

CHAPTER THREE

Variations in Hospitalizations for Medical Conditions

Variations in Hospitalizations for Medical Conditions

Medical science provides clear guidelines about the need to hospitalize patients with some conditions. For patients with these conditions, the need for specific kinds of care determines what will be done, and the use of medical resources is not influenced by either the physician's practice style or the per capita supply of hospital beds in the region. For example, patients with hip fractures are almost always hospitalized, because of the severity of their pain and the need for inpatient operative repair. Similarly, patients with newly diagnosed colorectal cancers are almost always hospitalized, because major bowel surgery is the universally accepted method of treating the disease.

But for many other conditions, medical science and theory are weak, and the rules of clinical practice are not nearly so clear cut. In the majority of cases of pneumonia, relapses of chronic pulmonary obstructive disease, or episodes of congestive heart failure, patients could be treated either in the hospital or in another setting (at home or in a nursing home, for example). When medical science is unclear, physicians must be guided by their subjective opinions about the effectiveness of admitting such patients to hospitals, rather than providing treatment in another setting. The variations among regions in admission rates of patients with these conditions can be ascribed to differences in clinical decision making, rather than to differences in underlying illness rates.

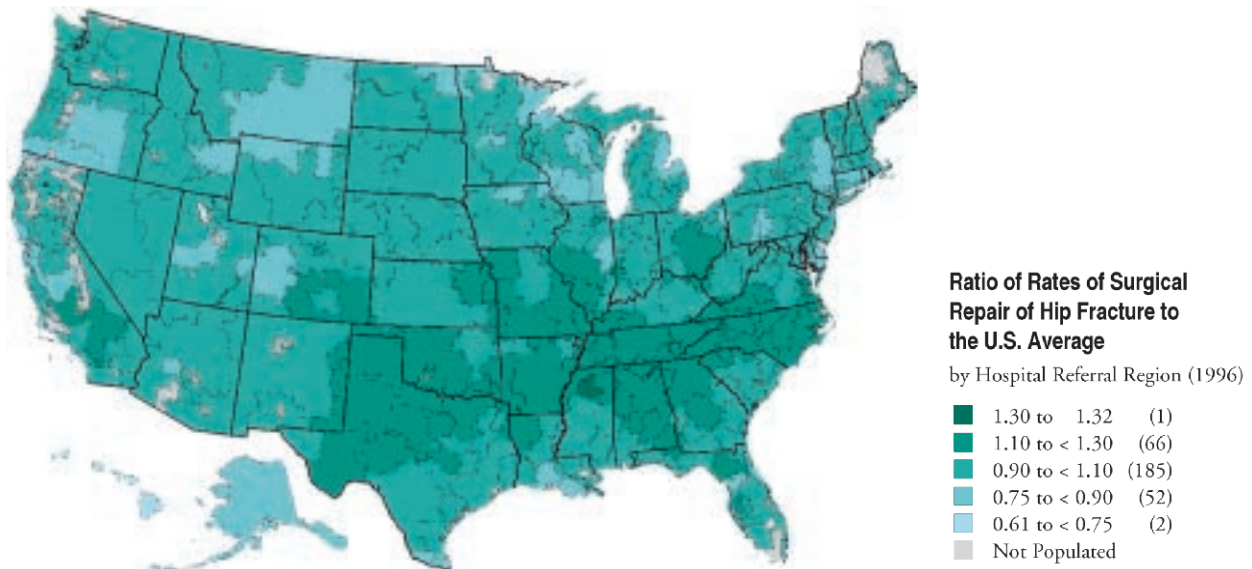
When science-based guidelines are weak, decisions to hospitalize are also influenced by a largely invisible factor: the capacity of the acute care hospital environment in which decisions are made. There is strong evidence that for the majority of conditions, decisions about hospitalization are dependent on physicians' practices, which are influenced by local hospital capacity (although physicians are not aware of the per capita bed supply). When decision making takes place under the assumption that more medical care is better, it is understandable that physicians will use available resources up to the point of their exhaustion. In other words, for sick patients whose care could be managed in either the hospital or the ambulatory setting, the availability of hospital beds leads to increased use of those beds. In conditions where

hospitalization is a judgment call, one of the considerations is the availability of hospital beds. The result is that variations in the rates of hospitalization are often driven by supply, rather than need.

The Patterns of Hospitalization for Treatment of Hip Fracture

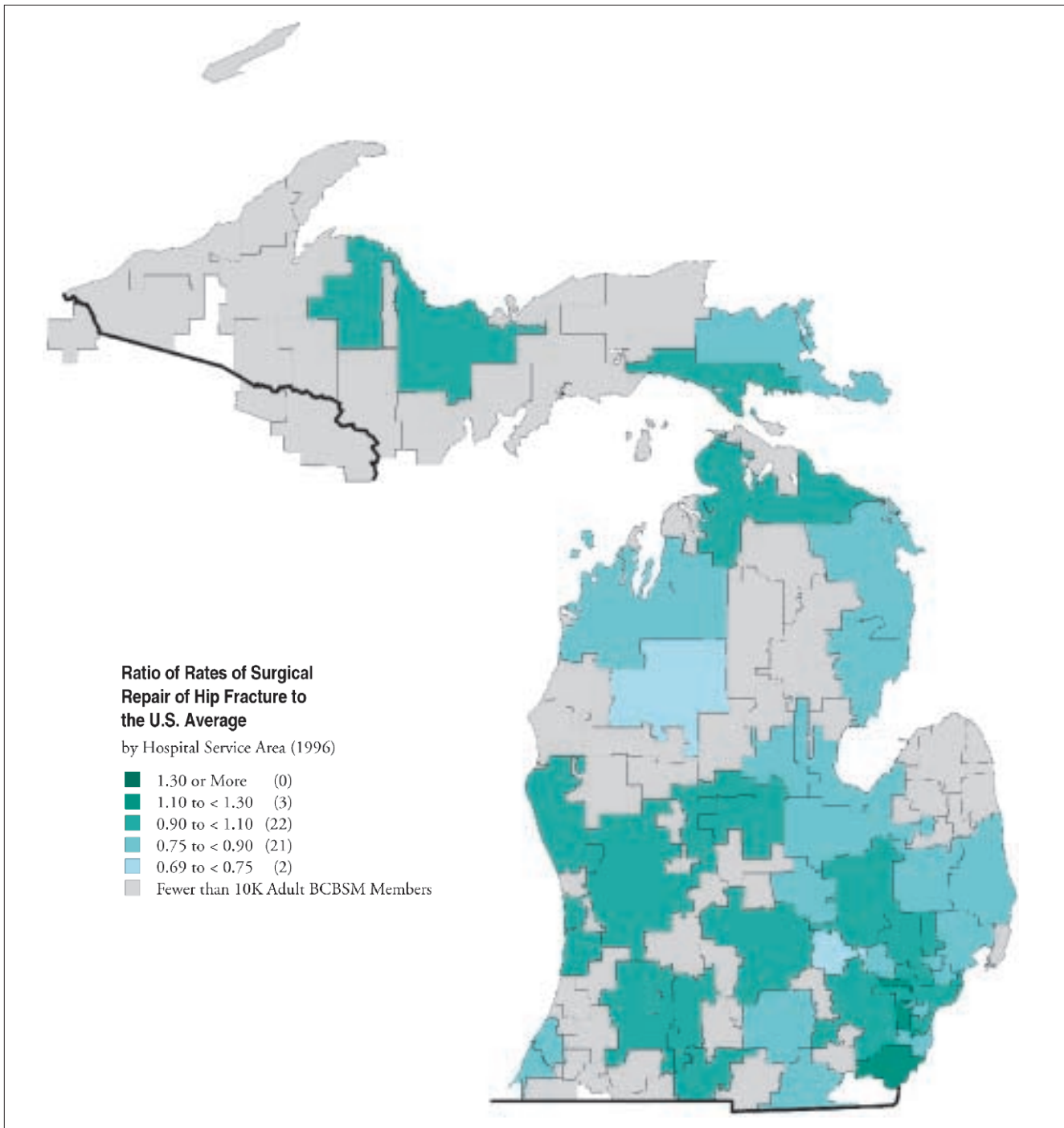
Rates of hospitalization for hip fracture reflect the actual incidence of disease for several reasons. First, people with hip fractures are virtually certain to seek care, because the condition is extremely painful, and the need for medical attention is easily recognized. Second, once the patient reaches medical care, it is virtually certain that the fracture will be diagnosed correctly. Third, it is virtually certain that the attending physician will admit the patient to a hospital bed, because there is unanimity within the medical profession about the necessity of hospitalization.

Differences in rates of hospitalizations, which closely reflect rates of underlying disease, appear to be related to environmental factors or other causes which result in higher than average rates of hip fracture in the mid-United States.



Map 3.1. Rates of Surgical Repair of Hip Fracture (1996)

There is little variation in rates of surgery to repair hip fractures among the nation's hospital referral regions. Only a few hospital referral regions had rates more than 30% higher than the national average, or more than 25% below the average.



Map 3.2. Hospitalization for Hip Fracture Among the 48 Largest Hospital Service Areas in Michigan (1996)

There is little variation in Medicare hospitalization rates for hip fractures among hospital service areas in Michigan. No hospital service areas had a rate more than 30% higher than the United States average; only two areas had rates at least 25% lower than the average.

Need, Not Hospital Capacity, Drives Hip Fracture Hospitalization Rates

In the early 1960s, Milton Roemer proposed that hospital beds, once built, would be used, no matter how many there are. But Roemer's law does not apply equally to all conditions. Hospital capacity has no influence on the rate of hospitalization for hip fractures; the decision to hospitalize is based on professional consensus. When all diagnosed cases are hospitalized, and the diagnosis itself is codified in an easily applied and highly specific set of rules, need drives hospitalization, independent of the available supply of hospital beds. In the case of hip fracture and a handful of other conditions, there would be a correlation between hospitalization rates and hospital beds per capita only if the number of hospital beds in a community had been determined by, among other things, the known population-based incidence rates of very low variation conditions such as colon cancer and hip fracture.

There is, in fact, little relationship between actual acute care hospital bed capacity and the incidence of colon cancer and hip fracture, in Michigan or elsewhere. Across the nation, there is little relationship between acute care hospital bed supply and rates of hospitalization for hip fracture. Within Michigan hospital service areas, there is also virtually no relationship (Figure 3. 2).

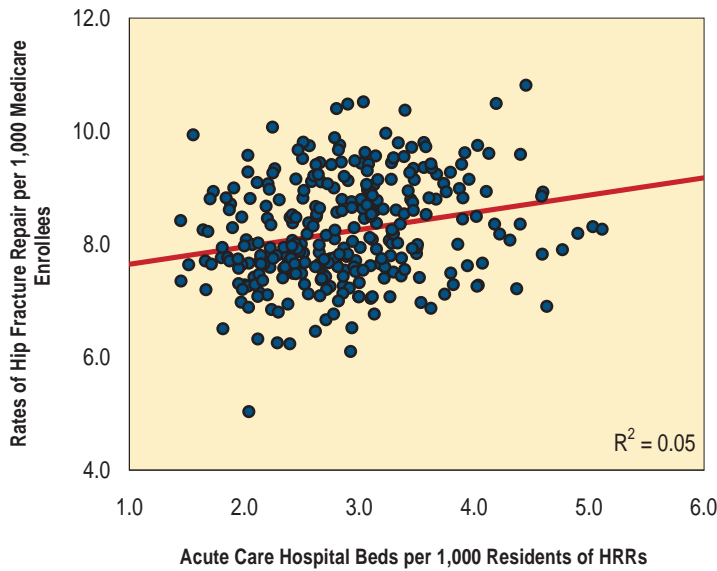


Figure 3.1. The Relationship Between the Supply of Acute Care Hospital Beds and Rates of Hospitalization for Hip Fracture (1996) Among Hospital Referral Regions in the United States

There was little relationship between regional supplies of acute care hospital beds and rates of surgery for the repair of hip fractures ($R^2 = .05$).

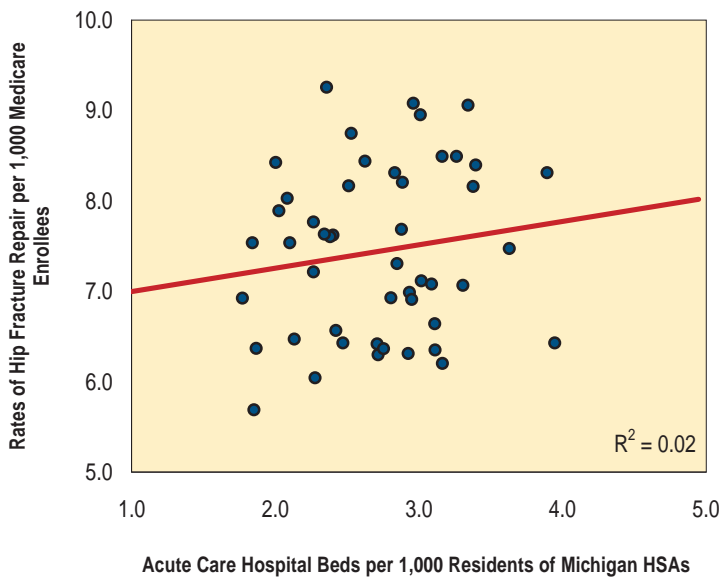


Figure 3.2. The Relationship Between the Supply of Acute Care Hospital Beds and Rates of Hospitalization for Hip Fracture Among the 48 Largest Hospital Service Areas in Michigan (1996)

There was little relationship between regional supplies of acute care hospital beds and rates of surgery for the repair of hip fractures ($R^2 = .02$). In the interest of statistical stability, only the 48 largest hospital service areas in Michigan are included in this analysis.

Variations in Discharges for Specific Medical Conditions

An important question is whether rates of admissions for repair of hip fractures, which are based on the rates of the conditions themselves, are the exception or the rule. Traditionally, small area analysis has approached this question by looking at the variations in Medicare hospitalization rates for specific medical conditions and comparing their patterns of variation to the patterns of hip fracture hospitalizations. More recently, these comparisons have been made on an illness-adjusted basis. There is substantially greater variation in hospitalization rates for medical conditions than in hospitalizations for hip fracture. For example, the degree of variation of the three most common causes of medical hospitalization (which, together, comprise more than 21% of Medicare medical hospitalizations) is substantially greater than for hip fracture (Figure 3.3).

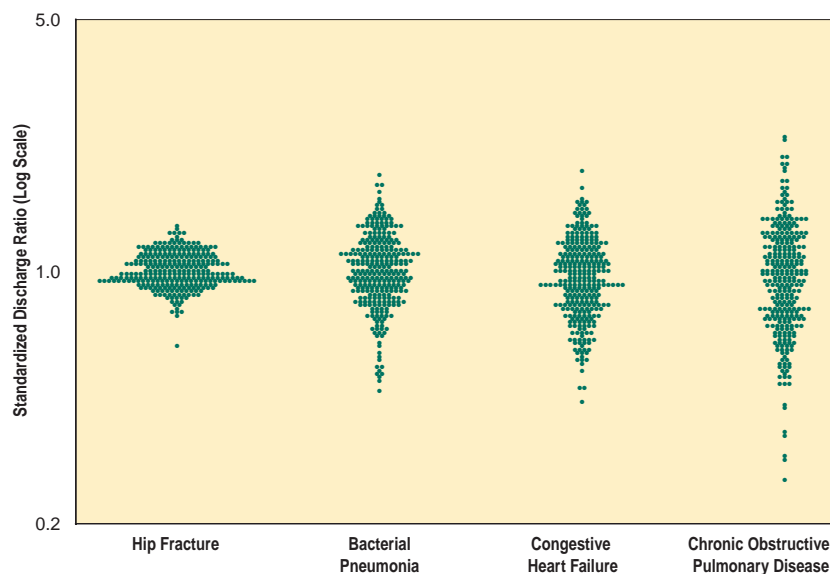


Figure 3.3. Profiles of Variations in Medicare Hospitalization Rates Among Hospital Referral Regions of Four Common Conditions (1996)

The figure gives the pattern of variation for medical hospitalizations among Medicare enrollees nationwide. Among hospital referral regions, there was little variation in rates of admissions for hip fracture; admissions for bacterial pneumonia, chronic pulmonary obstructive disease and congestive heart failure were much more variable.

There is a similar pattern in Michigan hospital service areas (Figure 3.4). Medicare hospitalizations for pneumonia, chronic obstructive pulmonary disease and congestive heart failure and hospitalization of adult members for chest pain and respiratory conditions are much more variable than hip fracture. For example, the coefficient of variation for admissions for adult respiratory conditions was more than three times that for hip fracture; the range of variation was 6.5, compared to 1.6 for hip

fracture; and the interquartile range was 1.7, compared to 1.3 for hip fracture (Table 3.1). A more complete discussion of the coefficient of variation as a measure of variability is included in the Appendix on Methods.

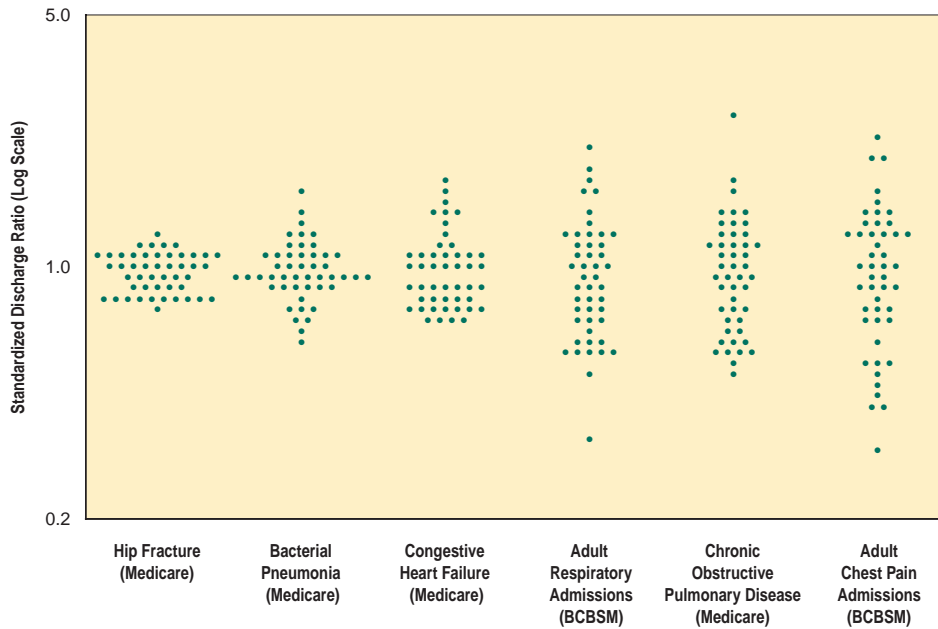


Figure 3.4. Profiles of Variations in Rates of Hospitalization of Adult BCBSM Members and Medicare Enrollees for Six Common Conditions Among the 48 Largest Michigan Hospital Service Areas
As is the case nationally, in Michigan there was little variability in rates of admissions for treatment of hip fracture admissions among the 48 hospital service areas with more than 10,000 adult BCBSM members. By contrast, hospitalizations for bacterial pneumonia and congestive heart failure were more variable; and admissions for adult respiratory conditions, chronic obstructive pulmonary disease, and chest pain were much more variable than admissions for hip fracture.

TABLE 3.1. QUANTITATIVE MEASURES OF VARIABILITY OF SIX COMMON CAUSES OF HOSPITALIZATION AMONG MEDICARE ENROLLEES AND ADULT BCBSM MEMBERS

	Hip Fracture Repair Per 1,000 Medicare Enrollees (1996)	Bacterial Pneumonia Admissions per 1,000 Medicare Enrollees (1996)	Congestive Heart Failure Admissions per 1,000 Medicare Enrollees (1996)	Adult Respiratory Admissions per 1,000 BCBSM Members (1997)	COPD Admissions per 1,000 Medicare Enrollees (1996)	Adult Chest Pain Admissions per 1,000 BCBSM Members (1997)
Index of Variation						
Coefficient of Variation (CV)	12.5	20.2	25.5	38.9	39.3	43.4
Ratio to CV of Surgical Repair of Hip Fracture	1.0	1.6	2.0	3.1	3.1	3.5
Range of Variation						
Extremal Ratio (highest to lowest region)	1.6	2.6	2.5	6.5	5.3	7.8
Interquartile Ratio (75th to 25th percentile region)	1.3	1.3	1.4	1.7	1.6	1.8

The following analyses demonstrate that the overall pattern of variation of medical conditions, as well as the hospitalization rate for ambulatory care-sensitive conditions, were highly variable among all age groups.

Discharges for Medical Conditions Among Adult BCBSM Members

Discharges for all medical (non-surgical) conditions — that is, for all 60 medical M-DRGs, taken as a group — among adult BCBSM members varied by a factor of more than three among hospital service areas with more than 10,000 adult BCBSM members, after adjustment for differences in age and sex of local populations.

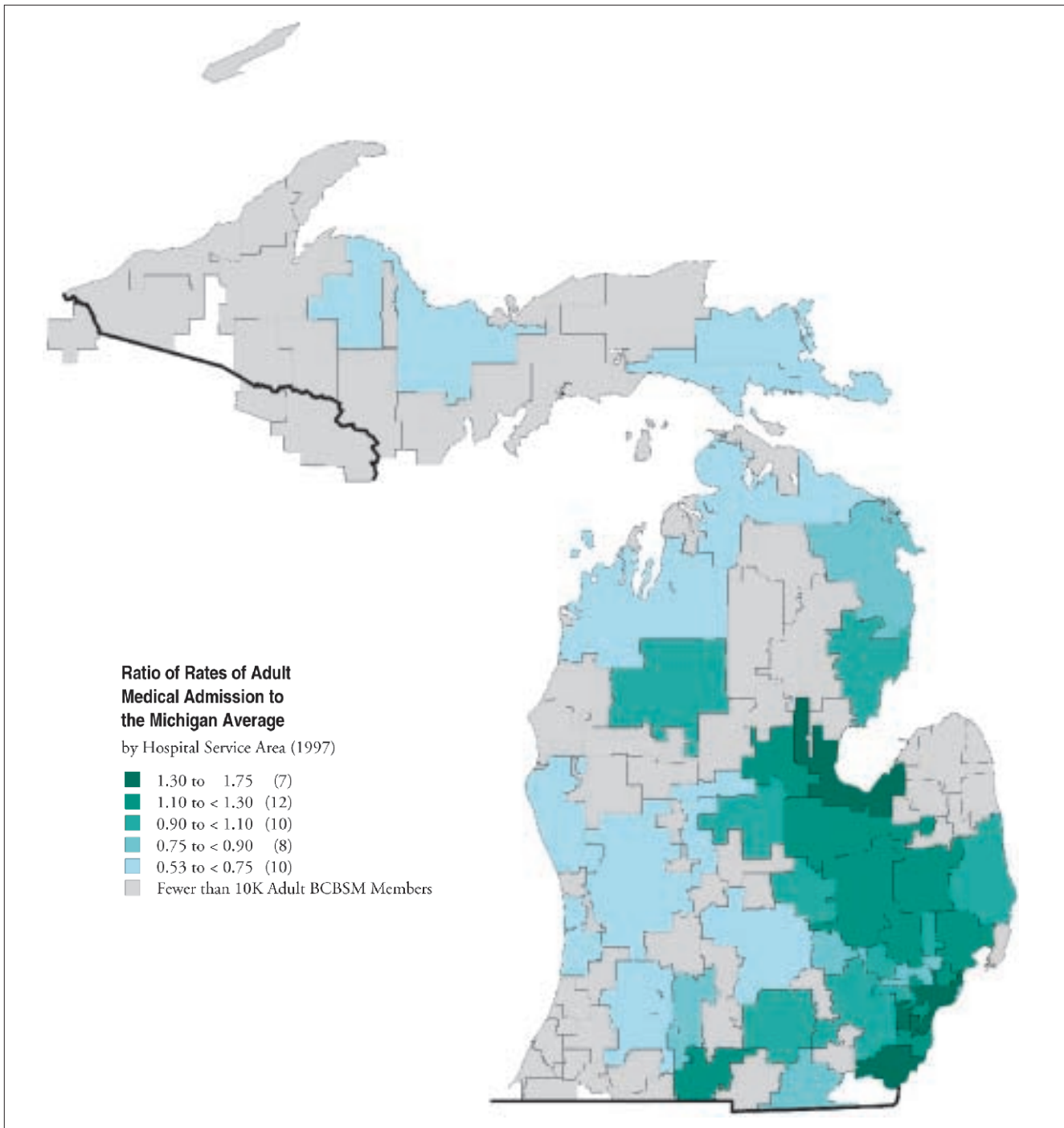
Among hospital service areas in Michigan where rates of discharges for medical conditions were substantially higher than the state average of 29.0 per 1,000 members were Monroe (50.5); Detroit (49.5); Wayne (49.4); Taylor (48.5) and Madison Heights (41.6).

In other hospital service areas, rates of adult medical discharges were well below the average, including Kalamazoo (15.5); Marquette (15.9); Grand Rapids (17.4); Sault Ste Marie (18.5) and Holland (19.6).



Figure 3.5. Discharges for All Medical Conditions Among Adult BCBSM Members (1997)

Rates of discharges for medical conditions ranged from fewer than 20 per 1,000 adult BCBSM members to more than 50, after adjustment for differences in age and sex of populations. Each point represents one of the 48 hospital service areas with more than 10,000 adult BCBSM members.



Map 3.3. Discharges for All Medical Conditions Among Adult BCBSM Members (1997)

Medical discharges were higher in southeastern Michigan than in other parts of the state. Seven hospital service areas had rates of medical discharges more than 30% higher than the state average; ten areas had rates at least 25% below the average.

Discharges for Medical Conditions Among Child BCBSM Members

Discharges for all pediatric medical (non-surgical) conditions among child BCBSM members varied by a factor of almost five among hospital service areas.

Among the hospital service areas where rates of pediatric medical discharges were substantially higher than the state average of 8.1 per 1,000 child members were Mount Pleasant (18.3); Monroe (16.6); Taylor (15.0); Jackson (12.7) and Bay City (12.6).

In other hospital service areas, rates of pediatric medical discharges were substantially lower than the state average, including Marquette (3.8); Sault Ste Marie (4.8); Howell (4.8) and Traverse City (6.0).

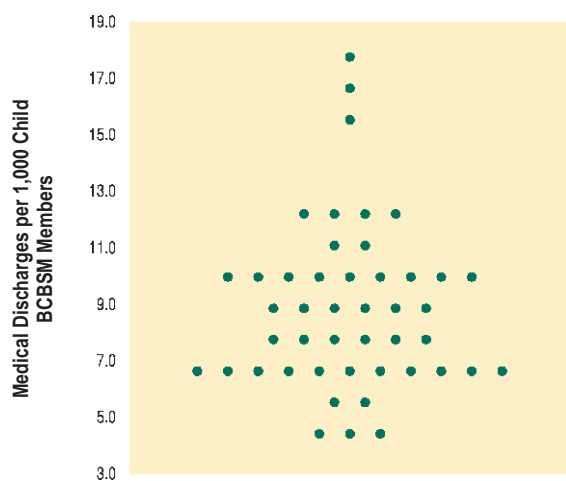
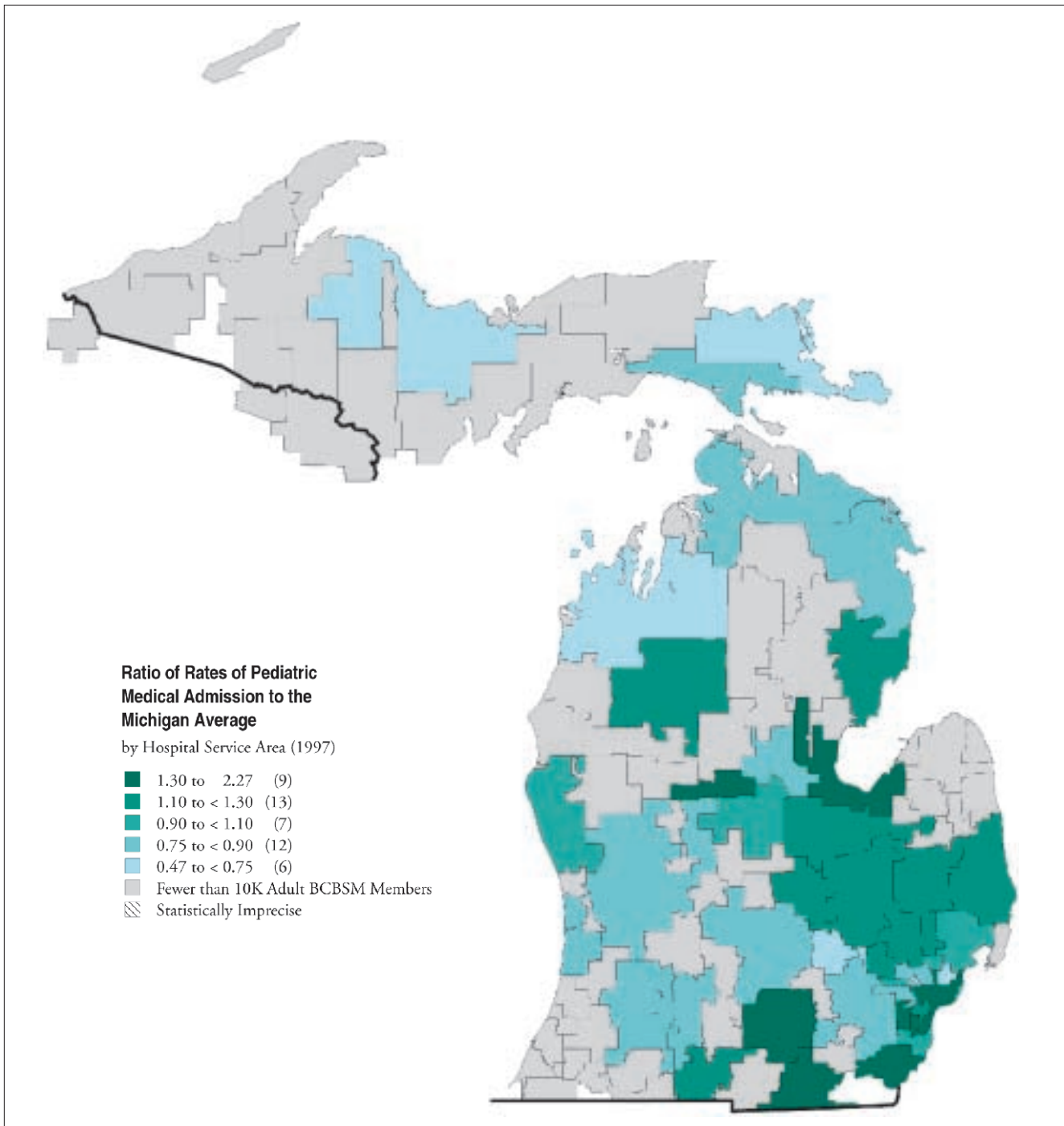


Figure 3.6. Age and Sex Adjusted Discharges for All Medical Conditions Among Child BCBSM Members (1997)

Rates of discharges for medical conditions ranged from fewer than four per 1,000 child BCBSM members to more than 18. Each point represents one of the 48 hospital service areas with more than 10,000 adult BCBSM members.



Map 3.4. Discharges for All Medical Conditions Among Child BCBSM Members (1997)

Rates of pediatric discharges for medical conditions were higher in southeastern Michigan than in other parts of the state, and closely followed the pattern of adult discharges for medical conditions. Nine hospital service areas had rates at least 30% higher than the state average; six areas had rates at least 25% below the average.

Discharges for Medical Conditions Among Michigan Medicare Enrollees

Discharges for all medical (non-surgical) conditions among Medicare enrollees varied by a factor of more than two, after adjustment for age, race and sex differences of populations.

Among the large hospital service areas where rates of medical discharges were substantially higher than the state average of 227.6 per 1,000 Medicare enrollees were Taylor (341.0); Madison Heights (308.4); Wayne (300.5); Monroe (297.9) and Bay City (294.4).

In other hospital service areas, rates were substantially lower than the state average, including Kalamazoo (159.9); Grand Rapids (164.8); Muskegon (169.1); Marquette (176.0) and St. Joseph (187.2).

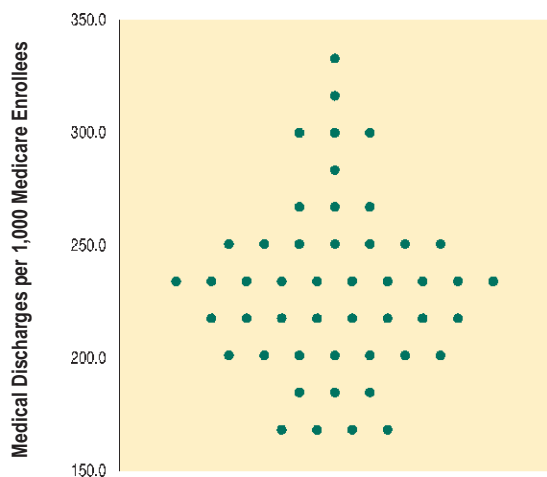
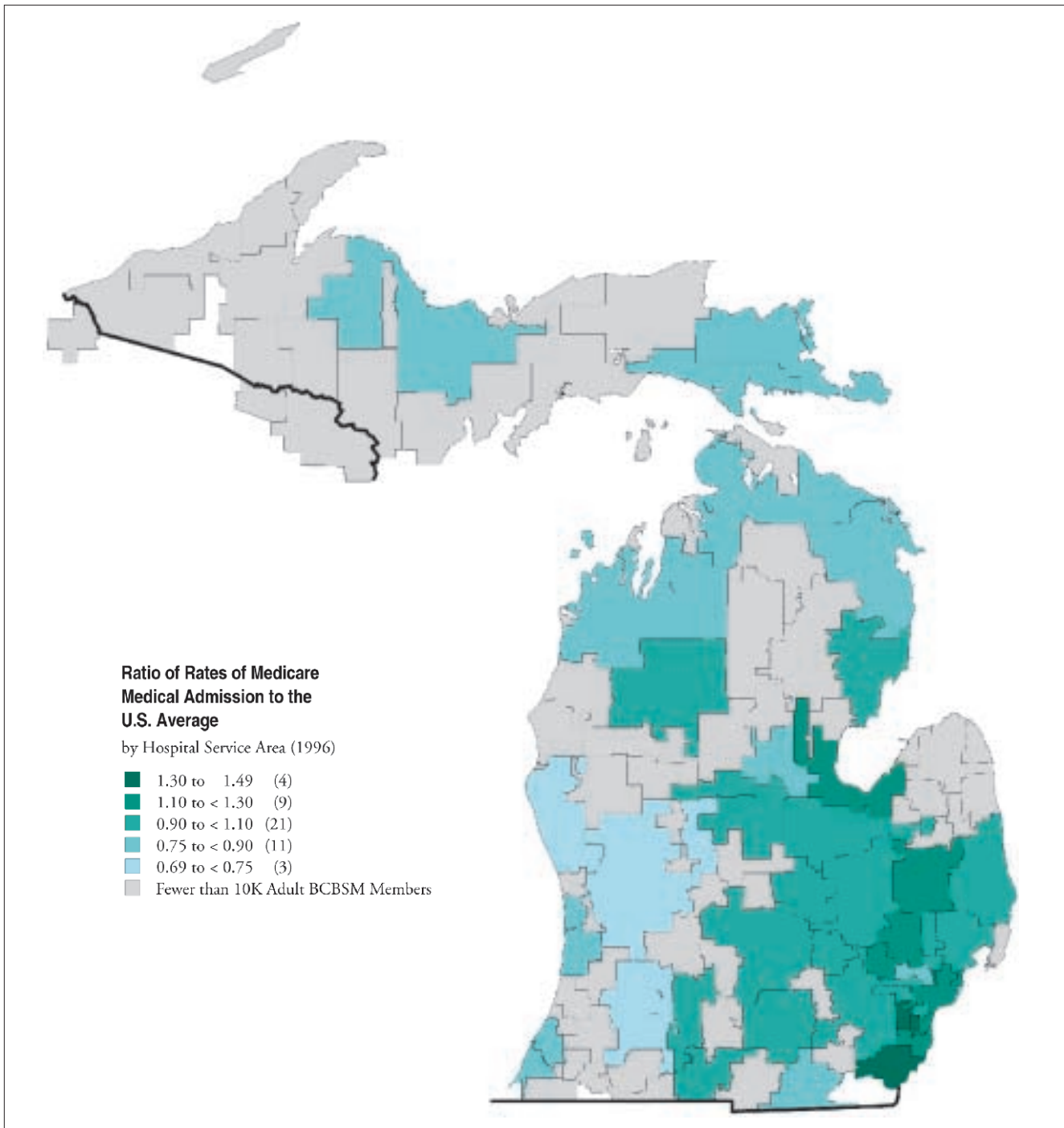


Figure 3.7. Age, Sex and Race Adjusted Discharges for All Medical Conditions Among Medicare Enrollees (1996)

Rates of discharges for medical conditions ranged from fewer than 160 per 1,000 Medicare enrollees to 340. Each point represents one of the 48 largest hospital service areas in Michigan.



Map 3.45. Discharges for All Medical Conditions Among Medicare Enrollees (1996)

Rates of medical discharges were generally higher in southeastern Michigan than in other parts of the state, resembling the patterns of discharges for adult and child members of BCBSM. Four hospital service areas had rates at least 30% higher than the state average; three areas had rates at least 25% below the average.

Hospital Capacity Matters

Roemer's law connecting hospital supply to hospital utilization (hospital beds, once built, will be used) accurately predicts the association between hospital beds and hospitalization rates for all medical conditions. The association is seen in Medicare enrollees' hospitalization rates nationally (among the 306 hospital referral regions the correlation between beds and medical admissions had an $R^2 = .54$, meaning that 54% of the variability in admissions for medical conditions could be explained by the relative supply of hospital beds in the region). The association is also seen among BCBSM members in living in Michigan hospital service areas with more than 100,000 total population. In these areas, the correlation between hospital beds per capita and adult BCBSM members' medical admissions members was .53; among child members it was .34. This means that more than half of the variation in rates of adult medical admissions could be explained by variations in local supplies of hospital beds, and that more than one-third of the variation in pediatric admissions could be explained by such variations in local supply of beds.

Smaller Michigan hospital service areas proved to be an exception to Roemer's law. Among the hospital service areas with more than 10,000 adult BCBSM members and total populations of less than 100,000, there was no correlation between beds and hospitalization rates ($R^2 = .00$). The reasons for this lack of correlation deserve further exploration. There are other considerations that influence the physician's decision to hospitalize, including family support and confidence that care and monitoring in the ambulatory setting is reliable, the severity of the illness, complicating medical conditions, and cultural attitudes toward medical care and hospitalization. Perhaps these other elements are different in the smaller Michigan hospital service areas.

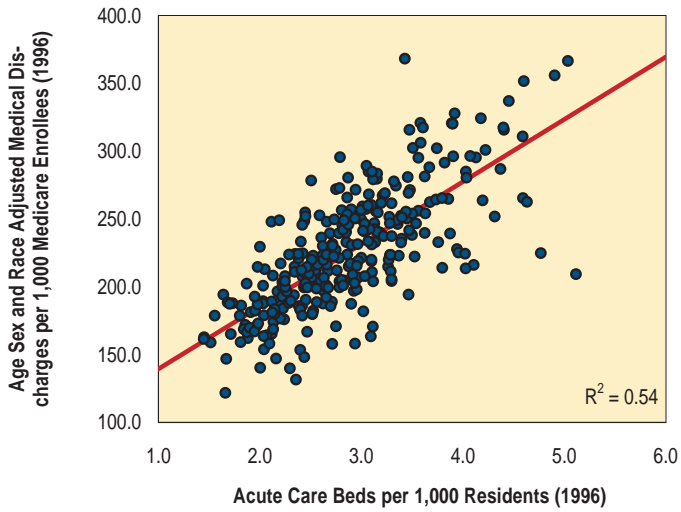


Figure 3.8. The Association Between Hospital Beds per 1,000 Residents and Age Race and Sex Adjusted Hospitalization Rates for Medical Conditions per 1,000 Medicare Enrollees (1996)

Nationally, more than half of the variability in rates of hospitalization for medical conditions can be attributed to differences in per capita supplies of acute care hospital beds among hospital referral regions ($R^2 = .54$).

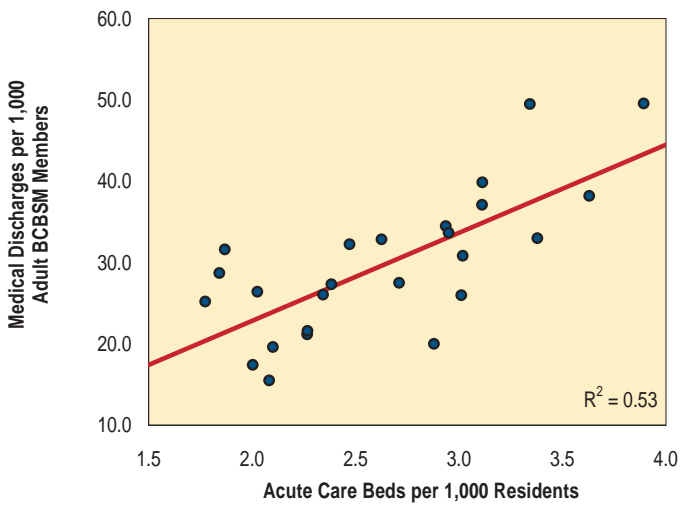


Figure 3.9a. The Association Between Hospital Beds per 1,000 Residents (1996) and Age and Sex Adjusted Hospitalization Rates for Medical Conditions per 1,000 Adult BCBSM Members (1997)

Among hospital service areas in Michigan with total populations of more than 100,000, the hospitalization rate for adult BCBSM members was closely correlated with bed capacity ($R^2 = .53$).

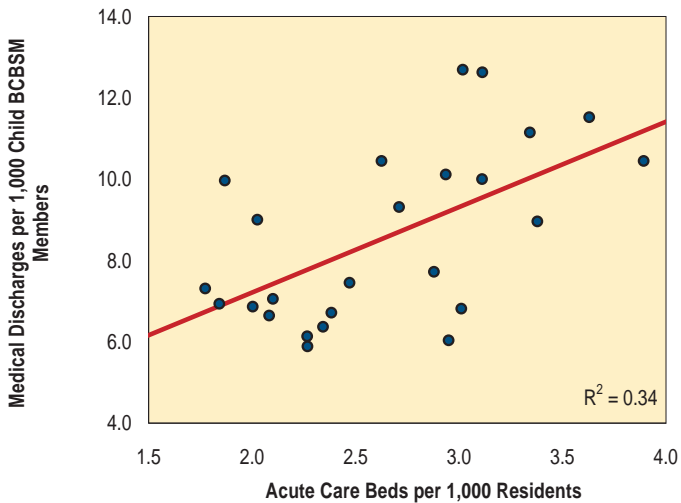


Figure 3.9b. The Association Between Hospital Beds per 1,000 Residents (1996) and Age and Sex Adjusted Hospitalization Rates for Medical Conditions per 1,000 Child BCBSM Members (1997)

Among hospital service areas in Michigan with total populations of more than 100,000, the hospitalization rate for child BCBSM members was also correlated with bed capacity ($R^2 = .34$).

Hospitalization for Ambulatory Care-Sensitive Conditions

Health Service researchers have used the incidence of hospitalization for certain conditions as an indicator of the quality of ambulatory care. The theory is that when the access to or the quality of ambulatory care are poor, patients with diseases such as asthma, pneumonia, chronic pulmonary obstructive disease and congestive heart failure are inadequately treated in the clinic or outpatient department; this sub optimal care results in higher rates of hospitalization, compared to similar patients with high quality care. Several researchers have suggested that the regions with high rates of hospitalization for these “ambulatory care-sensitive conditions” should be targeted for special interventions to improve the quality of primary care.

Discharge rates for ambulatory care-sensitive conditions varied substantially among hospital service areas in Michigan for Medicare enrollees and for adult and child BCBSM members. Figure 3.10 profiles the variation in rates of hospitalization for ambulatory care-sensitive conditions among the 48 hospital service areas with more than 10,000 adult BCBSM members and compares them to hip fracture. The ambulatory care-sensitive conditions are obviously much more variable (Table 3.2).

Discharges for ambulatory care-sensitive conditions among the Medicare population are highly correlated with discharge rates among both child and adult members of BCBSM — that is, regions with high rates of Medicare admissions for ambulatory care-sensitive conditions are also likely to have high rates of such admissions among both adult and child members of BCBSM. Medicare admissions for ambulatory care-sensitive conditions are highly correlated with adult BCBSM admissions ($R^2 = .77$) (Figure 3.11a). Ambulatory care-sensitive conditions Medicare admissions are also correlated with child BCBSM admissions ($R^2 = .40$) (Figure 3.11b). In addition, rates of admission for ambulatory care-sensitive conditions among adult BCBSM members are correlated with the same kinds of admissions among child BCBSM members ($R^2 = .38$) (Figure 3.11c).

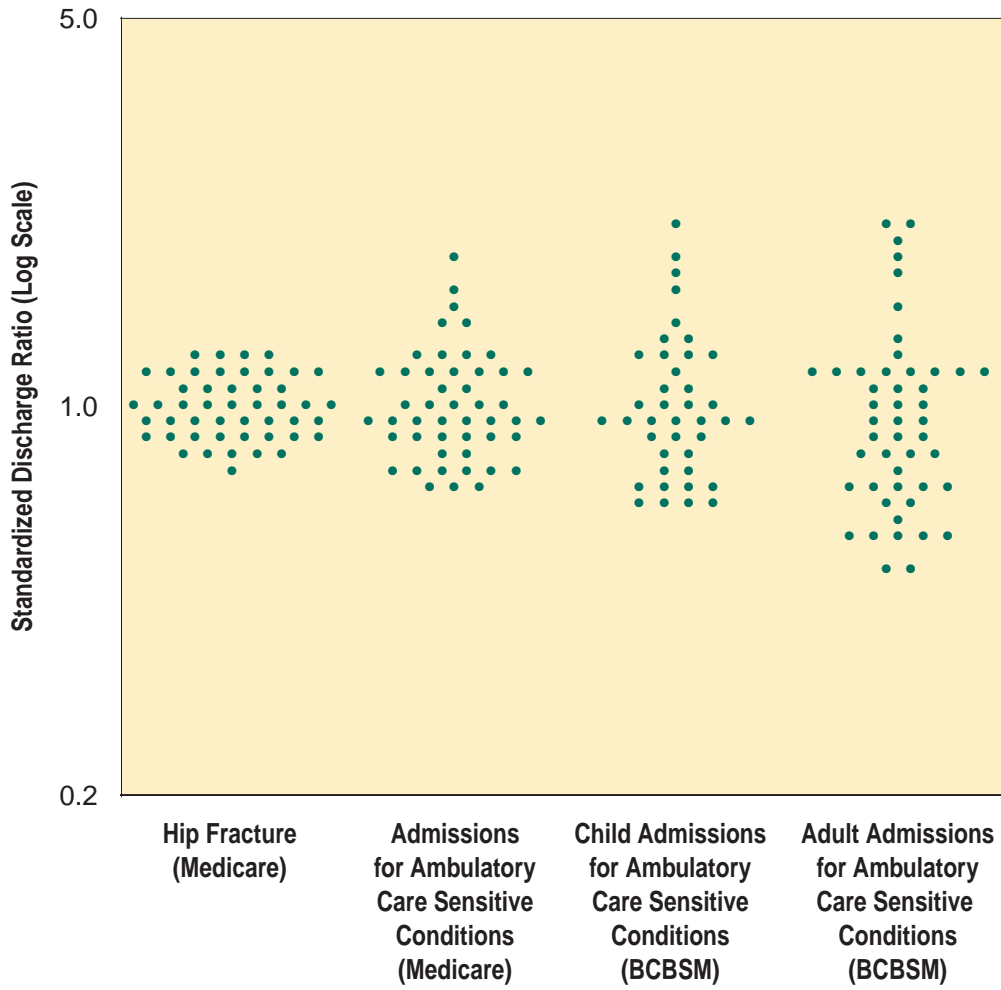


Figure 3.10. Profiles of Variations in Hospitalization Rates for Hip Fracture and for Ambulatory Care-Sensitive Conditions for Medicare (1996), and Adult and Child Members of BCBSM (1997)
Rates of admissions for hip fracture in the Medicare population were substantially less variable than rates of admissions for ambulatory care-sensitive conditions among the Medicare, adult BCBSM and pediatric BCBSM populations.

TABLE 3.2. QUANTITATIVE MEASURES OF VARIABILITY OF HIP FRACTURE AND AMBULATORY CARE-SENSITIVE CONDITIONS AMONG MEDICARE ENROLLEES AND ADULT AND CHILD BCBSM MEMBERS

	Hip Fracture Repair per 1,000 Medicare Enrollees (1996)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Medicare Enrollees (1996)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Child BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Adult BCBSM Members (1997)
Index of Variation				
Coefficient of Variation (CV)	12.5	23.5	31.3	39.0
Ratio to CV of Surgical Repair of Hip Fracture	1.0	1.9	2.5	3.1
Range of Variation				
Extremal Ratio (highest to lowest region)	1.6	2.6	3.7	4.2
Interquartile Ratio (75th to 25th percentile region)	1.3	1.3	1.5	1.6

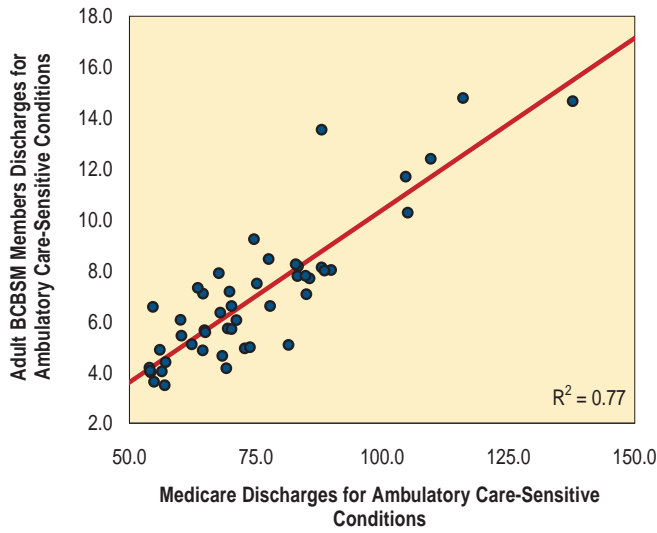


Figure 3.11a. The Association Between Medicare Discharges (1996) and Adult BCBSM Member Discharges for Ambulatory Care-Sensitive Conditions (1997)

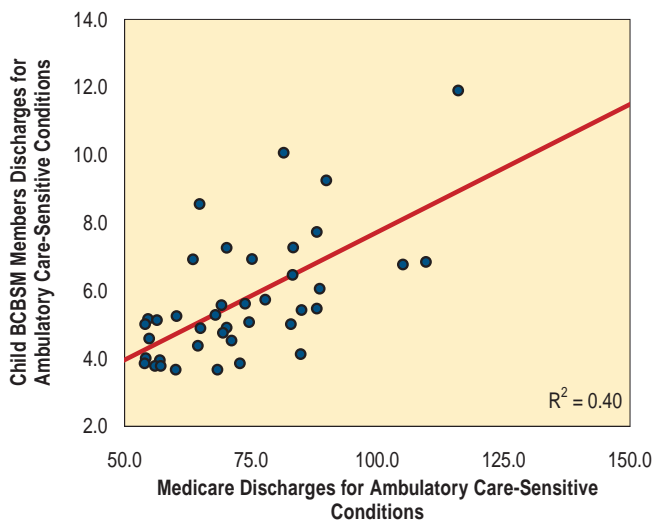


Figure 3.11b. The Association Between Medicare Discharges (1996) and Child BCBSM Member Discharges for Ambulatory Care-Sensitive Conditions (1997)

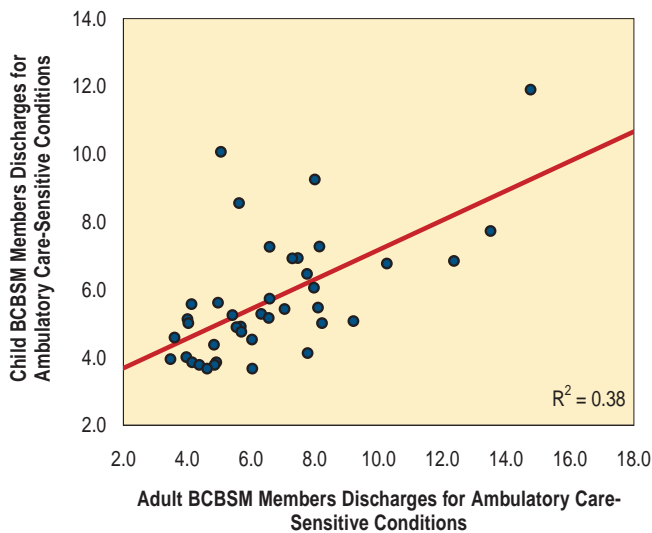


Figure 3.11c. The Association Between Discharges of Adult BCBSM Members and Child BCBSM Members for Ambulatory Care-Sensitive Conditions (1997)

Supply of Resources, Access and Continuity of Care and Hospitalizations for Ambulatory Care-Sensitive Conditions

Is there an association between the capacity of a region's health care system and rates of discharges for ambulatory care-sensitive conditions? That is, is the supply of resources related to whether patients are admitted to hospitals in cases where such hospitalizations might have been avoided by providing more appropriate care outside the hospital? Do communities with fewer primary care physicians or specialists have higher rates of such admissions? Does better access to care, and more continuity of care, help avoid preventable hospitalizations?

We asked this question about all Medicare enrollees in all hospital referral regions in the United States in the 1999 edition of the Dartmouth Atlas. Among Medicare enrollees, rates of discharges for ambulatory care-sensitive conditions were not related to the supply of primary care physicians per 100,000 residents ($R^2 = .04$); the supply of specialists ($R^2 = .02$); measures of access ($R^2 = .01$) or measures of continuity of care ($R^2 = .01$).

Within Michigan hospital service areas with populations of more than 100,000 there was no relationship between the numbers of primary care physicians or specialists per 100,000 residents and Medicare hospitalization rates for ambulatory care-sensitive conditions. Hospitalizations for child BCBSM members, however, were inversely related to supply of physicians: regions with more primary care physicians ($R^2 = .15$) and more specialists ($R^2 = .08$) had lower hospitalization rates for ambulatory care-sensitive conditions (Table 3.3).

TABLE 3.3. THE RELATIONSHIP BETWEEN THE SUPPLY OF GENERALIST AND SPECIALIST PHYSICIANS AND HOSPITAL BEDS, AND RATES OF DISCHARGES FOR AMBULATORY CARE-SENSITIVE CONDITIONS FOR ADULT AND CHILD BCBSM MEMBERS IN MICHIGAN HOSPITAL SERVICE AREAS WITH POPULATIONS OF MORE THAN 100,000

	Primary Care Physicians per 100,000 Residents (1996)	Specialist Physicians per 100,000 Residents (1996)	Acute Care Hospital Beds per 1,000 Residents (1996)
Admissions for Ambulatory Care Sensitive Conditions per 1,000 Adult BCBSM Members (1997)	0.01	0.00	0.57
Admissions for Ambulatory Care Sensitive Conditions per 1,000 Child BCBSM Members (1997)	0.15*	0.08*	0.32
<i>*Inversely correlated</i>			

What about the supply of hospital beds? The 1999 edition of the Dartmouth Atlas shows that Medicare hospitalizations for ambulatory care-sensitive conditions are highly correlated with hospital beds per 1,000 population ($R^2 = .55$). But among Medicare enrollees, hospitalization rates for ambulatory care-sensitive conditions were found to be even more highly correlated with all other medical conditions ($R^2 = .74$); and, not surprisingly, hospitalization rates for all other medical conditions were also found to be highly correlated with hospital beds per 1,000 ($R^2 = .49$).

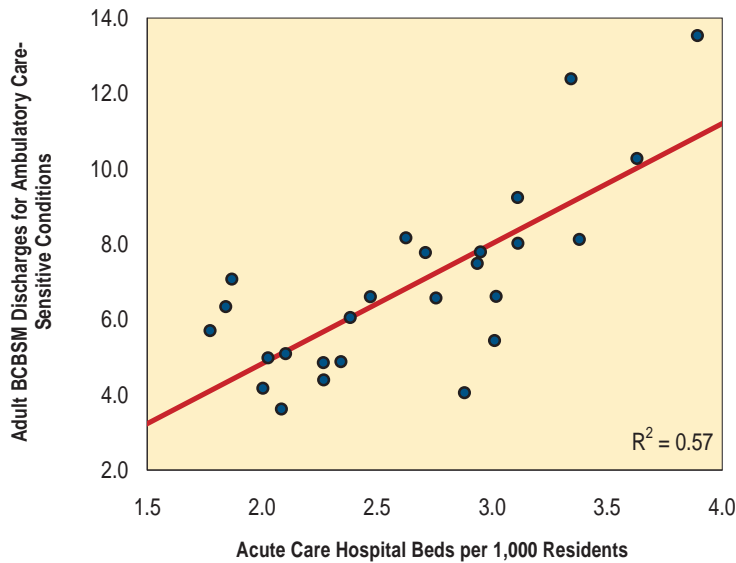


Figure 3.12a. The Association Between Allocated Acute Care Hospital Beds (1996) and Rates of Discharges for Ambulatory Care-Sensitive Conditions Among Adult BCBSM Members (1997)

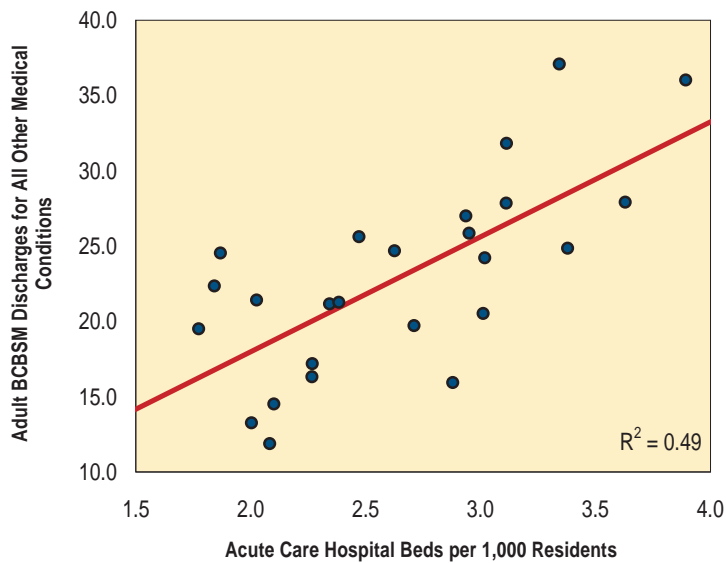


Figure 3.12b. The Association Between Allocated Acute Care Hospital Beds (1996) and Rates of Discharges for All Other Medical Conditions Among Adult BCBSM Members (1997)

A similar trend is seen for adult BCBSM members in Michigan’s hospital service areas with populations of more than 100,000. Rates of hospitalizations were highly correlated with beds with more than half of the variation “explained” by this variable ($R^2 = .57$). As for Medicare enrollees, hospitalization rates for ambulatory care-sensitive conditions were highly correlated with rates for all other medical conditions ($R^2 = .78$). (“All other medical conditions” refers to all hospital admissions that were neither for ambulatory care-sensitive conditions nor for surgical procedures.) Hospitalization rates for all other medical conditions were highly correlated with hospital beds ($R^2 = .49$) (Figure 3.12).

The pattern was the same for child BCBSM members, except that the correlations were not as strong (Table 3.3).

How should these correlations be interpreted? It appears that ambulatory care-sensitive conditions are not “special case” conditions. Rather, particular aspects of the local health care system, such as the supply of hospital beds, have a similar influence on medical admissions for almost all conditions, not just for ambulatory care-sensitive conditions. Further, with the possible exception of pediatric hospitalizations, there is no evidence that factors that might affect the quality of care — such as the size of the physician workforce or access to outpatient care — have a systematic influence on rates of discharges for ambulatory care-sensitive conditions (or for other medical conditions). Efforts to reduce unwanted variations in acute care hospitalizations for medical conditions will need to pay attention to the quality of ambulatory care and to bed capacity, at least in the larger hospital service areas.

The acute care hospital bed supply explained over half of the variation in hospitalization for ambulatory care-sensitive conditions as well as for all other medical conditions among Michigan hospital service areas with populations of more than 100,000.

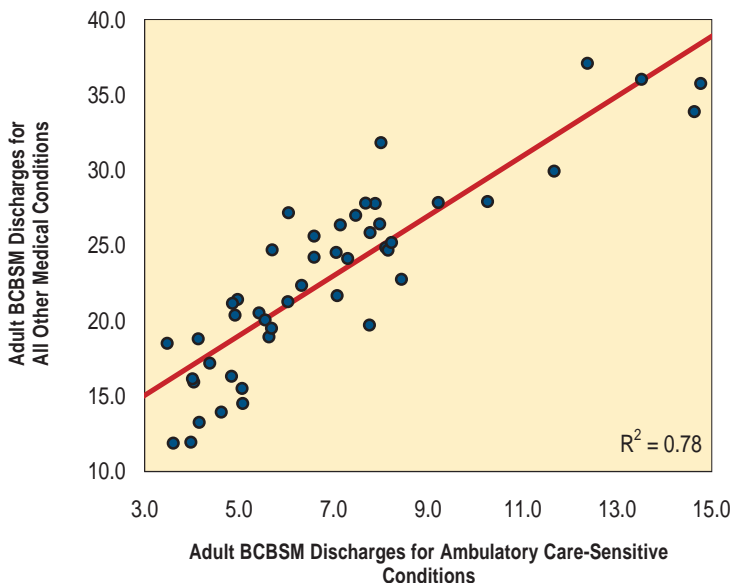


Figure 3.13. The Relationship Between Discharges for Ambulatory Care-Sensitive Conditions and Discharges for All Other Medical Conditions Among Adult BCBSM Members (1997)

There was a strong positive correlation between the rates of hospitalizations for all medical conditions and the rates of discharges for ambulatory care-sensitive conditions in adult BCBSM members ($R^2 = .78$).

The Medical Signatures of Selected Michigan Hospital Service Areas

Among the 48 hospital service areas with more than 10,000 adult BCBSM members, the rates of medical hospitalizations of Medicare enrollees and adult and child BCBSM members were highly correlated (Figure 3.14). However, the effect is not necessarily the same in each age group or health plan.

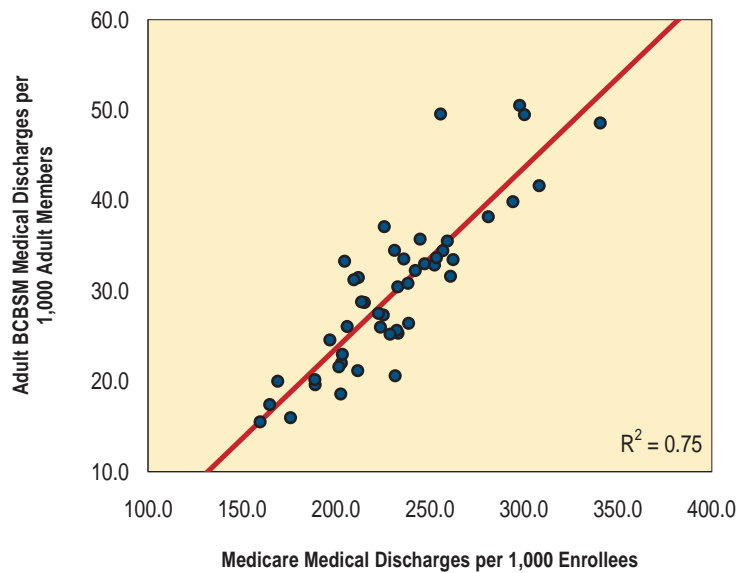


Figure 3.14a. The Association Between Medicare Medical Discharges (1996) And Medical Discharges of Adult BCBSM Members (1997) Among Michigan Hospital Service Areas

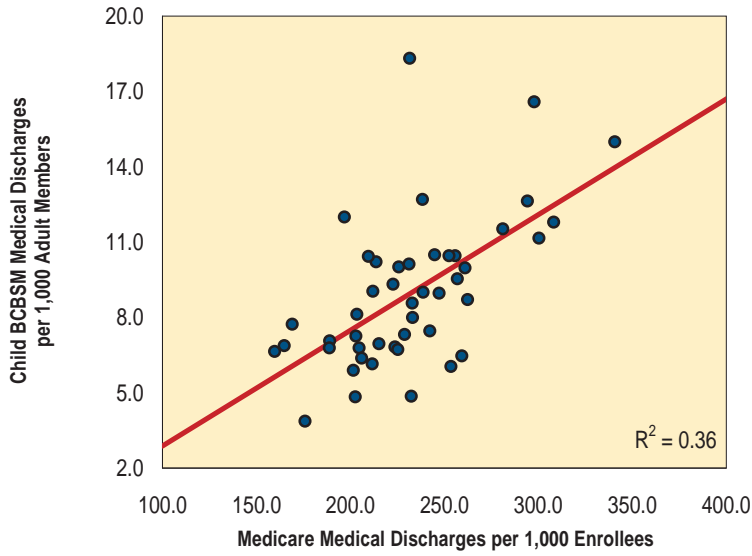


Figure 3.14b. The Association Between Medical Discharges for Medicare Enrollees (1996) and Child BCBSM Members Among Michigan Hospital Service Areas (1997)

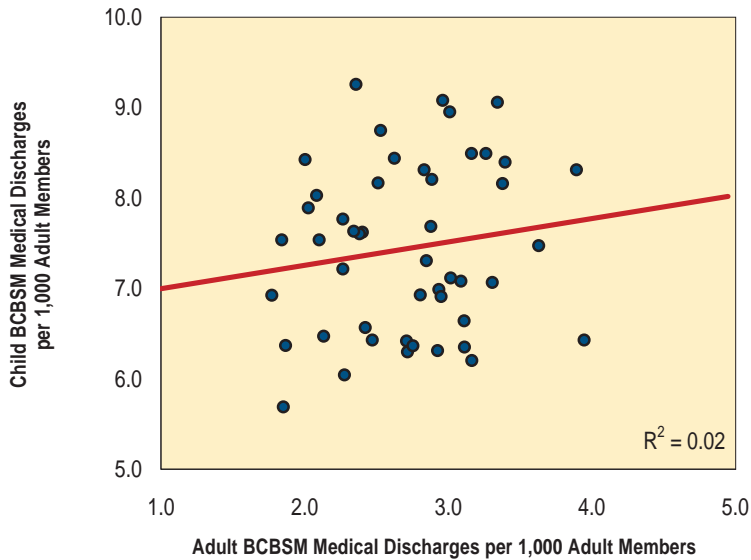


Figure 3.14c. The Association Between Medical Discharges for Adult BCBSM Members and Child BCBSM Members Among Michigan Hospital Service Areas (1997)
Rates of medical discharges are correlated among age groups and health plans. The figure shows medical admissions among Medicare enrollees and child BCBSM members ($R^2 = .36$) and medical admissions among adult and child BCBSM members ($R^2 = .33$)

One example of the effect of hospital bed capacity on utilization is the pattern of hospital bed allocation and use of care by Medicare enrollees and adult and child BCBSM members living in Battle Creek and Kalamazoo, two neighboring hospital service areas in south central Michigan (Figure 3.15). There were 45% more allocated hospital beds per 1,000 residents of the Battle Creek hospital service area than in the Kalamazoo hospital service area. Hospitalization rates for Medicare and adult BCBSM members who lived in Battle Creek were substantially higher than for adults in Kalamazoo, but rates of pediatric hospitalizations were about the same in the two communities. The rates of hospitalizations for specific conditions — Medicare enrollees admitted for congestive heart failure and chronic pulmonary obstructive disease and adult BCBSM members with chest pain and respiratory conditions — were consistently higher in Battle Creek than in Kalamazoo.

The Detroit, Flint and Royal Oak hospital service areas had quite different medical signatures (Figure 3.16). There were 66% more allocated hospital beds per 1,000 residents of the Detroit area than per 1,000 residents of Royal Oak, and 15% more in Detroit than in Flint.

There were striking disparities between rates of hospitalizations for medical admissions among adult BCBSM members living in these communities. Adult BCBSM members living in Detroit were 91% more likely to be admitted for medical conditions than members who lived in Royal Oak, and 50% more likely to be admitted than members who lived in Flint. By contrast, pediatric medical admissions occurred 64% more frequently among children living in Detroit than among children in Royal Oak, but were only 16% more frequent among BCBSM children in Detroit than among children in Flint. The smallest differences were in rates of medical hospitalizations among Medicare enrollees: rates in Detroit were only 24% higher than among residents of Royal Oak, and only 20% higher than among Medicare residents of Flint.

The reasons for this variation in how services are used by different age groups and health plans should be studied further. The reasons why clinicians in some areas (such as the Detroit hospital service area) seem to use beds disproportionately for adult BCBSM members, compared to Medicare enrollees, warrants further investigation.

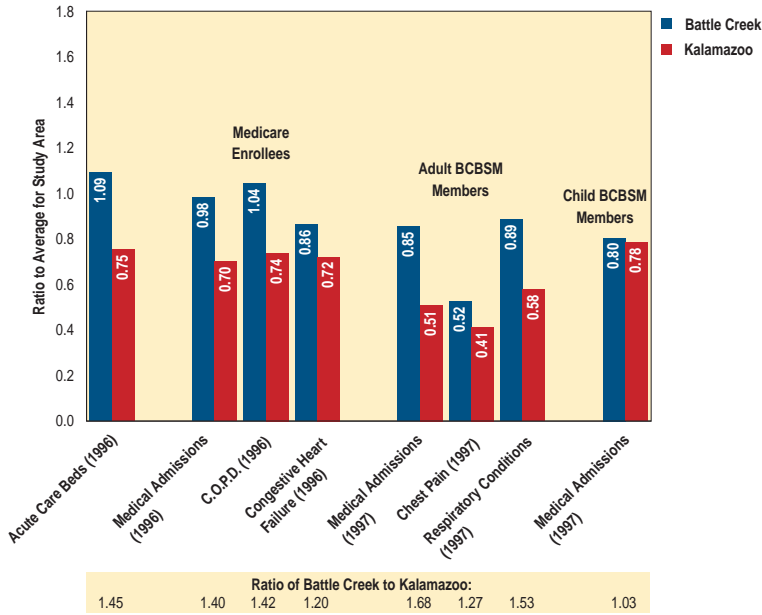


Figure 3.15. The Medical Signatures of the Battle Creek and Kalamazoo Hospital Service Areas

There were 45% more allocated hospital beds per 1,000 residents of the Battle Creek hospital service area than in the Kalamazoo hospital service area. Hospitalization rates for Medicare and adult BCBSM members who lived in Battle Creek were substantially higher than for adults in Kalamazoo, but rates of pediatric hospitalizations were about the same in the two communities. The rates of hospitalizations for specific conditions — Medicare enrollees admitted for congestive heart failure and chronic pulmonary obstructive disease and adult BCBSM members with chest pain and respiratory conditions — were consistently higher in Battle Creek than in Kalamazoo.

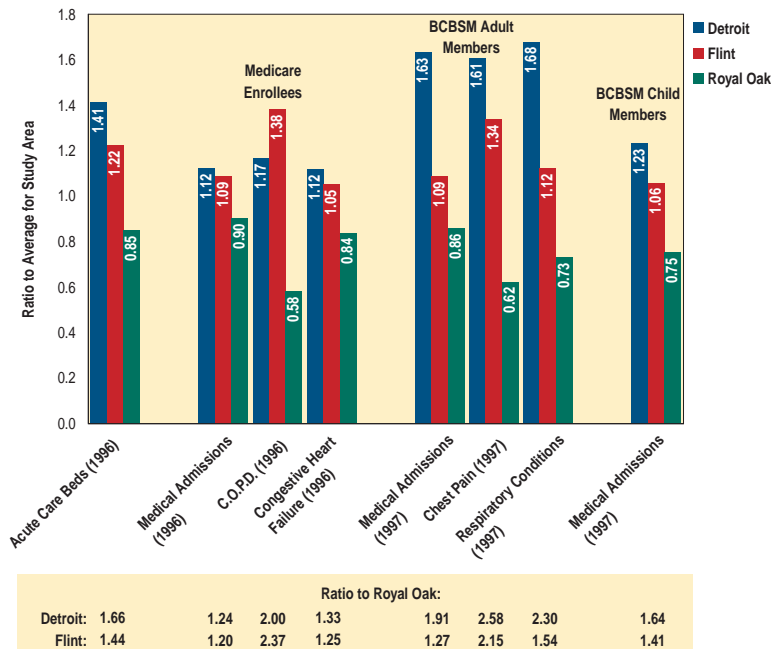


Figure 3.16. The Medical Signatures of the Detroit, Royal Oak, and Flint Hospital Service Areas

There were 66% more allocated hospital beds per 1,000 residents of the Detroit area than per 1,000 residents of Royal Oak, and 15% more in Detroit than in Flint. Adult BCBSM members living in Detroit were 91% more likely to be admitted for medical conditions than members who lived in Royal Oak, and 50% more likely to be admitted than members who lived in Flint. Pediatric medical admissions occurred 64% more frequently among children living in Detroit than among children in Royal Oak, but were only 16% more frequent among BCBSM children in Detroit than among children in Flint. The smallest differences were in rates of medical hospitalizations among Medicare enrollees: rates in Detroit were only 24% higher than among residents of Royal Oak, and only 20% higher than among Medicare residents of Flint.

Is More Acute Hospital Care Better?

The fundamental question is whether more acute hospital care results in better health outcomes. Previous research by the authors in the New Haven, Connecticut and Boston hospital service areas looked at this question. Sick people in New Haven are more likely to be treated outside the hospital than similarly sick people who live in Boston. If the rate of use of resources of New Haven prevailed throughout the United States, money available for other sectors of care — providing ambulatory care, for example — could be increased without increasing overall Medicare outlays.

It is then important to ask whether patients living in areas with lower hospital capacity and less utilization receive adequate levels of care. There are three arguments that suggest patient populations exposed to less acute hospital care are not being harmed:

First, there is no scientific evidence that more is always better. There are few studies of the outcomes of hospitalization versus less intensive ways of treating patients with the same disease profiles; and those that have been done show no advantage from more intensive care.

Second, the influence of supply on utilization occurs without clinicians' explicit knowledge of the relative level of available resources. Clinicians serving populations in hospital referral regions where the supply of acute care hospital resources is relatively low do not appear to be aware of constraints on their practice of medicine.

Third, hospitalization itself is intrinsically risky, and populations exposed to lower rates of hospitalization are less likely to experience untoward medical events associated with hospitalization. The magnitude of contemporary risks associated with hospitalization is not certain. The most comprehensive study of the risk of hospitalization, the Harvard Medical Practice Study, published in 1991, found that 3.7% of Medicare hospitalizations (i.e., people 65 and older) involved some form of complication, and in about 1% of Medicare hospitalizations complications resulted in death from an "untoward event."

How should the debate over whether more is better be framed? The first step is to understand the impact of increased supply on population-based utilization and outcomes. Most of the marginal resources in the acute care hospital sector appear to be invested in admitting patients to medical units in the hope of reducing mortality. The important question is population mortality: Do populations living in regions with higher hospitalization rates live longer than those in regions with lower rates?

Outcomes in terms of life expectancy are not different for populations living in Boston and New Haven. In the years since these studies began, the mortality rates of residents of Boston and New Haven have been essentially the same. This pattern is repeated across the United States: areas with greater hospital capacity, and with more inpatient days per capita, do not have lower mortality rates, even after controlling for a wide variety of health indicators. In other words, the United States might be on the “flat of the curve” in terms mortality. If this is true, achieving for all areas hospitalization rates similar to those in regions with fewer beds per capita would not affect life expectancy.

Chapter Three
Table Note

Rates are adjusted for differences in age and sex compositions of areas' populations. In the case of Medicare rates, adjustments were made for differences in age, sex, and race compositions of areas' populations. The rates represent the medical utilization of persons living in the specified area, regardless of where services were obtained. Hospital discharge rates are, depending on admitting diagnosis, per 1,000 BCBSM members, per 1,000 adult BCBSM members, or per 1,000 child BCBSM members. Rates of admissions in the Medicare population are per 1,000 Medicare enrollees. Data concerning the BCBSM population are for 1997; data concerning the Medicare population are for 1996. Medicare data excludes enrollees who were members of risk bearing health maintenance organizations. Specific codes used to define the numerator for rates, and methods of age, sex and race adjustments are given in the Appendix on Methods.

Rates of Hospitalizations for Medical Conditions by Hospital Service Areas (1996 and 1997)

HSA City	Adult BCBSM Members Included in Data Analysis (1997)	Child BCBSM Members Included in Data Analysis (1997)	Medicare Enrollees (1996)	Medical Admissions per 1,000 Adult BCBSM Members (1997)	Medical Admissions per 1,000 Child BCBSM Members (1997)	Medical Admissions per 1,000 Medicare Enrollees (1996)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Adult BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Child BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Medicare Enrollees (1996)	Admissions for Respiratory Conditions per 1,000 BCBSM Members (1997)	Admissions for Respiratory Conditions per 1,000 Adult Members (1997)	Admissions for Chest Pain Pneumonia per 1,000 Adult BCBSM Members (1997)	Admissions for Bacterial Meningitis per 1,000 Medicare Enrollees (1996)	Admissions for Congestive Heart Failure per 1,000 Medicare Enrollees (1996)	Admissions for Chronic Obstructive Pulmonary Disease per 1,000 Medicare Enrollees (1996)
Adrian	17,761	7,252	8,259	24.5	12.0	196.9	5.6	8.5	64.9	2.3	3.4	16.1	18.8	8.0	
Albion	2,805	915	2,014	N/A	N/A	233.3	(7.7)		86.8	N/A	N/A	19.4	21.6	11.0	
Allegan	3,534	1,453	2,852	N/A	N/A	223.9	(4.6)		77.0	N/A	N/A	19.0	22.4	12.9	
Alma	13,300	5,274	6,335	30.4	8.5	233.0	5.7	4.7	69.5	2.4	3.9	18.1	21.3	6.7	
Alpena	16,648	5,931	8,619	22.0	7.2	203.0	3.5	3.9	57.0	2.1	3.2	10.9	20.4	6.6	
Ann Arbor	80,828	25,484	39,968	28.7	6.9	215.3	6.3	5.3	68.0	2.8	2.3	12.5	22.2	9.9	
Bad Axe	4,966	1,881	3,292	N/A	N/A	173.7	6.1	(19.1)	60.6	N/A	N/A	15.7	18.4	6.3	
Battle Creek	20,415	7,627	14,698	25.9	6.8	223.9	5.4	5.2	60.3	2.6	1.6	11.1	21.5	10.8	
Bay City	32,463	10,913	17,054	39.8	12.6	294.4	8.0	9.2	90.0	2.9	4.7	11.9	36.7	14.8	
Berrien Center	165	61	209	N/A	N/A	170.5			50.2	N/A	N/A	16.2	12.3	4.8	
Big Rapids	6,382	2,168	3,925	17.2		160.2	3.1		54.3		(2.3)	14.5	19.9	6.4	
Cadillac	10,902	4,338	6,855	28.7	10.2	213.7	7.1	(7.1)	64.6	2.5	3.8	14.0	19.7	10.9	
Caro	4,026	1,422	1,709	N/A	N/A	228.3	7.9	(10.8)	70.4	N/A	N/A	16.1	16.3	7.5	
Carson City	4,135	1,563	1,754	28.6	(15.5)	227.1	8.5	(7.5)	81.0	(4.4)	(3.2)	20.9	23.8	10.8	
Cass City	2,745	1,017	1,459	N/A	N/A	277.3	(14.2)		109.9	N/A	N/A	29.2	38.7	10.7	
Charlevoix	6,214	2,443	2,624	N/A	N/A	201.2	7.7	(5.0)	70.3	N/A	N/A	18.0	24.9	6.8	
Charlotte	5,641	2,041	2,571	N/A	N/A	280.3	6.9	(7.1)	89.5	N/A	N/A	19.5	29.8	13.3	
Cheboygan	5,311	1,836	2,833	25.3	(8.1)	193.5	5.9		65.9	(2.1)	(2.7)	12.9	24.7	7.7	
Chelsea	3,716	1,234	2,229	17.0		168.8	4.5		44.0			16.4	11.4	5.8	
Clare	8,064	2,862	5,409	N/A	N/A	280.9	9.4	(6.8)	96.6	N/A	N/A	27.9	27.0	9.4	
Coldwater	10,574	4,358	5,655	35.7	10.5	244.9	7.9	(6.0)	67.7	3.8	3.9	11.2	22.6	13.4	
Crystal Falls	1,296	443	1,269	N/A	N/A	245.2	(9.1)		65.9	N/A	N/A	7.9	20.4	7.6	
Dearborn	24,489	8,356	26,294	37.1	10.0	225.9	9.2	5.1	74.7	4.1	4.2	14.1	25.8	10.2	
Deckerville	1,373	563	860	N/A	N/A	214.6			72.2	N/A	N/A	14.5	22.3	4.5	
Detroit	133,298	42,835	124,463	49.5	10.4	255.8	13.5	7.7	88.1	4.9	5.1	17.3	27.9	12.1	
Dowagiac	2,545	954	2,179	N/A	N/A	316.4	(8.7)	(11.8)	109.6	N/A	N/A	27.6	31.8	13.7	
Escanaba	8,164	3,040	6,483	28.6	(7.7)	218.1	6.1	(5.5)	74.6	(3.3)	(2.7)	12.4	23.0	8.2	
Farmington Hills	19,963	6,659	11,698	25.3	8.0	233.2	4.9	3.8	72.8	2.1	2.7	14.5	24.8	11.1	
Flint	132,327	42,991	51,834	32.9	9.0	247.4	8.1	5.5	88.1	3.3	4.2	17.3	26.2	14.3	
Frankfort	1,028	364	878	12.9		162.2			43.8			10.3	14.4	6.8	
Fremont	4,922	2,073	3,663	20.3		189.3	2.2	(5.9)	57.2		(2.5)	14.1	24.3	5.7	
Garden City	12,426	3,948	11,642	35.4	6.5	259.5	7.7	(3.2)	85.7	3.5	3.2	14.4	30.1	12.5	
Gaylord	9,264	3,637	4,705	N/A	N/A	181.3	3.8	(4.1)	50.8	N/A	N/A	6.4	20.7	5.8	
Gladwin	3,923	1,333	2,883	N/A	N/A	376.7	10.5		133.2	N/A	N/A	28.2	42.6	12.2	

VARIATIONS IN HOSPITALIZATIONS FOR MEDICAL CONDITIONS

HSA City	Adult BCBSM Members Included in Data Analysis (1997)	Child BCBSM Members Included in Data Analysis (1997)	Medicare Enrollees (1996)	Medical Admissions per 1,000 Adult BCBSM Members (1997)	Medical Admissions per 1,000 Child BCBSM Members (1997)	Medical Admissions per 1,000 Medicare Enrollees (1996)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Adult BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Child BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Medicare Enrollees (1996)	Admissions for Respiratory Conditions per 1,000 Adult BCBSM Members (1997)	Admissions for Chest Pain Medicare Enrollees (1997)	Admissions for Bacterial Pneumonia per 1,000 Medicare Enrollees (1996)	Admissions for Congestive Heart Failure per 1,000 Medicare Enrollees (1996)	Admissions for Chronic Obstructive Pulmonary Disease Per 1,000 Medicare Enrollees (1996)
Grand Haven	8,141	2,989	5,732	12.1	(3.8)	154.9	2.6		53.9		14.2	18.5	4.0	
Grand Rapids	117,284	46,706	74,069	17.4	6.9	164.8	4.2	3.8	54.0	1.7	1.3	13.3	17.4	6.4
Grayling	9,790	3,343	6,748	31.3	(7.2)	234.0	6.7	(6.4)	66.7	2.5	6.1	11.2	27.9	8.0
Greenville	3,096	1,241	2,105	N/A	N/A	228.7	(7.4)		103.9	N/A	N/A	30.7	22.6	19.4
Grosse Pointe	14,906	5,214	8,407	22.9	8.1	203.5	4.1	5.6	69.2	1.5	1.7	13.0	21.8	7.6
Hancock	4,066	1,635	3,125	N/A	N/A	204.7	8.5		64.0	N/A	N/A	17.8	15.1	7.7
Harbor Beach	1,698	724	1,248	N/A	N/A	262.5	(10.9)		93.5	N/A	N/A	21.9	28.2	7.8
Hastings	8,327	3,296	5,015	24.9	9.6	231.3	7.9	(5.7)	74.2	(3.5)	(3.4)	12.0	29.9	9.1
Hillsdale	7,830	3,115	4,700	30.4	(14.4)	253.9	7.7	(7.5)	80.1	(3.7)	(5.2)	15.6	23.9	12.9
Holland	11,661	4,360	10,907	19.6	7.0	189.1	5.1	(4.4)	62.4	1.7	3.1	16.2	19.3	6.2
Howell	12,797	4,802	4,430	25.6	4.8	232.6	5.6	4.9	65.1	2.2	2.5	12.8	26.4	5.4
Ionia	4,702	1,856	2,059	N/A	N/A	237.8	5.0		100.4	N/A	N/A	32.6	33.0	6.3
Iron Mountain	5,823	2,109	7,163	39.4	(12.6)	244.9	7.9	(8.0)	69.0	(3.3)	(4.7)	17.7	20.3	9.1
Iron River	1,779	659	2,287	N/A	N/A	247.0			69.8	N/A	N/A	16.3	26.7	13.1
Ironwood	3,316	1,077	4,996	N/A	N/A	184.1	(4.3)		52.9	N/A	N/A	11.7	15.1	8.9
Ishpeming	2,893	1,168	2,070	N/A	N/A	195.4	(4.2)		61.8	N/A	N/A	17.7	14.4	7.7
Jackson	26,112	9,332	20,290	30.8	12.7	238.5	6.6	7.2	70.3	3.4	2.4	13.9	20.0	14.2
Kalamazoo	52,957	19,843	32,194	15.5	6.6	159.9	3.6	4.6	54.9	1.7	1.3	13.8	18.0	7.6
L'Anse	2,973	1,179	1,953	N/A	N/A	275.9	(16.4)		103.4	N/A	N/A	15.6	30.5	10.3
Lakeview	1,079	448	612	N/A	N/A	208.5			81.3	N/A	N/A	16.3	37.7	6.4
Lansing	77,185	25,048	34,659	21.1	6.1	211.7	4.8	4.4	64.5	2.3	1.6	13.3	21.4	9.4
Lapeer	24,462	9,326	7,576	34.4	9.5	257.1	8.0	6.0	88.6	3.5	4.5	17.1	29.6	14.8
Laurium	2,863	1,158	2,910	N/A	N/A	243.8	(7.9)	(14.0)	82.7	N/A	N/A	24.4	23.4	9.0
Livonia	37,379	11,591	25,993	27.3	6.7	225.4	6.0	4.5	71.2	2.4	2.2	14.6	22.6	8.9
Ludington	6,835	2,547	5,244	23.0	(6.6)	193.7	4.6	(5.3)	48.4	(2.4)	(1.7)	11.1	19.0	3.6
Madison Heights	10,126	3,357	6,356	41.6	11.8	308.4	11.7	(5.8)	104.7	6.2	4.0	16.1	37.3	14.4
Manistee	4,572	1,550	3,860	N/A	N/A	228.8	7.8		70.9	N/A	N/A	14.2	27.3	8.2
Manistique	2,954	1,053	1,989	N/A	N/A	212.1			71.6	N/A	N/A	16.6	20.1	5.5
Marlette	2,181	887	985	N/A	N/A	251.7	(9.5)		93.7	N/A	N/A	12.6	31.4	4.0
Marquette	16,690	6,114	7,210	15.9	3.8	176.0	4.0	4.0	54.2	0.9	0.9	9.3	18.3	6.1
Marshall	6,061	1,995	2,885	N/A	N/A	188.5	4.6		62.8	N/A	N/A	21.1	15.3	5.5
Midland	15,794	5,662	10,426	33.2	6.8	204.8	6.1	3.7	60.1	2.1	2.8	16.2	19.4	6.1
Milford	25,860	9,030	7,983	31.6	10.0	261.2	7.1	5.4	85.0	3.1	4.1	15.6	28.0	14.3
Monroe	15,307	5,741	9,937	50.5	16.6	297.9	14.8	11.9	116.1	5.4	7.3	24.5	36.8	16.6
Mount Clemens	91,067	31,351	37,401	32.2	7.4	242.5	6.6	5.7	77.9	2.9	3.4	14.0	27.1	11.3
Mount Pleasant	12,984	5,012	4,159	20.5	18.3	231.7	5.1	10.1	81.5	1.9	2.4	15.1	26.2	9.8
Munising	1,474	548	1,033	N/A	N/A	253.1	(9.1)		61.9	N/A	N/A	7.9	21.6	6.6
Muskegon	31,566	12,637	23,941	19.9	7.7	169.1	4.0	5.0	54.1	1.9	2.2	12.5	19.6	6.9

HSA City	Adult BCBSM Members Included in Data Analysis (1997)	Child BCBSM Members Included in Data Analysis (1997)	Medicare Enrollees (1996)	Medical Admissions per 1,000 Adult BCBSM Members (1997)	Medical Admissions per 1,000 Child BCBSM Members (1997)	Medical Admissions per 1,000 Medicare Enrollees (1996)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Adult BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Child BCBSM Members (1997)	Admissions for Ambulatory Care Sensitive Conditions per 1,000 Medicare Enrollees (1996)	Admissions for Respiratory Conditions per 1,000 Adult BCBSM Members (1997)	Admissions for Chest Pain Pneumonia per 1,000 Medicare Enrollees (1997)	Admissions for Bacterial Pneumonia per 1,000 Medicare Enrollees (1996)	Admissions for Congestive Heart Failure per 1,000 Medicare Enrollees (1996)	Admissions for Chronic Obstructive Pulmonary Disease per 1,000 Medicare Enrollees (1996)
Newberry	2,748	1,020	1,665	N/A	N/A	284.2	(4.6)		83.0	N/A	N/A	15.1	17.8	7.2
Niles	6,393	2,173	8,315	N/A	N/A	212.9	5.5	(6.0)	65.3	N/A	N/A	15.0	21.8	10.0
Northport	600	191	453			196.1			46.2			14.2	19.8	6.6
Ontonagon	1,497	480	867	N/A	N/A	343.0	(13.8)		117.6	N/A	N/A	22.2	37.5	7.9
Owosso	17,052	6,357	7,650	31.4	9.0	212.1	7.3	6.9	63.6	2.7	3.9	10.7	19.2	12.1
Paw Paw	5,017	1,933	3,479	N/A	N/A	219.5	5.2		75.6	N/A	N/A	17.0	26.3	8.9
Petoskey	22,880	8,671	10,932	20.1	6.8	188.9	4.0	5.1	56.5	1.6	1.3	12.9	18.7	5.6
Pigeon	1,900	638	1,752	N/A	N/A	199.8	(8.4)		68.5	N/A	N/A	15.8	18.5	11.7
Pontiac	94,047	29,501	29,644	32.8	10.4	252.7	8.2	7.3	83.4	3.4	4.0	14.9	27.1	12.6
Port Huron	37,385	14,721	17,847	27.4	9.3	222.9	7.8	6.5	83.3	3.5	2.9	18.2	25.4	10.7
Reed City	5,858	2,336	3,573	N/A	N/A	260.2	9.3	(6.2)	87.0	N/A	N/A	13.2	27.6	10.1
Rochester	32,223	10,197	10,227	26.4	9.0	238.8	5.0	5.6	73.9	1.8	2.8	14.0	24.5	9.6
Royal Oak	84,577	26,353	47,091	26.0	6.4	206.1	4.9	3.8	56.1	2.1	2.0	9.8	20.9	6.0
Saginaw	60,296	20,781	29,186	34.4	10.1	231.4	7.5	6.9	75.3	3.2	3.6	14.1	26.1	11.7
Saline	2,748	987	1,207	N/A	N/A	212.7	(5.3)		60.2	N/A	N/A	11.0	25.6	7.5
Sandusky	2,599	1,065	1,196	N/A	N/A	287.7	(14.2)	(16.1)	123.7	N/A	N/A	24.1	37.4	12.4
Sault Ste Marie	11,653	4,756	4,427	18.5	4.8	202.8	4.6	3.7	68.4	1.7	3.1	15.2	18.1	6.1
South Haven	4,129	1,569	3,308	N/A	N/A	200.0	3.7		73.0	N/A	N/A	17.5	22.1	11.2
Southfield	11,749	3,064	8,163	33.5	(4.9)	236.2	7.2	(4.6)	69.9	2.9	1.4	15.4	21.0	8.1
St. Clair	7,999	2,751	3,973	29.1	(5.9)	242.3	7.6	(4.8)	96.8		(5.2)	20.3	25.8	18.4
St. Johns	3,920	1,398	1,820	N/A	N/A	170.9	5.8		53.0	N/A	N/A	9.8	17.7	6.0
St. Joseph	16,634	5,741	14,533	N/A	N/A	187.2	6.6	5.2	54.7	N/A	N/A	11.3	18.6	7.7
Standish	3,627	1,493	1,660	N/A	N/A	288.5	(11.9)		102.8	N/A	N/A	14.9	36.0	16.8
Sturgis	4,030	1,568	3,574	19.6		225.9	6.8		81.9	(3.8)		18.2	24.0	12.5
Tawas City	10,569	3,858	7,496	31.2	10.4	209.7	8.4	(7.5)	77.6	3.5	3.0	14.0	25.4	9.2
Taylor	10,976	3,737	6,206	48.5	15.0	341.0	14.6	(8.3)	137.8	4.7	6.2	21.3	41.7	28.8
Tecumseh	5,594	2,131	2,708	34.7	(6.6)	246.7	9.7		84.1	(3.9)	(5.9)	19.2	26.1	7.4
Three Rivers	5,470	2,128	3,932	N/A	N/A	198.6	6.5		61.1	N/A	N/A	19.7	10.6	7.9
Traverse City	38,548	14,489	20,499	21.5	5.9	201.7	4.4	3.8	57.2	1.6	2.3	10.7	20.3	8.2
Trenton	18,266	6,064	8,766	33.4	8.7	262.6	8.2	5.0	83.0	3.1	4.4	13.5	29.1	11.6
Troy	32,064	9,956	10,876	25.2	7.3	229.0	5.7	4.9	70.2	2.6	1.7	12.6	25.3	8.7
Warren	51,075	15,341	37,292	33.6	6.0	253.7	7.8	4.1	84.9	3.0	2.7	14.1	34.3	9.9
Watervliet	2,256	879	1,849	N/A	N/A	268.7			88.5	N/A	N/A	27.5	24.1	12.0
Wayne	25,963	8,604	17,844	49.4	11.1	300.5	12.4	6.8	109.7	5.2	6.5	19.9	34.5	18.0
West Branch	9,337	3,484	6,388	45.3	4.5	270.9	13.4	(4.2)	92.5	5.0	10.1	11.5	28.7	12.5
Wyandotte	22,263	7,460	20,123	38.2	11.5	281.2	10.3	6.8	105.1	3.7	4.4	18.3	43.0	11.9
Zeeland	2,177	1,052	1,961	N/A	N/A	194.0	(8.0)		51.3	N/A	N/A	10.1	22.3	3.5
Michigan	1,978,316	687,898	1,146,313	29.0	8.1	227.6	7.1	5.6	74.3	2.8	3.0	14.8	24.7	10.2

