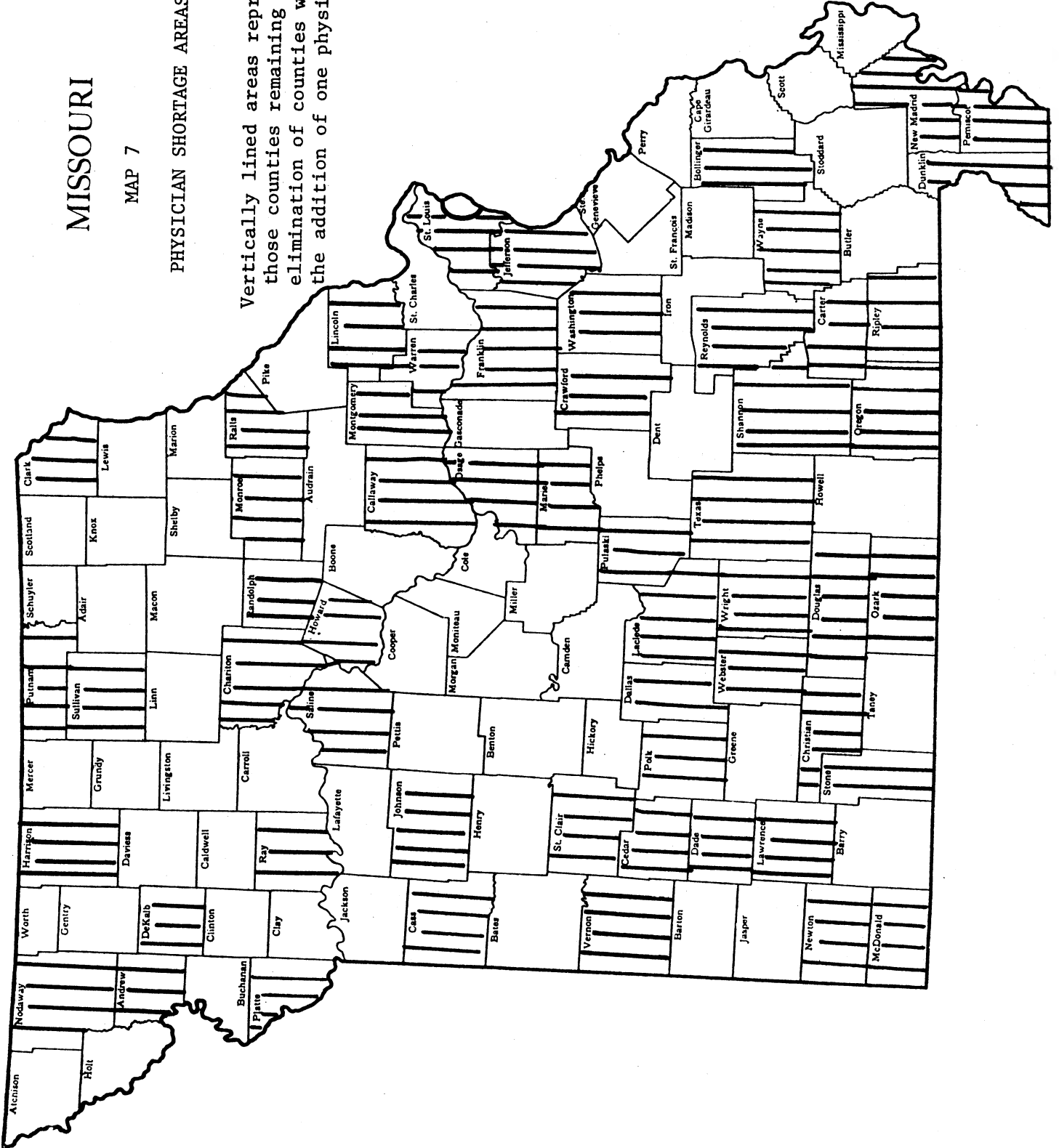
services.   (See Map 8, page 94.)

COUNTIES WITH GREATEST NEED

Carter	Texas
Ozark	McDonald
Dallas	Pemiscot
Christian	Cedar
Douglas	Howard
Osage	Wright
Reynolds	Montgomery
Shannon	Webster
Oregon	Laclede
Ripley	Dunklin

As can be seen by the map on page 94, there are still large areas of the State that have a severe deficit of physician services. This is especially true in the southern part of the State which is characterized by sparse population, low income, and very few towns of any size.

This latter distinction of counties with the greatest 'need' encounters many decision rule problems. While this method is one valid way of determining areas with the greatest need, some other method or methods may be used that are just as valid or justifiable as the one presented here. The reason for mentioning this point here is to acquaint the reader with the fact that this is only one decision rule process and to caution him/her concerning the acceptance of results at face value. The user must be sure that all the assumptions underlying the designation of critical shortage areas are noted and understood. Otherwise, invalid criteria may be utilized in obtaining results to influence policy decisions.

MISSOURI

MAP 8

COUNTIES WITH GREATEST NEED

Vertically lined areas represent
counties having the greatest
need for physician services.

CHAPTER V

RECENT LEGISLATION AND THE FUTURE

The model developed in the preceding chapter utilizes cir-

cumstances for future projections of change. The model is designed

for an "if ... then" type of analysis. If a given set of circum-

stances are true, then one set of consequences will follow. How-

ever, if a different set of circumstances are implemented, a differ-

ent set of consequences may result. As was shown in the preceding

chapter, variation in the weighting scheme did not drastically affect

the results obtained, but changing several of the variables included

can substantially alter the results. The omission or inclusion of

any single variable, except those necessary for the calculation of

the resource gap itself, does not significantly alter the relative

position of the counties although it may affect the ranking to a

small degree.

The above type of model is very flexible and can be adapted

to any number of sets of variables. This adaptability makes the

model versatile, and it can therefore be used for a wide range of

circumstances.

With new Federal legislation being implemented, The National

Health Planning and Resource Development Act of 1974 (Public Law 93-

641), it will be useful to examine the proposed designated Health

Service Areas (HSA's) with respect to the Resource Gap Allocation

Model in an effort to prepare for the future. However, before analy-

zing the results, the first step is to give a brief overview of this

law.

The National Health Planning and Resource Development Act of 1974

Just hours before the January 4, 1975, deadline, President

Ford signed into law the "National Health Planning and Resource

Development Act of 1974" (Public Law 93-641). Almost immediately

after the passage of this law, Health, Education, and Welfare (HEW)

officials began to set in motion the process of implementing the

plan. Under Public Law 93-641,[1] which is a compromise between

Senate Bill 2994 and House Bill 16204, the States were given 120

days after enactment of the law (until May 4, 1975) to designate

their own Health Service Areas. After this period, if the States

have not been able to designate acceptable Health Service Areas,

then the Secretary of HEW, without the necessity of further consul-

tation with the States, will do so.

The Health Service Areas (HSA's) are geographic planning

areas which must meet several requirements. For one,

> "The area shall be a geographic region
> appropriate for the effective planning and
> development of health services, determined on
> the basis of factors including population and
> the availability of resources to provide all
> necessary health services for residents of
> the area."[2]

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[1] Public Law 93-641, 93d Congress, (1975), pp. 6-15.

[2] Ibid., p. 5.

Secondly, to the extent practicable, the law provides that the designated areas are to include at least one center that is capable of providing highly specialized health services. It does not, however, elaborate on what is meant by 'highly specialized health services.' In the following material, this term is interpreted to include all other specialties beyond those in primary care as defined earlier.

The third provision under this law specifies the population criterion for designating service areas. The general provision is that each area must have at least 500,000 persons, but must not exceed three million population. There are exceptions to the population standard. The first exception provides that if an entire State has a population of less than 500,000, the State may be designated as an HSA. Another exception provides that if an area containing an SMSA has more than three million people the entire SMSA may be designated as an HSA. The rationale here is that the legislation was meant as a planning instrument and the SMSA's are basic data entities for other purposes. It was thought, therefore, that it would be beneficial to keep the data contained here consistent.[1]

The legislation also provides for an HSA to have fewer than 500,000 persons but to have at least 200,000 persons under 'unusual circumstances.' For an area having less than 200,000 population to be designated as an HSA, it has to satisfy the requirement of having

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[1]Stanley S. Wallack, Director of Health Resources, DHEW, conversation held during meeting of the Seventh Annual Seminar for Health Manpower Executives, Chicago, Illinois, May 1975.

'highly unusual circumstances.' In order for any area to be desig-

nated as an HSA under the latter two exceptions, careful documenta-

tion by the submitting Governor of reasons for granting the waiver

must be presented before the designation is awarded by the Department

of Health, Education, and Welfare.

The law also provides that in the planning and development

for the provision of health services in these areas, geographical

and economic barriers must be taken into account in all nonmetropo-

litan areas. It is recognized that there are differing needs between

nonmetropolitan and metropolitan areas. Time and distance must be

measured differently between the two. These differences are to be

reflected in the planning that is undertaken for the provision of

health services and health services development needs.

The legislation also provides that:

"Each standard metropolitan statistical area
(SMSA) shall be entirely within the boundaries
of one health service area, except that if the
Governor of each State in which a standard
metropolitan statistical area is located deter-
mines, with the approval of the Secretary, that
in order to meet the other requirements. . .
a health service area should contain only part
of the SMSA, then such statistical area shall
not be required to be entirely within the
boundaries of such health service area."[1]

Another entire section of the legislation deals with estab-

lishment of health systems agencies to administer the program. The

Secretary of HEW has eighteen months in which to designate all health

systems agencies in consultation with the proper State authorities.

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[1]Public Law 93-641, 93d Congress, (1975), p. 6.

After consultation, research, and public hearings, the
following map represents the official proposal to the Governor
of Missouri by the Health Service Areas Task Force[1] for the desig-
nation of HSA's for Missouri. (See Map 9, page 100, for the State
of Missouri). This proposal divides the State into five HSA's,
only one of which would require a waiver request under the less
than 500,000 population criterion. Given the characteristics and
size of the area, it was thought that documentation for the waiver
should not be too difficult.

On May 3, 1975, Missouri's Governor Christopher Bond sub-
mitted to the Secretary of Health, Education, and Welfare, a map
which differs significantly in the northwest part of the State from
the map presented by the Task Force (see Map 10, page 101, for these
changes). This designation places sixty counties into one HSA, with
only five counties in a Kansas City HSA. The other regions of the
State remain the same as those proposed by the Task Force.

The emphasis within the State has been to adhere to the
Regional Planning Commission (RPC) boundaries as closely as possible.[2]
Because of the minimum population requirement, it was impossible to
designate twenty HSA's corresponding to the twenty RPC's in the
State, but Governor Bond's office and the Office of Comprehensive

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[1]This Task Force was appointed by Lawrence Graham, Director of
the Missouri Department of Social Services. Graham was designated by
Governor Bond to submit a proposal for the designation of Health
Service Areas.

[2]William Mitchell, Director of Missouri State Office of
Comprehensive Health Planning, interview, Jefferson City, Missouri,
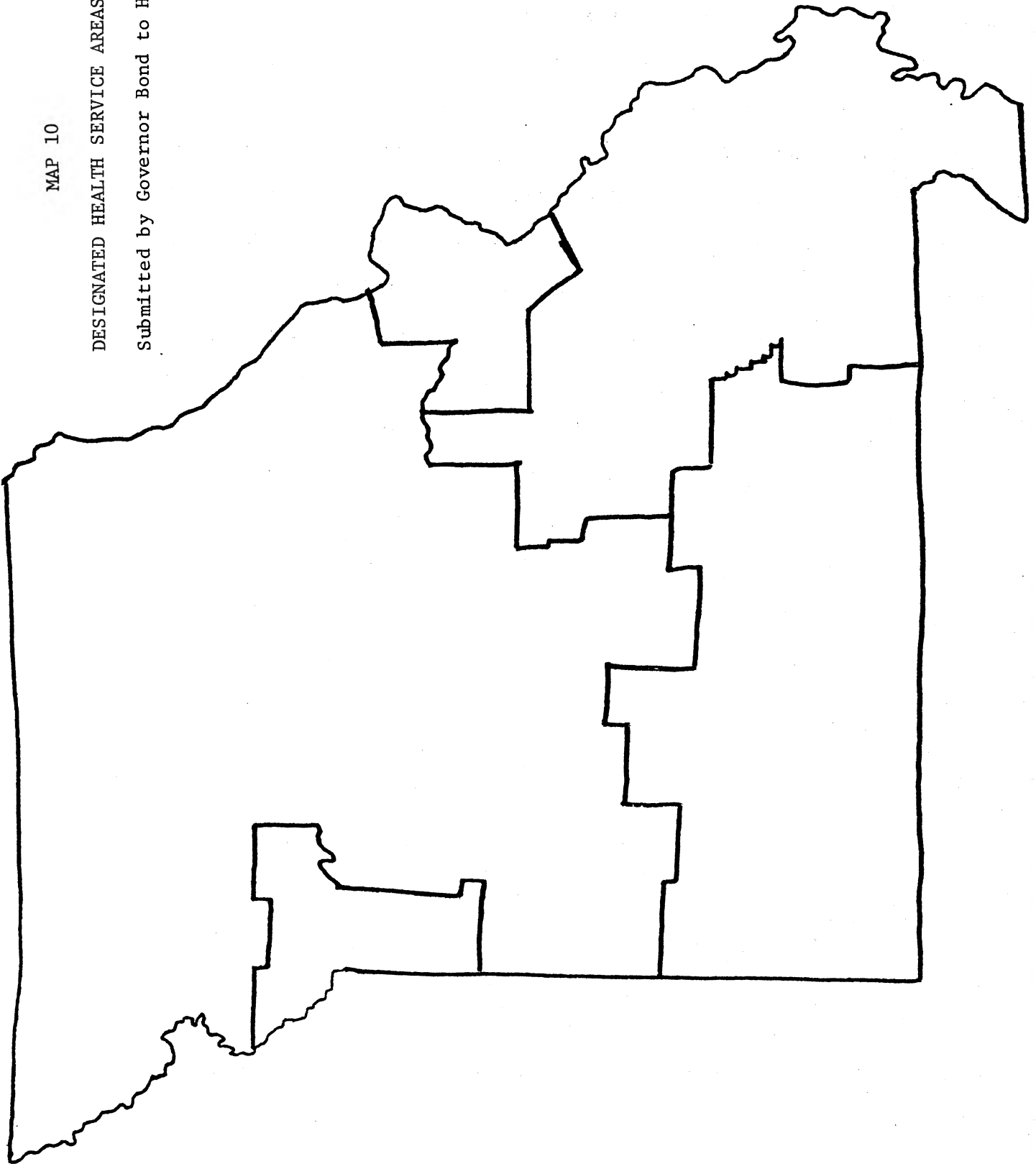May 23, 1975.

MAP 9

DESIGNATED HEALTH SERVICE AREAS --

HEALTH SERVICE AREAS TASK FORCE
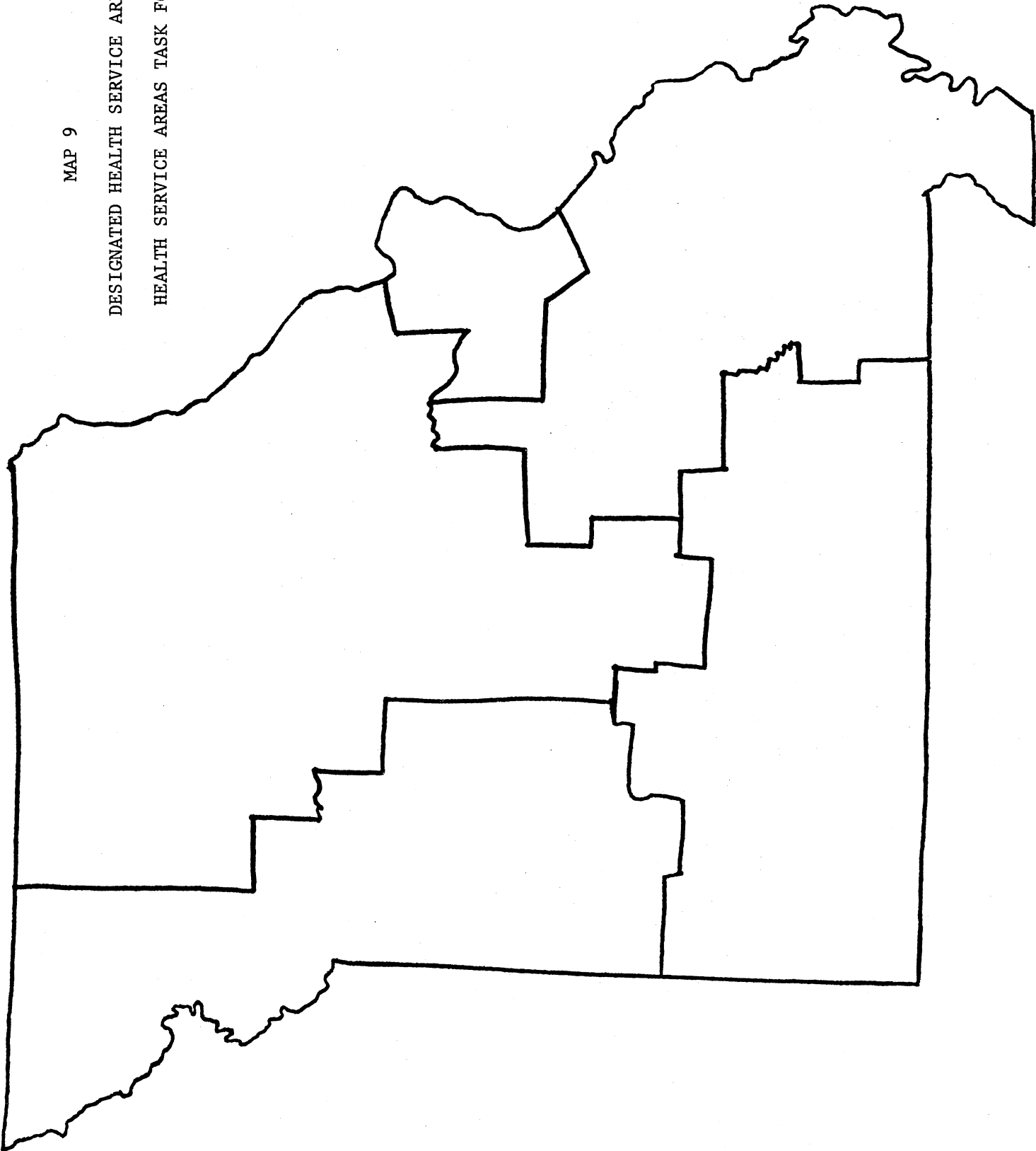
MAP 10

DESIGNATED HEALTH SERVICE AREAS

Submitted by Governor Bond to HEW

Health Planning were reluctant to split these RPC's. They, there-
fore, aggregated RPC's to form the new HSA's.

The rationale for adhering to RPC boundaries rather than
establishing new ones was an administrative one. Currently, all
State programs are being realigned to agree with the RPC boundaries.
Therefore, to minimize duplicative endeavors and to avoid splitting
regions which would occur if other lines were adhered to, the RPC
boundaries will remain as the basic planning boundaries.

Another important factor entering into the Kansas City area
HSA was the influence of Kansas Governor Bennett. Since part of the
Kansas City SMSA lies on the Kansas side, their views were given
consideration in the designation of Missouri HSA's. The legisla-
tion provides that if another Health Planning Commission, i.e.,
CHP 'b' agency, existed and all the other criteria were met, then
this area could be 'grandfathered in.' The indications from the
Kansas side were that this is what would be done unless only those
Missouri counties contained within their region were included. To
avoid conflict, Governor Bond agreed to the designation.

The southern part of the State remains the same as the
HSA's Task Force proposed, leaving the State with the necessity of
requesting one waiver.

The discussion which follows centers on the health services
provided in each of these HSA's and analyzes the adequacy of the
current supply of health resources.

One of the objectives of aggregating the small county units
into larger geographic regional Health Service Areas is an improvement

in the delivery of health services. This improvement may take the form of lower costs, the achievement of equality of access to quality care, the creation of a uniformly effective method of delivering health care, and/or an increase in public knowledge of health care and effective utilization of services.

This aggregation provides a starting point for comprehensive health planning. By looking at these larger areas, more realistic incentives can be offered to attract physicians into the area as well as provide a basis for more effective planning for the provision of all health services. Aggregating the county data for the State of Missouri into the five designated HSA's, the following results are obtained.

TABLE 10

HSA RESOURCES

HSA's	Primary Care Physicians	Other Specialty Physicians	Total Direct Patient Care Physicians	Total Resources Gap
Kansas City	543.25	503.25	1,046.50	-42.12
Northern	624.75	179.00	803.75	22.71
St. Louis	916.50	798.00	1,714.50	1.44
Southwest	346.25	130.25	476.50	-8.89
Southeast	258.50	58.00	316.50	1.45

(See Map 11, page 104, for summary by geographical location.)

As can be seen by Table 10 above, three of the health service areas have a deficit of health services. (See Map 12, page 105, for geographical location.) By analyzing the State in this manner, it

MAP 11

HSA RESOURCES

(1) 1,826,90
(2) 916.50
(3) 798.00
(4) 1,714. 50
(5) 1. 44
(6) 3

(1) 450,564
(2) 258.56
(3) 58.00
(4) 316.75
(5) 1.45
(6) 4

(1) 993,293
(2) 624.75
(3) 179.00
(4) 803.75
(5) 22.71
(6) 5

(1) 504,969
(2) 346.25
(3) 130.25
(4) 476.50
(5) -8.89
(6) 2

(1) 867,008
(2) 543.25
(3) 503.2
(4) 1046. 50
(5) -42. 12
(6) 1

(1) Population

(2) Number of pri-
mary direct
patient care
physicians

(3) Number of other
specialty phy-
sicians

(4) Number of total
physicians

(5) Resource gap
score for total
physicians

(6) Rank of HSA's
by resource
gap score

MAP 12

HSA's WITH UNMET NEED

Diagonally lined areas represent
HSA's having some degree of
unmet need.
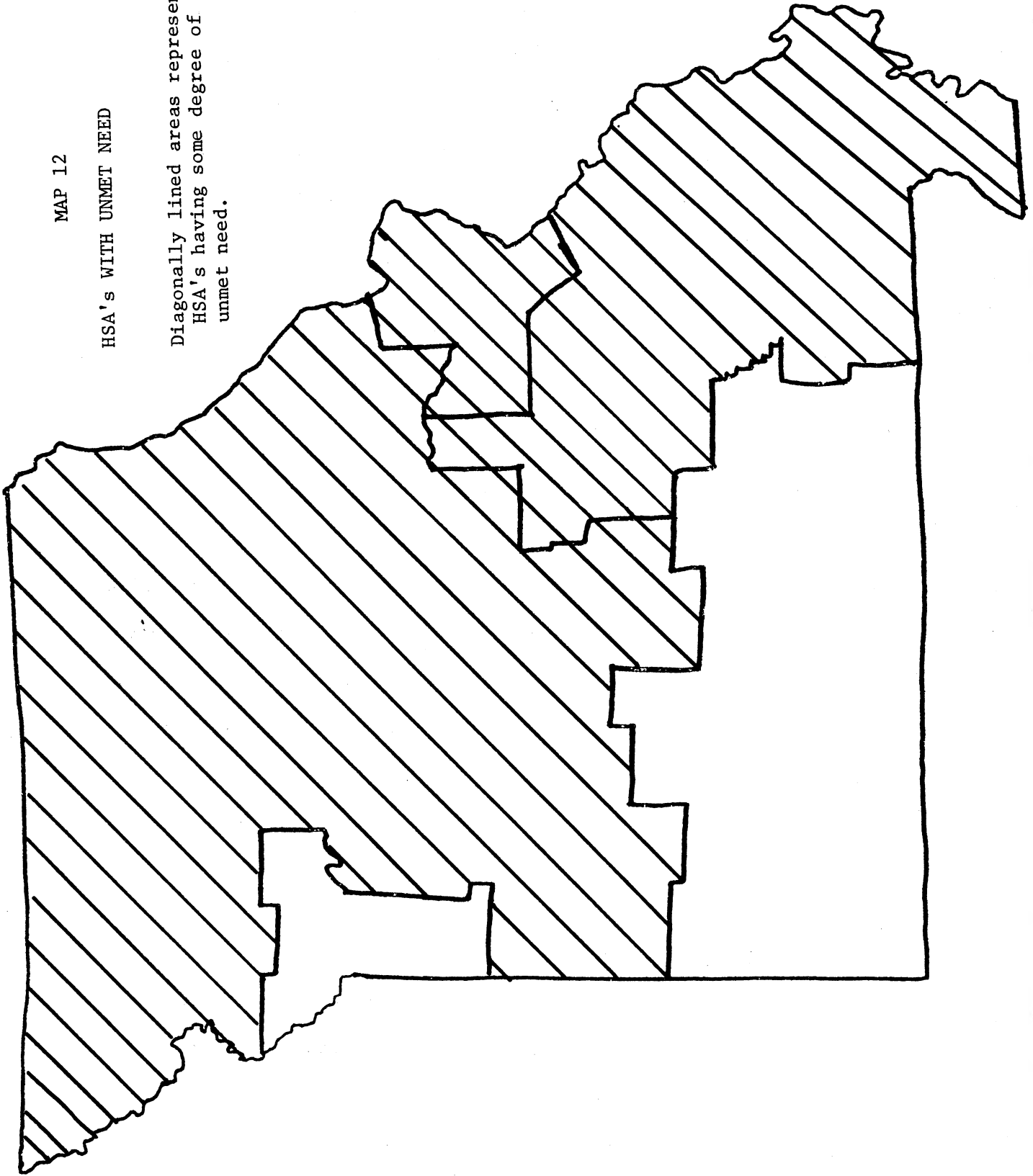
shows where the emphasis should be in any attempt to redistribute
health services. It is beyond the scope of this chapter to go into
ways and means of redistributing health resources, but the results
show where attempts need to be made to increase services provided.

Again, emphasis is given to the fact that relative positions
are utilized in this analysis. Based on this method, the Northern
HSA is the worst shortage area in comparison with the other HSA's.
This is not to suggest that the health status of the population in
the other HSA's could not be improved by increasing the amount of
physician services provided. It does, however, enable us to say
that given our limited resources the Northern HSA needs more attention
than the other HSA's in Missouri.

Summary

Establishing a policy for planning for the delivery of health
care services throughout Missouri involves building a framework within
which these HSA planners uniformly acquire an understanding of their
HSA's health needs and the programmatic needs of the entire health
system. This dissertation provides a basis for informed policy
planning. The issues set forth here constitute a forum within which
this State or any other defined region may initiate policies for
providing health care services.

The method presented here may be used by officials as a
point of departure in discussing, revising, and reaching a consensus
on the adequacy of their health care system. Planners can be guided
in performing their functions in systematic manner by planning prin-
ciples such as this Resource Gap Allocation Model.

This model is developed in such a manner that it can be easily adapted to meet the needs of the local planner. The flexibility of this model presents a standard method of analysis without the rigidity of forcing inappropriate factors on local planners. This allows metropolitan planners and nonmetropolitan planners to each incorporate relevant variables without destroying the uniformity of the basis for analysis.

Demographic data were included because a knowledge of the population base and its comparison is necessary for determining the demand for physician services. Different age/sex groups require certain types of services in differing amounts.

Socioeconomic data indicating income levels and major sources of employment were included since they provide insight into the population's ability to pay and, in turn, demand for health services and they have an impact on the type of health programs developed.

Health status data not only imply the type and amount of services needed by the population, but also tend to measure the relative efficiency of current health services being provided to the population. If the county has a poor health status, then the population 'needs' more health services. However, if they have an adequate number of health resources, then they are utilized relatively inefficiently. The health status of the county needs to be adjusted by an age factor before decisive statements can be made regarding the health status of the population.

The current amount of health resources available in a region along with a crude measure of their productivity and the current

average demand for those services were included to provide a measure

of the amount of unmet 'need' in a region. Before analyses of

current or future needs are possible, the resources presently avail-

able need to be known. The current utilization and productivity are

also necessary components of any valid analyses of the health needs

of an area.

The utilization of the multivariables Resource Gap

Allocation Model provides a means for determining a relative measure

of need within the State. The goal here is a means of comparing

areas, not a method for determining absolute need. This relative

position can be used as a basis for planning for the improvement

of health care in the State. The model is flexible enough to allow

changes in the health delivery system to occur without destroying

the basic model.

A crude measure of their productivity is utilized in deter-

mining services provided by physicians. This differentiates between

physicians by specialty and by age. The rationale for this differ-

entiation is that, for example, general practitioners are capable

of seeing more patients per hour than are general surgeons. (This

assumption has been verified by a study conducted by the AMA.)[1]

This method, however, still has a serious limitation. It

ignores such underlying factors in the future demand for physicians

services as the rising educational attainments of the population,

increased knowledge about personal health, rising income, the

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[1]American Medical Association, Profiles, 1974, p. 95.

increased move towards urbanization, the increased extension of
prepayment and third party payment programs, and the advances being
made in medical science. These factors can, however, be incorporated
without major modification in the model given future projections of
their occurrence.

The model can also be adapted easily to show results given
projections for the number of hours physicians will work per week
and the number of weeks they will work per year. Changes in produc-
tivity due to organizational changes, such as the expansion of group
practice, and/or the substitution of paramedical personnel in the
performance of the more routine tasks, can also be adapted within
the framework of this model with very little difficulty.

The method presented in this dissertation is currently being
used by the Office of Health Manpower Planning in Jefferson City,
Missouri, in the analyses of the need for physicians in Missouri.
Recently, the staff received a letter from the Health Services Research
and Training Program, Purdue University, concerning a report which
utilized this methodology. The letter expressed the following:

> ". . . After collecting and reviewing over
> sixty special studies from various agencies (i.e.,
> CHP's, EHSDS, RMP's, etc.) from across the United
> States, it was out opinion that of the studies on
> health manpower needs, the study conducted by your
> agency was clearly superior. Our methodologists
> were particularly impressed. . ."[1]

---

[1] Anthony Oreglia, Technical Director, letter.

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The undersigned, appointed by the Dean of the Graduate Faculty, have

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SELECTED APPLICATIONS

presented by   Lanis L. Hicks

a candidate for the degree of Doctor of Philosophy

and hereby certify that in their opinion it is worthy of acceptance.

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