North Carolina's HMO Provider Networks: A Comparison Between HMO Providers and All Physicians in the State

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The relative strengths of fee-for-service versus managed care are discussed. Trends occurring in health management organizations (HMO) enrollment for the United States and North Carolina are presented. The spatial distributions of North Carolina physicians associated with HMOs and all North Carolina physicians are compared using data aggregated from directories of HMO plans and from the North Carolina Board of Medical Examiners. Physician distributions were compared for regional concentrations (mountain, piedmont, and coastal) and undesirable locations. No dramatic differences were found to exist between the distributions of HMO and all physicians. This means that physicians, regardless of HMO status, were more apt to be located in urban and affluent areas. The bottom line, therefore, is that the geography of physicians remains largely unchanged with the rise of HMOs in North Carolina.

Introduction

For most of the twentieth century, hospitals were at the vanguard of patient care, and the health care universe revolved around them (Robinson 1996); hospitals had little competition, and little incentive to control costs. The introduction of health management organizations (HMOs) in recent years has dampened spiraling costs through lower overhead expenses and a case management approach to patient care. The result of these cost-cutting measures has been a shift of primary care doctors (i.e., general and family practitioners) to the center of the health care system, and the relative displacement of hospitals. The increasing importance of managed care has changed the contemporary health care landscape, such that it is no longer sufficient to simply have a physician nearby. Now the issue is whether the nearest physician is a participating provider in a person's health plan. If provider networks are not adequate, which populations are thought to have the least geographic accessibility to providers? This is an important and timely question as some recent studies have suggested that managed care might not be a viable option for rural, high unemployment, and minority populations (Fuchs 1994; Gaskin 1997; Mark and Mueller 1996; Harvard Law Review 1995; Ricketts et al. 1995).

Critics of HMOs charge that the desire to control costs could cause managed care plans to be reluctant to serve unprofitable populations and areas where costs exceed certain thresholds. For example, some rural populations have relatively high rates of chronic illnesses (Schneider and Greenberg 1992), and minorities have a higher incidence of diabetes and stroke (Gaskin 1997). Unfortunately, the same characteristics that label populations as unprofitable likewise indicate the existence of populations with tremendous health care needs. Supporters of HMOs, however, argue that if certain populations are not part of a managed care program, it is a factor of the immaturity of the markets. In the early stages of an HMO's development there is a greater emphasis on holding costs down. However, as the market matures an HMO can develop new product lines, and presumably reach patients who had been previously missed (Jennings et

al. 1997). Indeed, recent research may bear that out, as most rural counties are now in multiple HMO service areas (Lomicka 1997; Moscovice et al. 1998). However, even if rural areas are part of the service areas of HMOs that does not necessarily mean there are HMO physicians available to rural populations (Ricketts et al. 1995). Regardless of the root causes, neglected populations experience decreased availability (number) of network resources; less geographic accessibility (distribution); more cost and time to overcome space (distance), less access to routine or preventative care services, and, because of the latter problem, more serious medical conditions and therefore higher costs.

Our investigation addresses two of these issues - availability and accessibility. The purpose is to determine whether locational differences exist between all physicians and the subset of physicians networked within HMOs. Specifically, are these two sets of physicians located more or less in economically depressed, rural, and minority areas; in other words, areas that are unprofitable and therefore undesirable?

Medical Geography Perspective

An important aspect of medical geography is an analysis of the role location has on health. However, it is a challenge to discover what constitutes the geography of managed care. If managed care can be thought of as having three components, the plan, the provider, and the member, only one of these, the provider, has perhaps a clear geography. The HMO plan itself can be identified based upon its service area, which is almost always at the county level. This is a fairly coarse level of analysis for research at all but the regional and national scales. This coarseness means that at the state level most analysis of a plan's service area will be done with fairly broad strokes. With regard to HMO members there are two geographies at work: one is the member's work place, which is where he or she usually enrolls in an HMO; the other is the member's home. In North Carolina, as in most other states, enrollment numbers are collected according to the member's home county, and no information is collected with regard to where the member signed up for the plan. Since, in most instances, enrollment at the workplace is the driving force behind any new growth in HMOs, research focusing on the member's home county is missing an important part of the picture. Physicians in an HMO provider network, on the other hand, have a distinct geography, rooted in the location of their practices. While there is no readily available source of patient encounter data for HMO networks, physician's locations offer an opportunity to collect information on the managed care system below the county level.

Of course, physician location and health care delivery studies are a component of the medical geography specialty, and while it is not possible to list all relevant studies, there are several in this vein that have a bearing on this research and merit explicit mention.

Gary Shannon and Alan Dever's work, *Health Care Delivery* (1974) provides a valuable overview of factors behind physician location. Although the health care system has experienced significant changes since the original publication of this work a quarter century ago, the fundamental concepts still have relevance. Specifically, they note three factors that have a large influence on the locational decisions physician make. These factors are:

(1) Whether a location is stable economically;

(2) The presence of adequate medical facilities;

(3) The area of most recent training contact (Shannon and Dever 1974).

The work of Shannon and Dever has informed much of the scholarship behind the geography of physician location and many have used it as a foundation from which to build additional studies. One such example is the notion of push/pull factors in physician location as presented by Rena Gordon, Joel Meister and Robert Hughes (Gordon, Meister and Hughes 1992). They contend that there are factors that help pull physicians to a certain location or push them away from others. Push and pull factors are frequently used in migration studies, but the concept has bearing with regard to physician locations. According to the authors, the pull factor is the dominant force. An excess supply of physicians in one area is not enough to push a physician out of a location; instead, physicians locate because of pull factors. While managed care is not specifically mentioned, there might be merit in thinking of provider network development within a framework

of push/pull factors. In other words, managed care companies cannot be pushed into the creation of provider networks in undesirable areas, they must be pulled there by the potential for profits from increased market potential.

Perhaps the earliest geographical analysis of HMOs was published in 1983 (Cromley and Shannon, 1983). This study presents a valuable picture of HMOs ten years after the federal HMO Act of 1973 that sparked the development of HMOs in the U.S. The authors found that, nationally, service areas of HMOs were concentrated in areas where medical resources were already in place. This tends to support the notion that undesirable areas might not experience the same HMO penetration since these areas typically do not have many resources already in place.

The background section of this study compares the basic features of fee-for-service (FFS), where insurance and the provision of services are separate entities, and managed care, where insurance and the provision of services are integrated. Particular emphasis is given to describing U.S. and North Carolina growth trends in health management organizations (HMOs), the dominant form of managed care. The methods section describes the development and enhancement of HMO and Board of Medical Examiners (BME) physician databases for North Carolina. The results section incorporates tables and maps to present our findings on physician locations. Specifically, place characteristics (i.e., undesirable areas) are compared for the locations of all physicians (BME) and networked physicians (HMO). The discussion outlines possible explanations for the observed patterns, considers study limitations, and suggests some further studies.

Background

Managed care is considered to be an alternative to the "traditional" approach to health care in the U.S., known as fee-for-service (FFS) plans. In FFS a patient receives care and treatment from a doctor or hospital of choice; the provider then submits an invoice to an insurance carrier. After the patient meets a deductible, the carrier typically covers 80% to 100% of the bill. This approach offers the patient freedom in the choice of physician, hospital, and treatment; however, it provides little incentive to control costs.

"Managed care" describes health plans that attempt to control the cost, volume, and quality of care through the coordination of patient services (Morales-Burke 1996; Gray 1991). Providers become accountable, through strict case management measures, for a financial "bottom line." Primary care physicians function as "gatekeepers" who control patient access to expensive specialists and services. In 1995, 83% of physicians had at least one managed care contract (Simon et. al 1997). The most common type of plan is the health maintenance organization (HMO), but other types of managed care plan include preferred provider organizations (PPOs) and point of service (POS) plans. Our analysis focuses on HMOs as opposed to other managed care arrangements such as PPOs or POS plans. While these later varieties of managed care are increasingly important, HMOs are still the dominant form of managed care in North Carolina. Furthermore, HMOs must be licensed by the state of North Carolina (unlike PPOs or POS), and therefore the identity of HMOs in the state is known.

Under an HMO, the patient pays a fixed monthly cost and the plan provides all levels of care, from routine office visits to major surgery. To prevent the spiraling costs found in FFS plans, HMOs contract with physicians and facilities such as hospitals and clinics to provide care for its members for a negotiated fee, and patients are required to use that provider. This arrangement can benefit contracted physicians by providing a pool of patients as well as, in some cases, providing financial assistance for secretaries, building maintenance, and equipment purchases. In exchange, HMOs sometimes institute practice guidelines that physicians use to determine whether certain treatment options and specialist care are warranted for a patient.

There are three different approaches an HMO can take in the way it structures its relationship with providers. The first of these ways is the staff model, where the HMO employs the provider directly. Alternatively, the HMO can contract with multi-specialty medical group practices to provide health care services in what is known as the group model. The independent practice association (IPA) model is similar; however, under this arrangement the HMO contracts with community physicians and groups in private

practice. Most plans in North Carolina operate using this model, and of the three different types it could be the most likely to be influenced by a plan's attempts to avoid undesirable areas.

But there is more to the differences between FFS and managed care than just the mechanisms of payment. Managed care plans such as HMOs have brought about a fundamental shift in the American health care system. For most of the twentieth century, hospitals were at the center of an expensive health care system (Robinson 1996). HMOs and other managed care plans have rebelled against such high costs by favoring smaller, stand alone ambulatory care facilities. Such facilities have smaller overheads, as well as other advantages that allow them to operate on a much cheaper basis than comparable facilities run by hospitals. The result of these cost cutting measures is the shift of primary care doctors to the center of the health care system, and the displacement of hospitals. In a managed care plan, patients are treated first by their family doctor. Here every attempt is made to solve the problem within the primary care provider's office before going on to more expensive specialists.

From the patient's perspective the differences between the two approaches, FFS and HMO, may not be dramatic. If a patient's physician is part of an HMO network, then the patient may continue to see that doctor. In fact, participants in an HMO usually pay less in out of pocket expenses for routine office visits and prescriptions, sometimes as little as $5 to $10 a visit, with an additional nominal charge to fill a prescription. In addition, some HMOs pay for procedures traditional FFS plans would not cover such as vision care and routine preventative care. Critics point out, however, that patient dissatisfaction with HMOs comes in the less routine provision of care. The practice guidelines and case review procedures of HMOs can mean that for more serious illnesses or mental health therapy, the patient's choice of treatment or physician is limited or tightly controlled by the HMO. The differences could also be dramatic if an approved provider is not available nearby. It may then be a burden to reach an approved provider.

Perhaps the best analogy to assist in understanding the relative strengths and weaknesses between HMOs and FFS plans is presented by Dr. Patricia Roy (Roy 1992). For Dr. Roy, the difference between the two approaches is similar to the choice between taking the bus and owning a car. With a bus, one can get to one's destination cheaper, but the person is bound by the rules, schedule and route of the transit company. This means that he or she may have to wait before departure, may be forced to take a more circuitous route or even be forced to walk part of the trip, if their destination is not located exactly at a bus stop. Like the bus passenger, forced to follow others' rules, HMO enrollees must sometimes wait longer to see a specialist or pay out of pocket if they wish to visit a physician outside the network or receive a treatment not deemed "appropriate" by the HMO.

Owning a car, according to Roy, is much like the FFS plan. Car owners have the flexibility of leaving when they want, and going straight to their destination on their own schedule. The drawback to owning a car is that it is considerably more expensive than relying on the bus. A car owner has maintenance, insurance, as well as monthly car payments. For those covered by FFS plans, their health care is somewhat more flexible, they have the freedom of seeing nearly any physician they wish, and their plan will likely cover the cost. Such service comes at a premium, however. Routine maintenance such as physician office visits, and prescriptions are often the responsibility of the patient.

Although each approach has its advantages and disadvantages, HMOs have generally been credited with slowing the enormous growth in the cost of health care in the United States, while FFS is blamed for causing the increase in costs. (Zelman 1996). The desire to control costs prompted congress to write the HMO Act in 1973 (Fox 1996; Zelman 1996). This law provided federal assistance in the development of HMOs, including a provision that encompassed rural and underserved areas, and mandated that large employers offer HMOs to their employees, if such plans were available. Once HMOs were created, nationwide enrollment in the plans was slow through the rest of the 1970s. There were great geographic variations, with the Western region experiencing the highest enrollment and the Southeast the lowest (Figure 1). As costs associated with FFS plans continued to climb throughout the 1980s, HMOs became increasingly popular. Nationwide enrollment

in 1981 was 10 million; by 1987 it had grown to 30 million. During this period, growth continued strong in the West, the Northeast saw large gains, and the South still lagged behind (Interstudy 1991). In the 1990s HMOs have become even more popular. Estimates for 1997 HMO enrollment is 52.5 million, or about one fifth of the total population of the United States (Department of Health and Human Services 1997).

Compared to other parts of the U.S., managed care is a relatively recent phenomenon in North Carolina. The state licensed its first HMO in 1981, when Blue Cross/Blue Shield of North Carolina was approved. Starting in 1994, the number of operating HMOs in North Carolina began to grow dramatically (Figure 2). Between 1994 and 1997 HMOs grew from 10 to 24 plans with enrollments almost tripling from over one-half million to almost one and one-half million or approximately 20% of the state's population (North Carolina Department of Insurance 1998). However, this growth was not uniform with respect to rural and urban representation. The vast majority (84%) of the growth occurred in the state's urban areas, especially in Charlotte, Raleigh/Durham, and Winston-Salem/Greensboro; the non-metropolitan areas had the remaining 16% (North Carolina Department of Insurance 1998).

In a free market system such as ours, the profitability of a health care provider or health insurance plan is important. Critics, however, are concerned whether cost reductions will be achieved at the expense of the health of people in undesirable (i.e. unprofitable) locations (Fuchs 1994). If managed care plans are striving to reduce costs, they would be expected to avoid areas with exceptionally high costs (i.e., areas with low income and minority patients). Indeed, some HMOs use what are known as practice profiles to assess the practice patterns of physicians and help assess the types of patient seen by a physician (Kassirer 1994).

Methods

Concerns about the spatial distribution of provider networks of HMOs provide the basis for

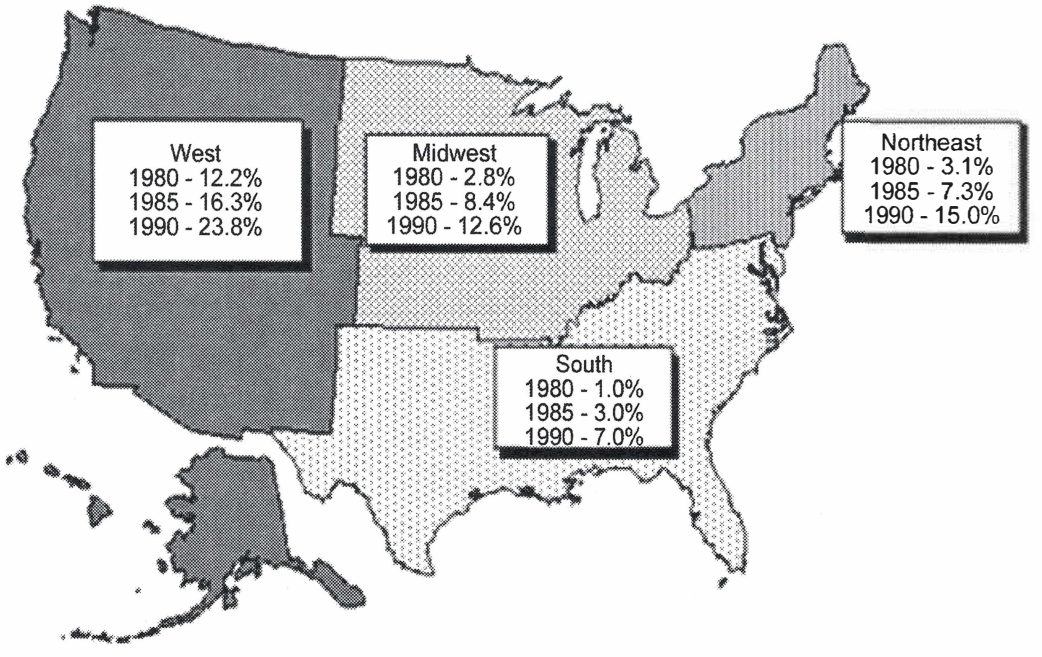

Figure 1. Percent of Population Enrolled in HMOs by Census Region 1980-1990 (Interstudy, 1991)

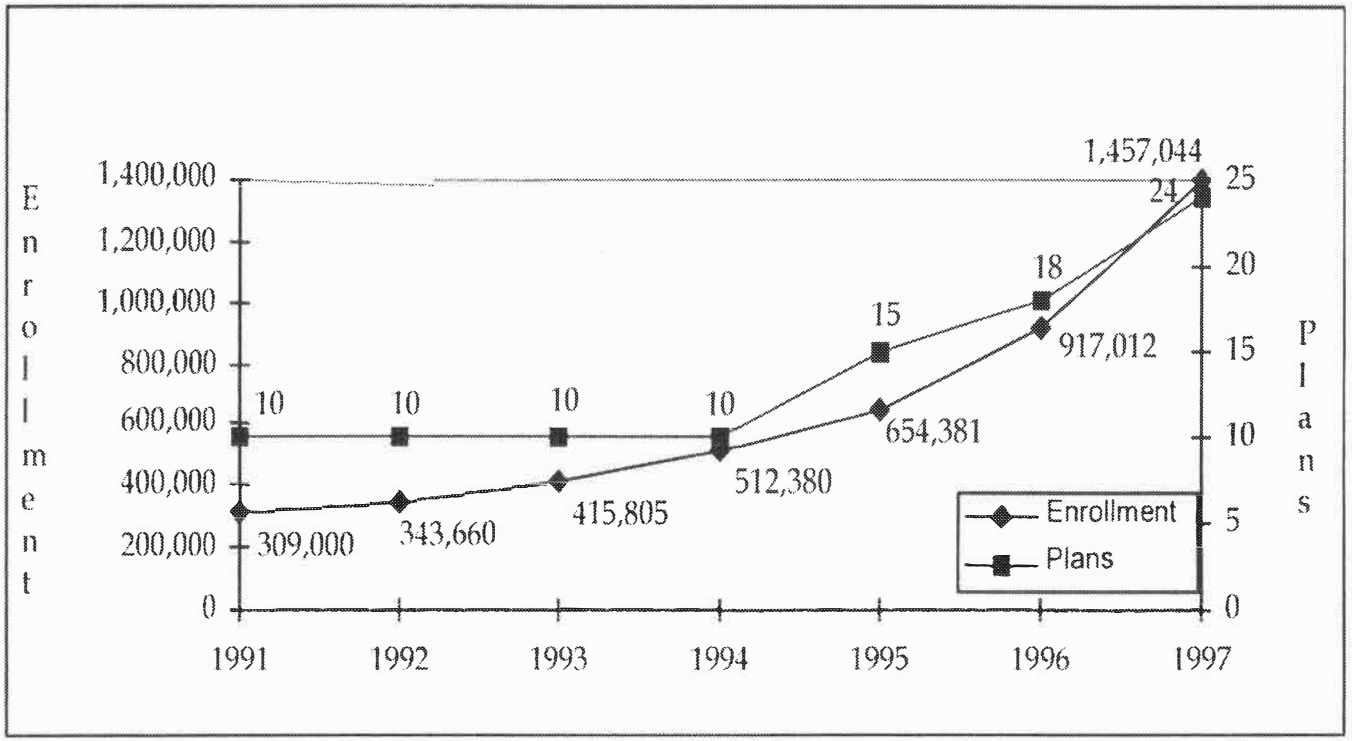

Figure 2. Growth in HMO enrollment and number of plans in North Carolina, 1991-1997 (North Carolina Department of Insurance 1998).

Table 1. Summary Tape File 3-B from the 1990 U.S. Census.

	Undesirability Trait Census Variable(s)
Rurality	Urban population
	Employment in industry classified as agriculture, forestry, and fisheries
Poverty	Persons with income 0.50 to 0.99 of poverty level
Education	Persons age 25 and over: Maximum educational attainment high school or equivalent
Race	Persons of Hispanic Origin
	Race, Non-white: Black, Amer. Indian, Eskimo, or Aleut, Asian or Pacific Islander, Other
Employment	Males 16+ in labor force: unemployed
	Females 16+ in labor force: unemployed
	Persons 16+ in labor force: unemployed

this research. The goal is to compare the locational patterns of HMO physicians to all physicians (BME). The specific research question is: "Are physicians in HMO provider networks located in areas with a lower degree of perceived undesirability compared to all physicians?" The measures of undesirability include one or more Census variables for rurality, poverty, education, race, and employment (Table 1). Percentages based on populations of ZIP Codes were calculated for each variable. Additionally, quartiles at the state level were determined; these quartiles provided a standard for regional comparisons.

Comparison characteristics will reflect what we will call *undesirableness* for brevity's sake, but simply reflect the presence of minority, rural, or impoverished (i.e., unemployed) populations or other traits that are suspected of not being a part of managed care plans. Though there are a considerable number of criteria that could be used to measure undesirability, we have chosen to use nine measures from the 1990 Census that reflect an area's poverty, its minority population, the rurality of the region, and the area's unemployment. This is important since many of the measures of undesirability will be associated with rurality. From the managed care company's perspective there are many perceptions about the patient populations mentioned above, and these perceptions could lead an HMO to feel these are undesirable groups for a managed care plan to target. This could, of course, be said for all providers in general.

This study compares two physician databases, an HMO database amalgamated from seven HMO directories, with the North Carolina Board of Medical Examiners (BME) physician licensure data. The BME is the licensing agency for all physicians working in North Carolina. The census variables (Table 1) were linked to physician records in both the HMO and BME databases. Zip Codes were selected as the geographic unit of analysis and these were aggregated into the mountain, piedmont, and coastal plain physiographic regions of North Carolina (Figure 3). These physiographic regions possess variations with respect to numerous socio-economic characteristics including patterns of health care services and therefore merit comparative analysis. For example, Asheville provides a large percentage of the tertiary health care services for most of the rural counties of western North Carolina (Albert 1994a, 1994b).

Directories from seven health plans, a mix of large and small, were used to create an HMO database

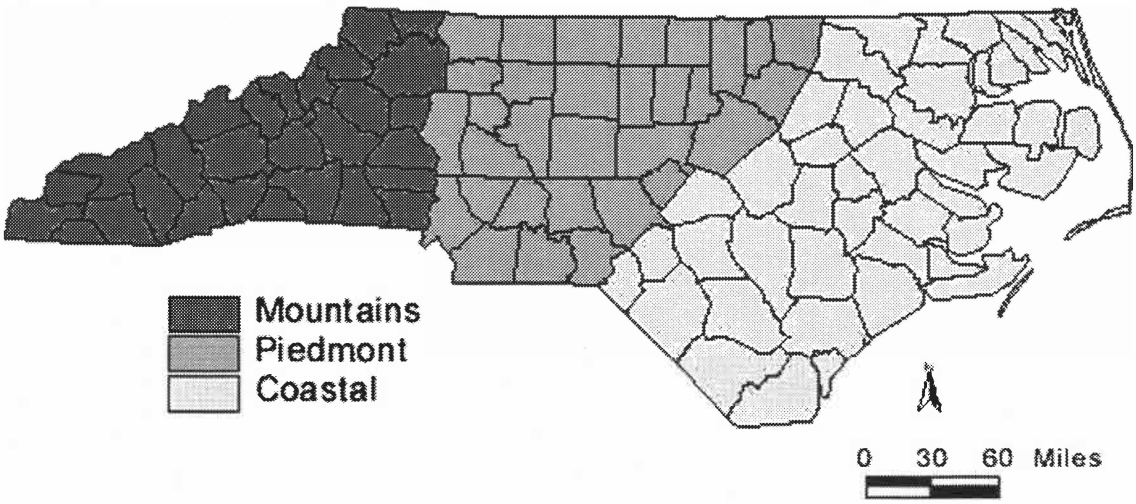

Figure 3. North Carolina physiographic regions.

Table 2. List of study HMOs, membership, enrollment ranking and share of total North Carolina Enrollment. Membership is as of 12/31/96 for commercially insured enrollment (North Carolina Department of Insurance 1998).

HMO	Rank	Membership	Share of NC Enrollment
Blue Cross Blue Shield	1	222,870	23.7%
Healthsource	2	194,302	20.7%
Partners Health Plan	4	125,397	13.3%
Prudential HMO	6	63,209	6.7%
Principal HMO	10	9,620	1.0%
Doctors Health Plan	11	8,564	0.9%
Personal Care Plan	14	5,606	0.6%
Total		**629,568**	**67.0%**

of 16,260 records with name, city, ZIP Code, physician specialty, and health plan fields. These seven HMOs accounted for a 67% share of North Carolina's HMO enrollment for 1996 (Table 2). It was necessary to match the HMO database to the BME database to determine the primary location of physicians (as opposed to their secondary and tertiary locations), because the BME includes a field of physicians' primary location, whereas the HMO database has multiple listings of physicians but does not confirm their primary location. As a result, 8,861 of the 16,260 HMO records could not be matched. After subtracting another 995 duplicate records, 6,404 HMO records remained. Therefore, the elimination of duplicate names (i.e., physicians who listed multiple locations and were associated with multiple plans) reduced the percentage matched to around forty percent (6,404/16,260). This moderate match rate was attributed to typographical errors and other variations in the name fields within and between the HMO and BME databases. The final record counts for BME and HMO physicians were further reduced because of a temporal mismatch between the Census and the BME database (1996). Because the Census file originated in 1990 and the BME database contained 1996 locations, 5,671 physicians were in ZIP Codes created after the 1990 Census, leaving 8,910 records in the BME database. There were 910 physicians from the HMO database in these new ZIP Codes; therefore, the final physician count for the HMO database was 5,494. These Census enhanced HMO and BME databases were used to generate descriptive statistics for the undesirability measures.

Results

Nine census variables were sorted and grouped into quartiles and used to measure "undesirableness" within the state's ZIP Codes. The upper limits of these quartiles (Q1, Q2, Q3,and Q4) are shown in Table 3. For example, the upper limits for percent urban are Q1=0.0%, Q2=0.0%, Q3=45.3%, and Q4=100%. Quartiles separate the rural (Q1 and Q2) from the urbanized (or more urbanized) ZIP Codes (Q3 and 4). Therefore, since the other measures of undesirableness covary, either positively or negatively, with rurality, quartiles provide one approach to comparing BME and HMO physicians with the selected measures. However, the authors recognize that because physician distributions are very skewed toward urban centers, other data classifications might have been appropriate. Respective quartile limits for each Census variable were then used as a basis for comparing the percent BME and HMO physicians statewide and regionally (mountain, piedmont, and coast).

The rurality of a location is expected to have a detrimental effect on the potential for managed care, and the results do bear out that most HMO physicians locate in areas with a higher urban percentage (Table 4). However, their tendency to do so is no greater than the general physician population. The mean percent urban for the HMO Physician ZIP Codes was 70.2%, which is remarkably close to the 69.2% mean for the BME physicians (Table 4). Both BME and HMO physicians are locating in the most urban ZIP Codes. The data show that for both groups, approximately three-quarters of their physicians are located in urban areas, that is in the highest quartile (greater than 45.3% urban)(Table 4). In fact, at the statewide scale only 6.5% of physicians in the BME database and 5.5% of HMO physicians are in rural areas (ZIP Codes with 0% urban population). It should be noted, however, that for percent urban, the first and second quartiles are both comprised of ZIP Codes with 0% urban population. The third quartile represents those ZIP Codes whose percent urban population is between 0 and 45.3% (Table 4). This quartile contains 18.9% of the BME physicians and 19.4% of the HMO physicians at the state level (Table 4). So, as expected, the pattern of HMO physician locations is similar to the pattern of urban areas. The areas around the state's MSA's (especially the Triangle, Triad and Charlotte MSAs in the piedmont) have the highest concentrations of physicians while the western mountains and the coastal plain have the lowest concentrations. This pattern mirrors the distribution of BME physicians. Therefore, no obvious geographic urban/rural disparities between HMO and BME physician locations exist at the state level.

	Urban	AAF	Educational Attainment	Total Unemployment	Female Unemployment	Male Unemployment	Below Poverty	Non White	Hispanic
Q1	0.0	1.6	27.8	3.1	3.3	2.5	8.7	5.6	0.1
Q2	0.0	3.8	31.4	4.5	5.1	3.8	12.5	16.7	0.5
Q3	45.3	7.1	35.1	6.1	7.4	5.3	18.9	36.7	1.0
Q4	100.0	61.9	64.9	24.3	64.7	20.8	59.3	45.7	12.8

Figure 3. Quartile limits for the measures of undesirability.

When the numbers are considered at a regional, instead of statewide scale, only the relative availability of both BME and HMO physicians in rural areas changes. In the mountains and the coastal plain a greater percentage of physicians are located in the most rural ZIP Codes, in contrast to the piedmont. However, the differences between the HMO physicians and the BME physicians are relatively minor for all three regions. The greatest differences between these two groups is found in the mountain region's most urban quartiles. Here 54% of all HMO physicians are in those ZIP Codes with a percent urban population greater than 45.3% (Table 4). This is 4% larger than the 50.4% value found among BME physicians. A possible explanation for the higher percent of HMO physicians in the mountain region is the well developed and concentrated health care sector centered on the City of Asheville, in Buncombe County. Asheville is an urban enclave providing tertiary (high level care) health services for fifteen to twenty rural counties in western North Carolina. In completely rural ZIP Codes, the analysis shows 9.8% of HMO physicians, 2.7% less than BME physicians (Table 4). These differences are relatively small, however, and do not demonstrate a significant avoidance of rural areas by HMO providers.

Because of the slight differences between BME and HMO physicians across the other eight Census variables, separate descriptions for each variable are not warranted; however, some of the more noticeable differences are reviewed here. No quartile in any region had a difference greater than +/-6% for the two provider types (Table 5). Of the seven regional quartiles with at least a +/- 4% difference between BME and HMO physicians, five were in the mountain and two were in the coast regions. The mountain region had two quartiles with higher and three quartiles with lower HMO presence. The two quartiles with higher percents of HMO physicians were quartile 1 (lowest) for population below poverty (+6%) and quartile 4 (highest) for urban (+4%). This makes sense because these two quartiles represent optimum quartiles for these particular Census variables. The three quartiles with lower percentages of HMO physicians were quartile 2 for population below poverty (-5.2%), quartile 3 for total unemployment (-4.7%), and quartile

Table 4. Percentages of physicians within quartiles by region. Note that since the first two quartiles are 0%, no value appears for the second quartile.

Percent Urban (Quartile Limits)		Statewide		Mountain		Piedmont		Coast	
		BME	HMO	BME	HMO	BME	HMO	BME	HMO
Quartile 1	0.0%	6.5%	5.5%	12.5%	9.8%	2.6%	2.6%	11.7%	10.0%
Quartile 2	0.0%	--	--	--	--	--	--	--	--
Quartile 3	45.3%	18.9%	19.4%	37.1%	35.8%	15.4%	16.9%	12.8%	12.8%
Quartile 4	100%	74.6%	75.1%	50.4%	54.4%	82.0%	80.5%	75.5%	77.1%

Table 5. Measures where the difference between BME and HMO physicians in the quartile is four percent or greater.

Measure	Quartile	BME Percent	HMO Percent	Difference for HMO	Region
Population below Poverty	1	31.8%	37.1%	+6%	Mountain
Population below Poverty	2	24.7%	19.5%	-5.2%	Mountain
Hispanic Origin	3	44.3%	49.3%	+5%	Coast
Total Unemployment	3	30.0%	25.3%	-4.7%	Mountain
Female Unemployment	3	23.4%	19.3%	-4.1%	Mountain
Hispanic Origin	4	30.7%	26.6%	-4.1%	Coast
Urban	4	50.4%	54.4%	+4.0%	Mountain

4 for Hispanic (-4.1%). These all represent less than optimal quartiles for their respective variables and therefore suggest less than favorable ZIP Codes.

The remaining two quartiles with greater than +4% differences were in the coast region (Table 5). Here, within quartile 2 (0.5% Hispanic), a low percentage, there were more (+5%) HMO physicians than BME physicians. Whereas, in quartile 4 (12.8% Hispanic) of the same variable, there were less (–4.1%) HMO than BME physicians.

Overall the small differences in percent of HMO and BME physicians at the state and regional scales indicate that these distributions are in fact not different. There were some subtle differences regionally as noted above; however, these differences are inconsequential. With just seven quartiles between +/- 6% points and most other quartile differences considerably less, there does not appear to be any justification to state that such differences are substantial. Therefore we must conclude that HMO and BME physicians had similar locational patterns. The fear concerning the growth of managed care is its availability to provide care in undesirable areas, or areas that may not offer a sufficient potential for profit. When the database is analyzed to look at the potential undesirableness, the results indicate that physicians in HMO provider networks are *at least as available* as BME physicians. However, both groups display a tendency to avoid undesirable areas.

Discussion

The most striking finding from the analysis is the lack of any substantial difference between BME and HMO physicians with regard to measures of undesirableness. These results run counter to the fears discussed previously that HMOs would avoid such high cost populations and areas. Indeed HMOs seem quite willing to recruit physicians from undesirable areas - assuming physicians are available. In fact, many of the most rural, impoverished and undesirable areas, have no physicians. Therefore, HMOs don't have to actively avoid these areas, the health care system already has! The populations with the greatest undesirability and potential for high costs don't have access to a physician, are likely to be uninsured and exist outside the health care system. For instance, only 19.4% of all the state's physicians are in ZIP Codes in the fourth quartile (highest) for poverty, and just 6.5% are in completely rural ZIP Codes (Table 4). With such numbers, the options are limited for building a provider network. The result is that, even if an HMO

wanted a presence in a completely rural ZIP Code, most likely it could find no physicians to enroll.

This represents one of the flaws of managed care's mandate to serve rural areas, as presented in the 1973 HMO Act. The HMOs can claim, with some justification, that they are doing the best that they can with what they have to work with. Of course, as the prominence of HMOs in health care increases their role may change from one of adaptation to the extant physician distribution pattern to the ability of influencing it (Kane and Schoen 1996). The effect of such potential influence on future physician distributions is uncertain.

One explanation for the study's findings may be that the data were collected at a fairly mature stage in the development of HMO networks in North Carolina. If the data had been collected on a periodic basis (say every two years) since the inception of HMOs in the state and displayed on a series of maps, the maps might have shown initial penetration of relatively affluent urban markets and then diffusion to more rural populations. That is, HMOs might originally have been located in the most favorable areas and then "trickled down" into less favorable places.

Market forces may also play a role in the similarities between BME and HMO physicians. The HMO market in North Carolina is very competitive. At the time of the study, there were twenty active HMOs competing to provide health coverage to employers. A provider network that was as inclusive as possible and included physicians in a variety of locations would have the advantage over a plan with a limited provider network. In the future, HMOs may be required to provide the same level of care to a company's rural employees as to its urban employees as a condition of contracting with an employer (Feldman and Dowd 1993), thus reducing geographic disparities.

Limitations and Future Studies

The principal limitations of this research were: 1) overlap of HMO and BME physician databases 2) accounting for and appropriately weighting (hours and number of patient visits) for physicians' multiple practice locations and 3) scale issues and limitations of the ZIP Code. The authors recognize that there is a substantial overlap between the two physician databases; however, manually entering the provider lists from all 24 HMO plans was not feasible given our limited resources. Therefore the HMO database consists of just HMO physicians, whereas the BME database includes both HMO and nonHMO physicians. Our analysis is limited by this drawback.

Although the BME database includes hours per week in medicine for physicians' primary, secondary and tertiary locations, the data fields (columns) suffer from a large percentage of missing observations (Albert, 1997; Albert and Gesler 1996; 1997). Whereas the HMO database had information on physicians' multiple locations and multiple health plan associations, it lacked any information that would weight these practice locations according to number of hours or patients.

Since only physicians' primary locations were considered here, one might speculate on the contribution of physicians' secondary and tertiary locations. Previous studies of multiple locations found this phenomenon to contribute towards the dispersal of physicians (Cromley and Albertsen 1993). Some sixteen percent of North Carolina's physicians were traveling between at least two locations in 1992 (Albert 1995; Albert, Gesler, and Levergood 2000). Since some physicians have multiple locations on the urging of managed care organizations (Albert and Gesler 1998) there is some justification in assuming that the percentage of multiple locations has risen concomitantly along with managed care. Albert (1998) noted that a significant correlation existed between multiple locations, the dependent variable, with Health Professional Shortage Areas (HPSAs) (positive correlation), farm population (positive correlation) and Metropolitan Statistical Areas (MSAs) (negative correlation). This finding suggests that multiple-location physicians have a substantial effect on increasing access to "unfavorable" areas (Albert 1998). The accounting for these multiple-locations within our research frame would have provided a higher level of precision; however, data and time constraints rule out the inclusion of multiple locations in this, our initial endeavor into the realm of managed care.

ZIP Codes approximate economic trading areas and therefore, in general, conform to transportation

and communication patterns. However, the tenets of central place theory suggest that population (patient) thresholds and market areas would be smaller for the more common physician specialties and larger for the less common physician specialties. Therefore, for the lower order specialties such as general practice, family practice, pediatric, and internal medicine, one might assume a reasonable correspondence between these specialties' market area and ZIP Codes. However, for the higher order specialties such as neurology, radiology, and pathology, an appropriate assumption is that there is less correspondence between these specialties' market areas and ZIP Codes (Albert 1996; Albert and Gesler 1996). Therefore, some degree of spatial mismatch exists between specialty market areas and ZIP Codes. Without patient encounter data, it is impossible to accurately determine physicians' market areas or their patient characteristics; however, the ZIP Code level does provide a reasonable spatial scale to assess population characteristics of physicians' primary practice locations.

This research is, to our knowledge, the first attempt to examine geographic aspects of managed care in North Carolina. Our findings captured a historical moment in the development of HMO networks as the collection of physicians peaked. If North Carolina follows the same trend as other HMO markets, there will be a period of consolidation as unprofitable HMOs go out of business, and the more profitable HMOs eliminate unprofitable physicians. It is possible that avoidance of undesirable areas will become more evident once HMOs enter their next phase – cost cutting. Such a developing scenario necessitates ongoing research into the evolving dynamic of managed care. Future research might focus on examining other time periods (e.g., 1998, 2000, 2002) other plans (e.g., preferred provider organizations, point of service, independent practice association), large versus small plans, length of plan's existence, and physician characteristics (e.g., age, gender, and race).

Conclusion

We asked: "[A]re physicians in HMO provider networks located in areas with a lower degree of perceived undesirability compared to all physicians?" The answer is, no! HMO provider networks seem to be equally present in areas with an undesirable population characteristics as the general at large physician population. This appeared to be true at the state, regional, and ZIP Code levels. Except for slight differences for some measures in the mountain and coastal regions, overall HMO physicians were as consistently present in undesirable ZIP Codes as BME physicians. This means that physicians, regardless of HMO status, were more apt to be located in urban and affluent areas. The bottom line, therefore, is that the geography of physician distribution - to date - remains largely unchanged with the rise of HMOs in North Carolina.

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