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HEALTH CARE DEMAND IN MICHIGAN:
AN EXAMINATION OF THE MICHIGAN CERTIFICATE OF NEED
ACUTE CARE BED NEED METHODOLOGY

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Mark Jeffrey Finn

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Master of Arts degree in Geography

Major Professor's Signature

30 Oct 07

Date

HEALTH CARE DEMAND IN MICHIGAN: AN EXAMINATION OF THE MICHIGAN CERTIFICATE OF NEED ACUTE CARE BED NEED METHODOLOGY

By

Mark Jeffrey Finn

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ABSTRACT

HEALTH CARE DEMAND IN MICHIGAN:
AN EXAMINATION OF THE MICHIGAN CERTIFICATE OF NEED
ACUTE CARE BED NEED METHODOLOGY

By

Mark Jeffrey Finn

Health care demand, or the demand of a health care system for facilities and services based on a measurement of a population's health care need, in Michigan is defined by the Michigan Certificate of Need Commission under its acute care bed need methodology and administrated by the Michigan Department of Community Health (MDCH). Michigan's current acute care bed need methodology was last redefined in 1978 and has since been recommended by one of its co-creator to be abandoned. This thesis presents a detailed background investigation of the history of Michigan's acute care bed need methodology and employs geospatial analysis techniques to examine the methodology using the Michigan Inpatient Data Base (MIDB): a database of every acute care hospital discharge in Michigan between 2001 and 2005. Results indicate the current bed need methodology is not defining an acute health care system that reflects patient utilization trends. Uncertainty in the acute care bed need methodology is introduced by the input of committees to interpret results, the sole use of the MIDB for utilization data, and the reliance on the 5-digit ZIP code as the primary geographic unit of analysis. A new acute care bed need methodology should be created in Michigan which should: 1) focus on the reduction of beds; 2) redefine the existing criteria for the movement of beds to other licensed sites; 3) incorporate measures of geographic access; 4) integrate outpatient discharges; 5) and include forecasts of related admissions and procedures.

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This thesis is dedicated to my wife Heather whose sacrifices, which were realized by our loss of precious time together, were for me the most humbling and painful of all.

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Images in this thesis are presented in color.

1 Introduction

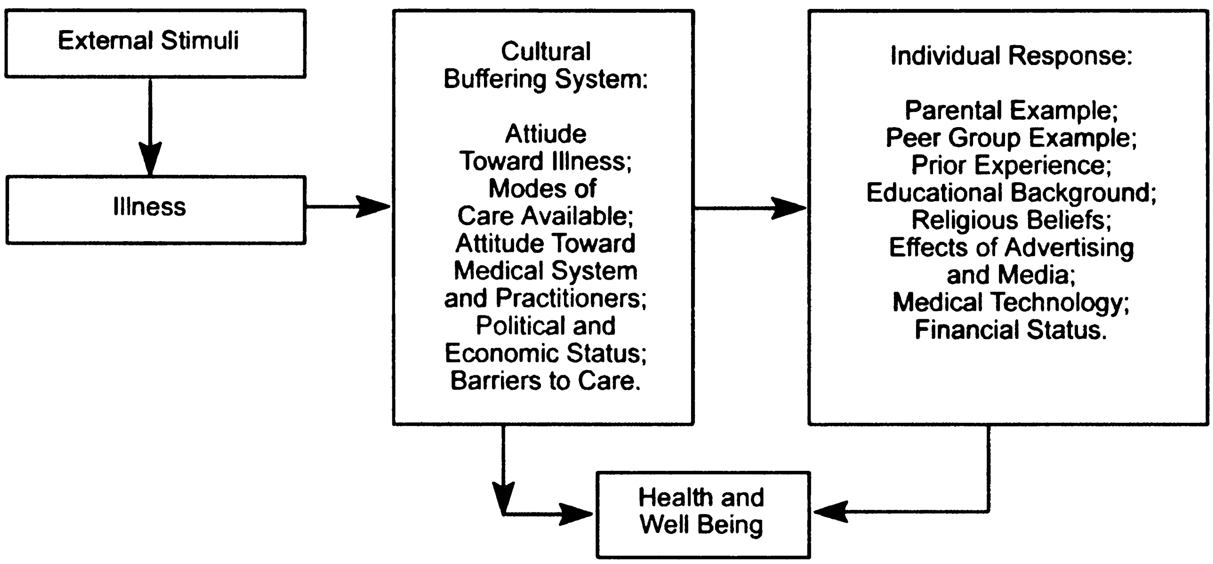
1.1 Introduction

Health care is the provision of services and supplies by agents of the health services or professions to individuals or communities with the express goal of achieving an optimal state of well-being. A study of total health care would include consideration for housing, nutrition, education, employment, politics, and other topics all of which underlie 'quality of life' and together promote or damage 'health' (Joseph and Philips 1984). The definition of health care used here focuses on primary health services or 'ill-health' services. Specifically, health care is used to describe the utilization of acute care provided by general hospitals. Acute care refers to medical services for patients with or at risk for acute or active medical conditions in a variety of ambulatory and inpatient settings (Gourevitch, Caronna, and Kalkut 2005).

A health care system is the organizational structure by which health care is provided. From a health care planning perspective, an ideal health care system provides an entire population with access to the broadest possible range of quality health services to prevent disease, promote wellness, and improve quality of life at reasonable costs and geographic efficiency (Michigan Department of Community Health 2007). From a medical geography perspective, an ideal health care system would precisely locate health care services and resources over space based on a clear understanding of future health care demand to provide optimal, potential accessibility to a population while overcoming all physical and socio-economic barriers.

Health care provision is complex and difficult to effectively manage. A health care system includes practitioners, administrators, researchers, facilities, specialized services and equipment, suppliers, private and public funding, international, federal and state regulation, political and business interests, Health Maintenance Organizations (HMOs), purchasers and payers of health care services, and health care consumers.

A health care delivery system must account for many interacting elements such as disease agents, hosts and vectors; cultural, economic, and environmental conditions; caregivers, insurance, government regulation, human behavior, and intervention (Fig. 1).



Interaction of the basic elements of a health care delivery system; redrafted by Mark Finn, from Meade and Earickson 2000
Fig. 1

According to Hunter (1974), the locational planning of health services must take into account: (1) the scope of the services provided (based on disease surveillance and its spatial patterns in the locality or in the region); (2) a realistic view of resources, needs, and finance; (3) the geographical distribution of the population at risk; (4) the projected population changes through natural increase or decrease and migration; and (5) disease forecasting.

Health care need and demand are not the same. In an ideal world, health needs should generate an appropriate demand, which then could be supplied in a systematic way by a health care delivery system. Black (1983) explained why this was not the case in reality: since actual health care needs are distorted by faulty perceptions, there is often little relationship between perceived needs and demand; and supply does not match need or demand. Demand is usually based on a measurement of utilization. Utilization is evidence that access to health care services has been achieved (Fiedler 1981). Demand vis-à-vis access is impacted by age, sex, ethnic origin, socioeconomic status, and insurance (Rothberg 1982; Anderson 1973; Ringel 2002); ecological factors such as distance and travel time (Shannon, Bashshur, and Metzner 1969; Acton 1975; McGuirk and Porell 1984); and individual factors such as patient behaviors and physicians' practices (Anderson and Newman 1973; Eisenberg 2002).

The focus of this research is on health care demand, the demand by a health care system for services based on a measurement of a population's health care need, limited to the State of Michigan. Health care demand in the majority of states is defined by the state government through hospital certificate-of-need regulation (CON). Michigan first enacted its CON law in 1972 as Public Act 256. CON law in Michigan is regulated by the Certificate of Need Commission and administered by the Michigan Department of Community Health (MDCH) Certificate-of-Need Division. Federal support of CON ended in 1986 with the repeal of the National Health Planning and Resources Development Act mainly due to concerns it had failed to reduce the nation's aggregate health care costs. Three years prior, 1983, Congress had passed legislation to move away from health care planning regulation to health care *fee* regulation to control the cost of

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health care. The Federal Government gave itself the authority under the diagnosis related group (DRG) system to establish the purchasing price for identifiable services for Medicare. Presently only fourteen states have eliminated their CON programs while the rest of the country's CON programs operate under state funding.

In a nationwide comparison of CON programs conducted by a consultant for the State of Washington, Michigan tied with North Carolina as having the most effective CON program in the country (Piper 2005). However at the state level, there has been concern about Michigan's CON Program. A 2002 performance audit of MDCH-CON conducted by the Auditor General of Michigan stated MDCH had failed to evaluate the state's CON Program in order to determine whether the CON Program was achieving its goal of balancing cost, quality, and access issues and ensuring that only needed services are developed in Michigan (McTavish 2002). MDCH responded to this audit by contracting Conover and Sloan of the Center for Health Policy, Law and Management at Duke University (nationally recognized experts in the field) to evaluate CON in Michigan (Conover and Sloan 2003). A follow-up audit report by the Auditor General of Michigan of MDCH-CON in 2005 indicated the Conover and Sloan report did not conclude whether the CON Program was achieving its stated program goal and MDCH still lacked measures to evaluate the performance of the CON program (McTavish 2005).

The primary objective of this research is to explore the efficacy of the methods used by the MDCH-CON to measure health care demand in the State of Michigan and to measure the efficiency of their existing methods of assessing demand to demonstrate the CON Program is achieving its goal of balancing cost, quality, and access and eliminating duplicative services. The questions this research is designed to address are:

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1. How do the current methods used by MDCH-CON represent real demand?
2. What is the level of uncertainty of these methods and what are the sources of the uncertainty?
3. How might demand measures be methodologically improved?

There are established statistical methods (Diehr et al. 1999; Keeler and Ying 1996) and econometric methods (Drummond et al. 2005) for the evaluation of a hospital's and health care system's costs. The Dartmouth Atlas of Health Care has developed a method to assess health care quality using a population-based approach (Fisher and Wennberg 2003). There is also extensive literature on health care access (Fiedler 1981) including methods to measure access in medical geography (Guagliardo 2004; Joseph and Philips 1984; Thomas 1992; Ricketts et al. 1994; Albert, Gesler, and Levergood 2000) and epidemiology (Clement and Wan 2001); and methods to locate health care facilities to promote access in operations research (Rushton 1987; Rahman and Smith 2000; Toregas et al. 1971; Harper et al. 2005). Roemer's Law (Roemer 1961), a bed built is a bed filled or increasing supply will increase admissions or length of stay, has been the foundation of CON legislation to eliminate duplicative services in the interest of reducing costs and overutilization. The methods used by MDCH-CON to measure demand are largely a means to eliminate duplicative services. Potentially, methods used to measure competition and antitrust issues in health care systems could be used to identify duplicative services (see Sohn 2002; Schramm and Renn 1984).

It is unreasonable for a study of this size to address all the aforementioned complexities of health care, health care systems, *individual* demand, and locational planning of health care services to create an ideal health care system for the State of

Michigan, but the fundamental issue of demand for health care services by a health care system can be addressed. Hence, assumptions must be made concerning variables outside the scope of this research. This thesis will evaluate MDCH-CON's methods for defining Michigan's health care demand for general hospitals based on acute care hospital bed need (Certificate of Need Commission 2007b). MDCH-CON methods utilize hospital discharge records recorded in the Michigan Inpatient Data Base (MIDB) and total population estimates and projections by ZIP code from the U.S. Census for a given planning year. These methods place an emphasis on planning with reference to a demonstrated demand by assuming past hospital utilization shed light on future usage. For the purposes of evaluating Michigan's methods to define health care demand, this thesis will adopt those methods' assumptions and limit its scope of variables to those found in its datasets.

This thesis is organized to provide the reader with an understanding of the problem and the methods used to solve it. The remainder of Chapter 1 is a literature review providing a background on medical geography and health care utilization, the history of health care planning and CON, Michigan CON, a discussion on the measurement of demand, and Michigan's acute care bed need methodology over time. Chapter 2 introduces the methods used in this study to examine Michigan's acute care bed need methodology. Chapter 3 presents the results of this examination and discussion. Chapter 4 closes with an overview of the thesis, major findings, and suggestions for future research.

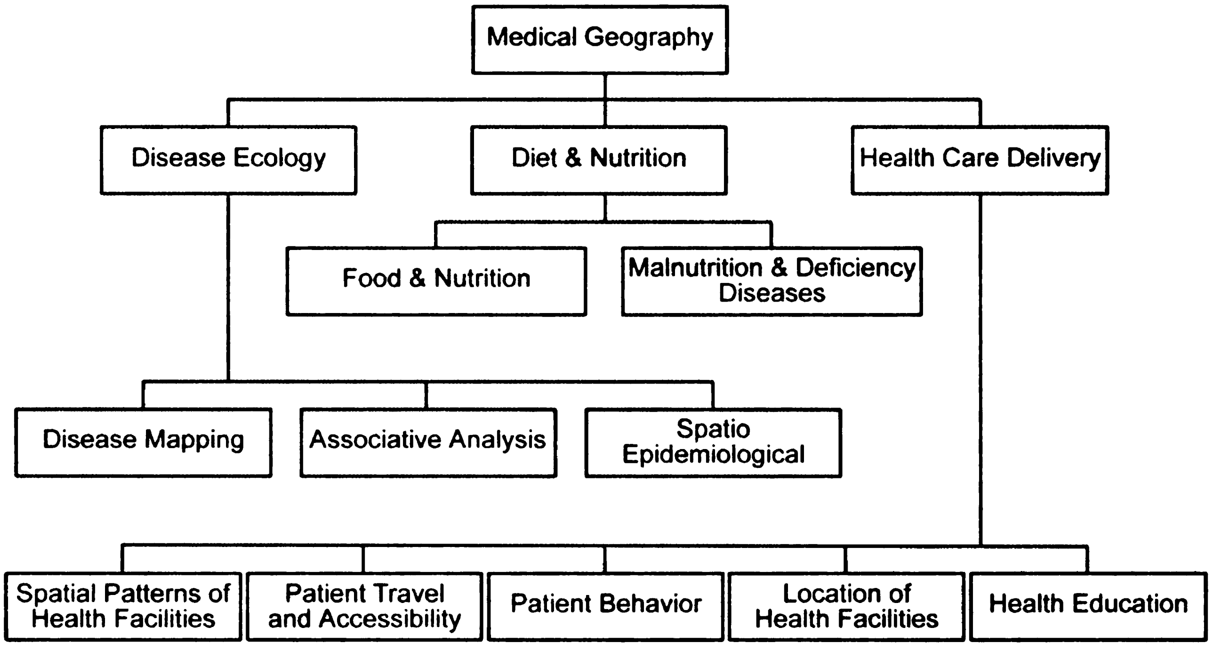
1.2 Literature Review

The first section discusses medical geography and health care utilization. The second section presents an overview of the history of health care planning and Certificate of Need (CON). The third section discusses Michigan CON. The fourth section provides an overview of the measurement of demand. The final section discusses Michigan's acute care bed need methodology over time.

1.2.1 Medical Geography and Health Care Utilization

Medical geography is the "geographical analysis of health, disease, mortality, and health care" (Johnston et al. 2000). It is an "integrative, multistranded subdiscipline" drawing freely from other social, physical, and biological sciences (Meade and Earickson 2000). The concept of geography in health has been present since the Hippocratic School's book "On Airs, Waters and Places" in the fifth century B.C. (Barrett 1980). Hippocrates' ecological perspective on health and disease continued to be philosophically important, even dominant, until the emergence of germ theory in the later half of the nineteenth century (Meade and Earickson 2000). The term, medical geography, did not appear in literature until Leonhard Ludwig Finke used it in 1792 in a three volume study, "Attempt at a General Medico-Practical Geography [Versuch einer allgemienen medicinisch-praktischen Geographie]" (Finke 1792-95). Other eighteenth and nineteenth century physicians carried on the Hippocratic tradition; their explanation of disease distribution and etiology and the beginnings of disease mapping have been researched extensively by Barrett (1980, 1991, 1993, 1996, 1998).

Despite its early origins, medical geography never experienced an explosive growth until the late 1970s and early 1980s (Meade and Earickson 2000). Figure 2 presents a classification scheme of the studies of general interest in the field of medical geography.



Classification scheme for the studies of general interest in medical geography; redrafted by Mark Finn, from Akhtar 1982.
Fig. 2

In the early 1990s, an epistemological and methodological debate in the discipline over the role of PLACE in medical geography resulted in a push for a "post-medical" geography of health (Kearns 1993, 1994a, 1994b; Kearns and Moon 2002; Paul 1994; for an overview of earlier debates in medical geography see Barrett 1986). This resulted in a division within the discipline between medical geography and health geography. *Health geography*, or the *geography of health and health care*, is "a sub-discipline focused on the dynamic, and recursive, relationship between health, health services, and PLACE, and on the impact of both health services and the health of population groups on the vitality of places" (Johnston et al. 2000). The adoption of the biomedical model of disease by conventional medical geographers has been the main critique by health geographers of medical geography. Critics argue that a socio-ecological model is needed to replace biomedicine. I will adopt a medical geography theoretical approach for this thesis.

The study of health care under medical geography, or the *geography of medical care*, emerged in the 1960s by medical geographers who felt the spatial organization of health institutions in an area were more important to study than disease ecology due to these institutions' important role in the persistence and elimination of diseases (Akhtar 1982). The geography of medical care had as Shannon (1980) put it "somewhat ignoble beginnings" in the covers of the "American Journal of Insanity" compared to the aristocratic-Hippocratic roots of medical geography. Edward Jarvis observed in 1851 that "the people in the vicinity of lunatic hospitals send more patients to them than those at a greater distance" (Jarvis 1851). This observation of distance decay in rates of utilization has since been referred to as 'Jarvis' Law' (see chapter 7 "Jarvis' Law and the Utilization of Mental Health Care" in Joseph and Phillips 1984).

Literature on health care delivery in the geography of medical care has identified many factors outside basic geographic proximity to hazards and epidemiology that influence health care utilization. Factors include:

Demographics. The ratio of women to men in a population will affect utilization of health care services. Studies have consistently shown women use more health care services than men (Cleary, Mechanic, and Greenley 1982; Hibbard and Pope 1983; Waldron 1983; Verbrugge and Wingard 1987; Bertakis et al. 2000).

It has long been believed that an aging population results in higher utilization of health care services. This has not been the case in some recent literature on acute care utilization (Reinhardt 2003; Busse, Krauth, and Schwartz 2002). Age is associated with an increase in the prevalence of chronic conditions and functional limitations. The elderly do have a higher rate of utilization for many procedures and are prescribed more drugs which may reduce the prevalence of other conditions (Bernstein et al. 2003), but it remains arguable whether overall acute care utilization does or does not increase.

Race and ethnicity influence utilization rates. Racial and ethnic disparities in health care have been extensively documented. Minority race or ethnicity has been linked to a reduced regular source of care (CDC 1998), fewer physician visits, and lower total expenditures on health care services (Fiscella, Franks, and Clancy 1998). Appreciable disparities also exist in health-care by race, Hispanic ethnicity, and English fluency (Fiscella et al. 2002).

It is difficult to isolate racial and ethnic disparities in health care from socioeconomic disparities due to their close intertwining in American society (Navarro 1990). However, research has shown socioeconomic position appears to be more of a determinant in health care utilization (Mutchler and Burr 1991; Fiscella et al. 2000). Lower socioeconomic position is associated with lower overall health care use, even among those with insurance (Fiscella, Franks, and Clancy 1998; Newacheck, Hughes, and Stoddard 1996; Wood et al. 1990; Fiscella et al. 2000).

Insurance. An individual's access to third party payment methods such as private insurance, Medicare, and Medicaid enable utilization by providing individuals with a better ability to purchase health care. However, insurance through managed care programs such as Health Maintenance Organizations (HMOs) and Preferred Provider Organizations (PPOs) can prevent utilization through cost controls which offer volume price discounts for physicians, gatekeeper restraints on specialty consultations, drug

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formularies, prior authorization of tests and admissions, and retrospective denial of payment for unnecessary services (Zelman and Berenson 1998).

Interrelationships between the utilization of health care and the demand for health insurance exist such as: (1) if the cost of out-of-pocket costs for care in a health plan fall, more individuals will enroll, and those already enrolled will make use of additional services; (2) individuals with poor health tend to choose insurance with high benefits, individuals with good health avoid such insurance due to its high cost; (3) the presence of insurance can undermine an individual's incentive to pursue health services, or since insurance shields the individual from paying for the full cost of services, the individual consumes more services than if he or she had no insurance (Ringel et al. 2002; Zweifel and Manning 2000).

Distance and Travel Time. There is a distance decay in rates of utilization known as 'Jarvis' Law' (see chapter 7 "Jarvis' Law and the Utilization of Mental Health Care" in Joseph and Phillips 1984). Individuals who are closer to health care services are more likely to utilize them. Distance and travel time from a patient's home to a facility has been found to be an important variable in differences in utilization (Shannon, Bashshur, and Metzner 1969; Acton 1975; McGuirk and Porell 1984). Individuals seeking specialized treatment are more willing to travel further than for primary and preventive services (Simon and Smith 1973).

Behavior. Social and perceptual variables influence an individual's utilization of health care services. Health perceptions define how individuals perceive their health whether they perceive that they are healthy or ill (Davies and Ware 1981). Psychological distress influences health perceptions and may result in healthy individuals developing

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symptoms that result in health-related concerns and a diminished sense of well-being (Manning and Wells 1992).

A review of 30 studies on health care utilization indicated that religion created significant differences in utilization rates (Schiller and Levin 1988). Advertising also influences individual behavior to pursue health care. Concerns over Direct-to-Consumer advertising and their effects on health care have emerged in 2002 in the New England Journal of Medicine (Rosenthal et al. 2002; Holmer 2002).

Medical Advancements and Changes in Medicine. Medical and technological advancements in health care have both reduced and encouraged utilization. For example, antibiotics and public health initiatives have dramatically reduced the need for services to treat infectious diseases. However, other factors, such as increases in the prevalence of chronic disease, may contribute to increases in overall utilization. New procedures and technologies, therapeutic technologies such as corrective eye surgeries, elective cosmetic surgery, and the direct marketing of drugs may increase utilization. Decreasing supply (hospital closures, large number of physicians retiring), ambulatory surgery, alternative sites of care (assisted living), and changes in practice patterns (encouraging self-care and healthy lifestyles; reducing length of hospital stay) reduce utilization (Bernstein et al. 2003).

Physicians. Individual physician decision making has a substantial influence on the utilization of medical services (Eisenberg 2002). Physicians control referrals, return visits, entry to hospitals, and access to prescribed medicines. The patient does not have sufficient knowledge to evaluate the quality and extent of services supplied and must rely on the physician to make decisions. There has been debate over whether physicians

actually influence demand in their own self interest, and models have been created to identify this supplier-induced demand (Feldman and Sloan 1988; Rice and Labelle 1989; Grytten and Sorensen 2001).

Although spatial analysis techniques applied to medical geography have existed for decades, in recent years the application of Geographic Information Science has become a new focus in the geography of medical care and medical geography in general (Albert, Gesler, and Levergood 2000; Cromley and McLafferty 2002; Lawson and Kleinman 2005; McLafferty 2003). Medical geography, as with U. S. geography as a whole, is perceived fragmented and yet to identify its core and focus on its future (Meade and Earickson 2000). In their conclusion on the section entitled "The Course of Medical Geography", Meade and Earickson (2000) conclude quoting John Hunter (1974);

> *The application of geographical concepts and techniques to health-related problems places medical geography, so defined, in the very heart or mainstream of the discipline of geography. I would suggest that there is no professional geographer, whatever his or her systematic bent or regional interest, who cannot effectively apply a measure of his or her particular skills or regional insights towards the understanding, or at least partial understanding, of a health problem. This is the essential challenge of medical geography.* (pp. 3-4)

1.2.2 History of Health Care Planning and CON

In the 1920s and 1930s the intellectual foundations of health care planning began in the United States through philanthropically supported programs promoting rural health care and later urban programs (Melhado 2006a). Influenced by the British humanitarian movement of the eighteenth century, United States health care was characterized by

voluntary charitable organizations and philanthropy for over two hundred years (Duffy 1990). Private philanthropy dominated medical education and research until 1940 and was the principle source of capital for hospital construction until the mid-1960s (Rosen 1965; Terenzio 1978). Planning was a private, voluntary effort on the part of hospital administrators and financers. The Great Depression and Second World War greatly affected health care capital availability as private and public giving declined (Terenzio 1978).

With the creation of the Blue Cross, the first major provider of hospitalization insurance, in the 1930s, the modern hospital system was founded on voluntary prepayment of hospital costs through private health insurance. Health insurance provided hospitals with an alternative to private philanthropy for financial support. It also moved the American health care system substantially toward realizing two major aspirations: (1) that everyone should have access to high quality medical care without barriers based on an individual's ability to pay; and (2) that all health care should be based on the most advanced scientific methods of treatment (Payton and Powsner 1980).

The cost of health care skyrocketed in the United States with more people being able to afford services and hospitals increasing their rates to pay for equipment for new advanced treatment methods: between 1929 and 1960 per capita medical expenditures went up 5 percent per year, between 1940 and 1960 the percentage of the civilian population with some form of voluntary health insurance septupled, and from the late twenties to the late fifties the average annual number of physician visits per person nearly doubled (Lerner and Anderson 1963).

"Hierarchical regionalism" is a phrase introduced by Fox (1986a) to summarize three assumptions that were the basis of policy for the organization of health services in the United States. These assumptions are: (1) the causes of and cures for most diseases are usually discovered in the laboratories of teaching hospitals and medical schools; (2) these discoveries are then disseminated down hierarchies of investigators, institutions, and practitioners, which serve particular geographical areas; (3) a central goal of health policy is stimulating the creation of hierarchies in regions which lack them and making existing ones more efficient. Hierarchical regionalism was the fundamental basis of policies to plan, build, and equip hospitals in the United States since the 1940s. It manifests itself in America's hierarchical health care system, focused on urban centers and their medical schools and research hospitals, with community hospitals in smaller towns, and rural clinics out in the periphery (see also Fox 1986b).

In 1946, the Hospital Survey and Construction Act (Public Law 79-725), popularly known as the Hill-Burton Act, was the first federal legislation attempting to organize the U.S. health care delivery system. The Hill-Burton Act was a state-federal partnership that subsidized the construction of mainly rural hospitals in "needy" areas. Need was defined as a bed-to-population ratio. The Hill-Burton Act led to the establishment of many state health planning agencies and forced states to identify general hospital service areas as a condition for funding of hospital construction (Meade and Earickson 2000): furthering hierarchical regionalism in American health care planning. The Hill-Burton Act required two-thirds financing from nonfederal sources which provided an initiative for fund-raisers to seek contributors for capital projects and acted as a catalyst in attracting funds from philanthropists (Terenzio 1978). However, the demand for hospitals in the postwar period resulted in a rapid growth of voluntary hospitals built without federal assistance in disregard of state plans set forth under the Hill-Burton Act. This resulted in the over allocation of beds in certain areas, shortages in others, and an enormous amount of duplication (Stevens 1971).

It was not until health insurance became widely available in the mid-1950s that rising hospital costs began to be perceived nationally as an inherent problem of the hospital industry. Hospital leaders feared the public criticism and loss of legitimacy as a voluntary system serving the public interest would result in governmental controls. As a result of the contradictory demands of providing better and more accessible health care services while keeping costs down, hospitals undertook planning as "a form of altruistic self-limitation in the public interest" and pushed for a national planning movement (Melhado 2006a).

Passage of federal Medicare and Medicaid legislation in 1965 brought on a near-crisis in public finance and led the federal government to take an active role in health care planning by encouraging the creation of state and regional planning agencies through the Comprehensive Health Planning Act of 1966 which offered various grants for studies and health demonstrations (Payton and Powsner 1980). Policy makers attempted to restrain the rate at which health care costs increased as they did in the past using strategies of hierarchical regionalism. These attempts included mandated peer review of the inpatient services physicians ordered for Medicare patients, incentives to create health maintenance organizations, the establishment of state and regional planning organizations, and Certificate-of-Need programs to inhibit new hospital construction and regulate the diffusion of new expensive medical technology (Fox 1986a).

Certificate-of-Need (CON) began as a community health planning council composed of local businesses and the Blue Cross[1] to evaluate the need for hospital beds in Rochester, New York. This council led to the passage of the first CON legislation by the State of New York in 1966 (Citizens Research Council of Michigan 2005). Certificate-of-Need (CON) programs attempted to control costs by regulating supply (McGinley 1995). The intent of CON *regulation* was to control health care costs by limiting expenditures for new health care facilities and equipment, preventing duplication and unnecessary use of expensive and sophisticated services, and increasing the quality of health care procedures (Michigan Legislative Service Bureau 2002). CON regulations were also intended to ensure adequate access to health care services. A CON *program* is established by state law. It requires health care service providers to demonstrate a need (defined by law or regulation in that state) for the creation, upgrading or modernization, expansion, relocation and acquisition of services and beds (Citizens Research Council of Michigan 2005). By 1968, the American Hospital Association publicly supported CON laws and began lobbying efforts to encourage CON regulation across the United States (Havighurst 1973). In seven years, thirty states had enacted CON regulations including Michigan (Fig. 3). Many of these state regulations were brought about by the lobbying efforts of hospitals which profited from state regulations by restricting the entry of competitors into their markets (Wolfson 2001).

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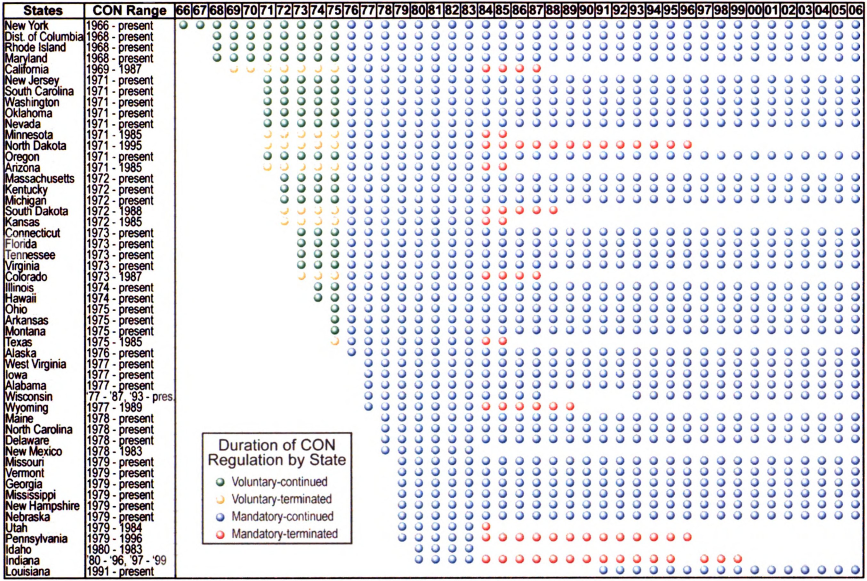
[1] The Blue Cross dominated the health care market as the majority of non-profit hospitals relied on them for financial support (Payton and Powsner 1980). Around the time CON legislation was passed in Michigan, the Blue Cross financed 55 percent of all health care in Michigan, had agreements with over 90 percent of Michigan Hospitals, had legislative authority to withhold its participation from any licensed hospital on the basis of need (deprived of authority by Public Act 233, 1972), and consequently had the power to force hospitals out of business who did not participate in Blue Cross (House Fiscal Agency 1974).

Duration of CON regulation by state; Redrafted by Mark Finn, from American Health Planning Association 2004. From 1966 to 1975, 30 states voluntarily started CON prior to the beginning of federally mandated CON under the National Health Planning Act. Of those 30 states, eight voluntarily terminated their programs after the end of these mandates in 1983. Of the remaining 20 states, six states terminated their CON after mandates ended.

Fig. 3


States
CON Range
66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
New York 1966 - present
Dist. of Columbia 1968 - present
Rhode Island 1968 - present
Maryland 1968 - present
California 1969 - 1987
New Jersey 1971 - present
South Carolina 1971 - present
Washington 1971 - present
Oklahoma 1971 - present
Nevada 1971 - present
Minnesota 1971 - 1985
North Dakota 1971 - 1995
Oregon 1971 - present
Arizona 1971 - 1985
Massachusetts 1972 - present
Kentucky 1972 - present
Michigan 1972 - present
South Dakota 1972 - 1988
Kansas 1972 - 1985
Connecticut 1973 - present
Florida 1973 - present
Tennessee 1973 - present
Virginia 1973 - present
Colorado 1973 - 1987
Illinois 1974 - present
Hawaii 1974 - present
Ohio 1975 - present
Arkansas 1975 - present
Montana 1975 - present
Texas 1975 - 1985
Alaska 1976 - present
West Virginia 1977 - present
Iowa 1977 - present
Alabama 1977 - present
Wisconsin '77 - '87, '93 - pres.
Wyoming 1977 - 1989
Maine 1978 - present
North Carolina 1978 - present
Delaware 1978 - present
New Mexico 1978 - 1983
Missouri 1979 - present
Vermont 1979 - present
Georgia 1979 - present
Mississippi 1979 - present
New Hampshire 1979 - present
Nebraska 1979 - present
Utah 1979 - 1984
Pennsylvania 1979 - 1996
Idaho 1980 - 1983
Indiana '80 - '96, '97 - '99
Louisiana 1991 - present
Duration of CON Regulation by State
Voluntary-continued
Voluntary-terminated
Mandatory-continued
Mandatory-terminated

The historical motives for CON regulation are complex and open to interpretation. According to Melhado (2006b): "What was in essence rationalization in the eyes of planners and their supporters was cartelization and self-serving in the eyes of their critics." Health planning agencies like CON determined the size of a community's hospital bed supply—a form of output restriction—and allocated areas of responsibility both geographically and by activity—creating market divisions (Havighurst 1973). Output restriction and market division are classic characteristics of a cartel (McGinley 1995). Payton and Powsner (1980) provide a scathing analysis of CON in Michigan consistent with the cartel characterization. Payton and Powsner argue the three objectives of CON were: (1) to restore public confidence in the voluntary hospitals and their financing arm, the Blue Cross, in order to deflect growing pressure for government regulation of hospital costs and government-sponsored compulsory health insurance; (2) to protect the dominance of the existing large voluntary teaching hospitals; and (3) to channel hospital growth in the developing suburbs into large, full-service, general hospitals. Further they argue areawide planning was used through CON by the Blue Cross to ensure dominance in the health care market by eliminating "cream skimmers[2]" and to ward off government action for control and/or socialized health care by demonstrating voluntary collective self-discipline. The presence of small hospitals in large urban areas was theoretically inconsistent with the tiered regional hospital model or, in other words, hierarchical regionalism.

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[2] "Cream skimmers" was a term given to small private hospitals offering lower than average costs for health care compared to larger hospitals. Larger hospitals need primary care patients to subsidize more expensive treatments for other patients, provide subjects for their teaching programs, and protect their market for referral services (Payton and Powsner 1980).

According to Havighurst (1973), the impact of third party payment and the prevalence of nonprofit firms may have provided dispensation for cartel-like behavior in the hospital industry. Third party coverage such as private insurance, Medicare, and Medicaid insulate consumers from concern regarding direct payment for services (Wolfson 2001). As a result, consumers could not be relied on to exert market discipline since suppliers could build new facilities and equipment knowing third party payers would cover their costs, and facilities were prone to the "medical arms race" in which hospitals competed for the best physicians, who in turn could attract patients (Conover and Sloan 2003). Research has shown increased competition in the health care services has the opposite effect of what is expected in conventional markets: hospital costs tend to be *higher* in areas with greater competition (Robinson and Luft 1987) and lengths of stay tend to be longer (Robinson and Luft 1988).

In 1974, the federal government passed the National Health Planning and Resources Development Act, Public Law 93-641 (National Health Planning Act) in response to the continuing escalation in cost of health care, growing concern over quality of care, and the emergence of national health insurance as a major policy issue (Werlin, Walcott, and Joroff 1976). The National Health Planning Act was enacted to establish a system for the regional planning of health services. The National Health Planning Act superseded the Hill-Burton Act and denied states funding from certain federal programs such as Medicare and Medicaid if the states did not have a state agency issuing certificates of need for new health care facilities and expenditures by 1980 (Cordato 2005). By 1980, every state had enacted CON regulation except Louisiana (later enacted in 1991) (Fig. 3).

Federal support for CON ended in 1986 with the repeal of the National Health Planning Act because of concerns it had failed to reduce the nation's aggregate health care costs and was beginning to produce detrimental effects in small communities[3] (McGinley 1995). It was left to the discretion of each state as to whether to continue with CON without federal support; many states did (Fig. 3). On the national level, health care planning had come to an end primarily due to its failure to control costs. Currently fourteen states have eliminated CON programs: Arizona, California, Colorado, Idaho, Indiana, Kansas, Minnesota, New Mexico, North Dakota, Pennsylvania, South Dakota, Texas, Utah, and Wyoming. Only Indiana and Wisconsin have restored CON following repeal. Since Ohio dropped CON for hospitals and all other services except long term care, the State has seen the construction of 150 additional surgery centers and 300 additional diagnostic imaging centers; the State of Ohio has since proposed bringing back their CON law for hospitals (Jackson 2002). Virginia was scheduled to eliminate its program in 2002, but retained it (Jackson 2002). For an in depth discussion of the decline of national health care planning, see Melhado (2006).

During the period of federal deregulation of health care planning in the 1980s, Congress discovered a new way to control the cost of health care: health care fee

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[3] Small communities considered CON insensitive to local community needs. Congressional Representative Rowland of the Eight District of Georgia expressed this to Congress at the time:

> *At first glance, the idea [of certificate-of-need] may have looked pretty good. In practice, the effect of certificate of need on health care costs has been dubious, at best. And the program has certainly been insensitive in many instances to the true needs of our communities.*
>
> *...The citizens of Putnam County are proud of their 20-year-old community hospital. They build it with local funding, without using any Federal Hill-Burton funds, and they still support it locally. They are proud enough to have recently approved a 1-cent sales tax to renovate the facility. They are not seeking an expansion. The hospital has always had 50 beds, and that's what they propose to maintain.*
>
> *However, when Putnam County authorities went to the State health planning agency for the required approval under the certificate of need program this year, they ran into unexpected trouble. The agency looked over the request for the locally funded hospital improvements and decided to deny it—unless the hospital eliminated ten beds.* (134 Cong. Rec. H9455-01 as cited in McGinley 1995)

regulation. In 1983, Congress passed legislation incorporating prospective payment into Medicare. Instead of reimbursing hospitals for the service costs set by the hospital, Medicare was now to pay a set flat fee for service, varying by type of diagnosis, arranged into 467 diagnosis related groups (DRGs). The DRG system gave the federal government the authority to establish the purchase price for identifiable services for Medicare beneficiaries (Stevens 1989). DRGs are still used today and are defined by the Health Care Financing Administration.

Health care in the 1990s was substantially altered by the rise of managed care as a method to finance and deliver health care over traditional insurance (Gaynor and Haas-Wilson 1999). Unlike traditional third party insurance which does not restrict either the provider or treatment choices of patients or doctors, managed care programs, such as Health Maintenance Organizations (HMOs) and Preferred Provider Organizations (PPOs), limit both provider and treatment to reduce costs. Managed care proposed to control costs through volume price discounts for physicians, gatekeeper restraints on specialty consultations, drug formularies, prior authorization of tests and admissions, and retrospective denial of payment for unnecessary services (Zelman and Berenson 1998). This led to increased price competition in certain areas; "creaming", the over-provision of services to low cost patients, "skimping", the under-provision of services to high cost patients, and "dumping", the explicit avoidance of high cost patients (Ellis 1998). Managed care caused other interrelated alterations in health care including the horizontal consolidation within markets for insurance, hospital services, and physician services and the blurring of the vertical distinctions between these markets (Gaynor and Haas-Wilson 1999).

Managed care was developed by employers, insurers, and some physician groups as a private sector alternative to governmental regulation (Robinson 2001). Managed care programs marketed themselves primarily to employers based on their ability to reduce the cost of health care benefits. In the past, third party insurance insulated consumers from considerations of cost and quality when choosing providers. Managed care programs restricted the consumer's access to health care and increased the role of employers in health care.

While managed care was an economic success, it was a cultural and political failure (Robinson 2001). The private health insurance industry in the United States changed its strategic focus, product design, and pricing policy as a result of the backlash against managed care (Robinson 2004). In the 2000s, the health care system became increasingly consumer driven. Robinson (2001) keyed the term *consumerism* as the new era of health care where consumer preference dictates the priority setting of health care. Robinson saw the rise of consumerism in the United States as evidence of the rejection of professional, governmental, and corporate mechanisms for allocating health care resources. This assertion is dubious for the entire United States because the majority of states still employ governmental mechanisms such as CON (Fig. 3). Several states abandoned CON due to its failure to control health care costs, but quality and access to health care played a greater role in Michigan CON than in other states in the initial decision to adopt CON and decisions made thereafter under CON regulation (Conover and Sloan 2003).

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1.2.3 Michigan CON

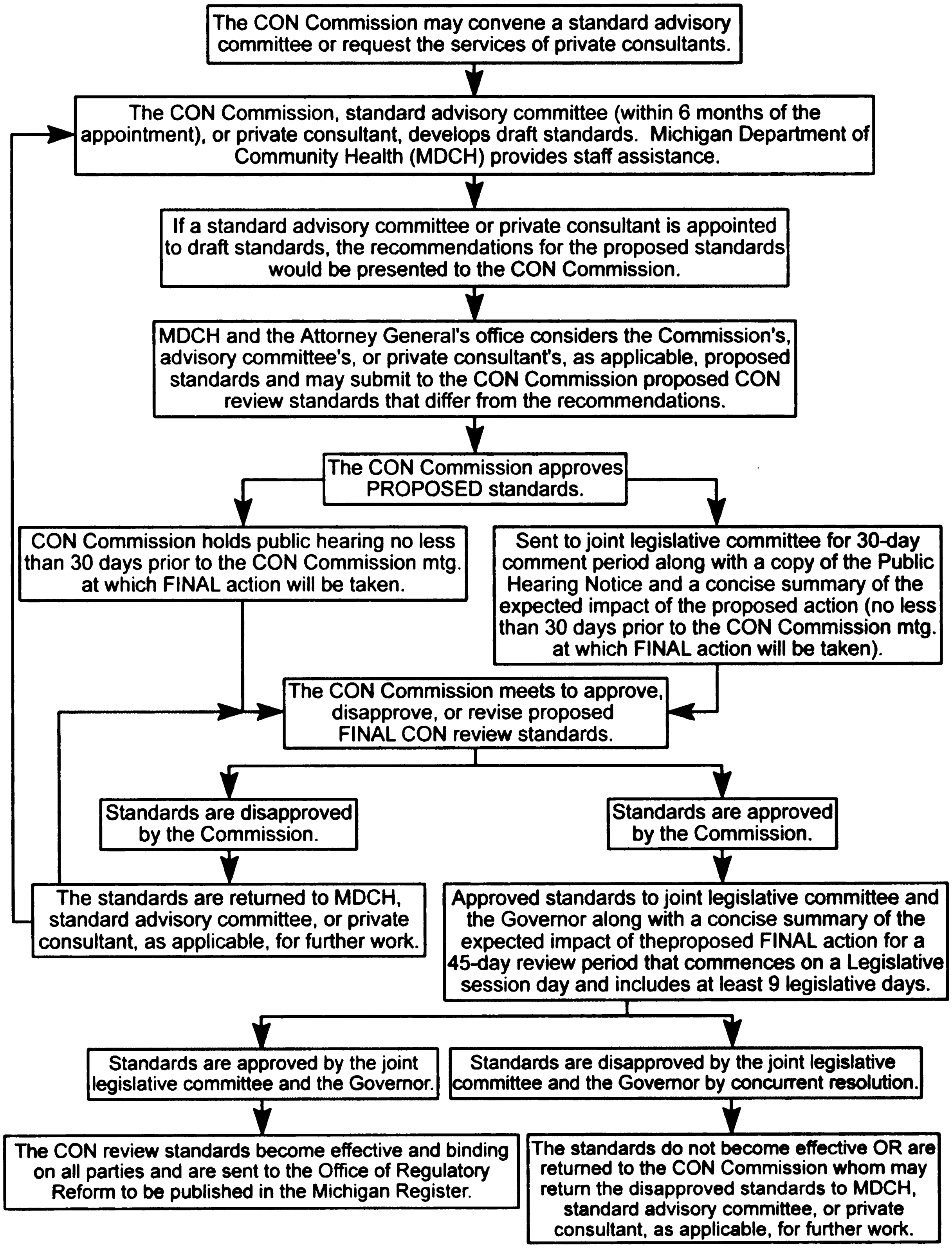
Michigan first enacted its Certificate of Need law in 1972 as Public Act 256. Over the years the law was amended several times (Michigan Legislative Service Bureau 2002). While the National Health Planning Act was repealed in 1986, Michigan's CON law was not. The goal of Michigan's CON Program is to balance cost, quality, and access issues and ensure only needed health services are developed in Michigan. The Program's ability to meet these goals was significantly affected by courts early on by overturning denied applications. To address this, Michigan's CON Reform Act of 1988 was passed to create a clear, systematic standards development process and reduce the number of services requiring CON approval. The Act also created the CON Commission, with membership appointed by the Governor and responsibility for approving CON review standards. The Commission also has the authority to make recommendations to revise the list of covered clinical services subject to CON review. The CON Section within the Michigan Department of Community Health is responsible for day-to-day operations of the program, including making decisions on CON applications consistent with the review standards set by the Commission. In 1993, additional amendments to the Act required ad hoc committees to be appointed by the Commission to provide expert assistance in the formation of review standards. The Act was amended again in 2002 expanding the Commission to 11 members, eliminating ad hoc committees, and establishing the use of standard advisory committees (SACs) or other private consultants/organizations for professional and technical assistance (Michigan Department of Community Health 2006).

The Commission consists of 11 members (five members from one major political party and six from another) appointed by the governor with the advice and consent of the Senate. The Commission must include:

- Two individuals representing hospitals
- One individual representing physicians engaged in the practice of medicine
- One individual representing physicians engaged in the practice of osteopathic medicine and surgery
- One individual who is a physician of a school of medicine or osteopathic medicine
- One individual representing nursing homes
- One individual representing nurses
- One individual representing a company that is self-insured for health coverage
- One individual representing a company that is not self-insured for health coverage (Certificate of Need Commission 2005)

Thus, two-thirds of the Commission are providers and about one-third are consumers/payers/purchasers (Citizens Research Council of Michigan 2005).

There are four SACs: Open Heart Standard Advisory Committee, Cardiac Catheterization Standard Advisory Committee, Nursing Home Standard Advisory Committee, and CT Standard Advisory Committee; and a new Medical Technology Advisory Committee (Certificate of Need Commission 2007a). The Commission may use SACs to assist in the development of proposed CON review standards (Fig. 4).



Process for developing Certificate of Need review standards; redrafted by Mark Finn, from Certificate of Need Commission 2007c

Fig. 4

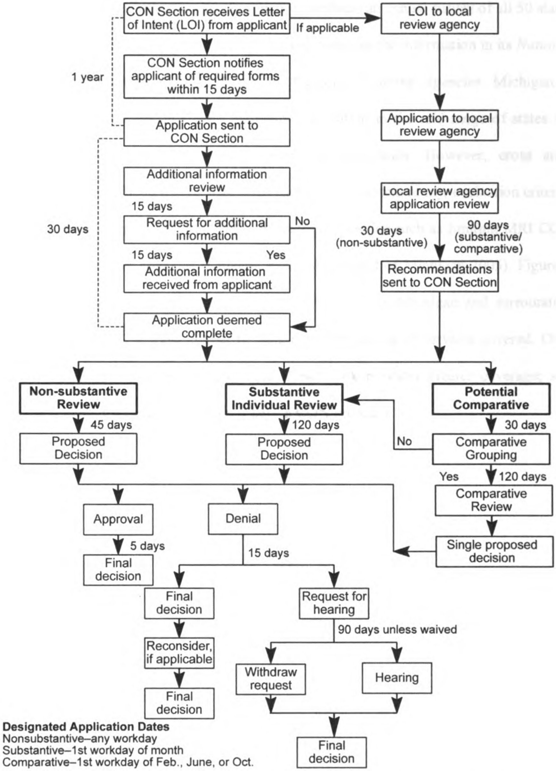
A person or entity is required to obtain a certificate of need, unless elsewhere specified in Part 222, for any of the following activities:

- Acquire an existing health facility or begin operation of a health facility at a site that is not currently licensed for that type of health facility.
- Make a change in the bed capacity of a health facility.
- Initiate, replace, or expand a covered clinical service.
- Make a covered capital expenditure (Legislative Council 2003).

The CON application process includes five steps (Fig. 5):

1. Letter of Intent filed and processed prior to submission of an application,
2. CON application filed on appropriate date as defined in the CON Administrative Rules,
3. Application reviewed by the Program Review Section,
4. Issuance of Proposed Decision by the Bureau in which the Program Review Section resides, (appeal if applicant disagrees with the Proposed Decision issued),
5. Issuance of the Final Decision by the MDCH Director (Michigan Department of Community Health 2006).

There are three types of CON review, each with an established time line by which MDCH CON Section must issue a proposed decision: nonsubstantive—45 days, substantive individual—120 days, and comparative—150 days (involving competitive applications for limited resources by two or more applicants) (Michigan Department of Community Health 2006).



Michigan Certificate of Need application review process; redrafted by Mark Finn, Certificate of Need Commission 2003
Fig. 5

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The American Health Planning Association conducts an annual survey of all 50 states and the District of Columbia CON Programs and compiles the information in its *National Directory * Certificate of Need Programs * Health Planning Agencies*. Michigan is classified by the American Health Planning Association in the mid-range of states for scope of CON coverage and monetary review thresholds. However, cross state comparisons are difficult due to state differences in service taxonomy, evaluation criteria, and state distinctions as to which entity provides the service such as limiting MRI CON coverage to inpatient hospitals (Citizens Research Council of Michigan 2005). Figure 6 presents a comparison of the services covered by CON in Michigan and surrounding states. Michigan is the most similar to Illinois in the number of services covered. Ohio and Wisconsin fall well below Michigan; New York provides greater coverage; and Indiana is excluded because it does not have a CON program.

Service	Michigan	Illinois	New York	Ohio	Wisconsin	USA
Diagnostic Equipment	4	2	5	0	0	
Cardiac Catheterization	•	•	•	•	•	32
CT Scanners	•	•	•	•	•	21
MRI Scanners	•	•	•	•	•	30
PET Scanners	•	•	•	•	•	24
Ultra-Sound	•	•	•	•	•	5
Surgical-Related	5	4	5	0	0	
Ambulatory Surgical Centers	•	•	•	•	•	30
Gamma Knives	•	•	•	•	•	25
Lithotripters	•	•	•	•	•	26
Open Heart Units	•	•	•	•	•	34
Organ Transplant Units	•	•	•	•	•	24
Other Acute Care	7	10	11	0	1	
Acute Care Services	•	•	•	•	•	32
Air Ambulance	•	•	•	•	•	12
Burn Care	•	•	•	•	•	14
Business Computers	•	•	•	•	•	4
Medical Office Buildings	•	•	•	•	•	3
Mobile High Tech	•	•	•	•	•	20
Neonatal ICU	•	•	•	•	•	27
Obstetrical	•	•	•	•	•	10
Psychiatric Services	•	•	•	•	•	29
Radiation Therapy	•	•	•	•	•	30
Rehabilitation	•	•	•	•	•	30
Renal Dialysis	•	•	•	•	•	23
Subacute Care	•	•	•	•	•	12
Substance Abuse	•	•	•	•	•	28
Swing Beds	•	•	•	•	•	17
Long Term Care-Related	1	2	4	1	2	38
Home Health	•	•	•	•	•	24
ICF/MR	•	•	•	•	•	26
Long Term Care	•	•	•	•	•	38
Residential Care Facilities	•	•	•	•	•	6
Grand Total	17	18	25	1	3	

Services covered by Certificate of Need in states surrounding Michigan; blue dots indicated covered services, and red dots indicate services not covered; redrafted by Mark Finn, from American Health Planning Association 2004

Fig. 6

The Michigan Auditor General issued a performance audit of Michigan's CON program in 2002 that contained five findings (McTavish 2002). Four of the findings related to costs and revenues of the program including fee structure, monitoring approved CON projects, application fee refunds, and monitoring compliance with CON review standards. The fifth finding was that:

> *[MDCH], in conjunction with the CON Commission, had not evaluated the CON Program in order to determine whether the CON Program was achieving its goal of balancing cost, quality, and access issues and ensuring that only needed services are developed in Michigan* (McTavish 2002).

This was considered a "material condition," meaning that:

> *...a condition existed which that could impair the ability of management to operate a program in an effective and efficient manner and/or could adversely affect the judgment of an interested person concerning the effectiveness and efficiency of the program* (McTavish 2002).

MDCH responded to this audit through a subcontract administered by the Michigan Public Health Institute (MPHI) to Conover and Sloan of the Center for Health Policy, Law and Management at Duke University (nationally recognized experts in the field) to evaluate CON in Michigan (Conover and Sloan 2003). In the past, Conover and Sloan wrote several articles critical of health care regulation (Sloan 1983, 1981; Sloan and Steinwald 1980), including a summary of the findings of an extensive examination of CON for the Delaware Health Care Commission (Conover and Sloan 1998), indicating regulation in general and CON regulation do not reduce health care spending; removal of CON regulations does not lead to a surge in acquisition of facilities and costs; and that CON regulation does not have much affect on quality of care but may improve access (Sloan and Steinwald 1980; Conover and Sloan 1998) for the uninsured, underinsured, and inner city population (at the expense of access in suburban areas). Their conclusions about Michigan CON were consistent with their 1998 paper.

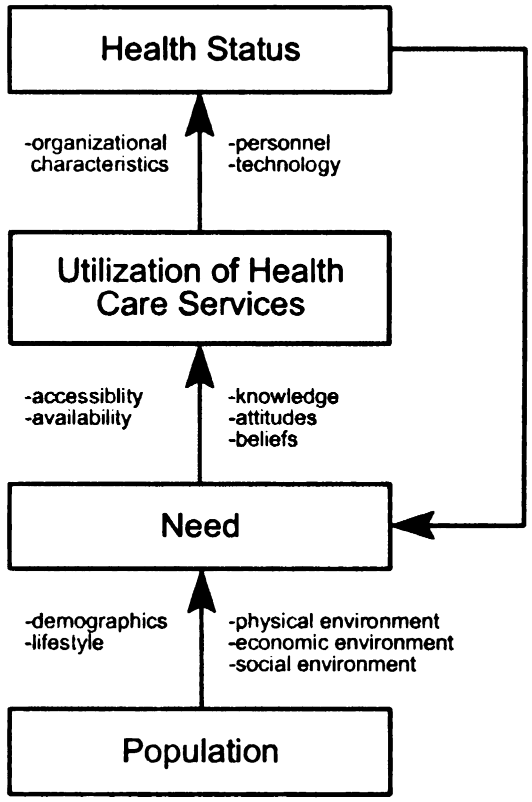
A follow-up audit report of MDCH-CON in 2005 indicated the Conover and Sloan report did not conclude whether the CON Program was achieving its stated program goals and MDCH still lacked measures to evaluate the performance of the CON program (McTavish 2005). "...[MDCH] had not developed quantifiable goals and objectives to help in evaluating the overall performance of the CON Program" (McTavish 2005).

The Federal Trade Commission and the Department of Justice issued a report in July of 2004 titled "Improving Health Care: A Dose of Competition". It recommended states

reconsider CON programs because they are not successful in containing health care costs, and they pose serious anticompetitive risks that usually outweigh their purported economic benefits (Federal Trade Commission 2004). Supporters of the Michigan CON Program state that Michigan's approach is different from other programs because standards are established by an independent commission that are tied to quantifiable requirements and cover all types of providers wishing to offer service (Citizens Research Council of Michigan 2005). In recent years, three prominent subjects of debate over Michigan's CON Program have been (1) its overall value, (2) its standards used to evaluate applications and for monitoring ongoing operations of certificate recipients, and (3) the inability of certain hospitals in Detroit to open new hospitals in suburban locations (Citizens Research Council of Michigan 2005).

1.2.4 Measurement of Demand

The epidemiological model of the delivery of health care services does not include demand (Fig. 7). The model does however include *need* which is not the same as *demand.* Health care need in epidemiology is defined as any self-perceived deviation from societal norms of health or problem detected by a health profession (Oleske 2001).



Epidemiological model of the delivery of health care services; redrafted by Mark Finn, from Oleske 2001
Fig. 7

A wide variety of definitions of need have been developed, and "it may be an illusion to suppose that there might ever be a consensus about the meaning of needs" (Culyer 1998). From a legal perspective, statutes have been constructed requiring the establishment of *need* as a precondition for the construction and operation of hospitals and other facilities (Case 1975). However, the concepts of need and demand are difficult to define for health care (Boulding 1966; see also Asadi-Lari, Packham, and Gray 2003). From an environmental sociology perspective, Bradshaw's taxonomy of need can be defined as: *normative need*, which is determined for individuals by professionals; *felt need*, which is expressed by individuals themselves; *expressed need*, which leads to a demand for service; and *comparative need*, which is professionally determined for certain population subgroups (Bradshaw 1972).

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Demand is an economist's term related to supply and need. A population's health care need should generate an appropriate demand, which then should be supplied in the form of physicians, facilities, and services by a health care delivery system. Health care has a derived, rather than a direct, demand (Grossman 1972). Consumers have a demand for health but cannot purchase it directly; they must purchase services that are used to produce health (Ringel et al. 2002).

Health care demand is an approximation of consumer (patient) need. In medical geography, health care need and demand can be very different (Ricketts et al. 1994). Depending on how one measures them, demand can be mistakenly used as a proxy for *felt need*. Differences in measurements, data sources, and experimental design affect the demand for health care services. Demand for the most part is defined by each state's CON using a bed to population need ratio. The measurement of health care demand outside of a state's CON program is found in econometric literature which is focused on cost, production, insurance, income, and capacity rather than access and quality (see Jones 2000; Grossman 2000). Again, the focus of this research is on the demand by a health care system for services based on a measurement of a population's health care need.

Consideration for the number and distribution of hospital beds related to the demand of need for services began to appear after 1920 as a general subject for consideration (Palmer 1956). In 1920, the New York Academy of Medicine conducted the first study correlating the need for general hospital beds with the population served in a given area (New York Academy of Medicine 1921). The study's conclusion established actual numbers and types of beds needed and recognized that a central group or agency was

needed to coordinate the use of hospital beds throughout the city. No prior efforts were made to relate the construction of hospital facilities to the requirements of their service area (Rosenthal 1964).

The two most ambitious early efforts to estimate bed requirements were the 1945 Public Health Service study and the 1947 study of the Commission of Hospital Care (Rosenthal 1964). The Public Health Service study (Mountin, Pennell, and Hoge 1945) established the 4.5 beds per 1,000 people rule used by the Hill-Burton Act and introduced the concept of health service areas. The Commission of Hospital Care study (1947) introduced a new approach to estimating bed needs from utilization data: *bed-death ratio*. The bed-death ratio used an estimate of the proportion of deaths that would occur in a hospital and the predicted death rate of a population to predict general hospital bed requirements (Rosenthal 1964). Several states used this method including Michigan and New York (Rosenthal 1964). Michigan's bed-death ratio is discussed further in Section 1.2.5.

The Hill-Burton Act's original methodology that required states to not exceed 4.5 beds per thousand people, except in rural or sparsely populated areas, was revised in the 1960s to include three major criteria for assessing bed need: 1) population (projected for five years); 2) use rates (i.e., the number of bed-days used by the population); and 3) an occupancy factor (i.e., the average percentage of beds maintained for patient care that are filled; for general hospital beds this average was 80 percent). An adjustment factor was also incorporated to help smaller hospitals adapt to fluctuating demands and emergencies (Melum 1975). The Hill-Burton formula consisted of:

Use Rate = Number of patient days / current population

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Average Daily Census (ADC) = Use rate * projected population / 365 *days*

Projected hospital bed need = ADC / .80 *occupancy* + 10 *adjustment factor*

In 1972, the Hill-Burton occupancy level standard was changed from 80 percent to 85 percent, and the + 10 adjustment factor was dropped in 1973 (Melum 1975). Also in 1973, the Federal Government altered its regulations regarding Hill-Burton's projection of existing use patterns in Federal Policy Memorandum No. A-1-73 allowing states to 1) discontinue the use of projected use rates, 2) use a maximum use rate in areas where the bed need formula reflects an unrealistic and excessive demand, and 3) use a minimum use rate in areas where there is no previous record of hospital utilization (Technical Advisory Committee 1977). The 1974 National Health Planning Act superseded the Hill-Burton Act, and bed need methodologies were defined by each state's CON program. See Melum (1975) for an overview of different states' bed need methodologies at the time.

Many factors influence the demand for hospital beds. A literature review of early studies on measuring bed needs for general hospitals compiled a list of 30 factors influencing bed needs (Appendix 1). However, these factors do not *directly* influence bed need or demand; they directly influence access and utilization. In the past few decades, these factors have been present as major topics in the study of health care access and utilization (see Section 1.2.1 for a discussion of health care utilization).

"Roemer's Law" had a profound effect on the measurement of a health care system's demand for services using hospital beds. In 1961, Roemer published a study which indicated hospital bed expansion in one region increased utilization, despite the absence of major changes in the morbidity of a population (Roemer 1961). This casual generality of a bed built is a bed filled or increasing supply will increase admissions or length of

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stay has become known as "Roemer's Law" in health services research (Kroneman and Nagy 2001). Roemer's observation has been the foundation of CON legislation to eliminate duplicative services in the interest of reducing costs and overutilization. Several studies on hospital utilization have shown Roemer's observation is not valid in all cases including: a study on rural Iowa which showed utilization was more related to the number of unique hospital services than bed supply (Rohrer 1990); a study in the Netherlands which found a positive correlation between bed supply and length of stay but not admission rates using both micro and macro level data (van Doorslaer and van Vliet 1989); and a study in Germany using a regression analysis of 13 different economic and social variables which could not contradict the effect of Roemer's Law in Germany but concluded the validity of Roemer's Law in Germany was (at least partially) due to the existing hospital planning (Kopetsch 2006).

1.2.5 Michigan's Acute Care Bed Need Methodology

Michigan's original standards for defining health care demand was outlined by the Michigan Hospital Study Committee in the *Michigan Hospital Survey Report* (Michigan Hospital Study Committee 1946). Their formula for estimating need for general hospital beds initially did not follow the guideline of 4.5 beds per 1,000 people set by the Hill-Burton program. Data on sickness (utilization) were rarely available and expensive, so general hospital bed need was related to the incidence of births and deaths. Their formula for incidence of birth assumed for each birth one bed is needed for an average length-of-stay of 11 days. This would require about 3 occupied beds per year for each hundred births. The *Bed-Death Ratio* was used for the calculation of the incidence of deaths. At the t

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the time in the United States, statistics showed the public used about 250 days of general hospital care for each death and correlated sickness in a general hospital. The bed-death ratio was 250 divided by 365 days–which equals .685 or about .7; each hospital death equals seven-tenths of a bed issued for one year. The calculation of occupied beds needed for an area was the product of the bed-death ratio and the number of deaths expected to be hospitalized.

Michigan's original facility service areas (FSAs), or a geographic area of available and readily accessible health care services used in regional health planning, were defined in accordance with the United States Public Health Service regulations set by the Hill Burton Act[4]. The Hill-Burton Act required state planning agencies to divide a state into FSAs based on a hierarchical system with *base areas* at the top centered on a medical center-teaching hospital, followed by regional hospital centers, community hospital centers, and public health and medical service centers. Federal law thus imposed a hierarchical health care system: (1) Teaching Center Hospital, (2) Regional Center Hospital, (3) Area Center Hospital, and (4) Community Hospital. In Michigan, the medical/teaching centers were the University of Michigan in Ann Arbor and Wayne University in Detroit. The regional centers were to have 200 beds or greater; the community hospital centers required 50 beds or greater serving 15,000-20,000 people or less if the hospital was more than 30 miles from a "good hospital"; and the public health and medical service centers were areas too small to justify 50 beds but were large enough or isolated. It was assumed people travel to the nearest hospital for minor illnesses-

[4] Michigan has changed its naming convention over time: "hospital service areas" changed to "facility service areas" or FSAs and are presently called "hospital subareas". To eliminate confusion, this thesis will use FSA to refer to hospital service areas, despite being later renamed hospital subareas. The acronym HSA will only refer to Health Systems Agencies as designated under the 1974 National Health Planning Act.

usually a community hospital-and for major illness physicians recommend they go to regional or teaching hospitals. It was also assumed the regions would conform to trade areas recognized by commercial marketing agencies (Michigan Hospital Study Committee 1946).

The delineation of FSAs was tentatively delineated in an "experimental, or trial and error basis" taking into consideration natural barriers, such as lakes and rivers (Michigan Hospital Study Committee 1946). The Michigan Hospital Study Committee commented on how unfortunate it was that county lines and these FSAs did not coincide (Figure 8).

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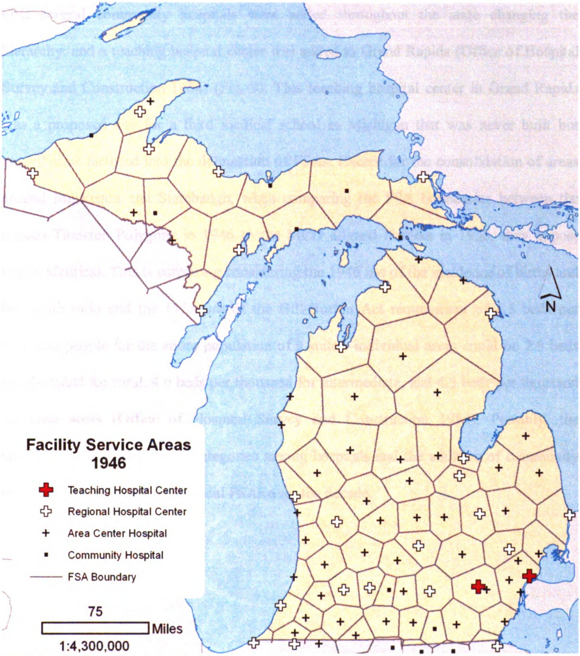

First Facility Service Areas in Michigan, 1946; redrafted by Mark Finn, from Michigan Hospital Study Committee 1946
Fig. 8

In the 1955 Michigan State Hospital Plan, the FSAs were redefined: the FSA boundaries were mapped alongside U.S. Census Minor Civil Division (MCD) borders; all out-of-state hospitals were removed other than South Bend and Sturgis, IN and Toledo,

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OH; several community hospitals were added throughout the state changing the hierarchy; and a teaching hospital center was added to Grand Rapids (Office of Hospital Survey and Construction 1954) (Fig. 9). This teaching hospital center in Grand Rapids was a proposed site for a third medical school in Michigan that was never built but nevertheless factored into the delineation of FSAs. Except for the consolidation of areas around Muskegon and Stambaugh, when comparing the FSA boundaries between the pseudo-Thiessen Polygons in 1946 to the MCD aligned borders in 1955, they appear nearly identical. This is surprising considering the 1946 use of the incidence of births and bed-death ratio and the 1955 use of the Hill-Burton Act requirement of 4.5 beds per thousand people for the entire population of a state—individual areas could be 2.5 beds per thousand for rural, 4.0 beds per thousand for intermediate, and 4.5 beds per thousand for base areas (Office of Hospital Survey and Construction 1954). Possibly, the redistribution of hierarchical categories among hospitals and the addition of community hospitals helped maintain identical FSAs over the decade.

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Facility Service Areas in Michigan, 1955; redrafted by Mark Finn, from Office of Hospital Survey and Construction 1954
Fig. 9

Despite slight increases in the population and bed requirements for each category to reflect population growth, the definition of FSAs for Michigan defined under the Hill-Burton Act (later Hill-Harris Act) remained the same until 1963 (Office of Hospital Survey and Construction 1954, 1957, 1959; Michigan Department of Health 1961, 1963).

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The bed need methodology did change in the 1955 Michigan State Hospital Plan. Instead of the incidence of births and death, the new methodology used guidelines set by the U.S. Commission on Hospital Care. It was assumed individuals in each FSA should be able to receive at least 1,300 hospital days care per thousand: 1,000 days per thousand in local (community) hospitals, 200 days in regional hospitals; and 100 or more days in base, or teaching, hospitals. Each FSA was assigned a need of 1,300 hospital days per thousand people. The numbers were summed and divided by 365 to obtain an *estimated average daily census*. To allow for the fact that hospitals cannot operate at 100 percent of occupancy, the Commission on Hospital Care formula was modified to include an *occupancy factor*: the square root of the estimated average daily census was multiplied by 2.5 (Office of Hospital Survey and Construction 1957). The total number of beds needed in each FSA was the estimated average daily census plus the occupancy factor. When the use of this formula resulted in percents of occupancy in excess of 85%, it was not used. Instead, the estimated average daily census was divided by .85 to get the number of beds needed.

Est. Avg. Daily Census = 1300 beds * FSA Population / 1000 / 365

Total Bed Need = 2.5 * SQRT(Est. Avg. Daily Census)

Despite slight alterations in hospital days per thousand and calculations of total population for specific regions of Michigan (particularly the Detroit Metro), the bed need methodology for Michigan remained the same until 1965 (Office of Hospital Survey and Construction 1954, 1957, 1959; Michigan Department of Health 1961, 1963, 1965). However in 1961 long-term care was separated from acute care bed need, and their bed

need methodology was renamed acute care bed need (Michigan Department of Health 1961).

The first significant change in methodologies since 1955 was in the definition of FSAs in 1963. Prior to 1963, in the Michigan Department of Health's *Michigan State Plan for Hospital and Medical Facilities Construction* the creation of FSAs was described as follows:

> *Under the regulations of the United States Public Health Service, the State Agency is required to divide the State into hospital service areas* [FSAs]. *These areas serve as the basis for developing the general hospital construction program. For purposes of this Plan, hospital service areas* [FSAs] *in Michigan shall be designated respectively (a) base, (b) regional center, and (c) community. These areas as defined below conform with the United States Public Health Service definitions for base, intermediate, and rural areas* (Michigan Department of Health 1961).

In 1963, the Michigan Department of Health's *Michigan State Plan for Hospital and Medical Facilities Construction* described the creation of FSAs as follows:

> *Under the regulations of the United States Public Health Service, the State Agency administering the Hill-Burton program must divide the state into health facility service areas* [FSAs]. *These areas serve as a basis for developing the construction program. They have been set up in terms of normal trading areas, taking into consideration population distribution, transportation and trade patterns, travel distance and data indicating the residence of patients served by existing hospitals. In general, boundaries of health facility service areas* [FSAs] *are so drawn that, with a few exceptions in the northern part of the state, no person in Michigan is more than 30 minutes travel time from an acute care facility* (Michigan Department of Health 1963).

The description goes on to describe the designation of base, regional centers, and community FSAs as was written in the previous Plan. 1963 was the first time important geographic factors were taken into consideration. However, nothing else was written in the document to indicate how these factors were derived or used in the definition of

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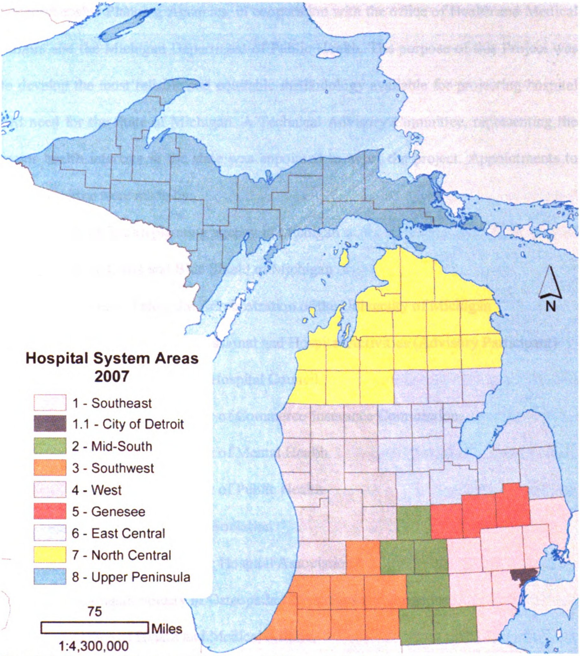
FSAs. In 1966, the *Michigan State Plan for Hospital and Medical Facilities Construction* included two maps showing average 24 hour traffic flow in 1962 and Michigan's 1960 Census population distribution. Nothing was written in the Plan to indicate who made the maps or how they were incorporated in the definition of FSAs. The 1963 definition of FSAs for Michigan remained the same until 1978 (Michigan Department of Public Health 1966, 1967, 1968, 1969, 1970, 1973, 1974, 1975; Nash 2007A) (Fig. 10). The hierarchical system was retained with the additional criteria that patient referral patterns be present up through the hierarchy. The FSAs are known as the 77 Hill-Burton subareas.

Facility Service Areas in Michigan, 1975; redrafted by Mark Finn, from Michigan Department of Public Health 1975 (hospital locations not shown in original map)
Fig. 10

The second significant change in methodologies since 1955 was in the calculation of acute care bed need in 1965. Federal regulations now required an occupancy factor of 80% + 10 acute care facilities. The formula assumed existing patterns of utilization would

continue into the future, and that the only need for additional beds was to accommodate population growth and current overcrowding. The formula penalized the low-utilization areas where lack of facilities prevented the natural level of utilization from developing and rewarded high utilization areas. The State of Michigan received Federal approval to modify the formula for estimating bed need to (1) provide a mechanism for upgrading low utilization areas, (2) provide a ceiling for high utilization areas, and (3) provide a realistic method for estimating bed need in the Detroit metropolitan area (Michigan Department of Public Health 1965). Essentially differing totals of hospital days per thousand were applied to specific regions in the state and the occupancy factor for acute care facilities was adjusted. Acute care bed need dramatically changed in the early '70s as Federal Policy Memorandum No. A-1-73 allowed changing of the formula used to determine acute care bed need. Michigan's acute care bed need formula of the early '70s added age adjustments, referral adjustments, and obstetrical use rates (Michigan Department of Public Health 1973, 1974, 1975).

The 1974 National Health Planning Act required all states to define areawide Health Systems Agencies (HSAs) for health care planning. Michigan politically defined 8 HSAs without any geographic or scientific consideration. These regions mapped to county boundaries and the City of Detroit are displayed in Figure 11 as they appear today.



Hospital System Areas in Michigan, 2007; redrafted by Mark Finn, from Citizens Research Council of Michigan 2005
Fig. 11

In the mid 1970s, the Acute Care Bed Need Methodology Project was initiated to revise Michigan's Hill-Burton rooted bed need methodology (Technical Advisory Committee 1977). The Project was developed by the Michigan Association of Areawide

Comprehensive Planning Agencies, in cooperation with the office of Health and Medical Affairs and the Michigan Department of Public Health. The purpose of this Project was to develop the most reliable and equitable methodology available for projecting hospital bed need for the State of Michigan. A Technical Advisory Committee, representing the major health interests in the state was appointed to assist the project. Appointments to this committee were made by:

- Each health planning agency in Michigan
- Blue Cross and Blue Shield of Michigan
- Bureau of Hospital Administration of the University of Michigan
- Commission on Professional and Hospital Activities (Advisory Participant)
- Greater Detroit Area Hospital Council
- Michigan Department of Commerce-Insurance Commission
- Michigan Department of Mental Health
- Michigan Department of Public Health
- Michigan Hospital Association
- Michigan Osteopathic Hospital Association
- Michigan Society of Osteopathic Physicians and Surgeons
- Office of Health and Medical Affairs.

The Bureau of Hospital Administration of the University of Michigan was retained as technical consultant to the project.

An initial Project recommendation was for the State of Michigan to adopt a *normative approach* for planning medical/surgical services. The normative approach incorporated a measure of expressed met demand and "expert judgment" to make decisions about appropriate hospital use. In this way, "...the standards chosen reflect what a community ought to be like as seen through the eyes of a group of well-meaning community professionals as well as what it is as measured by expressed met demand" (Technical Advisory Committee 1977). A weakness mentioned by the Project about their recommendations for a methodology was that a satisfactory decision rule for grouping hospitals based on patient origin data had not been researched. Michigan's acute care bed need methodology developed out of the recommendations, research, and compilation of patient data of the Project. This methodology is still used today.

The CON Review Standards for Hospital Beds (Certificate of Need Commission 2007b) details the Michigan CON Commission's *current* standards of measuring health care demand including (1) the definition of facility service areas (FSAs); (2) the determination of needed hospital bed supply; (3) bed need; (4) the requirements for approval of new beds in a hospital; (5) replacement of beds in a hospital in a replacement zone; and (6) relocation of existing licensed hospital beds. The standards for defining FSAs were written in 1978 by J. William Thomas, John R. Griffith, and Paul Durance of the Program and Bureau of Hospital Administration, School of Public Health, University of Michigan (Thomas, Griffith, and Durance 1979). Seventy-one FSAs were defined using aggregate hospital patient discharge data from 1976. These FSAs remained the same for the entire state until the CON Commission developed a new set for just the southern Lower Peninsula and Traverse City area of Michigan in 2002. The work group at the time decided to keep the same areas for the Upper Peninsula and northern Lower Peninsula after running the methodology several times with different parameters and levels of aggregation (Nash 2007). Each hospital in the State of Michigan is assigned to a

FSA until the CON Commission revises these FSAs. The FSAs are no longer mapped by the Commission and are listed in Appendix 2. These FSAs can be amended to reflect new sites assigned to a specific hospital service area, hospital closures, and licensure actions. These FSAs are to be updated at the direction of the Commission no later than two years after the official date of the federal decennial census, provided that population data at the federal ZIP code level, derived from the federal decennial census, are available; and final MIDB data are available to the Department for that same census year.

The 1978 method to define FSAs, developed by Thomas, Griffith, and Durance (1979), was a two step approach. The first step involved defining three sets of FSAs with three different objective models. The second step relied on a subjective panel of "experts" whom selected FSAs they felt were reasonable. The first step built off previous "relevance indices" or clustering methods for defining FSAs: Lembcke's Equal Likelihood Method (Poland and Lembcke 1962), Griffith's Relevance Index Method (1978), and a variant on Lembcke's method developed by Gittelsohn and Wennberg (1977). Poland and Lembcke defined FSAs by aggregating ZIP codes to a hospital where 50% or more of the population utilize the hospital. Gittelsohn and Wennberg used the same approach but specified 60% or more. Griffith used a relevance index where instead of assigning an entire population to a hospital, the size of each hospital service population is calculated by multiplying each ZIP code's total population by the percentage of patients from the ZIP code who use that hospital, and finally summing these values over all ZIP codes.

Thomas, Griffith, and Durance (1979) argued none of these methods worked well when applied to hospitals in large urban areas. Their argument was Lembcke's Equal

Likelihood Method and Gittelsohn and Wennberg's variant did not work well because urban hospitals typically have few ZIP codes with relevance indices greater than 50%. Additionally, Griffith's method could not create well-defined geographic areas for service communities with small relevance index values. Thomas, Griffith, and Durance proposed a method, based on Griffith's aforementioned relevance index method, to assign hospitals to clusters to maximize the average relevance index while constraining the maximum number of hospitals per cluster and/or minimum number of clusters formed which they called the "max relevance algorithm". Letting relevance index R_{ij} be the proportion of residents of areal unit *i* utilizing hospital(s) of cluster *j*, R_{ij} approaches an upper limit of 1.0 as more hospitals are added to cluster *j*. They used two other heuristic techniques, a "greedy heuristic" and a max-flow/min-cut algorithm, to determine near-optimal solutions for comparison to their own technique.

As Thomas, Griffith, and Durance (1979) describe them, the "greedy heuristic" and max-flow/min-cut algorithm form clusters by partitioning ZIP codes into non-overlapping cluster service areas and utilize a "patient flow" matrix developed from patient origin data. For a region with N areal units, each *ij* element of the N by N matrix gives the number of patients residing in areal unit *i* who utilize hospitals located in areal unit *j* plus the number residing in *j* who use hospitals in *i*. Both algorithms also require that $M < N$ of the areal units be selected as cluster service area centers, where M is the number of clusters to be formed. Cluster area centers were selected using methods defined in Thomas (1979).

Greedy heuristic. The "greedy heuristic" is not well described in Thomas, Griffith, and Durance (1979) or Thomas (1979). The greedy heuristic builds up cluster areas through the sequential assignment of areal units based on areas sharing the greatest amount of patient flow until all areal units have been assigned to a cluster.

Max-flow/min-cut algorithm. Thomas, Griffith, and Durance (1979) misrepresent this algorithm by describing the max-flow/min-cut algorithm as a technique that:

> *...defines clusters by "cutting" the region into ever-smaller pieces. As a first step, the region is divided into two cluster service areas. Another cut is then made to yield three clusters. The next cut yields four clusters, etc. Each areal unit in the region is considered to represent one node of a network; and the capacity of the arc connecting areal units i and j in the network is defined to be the patient flow shared between i and j. Ford and Fulkerson's* [1956] *max-flow/min-cut theorem then provides a basis for locating optional partitions* (1979).

The max-flow/min-cut algorithm is actually a special kind of linear programming problem for working with networks which states, "The maximum possible flow from left to right through a network is equal to the minimum value among all simple cut-sets" (Elias, Feinstein, and Shannon 1956). In other words, the maximum flow in a network is bound by its bottleneck. The network might represent communication channels, a railroad system, a power feeding system, or a network of pipes, provided it is possible to assign a definite max allowed rate of flow over a given segment or branch (Elias, Feinstein, and Shannon 1956). The max-flow/min-cut algorithm *cannot* define "clusters by "cutting" a region into ever-smaller pieces" (Thomas, Griffith, and Durance 1979). Ford and Fulkerson (1956), cited by Thomas, Griffith, and Durance, never indicate the max-flow/min-cut algorithm could either delineate a geographic area or cluster points.

Initial attempts to define hospital clusters in the Detroit Metro with the greedy heuristic and max-flow/min-cut algorithm failed due to the number of *ij* paths in the patient flow data which made them intractable for the computer to process. Both

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algorithms were reapplied independently to each ZIP code. Neither algorithm was able to locate an acceptable solution for the Detroit hospitals. Solutions contained single hospital clusters and one large cluster containing around 30 hospitals and 60 ZIP code areas. Additional calculations were made with certain large hospitals removed from the data, but problems with single hospital areas embedded in larger cluster areas and unacceptably large cluster areas in the central city continued to occur (Thomas, Griffith, and Durance 1979).

Max relevance algorithm. The first step in the max relevance algorithm is to calculate a population-weighted average relevance index R_j for each hospital. Letting:

P_i = population of areal unit i;

d_{ij} = number of patients from areal unit i treated at hospital j;

$D_i = \sum_j d_{ij}$ = total patients from areal unit i;

$I_j = \{i|(d_{ij} / D_i) \} \geq \alpha\}$, set of areal units for which the individual relevance values (d_{ij} / D_i) of hospital j exceeds or equals α, where α is specified $0 \leq \alpha \leq 1$.

$$\text{Then } R_j = \frac{\sum_{i \in I_j} P_i(d_{ij} / D_i)}{\sum_{i \in I_j} P_i}$$

After R_j is calculated for each individual hospital, the hospital with the smallest R_j is identified and is grouped with the hospital having the greatest individual relevance in hospital j's home areal unit to form a cluster. A new value of R_{j*} is determined as above,

where j^* refers to the two-hospital cluster. Values of R_j and R_{j*} are again scanned to identify the minimum R_j. The identified hospital or cluster is grouped with the hospital or cluster having the greatest individual relevance in the identified hospital's home areal unit. When a cluster j^* is identified for clustering, its home areal unit is assumed to be the areal unit of the hospital having the highest R_{ij} among the cluster hospitals' home areas. This iterative process terminates when: (1) all hospitals have been aggregated into a single large cluster; (2) a user-specified number of iterations have been completed; or (3) all identified clusters are stable. Condition (3) occurs when no cluster serves more than α of the patients in the home areal unit of any other cluster (where α is a percentage of the home area discharges).

Thomas, Griffith, and Durance completed the first step of the 1978 method to define FSAs on the Detroit Metro and for the most part discarded the greedy heuristic and max-flow/min-cut algorithm cluster results for the "max relevance algorithm" results. Thomas, Griffith, and Durance's predilection for Griffith's own "max relevance algorithm" may explain why they choose techniques for comparison which could not be computed and ultimately failed; one of which was questionable at best as to its relevance for delineating geographic areas or clustering.

The second step of the process relied on a subjective "group of experts familiar with the local area". The experts included four representatives from Detroit area hospitals, one from the health systems agency staff, one from the Greater Detroit Area Hospital Council, and two non-provider board members of the health systems agency. The experts selected clusters to define FSAs which in their opinion were the most reasonable and made the final determination as to which hospitals were to be clustered together. Although this methodology was originally specified to define FSAs for communities in large metropolitan areas (meaning Detroit), the max relevance algorithm was applied to the rest of Michigan and additional cluster review panels were formed to modify the results.

This methodology, which has become known as the *Griffith Methodology*, is the current methodology used by MDCH-CON to assign new hospitals to existing FSAs and define new FSAs. The methodology has been slightly modified to exclude ZIP codes (i) with a *market forecast factor* less than .05. The market forecast factor is the number of total inpatient discharges indicated by a market survey (created by an applicant applying for the approval to build a new licensed site for a hospital not MDCH) divided by the base year discharges. Also, FSAs or clusters with R_j scores less than .10 for all ZIP codes (areal units) are deleted from the computation (Certificate of Need Commission 2007b). The Griffith Methodology was last applied to the State of Michigan in 2002 where, as previously mentioned, results were discarded in favor of the 1978 FSAs for approximately 75% of the state (FSAs for the southern Lower Peninsula (Detroit) and Traverse City were modified). An accurate recreation of the Griffith Methodology to define FSAs is impossible due to the entanglement of political, business, and perceived public interests ascribed by expert committees composed of individuals representing hospitals, health systems, councils, and insurance providers.

Michigan's acute care bed need methodology (discussed in detail in Section 2.2) relies on the FSAs defined by the Griffith Methodology. The bed need methodology has come under fire in recent years. In Conover and Sloan's evaluation of Michigan acute

bed CON methodology (2003), they concluded no evidence indicates CON impacts costs/availability of hospital beds; nor would lifting restrictions on beds result in a surge in building of new facilities; and no evidence suggests CON for beds affects quality. The strongest case for continuing CON for hospital beds was for access. Key informants suggested in their study that if CON regulation for beds continued, the following improvements could be made: a) fix bed need methodology so that it is based on more current data; b) increase flexibility by permitting transfers of beds within hospital systems; and c) develop a mechanism to take excess capacity offline.

The debate over the acute care bed need methodology continued, and MDCH contacted Prof. Griffith at the University of Michigan to lend support to his 1978 methods. Griffith responded with a letter on January 14, 2004 writing:

> *I can no longer support the bed-need methodology as being in the best interest of the people of Michigan. The material [Larry Horvath, Manager of Michigan's CON Program] submitted frequently references the fact the methodology is old, and that conditions have changed, but it understates the magnitude and implications of those changes. Medical care itself, health insurance, information availability, and population needs have changed to an extent that makes the approach of approving hospital investment based on counts of total beds inappropriate... my recommendation is that the bed need methodology be abandoned* (Griffith 2004).

2 Methods

2.1 Computer Architecture and Data

The Michigan Department of Community Health CON Section and the Michigan Certificate of Need Commission (MDCH-CON) utilize three data sets to determine health care demand within the State of Michigan. The primary data set is the Michigan Inpatient Data Base (MIDB). The two secondary datasets are population projections created by the Michigan Department of Transportation (MDOT) and decennial census data compiled by the United States Census Bureau. The presented research in this thesis will only utilize these three data sets, along with a list of acute care hospitals in Michigan provided by MDCH.

2.1.1 Computer Architecture (System and Programs Used)

All analyses were computed on a Sun Microsystems Ultra 20 Workstation with a 2.61 GHz AMD Opteron Processor 152 and 3.37 GB of RAM. The workstation was running Microsoft Windows XP Professional. Additionally a Sun Microsystems Fire V40z Server containing MySQL 5.0.22 was remotely logged into from the Workstation using a JDBC connector to Star Office Base 8. The server ran Sun Solaris 10 (x86) with two 2.39 GHz AMD Opteron 850 Processors and 4.03 GB of RAM. Additional software used for this research includes Microsoft Access and Excel 2007, DBF Viewer 2000, SPSS 15.0, R 2.5.1, Python 2.5, ESRI ArcGIS 9.2, ESRI Arc/Info 9.2, and Adobe Illustrator and Fireworks CS3. In the proceeding methods subsections, each section will indicate which

[illegible]

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2 [illegible]

programs were used for analysis. Illustrator and Fireworks were used throughout for the creation of maps and figures.

2.1.2 Michigan Inpatient Data Base (MIDB)

The MIDB is a database containing inpatient discharge records for all Michigan hospitals and Michigan residents discharged from hospitals in bordering states not including Ontario, Canada for a calendar year (Certificate of Need Commission 2007b). Inpatient refers to a patient in residence in a hospital for at least one full night. A hospital discharge represents the release or dismissal of a patient from a hospital after a procedure or course of treatment. Hospital discharge records usually contain demographic information about the patient, primary and secondary diagnoses, diagnostic procedures, treatment procedures, length of stay, and insurance status (Cromley and McLafferty 2002). The data are compiled for the State of Michigan by the Michigan Health and Hospital Association.

The MIDBs for 2001, 2002, 2003, 2004, and 2005 were given to researchers at the Michigan State University, Department of Geography by MDCH for research in health care access within the State of Michigan. The MIDB for each year contains over 1.1 million individual discharge records, totaling over 5.8 million records. Each discharge record contains the hospital ID number and patient's home 5-digit ZIP code, sex, age group, date of discharge, length of stay, International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) primary diagnosis code, and Health Care Financing Administration (HCFA) defined Diagnoses Related Group (DRG) code. ICD-9-CM is based on the World Health Organization's Ninth Revision, International

Classification of Diseases (ICD-9) and is the official system of assigning codes to diagnoses and procedures associated with hospital utilization in the United States (National Center for Health Statistics 2007). DRG is a system used to classify inpatients into groups based on common characteristics expected to require similar service for payment of hospitalization in Medicare.

The MIDBs for 2001, 2002, 2003, 2004, and 2005 contain 100% of all inpatient hospital visits with few discernable data errors. Discernable data errors were detected by running a SELECT DISTINCT query for each field and comparing the output to known values. For example:

```
SELECT DISTINCT DISCHARGE.sex, Count(DISCHARGE.sex) AS total
FROM DISCHARGE
GROUP BY DISCHARGE.sex;
```

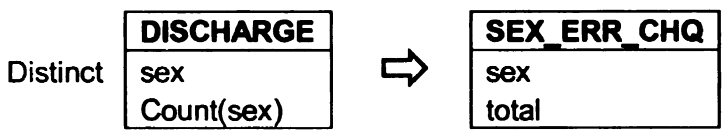

Fig. 12

This query selects distinct values from the *sex* field in the database *DISCHARGE* and returns the total for each value. The result of this query run on the MIDB for 2005 was:

```
+-----+--------+
| sex | total  |
+-----+--------+
| 0   | 10     |
| 1   | 489267 |
| 2   | 700285 |
+-----+--------+
```

Out of the 1,189,562 records in 2005, 10 individuals' sex could not be identified or were not properly recorded and were given the unknown sex default value of "0". Total discernable errors that are not record keeping codes, such as "0" in the *sex* field, and are actually mistyped, nonexistent, or null are recorded in Table 1. Mistyped or nonexistent

ZIP codes are identified by comparing ZIP code values to U.S. Census 2000 5-Digit ZIP Code Tabulation Areas (ZCTAs) Cartographic Boundary Files (shapefiles) for Michigan, Indiana, Ohio, and Wisconsin. Mistyped or nonexistent primary diagnosis codes are identified by comparison to the ICD-9-CM rich text files available on the Center for Disease Control's National Center for Health Statistics (NCHS) Web site[5]. Mistyped or nonexistent DRG codes are identified by comparison to the official HCFA DRG codes. The query used for this comparison matches the result of the previous SELECT DISTINCT query to a listing of known values and find records that do not match. For example, the ZIP code query is below

```
SELECT TOTALZIP.midb_zip, Sum(TOTALZIP.total) AS total,
KNOWNZIPS.zip
FROM TOTALZIP LEFT JOIN KNOWNZIPS ON
TOTALZIP.midb_zip = KNOWNZIPS.zip
GROUP BY TOTALZIP.midb_zip
HAVING KNOWNZIPS.zip Is Null;
```

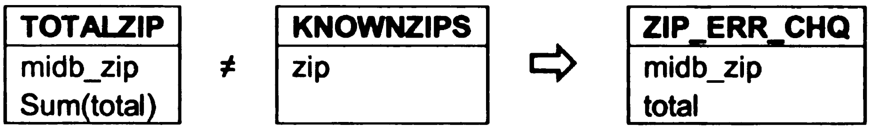

Fig. 13

This query uses a left join to combine all the distinct values found in the MIDB for the ZIP code field (*TOTALZIP.midb_zip)* to a known list of ZIP codes (*KNOWNZIPS.zip*). The ZIP codes that are not found in *KNOWNZIPS* (Is Null) are selected. The previous SELECT DISTINCT query was alternatively changed to count *hosp_id* to identify the

[5] Establishing a mistyped or nonexistent ICD-9-CM code was difficult. Many codes were used several thousand times which suggests they were not mistyped. Also the majority of codes that did not appear in the NCHS files did appear on the Wisconsin Department of Health and Family Services listing of diagnosis codes Web site on Feb 21, 2007 Available from within.dhfs.state.wi.us/helpfiles/dlookupbrowse.html. Only codes with obvious errors, such as blank spaces and unnecessary letters, were classified as mistyped or nonexistent.

Null values in the *midb_zip* field. Values identified as record keeping codes and not mistyped or nonexistent values were verified with MDCH.

Field	2001	2002	2003	2004	2005	Total
Age Group	0	0	0	0	0	0
Date of Visit	1	84	0	0	0	85
DRG	0	3	0	0	0	3
Hospital ID	0	82	0	0	0	82
Length of Stay	0	0	0	0	0	0
Patient ZIP Code	0	94	0	0	0	94
Primary Diagnosis	461	332	354	152	217	1516
Sex	0	43	0	0	0	43

Mistyped, Nonexistent, or Null Values in the MIDB
Table 1

Out of the over 5.8 million records in the MIDB only 1,823 individual record fields were unidentifiable. For the sake of simplicity, assuming none of the 1,823 errors fall within the same record, only 0.031% of all five years data combined contain discernable errors. These records were not removed because MDCH-CON does not remove them in their analysis of hospital bed demand (Certificate of Need Commission 2007b). This study will assume no errors of omission or comission are present in this database due to record keeping standards required by hospitals accepting Medicare and Medicaid (Soc. Sec. Act, Titles XVIII and XIX) and Maternal and Child Health Services (Soc. Sec. Act, Title V); the Health Insurance Portability and Accountability Act, Title II and the Department of Health and Human Services; Michigan Public Act 481 of 2006; and individual hospital administration policies.

The MIDB in the format provided by MDCH-CON is defined as a limited dataset and *partially* de-identified health information because it contains patient 5-digit ZIP codes and the month and day of discharge (National Institutes of Health 2007). Health data containing elements which can be used to re-identify individual records such as 5-digit ZIP codes and discharge dates are considered Protected Health Information (PHI) under

the Standards for Privacy of Individually Identifiable Health Information (U. S. Dept. of Health and Human Services 2002). This thesis was authorized for the research use and limited disclosure of the MIDB by MDCH-CON and was granted a waiver of the Authorization requirement by the Michigan State University Institutional Review Board (IRB # 07-362 / APP # i02484; P.I. Dr. Joseph Messina).

The MIDB was received from MDCH-CON in fixed width text files for four of the five years and one year in an old DBF4 file format most programs could not open. The DBF4 data file was converted to a comma-delimited text file using DBF Viewer 2000. DBF Viewer 2000 is a program developed specifically for viewing and converting old DBF file formats. The 2004 and 2005 MIDB text files did not have the age group calculated as per the CON standards for hospital bed demand (Certificate of Need Commission 2007b). These two files unlike the other years did have a patient age field. A corrected age group field was created by running a short Python script (Appendix 3) on the text files, and the patient age field was discarded as an unnecessary field for this study and potential unique identifier.

The five years of data were imported into a Microsoft Access database and a MySQL database. Microsoft Access was used because of its ease of exporting data in multiple formats, ability to handle the large database and interface with ESRI Geospatial Databases. A second copy of the MIDB was created by first exporting the data from Microsoft Access as comma-delimited text files and second importing the data into MySQL:

```
LOAD DATA LOCAL INFILE 'C:/midb2005.txt' INTO TABLE DISCHARGE
FIELDS TERMINATED BY ','
LINES TERMINATED BY '\r\n';
```

MySQL was selected because of its accessibility with scripting languages such as Python, speed, and ability to handle the large database. No data were lost or corrupted from the transfer from Microsoft Access to MySQL.

2.1.3 Michigan Acute Care Hospitals List

After inquiries to MDCH, no accurate, up-to-date table of Michigan acute care hospitals with hospital ID codes, Health Systems Agency (HSA), facility service area (FSA), and addresses was provided to researchers at the Michigan State University, Department of Geography. An accurate table of hospital IDs and hospital names only was provided for years 2003, 2004, 2005, and 2007. A separate listing of every health facility in Michigan with address and phone number was also provided. This listing was missing several acute care hospitals and contained incorrect addresses.

In the process of finding accurate hospital addresses online and geocoding the addresses, it was discovered the complete list of acute care hospitals in the 2007 CON Review Standards for Hospital Beds (Certificate of Need Commission 2007b) (Appendix1) contained closed hospitals such as the Greater Detroit Hospital and Medical Center (closed 1999), Renaissance Hospital & Medical Centers (closed 1999), Riverside Osteopathic Hospital (closed 2002), and St. John Northeast Community Hospital (closed 2003); merged hospitals such as Samaritan Health Center (acquired by Bay Regional Medical Center in 1982); and hospitals which have changed names such as Select Specialty Hospital – Wyandotte (now Henry Ford Wyandotte Hospital). The list was also missing hospitals found in the July 2, 2007 Bed Inventory (Certificate of Need Program 2007b).

The July 2, 2007 Bed Inventory did contain bed counts for *closed* hospitals such as Riverside Osteopathic Hospital, Select Specialty Hospital-Flint, and Select Specialty Hospital-Western Michigan. Closed hospitals are allowed to keep their beds as an asset, and MDCH-CON will temporarily continue to count the beds as part of the calculation of bed need for the FSA (Public Act 238). The list of hospitals with associated FSA and HSA found in the 2007 CON Review Standards for Hospital Beds (Appendix 2) was used unmodified for this study because these hospitals were used in the calculation of acute care bed need for the State of Michigan regardless of hospital closures.

Each Michigan acute care hospital found in the 2007 CON Review Standards for Hospital Beds document was geocoded using Yahoo! Maps Web Services - Geocoding API[6]. The coordinates were independently verified with Digital Orthophoto Quadrangles from the Center for Geographic Information – State of Michigan and imagery available through Yahoo! Maps. A shapefile of the geocoded hospitals was created in ESRI ArcGIS and projected to Michigan GeoRef.

2.2 Calculating Michigan Acute Care Bed Need

The Michigan acute care bed need calculation for a FSA is made using the MIDB and population estimates and projections by ZIP code in the following 13 step methodology.

Step 1: All hospital discharges for normal newborns (DRG 391) and psychiatric patients (ICD-9-CM codes 290 through 319 as a principal diagnosis) are excluded.

[6] This process was automated using an online batch geocoder created by the author of this thesis for MDCH. The online geocoder is a CGI script that sends an address to the Yahoo! Maps Web Services – Geocoding API and returns latitude and longitude. Available at http://health.geo.msu.edu/geocoder.htm.

Step 2: For each FSA discharge, calculate the total number of patient days for the following age groups: ages 0 (excluding normal newborns) through 14 (pediatric), ages 15 through 44, female ages 15 through 44 (DRGs 370 through 375 – obstetrical discharges), ages 45 through 64, ages 65 through 74, and ages 75 and older. Data from non-Michigan residents are included for each specific age group.

Step 3: For each FSA, calculate the *relevance index* (%Z) for each ZIP code and for each of the following age groups: ages 0 (excluding normal newborns) through 14 (pediatric), ages 15 through 44, female ages 15 through 44 (DRGs 370 through 375 – obstetrical discharges), ages 45 through 64, ages 65 through 74, and ages 75 and older. The relevance index is the number of inpatient hospital patient days provided by a specified FSA from a specific ZIP code divided by the total number of inpatient hospital patient days provided by all hospitals to that specific ZIP code.

Step 4: For each FSA, multiply each ZIP code %Z calculated in Step 3 by its base year ZIP code and age group specific year population. The result will be the ZIP code allocations by age group for each FSA.

Step 5: For each FSA, calculate the FSA base year population by age group by adding together all ZIP code population allocations calculated in Step 4 for each specific age group in that FSA. The result will be six population age groups for each FSA.

Step 6: For each FSA, calculate the patient day use rates for age groups: ages 0 (excluding normal newborns) through 14 (pediatric), ages 15 through 44, female ages 15 through 44 (DRGs 370 through 375 – obstetrical discharges), ages 45 through 64, ages 65 through 74, and ages 75 and older by dividing the results of Step 2 by the results of Step 5.

Step 7: For each FSA, multiply each ZIP code %Z calculated in Step 3 by its respective planning year ZIP code and age group specific year population. The results will be the projected ZIP code allocations by age group for each FSA.

Step 8: For each FSA, calculate the FSA projected year population by age group by adding together all projected ZIP code population allocations calculated in Step 7 for each specific age group. The result will be six population age groups.

Step 9: For each FSA, calculate the FSA's projected patient days for each age group by multiplying the six projected populations by age group calculated in Step 8 by the age specific use rates identified in Step 6.

Step 10: For each FSA, calculate the adult medical/surgical FSA projected patient days by adding together the following age group specific projected patient days calculated in Step 9: ages 15 through 44, ages 45 through 64, ages 65 through 74, and ages 75 and older.

Step 11: For each FSA, calculate the FSA projected average daily census (ADC) for three age groups: 0 (excluding normal newborns) through 14 (pediatric), female ages 15 through 44 (DRGs 370 through 375 –

obstetrical discharges), and adult medical/surgical by dividing the results calculated in Step 10 by 365 (or 366 if the planning year is a leap year). Round each ADC to a whole number. This will give three ADC computations per FSA.

Step 12: For each FSA and age group, select the appropriate occupancy rate from the occupancy rate table in Appendix 4.

Step 13: For each FSA and age group, calculate the FSA projected bed need number of hospital beds for the FSA by age group by dividing the ADC calculated in Step 11 by the appropriate occupancy rate determined in Step 9. To obtain the hospital bed need, add the three age group bed projections together. Round any part of a bed up to a whole bed.

2.3 Evaluation of Michigan CON Acute Care Bed Need Methodology

The methods presented in this section were used to evaluate how well Michigan's current acute care hospital system, as defined under the acute care bed need methodology, represents actual patient utilization trends using the 30 minutes travel time rule. The first section details the calculation of acute care patient discharges (visits) traveling outside 30 minutes facility service area (FSA) travel time areas by ZIP code. The second section calculates the average travel distance for patients traveling outside the 30 minutes FSA travel time areas by ZIP code. The third section identifies the nearest hospital to each FSA. The fourth section describes the methods used to analyze the hierarchical movement of patients to different sized hospitals outside 30 minutes FSA

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travel time areas as compared to the size of the largest nearby hospital. The fifth section computes a commitment index for each Health Systems Agency (HSA).

The focus of this thesis is on health care demand, the demand by a health care system for services based on a measurement of a population's health care need, limited to the State of Michigan. Need for acute care health services is defined in Michigan by realized access, or utilization, found in the MIDB. Factors influencing access such as patient behavior and socio-economic status or doctor referral networks will not be investigated as this research is an evaluation of a health care delivery system not population behavior. The data sets used are limited to those used by MDCH in the calculation of acute care bed need.

2.3.1 30 Minutes Travel Time Calculation

The 30 minutes travel time criterion is used by the State of Michigan in the definition of limited access areas to acute care. 30 minutes travel time to acute care hospitals in Michigan was calculated by researchers in the Department of Geography at Michigan State University working on the same grant project from the Michigan Department of Community Health as the author of this thesis. The methods used are thoroughly discussed in Messina et al. (2006). In brief, a raster model of travel time was created, as opposed to a road network model. A road network model assumes all travel begins on a road or the network leaving wide gaps in statewide coverage. A raster model was used to eliminate the significant gaps in statewide coverage a road network leaves because in many cases these gaps comprise areas with a) road networks too new to be included in the public system; b) areas of undocumented private or national road

designations (particularly private hospital roads); or c) urban districts with significant industrial facilities. The grid model required more computational power and storage than a network model, but it provided a complete spatial representation of the acute care hospitals and health coverage in Michigan. The final raster model was comprised of 1-kilometer cells whose values indicate the approximate travel time to the nearest acute care hospital for each FSA. This required the development of intermediate raster models representing the cost, in minutes, to traverse each cell.

The raster model was created using a road network which was publicly available from the Michigan Center for Geographic Information. Speed limits for road types were based on the speed limits of representative roads in the Mid-Michigan area. The PATHDISTANCE function in ESRI Arc/Info GRID was selected for the travel time methodology as opposed to Euclidean distance functions as Euclidean distance functions fail to effectively model transportation networks and variations in landscape. The PATHDISTANCE function determines the shortest weighted distance from each cell to the nearest cell in the set of source cells. The cost used to weight distances was based on the slowest speed limit of any road within a particular 1 km cell. This conservative estimate was used given the risks of underestimating actual travel time to the nearest hospital. While the final individual FSA grids were not published in Messina et al. (2006) and were combined to create a statewide map for that publication, the FSA grids were appreciatively provided in GRID and shapefile format for this thesis. Figure 14 shows the grid in orange created for FSA 1A.

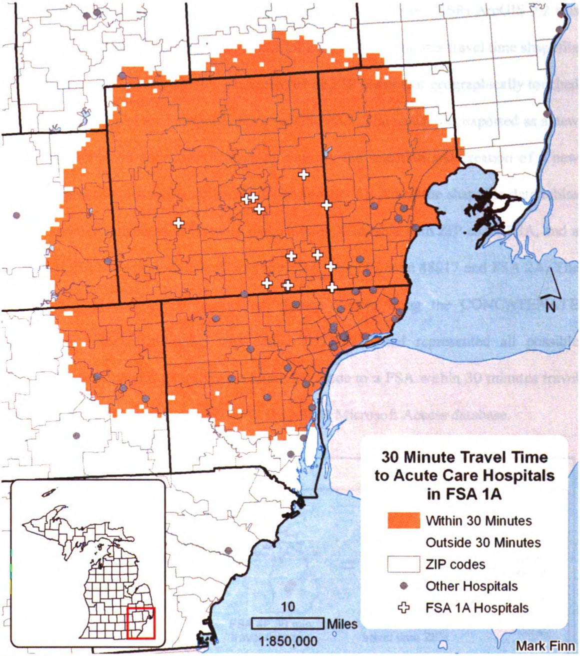

Fig. 14

The first step in demonstrating a significant percentage of patients travel longer than 30 minutes instead of accessing nearby hospitals was to create a table of ZIP codes within 30 minutes travel time of acute care hospitals for each FSA for comparison to the patient discharge records in the MIDB (Figure 15). A 5-digit ZIP code shapefile of Michigan was downloaded from the United States Census Bureau Web site[7]. ESRI ArcGIS 9.2 was used to run a Select by Location – Intersect for each FSA 30 minutes travel time shapefile on the Census ZIP code shapefile. This selected all ZIP codes that geographically touched the 30 minutes travel time shapefile for a specific FSA. The result was exported as a new shapefile. A Python script was written to simplify the selection and creation of a new shapefile process in ArcGIS for each FSA (Appendix 5). All of the shapefile data tables were combined in Microsoft Excel to make a three field table with ZIP code, FSA, and a combined ZIP code/FSA field such as "489172A" for ZIP code 48917 and FSA 2A. The combined field was added to facilitate future queries using the CONCATENATE function in Excel. This table was called *WITHIN30* and represented all possible combinations of patient travel from a home ZIP code to a FSA within 30 minutes travel time. The *WITHIN30* table was added to the MIDB Microsoft Access database.

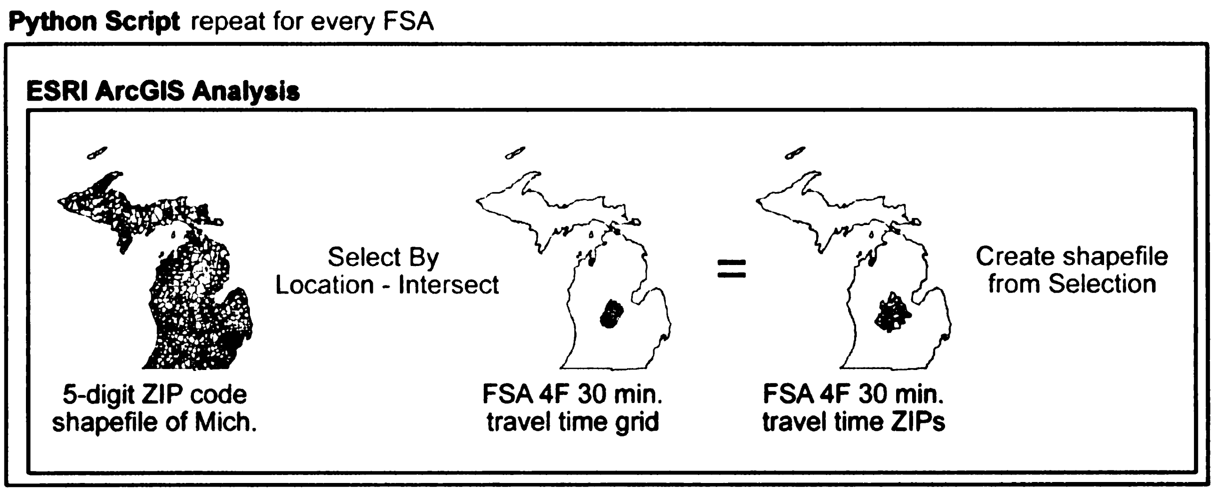

Fig. 15

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[7] Census 2000 5-Digit ZIP Code Tabulation Areas (ZCTAs) Cartographic Boundary Files were available from http://www.census.gov/geo/www/cob/z52000.html. The Michigan ZIP code shapefile was reprojected to Michigan GeoRef. This shapefile included many hydrological ZIP code areas, where ZIP codes are drawn around rivers and lakes, and large land areas (generally larger than 25 square miles), where insufficient information was available for the Census Bureau to determine the 5-digit codes. The hydrological ZIP codes will appear as water features on all subsequent ZIP code maps. The unknown ZIP code areas will be labeled as "excluded" and colored grey on all subsequent ZIP code maps. These excluded areas make up a significant portion of the Upper Peninsula of Michigan as they represent State and National Forests and are taken into consideration for this analysis.

The second step was to generate a table of every combination of patient home ZIP code to hospital FSA discharge appearing in the MIDB with the total number of patient discharges by combination ZIP code/FSA field. Since FSAs do not appear in the MIDB, but hospital IDs do, an additional table provided by MDCH was used containing FSA definitions by hospital called *HOSP_KEY* (Nash 2007B). The following SQL code created the table in Microsoft Access:

```
SELECT DISCHARGE.hosp_id, DISCHARGE.midb_zip, HOSP_KEY.fsa,
[DISCHARGE.midb_zip] & [HOSP_KEY.fsa] AS zipfsa,
Count(DISCHARGE.hosp_id) AS total
FROM DISCHARGE LEFT JOIN HOSP_KEY ON DISCHARGE.hosp_id =
HOSP_KEY.hosp_id
GROUP BY DISCHARGE.hosp_id, DISCHARGE.midb_zip, HOSP_KEY.fsa;
```

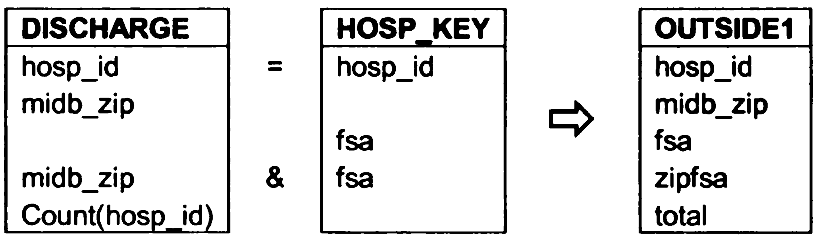

Fig. 16

The SQL code created a table called *OUTSIDE1* which listed the hospital visited (*hosp_id*), patient ZIP code (*midb_zip*), FSA (*fsa*), combined ZIP code and FSA (*zipfsa*), and total visits by ZIP Code/FSA combination (*total*).

The third step was to extract combinations of actual patient discharges from *OUTSIDE1* that did not appear in the 30 minutes travel time analysis table *WITHIN30*. This was accomplished using a SQL query which left joined the two tables on *zipfsa*, and selected the null join values. This SQL query compares two tables and finds records without matches:

```
SELECT OUTSIDE1.zipfsa, OUTSIDE1.midb_zip, Sum(OUTSIDE1.total) AS
```

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```
total, WITHIN30.zipfsa
FROM OUTSIDE1 LEFT JOIN WITHIN30 ON
OUTSIDE1.zipfsa=WITHIN30.zipfsa
GROUP BY OUTSIDE1.zipfsa, OUTSIDE1.midb_zip, WITHIN30.zipfsa
HAVING WITHIN30.zipfsa Is Null;
```

Fig. 17

The use of the *WITHIN30* table, based on the Census ZIP code shapefile, eliminates all out-of-state ZIP codes and post office boxes from this analysis. The resulting table was called *OUTSIDE2*.

The fourth step was to sum up the outside 30 minutes travel time visits found in *OUTSIDE2* for each ZIP code using a SELECT and SUM SQL query:

```
SELECT OUTSIDE2.midb_zip, Sum(OUTSIDE2.total) AS total
FROM OUTSIDE2
GROUP BY OUTSIDE2.midb_zip;
```

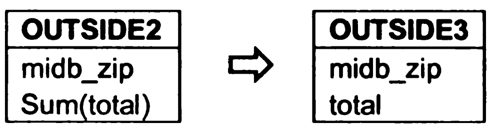

Fig. 18

The resulting table was called *OUTSIDE3* and contained all patient discharges in Michigan where the patient traveled longer than 30 minutes to an acute care hospital.

The fifth step was to run a separate query to total patient discharges in the MIDB by ZIP code.

```
SELECT discharge.midb_zip, Count(discharge.midb_zip) AS total
FROM discharge
GROUP BY discharge.midb_zip;
```

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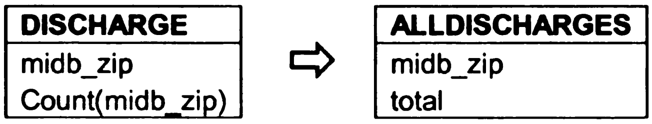

Fig. 19

This table, *ALLDISCHARGES*, was finally joined to the *OUTSIDE3* table by ZIP code for the purpose of calculating the percentage of patients traveling longer than 30 minutes to an acute care hospital by ZIP code.

```
SELECT ALLDISCHARGES.midb_zip, ALLDISCHARGES.total AS all,
OUTSIDE3.total AS out
FROM ALLDISCHARGES LEFT JOIN outside3 ON ALLDISCHARGES.midb_zip =
OUTSIDE3.midb_zip;
```

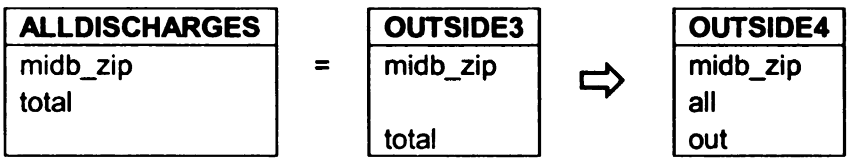

Fig. 20

Additional considerations were taken into account for this 30 minutes travel time analysis. First, as indicated in Messina et al. (2006) analysis, there are areas in Michigan without a single acute care hospital located within 30 minutes travel time (Figure 21). The inclusion of these areas in the total statewide calculation of patients traveling longer than 30 minutes for acute care could distort conclusions. Second, a modifiable areal unit problem (MAUP) (Openshaw 1984) exists when selecting ZIP codes that touch the 30 minutes travel time shapefiles. As shown in Figure 10, many ZIP codes are only partially overlapped by the 30 minutes travel time shapefile. The inclusion of all discharges from a population living throughout the ZIP code when only small portions of the ZIP code are within the 30 minutes travel time could skew calculations.

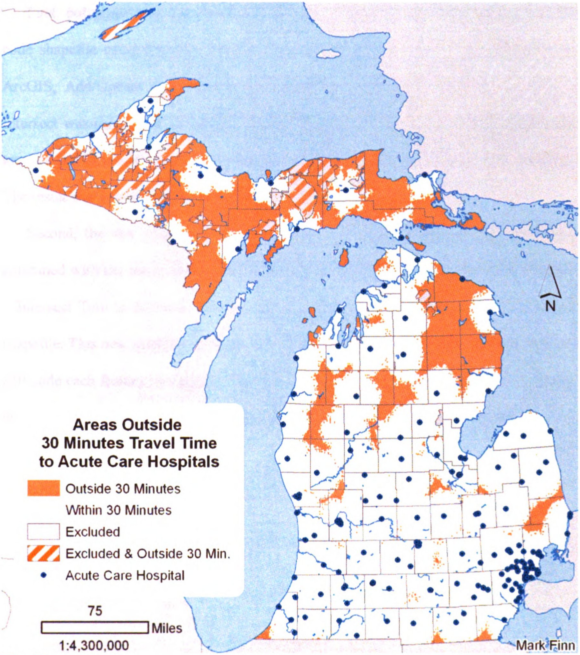

Fig. 21

Additional steps were taken to produce alternative outside 30 minutes travel time results by excluding areas without any acute care access within 30 minutes and excluding ZIP codes only partially within 30 minutes travel time to deal with MAUP.

First, polygonal area was calculated and added to each ZIP code in the Census ZIP code shapefile using Hawth's Analysis Tools for ArcGIS[8], a third party extension for ArcGIS, Add/Update Area & Perimeter Field tool. Second, a Select by Location – Intersect was run on the ZIP code shapefile to select all ZIP codes that geographically touched the 30 minutes travel time shapefile for the entire State of Michigan (Figure 21). The result was exported as a new shapefile.

Second, the new shapefile of ZIP codes with the added polygonal area field were combined with the statewide 30 minutes travel time shapefile in ArcGIS for the Overlay – Intersect Tool to compute the geometric intersection of the two shapefiles as a new shapefile. This new shapefile contained the original ZIP code polygonal area field and the ZIP code each feature overlapped. The Hawth's Add/Update Area & Perimeter Field tool was again used to add the polygonal area of the intersection to the new shapefile.

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[8] Beyer, H. L. 2004. *Hawth's Analysis Tools for ArcGIS*. Available at http://www.spatialecology.com/htools.

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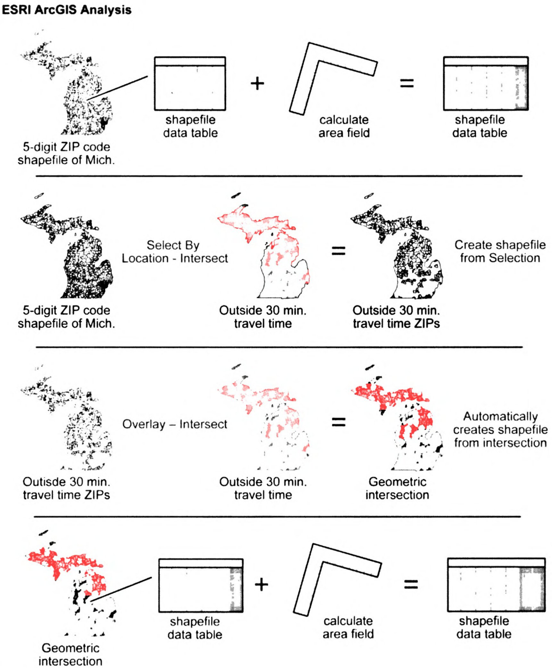

Fig. 22

Third, the DBF of the shapefile was imported into Access, and two independent queries were run to sum the unique ZIP code overlapping polygonal areas and ZIP code polygonal areas to deal with non-contiguous ZIP codes and islands of overlapping areas. The two queries used the same SQL select statement as the one below:

```
SELECT DISTINCT OVERLAP.zip, Sum(OVERLAP.area) AS area
FROM OVERLAP
GROUP BY OVERLAP.zip;
```

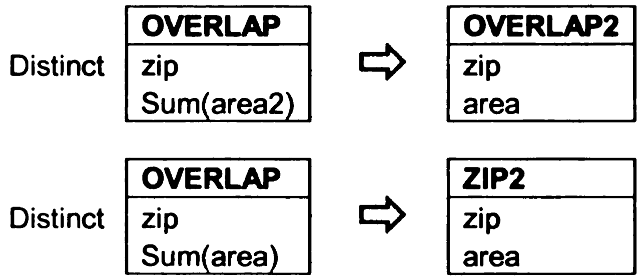

Fig. 23

The two queries were joined by ZIP code and divided to compute percent overlap:

```
SELECT OVERLAP2.zip, OVERLAP2.area AS overarea, ZIP2.area AS
ziparea, ZIP2.area / OVERLAP2.area AS perc_over
FROM OVERLAP2 INNER JOIN ZIP2 ON OVERLAP2.zip = ZIP2.zip
GROUP BY OVERLAP2.zip, OVERLAP2.area, ZIP2.area, ZIP2.area /
OVERLAP2.area;
```

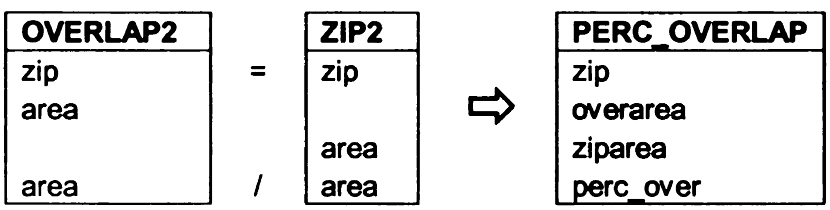

Fig. 24

The above query was opened in Excel and ten additional columns were added representing 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% overlap of areas where ZIP codes fall outside 30 minutes travel time to acute care hospitals. These columns were filled with '1's if the percent overlap exceeded the given percentage. The spreadsheet was then imported back into Access along with the table created earlier containing total patient discharges and discharges outside 30 minutes travel time by ZIP code.

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Fourth, 11 tables were created to eliminate ZIP code records containing the 10 varying percentages of overlap or any overlap at all by first creating two field tables of ZIP codes and the '1's indicating ZIP code overlap for a given percentage, and then comparing these tables to the table containing total patient discharges and discharges outside 30 minutes travel time by ZIP code:

```
SELECT PERC_OVERLAP.zip, PERC_OVERLAP.p100
FROM PERC_OVERLAP
WHERE PERC_OVERLAP.p100='1';
```

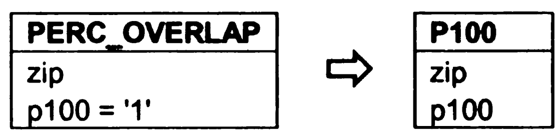

Fig. 25

```
SELECT OUTSIDE4.*, P100.p100
FROM totals LEFT JOIN P100 ON OUTSIDE.zip = P100.zip
WHERE P100.p100 Is Null;
```

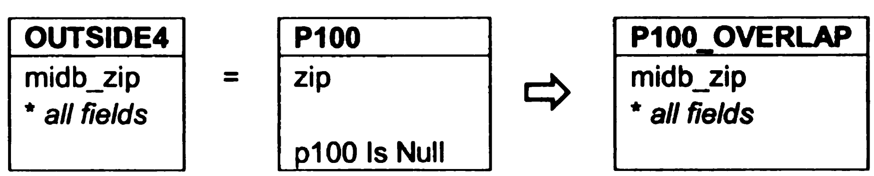

Fig. 26

The resulting tables contained total visits and visits outside 30 minutes with records removed according to overlap percentage. These tables were imported into ArcMap and individually joined to the Census ZIP code shapefile and exported as new shapefiles. The previously used Python script written to facilitate the selection and creation of a new shapefile process in ArcGIS was again run for each FSA for each percentage of overlap (Appendix 5). Each resulting shapefiles' data table included 30 minutes travel time ZIP code totals based on a specific percentage of overlap and FSA.

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2[illegible]

Final maps were created in ESRI ArcGIS and graphs were made in SPSS. Census 2000 data were included on the graphs. The Census data were exported to an Access database from the Census 2000 Summary file 1--National file CD and joined by ZIP code to the ZIP code shapefile.

The FSA 30 minutes travel time grids used in this analysis significantly overlap where FSAs are close together. Figure 27 shows the degree of FSA 30 minutes travel time area overlap mapped to ZIP codes. This observation is noted not as a limitation of the methods used in this thesis but as a limitation of the current definition of FSAs in Michigan.

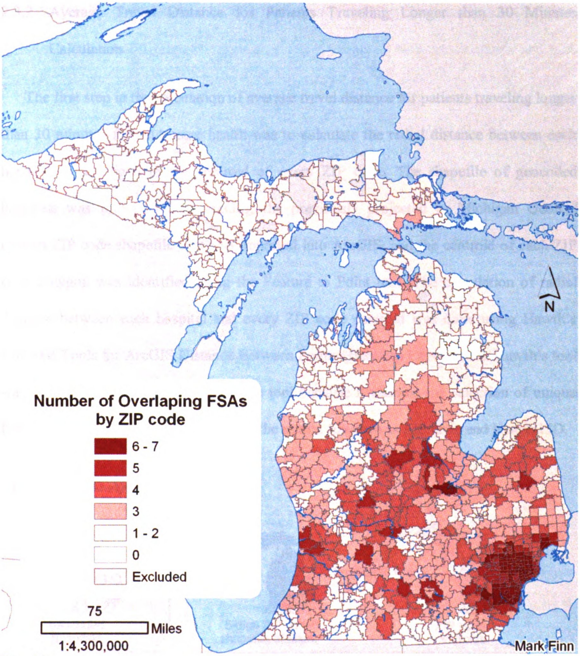

Number of Overlaping FSAs
by ZIP code
6 - 7
5
4
3
1 - 2
0
Excluded
75
Miles
1:4,300,000
N
Mark Finn

Fig. 27

2.3.2 Average Travel Distance for Patients Traveling Longer than 30 Minutes Calculation

The first step in the calculation of average travel distance for patients traveling longer than 30 minutes for acute care health was to calculate the radial distance between each hospital in Michigan to the centroid of every ZIP code. The shapefile of geocoded hospitals was imported into ArcGIS, the previously projected to Michigan GeoRef Census ZIP code shapefile was also imported into ArcGIS, and the centroid of each ZIP code polygon was identified using the Feature to Point tool. The calculation of radial distance between each hospital and every ZIP code centroid was done using Hawth's Analysis Tools for ArcGIS Distance Between Points (Between Layers) tool. Hawth's tool was used over ArcGIS's Point Distance tool because it enabled the selection of unique fields to identify calculated distances in the output file such as ZIP code and hospital ID.

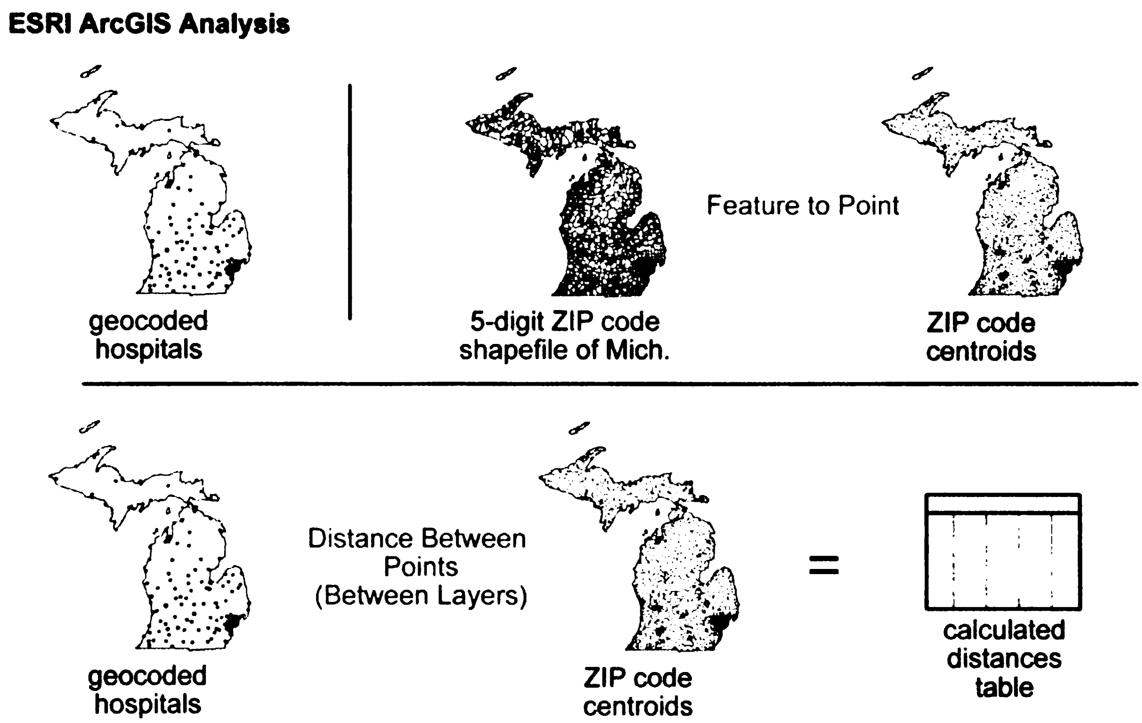


Fig. 28

The output comma delimited shapefile was imported into Microsoft Access where a SELECT DISTINCT query was run to average distances between hospitals and non-contiguous ZIP codes.

```
SELECT DISTINCT OUTPUT.hosp_id, OUTPUT.zip,
Avg(OUTPUT.distance) AS meters
FROM OUTPUT
GROUP BY OUTPUT.hosp_id, OUTPUT.zip;
```

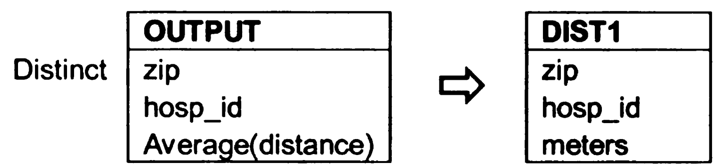


Fig. 29

A second query was run to calculate distance in miles.

```
SELECT DIST1.hosp_id, DIST1.zip, DIST1.meters,
DIST1.meters*0.000621371192 AS miles
FROM DIST1;
```

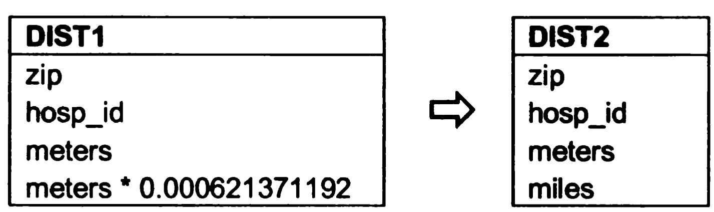


Fig. 30

The resulting table contained the radial distance between each hospital in Michigan to the centroid of every ZIP code.

The second step in the calculation of average travel distance for patients traveling longer than 30 minutes for acute care was to combine the table of radial distance measurements with the MIDB to calculate average travel distance. The MIDB, table *DISCHARGE*, is combined with *HOSP_KEY* table and the previously created *DIST2* table in two independent left joins.

```
SELECT HOSP_KEY.fsa, DISCHARGE.hosp_id, DISCHARGE.midb_zip,
[DISCHARGE.midb_zip] & [HOSP_KEY.fsa] AS zipfsa, DIST2.miles
FROM (DISCHARGE LEFT JOIN DIST2 ON (DISCHARGE.midb_zip =
DIST2.zip) AND (DISCHARGE.hosp_id = DIST2.hosp_id)) LEFT
JOIN HOSP_KEY ON DISCHARGE.hosp_id = HOSP_KEY.hosp_id;
```

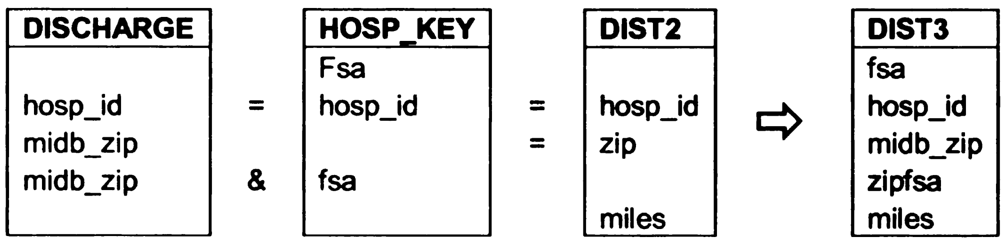


Fig. 31

Next, all visits within 30 minutes were removed from *DIST3* using the table *WITHIN30* created earlier, and null distance values (resulting from out-of-state visits, post office boxes, and unique identifier database codes) were removed.

```
SELECT DIST3.midb_zip, DIST3.miles
FROM DIST3 LEFT JOIN WITHIN30 ON DIST3.zipfsa = WITHIN30.zipfsa
WHERE DIST3.miles Is Not Null AND WITHIN30.zipfsa Is Null;
```

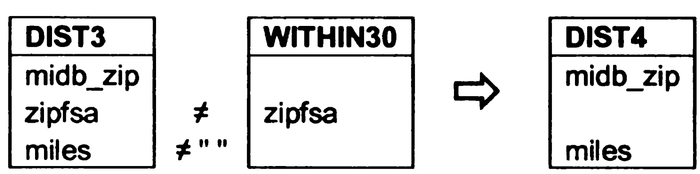


Fig. 32

Finally, the distances were averaged by ZIP code.

```
SELECT DISTINCT DIST4.midb_zip, Avg(DIST4.miles) AS avg_dist
FROM DIST4
GROUP BY DIST4.midb_zip;
```

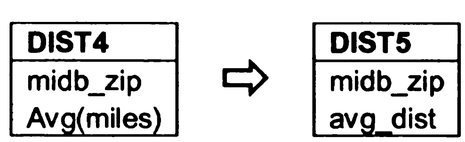


Fig. 33

Final maps of table *DIST5* were created in ESRI ArcGIS and graphs were made in SPSS.

2.3.3 Proximity to the Nearest Acute Care Hospital Outside FSA Calculation

The proximity to nearby hospital alternatives for acute care needs to be taken into consideration when looking at utilization trends. The previously geocoded and projected to Michigan GeoRef Michigan acute care hospitals shapefile was used to run a Near(Analysis) calculation in ESRI Arc/Info 9.2 to determine the distance from each point in a FSA cluster of hospital points to the nearest hospital. A Python script was written to facilitate the selection and creation of shapefiles for hospitals within each FSA and outside each FSA using ESRI ArcGIS 9.2 and then run the Near(Analysis) on the resulting shapefiles (Appendix 6). The resulting shapefile data tables were sorted ascending in Microsoft Access and the shortest distance to an acute care hospital for each FSA was recorded in a Microsoft Excel worksheet.

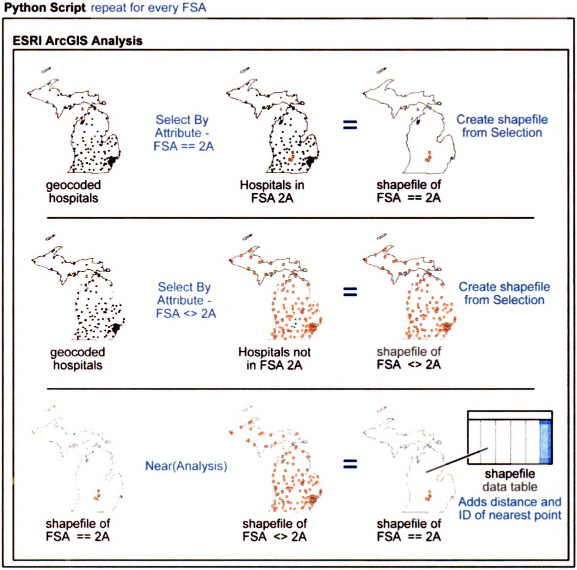


Fig. 34

2.3.4 Hospital Hierarchical Movement of Patient Visits Outside 30 Minutes Travel Time Analysis

Hospitals in Michigan were initially defined within a hierarchy under the Hill-Burton Act. Today their relative sizes based on the number of acute care beds fit to a certain extent these old hierarchical definitions with smaller community hospitals or rural

hospitals, medium sized regional hospitals, and large research and teaching hospitals. An analysis of hierarchical movement on the basis of moving from smaller hospitals to larger, larger to smaller, or same sized hospitals would further illustrate utilization patterns where patients travel outside 30 minutes FSA travel time areas for acute care.

The first step in identifying the hierarchical movement of patients traveling outside 30 minutes FSA travel time in relation to their FSA service area hospitals was to assign a hierarchical classification to Michigan hospitals and create hierarchical movement criteria. Since no hierarchical system exists today in Michigan, and the number of acute care hospital beds was used to distinguish between hospitals in the hierarchical system defined under the Hill-Burton Act, hospital acute care bed count was used to distinguish between hospital sizes. Hospitals considered larger had to have 1.25 times as many beds, and hospitals considered smaller had to have .75 times as few beds. This fractional scale was used instead of a finite bed count due to the variability in hospital sizes in Michigan which vary from the single digits up to a little over 1000 beds.

The number of hospital beds in each Michigan acute care hospital was added to the Microsoft Access database containing the MIDB. The bed counts were taken from the July 2, 2007 Bed Inventory available from the Michigan Department of Community Health Certificate of Need Program Web site[9]. Two tables were created: one with hospital names, IDs, and number of beds; and one with each FSA and the maximum number of beds at the FSA's largest hospital. The first query in Access assigned the maximum number of beds at a hospital within 30 minutes to each ZIP code. The previously created *WITHIN30* table, which excludes ZIP codes falling outside 30 minutes travel time service areas, was used for this query to reduce unnecessary computations.

---

[9] http://www.michigan.gov/documents/mdch/HOSPBEDINVJAN07_182193_7.pdf

```
SELECT WITHIN30.zip, Max(BEDS.maxofbeds) AS maxofbeds
FROM WITHIN30 LEFT JOIN BEDS ON WITHIN30.fsa = BEDS.fsa
GROUP BY WITHIN30.zip;
```

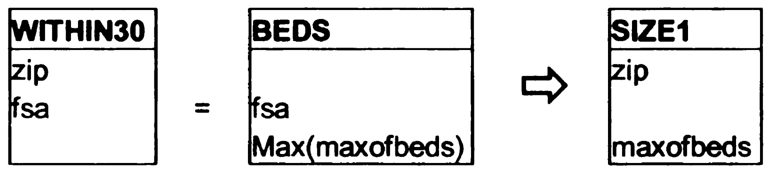


Fig. 35

The resulting table *SIZE1* contains the maximum number of beds at the largest facility among overlapping FSA 30 minutes service areas.

SIZE1 was combined with the *OUTSIDE1* table, created previously to total visits in the MIDB by ZIP code and hospital ID, and the *HOSP_BED* table which contained hospital name, ID, and number of beds. The difference between the maximum number of beds available at a facility within 30 minutes and the visited facility's bed count was calculated.

```
SELECT OUTSIDE1.midb_zip, OUTSIDE1.total, SIZE1.maxofbeds,
HOSP_BED.beds, SIZE1.maxofbeds - HOSP_BED.beds AS difference
FROM (OUTSIDE1 INNER JOIN SIZE1 ON OUTSIDE1.midb_zip = SIZE1.zip)
LEFT JOIN HOSP_BED ON OUTSIDE1.fsa = HOSP_BED.fsa
GROUP BY OUTSIDE1.midb_zip, OUTSIDE1.total, SIZE1.maxofbeds,
HOSP_BED.BEDS, SIZE1.maxofbeds - HOSP_BED.beds;
```

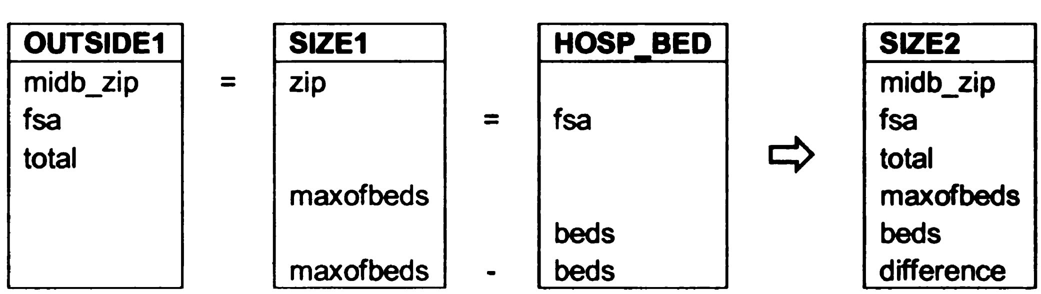


Fig. 36

The resulting table *SIZE2* contained records with null values for *maxofbeds* because the record's ZIP code did not fall within any FSA 30 minutes service area. These were removed in the next step.

Due to the difficulty in writing if-then-else statements in Access, *SIZE2* was exported as a comma delimited text file and processed in Python (Appendix 7). The Python script checked to determine whether the *difference* value of each record was positive or negative and then created a new field in the table and assigned it a -1 for visits traveling to smaller hospitals or 1 for visits traveling to larger hospitals if the ratio of *maxofbeds* to *beds* was less than or greater than 25%. A value of 0 was given to visits traveling to similar sized hospitals when the ratio of *maxofbeds* to *beds* was not greater than 25%. The resulting table was imported back into Access and named *SIZE3*.

Three queries were written to separately sum the total number of visits from a ZIP code to larger, smaller, and similar sized hospitals. These resulting tables were then joined to a table of Michigan ZIP codes.

```
SELECT SIZE3.zip, Sum(SIZE3.total) AS down, SIZE3.move

FROM SIZE3

GROUP BY SIZE3.zip, SIZE3.move

HAVING SIZE3.move=-1;
```

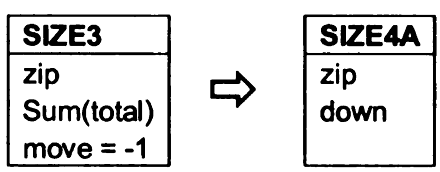


Fig. 37

and

```
SELECT SIZE3.zip, Sum(SIZE3.total) AS up, SIZE3.move

FROM SIZE3

GROUP BY SIZE3.zip, SIZE3.move
```

```
HAVING SIZE3.move=1;
```

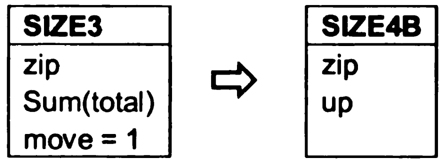


Fig. 38

and

```
SELECT SIZE3.zip, Sum(SIZE3.total) AS same, SIZE3.move
FROM SIZE3
GROUP BY SIZE3.zip, SIZE3.move
HAVING SIZE3.move=0;
```

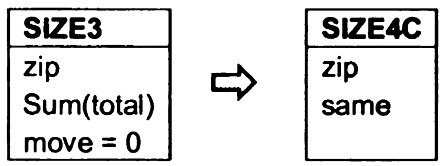


Fig. 39

and combined with

```
SELECT MIZIPS.zip, SIZE4A.down, SIZE4B.up, SIZE4C.same
FROM ((MIZIPS LEFT JOIN SIZE4A ON MIZIPS.zip=SIZE4A.ZIP)
LEFT JOIN SIZE4B ON MIZIPS.zip=SIZE4B.ZIP) LEFT JOIN SIZE4C
ON MIZIPS.zip=SIZE4C.ZIP;
```

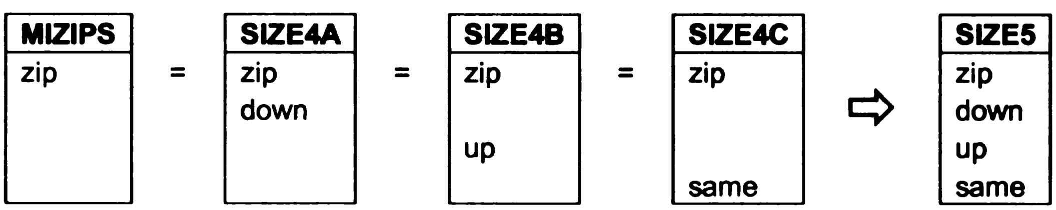


Fig. 40

Final maps of table *SIZE5* were created in ESRI ArcGIS.

2.3.5 HSA Commitment Index Calculation

A commitment index (CI) is the calculation of the number of patients traveling to a hospital from a ZIP code divided by the number of patient visits to the hospital from all ZIP codes. The calculation of each HSA's CI was entirely performed in Microsoft Access. The first query in Access calculated the total number of visits from a ZIP code to hospitals within a HSA using the MIDB database *DISCHARGE* and a table which identifies the HSA for each hospital *HOSP_KEY*.

```
SELECT DISCHARGE.midb_zip, Count(DISCHARGE.midb_zip) AS total
FROM DISCHARGE RIGHT JOIN HOSP_KEY ON DISCHARGE.hosp_id =
HOSP_KEY.hosp_id
GROUP BY DISCHARGE.midb_zip, HOSP_KEY.hsa
HAVING HOSP_KEY.hsa = '1';
```

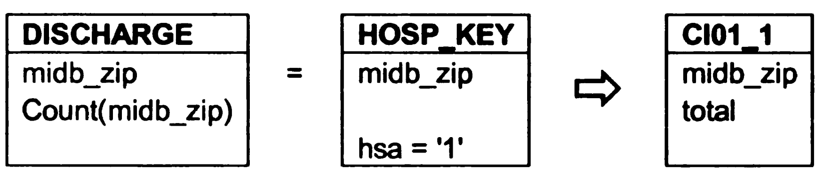
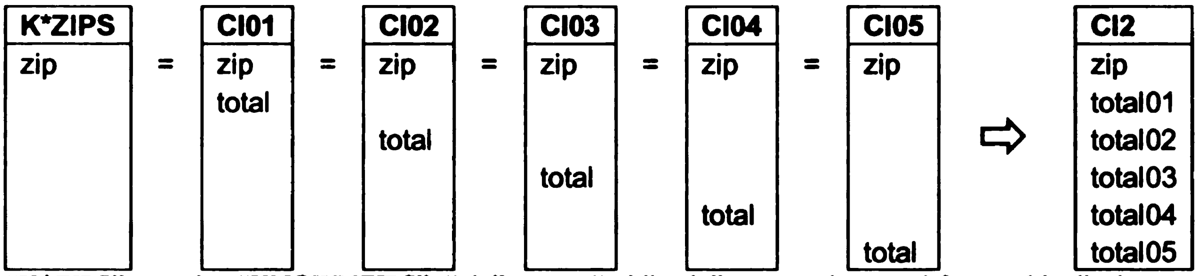


Fig. 41

This query was run for each year for each HSA 1 through 8. The resulting 40 output tables were combined by HSA with a list of known ZIP codes to create 8 tables of total visits by ZIP code.

```
SELECT KNOWNZIPS.zip, CI01_1.total AS total01, CI02_1.total AS
total02, CI03_1.total AS total03, CI04_1.total AS total04,
CI05_1.total AS total05
FROM ((((KNOWNZIPS LEFT JOIN CI01_1 ON
KNOWNZIPS.zip=CI01_1.midb_zip) LEFT JOIN CI02_1 ON
KNOWNZIPS.zip=CI02_1.midb_zip) LEFT JOIN CI03_1 ON
KNOWNZIPS.zip=CI03_1.midb_zip) LEFT JOIN CI04_1 ON
```

```
KNOWNZIPS.zip=CI04_1.midb_zip) LEFT JOIN CI05_1 ON
KNOWNZIPS.zip=CI05_1.midb_zip;
```



"K*ZIPS" meaning "KNOWNZIPS"; "zip" means "midb_zip"; names shortened for graphic display

Fig. 42

An additional query was run to sum the visits for all five years into a single column for each HSA table.

```
SELECT CI2.zip, CI2.total01 + CI2.total02 + CI2.total03 +
CI2.total04 + CI2.total05 AS total1_5
FROM CI2
GROUP BY CI2.zip, CI2.total01 + CI2.total02 + CI2.total03 +
CI2.total04 + CI2.total05;
```

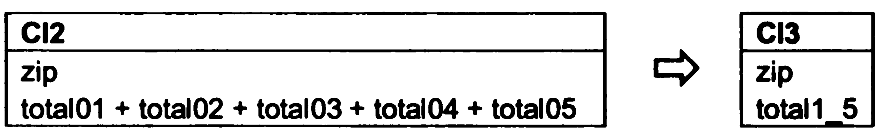


Fig. 43

The final tables were exported in DBF4 format and mapped in ESRI ArcGIS using the Percent of Total - Normalization option.

3 Results and Discussion

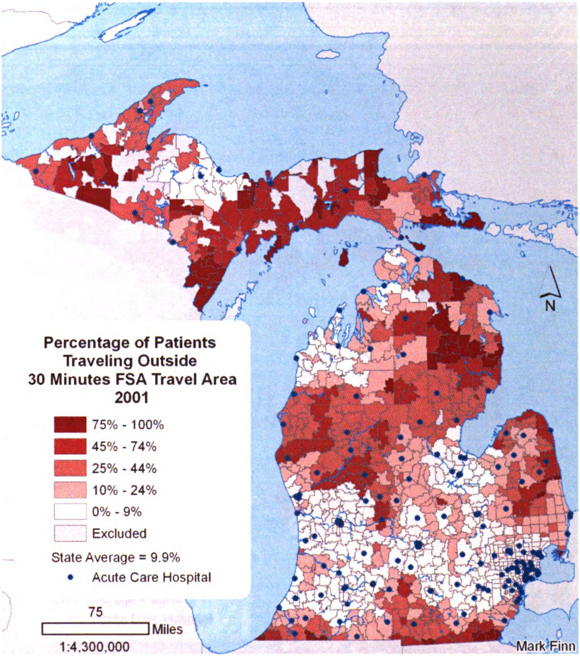
3.1 Results of 30 Minutes Travel Time Analysis

The use of 30 minutes travel time areas for assessing geographic access was first incorporated, although vaguely described, in 1963 to Michigan's acute care bed need methodology (Michigan Department of Health 1963)(see Section 1.2.5). The movement from distance measurements to travel time measurements as a meaningful indicator of geographic accessibility was discussed in Bosanac et al. (1976). Bosanac et al. indicated 30 minutes travel time became the standard for assessing geographic access in health care planning in the 1970s after several states including Virginia, Wisconsin, Pennsylvania, and Kentucky adopted it. Today, the State of Michigan defines a *limited access area* as a geographic area containing a population of 50,000 or more based on the planning year, not within 30 minutes drive time of an existing licensed acute care hospital with 24 hour/7 days a week emergency services, and utilizing the slowest route available as defined by the Michigan Department of Transportation (Certificate of Need Commission 2007b). It has been recommended to the Michigan CON Hospital Beds Standard Advisory Committee (CON-HBSAC) that the 30 minutes travel time rule be expanded to all areas regardless of population size (Hospital Beds Standard Advisory Committee 2004). Research has been conducted identifying areas in Michigan exceeding 30 minutes travel time to an acute care hospital (Messina et al. 2006). In a report published in the Michigan CON-HBSAC meeting minutes August 2, 2006, the author of this thesis expanded on this study to measure actual percentages of patients traveling outside 30 minutes FSA travel time areas using MIDB patient discharge data (Hospital Beds

Standard Advisory Committee 2006). These results for evaluating 30 minutes travel time in Michigan are an extension of Hospital Beds Standard Advisory Committee (2006) and Messina et al. (2006).

The purpose of Michigan's acute care bed need methodology was to develop an acute care hospital system which represented health care demand or actual patient utilization trends. It was assumed that past utilization records and state total population projections would inform planners of future usage, and patients would seek the nearest hospital. By demonstrating that a significant percentage of patients travel longer than 30 minutes instead of accessing nearby hospitals and some local hospitals are almost entirely avoided by their 30 minutes service area population, it can be shown the current acute care hospital system in Michigan as defined by the acute care bed need methodology is failing to represent health care demand and actual patient utilization trends.

Figures 44-48 show a choropleth map of the percentage of inpatient discharges in Michigan where the patient traveled outside the hospital's FSA 30 minutes travel time areas for 2001-2005. These maps exclude out-of-state patient visits and post office boxes.



Percentage of Patients
Traveling Outside
30 Minutes FSA Travel Area
2001
75% - 100%
45% - 74%
25% - 44%
10% - 24%
0% - 9%
Excluded
State Average = 9.9%
Acute Care Hospital
75
Miles
1:4,300,000
N
Mark Finn

Fig. 44

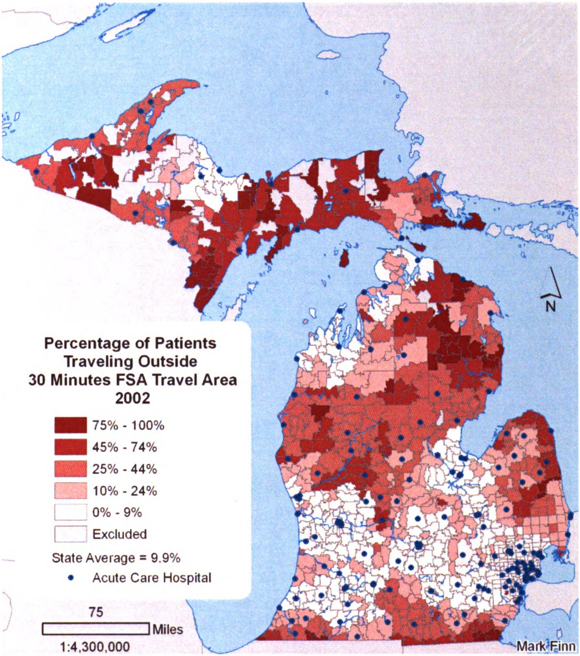

Percentage of Patients
Traveling Outside
30 Minutes FSA Travel Area
2002
75% - 100%
45% - 74%
25% - 44%
10% - 24%
0% - 9%
Excluded
State Average = 9.9%
Acute Care Hospital
75
Miles
1:4,300,000
N
Mark Finn

Fig. 45

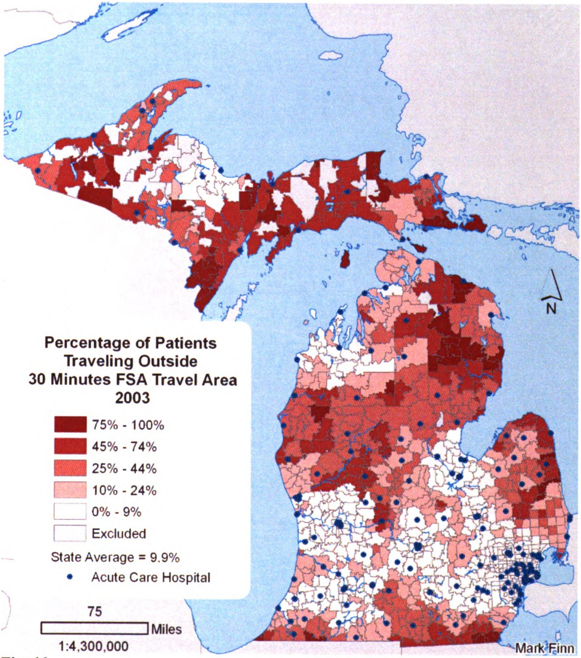

Percentage of Patients
Traveling Outside
30 Minutes FSA Travel Area
2003
75% - 100%
45% - 74%
25% - 44%
10% - 24%
0% - 9%
Excluded
State Average = 9.9%
Acute Care Hospital
75
Miles
1:4,300,000
N
Mark Finn

Fig. 46

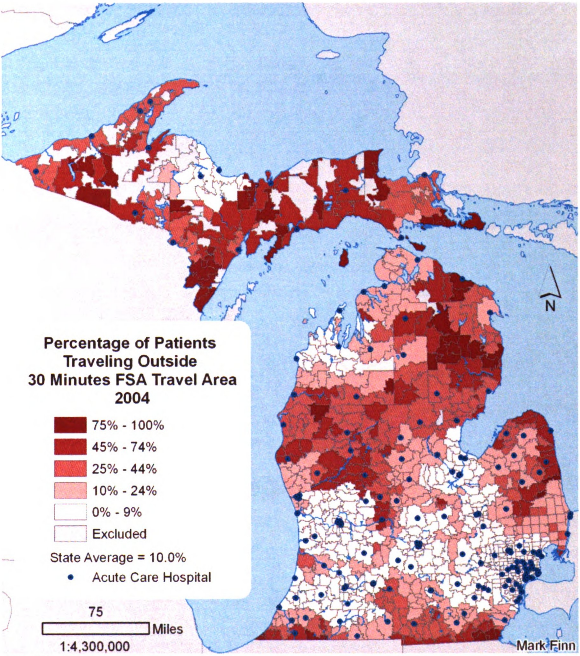

Percentage of Patients
Traveling Outside
30 Minutes FSA Travel Area
2004
75% - 100%
45% - 74%
25% - 44%
10% - 24%
0% - 9%
Excluded
State Average = 10.0%
Acute Care Hospital
75
Miles
1:4,300,000
N
Mark Finn

Fig. 47

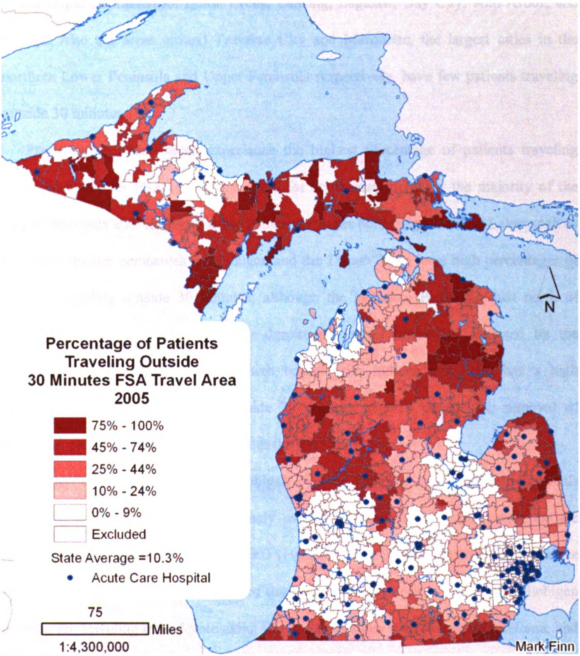


Fig. 48

The spatial distribution of patients traveling outside 30 minutes FSA travel time areas for acute care creates a distinct pattern which is present over all five years. Few patients travel longer than 30 minutes in metropolitan areas, particularly urban areas with multiple hospitals. Michigan's largest cities, which form a belt across the south central Lower

Peninsula, create a large area of patients not traveling outside 30 minutes centered around Grand Rapids, Kalamazoo, Battle Creek, Lansing, Saginaw, Bay City, Ann Arbor, and Detroit. Also the areas around Traverse City and Marquette, the largest cities in the northern Lower Peninsula and Upper Peninsula respectively, have few patients traveling outside 30 minutes.

Predominantly rural areas experience the highest percentage of patients traveling outside 30 minutes FSA travel time areas for acute care including the majority of the Upper Peninsula and northern Lower Peninsula. Areas bordering the Great Lakes such as the many smaller peninsulas in Michigan and the *Thumb*[10] also have high percentages of patients traveling outside 30 minutes; although the Leelanau Peninsula, just north of Traverse City, has a low percentage despite the travel limitations imposed by the surrounding water. Michigan's southern border with Indiana and Ohio has a high percentage of patients traveling outside 30 minutes as well despite the removal of Michigan out-of-state hospital visits from the analysis.

A map of the percentage of Michigan patients traveling to out-of-state hospitals versus all hospital visits was previously created by the author of this thesis for the combined years of 2001, 2002, and 2003 (Hospital Beds Standard Advisory Committee 2006). Figure 49, a redrafted version of this map, shows a large percentage of Michigan patients are traveling out-of-state along the State's borders with Wisconsin, Indiana, and Ohio. Despite having the most densely clustered and largest hospitals in the state located a short distance north, the area of Michigan south of Detroit and Ann Arbor and

---

[10] The Thumb of Michigan is a region so named because the Lower Peninsula is shaped like a mitten. The Thumb refers to the extended peninsula that stretches northward into Lake Huron and Saginaw Bay formed by Huron, Sanilac, and Tuscola counties.

bordering Ohio still has a large percentage of Michigan patients traveling to out-of-state hospitals.

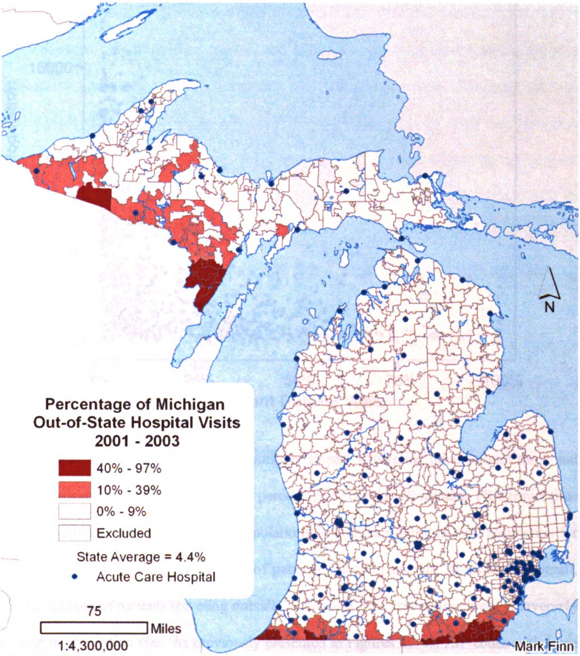


Fig. 49

A scatterplot of the average percentage of patients traveling outside 30 minutes FSA travel time areas for acute care for 2001 through 2005 versus total population by ZIP code was created in SPSS (Figure 50).

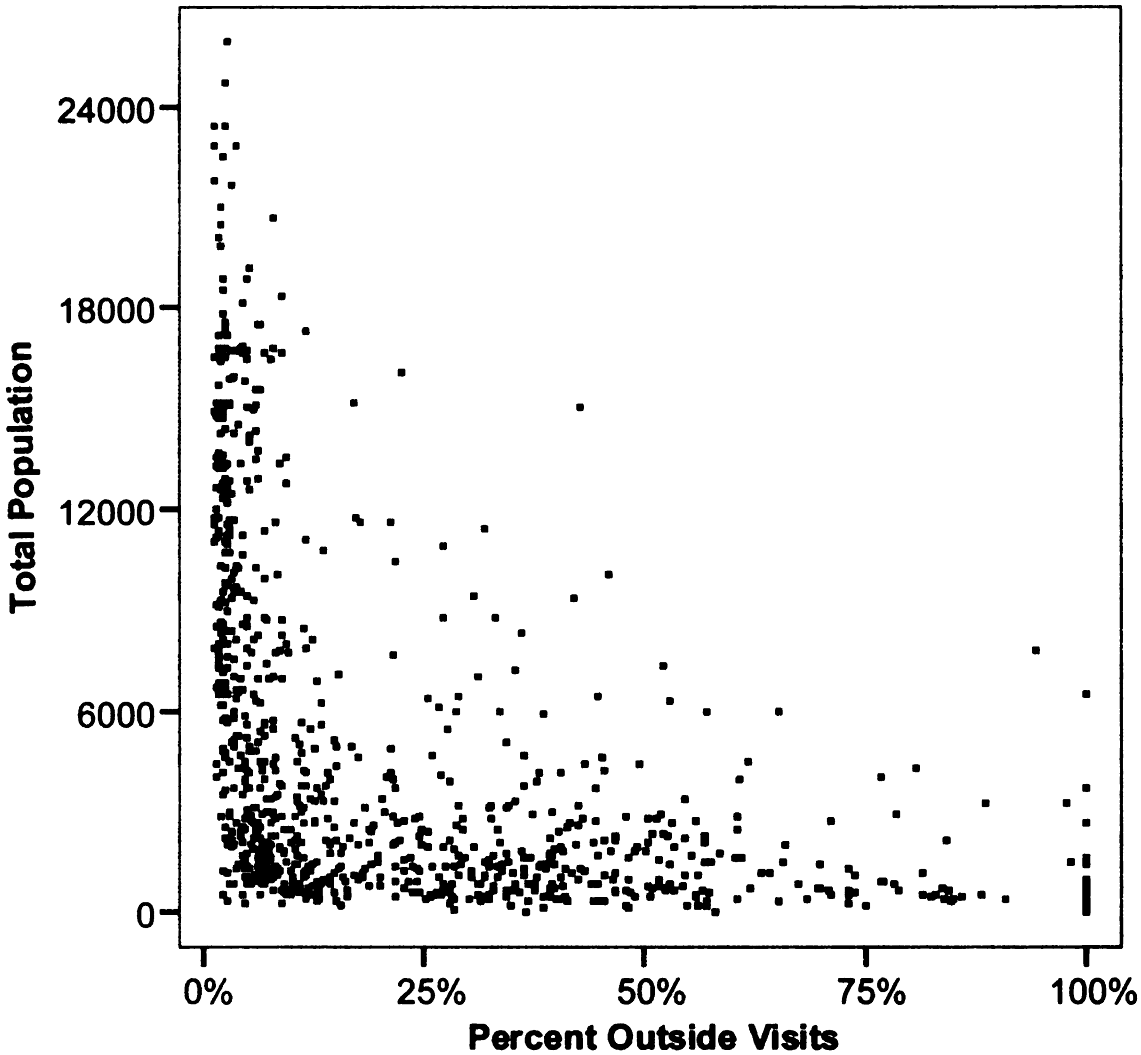


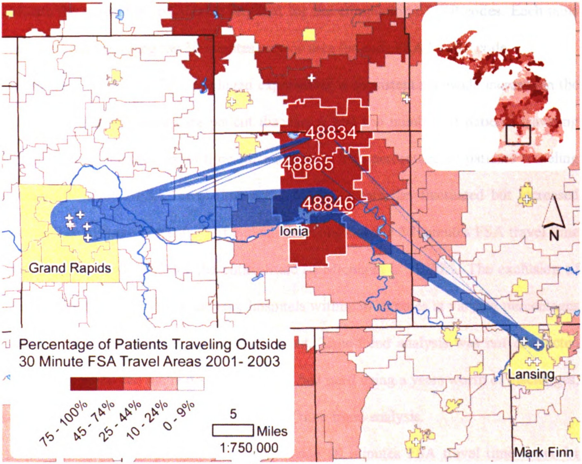
Fig. 50

The scatterplot is nonlinear and negatively sloped. Clustering occurs about the x and y axes indicating high variability in the percentage of outside 30 minutes FSA travel time areas for ZIP codes with very small populations or high variability in total population for ZIP codes with very low percentages of patients traveling outside 30 minutes. Overall, the percentage of patients traveling outside 30 minutes FSA travel time areas is inversely related to population size. As previously presented in Figures 44-48, ZIP codes with large populations (urban) have lower percentages of patients traveling outside 30 minutes, and small populated areas (rural) have higher percentages of patients traveling outside 30 minutes.

Looking back at Figures 44-48 a spatial pattern emerges when drawing circular thresholds on the maps around large cities approximating patient commitment to the large hospitals or groups of hospitals within the cities. For example, small circles can be pictured around Grand Rapids, Alpena, and Marquette; and large circles can be pictured around the Detroit-Ann Arbor Metro and Bay City-Saginaw area. The ridge of high percentages traveling outside 30 minutes FSA travel time areas for acute care occurring south to southwest of the Detroit Metro and Ann Arbor areas extending up between Grand Rapids and Lansing appears to be the result of an edge effect. This ridge could be described as an element of distance decay where the friction of distance to a major hospital, such as in between Lansing and Grand Rapids, is equal, and patients must decide to travel one way or the other. The size of these circular areas varies; ZIP codes with high percentages traveling outside 30 minutes occur on the edges of or in between these circular areas.

A spider diagram map of the ridge between Grand Rapids and Lansing was previously created by the author of this thesis for the combined years of 2001, 2002, and 2003 to show patient destinations for the top 90% of hospital discharges (Hospital Beds Standard Advisory Committee 2006). Figure 51, a redrafted version of the Grand Rapids and Lansing spider diagram, shows the high percentage of patients traveling outside 30 minutes FSA travel time areas for acute care might be the result of an edge effect. The ridge between Lansing and Grand Rapids is an element of distance decay where the friction of distance to Lansing or Grand Rapids hospitals results in movement to both cities, but predominantly Grand Rapids.

2



Top 90% of Hospital Visits Traveling Outside 30 Minutes Travel Time FSA Areas from ZIP Codes 48834, 48865, and 48846; Legend for blue spider diagram removed for confidentiality.
Fig. 51

Alternative outside 30 minutes FSA travel time area results which excluded areas without any acute care access within 30 minutes and excluded ZIP codes only partially within 30 minutes travel time to deal with the modifiable areal unit problem are presented in Appendix 8. Appendix 8 includes detailed tables of the total visits and percent visits outside 30 minutes FSA travel time areas for acute care for the State of Michigan and each FSA for years 2001 through 2005. *Total* indicates no elimination of ZIP codes which overlap areas where there is no acute care hospital within 30 minutes travel time; *Any* indicates the elimination of all ZIP codes which overlap; and the *percentages* indicate the percentage of overlap required for the elimination of ZIP codes. Each table contains a map showing the 30 minutes service area for each FSA by ZIP code.

Between 2001 and 2005, Michigan experienced a consistent statewide increase in the number of in-state, acute care patient discharges and the number of patients traveling longer than 30 minutes travel time for acute care. The percentage of patients traveling outside 30 minutes FSA travel time areas for acute care has fluctuated but increased overall. The average percentage of patients traveling outside 30 minutes FSA travel time areas for 2001 and 2005 for the entire State of Michigan is 10.00%. The exclusion of areas of Michigan without acute care hospitals within 30 minutes at varying percentages decreased the state average by 3.15% at most. Time-trend analysis was not conducted because the acute bed methodology evaluates bed need using a years worth of discharges, so five years of data would be insufficient for time-trend analysis.

The percentage of patients traveling outside 30 minutes FSA travel time areas for acute care by FSA varies significantly. A histogram was created of the average percentage for 2001 through 2005 for each FSA (Figure 52).

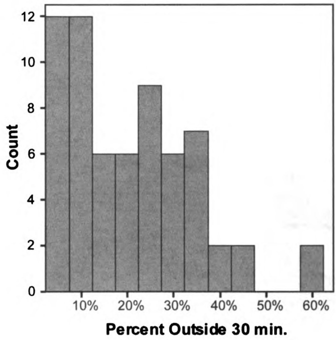
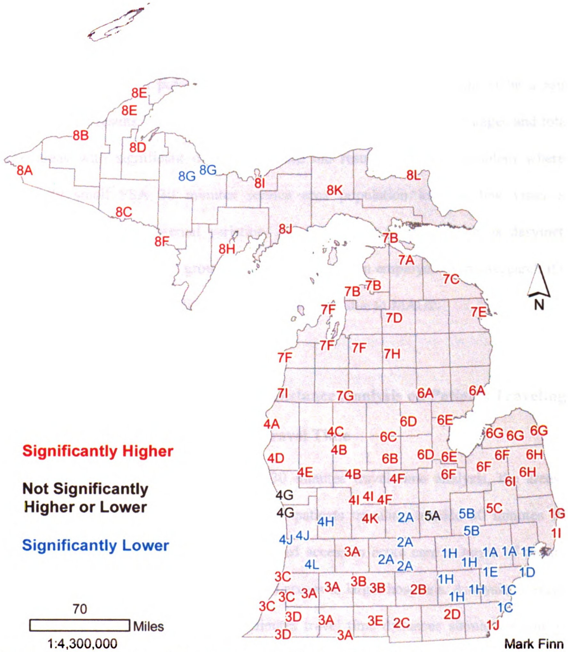


Fig. 52

The majority of FSAs throughout Michigan are around the State average of 10.00%. The distribution is not normal; there are peaks around 25% and 35%, and a drop off occurs after 35%. All 60 calculated percentages of patients traveling outside 30 minutes FSA travel time areas for acute care for each FSA in Appendix 8 were compared in R with a Welch's Two Sample t-test to determine whether the values were significantly higher or lower than the State of Michigan's percentages. A Welch's t-test is an adaptation of the Student's t-test intended for use with two samples having unequal variances. Figure 53 is a map of Michigan FSAs indicating whether their percentages of patients traveling outside 30 minutes FSA travel time areas for acute care are statistically higher (red), lower (blue), or not significantly higher or lower (black) than the state average. FSAs considered larger have a t value greater than 2, and FSAs considered smaller have a t value less than -2. The results of the t-test are listed in Appendix 9.



Statistical Comparison of FSA Percentage of Patients Traveling Longer than 30 Minutes Travel Time for Acute Care to the State of Michigan Percentage; Note labels are non-overlapping, so the map shows only approximate distribution of hospitals by FSA.
Fig. 53

The entire State of Michigan has a significantly higher percentage of patients traveling outside 30 minutes FSA travel time areas for acute care except for the belt of major cities across the south central Lower Peninsula and the largest city in the Upper

Peninsula, Marquette. Other than Muskegon (4G) and Owosso (5A), these exceptions are for the most part significantly lower than the state average.

The calculation of percent overlap to deal with MAUP was meant to be a rough estimate. The results in Appendix 8 show little change in overall percentages and totals. The areas with significant differences were the result of a units problem where a relatively small FSA 30 minutes service area population loses a few visits and dramatically changes internal variation. More complex methods, such as dasymetric mapping with census block group data, would have been employed in this research if the results had indicated a significant distortion occurred due to MAUP.

3.2 Results of Average Travel Distance Analysis on Patients Traveling Longer than 30 Minutes Travel Time

As indicated by the results of the 30 minutes travel time analysis, the areas in Michigan with a significant percentage of patients traveling outside 30 minutes FSA travel time areas are rural areas with limited access to acute care in terms of distance, number of alternative hospital choices, and access to larger hospitals. Analysis of average travel distance for these outside 30 minutes travel time distances should indicate that areas with higher percentages of patients traveling longer than 30 minutes also travel further distances.

The distances calculated reflect radial distances between ZIP code centroids and hospitals. Alternative representations of distance using transportation networks and estimates of population cores such as dasymetric mapping with Census tract data or geocoded patient addresses could be used to possibly better approximate average travel distance in future studies. However, these approaches are unnecessary for the research presented in this thesis. MDCH-CON relies on ZIP codes as the primary unit of analysis for its acute care bed need methodology. Conducting analysis on millions of patient addresses using ZIP codes instead of geocoding addresses reduces the amount of error propagated by current geocoding technologies in health studies (Krieger et al. 2001; Oliver et al. 2005; Ward et al. 2005). The aim of these present methods is to present a generalized representation of patient utilization focused on acute care facilities not population behavior while preserving the confidentiality of the MIDB discharge records.

A scatterplot of average travel distance by patients traveling outside 30 minutes FSA travel time within a ZIP code versus the percentage of patients traveling outside 30 minutes FSA travel time areas was created in SPSS (Figure 54).

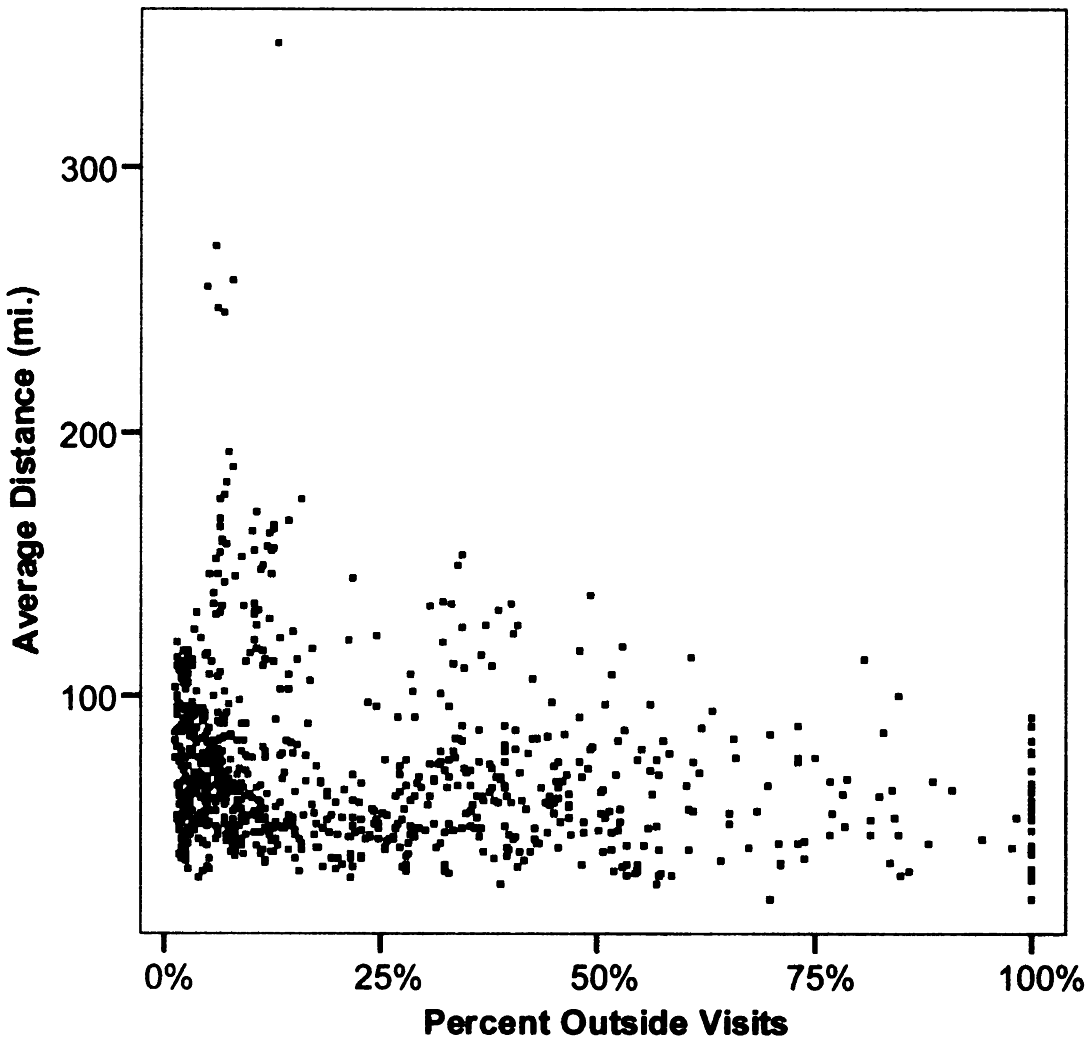
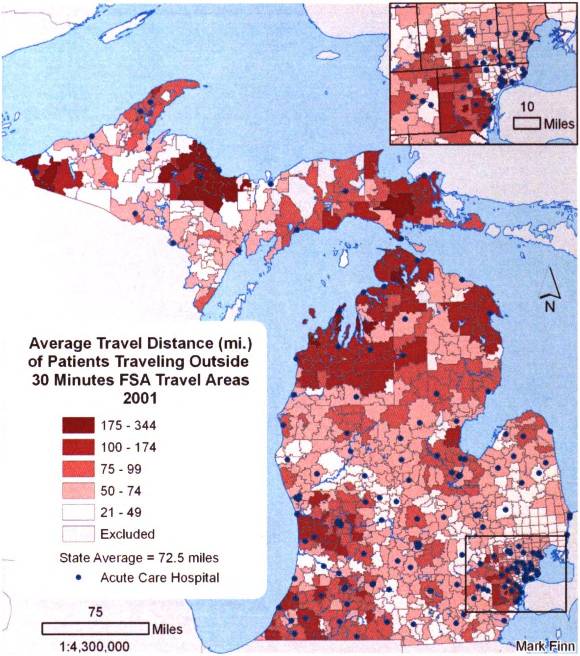


Fig. 54

The scatterplot is nonlinear and negatively sloped. The right side of the scatterplot shows high percentages of visits outside 30 minutes FSA travel time areas with a weak correlation to average travel distance. The points on the right side are highly variable, but relatively evenly distributed suggesting an even number of ZIP codes exist with patients traveling both long and short distances. The left side of the scatterplot showing low percentages of visits outside 30 minutes FSA travel time areas is tightly clustered with a negative slope. It appears ZIP codes with a higher percentage of patients traveling outside 30 minutes FSA travel time areas travel shorter distances on average. However, there are quite a few ZIP codes on the left side where patients travel great distances on average.

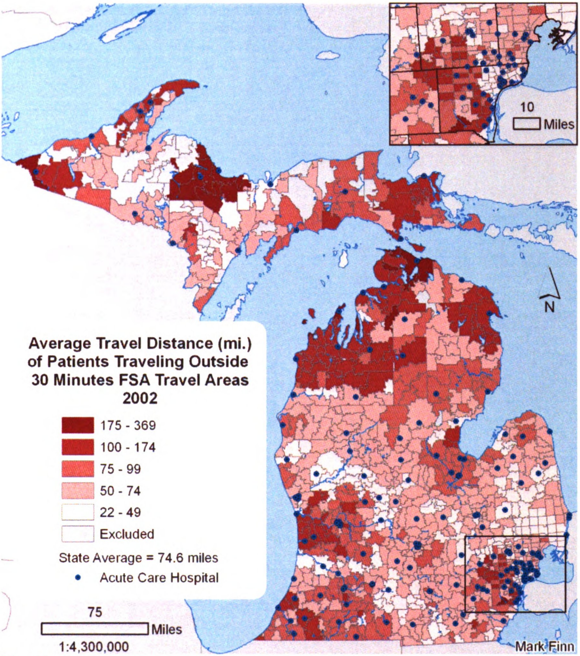
This scatterplot is difficult to read due to the unit of analysis, the ZIP code. ZIP codes are not evenly distributed throughout Michigan; urban areas have smaller, more concentrated numbers of ZIP codes, and rural areas have large sparse ZIP codes. The results of the 30 minutes travel time analysis indicated rural areas have high percentages of patients traveling outside 30 minutes FSA travel time areas for acute care, and urban areas have low percentages. Therefore the right side of the scatterplot showing high percentages predominantly represents rural Michigan, and the left side of the scatterplot showing low percentages predominantly represents urban Michigan. Patients in rural ZIP codes equally travel long and short distances, but not as far as some patients in urban ZIP codes. Patients in urban ZIP codes travel greater distances on average when traveling outside 30 minutes FSA travel time areas. In the few urban ZIP codes where there is a large percentage of visits outside 30 minutes FSA travel time areas the average travel distance is shorter. Identifying areas where patients are traveling great distances for acute care, particularly in and around urban areas, should indicate the current acute care hospital system in Michigan as defined by the acute care bed need methodology is failing to represent health care demand and actual patient utilization trends if patients are traveling such distances and avoiding nearby hospitals.

Figures 55-59 show a choropleth map of the average travel distance in miles of patients traveling outside 30 minutes FSA travel areas for acute care for 2001-2005. These maps exclude out-of-state patient visits and post office boxes.



Average Travel Distance (mi.)
of Patients Traveling Outside
30 Minutes FSA Travel Areas
2001
175 - 344
100 - 174
75 - 99
50 - 74
21 - 49
Excluded
State Average = 72.5 miles
Acute Care Hospital
75
Miles
1:4,300,000
10
Miles
N
Mark Finn

Fig. 55


Average Travel Distance (mi.)
of Patients Traveling Outside
30 Minutes FSA Travel Areas
2002
175 - 369
100 - 174
75 - 99
50 - 74
22 - 49
Excluded
State Average = 74.6 miles
Acute Care Hospital
75
Miles
1:4,300,000
10
Miles
N
Mark Finn
Fig. 56

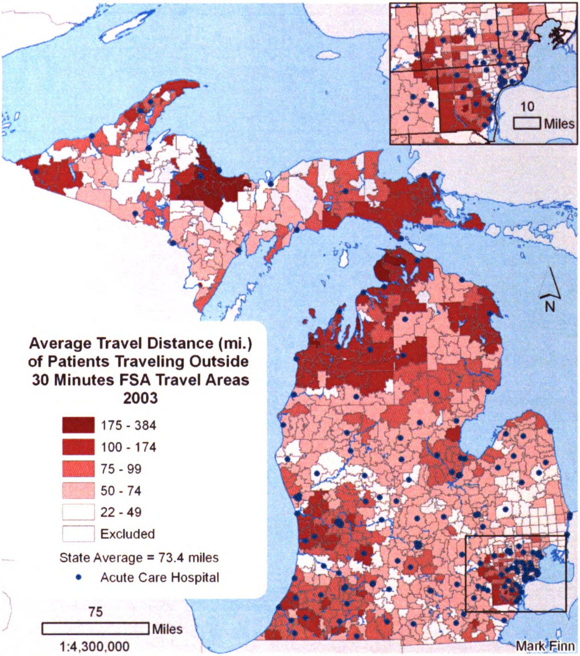

Average Travel Distance (mi.)
of Patients Traveling Outside
30 Minutes FSA Travel Areas
2003
175 - 384
100 - 174
75 - 99
50 - 74
22 - 49
Excluded
State Average = 73.4 miles
Acute Care Hospital
75
Miles
1:4,300,000
10
Miles
N
Mark Finn

Fig. 57

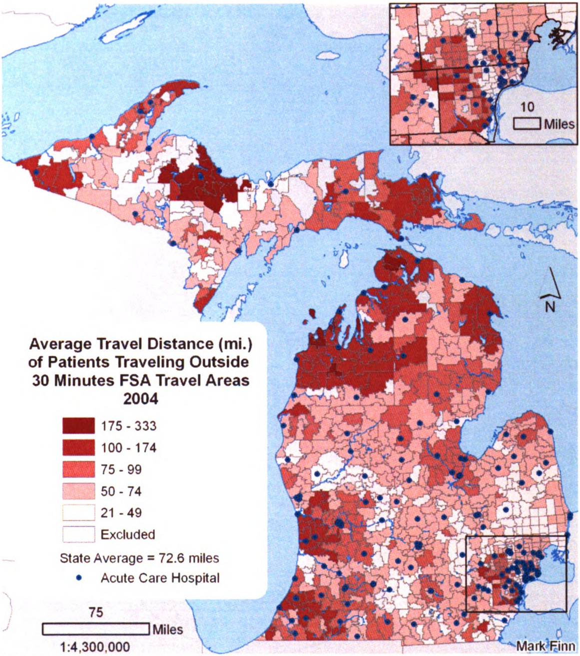

10
Miles
N
Average Travel Distance (mi.)
of Patients Traveling Outside
30 Minutes FSA Travel Areas
2004
175 - 333
100 - 174
75 - 99
50 - 74
21 - 49
Excluded
State Average = 72.6 miles
Acute Care Hospital
75
Miles
1:4,300,000
Mark Finn

Fig. 58

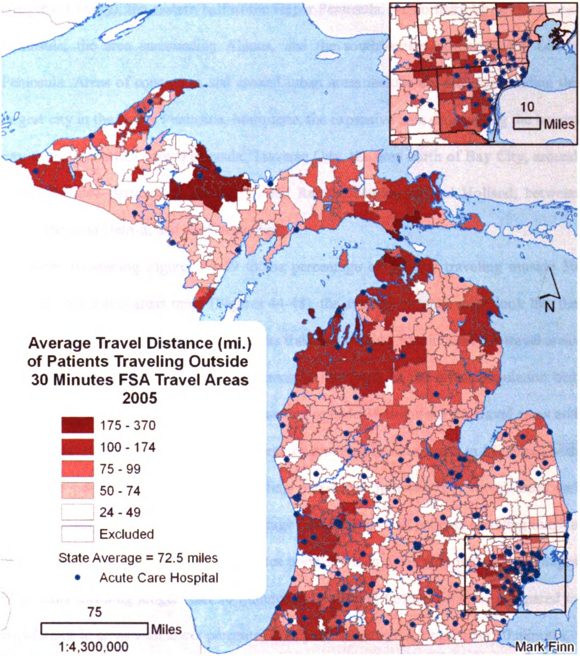


Fig. 59

The spatial distribution of the average travel distance of patients traveling outside 30 minutes FSA travel time areas for acute care creates a distinct pattern which is present all five years. As indicated in the scatterplot, there is an equal distribution of rural areas where patients on average travel short and long distances. Rural areas of concern where patients travel long distances on average include the western tip of the Upper Peninsula

(Gogebic County), the eastern half of the Upper Peninsula, the northern tip of the Lower Peninsula, the area surrounding Alpena, and the southwestern corner of the Lower Peninsula. Areas of concern in and around urban areas include the area surrounding the largest city in the Upper Peninsula, Marquette, the expansive area surrounding the largest city in the northern Lower Peninsula, Traverse City, the area north of Bay City, around Grand Rapids—particularly between Grand Rapids, Muskegon, and Holland, between Ann Arbor and Detroit, and west of Pontiac.

When comparing Figures 55-59 to the percentage of patients traveling outside 30 minutes FSA travel areas maps (Figures 44-48), the average distance maps look like the exact opposite of the percentage of patients traveling outside 30 minutes FSA travel areas maps. Detroit and the central Lower Peninsula just north of the urban population belt both have low percentages of patients traveling outside 30 minutes FSA travel areas and average travel distances. There are no large or moderately sized areas in Michigan with both high percentages of patients traveling outside 30 minutes FSA travel areas and average travel distances. Analysis of average travel distance of patients traveling outside 30 minutes FSA travel time areas indicates populations in areas with higher percentages of patients traveling longer than 30 minutes do not travel further distances compared to populations in areas with lower percentages of patients traveling longer than 30 minutes.

3.3 Results of Calculation of Proximity to the Nearest Acute Care Hospital Outside FSA

Consideration for proximity to nearby hospital alternatives for acute care can affect utilization trends. The measurement of proximity to the nearest acute care hospital outside an FSA was calculated to identify areas where the presence of hospital alternatives may affect utilization trends.

FSA	Dist. (mi.)
1A	2.8
1B	2.5
1C	6.5
1D	2.5
1E	3.6
1F	6.6
1G	11.9
1H	11.2
1I	11.9
1J	16.0
2A	19.0
2B	19.1
2C	18.6
2D	13.6
3A	11.6
3B	19.1
3C	9.2
3D	9.2
3E	18.6
4A	23.0
4B	13.0
4C	13.0
4D	23.0
4E	20.1
4F	12.0
4G	20.0
4H	19.0
4I	12.0
4J	19.0
4K	15.9
4L	11.6
5A	19.0

FSA	Dist. (mi.)
5B	19.7
5C	19.7
6A	23.5
6B	15.2
6C	15.3
6D	16.0
6E	11.8
6F	11.8
6G	15.5
6H	13.9
6I	13.9
7A	19.3
7B	19.3
7C	30.5
7D	25.6
7E	30.5
7F	21.3
7G	26.3
7H	23.8
7I	23.0
8A	46.6
8B	38.8
8C	34.0
8D	26.8
8E	26.8
8F	34.0
8G	37.9
8H	43.8
8I	37.1
8J	37.1
8K	44.1
8L	47.4

Shortest Radial Distance from a Hospital in a FSA to a Hospital Outside a FSA
Table 2

The average shortest radial distance from a hospital in a FSA to a hospital outside a FSA is 20 miles. FSA 8L (Sault Ste. Marie) is the furthest from any hospital with 47.4 miles, and FSA 1B (Warren) is the closest to any hospital with 2.5 miles. A comparison of Figures 55-59 of the average travel distance of patients traveling outside 30 minutes

FSA travel time areas for acute care to Table 3 above reveals several areas in Michigan where patients travel great distances when living in close proximity to alternative hospitals. These areas include the northern Lower Peninsula, the area just north of Bay City, the southwest Lower Peninsula, and between Ann Arbor and Detroit.

3.4 Results of Hospital Hierarchical Movement Analysis of Patient Visits Outside 30 Minutes Travel Time

Michigan's health care system was developed to be a hierarchical delivery system under the Hill-Burton era with *base areas* centered on a medical center-teaching hospital, followed by regional hospital centers, community hospital centers, and public health and medical service centers. Although the definition of Michigan acute care hospitals within this hierarchy ended with the Griffith Methodology, the post WWII Hill-Burton era of rapid hospital construction left its hierarchical imprint on Michigan with the selective building of hospitals to balance the hierarchy, restrictions on hospital expansions, and limitations on hospital relocation.

Outside of state regulation, most hospitals across the United States are integrated into communities through ties with area physicians and other health care providers, clinics, outpatient facilities, and other practitioners (Gourevith, Caronna, and Kalkut 2005). It is assumed local area providers will refer patients to nearby hospitals within this network, and it is assumed patients will seek out nearby hospitals for service versus traveling a great distance. It is assumed patients will be referred up the hierarchy to larger facilities or patients may choose larger facilities over smaller facilities.

If the Michigan acute care health system as defined under the acute care bed need methodology is accurately representing utilization trends, it could be assumed patients in urban areas that travel outside 30 minutes for health care would travel to larger hospitals such as the large teaching hospitals found in the urban center and not to smaller rural hospitals. It could also be assumed these urban patients would travel to hospitals the same size as their local hospitals as a result of referral or in response to competition or advertising. Urban patients or rural patients passing up nearby hospitals for significantly smaller hospitals could indicate some form of avoidance. The combination of the results of this hierarchical movement analysis with the results of the patient travel outside of 30 minutes travel time analysis and proximity to nearby hospital alternatives outside a FSA analysis should demonstrate patient avoidance of certain acute care hospitals regardless of nearby alternatives and hospital size.

Appendix 10 shows the results of the hierarchical movement analysis of patient visits outside 30 minutes travel time with six maps for each year between 2001 and 2005: three maps of the total number of visits to smaller, similar sized, and larger hospitals normalized by Census 2000 total population; and three maps of the percentage of visits to smaller, similar sized, and larger hospitals versus all patient visits outside 30 minutes travel time. The spatial distribution of patients traveling outside 30 minutes FSA travel time areas for acute care to smaller, similar sized, and larger hospitals (see Section 2.3.2 for specific definition) create distinct patterns which are present over all five years.

Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas. The state average for the normalized total number of visits to smaller hospitals outside 30 minutes FSA travel areas does not vary from 0.9 between 2001 and 2005 except in 2001 at 1.0.

The maximum ZIP code normalized totals between 2001 and 2005 is roughly 5.7 except for in 2001 when an extreme 29.3 value for a single ZIP code in Lakeland, Michigan (near Ann Arbor) appears as the result of a units problem where the population of this ZIP code is only 50 people. The greatest number of visits to smaller hospitals outside 30 minutes FSA travel areas occurs throughout the southern LP. The areas with the highest normalized totals are around Saginaw, Hastings, southeast of Lansing, and throughout Metro Detroit. These areas have a large number of patients traveling to smaller hospitals compared to the rest of Michigan.

Percentage of Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel areas. The state average percentage decreases from 52.0% in 2001 to 49.5% in 2002 and then decreases to 49.4% in 2004, and remains the same in 2005. The maximum percentage for a ZIP code is 99% throughout the five year period. The majority of the Lower Peninsula has a high percentage of patients traveling outside 30 minutes FSA travel areas to smaller hospitals than the hospitals within 30 minutes travel time. The areas with the highest percentages, where over 80% of patients travel to smaller hospitals, are in the urban population belt across the Lower Peninsula. The high values in the southeast Lower Peninsula in and around the Detroit Metro are the result of having the largest hospitals in Michigan within 30 minutes travel time.

Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Time. The state average for the normalized total of visits to similar sized hospitals outside 30 minutes FSA travel areas is .19 with little variation between 2001 and 2005. This average is significantly lower than the average going to smaller hospitals. The normalized totals throughout the state are low. The maximum value decreases from 3.68 in 2001 to 1.20 in

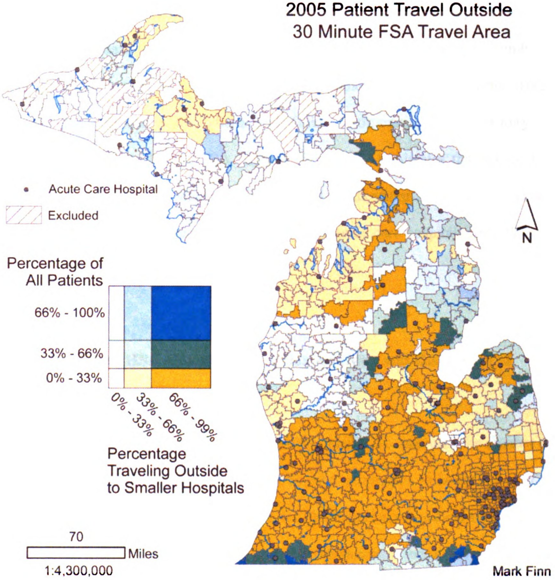
2005. The areas with the highest normalized totals are around Saginaw Bay, Flint, Muskegon, and south of Kalamazoo down to the Indiana border.

Percentage of Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Areas. The state average percentage decreases from 19.4% in 2001 to 17.4% in 2004 and 2005. The maximum percentage for a ZIP code decreases from 100% to 84% between 2001 and 2005. Few areas in Michigan have a high percentage of patient travel to similar sized hospitals. The areas with the highest percentages, where over 80% of patients travel to similar sized hospitals, in the Upper Peninsula include the area in between Bessemer and Ontonagon; the areas around L'Anse and Iron Mountain; and within Menominee County. In the Lower Peninsula, only Flint has high percentages, over 60%, of patient travel to similar sized hospitals. Flint is an interesting case as it falls in between Lansing, Saginaw, Bay City, and northern Metro Detroit. All of these areas contain similar sized hospitals to those in Flint.

Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas. The state average for the normalized total of visits to larger hospitals is .01 in 2001 and .05 for 2002 through 2005. This average is significantly lower than the average going to smaller hospitals and the average going to similar sized hospitals. The maximum value for a ZIP code fluctuates between 1.00 and .76. The majority of patients in Michigan do not travel to larger hospitals when traveling outside their 30 minutes FSA travel areas. The only areas where patients are traveling to larger hospitals are those just outside 30 minutes of a major city in rural areas. For example, a distinct 30 minutes travel border encircles northern Grand Rapids. The areas in Michigan with the highest normalized totals are those on the 30 minutes periphery boundary of northern Grand Rapids, northern Metro Detroit, and eastern Bay City-Saginaw.

Percentage of Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas. The state average percentage fluctuates between 7.2% and 7.8% between 2001 and 2005. This percentage is much lower than the average percentage of patients going to smaller hospitals and the average percentage of patients going to similar sized hospitals. The maximum percentage for a ZIP code fluctuates between 80% and 87% for the five year period. Two ZIP codes in Sanilac County are the only areas in Michigan containing a high percentage, greater than 80%.

Figure 60 shows a bivariate map of 2005 patient travel outside 30 minutes FSA travel areas with the percentage of all patients traveling outside 30 minutes and the percentage traveling outside 30 minutes to smaller hospitals.



2005 Patient Travel Outside 30 Minutes FSA Travel Areas Bivariate Map: Percentage of All Patients and Percentage Traveling Outside to Smaller Hospitals
Fig. 60

Figure 60 depicts the combination of the results of this hierarchical movement analysis for patients traveling to smaller hospitals and the results of the patient travel outside of 30 minutes travel time analysis (Section 3.1). Areas where there is a local hospital avoidance as revealed by areas with a high percentage of patients traveling outside 30 minutes travel time and high percentage traveling to smaller hospitals, indicated in medium to dark blues and greens on the map, the central Upper Peninsula and portions of Mackinac County; the northeastern Lower Peninsula, Thumb of Michigan, and west central Michigan north of Grand Rapids; and particularly high areas along Michigan's border with Indiana and Ohio. Incorporating the proximity to alternative hospitals outside of a FSA analysis (Section 3.3) indicates that the central Upper Peninsula, portions of Mackinac County, and northeastern Lower Peninsula are areas in Michigan where patients are avoiding nearby acute care hospitals regardless of nearby alternatives and hospital size.

3.5 Results of HSA Commitment Index Analysis and Discussion of FSAs

Griffith's index of commitment, or commitment index (CI), measures the number of admissions to a hospital x from area y divided by total admissions to hospital x (1972). The commitment index is predominantly used for the definition of medical service areas (Ricketts et al. 1994). This thesis will use the commitment index to evaluate the definition of HSAs in Michigan. This analysis focuses on the hospitals within a HSA (Appendix 2) in relation to the population within the MDCH-CON defined HSA area (Figure 11). ZIP codes with a high CI located in another HSA's area would demonstrate a patient utilization trend incongruent to Michigan's current HSA definitions. Maps of ZIP code commitment indices for each HSA for the combined years of 2001 through 2005 were created to show the relative market share of patients utilizing acute care for each HSA (Figures 61-68).

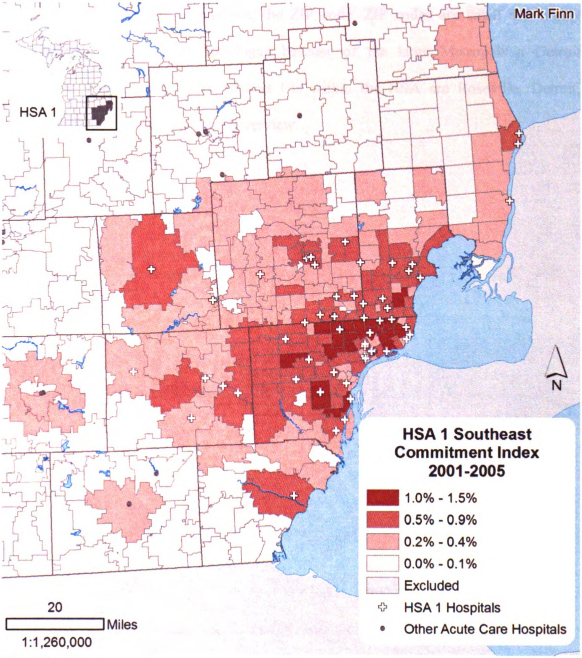


Fig. 61

Figure 61 shows the CI for HSA 1 – Southeast. The distribution of ZIP codes with high CIs is congruent overall to the geographic definition of the HSA (shown on the small inset map). A few outliers are present around Ann Arbor, Adrian, and southeastern Sanilac County, but their CI values are very low. Compared to the other HSAs (Figures 61-67), the values of CI by ZIP code are significantly lower in HSA 1 – Southeast. This is an artifact of the unit of analysis, the ZIP code. ZIP codes are small and highly concentrated in southeastern Michigan because of the large Metropolitan Detroit population. The areas with the highest CIs within the HSA are Roseville, Detroit, Westland, Taylor, Wyandotte, and Riverview.

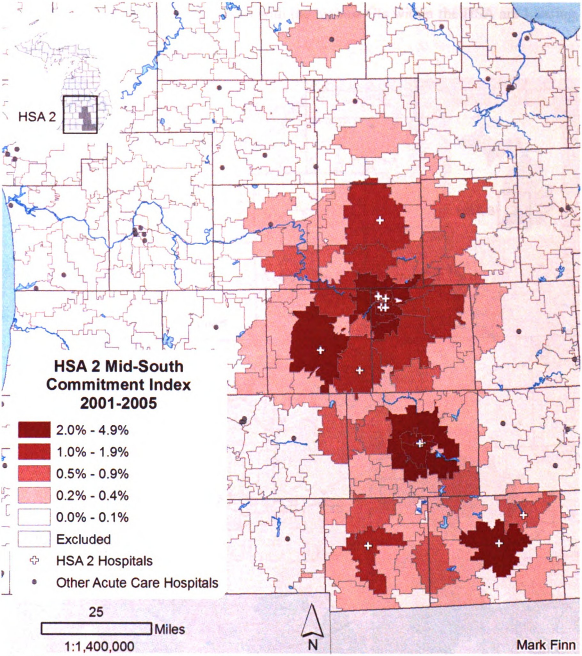


Fig. 62

Figure 62 shows the CI for HSA 2 – Mid-South. The distribution of ZIP codes with high CIs is congruent overall to the geographic definition of the HSA. Most of the immediate outliers are the result of ZIP code boundaries not matching county boundaries which are the political boundaries HSA are based upon. One outlier with a moderate CI is present around Owosso. Two outliers with low CIs appear north of the HSA around Mt.

Pleasant and south of Alma. The areas with the highest CIs within the HSA are Lansing, Charlotte, Jackson, and Adrian.

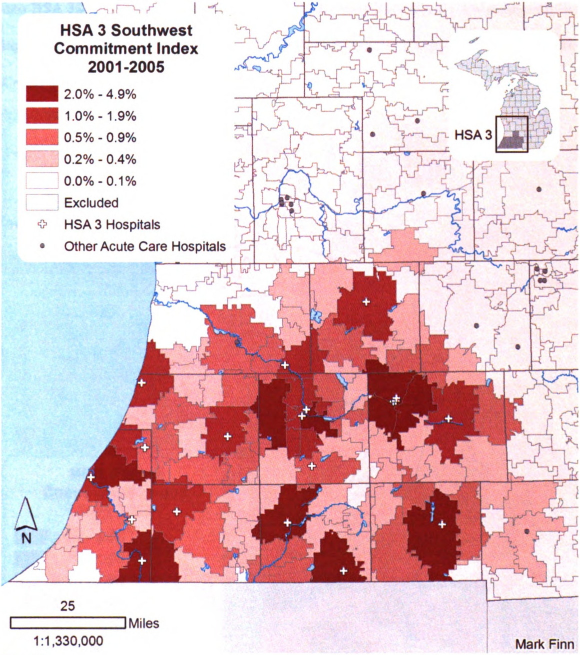


Fig. 63

Figure 63 shows the CI for HSA 3 – Southwest. The distribution of ZIP codes with high CIs is congruent overall to the geographic definition of the HSA. Most of the immediate outliers are the result of ZIP code boundaries not matching HSA/county boundaries. Allegan County is an area with moderately high CIs which is located outside HSA 3. However, many of the ZIP codes in Allegan County have boundaries that extend into HSA 3. One outlying area with a low CI is present around Adrian. The areas with the highest CIs within the HSA are the ZIP codes around St. Joseph, Kalamazoo, Battle Creek, Three Rivers, Sturgis, and Coldwater.

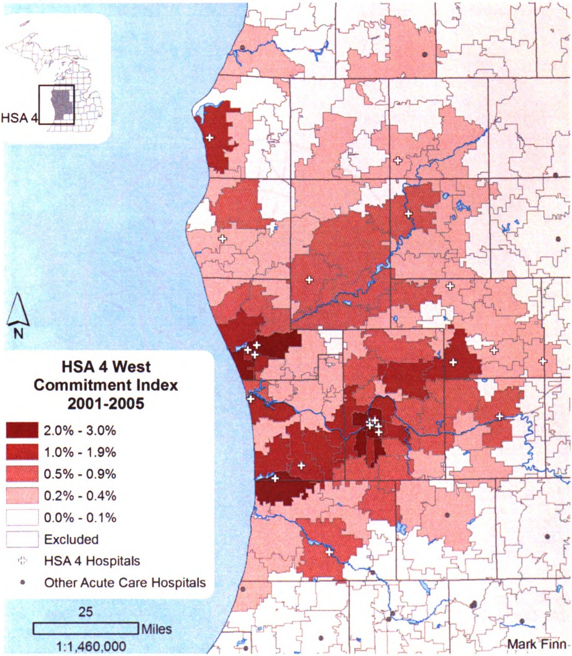


Fig. 64

Figure 64 shows the CI for HSA 4 – West. The distribution of ZIP codes with high CIs is completely congruent to the geographic definition of the HSA. The only outliers are the result of ZIP code boundaries not matching HSA/county boundaries. The areas with the highest CIs within the HSA are around Muskegon, Grand Rapids, and Holland.

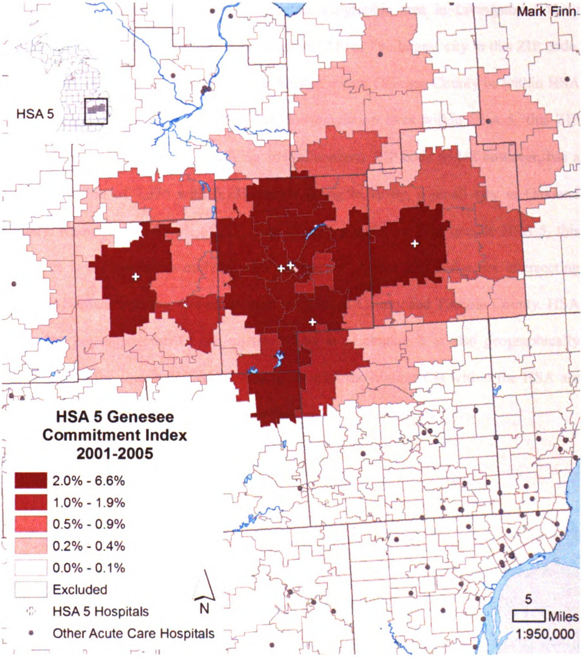


Fig. 65

Figure 65 shows the CI for HSA 5 – Genesee. The distribution of ZIP codes with high CIs is not congruent to the geographic definition of the HSA. Two large ZIP codes overlapping the Genesee, Livingston, and Oakland county borders have high CI, 48430 and 48442. According to Census 2000 data, the aforementioned ZIP code with the higher CI along these borders and with the greatest geographic area in Livingston County outside HSA 5, 48430, has a total population of 12,816. The largest city in this ZIP code, Fenton, has a population of 10,582 and is located within Genesee County or within HSA 5. Knowing that 82.6% of ZIP code 48430's population lives within HSA 5, this ZIP code will not be considered an outlying area of concern. ZIP code 48442 however, has a total population of 7,336 with 6,135 people living in Holly, a small city in Oakland County. Knowing that 83.6% of ZIP code 48442's population lives outside HSA 5, this ZIP code is considered an outlying area of concern. A few ZIP codes not intersecting HSA 5's borders with low CIs are located in Oakland County and Tuscola County. HSA 5 has the highest overall CI out all the HSAs in Michigan; it is also geographically smallest with the fewest ZIP codes. The areas with the highest CIs within the HSA are Owosso, Flint, Grand Blanc, Lapeer, and Fenton.

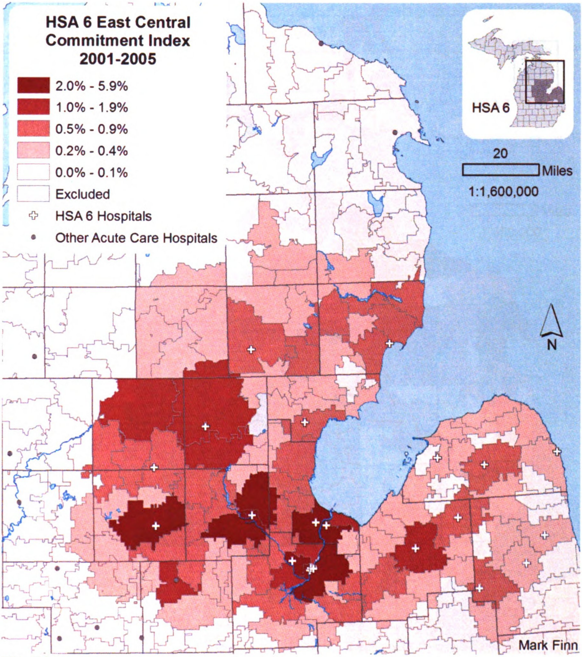


Fig. 66

Figure 66 shows the CI for HSA 6 – East Central. The distribution of ZIP codes with high CIs is congruent overall to the geographic definition of the HSA. All but one ZIP code outlier are the result of ZIP code boundaries not matching HSA/county boundaries. This outlier is located in central Oscoda County. The areas with the highest CIs within the HSA are Mt. Pleasant, Midland, Bay City, and Saginaw.

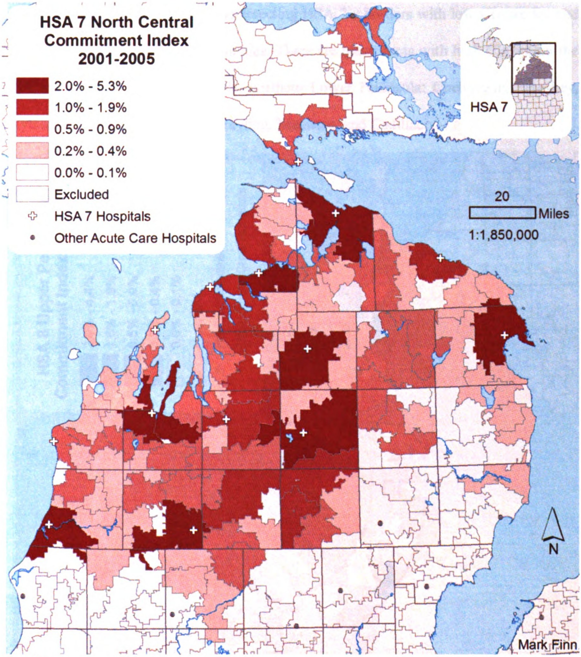


Fig. 67

Figure 67 shows the CI for HSA 7 – Northern Central. The distribution of ZIP codes with high CIs is not congruent to the geographic definition of the HSA. Several ZIP codes with moderate sized CI are present in the Upper Peninsula counties of Chippewa and Mackinac and the Lower Peninsula county of Roscommon. There are several ZIP code outliers which are the result of ZIP code boundaries not matching HSA/county boundaries. A few ZIP codes not intersecting HSA 7's borders with low CIs are located in Osceola, Mecosta, and Iosco Counties. There are many areas with high CIs within the HSA around the larger cities of the northern Lower Peninsula: Cheboygan, Petoskey, Gaylord, Alpena, Traverse City, Grayling, Manistee, and Cadillac.

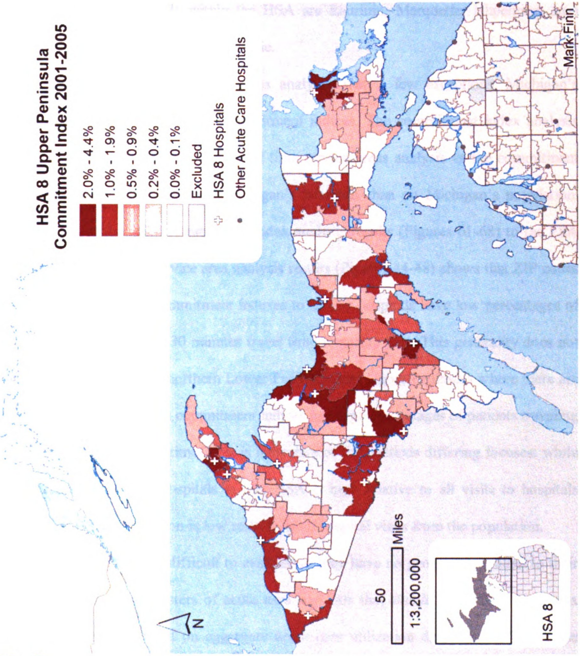


Fig. 68

Figure 68 shows the CI for HSA 8 – Upper Peninsula. The distribution of ZIP codes with high CIs is congruent to the geographic definition of the HSA. HSA 8 is surrounded by water, except for its western border with Wisconsin, and has only Mackinaw Bridge to connect it to the Lower Peninsula. This FSA has no outlying ZIP codes with CIs. The areas with the highest CIs within the HSA are Laurium, Marquette, Ishpeming, Iron Mountain, Escanaba, and Sault Ste. Marie.

Based on the commitment index analysis, with a few exceptions, Michigan's HSAs closely align with patient commitment indices. The commitment index analysis differs from the FSA 30 minutes travel time service areas analysis as the commitment index analysis focuses more on Michigan's hospitals than on Michigan's population. Comparison of the HSA commitment index analysis results (Figures 61-68) to the FSA 30 minutes travel time service area analysis results (Figures 44-48) shows that ZIP codes in Michigan with high commitment indexes to nearby hospitals have low percentages of patients traveling outside 30 minutes travel time for acute care. This generality does not hold true for areas in the northern Lower Peninsula and Upper Peninsula where there are many ZIP codes with high commitment indices and high percentages of patients traveling outside 30 minutes travel time. This is indicative of the methods differing focuses: while the portion of visits to hospitals in that HSA is high relative to all visits to hospitals within that HSA, the portion is low relative to all hospital visits from the population.

Michigan's FSAs are difficult to evaluate as they have no geographical basis to their assignment. They are clusters of acute care hospitals that *should* be defined by a max relevance algorithm based on aggregate acute care utilization data from 1976 for the majority of Michigan—the southern Lower Peninsula (Metro Detroit) and Traverse City area of Michigan were redefined in 2002 (Nash 2007). However, both times an expert committee ultimately decided on whether to accept the results.

Figures 69 and 70 draw geographic comparisons between the 2007 FSA clusters and the 1946 and 1975 FSA areas. FSAs that have been split up into smaller FSAs are indicated by dotted red lines, and FSAs that have been combined are indicated by solid red lines.

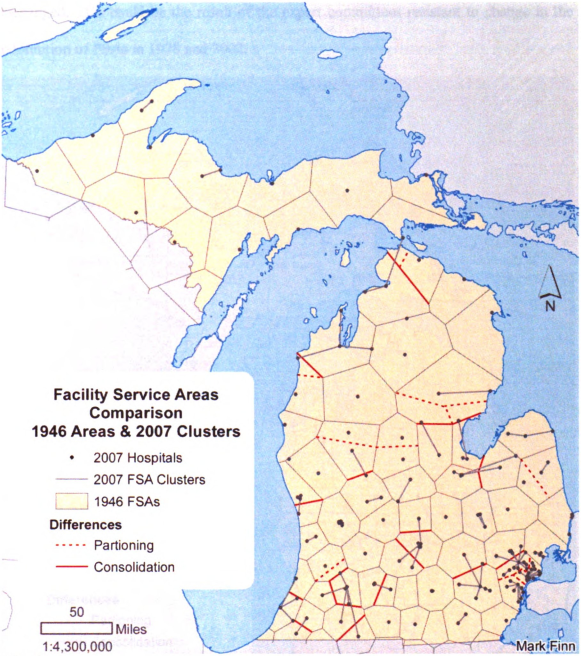


Fig. 69

Upon visual examination of Figure 69, it is apparent the greatest changes between 1946 and 2007 occurred in the southern Lower Peninsula. Outside of Metro Detroit where partitioning occurred, the majority of changes resulted in the consolidation of FSAs. The partitioning of FSAs occurred throughout the central Lower Peninsula. The entire Upper Peninsula and portions of the northern Lower Peninsula have remained unchanged. This could be the result of the expert committees resistant to change in the redefinition of FSAs in 1978 and 2002.

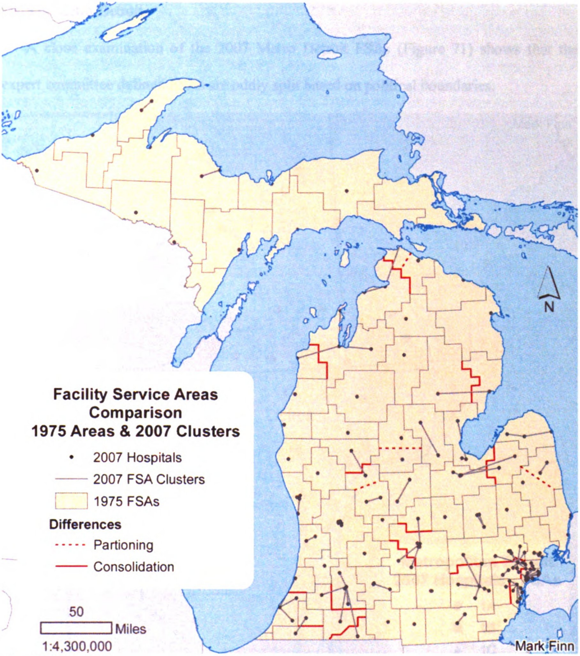


Fig. 70

Comparing Figure 69 to Figure 70, the FSA locations and distribution appear quite similar between 1946 and 1975. Many of the FSA partioning and consolidations in the northern Lower Peninsula and southwestern Lower Peninsula remain the same indicating these changes likely occurred in the 1978 definition of FSAs. One significant change has been the consolidation after 1975 of the FSAs which were partitioned between 1946 and 1975 in Metro Detroit.

A close examination of the 2007 Metro Detroit FSAs (Figure 71) shows that the expert committee defined FSAs are oddly split based on political boundaries.

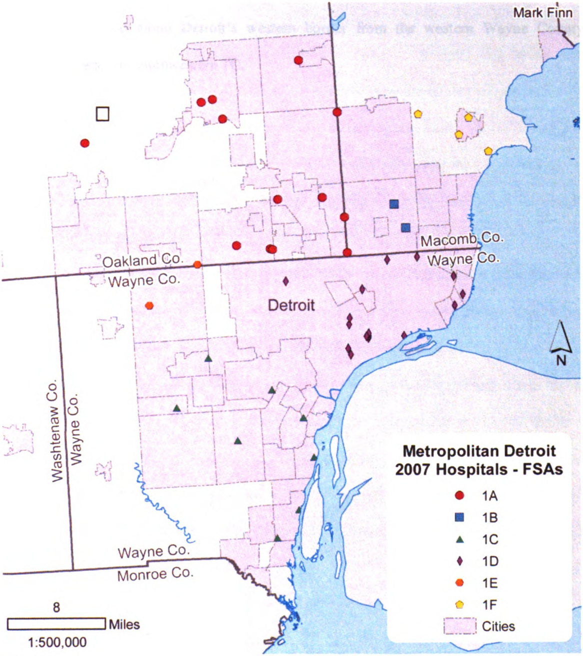


Fig. 71

The northern Wayne County line which is formed by 8 Mile Road, a *de facto* cultural and economic dividing line and boundary between the City of Detroit and Detroit's northern suburbs in Oakland and Macomb Counties, distinctly separates FSAs 1D and 1E from the Oakland County 1A FSA and Macomb County 1B. The Oakland County–Macomb County line divides FSA 1A from 1B. Detroit and Grosse Pointe form together and are separated along Detroit's western border from the western Wayne County suburbs 1E and the southwestern 1C.

4 Conclusions

4.1 Overview

The structure and spatial organization of health care systems are the result of decades of politics, business, payment mechanisms, social programs, scientific planning, utilization, medical advancements, and population changes. Certificate-of-Need Programs (CON) were created to manage the growth of these systems by controlling health care costs, preventing the duplication of services, and increasing the quality of and access to health care. Federal support for Certificate-of-Need Programs ended in 1986 with the repeal of the National Health Planning Act, and the health care planning movement in the United States declined. In Michigan and the majority of states, their CON Programs continued with state funding.

The American Health Planning Association (2004) places Michigan's CON Program in the mid-range of states for scope of CON coverage and monetary review thresholds. Compared to surrounding states, Michigan covers more services under CON than Ohio, Wisconsin, and Indiana (no CON program), is most similar to Illinois, and covers fewer services than New York. In a nationwide comparison of CON programs conducted by a consultant for the State of Washington, Michigan ranked along side North Carolina as having the most effective CON program in the country (Piper 2005). However at the state level, a 2002 Auditor General of Michigan audit report and 2005 follow up audit report stated MDCH had failed to evaluate the state's CON Program in order to determine whether the CON Program was achieving its goal of balancing cost, quality, and access issues and ensuring that only needed services are developed in Michigan (McTavish 2002, 2005).

The purpose of this thesis was to explore the efficacy of the methods used by the Michigan Department of Community Health – Certificate-of-Need Division and the Certificate-of-Need Commission (MDCH-CON) to measure health care demand in the State of Michigan. Health care demand in Michigan is defined under MDCH-CON's acute care hospital bed need methodology (Certificate of Need Commission 2007b). This definition of health care demand is indicative of the demand of a health care system for services based on a measurement of a population's health care need, not individual demand.

Michigan's original acute care bed need methodology was outlined in 1946 by the Michigan Hospital Study Committee. Their formula for estimating need for general hospital beds was based on the Hill-Burton Act guideline of 4.5 beds per 1,000 people. Bed need was calculated using a bed-death ratio and the incidence of birth (assuming an average length-of-stay of 11 days). Michigan's original facility service areas (FSAs), were defined in accordance with the Hill-Burton Act and looked similar to Thiessen Polygons (Figure 8). In 1955 the FSAs were redefined and mapped to U.S. Census Minor Civil Division borders (Figure 9). Also in 1955, the bed need methodology was changed to incorporate the guidelines set by the U.S. Commission on Hospital Care using a measure of hospital days per thousand people. The FSAs in Michigan again changed in 1963 taking into consideration population distribution, transportation and trade patterns, travel distance and data indicating the residence of patients served by existing hospitals. These FSAs remained the same until 1978 (Figure 10). In 1961, long-term care beds were separated from the general bed need methodology, and the bed need methodology was renamed acute care bed need. In 1965, the acute care bed need methodology incorporated an occupancy factor required by Federal regulation which was modified under Federal approval for the State of Michigan. The acute care bed need methodology dramatically changed in the early 1970s as Federal Policy Memorandum No. A-1-73 allowed changing of the formula used to determine acute care bed need. Michigan's new formula incorporated age adjustments, referral adjustments, and obstetrical use rates.

The National Health Planning and Resources Development Act of 1974 required all states to define area wide Health Systems Agencies (HSAs) for health planning. Michigan politically defined 8 HSAs without any geographic or scientific consideration. These regions mapped to county boundaries and the City of Detroit, are displayed in Figure 11, as they appear today.

The CON Review Standards for Hospital Beds (Certificate of Need Commission 2007b) details the Michigan CON Commissions current standards for measuring health care demand. Their standards or methodology was defined in 1978 by Thomas, Griffith, and Durance (1979) as a two step approach. The first step of the methodology was to generate proposed FSAs using a relevance clustering algorithm based on patient utilization data. The second step of the methodology relied on a subjective panel of "experts" who selected FSAs they felt reasonable based on their knowledge of the area. This methodology came to be known as the Griffith Methodology. The methodology was last applied to the State of Michigan in 2002 where results were discarded in favor of the 1978 FSAs for approximately 75% of the state (FSAs for the southern Lower Peninsula (Detroit) and Traverse City were modified). An accurate recreation of the Griffith

Methodology to define FSAs is impossible due to the entanglement of political, business, and perceived public interests ascribed by expert committees composed of individuals representing hospitals, health systems, councils, and insurance providers. Griffith wrote a letter to Larry Horvath, Manager of Michigan's CON Program, on January 4, 2004, indicating he no longer could support his bed need methodology as being in the best interest of the people of Michigan and recommended the bed need methodology be abandoned.

The current acute care bed need methodology used by MDCH-CON to represent real demand measures demand uses patient discharge data from the Michigan Inpatient Data Base (MIDB) in combination with U.S. Census Bureau total population statistics and population projections by ZIP code. The methodology measures a relevance index for each FSA based on patient days for specific age groups and obstetrical discharges within ZIP codes; these ZIP code relevance indices are combined with base year total population and projected population and divided by 365 to create the FSA projected average daily census; the FSA projected average daily census is divided by occupancy rates listed in a table (Appendix 4) to calculate the FSA projected bed need.

The analysis presented in this thesis to explore the methods used by MDCH-CON to measure health care demand utilized the same data sets used in the calculation of the acute care bed need methodology: the Michigan Inpatient Data Base (MIDB), a database of acute care hospital discharges, and U.S. Census total population estimates and projections by ZIP code. Further, the acute care bed need methodology placed an emphasis on planning with reference to a demonstrated demand by assuming past hospital utilization shed light on future usage, and this thesis also adopted this assumption and limited its scope of variables to those found in the methodology's datasets.

The State of Michigan defines a *limited access area* as a geographic area containing a population of 50,000 or more based on the planning year, not within 30 minutes drive time of an existing licensed acute care hospital with 24 hour/7 days a week emergency services, and utilizing the slowest route available as defined by the Michigan Department of Transportation (Certificate of Need Commission 2007b). It has been recommended to the Michigan CON Hospital Beds Standard Advisory Committee (CON-HBSAC) the 30 minutes travel time rule be expanded to all areas regardless of population size (Hospital Beds Standard Advisory Committee 2004). The purpose of Michigan's acute care bed need methodology was to develop an acute care hospital system which represented health care demand or actual patient utilization trends. The 30 minutes travel time rule was used to determine whether the current acute care hospital system in Michigan as defined by the acute care bed need methodology was failing to represent health care demand and actual patient utilization trends.

The methods used in this exploration calculated the percentage of patient visits traveling further than 30 minutes travel time and those patients' average radial travel distance; identified the nearest hospital to each FSA; analyzed the hierarchical movement of patients to differing sized hospitals traveling further than 30 minutes travel time; and computed a commitment index for the evaluation of HSAs.

Results of this analysis indicated a significant percentage of patients travel longer than 30 minutes instead of accessing nearby hospitals and some local hospitals are almost entirely avoided by their 30 minutes service area population. Additionally, HSAs despite being mapped to county boundaries reflect utilization trends well, while FSAs greatly overlapped in their 30 minutes travel time service areas and changed very little since 1946.

4.2 Major Findings

How do the current methods used by MDCH-CON represent real demand?

If the current methods used by MDCH-CON, as defined in the acute care bed need methodology, represent real demand, then Michigan's acute care system would reflect patient utilization trends. This thesis evaluated whether Michigan's acute care system reflected patient utilization based on the 30 minutes travel time limit. Results indicated an increasing percentage of Michigan's population was traveling further than 30 minutes for acute care between 2001 and 2005 (Section 3.1). Outside of major metropolitan areas, there was a statistically significant problem with Michigan's population traveling further than 30 minutes for acute care (Figure 53). The most extreme cases were in the Upper Peninsula where 60% of the 30 minutes travel time service area patients around FSAs 8I, 8J, and 8K traveled further than 30 minutes for acute care instead of visiting nearby hospitals (Appendix 8). Travel distance analysis (Section 3.2) indicated that despite access to arguably the highest quality and quantity of care, Michigan's urban population was traveling the furthest when traveling outside 30 minutes travel time areas for acute care. Even when taking into consideration the relative proximity to nearby hospital alternatives (Section 3.3) and the size of these hospital alternatives (Section 3.4), there are several hospitals in Michigan avoided by their 30 minutes service area population. These areas include the central Upper Peninsula, portions of Mackinac County, and northeastern Lower Peninsula. Michigan's acute care bed need methodology is not adequately representing real demand.

What is the level of uncertainty of these methods and what are the sources of the uncertainty?

Uncertainty in the acute care bed need methodology is introduced by the input of committees to interpret results, the sole use of the Michigan Inpatient Data Base for utilization data, and the reliance on the 5-digit ZIP code as the primary geographic unit of analysis.

The acute care bed need methodology was not recreated for this study due to its being highly subjective: results for the definition of FSAs in 1978 were discarded by the expert committees at the time, and many Michigan FSAs continued to be defined by Hill-Burton era methods; results for 2002 were discarded for the entire state except for around Detroit and Traverse City, and now the Detroit Metro's FSA divisions are distinctly related to political boundaries and not utilization (Section 3.5). For example, the northern Wayne County line which is formed by 8 Mile Road, a *de facto* cultural and economic dividing line and boundary between the City of Detroit and Detroit's northern suburbs in Oakland and Macomb Counties, distinctly separates FSAs 1D and 1E from the Oakland County 1A FSA and Macomb County 1B. The 30 minutes service areas for these four FSAs notably overlap each other (Figure 27). No matter the findings produced by the methodology, political, business, and perceived public interests ultimately bias the final results by expert committees composed of individuals representing hospitals, health systems, councils, and insurance providers.

Additional uncertainty is the result of the acute care bed need methodology use of the Michigan Inpatient Data Base (MIDB) for utilization data. This data set was originally created out of the mid 1970s Michigan Acute Care Bed Need Methodology Project as a collaborative effort (Michigan Department of Public Health 1976). The dataset is complete and has few discernable errors. However, the use of the MIDB solely for understanding acute care utilization reflects the outdated nature of the 1978 methodology. Due in part to advances in medical treatment; the rapid growth of home care and new, for-profit ambulatory surgery centers; and Congress creating the diagnosis related group (DRG) system in 1983 which restricted lengths of stay under strict discharge planning to maximize profitability for hospitals from Medicare patients, there has been a dramatic increase in outpatient utilization (Feinglass and Holloway 1991). Using the 2003 Annual Hospital Statistical Questionnaire / Table 5 of all operating room discharges in Michigan, 180,404 cases from freestanding facilities would be discounted from the acute care bed need methodology (Michigan Department of Community Health 2003).

The U.S. Postal Service defined 5-digit ZIP code is the primary geographic unit of analysis used by the acute care bed need methodology. ZIP (Zone Improvement Plan) codes are created to facilitate mail delivery for the U.S. Postal Service; they are assigned to a section of a street, a collection of streets, an establishment, structure, or group of post office boxes (Albert, Gesler, and Levergood. 2000). Compounding problems arise from using a non-related administrative boundary to aggregate data into areas (Kirby 1996). ZIP codes encompass neighborhoods with highly divergent economic, social, and environmental characteristics and cross political and census boundaries, making it difficult to overlay data for GIS analysis (Kirby 1996; Cromley and McLafferty 2002).

ZIP codes are not evenly distributed throughout Michigan; urban areas have smaller, more concentrated numbers of ZIP codes, and rural areas have large sparse ZIP codes. Additionally, several ZIP codes in Michigan cross three county boundaries, and many ZIP codes are non-contiguous making distance measurements difficult.

How might demand measures be methodologically improved?

The focus of the Michigan's acute care bed need methodology is still on identifying the need for the *expansion* of a health care system by licensing new beds and constructing new hospitals. This emphasis on expansion is a holdover from the beginnings of the health care planning movement during the Hill-Burton / post WWII era of construction of hospitals to provide for America's growing population. Currently, every FSA in Michigan is in excess capacity of acute care beds totaling 6,879 beds or 25% of all acute care bed in the state according to the July 2, 2007 Bed Inventory (Certificate of Need Program 2007b). Even closed hospitals are allowed to keep their beds. These excess beds are not being utilized; the 2005 average acute care hospital occupancy rate was only 56.7% (Certificate of Need Program 2007a). Additionally, official state population projections created by the Michigan Department of Transportation (2003), indicate a substantial decline in Wayne County and other areas between 2005 and 2030. Wayne County also has the highest concentration of hospitals and highest number of acute care beds in the state. The acute care bed need methodology should be improved by focusing on the reduction of beds.

The current requirements for the relocation of existing licensed hospital beds to another licensed site are not subject to a distance limitation, but are limited to either acute care hospitals within the same FSA or if the hospital at the existing licensed hospital site has operated at an adjusted occupancy rate of 80% or above for the previous, consecutive 24 months based on its licensed and approved hospital bed capacity, hospitals within the same HSA (Certificate of Need Commission 2007b). Michigan's current FSAs are unfit to be used as bed relocation requirements because they are by and large politically constructed, particularly around the Detroit Metro (see Section 3.5), and do not reflect current patient utilization trends. The distinct politically defined boundaries of FSAs between inner-city Detroit and its suburbs could explain recent concerns over the inability of certain hospitals in Detroit to open new hospitals in suburban locations (Citizens Research Council of Michigan 2005). The acute care bed need methodology should be improved by redefining the existing criteria for the movement of beds to other licensed sites either through the development of new criteria or redefinition of FSAs.

The acute care bed need methodology is a patient origin method. It takes into account the patient home ZIP code and the hospital visited to calculate patient days for specific age groups and obstetrical discharges by patient home ZIP code. In Conover and Sloan's evaluation of Michigan acute care bed methodology (2003), they concluded the strongest case for continuing CON for acute care hospital beds was for access. Incorporating measures of geographic access would improve the acute care bed need methodology by helping to reduce the problem of patients being referred or forced due to limited access to travel further than 30 minutes for acute care. The incorporation of geographic access would require the development of criteria for measuring distance from hospitals; hospitals generally take up large areas and a statewide standard would need to be imposed on whether to measure from the corner or centroid of the property or building, front door, or geocoded street address. Due to the aforementioned problems with ZIP codes, distances would need to be measured from patient home addresses for the greatest degree of accuracy. Criteria would also need to be determined for how distance should be measured.

The acute care bed need methodology does not represent current health care utilization trends. As mentioned above, thousands of outpatient discharges are not reflected in the methodology. In addition, Griffith (2004) points out several ways medical care, health insurance, information availability, and population needs have changed since 1978 in his letter ending his support for the acute care bed need methodology. A new acute care bed need methodology ought to be created. The assumption that all acute care procedures are uniform and interchangeable in the estimation of acute care need should be amended. Data are available in the Michigan Inpatient Data Base (MIDB) to forecast acute care need based on similar admissions and procedures such as Diagnosis Related Groups. Griffith (2004) takes this a step further saying that acute care need should be based on population need for a disease or service instead of based on beds:

> *An approach based on population need for a disease or service is substantially superior to one based on beds. It measures patients rather than facilities, indicates the resources more specifically and more accurately, and reveals important considerations about community health* (Griffith 2004).

The use of beds as the primary unit of acute care need determination and resource allocation has long been the standard in health care planning and should *not* change. The purpose of Certificate-of-Need regulation is to manage the growth of a state's health care system, so the focus of its need methodology should be based on facilities—their location, capacities, and available services—and the continual improvement of the health care system to meet the needs of the population. In the past, separate CON review standards have been created when necessary in Michigan for allocating resources based on surgical services and procedures such as: bone marrow, heart, lung, liver, and pancreas transplants; Magnetic Resonance Imaging (MRI), Computed Tomography (CT) Scanners, and Positron Emission Tomography (PET) Scanners; and open heart surgery, cardiac catheterization, and urinary lithotripters. A new acute care bed need methodology should be created which incorporates admissions and procedures into its assessment of need, but population admissions and procedures should not substitute facility beds and services.

4.3 Future Research

A new acute care bed need methodology ought to be created in Michigan which should: 1) focus on the reduction of beds; 2) redefine the existing criteria for the movement of beds to other licensed sites; 3) incorporate measures of geographic access; 4) integrate outpatient discharges; 5) and include forecasts of related admissions and procedures. Additional research should be conducted to identify the impacts of Michigan's excess capacity on costs, quality, access issues, unnecessary utilization, and duplicative services. This research could then be used to persuade state policy makers and planners of the need for the reduction of health care services in Michigan. Impact studies should also be conducted on areas of Michigan which could be affected by possible consolidation, closure, conversion, restructuring, and reallocation of the State's health care system.

This thesis identifies several potential areas for future research in addition to the recommendations to improve the acute care bed need methodology discussed above. First, the spider diagram (Figure 51) and the 30 minutes travel time maps (Figures 44-48) may have identified a utilization based hierarchy to Michigan acute care hospitals based on a distance decay of how far patients are willing to travel based on perceptions of hospitals, referrals, or the services offered. An analysis of acute care hospital markets could be further researched to aid health planners in the redefinition of FSAs and HSAs. Second, the fact that Michigan's urban population was traveling the furthest distance when traveling outside 30 minutes travel time areas for acute care despite access to arguably the highest quality and quantity of care needs to be investigated further (Section 3.2). These visits were usually to smaller facilities relative to nearby hospitals which would suggest these patients were seeking specialized services (Section 3.4). Investigating travel distances based on acute care procedure may help identify the cause of this utilization trend. Third, the out-of-state travel map (Figure 49) showed a significant percentage of Michigan residents travel out-of-state for acute care when living just south of Ann Arbor and Detroit. A health geography study of this area incorporating surveys and discharge data would help determine why this is occurring.

> *Need is endlessly redefined as the definition of good health continually changes, or by determining that what was once a medically or morally acceptable failure is no longer tolerable such as the death of a low birthweight baby, often as a function of technological possibility* (Callahan 1991-1992).

As our definition of need continually changes with medical advancements, changes in health care utilization, and changes within the population, so does our definition of access. The measurement of health care demand in Michigan must be continually updated and reevaluated to ensure adequate access to health care and that the needs of the population are met by the health care system.

Appendix 1

Factors Identified in Early Literature as Influencing Bed Needs for General Hospitals (Palmer 1956)

1. Availability and competency of physicians and other professional personnel in an area, including specialists.

2. The degree to which hospital staffs are open or closed to physicians of the locality.

3. Attitudes and customs of local physicians toward hospital care.

4. Inability of physicians to make home calls in remote areas.

5. Distance from the nearest hospital or from hospitals in adjacent areas.

6. The prevalence of substandard hospitals in an area.

7. Availability and effectiveness of other types of medical facilities in an area, including diagnostic or treatment clinics, chronic disease and other long-term hospitals, nursing and convalescent homes, rehabilitation facilities, medical schools, government hospitals, home care programs, social welfare services.

8. Advances in medical science, including the changes in medical techniques and the development of new drugs and technical equipment, which may affect the length of hospital stay or the number of hospitalizations.

9. Disease prevention activities in an area.

10. The awareness or attitudes of the general public toward the need and value of hospital care.

11. The quality and extent of health education in an area.

12. The purchasing power of the local population, as reflected by the levels of income and the prevailing prices paid for goods and services.

13. The extent of coverage by hospital insurance in the area.

14. The extent to which fee hospital and medical services are provided in the area by private and governmental agencies.

15. Occupancy rates.
16. Length of stay and number of admissions per bed per year.
17. Size of the hospital or hospitals in an area.
18. Selective admissions.
19. Changes in hospital administrative techniques.
20. Coordination and integration of hospital and other medical services.
21. The extent to which hospital beds in a city are used for non-residents.
22. The housing situation in an area, including the existence of any shortages and the number of smaller dwelling units.
23. The adequacy of transportation facilities.
24. Trends in size of population, including seasonal fluctuations.
25. Population density and distribution (urban or rural).
26. Composition of population (age, race, sex, marital status).
27. Cultural characteristics of the population, including educational level, local customs and mores, and religious affiliations.
28. Morbidity rates of the population (prevalence and incidence).
29. Industrial, occupational, and recreational hazards in an area.
30. Climate and topography of a region, as they affect the prevalence and endemicity of specific diseases.

Appendix 2

Michigan HSAs and FSAs (Certificate of Need Commission 2007b)

HSA	FSA	Hospital Name	City
1 - Southeast	1A	North Oakland Med Centers	Pontiac
	1A	Pontiac Osteopathic Hospital	Pontiac
	1A	St. Joseph Mercy – Oakland	Pontiac
	1A	Select Specialty Hospital - Pontiac	Pontiac
	1A	Crittenton Hospital	Rochester
	1A	Huron Valley – Sinai Hospital	Commerce Twp
	1A	Wm Beaumont Hospital	Royal Oak
	1A	Wm Beaumont Hospital – Troy	Troy
	1A	Providence Hospital	Southfield
	1A	Great Lakes Rehabilitation Hospital	Southfield
	1A	Straith Hospital for Special Surg	Southfield
	1A	The Orthopaedic Specialty Hospital	Madison Heights
	1A	St. John Oakland Hospital	Madison Heights
	1A	Southeast Michigan Surgical Hospital	Warren
	1B	Bi-County Community Hospital	Warren
	1B	St. John Macomb Hospital	Warren
	1C	Oakwood Hosp And Medical Center	Dearborn
	1C	Garden City Hospital	Garden City
	1C	Henry Ford –Wyandotte Hospital	Wyandotte
	1C	Select Specialty Hosp Wyandotte	Wyandotte
	1C	Oakwood Annapolis Hospital	Wayne
	1C	Oakwood Heritage Hospital	Taylor
	1C	Riverside Osteopathic Hospital	Trenton
	1C	Oakwood Southshore Medical Center	Trenton
	1C	Kindred Hospital – Detroit	Lincoln Park
	1D	Sinai-Grace Hospital	Detroit
	1D	Rehabilitation Institute of Michigan	Detroit
	1D	Harper University Hospital	Detroit
	1D	St. John Detroit Riverview Hospital	Detroit
	1D	Henry Ford Hospital	Detroit
	1D	St. John Hospital & Medical Center	Detroit
	1D	Children's Hospital of Michigan	Detroit
	1D	Detroit Receiving Hospital & Univ Hlth	Detroit
	1D	St. John Northeast Community Hosp	Detroit
	1D	Kindred Hospital–Metro Detroit	Detroit
	1D	SCCI Hospital-Detroit	Detroit
	1D	Greater Detroit Hosp–Medical Center	Detroit
	1D	Renaissance Hosp & Medical Centers	Detroit
	1D	United Community Hospital	Detroit
	1D	Harper-Hutzel Hospital	Detroit
	1D	Select Specialty Hosp–NW Detroit	Detroit
	1D	Bon Secours Hospital	Grosse Pointe

HSA	FSA	Hospital Name	City
1 – Southeast (cont.)	1D	Cottage Hospital	Grosse Pointe Farm
	1E	Botsford General Hospital	Farmington Hills
	1E	St. Mary Mercy Hospital	Livonia
	1F	Mount Clemens General Hospital	Mt. Clemens
	1F	Select Specialty Hosp – Macomb Co.	Mt. Clemens
	1F	St. John North Shores Hospital	Harrison Twp.
	1F	St. Joseph's Mercy Hosp & Hlth Serv	Clinton Twp
	1F	St. Joseph's Mercy Hospital & Health	Mt. Clemens
	1G	Mercy Hospital	Port Huron
	1G	Port Huron Hospital	Port Huron
	1H	St. Joseph Mercy Hospital	Ann Arbor
	1H	University Of Michigan Health System	Ann Arbor
	1H	Select Specialty Hosp–Ann Arbor	Ann Arbor
	1H	Chelsea Community Hospital	Chelsea
	1H	Saint Joseph Mercy Livingston Hosp	Howell
	1H	Saint Joseph Mercy Saline Hospital	Saline
	1H	Forest Health Medical Center	Ypsilanti
	1H	Brighton Hospital	Brighton
	1I	St. John River District Hospital	East China
	1J	Mercy Memorial Hospital	Monroe
2 - Mid-Southern	2A	Clinton Memorial Hospital	St. Johns
	2A	Eaton Rapids Medical Center	Eaton Rapids
	2A	Hayes Green Beach Memorial Hosp	Charlotte
	2A	Ingham Reg Med Cntr (Greenlawn)	Lansing
	2A	Ingham Reg Med Cntr (Pennsylvania)	Lansing
	2A	Edward W. Sparrow Hospital	Lansing
	2A	Sparrow – St. Lawrence Campus	Lansing
	2B	Carelink of Jackson	Jackson
	2B	W. A. Foote Memorial Hospital	Jackson
	2C	Hillsdale Community Health Center	Hillsdale
	2D	Emma L. Bixby Medical Center	Adrian
	2D	Herrick Memorial Hospital	Tecumseh
3 - Southwest	3A	Borgess Medical Center	Kalamazoo
	3A	Bronson Methodist Hospital	Kalamazoo
	3A	Borgess-Pipp Health Center	Plainwell
	3A	Lakeview Community Hospital	Paw Paw
	3A	Bronson – Vicksburg Hospital	Vicksburg
	3A	Pennock Hospital	Hastings
	3A	Three Rivers Area Hospital	Three Rivers
	3A	Sturgis Hospital	Sturgis
	3A	Sempercare Hospital at Bronson	Kalamazoo
	3B	Fieldstone Ctr of Battle Crk. Health	Battle Creek
	3B	Battle Creek Health System	Battle Creek
	3B	Select Spec Hosp–Battle Creek	Battle Creek
	3B	SW Michigan Rehab. Hosp.	Battle Creek
	3B	Oaklawn Hospital	Marshall
	3C	Community Hospital	Watervliet
	3C	Lakeland Hospital - St. Joseph	St. Joseph
	3C	Lakeland Specialty Hospital	Berrien Center

HSA	FSA	Hospital Name	City
3 – Southwest (cont.)	3C	South Haven Community Hospital	South Haven
	3D	Lakeland Hospital - Niles	Niles
	3D	Lee Memorial Hospital	Dowagiac
	3E	Community Hlth Ctr Of Branch Co	Coldwater
4 - West	4A	Memorial Medical Center Of West MI	Ludington
	4B	Kelsey Memorial Hospital	Lakeview
	4B	Mecosta County General Hospital	Big Rapids
	4C	Spectrum Hlth-Reed City Campus	Reed City
	4D	Lakeshore Community Hospital	Shelby
	4E	Gerber Memorial Hospital	Fremont
	4F	Carson City Hospital	Carson City
	4F	Gratiot Community Hospital	Alma
	4G	Hackley Hospital	Muskegon
	4G	Mercy Gen Hlth Partners–(Sherman)	Muskegon
	4G	Mercy Gen Hlth Partners–(Oak)	Muskegon
	4G	Lifecare Hospitals of Western MI	Muskegon
	4G	Select Spec Hosp–Western MI	Muskegon
	4G	North Ottawa Community Hospital	Grand Haven
	4H	Spectrum Hlth–Blodgett Campus	E. Grand Rapids
	4H	Spectrum Hlth–Butterworth Campus	Grand Rapids
	4H	Spectrum Hlth–Kent Comm Campus	Grand Rapids
	4H	Mary Free Bed Hospital & Rehab Ctr	Grand Rapids
	4H	Metropolitan Hospital	Grand Rapids
	4H	Saint Mary's Mercy Medical Center	Grand Rapids
	4I	Sheridan Community Hospital	Sheridan
	4I	United Memorial Hospital & LTCU	Greenville
	4J	Holland Community Hospital	Holland
	4J	Zeeland Community Hospital	Zeeland
	4K	Ionia County Memorial Hospital	Ionia
	4L	Allegan General Hospital	Allegan
5 - GLS	5A	Memorial Healthcare	Owosso
	5B	Genesys Reg Med Ctr–Hlth Park	Grand Blanc
	5B	Hurley Medical Center	Flint
	5B	Mclaren Regional Medical Center	Flint
	5B	Select Specialty Hospital-Flint	Flint
	5C	Lapeer Regional Hospital	Lapeer
6 - East	6A	West Branch Regional Medical Cntr	West Branch
	6A	Tawas St Joseph Hospital	Tawas City
	6B	Central Michigan Community Hosp	Mt. Pleasant
	6C	Mid-Michigan Medical Center-Clare	Clare
	6D	Mid-Michigan Medical Cntr - Gladwin	Gladwin
	6D	Mid-Michigan Medical Cntr - Midland	Midland
	6E	Bay Regional Medical Center	Bay City
	6E	Bay Regional Medical Ctr-West	Bay City
	6E	Samaritan Health Center	Bay City
	6E	Bay Special Care	Bay City
	6E	Standish Community Hospital	Standish
	6F	Select Specialty Hosp–Saginaw	Saginaw
	6F	Covenant Medical Centers, Inc	Saginaw

HSA	FSA	Hospital Name	City
6 – East (cont.)	6F	Covenant Medical Cntr–N Michigan	Saginaw
	6F	Covenant Medical Cntr–N Harrison	Saginaw
	6F	Healthsource Saginaw	Saginaw
	6F	St. Mary's Medical Center	Saginaw
	6F	Caro Community Hospital	Caro
	6F	Hills And Dales General Hospital	Cass City
	6G	Harbor Beach Community Hosp	Harbor Beach
	6G	Huron Medical Center	Bad Axe
	6G	Scheurer Hospital	Pigeon
	6H	Deckerville Community Hospital	Deckerville
	6H	Mckenzie Memorial Hospital	Sandusky
	6I	Marlette Community Hospital	Marlette
7 - Northern Lower	7A	Cheboygan Memorial Hospital	Cheboygan
	7B	Charlevoix Area Hospital	Charlevoix
	7B	Mackinac Straits Hospital	St. Ignace
	7B	Northern Michigan Hospital	Petoskey
	7C	Rogers City Rehabilitation Hospital	Rogers City
	7D	Otsego Memorial Hospital	Gaylord
	7E	Alpena General Hospital	Alpena
	7F	Kalkaska Memorial Health Center	Kalkaska
	7F	Leelanau Memorial Health Center	Northport
	7F	Munson Medical Center	Traverse City
	7F	Paul Oliver Memorial Hospital	Frankfort
	7G	Mercy Hospital - Cadillac	Cadillac
	7H	Mercy Hospital - Grayling	Grayling
	7I	West Shore Medical Center	Manistee
8 - Upper Peninsula	8A	Grand View Hospital	Ironwood
	8B	Ontonagon Memorial Hospital	Ontonagon
	8C	Iron County General Hospital	Iron River
	8D	Baraga County Memorial Hospital	L'anse
	8E	Keweenaw Memorial Medical Center	Laurium
	8E	Portage Health System	Hancock
	8F	Dickinson County Memorial Hospital	Iron Mountain
	8G	Bell Memorial Hospital	Ishpeming
	8G	Marquette General Hospital	Marquette
	8H	St. Francis Hospital	Escanaba
	8I	Munising Memorial Hospital	Munising
	8J	Schoolcraft Memorial Hospital	Manistique
	8K	Helen Newberry Joy Hospital	Newberry
	8L	Chippewa Co. War Memorial Hosp	Sault Ste Marie

Appendix 3

Python code to calculate age groups from age field for the MIDB 2004 and 2005 fixed width text files.

```
# Author          :   Mark J. Finn
# Program         :   calc_age_g.py
# Created         :   June 2007
# Description     :   this file calculates age group for MIDB2004 and
#                     MIDB2005

f = open("MIDB2005.txt", 'r')
f2 = open("MIDB2005age_g.txt", "w")
for line in f.readlines():
    #Format 0123 hosp id 4 sex 567 AGE
    if int(line[5:8]) > 120:
        agegroup = "99"
    elif int(line[5:8]) >= 75:
        agegroup = "75 TO 120 YRS"
    elif int(line[5:8]) >= 65:
        agegroup = "65 TO 74 YRS"
    elif int(line[5:8]) >= 45:
        agegroup = "45 TO 64 YRS"
    elif int(line[5:8]) >= 15:
        agegroup = "15 TO 44 YRS"
    elif int(line[5:8]) >= 0:
        agegroup = "0 TO 14 YRS"
    else:
        agegroup = "99"
    f2.write(line[:-1]+ agegroup + '\n')
f.close()
f2.close()
print "done"
```

Appendix 4

Occupancy Rate Table (Certificate of Need Commission 2007b)

Adult Medical/Surgical				
			Beds	
ADC>=	ADC<	Occup	Start	Stop
30		0.60		<=50
31	32	0.60	52	52
32	34	0.61	53	56
35	37	0.62	57	60
38	41	0.63	61	65
42	46	0.64	66	72
47	50	0.65	73	77
51	56	0.66	78	85
57	63	0.67	86	94
64	70	0.68	95	103
71	79	0.69	104	114
80	89	0.70	115	126
90	100	0.71	127	140
101	114	0.72	141	157
115	130	0.73	158	177
131	149	0.74	178	200
150	172	0.75	201	227
173	200	0.76	228	261
201	234	0.77	262	301
235	276	0.78	302	350
277	327	0.79	351	410
328	391	0.80	411	484
392	473	0.81	485	578
474	577	0.82	579	696
578	713	0.83	697	850
714	894	0.84	851	894
895		0.85	>=1054	

Pediatric Beds				
			Beds	
ADC>=	ADC<	Occup	Start	Stop
30		0.50		<=50
30	33	0.50	61	66
34	40	0.51	67	79
41	46	0.52	80	88
47	53	0.53	89	100
54	60	0.54	101	111
61	67	0.55	112	121
68	74	0.56	122	131
75	80	0.57	132	139
81	87	0.58	140	149
88	94	0.59	150	158
95	101	0.60	159	167
102	108	0.61	168	175
109	114	0.62	176	182
115	121	0.63	183	190
122	128	0.64	191	198
129	135	0.65	199	206
136	142	0.66	207	213
143	149	0.67	214	220
150	155	0.68	221	226
156	162	0.69	227	232
163	169	0.70	233	239
170	176	0.71	240	245
177	183	0.72	246	252
184	189	0.73	253	256
190	196	0.74	257	262
197		0.75		>=263

cont.

Obstetric Beds				
			Beds	
ADC>=	ADC<	Occup	Start	Stop
	30	0.50		<=50
30	33	0.50	61	66
34	40	0.51	67	79
41	46	0.52	80	88
47	53	0.53	89	100
54	60	0.54	101	111
61	67	0.55	112	121
68	74	0.56	122	131
75	80	0.57	132	139
81	87	0.58	140	149
88	94	0.59	150	158
95	101	0.60	159	167
102	108	0.61	168	175
109	114	0.62	176	182
115	121	0.63	183	190
122	128	0.64	191	198
129	135	0.65	199	206
136	142	0.66	207	213
143	149	0.67	214	220
150	155	0.68	221	226
156	162	0.69	227	232
163	169	0.70	233	239
170	176	0.71	240	245
177	183	0.72	246	252
184	189	0.73	253	256
190	196	0.74	257	262
197		0.75	>=263	

Appendix 5

Python code to select ZIP codes intersecting FSA 30 minutes travel time areas in ArcGIS

```
# Author           :   Mark J. Finn
# Program          :   select_intersect.py
# Created          :   June 2007
# Description      :   this file creates shapefiles of select by location
#                      - intersection in ArcGIS

import arcgisscripting

gp = arcgisscripting.create() # Create the Geoprocessor

fsas = ('1A', '1B', '1C', '1D', '1E', '1F', '1G', '1H', '1I', '1J',
'2A', '2B', '2C', '2D', '3A', '3B', '3C', '3D', '3E', '4A', '4B', '4C',
'4D', '4E', '4F', '4G', '4H', '4I', '4J', '4K', '4L', '5A', '5B', '5C',
'6A', '6B', '6C', '6D', '6E', '6F', '6G', '6H', '6I', '7A', '7B', '7C',
'7D', '7E', '7F', '7G', '7H', '7I', '8A', '8B', '8C', '8D', '8E', '8F',
'8G', '8H', '8I', '8J', '8K', '8L')

gp.MakeFeatureLayer("e:/michigan.mdb/ZIPs", "ZIPs_lyr")

for x in fsas:
      try:
            # Make a layer from the feature class
            gp.MakeFeatureLayer("e:/michigan.mdb/fsa"
            + x, "fsa" + x + "_lyr")

            # Select all ZIP codes that overlap with FSA 30 minutes
              service areas
            gp.SelectLayerByLocation("ZIPs_lyr", "intersect",
            "fsa" + x + "_lyr")

            # Write the selected features to a new featureclass
            gp.CopyFeatures("ZIPs_lyr", "e:/michigan.mdb/" + x)

            print x

      except:
            # If an error occurred print the message to the screen
            print gp.GetMessages()

print 'Done'
```

Appendix 6

Python code to calculate nearest point distance between hospitals within an FSA to all other hospitals.

```
# Author         :   Mark J. Finn
# Program        :   proximity.py
# Created        :   July 2007
# Description    :   this file creates shapefiles of select by
#                    attribute and calculates Arc/Info Near(Analysis)
#                    function

gp = arcgisscripting.create() # Create the Geoprocessor
gp.workspace = "f:/michigan.mdb"
gp.toolbox = "analysis"

fsas = ('1A', '1B', '1C', '1D', '1E', '1F', '1G', '1H', '1I', '1J',
'2A', '2B', '2C', '2D', '3A', '3B', '3C', '3D', '3E', '4A', '4B', '4C',
'4D', '4E', '4F', '4G', '4H', '4I', '4J', '4K', '4L', '5A', '5B', '5C',
'6A', '6B', '6C', '6D', '6E', '6F', '6G', '6H', '6I', '7A', '7B', '7C',
'7D', '7E', '7F', '7G', '7H', '7I', '8A', '8B', '8C', '8D', '8E', '8F',
'8G', '8H', '8I', '8J', '8K', '8L')

gp.MakeFeatureLayer("F:/michigan.mdb/hosps", "hosps_lyr")

for x in fsas:
    try:
        # Make a layer from the feature class of hospitals of a FSA
        gp.SelectLayerByAttribute("hosps_lyr", "NEW_SELECTION", " [fsa]
         = '" + x + "'")

        # Write the selected features to a new featureclass
        gp.CopyFeatures("hosps_lyr", "f:/michigan.mdb/is_" + x)

        # Make a layer from the feature class of hospitals not of the
        #FSA
        gp.SelectLayerByAttribute("hosps_lyr", "NEW_SELECTION", " [fsa]
         <> '" + x + "'")

        # Write the selected features to a new featureclass
        gp.CopyFeatures("hosps_lyr", "f:/michigan.mdb/not_" + x)

        # Calculate Point Distance
        gp.near("is_" + x, "not_" + x, "1000000000", "LOCATION",
         "NO_ANGLE")

        print x

    except:
        # If an error occurred print the message to the screen
        print gp.GetMessages()

print 'Done'
```

Appendix 7

Python code creates a new field within table SIZE2 which indicates whether the patient visited a larger, smaller or similar sized hospital compared to the largest hospital in its 30 minutes travel area

```
# Author          :    Mark J. Finn
# Program         :    size3.py
# Created         :    July 2007
# Description     :    this file reads in the comma delimitated text file
#                      size2.txt and creates a new field indicating
#                      comparative hospital size

import re
f = open("f:/size2.txt", 'r')
f2 = open("f:/size3.txt", "w")

for line in f.readlines():

        x = re.split(',',line)
        if len(x[4]) > 1: # eliminate nulls
            if float(x[4]) > 0 and float(x[3])/float(x[2]) < .75:
                f2.write(line[:-1] + ',-1\n')
            elif float(x[4]) < 0 and float(x[2])/float(x[3]) < .75:
                f2.write(line[:-1] + ',1\n')
            else:
                f2.write(line[:-1] + ',0\n')
f.close()
f2.close()
print 'Done'
```

Appendix 8

Patient Visits Traveling Longer than 30 Minutes for Acute Care

Entire State		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1117283	110957	9.93%	1125475	111478	9.90%
Percent of Overlap	Any	953717	66127	6.93%	957190	64933	6.78%
	10%	1040707	82052	7.88%	1046709	81324	7.77%
	20%	1059482	87226	8.23%	1066125	86853	8.15%
	30%	1068399	89489	8.38%	1075677	89392	8.31%
	40%	1083200	93752	8.66%	1090659	93789	8.60%
	50%	1088237	95569	8.78%	1095749	95645	8.73%
	60%	1093920	97095	8.88%	1101445	97184	8.82%
	70%	1097030	98078	8.94%	1104366	98093	8.88%
	80%	1100088	99407	9.04%	1107784	99589	8.99%
	90%	1103309	101198	9.17%	1111178	101441	9.13%
	100%	1112144	107960	9.71%	1120531	108634	9.69%

Entire State		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1140423	112785	9.89%	1150134	115484	10.04%
Percent of Overlap	Any	968094	64643	6.68%	978310	67396	6.89%
	10%	1059828	81858	7.72%	1070033	84756	7.92%
	20%	1079738	87561	8.11%	1089916	90382	8.29%
	30%	1089696	90147	8.27%	1099904	93000	8.46%
	40%	1104913	94670	8.57%	1115078	97468	8.74%
	50%	1110311	96550	8.70%	1120099	99216	8.86%
	60%	1115933	98112	8.79%	1125525	100729	8.95%
	70%	1119018	99028	8.85%	1128753	101780	9.02%
	80%	1122296	100507	8.96%	1132056	103272	9.12%
	90%	1125783	102379	9.09%	1135518	105149	9.26%
	100%	1135326	109779	9.67%	1145138	112544	9.83%

Entire State		2005		
		ALL	OUT	%OUT
	TOTAL	1162229	119496	10.28%
Percent of Overlap	Any	986529	69300	7.02%
	10%	1080718	87358	8.08%
	20%	1100643	93610	8.51%
	30%	1110665	96244	8.67%
	40%	1126708	101006	8.96%
	50%	1131877	102893	9.09%
	60%	1137364	104550	9.19%
	70%	1140709	105668	9.26%
	80%	1144156	107276	9.38%
	90%	1147622	109081	9.50%
	100%	1157215	116498	10.07%

Legend for Appendix Maps

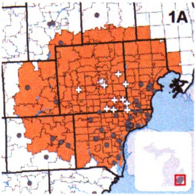
- Within 30 Minutes
- Outside 30 Minutes
- Counties
- Excluded
- Hydro ZIP codes
- Excluded & Within 30 Min.
- Other Hospitals
- FSA Hospitals

All maps created by Mark Finn.

FSA 1A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	563620	19005	3.37%	564101	17478	3.10%
Percent of Overlap	Any	552693	17828	3.23%	553022	16378	2.96%
	10%	560323	18443	3.29%	560671	16943	3.02%
	20%	560323	18443	3.29%	560671	16943	3.02%
	30%	560323	18443	3.29%	560671	16943	3.02%
	40%	561818	18738	3.34%	562197	17246	3.07%
	50%	561818	18738	3.34%	562197	17246	3.07%
	60%	562857	18875	3.35%	563285	17353	3.08%
	70%	562857	18875	3.35%	563285	17353	3.08%
	80%	563362	18960	3.37%	563830	17438	3.09%
	90%	563362	18960	3.37%	563830	17438	3.09%
	100%	563620	19005	3.37%	564101	17478	3.10%

FSA 1A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	570960	15408	2.70%	578838	16059	2.77%
Percent of Overlap	Any	559094	14187	2.54%	567164	14862	2.62%
	10%	567510	14860	2.62%	575423	15577	2.71%
	20%	567510	14860	2.62%	575423	15577	2.71%
	30%	567510	14860	2.62%	575423	15577	2.71%
	40%	569088	15179	2.67%	576973	15833	2.74%
	50%	569088	15179	2.67%	576973	15833	2.74%
	60%	570146	15272	2.68%	578021	15947	2.76%
	70%	570146	15272	2.68%	578021	15947	2.76%
	80%	570661	15350	2.69%	578520	16022	2.77%
	90%	570661	15350	2.69%	578520	16022	2.77%
	100%	570960	15408	2.70%	578838	16059	2.77%

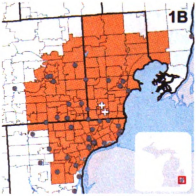
FSA 1A		2005		
		ALL	OUT	%OUT
	TOTAL	582441	16503	2.83%
Percent of Overlap	Any	570639	15201	2.66%
	10%	578902	15896	2.75%
	20%	578902	15896	2.75%
	30%	578902	15896	2.75%
	40%	580547	16238	2.80%
	50%	580547	16238	2.80%
	60%	581612	16377	2.82%
	70%	581612	16377	2.82%
	80%	582115	16453	2.83%
	90%	582115	16453	2.83%
	100%	582441	16503	2.83%



FSA 1B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	405412	11190	2.76%	403501	10502	2.60%
Percent of Overlap	Any	402963	10870	2.70%	401015	10237	2.55%
	10%	403868	10968	2.72%	401868	10310	2.57%
	20%	403868	10968	2.72%	401868	10310	2.57%
	30%	403868	10968	2.72%	401868	10310	2.57%
	40%	403868	10968	2.72%	401868	10310	2.57%
	50%	403868	10968	2.72%	401868	10310	2.57%
	60%	404907	11105	2.74%	402956	10417	2.59%
	70%	404907	11105	2.74%	402956	10417	2.59%
	80%	405412	11190	2.76%	403501	10502	2.60%
	90%	405412	11190	2.76%	403501	10502	2.60%
	100%	405412	11190	2.76%	403501	10502	2.60%

FSA 1B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	407262	9235	2.27%	410785	9611	2.34%
Percent of Overlap	Any	404757	9003	2.22%	408339	9351	2.29%
	10%	405689	9064	2.23%	409238	9422	2.30%
	20%	405689	9064	2.23%	409238	9422	2.30%
	30%	405689	9064	2.23%	409238	9422	2.30%
	40%	405689	9064	2.23%	409238	9422	2.30%
	50%	405689	9064	2.23%	409238	9422	2.30%
	60%	406747	9157	2.25%	410286	9536	2.32%
	70%	406747	9157	2.25%	410286	9536	2.32%
	80%	407262	9235	2.27%	410785	9611	2.34%
	90%	407262	9235	2.27%	410785	9611	2.34%
	100%	407262	9235	2.27%	410785	9611	2.34%

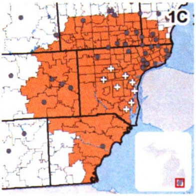
FSA 1B		2005		
		ALL	OUT	%OUT
	TOTAL	409135	9392	2.30%
Percent of Overlap	Any	406566	9109	2.24%
	10%	407567	9177	2.25%
	20%	407567	9177	2.25%
	30%	407567	9177	2.25%
	40%	407567	9177	2.25%
	50%	407567	9177	2.25%
	60%	408632	9316	2.28%
	70%	408632	9316	2.28%
	80%	409135	9392	2.30%
	90%	409135	9392	2.30%
	100%	409135	9392	2.30%



FSA 1C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	455505	17650	3.87%	455816	16123	3.54%
Percent of Overlap	Any	453120	16581	3.66%	453277	15136	3.34%
	10%	455505	17650	3.87%	455816	16123	3.54%
	20%	455505	17650	3.87%	455816	16123	3.54%
	30%	455505	17650	3.87%	455816	16123	3.54%
	40%	455505	17650	3.87%	455816	16123	3.54%
	50%	455505	17650	3.87%	455816	16123	3.54%
	60%	455505	17650	3.87%	455816	16123	3.54%
	70%	455505	17650	3.87%	455816	16123	3.54%
	80%	455505	17650	3.87%	455816	16123	3.54%
	90%	455505	17650	3.87%	455816	16123	3.54%
	100%	455505	17650	3.87%	455816	16123	3.54%

FSA 1C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	457675	13303	2.91%	462850	13771	2.98%
Percent of Overlap	Any	454988	12364	2.72%	460094	12898	2.80%
	10%	457675	13303	2.91%	462850	13771	2.98%
	20%	457675	13303	2.91%	462850	13771	2.98%
	30%	457675	13303	2.91%	462850	13771	2.98%
	40%	457675	13303	2.91%	462850	13771	2.98%
	50%	457675	13303	2.91%	462850	13771	2.98%
	60%	457675	13303	2.91%	462850	13771	2.98%
	70%	457675	13303	2.91%	462850	13771	2.98%
	80%	457675	13303	2.91%	462850	13771	2.98%
	90%	457675	13303	2.91%	462850	13771	2.98%
	100%	457675	13303	2.91%	462850	13771	2.98%

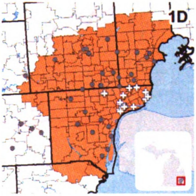
FSA 1C		2005		
		ALL	OUT	%OUT
	TOTAL	463551	13721	2.96%
Percent of Overlap	Any	460780	12797	2.78%
	10%	463551	13721	2.96%
	20%	463551	13721	2.96%
	30%	463551	13721	2.96%
	40%	463551	13721	2.96%
	50%	463551	13721	2.96%
	60%	463551	13721	2.96%
	70%	463551	13721	2.96%
	80%	463551	13721	2.96%
	90%	463551	13721	2.96%
	100%	463551	13721	2.96%



FSA 1D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	502470	15976	3.18%	503070	14313	2.85%
Percent of Overlap	Any	500381	15616	3.12%	500918	14062	2.81%
	10%	502470	15976	3.18%	503070	14313	2.85%
	20%	502470	15976	3.18%	503070	14313	2.85%
	30%	502470	15976	3.18%	503070	14313	2.85%
	40%	502470	15976	3.18%	503070	14313	2.85%
	50%	502470	15976	3.18%	503070	14313	2.85%
	60%	502470	15976	3.18%	503070	14313	2.85%
	70%	502470	15976	3.18%	503070	14313	2.85%
	80%	502470	15976	3.18%	503070	14313	2.85%
	90%	502470	15976	3.18%	503070	14313	2.85%
	100%	502470	15976	3.18%	503070	14313	2.85%

FSA 1D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	508488	11360	2.23%	514016	11713	2.28%
Percent of Overlap	Any	506123	11239	2.22%	511566	11582	2.26%
	10%	508488	11360	2.23%	514016	11713	2.28%
	20%	508488	11360	2.23%	514016	11713	2.28%
	30%	508488	11360	2.23%	514016	11713	2.28%
	40%	508488	11360	2.23%	514016	11713	2.28%
	50%	508488	11360	2.23%	514016	11713	2.28%
	60%	508488	11360	2.23%	514016	11713	2.28%
	70%	508488	11360	2.23%	514016	11713	2.28%
	80%	508488	11360	2.23%	514016	11713	2.28%
	90%	508488	11360	2.23%	514016	11713	2.28%
	100%	508488	11360	2.23%	514016	11713	2.28%

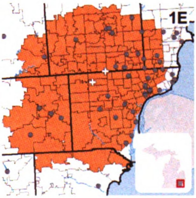
FSA 1D		2005		
		ALL	OUT	%OUT
	TOTAL	515896	11811	2.29%
Percent of Overlap	Any	513368	11644	2.27%
	10%	515896	11811	2.29%
	20%	515896	11811	2.29%
	30%	515896	11811	2.29%
	40%	515896	11811	2.29%
	50%	515896	11811	2.29%
	60%	515896	11811	2.29%
	70%	515896	11811	2.29%
	80%	515896	11811	2.29%
	90%	515896	11811	2.29%
	100%	515896	11811	2.29%



FSA 1E		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	442971	13985	3.16%	442032	12394	2.80%
Percent of Overlap	Any	442661	13922	3.15%	441705	12347	2.80%
	10%	442971	13985	3.16%	442032	12394	2.80%
	20%	442971	13985	3.16%	442032	12394	2.80%
	30%	442971	13985	3.16%	442032	12394	2.80%
	40%	442971	13985	3.16%	442032	12394	2.80%
	50%	442971	13985	3.16%	442032	12394	2.80%
	60%	442971	13985	3.16%	442032	12394	2.80%
	70%	442971	13985	3.16%	442032	12394	2.80%
	80%	442971	13985	3.16%	442032	12394	2.80%
	90%	442971	13985	3.16%	442032	12394	2.80%
	100%	442971	13985	3.16%	442032	12394	2.80%

FSA 1E		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	445536	10276	2.31%	452359	10737	2.37%
Percent of Overlap	Any	445170	10256	2.30%	452018	10709	2.37%
	10%	445536	10276	2.31%	452359	10737	2.37%
	20%	445536	10276	2.31%	452359	10737	2.37%
	30%	445536	10276	2.31%	452359	10737	2.37%
	40%	445536	10276	2.31%	452359	10737	2.37%
	50%	445536	10276	2.31%	452359	10737	2.37%
	60%	445536	10276	2.31%	452359	10737	2.37%
	70%	445536	10276	2.31%	452359	10737	2.37%
	80%	445536	10276	2.31%	452359	10737	2.37%
	90%	445536	10276	2.31%	452359	10737	2.37%
	100%	445536	10276	2.31%	452359	10737	2.37%

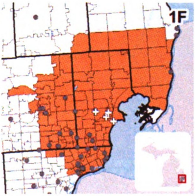
FSA 1E		2005		
		ALL	OUT	%OUT
	TOTAL	454971	10905	2.40%
Percent of Overlap	Any	454636	10876	2.39%
	10%	454971	10905	2.40%
	20%	454971	10905	2.40%
	30%	454971	10905	2.40%
	40%	454971	10905	2.40%
	50%	454971	10905	2.40%
	60%	454971	10905	2.40%
	70%	454971	10905	2.40%
	80%	454971	10905	2.40%
	90%	454971	10905	2.40%
	100%	454971	10905	2.40%



FSA 1F		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	316594	9789	3.09%	314994	10010	3.18%
Percent of Overlap	Any	310145	8878	2.86%	308327	9161	2.97%
	10%	312881	9137	2.92%	311085	9371	3.01%
	20%	312881	9137	2.92%	311085	9371	3.01%
	30%	312881	9137	2.92%	311085	9371	3.01%
	40%	314376	9432	3.00%	312611	9674	3.09%
	50%	314376	9432	3.00%	312611	9674	3.09%
	60%	315831	9659	3.06%	314178	9885	3.15%
	70%	315831	9659	3.06%	314178	9885	3.15%
	80%	316336	9744	3.08%	314723	9970	3.17%
	90%	316336	9744	3.08%	314723	9970	3.17%
	100%	316594	9789	3.09%	314994	10010	3.18%

FSA 1F		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	317995	9773	3.07%	320247	10025	3.13%
Percent of Overlap	Any	311182	8890	2.86%	313693	9231	2.94%
	10%	314067	9105	2.90%	316381	9443	2.98%
	20%	314067	9105	2.90%	316381	9443	2.98%
	30%	314067	9105	2.90%	316381	9443	2.98%
	40%	315645	9424	2.99%	317931	9699	3.05%
	50%	315645	9424	2.99%	317931	9699	3.05%
	60%	317181	9637	3.04%	319430	9913	3.10%
	70%	317181	9637	3.04%	319430	9913	3.10%
	80%	317696	9715	3.06%	319929	9988	3.12%
	90%	317696	9715	3.06%	319929	9988	3.12%
	100%	317995	9773	3.07%	320247	10025	3.13%

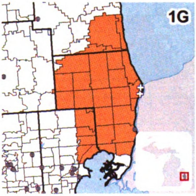
FSA 1F		2005		
		ALL	OUT	%OUT
	TOTAL	319508	9924	3.11%
Percent of Overlap	Any	312585	8963	2.87%
	10%	315478	9202	2.92%
	20%	315478	9202	2.92%
	30%	315478	9202	2.92%
	40%	317123	9544	3.01%
	50%	317123	9544	3.01%
	60%	318679	9798	3.07%
	70%	318679	9798	3.07%
	80%	319182	9874	3.09%
	90%	319182	9874	3.09%
	100%	319508	9924	3.11%



FSA 1G		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	25034	3542	14.15%	25434	3590	14.11%
Percent of Overlap	Any	17836	2101	11.78%	17990	2073	11.52%
	10%	18541	2238	12.07%	18654	2204	11.82%
	20%	20821	2583	12.41%	21135	2569	12.16%
	30%	20821	2583	12.41%	21135	2569	12.16%
	40%	22368	2897	12.95%	22656	2903	12.81%
	50%	22796	2999	13.16%	23024	2993	13.00%
	60%	24084	3258	13.53%	24380	3278	13.45%
	70%	24084	3258	13.53%	24380	3278	13.45%
	80%	24084	3258	13.53%	24380	3278	13.45%
	90%	24505	3409	13.91%	24859	3461	13.92%
	100%	25034	3542	14.15%	25434	3590	14.11%

FSA 1G		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	26586	3735	14.05%	26761	3881	14.50%
Percent of Overlap	Any	18834	2084	11.07%	19177	2405	12.54%
	10%	19485	2214	11.36%	19907	2561	12.86%
	20%	22026	2564	11.64%	22486	2938	13.07%
	30%	22026	2564	11.64%	22486	2938	13.07%
	40%	23730	2918	12.30%	24062	3228	13.42%
	50%	24151	3023	12.52%	24445	3312	13.55%
	60%	25510	3353	13.14%	25718	3573	13.89%
	70%	25510	3353	13.14%	25718	3573	13.89%
	80%	25510	3353	13.14%	25718	3573	13.89%
	90%	25997	3549	13.65%	26164	3732	14.26%
	100%	26586	3735	14.05%	26761	3881	14.50%

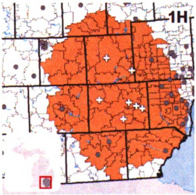
FSA 1G		2005		
		ALL	OUT	%OUT
	TOTAL	27340	3955	14.47%
Percent of Overlap	Any	19441	2232	11.48%
	10%	20181	2363	11.71%
	20%	22769	2807	12.33%
	30%	22769	2807	12.33%
	40%	24430	3171	12.98%
	50%	24814	3259	13.13%
	60%	26184	3574	13.65%
	70%	26184	3574	13.65%
	80%	26184	3574	13.65%
	90%	26728	3795	14.20%
	100%	27340	3955	14.47%



FSA 1H		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	280737	15446	5.50%	286586	14317	5.00%
Percent of Overlap	Any	271250	13981	5.15%	276603	12806	4.63%
	10%	279821	15119	5.40%	285574	13934	4.88%
	20%	280321	15438	5.51%	286100	14299	5.00%
	30%	280737	15446	5.50%	286586	14317	5.00%
	40%	280737	15446	5.50%	286586	14317	5.00%
	50%	280737	15446	5.50%	286586	14317	5.00%
	60%	280737	15446	5.50%	286586	14317	5.00%
	70%	280737	15446	5.50%	286586	14317	5.00%
	80%	280737	15446	5.50%	286586	14317	5.00%
	90%	280737	15446	5.50%	286586	14317	5.00%
	100%	280737	15446	5.50%	286586	14317	5.00%

FSA 1H		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	289573	13047	4.51%	296850	14518	4.89%
Percent of Overlap	Any	279108	11521	4.13%	286287	13034	4.55%
	10%	288484	12645	4.38%	295735	14131	4.78%
	20%	289075	13025	4.51%	296314	14494	4.89%
	30%	289573	13047	4.51%	296850	14518	4.89%
	40%	289573	13047	4.51%	296850	14518	4.89%
	50%	289573	13047	4.51%	296850	14518	4.89%
	60%	289573	13047	4.51%	296850	14518	4.89%
	70%	289573	13047	4.51%	296850	14518	4.89%
	80%	289573	13047	4.51%	296850	14518	4.89%
	90%	289573	13047	4.51%	296850	14518	4.89%
	100%	289573	13047	4.51%	296850	14518	4.89%

FSA 1H		2005		
		ALL	OUT	%OUT
	TOTAL	303019	14938	4.93%
Percent of Overlap	Any	292312	13384	4.58%
	10%	301981	14538	4.81%
	20%	302543	14926	4.93%
	30%	303019	14938	4.93%
	40%	303019	14938	4.93%
	50%	303019	14938	4.93%
	60%	303019	14938	4.93%
	70%	303019	14938	4.93%
	80%	303019	14938	4.93%
	90%	303019	14938	4.93%
	100%	303019	14938	4.93%



FSA 1I		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	24380	3624	14.86%	24652	3638	14.76%
Percent of Overlap	Any	19310	2661	13.78%	19432	2624	13.50%
	10%	20569	2933	14.26%	20612	2897	14.05%
	20%	22106	3132	14.17%	22346	3130	14.01%
	30%	22106	3132	14.17%	22346	3130	14.01%
	40%	23082	3303	14.31%	23321	3317	14.22%
	50%	23510	3405	14.48%	23689	3407	14.38%
	60%	24109	3536	14.67%	24348	3549	14.58%
	70%	24109	3536	14.67%	24348	3549	14.58%
	80%	24109	3536	14.67%	24348	3549	14.58%
	90%	24109	3536	14.67%	24348	3549	14.58%
	100%	24380	3624	14.86%	24652	3638	14.76%

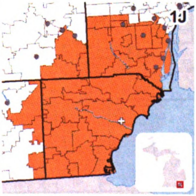
FSA 1I		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	25815	3792	14.69%	26132	4042	15.47%
Percent of Overlap	Any	20348	2690	13.22%	20718	3014	14.55%
	10%	21564	2949	13.68%	21988	3304	15.03%
	20%	23350	3174	13.59%	23868	3552	14.88%
	30%	23350	3174	13.59%	23868	3552	14.88%
	40%	24414	3379	13.84%	24832	3704	14.92%
	50%	24835	3484	14.03%	25215	3788	15.02%
	60%	25525	3664	14.35%	25853	3930	15.20%
	70%	25525	3664	14.35%	25853	3930	15.20%
	80%	25525	3664	14.35%	25853	3930	15.20%
	90%	25525	3664	14.35%	25853	3930	15.20%
	100%	25815	3792	14.69%	26132	4042	15.47%

FSA 1I		2005		
		ALL	OUT	%OUT
	TOTAL	26241	3820	14.56%
Percent of Overlap	Any	20791	2739	13.17%
	10%	22059	2997	13.59%
	20%	23879	3272	13.70%
	30%	23879	3272	13.70%
	40%	24885	3469	13.94%
	50%	25269	3557	14.08%
	60%	25955	3710	14.29%
	70%	25955	3710	14.29%
	80%	25955	3710	14.29%
	90%	25955	3710	14.29%
	100%	26241	3820	14.56%

FSA 1J		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	93817	13676	14.58%	98051	12300	12.54%
Percent of Overlap	Any	87739	9232	10.52%	91538	7661	8.37%
	10%	90225	10387	11.51%	94156	8711	9.25%
	20%	90725	10706	11.80%	94682	9076	9.59%
	30%	90725	10706	11.80%	94682	9076	9.59%
	40%	92648	12537	13.53%	96785	11058	11.43%
	50%	92648	12537	13.53%	96785	11058	11.43%
	60%	92648	12537	13.53%	96785	11058	11.43%
	70%	92648	12537	13.53%	96785	11058	11.43%
	80%	93030	12911	13.88%	97152	11420	11.75%
	90%	93030	12911	13.88%	97152	11420	11.75%
	100%	93817	13676	14.58%	98051	12300	12.54%

FSA 1J		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	100607	10201	10.14%	101819	10289	10.11%
Percent of Overlap	Any	93840	5552	5.92%	94987	5721	6.02%
	10%	96631	6580	6.81%	97864	6699	6.85%
	20%	97222	6960	7.16%	98443	7062	7.17%
	30%	97222	6960	7.16%	98443	7062	7.17%
	40%	99311	8926	8.99%	100509	9008	8.96%
	50%	99311	8926	8.99%	100509	9008	8.96%
	60%	99311	8926	8.99%	100509	9008	8.96%
	70%	99311	8926	8.99%	100509	9008	8.96%
	80%	99703	9314	9.34%	100867	9358	9.28%
	90%	99703	9314	9.34%	100867	9358	9.28%
	100%	100607	10201	10.14%	101819	10289	10.11%

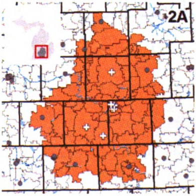
FSA 1J		2005		
		ALL	OUT	%OUT
	TOTAL	103658	10417	10.05%
Percent of Overlap	Any	96649	5594	5.79%
	10%	99524	6608	6.64%
	20%	100086	6996	6.99%
	30%	100086	6996	6.99%
	40%	102215	9004	8.81%
	50%	102215	9004	8.81%
	60%	102215	9004	8.81%
	70%	102215	9004	8.81%
	80%	102622	9404	9.16%
	90%	102622	9404	9.16%
	100%	103658	10417	10.05%



FSA 2A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	106117	8908	8.39%	107987	7494	6.94%
Percent of Overlap	Any	95078	7914	8.32%	96514	6473	6.71%
	10%	104729	8728	8.33%	106627	7322	6.87%
	20%	105532	8884	8.42%	107363	7461	6.95%
	30%	105948	8892	8.39%	107849	7479	6.93%
	40%	106117	8908	8.39%	107987	7494	6.94%
	50%	106117	8908	8.39%	107987	7494	6.94%
	60%	106117	8908	8.39%	107987	7494	6.94%
	70%	106117	8908	8.39%	107987	7494	6.94%
	80%	106117	8908	8.39%	107987	7494	6.94%
	90%	106117	8908	8.39%	107987	7494	6.94%
	100%	106117	8908	8.39%	107987	7494	6.94%

FSA 2A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	108503	7823	7.21%	110401	9335	8.46%
Percent of Overlap	Any	96955	6756	6.97%	98910	8257	8.35%
	10%	107154	7653	7.14%	108991	9152	8.40%
	20%	107852	7787	7.22%	109688	9291	8.47%
	30%	108350	7809	7.21%	110224	9315	8.45%
	40%	108503	7823	7.21%	110401	9335	8.46%
	50%	108503	7823	7.21%	110401	9335	8.46%
	60%	108503	7823	7.21%	110401	9335	8.46%
	70%	108503	7823	7.21%	110401	9335	8.46%
	80%	108503	7823	7.21%	110401	9335	8.46%
	90%	108503	7823	7.21%	110401	9335	8.46%
	100%	108503	7823	7.21%	110401	9335	8.46%

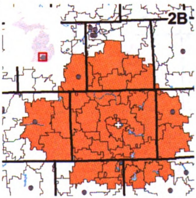
FSA 2A		2005		
		ALL	OUT	%OUT
	TOTAL	111887	9435	8.43%
Percent of Overlap	Any	100108	8367	8.36%
	10%	110584	9257	8.37%
	20%	111244	9409	8.46%
	30%	111720	9421	8.43%
	40%	111887	9435	8.43%
	50%	111887	9435	8.43%
	60%	111887	9435	8.43%
	70%	111887	9435	8.43%
	80%	111887	9435	8.43%
	90%	111887	9435	8.43%
	100%	111887	9435	8.43%



FSA 2B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	51459	5867	11.40%	51901	4206	8.10%
Percent of Overlap	Any	46194	5216	11.29%	46429	3577	7.70%
	10%	50448	5707	11.31%	50922	4058	7.97%
	20%	51251	5863	11.44%	51658	4197	8.12%
	30%	51459	5867	11.40%	51901	4206	8.10%
	40%	51459	5867	11.40%	51901	4206	8.10%
	50%	51459	5867	11.40%	51901	4206	8.10%
	60%	51459	5867	11.40%	51901	4206	8.10%
	70%	51459	5867	11.40%	51901	4206	8.10%
	80%	51459	5867	11.40%	51901	4206	8.10%
	90%	51459	5867	11.40%	51901	4206	8.10%
	100%	51459	5867	11.40%	51901	4206	8.10%

FSA 2B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	49939	4109	8.23%	53071	5952	11.22%
Percent of Overlap	Any	44545	3518	7.90%	47893	5340	11.15%
	10%	48992	3964	8.09%	52106	5801	11.13%
	20%	49690	4098	8.25%	52803	5940	11.25%
	30%	49939	4109	8.23%	53071	5952	11.22%
	40%	49939	4109	8.23%	53071	5952	11.22%
	50%	49939	4109	8.23%	53071	5952	11.22%
	60%	49939	4109	8.23%	53071	5952	11.22%
	70%	49939	4109	8.23%	53071	5952	11.22%
	80%	49939	4109	8.23%	53071	5952	11.22%
	90%	49939	4109	8.23%	53071	5952	11.22%
	100%	49939	4109	8.23%	53071	5952	11.22%

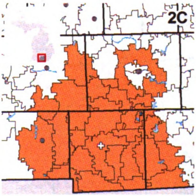
FSA 2B		2005		
		ALL	OUT	%OUT
	TOTAL	54206	5831	10.76%
Percent of Overlap	Any	48830	5186	10.62%
	10%	53308	5673	10.64%
	20%	53968	5825	10.79%
	30%	54206	5831	10.76%
	40%	54206	5831	10.76%
	50%	54206	5831	10.76%
	60%	54206	5831	10.76%
	70%	54206	5831	10.76%
	80%	54206	5831	10.76%
	90%	54206	5831	10.76%
	100%	54206	5831	10.76%



FSA 2C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	21758	5583	25.66%	21958	4791	21.82%
Percent of Overlap	Any	18381	4276	23.26%	18638	3529	18.93%
	10%	19717	4734	24.01%	19973	4001	20.03%
	20%	21280	5281	24.82%	21493	4505	20.96%
	30%	21280	5281	24.82%	21493	4505	20.96%
	40%	21758	5583	25.66%	21958	4791	21.82%
	50%	21758	5583	25.66%	21958	4791	21.82%
	60%	21758	5583	25.66%	21958	4791	21.82%
	70%	21758	5583	25.66%	21958	4791	21.82%
	80%	21758	5583	25.66%	21958	4791	21.82%
	90%	21758	5583	25.66%	21958	4791	21.82%
	100%	21758	5583	25.66%	21958	4791	21.82%

FSA 2C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	21898	4764	21.76%	22524	5285	23.46%
Percent of Overlap	Any	18745	3583	19.11%	19324	4122	21.33%
	10%	19926	3954	19.84%	20565	4511	21.94%
	20%	21396	4472	20.90%	22064	5007	22.69%
	30%	21396	4472	20.90%	22064	5007	22.69%
	40%	21898	4764	21.76%	22524	5285	23.46%
	50%	21898	4764	21.76%	22524	5285	23.46%
	60%	21898	4764	21.76%	22524	5285	23.46%
	70%	21898	4764	21.76%	22524	5285	23.46%
	80%	21898	4764	21.76%	22524	5285	23.46%
	90%	21898	4764	21.76%	22524	5285	23.46%
	100%	21898	4764	21.76%	22524	5285	23.46%

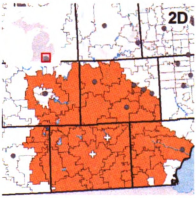
FSA 2C		2005		
		ALL	OUT	%OUT
	TOTAL	22529	5099	22.63%
Percent of Overlap	Any	19345	3907	20.20%
	10%	20593	4277	20.77%
	20%	22081	4820	21.83%
	30%	22081	4820	21.83%
	40%	22529	5099	22.63%
	50%	22529	5099	22.63%
	60%	22529	5099	22.63%
	70%	22529	5099	22.63%
	80%	22529	5099	22.63%
	90%	22529	5099	22.63%
	100%	22529	5099	22.63%



FSA 2D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	56267	9245	16.43%	58583	9900	16.90%
Percent of Overlap	Any	51097	5463	10.69%	53140	5895	11.09%
	10%	52388	6159	11.76%	54449	6618	12.15%
	20%	53484	6738	12.60%	55648	7270	13.06%
	30%	53484	6738	12.60%	55648	7270	13.06%
	40%	55885	8871	15.87%	58216	9538	16.38%
	50%	55885	8871	15.87%	58216	9538	16.38%
	60%	55885	8871	15.87%	58216	9538	16.38%
	70%	55885	8871	15.87%	58216	9538	16.38%
	80%	56267	9245	16.43%	58583	9900	16.90%
	90%	56267	9245	16.43%	58583	9900	16.90%
	100%	56267	9245	16.43%	58583	9900	16.90%

FSA 2D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	58524	10374	17.73%	59800	10837	18.12%
Percent of Overlap	Any	52895	6284	11.88%	54346	6894	12.69%
	10%	54332	7073	13.02%	55664	7627	13.70%
	20%	55541	7728	13.91%	56916	8263	14.52%
	30%	55541	7728	13.91%	56916	8263	14.52%
	40%	58132	9986	17.18%	59442	10487	17.64%
	50%	58132	9986	17.18%	59442	10487	17.64%
	60%	58132	9986	17.18%	59442	10487	17.64%
	70%	58132	9986	17.18%	59442	10487	17.64%
	80%	58524	10374	17.73%	59800	10837	18.12%
	90%	58524	10374	17.73%	59800	10837	18.12%
	100%	58524	10374	17.73%	59800	10837	18.12%

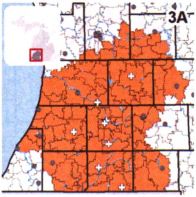
FSA 2D		2005		
		ALL	OUT	%OUT
	TOTAL	61304	11115	18.13%
Percent of Overlap	Any	55691	6985	12.54%
	10%	57094	7763	13.60%
	20%	58320	8428	14.45%
	30%	58320	8428	14.45%
	40%	60897	10715	17.60%
	50%	60897	10715	17.60%
	60%	60897	10715	17.60%
	70%	60897	10715	17.60%
	80%	61304	11115	18.13%
	90%	61304	11115	18.13%
	100%	61304	11115	18.13%



FSA 3A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	121797	11344	9.31%	123408	11521	9.34%
Percent of Overlap	Any	109543	8914	8.14%	110492	9073	8.21%
	10%	121797	11344	9.31%	123408	11521	9.34%
	20%	121797	11344	9.31%	123408	11521	9.34%
	30%	121797	11344	9.31%	123408	11521	9.34%
	40%	121797	11344	9.31%	123408	11521	9.34%
	50%	121797	11344	9.31%	123408	11521	9.34%
	60%	121797	11344	9.31%	123408	11521	9.34%
	70%	121797	11344	9.31%	123408	11521	9.34%
	80%	121797	11344	9.31%	123408	11521	9.34%
	90%	121797	11344	9.31%	123408	11521	9.34%
	100%	121797	11344	9.31%	123408	11521	9.34%

FSA 3A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	126291	12029	9.52%	128889	12801	9.93%
Percent of Overlap	Any	112854	9280	8.22%	115574	10077	8.72%
	10%	126291	12029	9.52%	128889	12801	9.93%
	20%	126291	12029	9.52%	128889	12801	9.93%
	30%	126291	12029	9.52%	128889	12801	9.93%
	40%	126291	12029	9.52%	128889	12801	9.93%
	50%	126291	12029	9.52%	128889	12801	9.93%
	60%	126291	12029	9.52%	128889	12801	9.93%
	70%	126291	12029	9.52%	128889	12801	9.93%
	80%	126291	12029	9.52%	128889	12801	9.93%
	90%	126291	12029	9.52%	128889	12801	9.93%
	100%	126291	12029	9.52%	128889	12801	9.93%

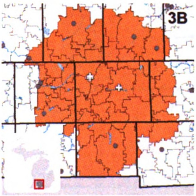
FSA 3A		2005		
		ALL	OUT	%OUT
	TOTAL	131609	13023	9.90%
Percent of Overlap	Any	117400	10311	8.78%
	10%	131609	13023	9.90%
	20%	131609	13023	9.90%
	30%	131609	13023	9.90%
	40%	131609	13023	9.90%
	50%	131609	13023	9.90%
	60%	131609	13023	9.90%
	70%	131609	13023	9.90%
	80%	131609	13023	9.90%
	90%	131609	13023	9.90%
	100%	131609	13023	9.90%



FSA 3B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	51305	6472	12.61%	51237	4954	9.67%
Percent of Overlap	Any	49028	5962	12.16%	49051	4521	9.22%
	10%	50502	6316	12.51%	50501	4815	9.53%
	20%	51305	6472	12.61%	51237	4954	9.67%
	30%	51305	6472	12.61%	51237	4954	9.67%
	40%	51305	6472	12.61%	51237	4954	9.67%
	50%	51305	6472	12.61%	51237	4954	9.67%
	60%	51305	6472	12.61%	51237	4954	9.67%
	70%	51305	6472	12.61%	51237	4954	9.67%
	80%	51305	6472	12.61%	51237	4954	9.67%
	90%	51305	6472	12.61%	51237	4954	9.67%
	100%	51305	6472	12.61%	51237	4954	9.67%

FSA 3B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	52673	4880	9.26%	53090	5160	9.72%
Percent of Overlap	Any	50492	4466	8.84%	50962	4715	9.25%
	10%	51975	4746	9.13%	52393	5021	9.58%
	20%	52673	4880	9.26%	53090	5160	9.72%
	30%	52673	4880	9.26%	53090	5160	9.72%
	40%	52673	4880	9.26%	53090	5160	9.72%
	50%	52673	4880	9.26%	53090	5160	9.72%
	60%	52673	4880	9.26%	53090	5160	9.72%
	70%	52673	4880	9.26%	53090	5160	9.72%
	80%	52673	4880	9.26%	53090	5160	9.72%
	90%	52673	4880	9.26%	53090	5160	9.72%
	100%	52673	4880	9.26%	53090	5160	9.72%

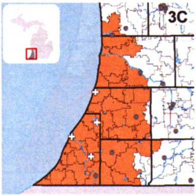
FSA 3B		2005		
		ALL	OUT	%OUT
	TOTAL	53678	5176	9.64%
Percent of Overlap	Any	51520	4723	9.17%
	10%	53018	5024	9.48%
	20%	53678	5176	9.64%
	30%	53678	5176	9.64%
	40%	53678	5176	9.64%
	50%	53678	5176	9.64%
	60%	53678	5176	9.64%
	70%	53678	5176	9.64%
	80%	53678	5176	9.64%
	90%	53678	5176	9.64%
	100%	53678	5176	9.64%



FSA 3C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	51817	9005	17.38%	52370	9048	17.28%
Percent of Overlap	Any	49164	7447	15.15%	49688	7570	15.24%
	10%	50681	8291	16.36%	51212	8392	16.39%
	20%	50681	8291	16.36%	51212	8392	16.39%
	30%	50894	8356	16.42%	51483	8444	16.40%
	40%	50894	8356	16.42%	51483	8444	16.40%
	50%	50894	8356	16.42%	51483	8444	16.40%
	60%	51333	8589	16.73%	51856	8628	16.64%
	70%	51333	8589	16.73%	51856	8628	16.64%
	80%	51374	8608	16.76%	51889	8646	16.66%
	90%	51776	8973	17.33%	52283	8995	17.20%
	100%	51817	9005	17.38%	52370	9048	17.28%

FSA 3C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	52441	9306	17.75%	51921	9991	19.24%
Percent of Overlap	Any	49670	7761	15.63%	49148	8385	17.06%
	10%	51327	8688	16.93%	50784	9319	18.35%
	20%	51327	8688	16.93%	50784	9319	18.35%
	30%	51582	8727	16.92%	51006	9378	18.39%
	40%	51582	8727	16.92%	51006	9378	18.39%
	50%	51582	8727	16.92%	51006	9378	18.39%
	60%	51994	8921	17.16%	51442	9587	18.64%
	70%	51994	8921	17.16%	51442	9587	18.64%
	80%	52024	8941	17.19%	51477	9604	18.66%
	90%	52389	9267	17.69%	51861	9942	19.17%
	100%	52441	9306	17.75%	51921	9991	19.24%

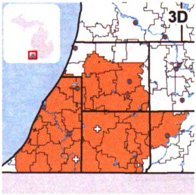
FSA 3C		2005		
		ALL	OUT	%OUT
	TOTAL	52643	10613	20.16%
Percent of Overlap	Any	49991	9031	18.07%
	10%	51621	9972	19.32%
	20%	51621	9972	19.32%
	30%	51804	10018	19.34%
	40%	51804	10018	19.34%
	50%	51804	10018	19.34%
	60%	52224	10256	19.64%
	70%	52224	10256	19.64%
	80%	52259	10278	19.67%
	90%	52593	10569	20.10%
	100%	52643	10613	20.16%



FSA 3D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	36633	8314	22.70%	37090	8244	22.23%
Percent of Overlap	Any	33622	6493	19.31%	34096	6515	19.11%
	10%	35997	8020	22.28%	36446	8008	21.97%
	20%	35997	8020	22.28%	36446	8008	21.97%
	30%	36194	8081	22.33%	36717	8060	21.95%
	40%	36194	8081	22.33%	36717	8060	21.95%
	50%	36194	8081	22.33%	36717	8060	21.95%
	60%	36633	8314	22.70%	37090	8244	22.23%
	70%	36633	8314	22.70%	37090	8244	22.23%
	80%	36633	8314	22.70%	37090	8244	22.23%
	90%	36633	8314	22.70%	37090	8244	22.23%
	100%	36633	8314	22.70%	37090	8244	22.23%

FSA 3D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	37063	8586	23.17%	37301	9314	24.97%
Percent of Overlap	Any	33790	6667	19.73%	34088	7361	21.59%
	10%	36396	8353	22.95%	36643	9046	24.69%
	20%	36396	8353	22.95%	36643	9046	24.69%
	30%	36651	8392	22.90%	36865	9105	24.70%
	40%	36651	8392	22.90%	36865	9105	24.70%
	50%	36651	8392	22.90%	36865	9105	24.70%
	60%	37063	8586	23.17%	37301	9314	24.97%
	70%	37063	8586	23.17%	37301	9314	24.97%
	80%	37063	8586	23.17%	37301	9314	24.97%
	90%	37063	8586	23.17%	37301	9314	24.97%
	100%	37063	8586	23.17%	37301	9314	24.97%

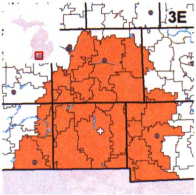
FSA 3D		2005		
		ALL	OUT	%OUT
	TOTAL	37455	9684	25.86%
Percent of Overlap	Any	34305	7714	22.49%
	10%	36852	9400	25.51%
	20%	36852	9400	25.51%
	30%	37035	9446	25.51%
	40%	37035	9446	25.51%
	50%	37035	9446	25.51%
	60%	37455	9684	25.86%
	70%	37455	9684	25.86%
	80%	37455	9684	25.86%
	90%	37455	9684	25.86%
	100%	37455	9684	25.86%



FSA 3E		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	20717	4845	23.39%	20970	4145	19.77%
Percent of Overlap	Any	19931	4555	22.85%	20192	3861	19.12%
	10%	20717	4845	23.39%	20970	4145	19.77%
	20%	20717	4845	23.39%	20970	4145	19.77%
	30%	20717	4845	23.39%	20970	4145	19.77%
	40%	20717	4845	23.39%	20970	4145	19.77%
	50%	20717	4845	23.39%	20970	4145	19.77%
	60%	20717	4845	23.39%	20970	4145	19.77%
	70%	20717	4845	23.39%	20970	4145	19.77%
	80%	20717	4845	23.39%	20970	4145	19.77%
	90%	20717	4845	23.39%	20970	4145	19.77%
	100%	20717	4845	23.39%	20970	4145	19.77%

FSA 3E		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	21628	4042	18.69%	21374	4115	19.25%
Percent of Overlap	Any	20946	3812	18.20%	20643	3871	18.75%
	10%	21628	4042	18.69%	21374	4115	19.25%
	20%	21628	4042	18.69%	21374	4115	19.25%
	30%	21628	4042	18.69%	21374	4115	19.25%
	40%	21628	4042	18.69%	21374	4115	19.25%
	50%	21628	4042	18.69%	21374	4115	19.25%
	60%	21628	4042	18.69%	21374	4115	19.25%
	70%	21628	4042	18.69%	21374	4115	19.25%
	80%	21628	4042	18.69%	21374	4115	19.25%
	90%	**21628**	**4042**	**18.69%**	**21374**	**4115**	**19.25%**
	100%	21628	4042	18.69%	21374	4115	19.25%

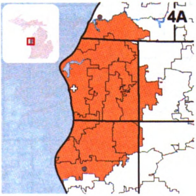
FSA 3E		2005		
		ALL	OUT	%OUT
	TOTAL	21807	3981	18.26%
Percent of Overlap	Any	21089	3770	17.88%
	10%	21807	3981	18.26%
	20%	21807	3981	18.26%
	30%	21807	3981	18.26%
	40%	21807	3981	18.26%
	50%	21807	3981	18.26%
	60%	21807	3981	18.26%
	70%	21807	3981	18.26%
	80%	21807	3981	18.26%
	90%	21807	3981	18.26%
	100%	21807	3981	18.26%



FSA 4A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	6563	2180	33.22%	6460	2206	34.15%
Percent of Overlap	Any	3374	1066	31.59%	3302	1092	33.07%
	10%	6243	2040	32.68%	6094	2038	33.44%
	20%	6243	2040	32.68%	6094	2038	33.44%
	30%	6411	2115	32.99%	6261	2127	33.97%
	40%	6411	2115	32.99%	6261	2127	33.97%
	50%	6411	2115	32.99%	6261	2127	33.97%
	60%	6411	2115	32.99%	6261	2127	33.97%
	70%	6411	2115	32.99%	6261	2127	33.97%
	80%	6563	2180	33.22%	6460	2206	34.15%
	90%	6563	2180	33.22%	6460	2206	34.15%
	100%	6563	2180	33.22%	6460	2206	34.15%

FSA 4A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	6794	2345	34.52%	6863	2529	36.85%
Percent of Overlap	Any	3402	1177	34.60%	3543	1307	36.89%
	10%	6425	2180	33.93%	6519	2372	36.39%
	20%	6425	2180	33.93%	6519	2372	36.39%
	30%	6608	2284	34.56%	6708	2468	36.79%
	40%	6608	2284	34.56%	6708	2468	36.79%
	50%	6608	2284	34.56%	6708	2468	36.79%
	60%	6608	2284	34.56%	6708	2468	36.79%
	70%	6608	2284	34.56%	6708	2468	36.79%
	80%	6794	2345	34.52%	6863	2529	36.85%
	90%	6794	2345	34.52%	6863	2529	36.85%
	100%	6794	2345	34.52%	6863	2529	36.85%

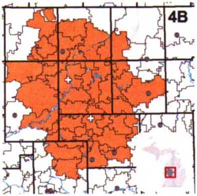
FSA 4A		2005		
		ALL	OUT	%OUT
	TOTAL	7030	2565	36.49%
Percent of Overlap	Any	3586	1277	35.61%
	10%	6668	2400	35.99%
	20%	6668	2400	35.99%
	30%	6843	2492	36.42%
	40%	6843	2492	36.42%
	50%	6843	2492	36.42%
	60%	6843	2492	36.42%
	70%	6843	2492	36.42%
	80%	7030	2565	36.49%
	90%	7030	2565	36.49%
	100%	7030	2565	36.49%



FSA 4B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	29347	8548	29.13%	29677	8910	30.02%
Percent of Overlap	Any	16836	4678	27.79%	16887	4760	28.19%
	10%	25136	7568	30.11%	25495	7885	30.93%
	20%	26686	8083	30.29%	27019	8452	31.28%
	30%	28388	8312	29.28%	28759	8702	30.26%
	40%	28960	8354	28.85%	29261	8725	29.82%
	50%	29168	8456	28.99%	29510	8838	29.95%
	60%	29168	8456	28.99%	29510	8838	29.95%
	70%	29168	8456	28.99%	29510	8838	29.95%
	80%	29347	8548	29.13%	29677	8910	30.02%
	90%	29347	8548	29.13%	29677	8910	30.02%
	100%	29347	8548	29.13%	29677	8910	30.02%

FSA 4B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	30310	9219	30.42%	30757	9417	30.62%
Percent of Overlap	Any	16871	4949	29.33%	17246	5195	30.12%
	10%	25811	8116	31.44%	26236	8363	31.88%
	20%	27483	8728	31.76%	27823	8899	31.98%
	30%	29453	9021	30.63%	29844	9209	30.86%
	40%	29923	9037	30.20%	30346	9226	30.40%
	50%	30175	9154	30.34%	30584	9328	30.50%
	60%	30175	9154	30.34%	30584	9328	30.50%
	70%	30175	9154	30.34%	30584	9328	30.50%
	80%	30310	9219	30.42%	30757	9417	30.62%
	90%	30310	9219	30.42%	30757	9417	30.62%
	100%	30310	9219	30.42%	30757	9417	30.62%

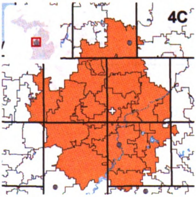
FSA 4B		2005		
		ALL	OUT	%OUT
	TOTAL	31592	10414	32.96%
Percent of Overlap	Any	17818	5752	32.28%
	10%	26759	9066	33.88%
	20%	28559	9823	34.40%
	30%	30630	10165	33.19%
	40%	31148	10177	32.67%
	50%	31408	10307	32.82%
	60%	31408	10307	32.82%
	70%	31408	10307	32.82%
	80%	31592	10414	32.96%
	90%	31592	10414	32.96%
	100%	31592	10414	32.96%



FSA 4C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	13798	5148	37.31%	13769	5342	38.80%
Percent of Overlap	Any	6324	2390	37.79%	6194	2442	39.43%
	10%	9957	3545	35.60%	9919	3723	37.53%
	20%	12200	4287	35.14%	12132	4544	37.45%
	30%	12453	4380	35.17%	12395	4649	37.51%
	40%	13080	4797	36.67%	12987	5006	38.55%
	50%	13288	4899	36.87%	13236	5119	38.67%
	60%	13288	4899	36.87%	13236	5119	38.67%
	70%	13288	4899	36.87%	13236	5119	38.67%
	80%	13798	5148	37.31%	13769	5342	38.80%
	90%	13798	5148	37.31%	13769	5342	38.80%
	100%	13798	5148	37.31%	13769	5342	38.80%

FSA 4C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	14116	5484	38.85%	14343	5722	39.89%
Percent of Overlap	Any	6370	2529	39.70%	6621	2728	41.20%
	10%	10061	3794	37.71%	10290	4043	39.29%
	20%	12472	4673	37.47%	12576	4812	38.26%
	30%	12830	4800	37.41%	12910	4942	38.28%
	40%	13408	5176	38.60%	13604	5381	39.55%
	50%	13660	5293	38.75%	13842	5483	39.61%
	60%	13660	5293	38.75%	13842	5483	39.61%
	70%	13660	5293	38.75%	13842	5483	39.61%
	80%	14116	5484	38.85%	14343	5722	39.89%
	90%	14116	5484	38.85%	14343	5722	39.89%
	100%	14116	5484	38.85%	14343	5722	39.89%

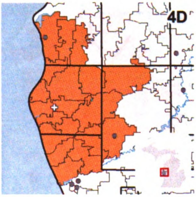
FSA 4C		2005		
		ALL	OUT	%OUT
	TOTAL	15145	6755	44.60%
Percent of Overlap	Any	6848	3190	46.58%
	10%	10764	4650	43.20%
	20%	13365	5747	43.00%
	30%	13695	5896	43.05%
	40%	14330	6338	44.23%
	50%	14590	6468	44.33%
	60%	14590	6468	44.33%
	70%	14590	6468	44.33%
	80%	15145	6755	44.60%
	90%	15145	6755	44.60%
	100%	15145	6755	44.60%



FSA 4D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	11548	2614	22.64%	11376	2558	22.49%
Percent of Overlap	Any	8567	1767	20.63%	8603	1811	21.05%
	10%	11172	2437	21.81%	10960	2356	21.50%
	20%	11172	2437	21.81%	10960	2356	21.50%
	30%	11340	2512	22.15%	11127	2445	21.97%
	40%	11340	2512	22.15%	11127	2445	21.97%
	50%	11548	2614	22.64%	11376	2558	22.49%
	60%	11548	2614	22.64%	11376	2558	22.49%
	70%	11548	2614	22.64%	11376	2558	22.49%
	80%	11548	2614	22.64%	11376	2558	22.49%
	90%	11548	2614	22.64%	11376	2558	22.49%
	100%	11548	2614	22.64%	11376	2558	22.49%

FSA 4D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	11936	2870	24.04%	11815	2944	24.92%
Percent of Overlap	Any	8951	2007	22.42%	8756	2039	23.29%
	10%	11501	2649	23.03%	11388	2746	24.11%
	20%	11501	2649	23.03%	11388	2746	24.11%
	30%	11684	2753	23.56%	11577	2842	24.55%
	40%	11684	2753	23.56%	11577	2842	24.55%
	50%	11936	2870	24.04%	11815	2944	24.92%
	60%	11936	2870	24.04%	11815	2944	24.92%
	70%	11936	2870	24.04%	11815	2944	24.92%
	80%	11936	2870	24.04%	11815	2944	24.92%
	90%	11936	2870	24.04%	11815	2944	24.92%
	100%	11936	2870	24.04%	11815	2944	24.92%

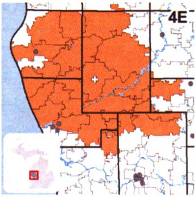
FSA 4D		2005		
		ALL	OUT	%OUT
	TOTAL	12191	3037	24.91%
Percent of Overlap	Any	9108	2125	23.33%
	10%	11756	2815	23.95%
	20%	11756	2815	23.95%
	30%	11931	2907	24.37%
	40%	11931	2907	24.37%
	50%	12191	3037	24.91%
	60%	12191	3037	24.91%
	70%	12191	3037	24.91%
	80%	12191	3037	24.91%
	90%	12191	3037	24.91%
	100%	12191	3037	24.91%



FSA 4E		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	21670	4883	22.53%	21546	4902	22.75%
Percent of Overlap	Any	5631	936	16.62%	5636	916	16.25%
	10%	18872	4590	24.32%	18731	4594	24.53%
	20%	18963	4592	24.22%	18842	4597	24.40%
	30%	20494	4711	22.99%	20407	4730	23.18%
	40%	21066	4753	22.56%	20909	4753	22.73%
	50%	21670	4883	22.53%	21546	4902	22.75%
	60%	21670	4883	22.53%	21546	4902	22.75%
	70%	21670	4883	22.53%	21546	4902	22.75%
	80%	21670	4883	22.53%	21546	4902	22.75%
	90%	21670	4883	22.53%	21546	4902	22.75%
	100%	21670	4883	22.53%	21546	4902	22.75%

FSA 4E		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	22839	5339	23.38%	21847	4977	22.78%
Percent of Overlap	Any	5983	1113	18.60%	5642	990	17.55%
	10%	19904	5025	25.25%	18874	4682	24.81%
	20%	20031	5029	25.11%	18979	4684	24.68%
	30%	21655	5185	23.94%	20719	4833	23.33%
	40%	22125	5201	23.51%	21221	4850	22.85%
	50%	22839	5339	23.38%	21847	4977	22.78%
	60%	22839	5339	23.38%	21847	4977	22.78%
	70%	22839	5339	23.38%	21847	4977	22.78%
	80%	22839	5339	23.38%	21847	4977	22.78%
	90%	22839	5339	23.38%	21847	4977	22.78%
	100%	22839	5339	23.38%	21847	4977	22.78%

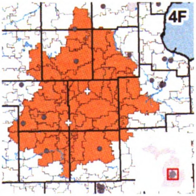
FSA 4E		2005		
		ALL	OUT	%OUT
	TOTAL	22549	5521	24.48%
Percent of Overlap	Any	5940	1106	18.62%
	10%	19419	5203	26.79%
	20%	19542	5205	26.63%
	30%	21317	5347	25.08%
	40%	21835	5359	24.54%
	50%	22549	5521	24.48%
	60%	22549	5521	24.48%
	70%	22549	5521	24.48%
	80%	22549	5521	24.48%
	90%	22549	5521	24.48%
	100%	22549	5521	24.48%



FSA 4F		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	36268	7155	19.73%	36852	7534	20.44%
Percent of Overlap	Any	28734	6062	21.10%	29214	6346	21.72%
	10%	33231	6892	20.74%	33830	7259	21.46%
	20%	34877	7048	20.21%	35524	7445	20.96%
	30%	35280	7079	20.07%	35980	7482	20.79%
	40%	36268	7155	19.73%	36852	7534	20.44%
	50%	36268	7155	19.73%	36852	7534	20.44%
	60%	36268	7155	19.73%	36852	7534	20.44%
	70%	36268	7155	19.73%	36852	7534	20.44%
	80%	36268	7155	19.73%	36852	7534	20.44%
	90%	36268	7155	19.73%	36852	7534	20.44%
	100%	36268	7155	19.73%	36852	7534	20.44%

FSA 4F		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	36561	7654	20.93%	37384	7398	19.79%
Percent of Overlap	Any	28816	6450	22.38%	29573	6319	21.37%
	10%	33444	7357	22.00%	34337	7145	20.81%
	20%	35189	7556	21.47%	36034	7300	20.26%
	30%	35647	7591	21.29%	36468	7328	20.09%
	40%	36561	7654	20.93%	37384	7398	19.79%
	50%	36561	7654	20.93%	37384	7398	19.79%
	60%	36561	7654	20.93%	37384	7398	19.79%
	70%	36561	7654	20.93%	37384	7398	19.79%
	80%	36561	7654	20.93%	37384	7398	19.79%
	90%	36561	7654	20.93%	37384	7398	19.79%
	100%	36561	7654	20.93%	37384	7398	19.79%

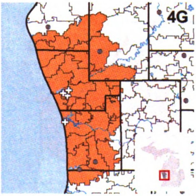
FSA 4F		2005		
		ALL	OUT	%OUT
	TOTAL	37837	7951	21.01%
Percent of Overlap	Any	30094	6825	22.68%
	10%	34782	7669	22.05%
	20%	36421	7852	21.56%
	30%	36852	7884	21.39%
	40%	37837	7951	21.01%
	50%	37837	7951	21.01%
	60%	37837	7951	21.01%
	70%	37837	7951	21.01%
	80%	37837	7951	21.01%
	90%	37837	7951	21.01%
	100%	37837	7951	21.01%



FSA 4G		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	59229	4908	8.29%	59402	4862	8.18%
Percent of Overlap	Any	47067	3371	7.16%	47264	3406	7.21%
	10%	58880	4903	8.33%	58996	4852	8.22%
	20%	59062	4907	8.31%	59218	4858	8.20%
	30%	59229	4908	8.29%	59402	4862	8.18%
	40%	59229	4908	8.29%	59402	4862	8.18%
	50%	59229	4908	8.29%	59402	4862	8.18%
	60%	59229	4908	8.29%	59402	4862	8.18%
	70%	59229	4908	8.29%	59402	4862	8.18%
	80%	59229	4908	8.29%	59402	4862	8.18%
	90%	59229	4908	8.29%	59402	4862	8.18%
	100%	59229	4908	8.29%	59402	4862	8.18%

FSA 4G		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	60905	5421	8.90%	59033	5114	8.66%
Percent of Overlap	Any	48319	3796	7.86%	46907	3630	7.74%
	10%	60464	5400	8.93%	58625	5107	8.71%
	20%	60718	5408	8.91%	58835	5111	8.69%
	30%	60905	5421	8.90%	59033	5114	8.66%
	40%	60905	5421	8.90%	59033	5114	8.66%
	50%	60905	5421	8.90%	59033	5114	8.66%
	60%	60905	5421	8.90%	59033	5114	8.66%
	70%	60905	5421	8.90%	59033	5114	8.66%
	80%	60905	5421	8.90%	59033	5114	8.66%
	90%	60905	5421	8.90%	59033	5114	8.66%
	100%	60905	5421	8.90%	59033	5114	8.66%

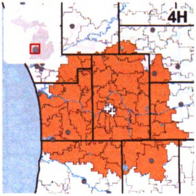
FSA 4G		2005		
		ALL	OUT	%OUT
	TOTAL	60005	5627	9.38%
Percent of Overlap	Any	47636	3942	8.28%
	10%	59570	5617	9.43%
	20%	59816	5621	9.40%
	30%	60005	5627	9.38%
	40%	60005	5627	9.38%
	50%	60005	5627	9.38%
	60%	60005	5627	9.38%
	70%	60005	5627	9.38%
	80%	60005	5627	9.38%
	90%	60005	5627	9.38%
	100%	60005	5627	9.38%



FSA 4H		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	99900	3024	3.03%	101233	3093	3.06%
Percent of Overlap	Any	83038	2418	2.91%	83458	2489	2.98%
	10%	97426	2927	3.00%	98723	2984	3.02%
	20%	97608	2931	3.00%	98945	2990	3.02%
	30%	98971	2975	3.01%	100343	3034	3.02%
	40%	99504	2996	3.01%	100845	3057	3.03%
	50%	99900	3024	3.03%	101233	3093	3.06%
	60%	99900	3024	3.03%	101233	3093	3.06%
	70%	99900	3024	3.03%	101233	3093	3.06%
	80%	99900	3024	3.03%	101233	3093	3.06%
	90%	99900	3024	3.03%	101233	3093	3.06%
	100%	99900	3024	3.03%	101233	3093	3.06%

FSA 4H		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	103468	3241	3.13%	103523	3209	3.10%
Percent of Overlap	Any	85330	2632	3.08%	85413	2588	3.03%
	10%	100841	3144	3.12%	100872	3110	3.08%
	20%	101095	3152	3.12%	101082	3114	3.08%
	30%	102536	3204	3.12%	102633	3167	3.09%
	40%	103006	3220	3.13%	103135	3184	3.09%
	50%	103468	3241	3.13%	103523	3209	3.10%
	60%	103468	3241	3.13%	103523	3209	3.10%
	70%	103468	3241	3.13%	103523	3209	3.10%
	80%	103468	3241	3.13%	103523	3209	3.10%
	90%	103468	3241	3.13%	103523	3209	3.10%
	100%	103468	3241	3.13%	103523	3209	3.10%

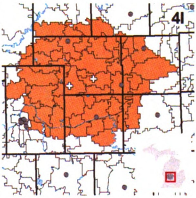
FSA 4H		2005		
		ALL	OUT	%OUT
	TOTAL	106436	3384	3.18%
Percent of Overlap	Any	86967	2724	3.13%
	10%	103618	3286	3.17%
	20%	103864	3290	3.17%
	30%	105464	3340	3.17%
	40%	105982	3352	3.16%
	50%	106436	3384	3.18%
	60%	106436	3384	3.18%
	70%	106436	3384	3.18%
	80%	106436	3384	3.18%
	90%	106436	3384	3.18%
	100%	106436	3384	3.18%



FSA 4l		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	37047	6599	17.81%	38130	6655	17.45%
Percent of Overlap	Any	26074	5454	20.92%	26687	5499	20.61%
	10%	35318	6535	18.50%	36414	6592	18.10%
	20%	35318	6535	18.50%	36414	6592	18.10%
	30%	36514	6578	18.02%	37628	6632	17.63%
	40%	37047	6599	17.81%	38130	6655	17.45%
	50%	37047	6599	17.81%	38130	6655	17.45%
	60%	37047	6599	17.81%	38130	6655	17.45%
	70%	37047	6599	17.81%	38130	6655	17.45%
	80%	37047	6599	17.81%	38130	6655	17.45%
	90%	37047	6599	17.81%	38130	6655	17.45%
	100%	37047	6599	17.81%	38130	6655	17.45%

FSA 4l		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	38404	7079	18.43%	38969	6959	17.86%
Percent of Overlap	Any	26882	5840	21.72%	27325	5805	21.24%
	10%	36680	7024	19.15%	37114	6892	18.57%
	20%	36680	7024	19.15%	37114	6892	18.57%
	30%	37934	7063	18.62%	38467	6942	18.05%
	40%	38404	7079	18.43%	38969	6959	17.86%
	50%	38404	7079	18.43%	38969	6959	17.86%
	60%	38404	7079	18.43%	38969	6959	17.86%
	70%	38404	7079	18.43%	38969	6959	17.86%
	80%	38404	7079	18.43%	38969	6959	17.86%
	90%	38404	7079	18.43%	38969	6959	17.86%
	100%	38404	7079	18.43%	38969	6959	17.86%

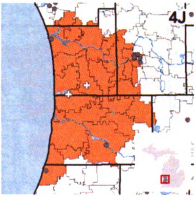
FSA 4l		2005		
		ALL	OUT	%OUT
	TOTAL	40940	7475	18.26%
Percent of Overlap	Any	28516	6187	21.70%
	10%	39011	7419	19.02%
	20%	39011	7419	19.02%
	30%	40422	7463	18.46%
	40%	40940	7475	18.26%
	50%	40940	7475	18.26%
	60%	40940	7475	18.26%
	70%	40940	7475	18.26%
	80%	40940	7475	18.26%
	90%	40940	7475	18.26%
	100%	40940	7475	18.26%



FSA 4J		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	68482	3113	4.55%	69147	3212	4.65%
Percent of Overlap	Any	64312	3007	4.68%	64693	3088	4.77%
	10%	68482	3113	4.55%	69147	3212	4.65%
	20%	68482	3113	4.55%	69147	3212	4.65%
	30%	68482	3113	4.55%	69147	3212	4.65%
	40%	68482	3113	4.55%	69147	3212	4.65%
	50%	68482	3113	4.55%	69147	3212	4.65%
	60%	68482	3113	4.55%	69147	3212	4.65%
	70%	68482	3113	4.55%	69147	3212	4.65%
	80%	68482	3113	4.55%	69147	3212	4.65%
	90%	68482	3113	4.55%	69147	3212	4.65%
	100%	68482	3113	4.55%	69147	3212	4.65%

FSA 4J		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	69897	3385	4.84%	69242	3380	4.88%
Percent of Overlap	Any	65336	3276	5.01%	64626	3245	5.02%
	10%	69897	3385	4.84%	69242	3380	4.88%
	20%	69897	3385	4.84%	69242	3380	4.88%
	30%	69897	3385	4.84%	69242	3380	4.88%
	40%	69897	3385	4.84%	69242	3380	4.88%
	50%	69897	3385	4.84%	69242	3380	4.88%
	60%	69897	3385	4.84%	69242	3380	4.88%
	70%	69897	3385	4.84%	69242	3380	4.88%
	80%	69897	3385	4.84%	69242	3380	4.88%
	90%	69897	3385	4.84%	69242	3380	4.88%
	100%	69897	3385	4.84%	69242	3380	4.88%

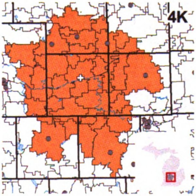
FSA 4J		2005		
		ALL	OUT	%OUT
	TOTAL	69683	3413	4.90%
Percent of Overlap	Any	64775	3296	5.09%
	10%	69683	3413	4.90%
	20%	69683	3413	4.90%
	30%	69683	3413	4.90%
	40%	69683	3413	4.90%
	50%	69683	3413	4.90%
	60%	69683	3413	4.90%
	70%	69683	3413	4.90%
	80%	69683	3413	4.90%
	90%	69683	3413	4.90%
	100%	69683	3413	4.90%



FSA 4K		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	29568	4419	14.95%	30665	4484	14.62%
Percent of Overlap	Any	21852	3996	18.29%	22424	4004	17.86%
	10%	29568	4419	14.95%	30665	4484	14.62%
	20%	29568	4419	14.95%	30665	4484	14.62%
	30%	29568	4419	14.95%	30665	4484	14.62%
	40%	29568	4419	14.95%	30665	4484	14.62%
	50%	29568	4419	14.95%	30665	4484	14.62%
	60%	29568	4419	14.95%	30665	4484	14.62%
	70%	29568	4419	14.95%	30665	4484	14.62%
	80%	29568	4419	14.95%	30665	4484	14.62%
	90%	29568	4419	14.95%	30665	4484	14.62%
	100%	29568	4419	14.95%	30665	4484	14.62%

FSA 4K		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	30280	4682	15.46%	30672	4705	15.34%
Percent of Overlap	Any	22121	4175	18.87%	22446	4201	18.72%
	10%	30280	4682	15.46%	30672	4705	15.34%
	20%	30280	4682	15.46%	30672	4705	15.34%
	30%	30280	4682	15.46%	30672	4705	15.34%
	40%	30280	4682	15.46%	30672	4705	15.34%
	50%	30280	4682	15.46%	30672	4705	15.34%
	60%	30280	4682	15.46%	30672	4705	15.34%
	70%	30280	4682	15.46%	30672	4705	15.34%
	80%	30280	4682	15.46%	30672	4705	15.34%
	90%	30280	4682	15.46%	30672	4705	15.34%
	100%	30280	4682	15.46%	30672	4705	15.34%

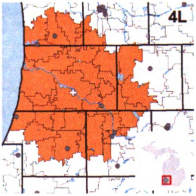
FSA 4K		2005		
		ALL	OUT	%OUT
	TOTAL	31904	5065	15.88%
Percent of Overlap	Any	23198	4587	19.77%
	10%	31904	5065	15.88%
	20%	31904	5065	15.88%
	30%	31904	5065	15.88%
	40%	31904	5065	15.88%
	50%	31904	5065	15.88%
	60%	31904	5065	15.88%
	70%	31904	5065	15.88%
	80%	31904	5065	15.88%
	90%	31904	5065	15.88%
	100%	31904	5065	15.88%



FSA 4L		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	56609	3102	5.48%	57231	3308	5.78%
Percent of Overlap	Any	52912	3020	5.71%	53314	3190	5.98%
	10%	56609	3102	5.48%	57231	3308	5.78%
	20%	56609	3102	5.48%	57231	3308	5.78%
	30%	56609	3102	5.48%	57231	3308	5.78%
	40%	56609	3102	5.48%	57231	3308	5.78%
	50%	56609	3102	5.48%	57231	3308	5.78%
	60%	56609	3102	5.48%	57231	3308	5.78%
	70%	56609	3102	5.48%	57231	3308	5.78%
	80%	56609	3102	5.48%	57231	3308	5.78%
	90%	56609	3102	5.48%	57231	3308	5.78%
	100%	56609	3102	5.48%	57231	3308	5.78%

FSA 4L		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	58053	3410	5.87%	58939	3515	5.96%
Percent of Overlap	Any	54080	3300	6.10%	54915	3408	6.21%
	10%	58053	3410	5.87%	58939	3515	5.96%
	20%	58053	3410	5.87%	58939	3515	5.96%
	30%	58053	3410	5.87%	58939	3515	5.96%
	40%	58053	3410	5.87%	58939	3515	5.96%
	50%	58053	3410	5.87%	58939	3515	5.96%
	60%	58053	3410	5.87%	58939	3515	5.96%
	70%	58053	3410	5.87%	58939	3515	5.96%
	80%	58053	3410	5.87%	58939	3515	5.96%
	90%	58053	3410	5.87%	58939	3515	5.96%
	100%	58053	3410	5.87%	58939	3515	5.96%

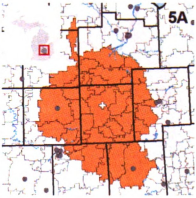
FSA 4L		2005		
		ALL	OUT	%OUT
	TOTAL	61622	3814	6.19%
Percent of Overlap	Any	57331	3691	6.44%
	10%	61622	3814	6.19%
	20%	61622	3814	6.19%
	30%	61622	3814	6.19%
	40%	61622	3814	6.19%
	50%	61622	3814	6.19%
	60%	61622	3814	6.19%
	70%	61622	3814	6.19%
	80%	61622	3814	6.19%
	90%	61622	3814	6.19%
	100%	61622	3814	6.19%



FSA 5A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	37717	3155	8.36%	38421	3336	8.68%
Percent of Overlap	Any	29439	2398	8.15%	30316	2654	8.75%
	10%	35910	3019	8.41%	36815	3247	8.82%
	20%	35910	3019	8.41%	36815	3247	8.82%
	30%	35910	3019	8.41%	36815	3247	8.82%
	40%	37717	3155	8.36%	38421	3336	8.68%
	50%	37717	3155	8.36%	38421	3336	8.68%
	60%	37717	3155	8.36%	38421	3336	8.68%
	70%	37717	3155	8.36%	38421	3336	8.68%
	80%	37717	3155	8.36%	38421	3336	8.68%
	90%	37717	3155	8.36%	38421	3336	8.68%
	100%	37717	3155	8.36%	38421	3336	8.68%

FSA 5A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	38769	3421	8.82%	40311	3569	8.85%
Percent of Overlap	Any	30305	2631	8.68%	31402	2750	8.76%
	10%	37094	3309	8.92%	38656	3449	8.92%
	20%	37094	3309	8.92%	38656	3449	8.92%
	30%	37094	3309	8.92%	38656	3449	8.92%
	40%	38769	3421	8.82%	40311	3569	8.85%
	50%	38769	3421	8.82%	40311	3569	8.85%
	60%	38769	3421	8.82%	40311	3569	8.85%
	70%	38769	3421	8.82%	40311	3569	8.85%
	80%	38769	3421	8.82%	40311	3569	8.85%
	90%	38769	3421	8.82%	40311	3569	8.85%
	100%	38769	3421	8.82%	40311	3569	8.85%

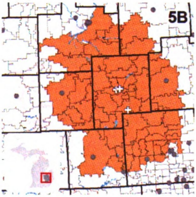
FSA 5A		2005		
		ALL	OUT	%OUT
	TOTAL	41177	3706	9.00%
Percent of Overlap	Any	32269	2935	9.10%
	10%	39374	3586	9.11%
	20%	39374	3586	9.11%
	30%	39374	3586	9.11%
	40%	41177	3706	9.00%
	50%	41177	3706	9.00%
	60%	41177	3706	9.00%
	70%	41177	3706	9.00%
	80%	41177	3706	9.00%
	90%	41177	3706	9.00%
	100%	41177	3706	9.00%



FSA 5B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	139921	8816	6.30%	140750	9020	6.41%
Percent of Overlap	Any	123832	7474	6.04%	124369	7712	6.20%
	10%	137175	8576	6.25%	138031	8810	6.38%
	20%	138232	8641	6.25%	139154	8880	6.38%
	30%	139102	8756	6.29%	140016	8983	6.42%
	40%	139921	8816	6.30%	140750	9020	6.41%
	50%	139921	8816	6.30%	140750	9020	6.41%
	60%	139921	8816	6.30%	140750	9020	6.41%
	70%	139921	8816	6.30%	140750	9020	6.41%
	80%	139921	8816	6.30%	140750	9020	6.41%
	90%	139921	8816	6.30%	140750	9020	6.41%
	100%	139921	8816	6.30%	140750	9020	6.41%

FSA 5B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	141577	9360	6.61%	143851	9653	6.71%
Percent of Overlap	Any	124350	7879	6.34%	126556	8185	6.47%
	10%	138802	9142	6.59%	141158	9452	6.70%
	20%	139899	9218	6.59%	142242	9526	6.70%
	30%	140816	9311	6.61%	143112	9603	6.71%
	40%	141577	9360	6.61%	143851	9653	6.71%
	50%	141577	9360	6.61%	143851	9653	6.71%
	60%	141577	9360	6.61%	143851	9653	6.71%
	70%	141577	9360	6.61%	143851	9653	6.71%
	80%	141577	9360	6.61%	143851	9653	6.71%
	90%	141577	9360	6.61%	143851	9653	6.71%
	100%	141577	9360	6.61%	143851	9653	6.71%

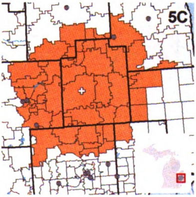
FSA 5B		2005		
		ALL	OUT	%OUT
	TOTAL	147140	10312	7.01%
Percent of Overlap	Any	129583	8861	6.84%
	10%	144307	10108	7.00%
	20%	145432	10182	7.00%
	30%	146322	10259	7.01%
	40%	147140	10312	7.01%
	50%	147140	10312	7.01%
	60%	147140	10312	7.01%
	70%	147140	10312	7.01%
	80%	147140	10312	7.01%
	90%	147140	10312	7.01%
	100%	147140	10312	7.01%



FSA 5C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	76161	7261	9.53%	76089	7416	9.75%
Percent of Overlap	Any	61859	5316	8.59%	61407	5464	8.90%
	10%	72483	6546	9.03%	72292	6720	9.30%
	20%	72483	6546	9.03%	72292	6720	9.30%
	30%	73353	6661	9.08%	73154	6823	9.33%
	40%	74443	6928	9.31%	74251	7086	9.54%
	50%	74443	6928	9.31%	74251	7086	9.54%
	60%	75482	7065	9.36%	75339	7193	9.55%
	70%	75482	7065	9.36%	75339	7193	9.55%
	80%	75482	7065	9.36%	75339	7193	9.55%
	90%	75903	7216	9.51%	75818	7376	9.73%
	100%	76161	7261	9.53%	76089	7416	9.75%

FSA 5C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	77288	7835	10.14%	77863	8001	10.28%
Percent of Overlap	Any	61645	5730	9.30%	62319	5873	9.42%
	10%	73373	7132	9.72%	73983	7372	9.96%
	20%	73373	7132	9.72%	73983	7372	9.96%
	30%	74290	7225	9.73%	74853	7449	9.95%
	40%	75444	7488	9.93%	76051	7691	10.11%
	50%	75444	7488	9.93%	76051	7691	10.11%
	60%	76502	7581	9.91%	77099	7805	10.12%
	70%	76502	7581	9.91%	77099	7805	10.12%
	80%	76502	7581	9.91%	77099	7805	10.12%
	90%	76989	7777	10.10%	77545	7964	10.27%
	100%	77288	7835	10.14%	77863	8001	10.28%

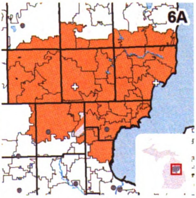
FSA 5C		2005		
		ALL	OUT	%OUT
	TOTAL	79080	8588	10.86%
Percent of Overlap	Any	63288	6285	9.93%
	10%	74961	7789	10.39%
	20%	74961	7789	10.39%
	30%	75851	7866	10.37%
	40%	77145	8178	10.60%
	50%	77145	8178	10.60%
	60%	78210	8317	10.63%
	70%	78210	8317	10.63%
	80%	78210	8317	10.63%
	90%	78754	8538	10.84%
	100%	79080	8588	10.86%



FSA 6A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	18373	6904	37.58%	18746	7181	38.31%
Percent of Overlap	Any	7166	2340	32.65%	7307	2419	33.11%
	10%	11419	3604	31.56%	11617	3717	32.00%
	20%	13489	4507	33.41%	13634	4645	34.07%
	30%	14970	5147	34.38%	15286	5367	35.11%
	40%	14970	5147	34.38%	15286	5367	35.11%
	50%	14970	5147	34.38%	15286	5367	35.11%
	60%	15662	5477	34.97%	15920	5675	35.65%
	70%	15662	5477	34.97%	15920	5675	35.65%
	80%	16382	5797	35.39%	16595	6012	36.23%
	90%	17870	6590	36.88%	18246	6852	37.55%
	100%	18373	6904	37.58%	18746	7181	38.31%

FSA 6A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	19118	7317	38.27%	20387	7841	38.46%
Percent of Overlap	Any	7601	2526	33.23%	8359	2748	32.87%
	10%	11802	3897	33.02%	12757	4203	32.95%
	20%	13973	4930	35.28%	15056	5261	34.94%
	30%	15751	5678	36.05%	16805	5999	35.70%
	40%	15751	5678	36.05%	16805	5999	35.70%
	50%	15751	5678	36.05%	16805	5999	35.70%
	60%	16411	5985	36.47%	17442	6337	36.33%
	70%	16411	5985	36.47%	17442	6337	36.33%
	80%	17058	6264	36.72%	18154	6653	36.65%
	90%	18682	7044	37.70%	19837	7475	37.68%
	100%	19118	7317	38.27%	20387	7841	38.46%

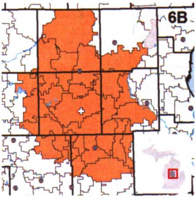
FSA 6A		2005		
		ALL	OUT	%OUT
	TOTAL	19819	7647	38.58%
Percent of Overlap	Any	7575	2420	31.95%
	10%	12145	3949	32.52%
	20%	14396	5053	35.10%
	30%	16251	5832	35.89%
	40%	16251	5832	35.89%
	50%	16251	5832	35.89%
	60%	16874	6152	36.46%
	70%	16874	6152	36.46%
	80%	17617	6490	36.84%
	90%	19328	7303	37.78%
	100%	19819	7647	38.58%



FSA 6B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	24804	5168	20.84%	25621	5920	23.11%
Percent of Overlap	Any	16575	3017	18.20%	17045	3392	19.90%
	10%	21515	4365	20.29%	22234	4954	22.28%
	20%	22468	4480	19.94%	23240	5094	21.92%
	30%	24804	5168	20.84%	25621	5920	23.11%
	40%	24804	5168	20.84%	25621	5920	23.11%
	50%	24804	5168	20.84%	25621	5920	23.11%
	60%	24804	5168	20.84%	25621	5920	23.11%
	70%	24804	5168	20.84%	25621	5920	23.11%
	80%	24804	5168	20.84%	25621	5920	23.11%
	90%	24804	5168	20.84%	25621	5920	23.11%
	100%	24804	5168	20.84%	25621	5920	23.11%

FSA 6B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	25956	5886	22.68%	26514	5698	21.49%
Percent of Overlap	Any	17074	3355	19.65%	17510	3197	18.26%
	10%	22319	4879	21.86%	22835	4664	20.42%
	20%	23342	5023	21.52%	23834	4787	20.08%
	30%	25956	5886	22.68%	26514	5698	21.49%
	40%	25956	5886	22.68%	26514	5698	21.49%
	50%	25956	5886	22.68%	26514	5698	21.49%
	60%	25956	5886	22.68%	26514	5698	21.49%
	70%	25956	5886	22.68%	26514	5698	21.49%
	80%	25956	5886	22.68%	26514	5698	21.49%
	90%	25956	5886	22.68%	26514	5698	21.49%
	100%	25956	5886	22.68%	26514	5698	21.49%

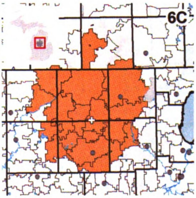
FSA 6B		2005		
		ALL	OUT	%OUT
	TOTAL	26030	5855	22.49%
Percent of Overlap	Any	17365	3423	19.71%
	10%	22545	4883	21.66%
	20%	23484	5014	21.35%
	30%	26030	5855	22.49%
	40%	26030	5855	22.49%
	50%	26030	5855	22.49%
	60%	26030	5855	22.49%
	70%	26030	5855	22.49%
	80%	26030	5855	22.49%
	90%	26030	5855	22.49%
	100%	26030	5855	22.49%



FSA 6C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	20416	5679	27.82%	21213	6298	29.69%
Percent of Overlap	Any	6749	1670	24.74%	6994	1791	25.61%
	10%	13021	3461	26.58%	13579	3826	28.18%
	20%	15620	3918	25.08%	16280	4360	26.78%
	30%	17956	4606	25.65%	18661	5186	27.79%
	40%	18934	4954	26.16%	19583	5564	28.41%
	50%	18934	4954	26.16%	19583	5564	28.41%
	60%	18934	4954	26.16%	19583	5564	28.41%
	70%	18934	4954	26.16%	19583	5564	28.41%
	80%	19292	5138	26.63%	19917	5708	28.66%
	90%	20416	5679	27.82%	21213	6298	29.69%
	100%	20416	5679	27.82%	21213	6298	29.69%

FSA 6C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	21071	6189	29.37%	21620	6239	28.86%
Percent of Overlap	Any	6858	1776	25.90%	7291	1737	23.82%
	10%	13205	3746	28.37%	13727	3706	27.00%
	20%	15990	4301	26.90%	16424	4185	25.48%
	30%	18604	5164	27.76%	19104	5096	26.68%
	40%	19536	5498	28.14%	19964	5484	27.47%
	50%	19536	5498	28.14%	19964	5484	27.47%
	60%	19536	5498	28.14%	19964	5484	27.47%
	70%	19536	5498	28.14%	19964	5484	27.47%
	80%	19806	5628	28.42%	20310	5662	27.88%
	90%	21071	6189	29.37%	21620	6239	28.86%
	100%	21071	6189	29.37%	21620	6239	28.86%

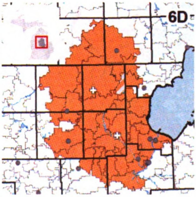
FSA 6C		2005		
		ALL	OUT	%OUT
	TOTAL	21792	6518	29.91%
Percent of Overlap	Any	7374	1897	25.73%
	10%	13792	3875	28.10%
	20%	16471	4477	27.18%
	30%	19017	5318	27.96%
	40%	20073	5734	28.57%
	50%	20073	5734	28.57%
	60%	20073	5734	28.57%
	70%	20073	5734	28.57%
	80%	20441	5948	29.10%
	90%	21792	6518	29.91%
	100%	21792	6518	29.91%



FSA 6D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	75928	9153	12.05%	76821	10043	13.07%
Percent of Overlap	Any	54608	5203	9.53%	55203	5647	10.23%
	10%	68369	7556	11.05%	69225	8239	11.90%
	20%	71903	8147	11.33%	72838	8911	12.23%
	30%	74389	8773	11.79%	75412	9669	12.82%
	40%	75208	8833	11.74%	76146	9706	12.75%
	50%	75208	8833	11.74%	76146	9706	12.75%
	60%	75208	8833	11.74%	76146	9706	12.75%
	70%	75208	8833	11.74%	76146	9706	12.75%
	80%	75928	9153	12.05%	76821	10043	13.07%
	90%	75928	9153	12.05%	76821	10043	13.07%
	100%	75928	9153	12.05%	76821	10043	13.07%

FSA 6D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	77026	9828	12.76%	77701	10315	13.28%
Percent of Overlap	Any	55638	5539	9.96%	56035	5780	10.31%
	10%	69157	8018	11.59%	69737	8485	12.17%
	20%	72904	8729	11.97%	73470	9140	12.44%
	30%	75618	9500	12.56%	76250	9949	13.05%
	40%	76379	9549	12.50%	76989	9999	12.99%
	50%	76379	9549	12.50%	76989	9999	12.99%
	60%	76379	9549	12.50%	76989	9999	12.99%
	70%	76379	9549	12.50%	76989	9999	12.99%
	80%	77026	9828	12.76%	77701	10315	13.28%
	90%	77026	9828	12.76%	77701	10315	13.28%
	100%	77026	9828	12.76%	77701	10315	13.28%

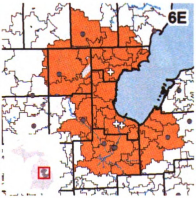
FSA 6D		2005		
		ALL	OUT	%OUT
	TOTAL	77995	10439	13.38%
Percent of Overlap	Any	55838	5866	10.51%
	10%	70137	8572	12.22%
	20%	73787	9324	12.64%
	30%	76434	10048	13.15%
	40%	77252	10101	13.08%
	50%	77252	10101	13.08%
	60%	77252	10101	13.08%
	70%	77252	10101	13.08%
	80%	77995	10439	13.38%
	90%	77995	10439	13.38%
	100%	77995	10439	13.38%



FSA 6E		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	97104	8827	9.09%	97714	9104	9.32%
Percent of Overlap	Any	78944	5961	7.55%	79364	6162	7.76%
	10%	94094	8508	9.04%	94705	8802	9.29%
	20%	96285	8767	9.11%	96980	9067	9.35%
	30%	96285	8767	9.11%	96980	9067	9.35%
	40%	97104	8827	9.09%	97714	9104	9.32%
	50%	97104	8827	9.09%	97714	9104	9.32%
	60%	97104	8827	9.09%	97714	9104	9.32%
	70%	97104	8827	9.09%	97714	9104	9.32%
	80%	97104	8827	9.09%	97714	9104	9.32%
	90%	97104	8827	9.09%	97714	9104	9.32%
	100%	97104	8827	9.09%	97714	9104	9.32%

FSA 6E		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	96338	9186	9.54%	96682	9755	10.09%
Percent of Overlap	Any	78264	6188	7.91%	78423	6467	8.25%
	10%	93308	8862	9.50%	93673	9453	10.09%
	20%	95577	9137	9.56%	95943	9705	10.12%
	30%	95577	9137	9.56%	95943	9705	10.12%
	40%	96338	9186	9.54%	96682	9755	10.09%
	50%	96338	9186	9.54%	96682	9755	10.09%
	60%	96338	9186	9.54%	96682	9755	10.09%
	70%	96338	9186	9.54%	96682	9755	10.09%
	80%	96338	9186	9.54%	96682	9755	10.09%
	90%	96338	9186	9.54%	96682	9755	10.09%
	100%	96338	9186	9.54%	96682	9755	10.09%

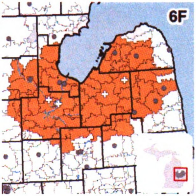
FSA 6E		2005		
		ALL	OUT	%OUT
	TOTAL	97921	9618	9.82%
Percent of Overlap	Any	78832	6344	8.05%
	10%	94791	9273	9.78%
	20%	97103	9565	9.85%
	30%	97103	9565	9.85%
	40%	97921	9618	9.82%
	50%	97921	9618	9.82%
	60%	97921	9618	9.82%
	70%	97921	9618	9.82%
	80%	97921	9618	9.82%
	90%	97921	9618	9.82%
	100%	97921	9618	9.82%



FSA 6F		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	108097	9426	8.72%	108676	9394	8.64%
Percent of Overlap	Any	87363	7609	8.71%	87764	7553	8.61%
	10%	101361	8808	8.69%	101929	8769	8.60%
	20%	105017	9144	8.71%	105752	9165	8.67%
	30%	106290	9290	8.74%	107070	9305	8.69%
	40%	108097	9426	8.72%	108676	9394	8.64%
	50%	108097	9426	8.72%	108676	9394	8.64%
	60%	108097	9426	8.72%	108676	9394	8.64%
	70%	108097	9426	8.72%	108676	9394	8.64%
	80%	108097	9426	8.72%	108676	9394	8.64%
	90%	108097	9426	8.72%	108676	9394	8.64%
	100%	108097	9426	8.72%	108676	9394	8.64%

FSA 6F		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	108497	9842	9.07%	107806	9958	9.24%
Percent of Overlap	Any	87158	7908	9.07%	86599	7969	9.20%
	10%	101582	9183	9.04%	101067	9381	9.28%
	20%	105447	9602	9.11%	104847	9733	9.28%
	30%	106822	9730	9.11%	106151	9838	9.27%
	40%	108497	9842	9.07%	107806	9958	9.24%
	50%	108497	9842	9.07%	107806	9958	9.24%
	60%	108497	9842	9.07%	107806	9958	9.24%
	70%	108497	9842	9.07%	107806	9958	9.24%
	80%	108497	9842	9.07%	107806	9958	9.24%
	90%	108497	9842	9.07%	107806	9958	9.24%
	100%	108497	9842	9.07%	107806	9958	9.24%

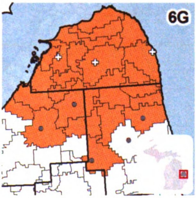
FSA 6F		2005		
		ALL	OUT	%OUT
	TOTAL	109660	9961	9.08%
Percent of Overlap	Any	87825	7984	9.09%
	10%	102833	9344	9.09%
	20%	106536	9732	9.13%
	30%	107857	9841	9.12%
	40%	109660	9961	9.08%
	50%	109660	9961	9.08%
	60%	109660	9961	9.08%
	70%	109660	9961	9.08%
	80%	109660	9961	9.08%
	90%	109660	9961	9.08%
	100%	109660	9961	9.08%



FSA 6G		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10529	2930	27.83%	10737	2874	26.77%
Percent of Overlap	Any	9422	2641	28.03%	9684	2607	26.92%
	10%	10529	2930	27.83%	10737	2874	26.77%
	20%	10529	2930	27.83%	10737	2874	26.77%
	30%	10529	2930	27.83%	10737	2874	26.77%
	40%	10529	2930	27.83%	10737	2874	26.77%
	50%	10529	2930	27.83%	10737	2874	26.77%
	60%	10529	2930	27.83%	10737	2874	26.77%
	70%	10529	2930	27.83%	10737	2874	26.77%
	80%	10529	2930	27.83%	10737	2874	26.77%
	90%	10529	2930	27.83%	10737	2874	26.77%
	100%	10529	2930	27.83%	10737	2874	26.77%

FSA 6G		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10804	3060	28.32%	10324	2880	27.90%
Percent of Overlap	Any	9707	2731	28.13%	9324	2606	27.95%
	10%	10804	3060	28.32%	10324	2880	27.90%
	20%	10804	3060	28.32%	10324	2880	27.90%
	30%	10804	3060	28.32%	10324	2880	27.90%
	40%	10804	3060	28.32%	10324	2880	27.90%
	50%	10804	3060	28.32%	10324	2880	27.90%
	60%	10804	3060	28.32%	10324	2880	27.90%
	70%	10804	3060	28.32%	10324	2880	27.90%
	80%	10804	3060	28.32%	10324	2880	27.90%
	90%	10804	3060	28.32%	10324	2880	27.90%
	100%	10804	3060	28.32%	10324	2880	27.90%

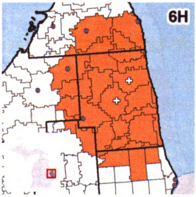
FSA 6G		2005		
		ALL	OUT	%OUT
	TOTAL	10885	2910	26.73%
Percent of Overlap	Any	9816	2602	26.51%
	10%	10885	2910	26.73%
	20%	10885	2910	26.73%
	30%	10885	2910	26.73%
	40%	10885	2910	26.73%
	50%	10885	2910	26.73%
	60%	10885	2910	26.73%
	70%	10885	2910	26.73%
	80%	10885	2910	26.73%
	90%	10885	2910	26.73%
	100%	10885	2910	26.73%



FSA 6H		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10458	3479	33.27%	10306	3391	32.90%
Percent of Overlap	Any	7131	2569	36.03%	7164	2554	35.65%
	10%	7844	2919	37.21%	7768	2841	36.57%
	20%	8587	3065	35.69%	8515	2973	34.91%
	30%	8587	3065	35.69%	8515	2973	34.91%
	40%	9158	3208	35.03%	9061	3120	34.43%
	50%	9586	3310	34.53%	9429	3210	34.04%
	60%	10458	3479	33.27%	10306	3391	32.90%
	70%	10458	3479	33.27%	10306	3391	32.90%
	80%	10458	3479	33.27%	10306	3391	32.90%
	90%	10458	3479	33.27%	10306	3391	32.90%
	100%	10458	3479	33.27%	10306	3391	32.90%

FSA 6H		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10525	3591	34.12%	10195	3440	33.74%
Percent of Overlap	Any	7205	2682	37.22%	7066	2614	36.99%
	10%	7828	3002	38.35%	7679	2928	38.13%
	20%	8583	3127	36.43%	8378	3057	36.49%
	30%	8583	3127	36.43%	8378	3057	36.49%
	40%	9223	3276	35.52%	8990	3195	35.54%
	50%	9644	3381	35.06%	9373	3279	34.98%
	60%	10525	3591	34.12%	10195	3440	33.74%
	70%	10525	3591	34.12%	10195	3440	33.74%
	80%	10525	3591	34.12%	10195	3440	33.74%
	90%	10525	3591	34.12%	10195	3440	33.74%
	100%	10525	3591	34.12%	10195	3440	33.74%

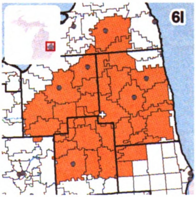
FSA 6H		2005		
		ALL	OUT	%OUT
	TOTAL	10623	3650	34.36%
Percent of Overlap	Any	7262	2672	36.79%
	10%	7937	3026	38.13%
	20%	8705	3195	36.70%
	30%	8705	3195	36.70%
	40%	9360	3362	35.92%
	50%	9744	3450	35.41%
	60%	10623	3650	34.36%
	70%	10623	3650	34.36%
	80%	10623	3650	34.36%
	90%	10623	3650	34.36%
	100%	10623	3650	34.36%



FSA 6I		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	20096	5405	26.90%	20360	5280	25.93%
Percent of Overlap	Any	14585	3878	26.59%	14923	3789	25.39%
	10%	17491	4850	27.73%	17726	4715	26.60%
	20%	18234	4996	27.40%	18473	4847	26.24%
	30%	19104	5111	26.75%	19335	4950	25.60%
	40%	19675	5254	26.70%	19881	5097	25.64%
	50%	19675	5254	26.70%	19881	5097	25.64%
	60%	19675	5254	26.70%	19881	5097	25.64%
	70%	19675	5254	26.70%	19881	5097	25.64%
	80%	19675	5254	26.70%	19881	5097	25.64%
	90%	20096	5405	26.90%	20360	5280	25.93%
	100%	20096	5405	26.90%	20360	5280	25.93%

FSA 6I		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	21009	5722	27.24%	20589	5662	27.50%
Percent of Overlap	Any	15290	4183	27.36%	15051	4117	27.35%
	10%	18210	5159	28.33%	17962	5159	28.72%
	20%	18965	5284	27.86%	18661	5288	28.34%
	30%	19882	5377	27.04%	19531	5365	27.47%
	40%	20522	5526	26.93%	20143	5503	27.32%
	50%	20522	5526	26.93%	20143	5503	27.32%
	60%	20522	5526	26.93%	20143	5503	27.32%
	70%	20522	5526	26.93%	20143	5503	27.32%
	80%	20522	5526	26.93%	20143	5503	27.32%
	90%	21009	5722	27.24%	20589	5662	27.50%
	100%	21009	5722	27.24%	20589	5662	27.50%

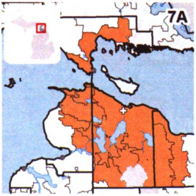
FSA 6I		2005		
		ALL	OUT	%OUT
	TOTAL	21521	5920	27.51%
Percent of Overlap	Any	15598	4234	27.14%
	10%	18664	5286	28.32%
	20%	19432	5455	28.07%
	30%	20322	5532	27.22%
	40%	20977	5699	27.17%
	50%	20977	5699	27.17%
	60%	20977	5699	27.17%
	70%	20977	5699	27.17%
	80%	20977	5699	27.17%
	90%	21521	5920	27.51%
	100%	21521	5920	27.51%



FSA 7A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	6769	1125	16.62%	7051	1088	15.43%
Percent of Overlap	Any	392	82	20.92%	276	29	10.51%
	10%	5141	592	11.52%	5388	491	9.11%
	20%	5141	592	11.52%	5388	491	9.11%
	30%	5141	592	11.52%	5388	491	9.11%
	40%	6079	738	12.14%	6356	663	10.43%
	50%	6079	738	12.14%	6356	663	10.43%
	60%	6079	738	12.14%	6356	663	10.43%
	70%	6079	738	12.14%	6356	663	10.43%
	80%	6079	738	12.14%	6356	663	10.43%
	90%	6557	1009	15.39%	6855	959	13.99%
	100%	6769	1125	16.62%	7051	1088	15.43%

FSA 7A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	7280	1475	20.26%	7288	1365	18.73%
Percent of Overlap	Any	290	43	14.83%	290	29	10.00%
	10%	5486	759	13.84%	5535	697	12.59%
	20%	5486	759	13.84%	5535	697	12.59%
	30%	5486	759	13.84%	5535	697	12.59%
	40%	6400	928	14.50%	6425	834	12.98%
	50%	6400	928	14.50%	6425	834	12.98%
	60%	6400	928	14.50%	6425	834	12.98%
	70%	6400	928	14.50%	6425	834	12.98%
	80%	6400	928	14.50%	6425	834	12.98%
	90%	7034	1321	18.78%	7053	1239	17.57%
	100%	7280	1475	20.26%	7288	1365	18.73%

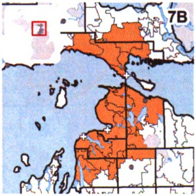
FSA 7A		2005		
		ALL	OUT	%OUT
	TOTAL	7040	1336	18.98%
Percent of Overlap	Any	272	35	12.87%
	10%	5312	682	12.84%
	20%	5312	682	12.84%
	30%	5312	682	12.84%
	40%	6292	875	13.91%
	50%	6292	875	13.91%
	60%	6292	875	13.91%
	70%	6292	875	13.91%
	80%	6292	875	13.91%
	90%	6828	1199	17.56%
	100%	7040	1336	18.98%



FSA 7B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	14430	1624	11.25%	14896	1715	11.51%
Percent of Overlap	Any	6088	573	9.41%	6040	649	10.75%
	10%	10653	1034	9.71%	10977	1100	10.02%
	20%	11956	1307	10.93%	12328	1366	11.08%
	30%	11956	1307	10.93%	12328	1366	11.08%
	40%	13898	1517	10.92%	14258	1561	10.95%
	50%	13988	1546	11.05%	14345	1586	11.06%
	60%	13988	1546	11.05%	14345	1586	11.06%
	70%	13988	1546	11.05%	14345	1586	11.06%
	80%	14430	1624	11.25%	14896	1715	11.51%
	90%	14430	1624	11.25%	14896	1715	11.51%
	100%	14430	1624	11.25%	14896	1715	11.51%

FSA 7B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	14834	1993	13.44%	14668	2102	14.33%
Percent of Overlap	Any	5892	601	10.20%	5690	710	12.48%
	10%	10868	1230	11.32%	10708	1348	12.59%
	20%	12292	1595	12.98%	12025	1696	14.10%
	30%	12292	1595	12.98%	12025	1696	14.10%
	40%	14269	1855	13.00%	13997	1932	13.80%
	50%	14336	1882	13.13%	14085	1974	14.01%
	60%	14336	1882	13.13%	14085	1974	14.01%
	70%	14336	1882	13.13%	14085	1974	14.01%
	80%	14834	1993	13.44%	14668	2102	14.33%
	90%	14834	1993	13.44%	14668	2102	14.33%
	100%	14834	1993	13.44%	14668	2102	14.33%

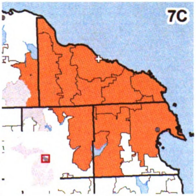
FSA 7B		2005		
		ALL	OUT	%OUT
	TOTAL	14822	2191	14.78%
Percent of Overlap	Any	5921	746	12.60%
	10%	10831	1362	12.58%
	20%	12118	1745	14.40%
	30%	12118	1745	14.40%
	40%	14161	2021	14.27%
	50%	14257	2066	14.49%
	60%	14257	2066	14.49%
	70%	14257	2066	14.49%
	80%	14822	2191	14.78%
	90%	14822	2191	14.78%
	100%	14822	2191	14.78%



FSA 7C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5444	1944	35.71%	5596	1994	35.63%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	2862	541	18.90%	2954	533	18.04%
	20%	2862	541	18.90%	2954	533	18.04%
	30%	2862	541	18.90%	2954	533	18.04%
	40%	3044	600	19.71%	3117	591	18.96%
	50%	3044	600	19.71%	3117	591	18.96%
	60%	3044	600	19.71%	3117	591	18.96%
	70%	3044	600	19.71%	3117	591	18.96%
	80%	3480	724	20.80%	3600	731	20.31%
	90%	3958	995	25.14%	4099	1027	25.05%
	100%	4770	1711	35.87%	4892	1753	35.83%

FSA 7C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5651	2390	42.29%	5348	2241	41.90%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	2827	662	23.42%	2690	599	22.27%
	20%	2827	662	23.42%	2690	599	22.27%
	30%	2827	662	23.42%	2690	599	22.27%
	40%	3013	738	24.49%	2845	656	23.06%
	50%	3013	738	24.49%	2845	656	23.06%
	60%	3013	738	24.49%	2845	656	23.06%
	70%	3013	738	24.49%	2845	656	23.06%
	80%	3430	873	25.45%	3270	822	25.14%
	90%	4064	1266	31.15%	3898	1227	31.48%
	100%	4990	2100	42.08%	4759	1979	41.58%

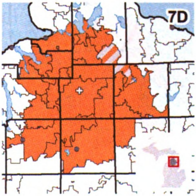
FSA 7C		2005		
		ALL	OUT	%OUT
	TOTAL	5531	2271	41.06%
Percent of Overlap	Any	0	0	0
	10%	2877	674	23.43%
	20%	2877	674	23.43%
	30%	2877	674	23.43%
	40%	3068	750	24.45%
	50%	3068	750	24.45%
	60%	3068	750	24.45%
	70%	3068	750	24.45%
	80%	3579	947	26.46%
	90%	4115	1271	30.89%
	100%	4935	2016	40.85%



FSA 7D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	11550	2803	24.27%	12145	2955	24.33%
Percent of Overlap	Any	3361	863	25.68%	3590	946	26.35%
	10%	7909	1623	20.52%	8433	1757	20.83%
	20%	10291	1978	19.22%	10866	2085	19.19%
	30%	10485	2073	19.77%	11030	2166	19.64%
	40%	10595	2131	20.11%	11151	2241	20.10%
	50%	10595	2131	20.11%	11151	2241	20.10%
	60%	10595	2131	20.11%	11151	2241	20.10%
	70%	10595	2131	20.11%	11151	2241	20.10%
	80%	10595	2131	20.11%	11151	2241	20.10%
	90%	10595	2131	20.11%	11151	2241	20.10%
	100%	11550	2803	24.27%	12145	2955	24.33%

FSA 7D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	12550	3149	25.09%	12470	3144	25.21%
Percent of Overlap	Any	3824	1070	27.98%	3636	1041	28.63%
	10%	8648	1927	22.28%	8650	1930	22.31%
	20%	11184	2275	20.34%	11174	2324	20.80%
	30%	11374	2365	20.79%	11381	2425	21.31%
	40%	11483	2426	21.13%	11464	2468	21.53%
	50%	11483	2426	21.13%	11464	2468	21.53%
	60%	11483	2426	21.13%	11464	2468	21.53%
	70%	11483	2426	21.13%	11464	2468	21.53%
	80%	11483	2426	21.13%	11464	2468	21.53%
	90%	11483	2426	21.13%	11464	2468	21.53%
	100%	12550	3149	25.09%	12470	3144	25.21%

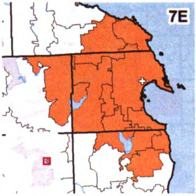
FSA 7D		2005		
		ALL	OUT	%OUT
	TOTAL	12684	3325	26.21%
Percent of Overlap	Any	3845	1106	28.76%
	10%	8820	2024	22.95%
	20%	11317	2439	21.55%
	30%	11528	2544	22.07%
	40%	11618	2595	22.34%
	50%	11618	2595	22.34%
	60%	11618	2595	22.34%
	70%	11618	2595	22.34%
	80%	11618	2595	22.34%
	90%	11618	2595	22.34%
	100%	12684	3325	26.21%



FSA 7E		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5148	1176	22.84%	5282	1195	22.62%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	2862	541	18.90%	2954	533	18.04%
	20%	3278	639	19.49%	3319	623	18.77%
	30%	3278	639	19.49%	3319	623	18.77%
	40%	3460	698	20.17%	3482	681	19.56%
	50%	3460	698	20.17%	3482	681	19.56%
	60%	3460	698	20.17%	3482	681	19.56%
	70%	3460	698	20.17%	3482	681	19.56%
	80%	4121	886	21.50%	4197	903	21.52%
	90%	4272	939	21.98%	4352	964	22.15%
	100%	4325	964	22.29%	4410	985	22.34%

FSA 7E		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5038	1396	27.71%	4751	1281	26.96%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	2827	662	23.42%	2690	599	22.27%
	20%	3229	790	24.47%	3067	702	22.89%
	30%	3229	790	24.47%	3067	702	22.89%
	40%	3415	866	25.36%	3222	759	23.56%
	50%	3415	866	25.36%	3222	759	23.56%
	60%	3415	866	25.36%	3222	759	23.56%
	70%	3415	866	25.36%	3222	759	23.56%
	80%	4046	1061	26.22%	3843	990	25.76%
	90%	4193	1120	26.71%	3971	1036	26.09%
	100%	4244	1142	26.91%	4028	1057	26.24%

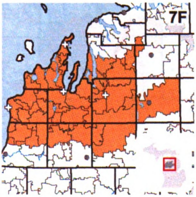
FSA 7E		2005		
		ALL	OUT	%OUT
	TOTAL	5160	1419	27.50%
Percent of Overlap	Any	0	0	0
	10%	2877	674	23.43%
	20%	3277	777	23.71%
	30%	3277	777	23.71%
	40%	3468	853	24.60%
	50%	3468	853	24.60%
	60%	3468	853	24.60%
	70%	3468	853	24.60%
	80%	4182	1121	26.81%
	90%	4327	1167	26.97%
	100%	4383	1188	27.10%



FSA 7F		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	19377	1788	9.23%	19846	1899	9.57%
Percent of Overlap	Any	6955	482	6.93%	7324	539	7.36%
	10%	14252	1156	8.11%	14766	1274	8.63%
	20%	15632	1387	8.87%	16176	1508	9.32%
	30%	16391	1441	8.79%	16938	1574	9.29%
	40%	17535	1525	8.70%	18023	1678	9.31%
	50%	18499	1696	9.17%	18932	1817	9.60%
	60%	18629	1703	9.14%	19080	1829	9.59%
	70%	18629	1703	9.14%	19080	1829	9.59%
	80%	19191	1757	9.16%	19655	1871	9.52%
	90%	19247	1764	9.17%	19710	1876	9.52%
	100%	19377	1788	9.23%	19846	1899	9.57%

FSA 7F		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	20059	1886	9.40%	20517	1932	9.42%
Percent of Overlap	Any	7262	558	7.68%	7253	524	7.22%
	10%	14782	1284	8.69%	15082	1283	8.51%
	20%	16276	1492	9.17%	16644	1526	9.17%
	30%	17005	1551	9.12%	17386	1594	9.17%
	40%	18101	1653	9.13%	18587	1707	9.18%
	50%	19059	1791	9.40%	19571	1835	9.38%
	60%	19225	1804	9.38%	19710	1842	9.35%
	70%	19225	1804	9.38%	19710	1842	9.35%
	80%	19848	1859	9.37%	20301	1903	9.37%
	90%	19921	1871	9.39%	20363	1909	9.37%
	100%	20059	1886	9.40%	20517	1932	9.42%

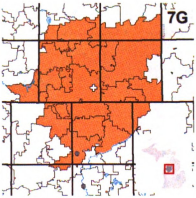
FSA 7F		2005		
		ALL	OUT	%OUT
	TOTAL	20944	2108	10.06%
Percent of Overlap	Any	7157	587	8.20%
	10%	15222	1386	9.11%
	20%	16779	1626	9.69%
	30%	17538	1709	9.74%
	40%	18804	1814	9.65%
	50%	19946	1988	9.97%
	60%	20059	1997	9.96%
	70%	20059	1997	9.96%
	80%	20695	2063	9.97%
	90%	20758	2070	9.97%
	100%	20944	2108	10.06%



FSA 7G		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	9287	2287	24.63%	9378	2460	26.23%
Percent of Overlap	Any	1327	452	34.06%	1350	495	36.67%
	10%	4439	1164	26.22%	4688	1339	28.56%
	20%	5605	1522	27.15%	5835	1743	29.87%
	30%	6163	1554	25.21%	6381	1778	27.86%
	40%	6850	1732	25.28%	7059	1983	28.09%
	50%	8488	2060	24.27%	8571	2243	26.17%
	60%	8488	2060	24.27%	8571	2243	26.17%
	70%	8488	2060	24.27%	8571	2243	26.17%
	80%	9287	2287	24.63%	9378	2460	26.23%
	90%	9287	2287	24.63%	9378	2460	26.23%
	100%	9287	2287	24.63%	9378	2460	26.23%

FSA 7G		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	9566	2421	25.31%	9520	2422	25.44%
Percent of Overlap	Any	1394	474	34.00%	1428	497	34.80%
	10%	4643	1263	27.20%	4760	1324	27.82%
	20%	5883	1706	29.00%	5919	1710	28.89%
	30%	6419	1740	27.11%	6445	1739	26.98%
	40%	7076	1919	27.12%	7081	1947	27.50%
	50%	8700	2183	25.09%	8713	2177	24.99%
	60%	8700	2183	25.09%	8713	2177	24.99%
	70%	8700	2183	25.09%	8713	2177	24.99%
	80%	9566	2421	25.31%	9520	2422	25.44%
	90%	9566	2421	25.31%	9520	2422	25.44%
	100%	9566	2421	25.31%	9520	2422	25.44%

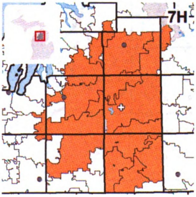
FSA 7G		2005		
		ALL	OUT	%OUT
	TOTAL	10450	2900	27.75%
Percent of Overlap	Any	1412	566	40.08%
	10%	4947	1516	30.64%
	20%	6253	2031	32.48%
	30%	6807	2083	30.60%
	40%	7606	2300	30.24%
	50%	9552	2614	27.37%
	60%	9552	2614	27.37%
	70%	9552	2614	27.37%
	80%	10450	2900	27.75%
	90%	10450	2900	27.75%
	100%	10450	2900	27.75%



FSA 7H		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10116	3319	32.81%	10495	3460	32.97%
Percent of Overlap	Any	1879	813	43.27%	1870	780	41.71%
	10%	3941	1189	30.17%	4081	1211	29.67%
	20%	5991	1648	27.51%	6192	1733	27.99%
	30%	7453	2294	30.78%	7768	2403	30.93%
	40%	7453	2294	30.78%	7768	2403	30.93%
	50%	8272	2458	29.71%	8524	2533	29.72%
	60%	8272	2458	29.71%	8524	2533	29.72%
	70%	8272	2458	29.71%	8524	2533	29.72%
	80%	8992	2778	30.89%	9199	2870	31.20%
	90%	10116	3319	32.81%	10495	3460	32.97%
	100%	10116	3319	32.81%	10495	3460	32.97%

FSA 7H		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	11118	3588	32.27%	11239	3610	32.12%
Percent of Overlap	Any	2138	941	44.01%	2024	872	43.08%
	10%	4434	1372	30.94%	4330	1311	30.28%
	20%	6690	1893	28.30%	6698	1877	28.02%
	30%	8394	2616	31.17%	8401	2602	30.97%
	40%	8394	2616	31.17%	8401	2602	30.97%
	50%	9206	2748	29.85%	9217	2717	29.48%
	60%	9206	2748	29.85%	9217	2717	29.48%
	70%	9206	2748	29.85%	9217	2717	29.48%
	80%	9853	3027	30.72%	9929	3033	30.55%
	90%	11118	3588	32.27%	11239	3610	32.12%
	100%	11118	3588	32.27%	11239	3610	32.12%

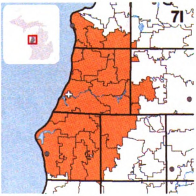
FSA 7H		2005		
		ALL	OUT	%OUT
	TOTAL	11730	3859	32.90%
Percent of Overlap	Any	2070	925	44.69%
	10%	4433	1397	31.51%
	20%	6836	2018	29.52%
	30%	8663	2794	32.25%
	40%	8663	2794	32.25%
	50%	9636	2951	30.62%
	60%	9636	2951	30.62%
	70%	9636	2951	30.62%
	80%	10379	3289	31.69%
	90%	11730	3859	32.90%
	100%	11730	3859	32.90%



FSA 7I		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10402	2743	26.37%	10240	2913	28.45%
Percent of Overlap	Any	3255	674	20.71%	3257	728	22.35%
	10%	9002	2226	24.73%	8839	2395	27.10%
	20%	9002	2226	24.73%	8839	2395	27.10%
	30%	9203	2248	24.43%	9055	2426	26.79%
	40%	9543	2313	24.24%	9378	2511	26.78%
	50%	9543	2313	24.24%	9378	2511	26.78%
	60%	9543	2313	24.24%	9378	2511	26.78%
	70%	9543	2313	24.24%	9378	2511	26.78%
	80%	9991	2517	25.19%	9879	2721	27.54%
	90%	9991	2517	25.19%	9879	2721	27.54%
	100%	10402	2743	26.37%	10240	2913	28.45%

FSA 7I		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	10671	2900	27.18%	10790	3125	28.96%
Percent of Overlap	Any	3328	715	21.48%	3406	838	24.60%
	10%	9271	2385	25.73%	9359	2567	27.43%
	20%	9271	2385	25.73%	9359	2567	27.43%
	30%	9464	2410	25.46%	9575	2606	27.22%
	40%	9801	2494	25.45%	9928	2701	27.21%
	50%	9801	2494	25.45%	9928	2701	27.21%
	60%	9801	2494	25.45%	9928	2701	27.21%
	70%	9801	2494	25.45%	9928	2701	27.21%
	80%	10311	2703	26.21%	10407	2911	27.97%
	90%	10311	2703	26.21%	10407	2911	27.97%
	100%	10671	2900	27.18%	10790	3125	28.96%

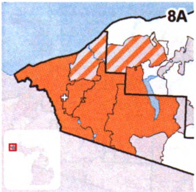
FSA 7I		2005		
		ALL	OUT	%OUT
	TOTAL	11294	3504	31.03%
Percent of Overlap	Any	3446	847	24.58%
	10%	9736	2890	29.68%
	20%	9736	2890	29.68%
	30%	9941	2921	29.38%
	40%	10324	3020	29.25%
	50%	10324	3020	29.25%
	60%	10324	3020	29.25%
	70%	10324	3020	29.25%
	80%	10843	3254	30.01%
	90%	10843	3254	30.01%
	100%	11294	3504	31.03%



FSA 8A		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1550	469	30.26%	1498	499	33.31%
Percent of Overlap	Any	53	24	45.28%	0	0	0
	10%	356	132	37.08%	323	119	36.84%
	20%	1235	361	29.23%	1193	400	33.53%
	30%	1235	361	29.23%	1193	400	33.53%
	40%	1235	361	29.23%	1193	400	33.53%
	50%	1235	361	29.23%	1193	400	33.53%
	60%	1235	361	29.23%	1193	400	33.53%
	70%	1235	361	29.23%	1193	400	33.53%
	80%	1471	424	28.82%	1409	454	32.22%
	90%	1471	424	28.82%	1409	454	32.22%
	100%	1550	469	30.26%	1498	499	33.31%

FSA 8A		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1551	544	35.07%	1539	584	37.95%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	333	140	42.04%	318	125	39.31%
	20%	1251	432	34.53%	1177	430	36.53%
	30%	1251	432	34.53%	1177	430	36.53%
	40%	1251	432	34.53%	1177	430	36.53%
	50%	1251	432	34.53%	1177	430	36.53%
	60%	1251	432	34.53%	1177	430	36.53%
	70%	1251	432	34.53%	1177	430	36.53%
	80%	1479	505	34.14%	1442	533	36.96%
	90%	1479	505	34.14%	1442	533	36.96%
	100%	1551	544	35.07%	1539	584	37.95%

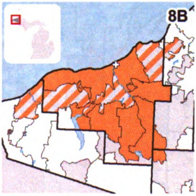
FSA 8A		2005		
		ALL	OUT	%OUT
	TOTAL	1827	844	46.20%
Percent of Overlap	Any	0	0	0
	10%	405	185	45.68%
	20%	1424	654	45.93%
	30%	1424	654	45.93%
	40%	1424	654	45.93%
	50%	1424	654	45.93%
	60%	1424	654	45.93%
	70%	1424	654	45.93%
	80%	1718	790	45.98%
	90%	1718	790	45.98%
	100%	1827	844	46.20%



FSA 8B		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1969	919	46.67%	2013	914	45.40%
Percent of Overlap	Any	45	27	60.00%	0	0	0
	10%	81	39	48.15%	0	0	0
	20%	81	39	48.15%	0	0	0
	30%	81	39	48.15%	0	0	0
	40%	1437	568	39.53%	1626	616	37.88%
	50%	1437	568	39.53%	1626	616	37.88%
	60%	1437	568	39.53%	1626	616	37.88%
	70%	1437	568	39.53%	1626	616	37.88%
	80%	1643	670	40.78%	1626	616	37.88%
	90%	1643	670	40.78%	1626	616	37.88%
	100%	1925	879	45.66%	1948	855	43.89%

FSA 8B		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1927	1017	52.78%	1871	949	50.72%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	0	0	0	0	0	0
	20%	0	0	0	0	0	0
	30%	0	0	0	0	0	0
	40%	1571	725	46.15%	1499	645	43.03%
	50%	1571	725	46.15%	1499	645	43.03%
	60%	1571	725	46.15%	1499	645	43.03%
	70%	1571	725	46.15%	1499	645	43.03%
	80%	1571	725	46.15%	1499	645	43.03%
	90%	1571	725	46.15%	1499	645	43.03%
	100%	1873	965	51.52%	1810	895	49.45%

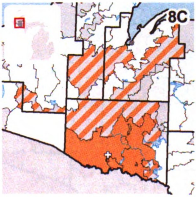
FSA 8B		2005		
		ALL	OUT	%OUT
	TOTAL	2098	990	47.19%
Percent of Overlap	Any	0	0	0
	10%	0	0	0
	20%	0	0	0
	30%	0	0	0
	40%	1754	713	40.65%
	50%	1754	713	40.65%
	60%	1754	713	40.65%
	70%	1754	713	40.65%
	80%	1754	713	40.65%
	90%	1754	713	40.65%
	100%	2046	944	46.14%



FSA 8C		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	3672	1406	38.29%	4197	1695	40.39%
Percent of Overlap	Any	308	161	52.27%	87	35	40.23%
	10%	2254	973	43.17%	2567	1103	42.97%
	20%	2296	998	43.47%	2567	1103	42.97%
	30%	2296	998	43.47%	2567	1103	42.97%
	40%	2296	998	43.47%	2567	1103	42.97%
	50%	3672	1406	38.29%	4197	1695	40.39%
	60%	3672	1406	38.29%	4197	1695	40.39%
	70%	3672	1406	38.29%	4197	1695	40.39%
	80%	3672	1406	38.29%	4197	1695	40.39%
	90%	3672	1406	38.29%	4197	1695	40.39%
	100%	3672	1406	38.29%	4197	1695	40.39%

FSA 8C		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	4117	1605	38.98%	3964	1621	40.89%
Percent of Overlap	Any	55	21	38.18%	102	69	67.65%
	10%	2437	1077	44.19%	2426	1153	47.53%
	20%	2437	1077	44.19%	2426	1153	47.53%
	30%	2437	1077	44.19%	2426	1153	47.53%
	40%	2437	1077	44.19%	2426	1153	47.53%
	50%	4117	1605	38.98%	3964	1621	40.89%
	60%	4117	1605	38.98%	3964	1621	40.89%
	70%	4117	1605	38.98%	3964	1621	40.89%
	80%	4117	1605	38.98%	3964	1621	40.89%
	90%	4117	1605	38.98%	3964	1621	40.89%
	100%	4117	1605	38.98%	3964	1621	40.89%

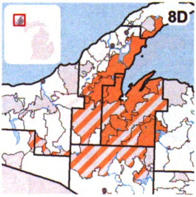
FSA 8C		2005		
		ALL	OUT	%OUT
	TOTAL	3760	1626	43.24%
Percent of Overlap	Any	138	106	76.81%
	10%	2294	1118	48.74%
	20%	2294	1118	48.74%
	30%	2294	1118	48.74%
	40%	2294	1118	48.74%
	50%	3760	1626	43.24%
	60%	3760	1626	43.24%
	70%	3760	1626	43.24%
	80%	3760	1626	43.24%
	90%	3760	1626	43.24%
	100%	3760	1626	43.24%



FSA 8D		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1771	668	37.72%	2013	671	33.33%
Percent of Overlap	Any	291	107	36.77%	254	76	29.92%
	10%	1061	429	40.43%	1047	383	36.58%
	20%	1108	449	40.52%	1103	417	37.81%
	30%	1623	630	38.82%	1801	605	33.59%
	40%	1623	630	38.82%	1801	605	33.59%
	50%	1623	630	38.82%	1801	605	33.59%
	60%	1645	637	38.72%	1848	626	33.87%
	70%	1645	637	38.72%	1848	626	33.87%
	80%	1645	637	38.72%	1848	626	33.87%
	90%	1645	637	38.72%	1848	626	33.87%
	100%	1771	668	37.72%	2013	671	33.33%

FSA 8D		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	2078	745	35.85%	2085	788	37.79%
Percent of Overlap	Any	290	100	34.48%	315	124	39.37%
	10%	1140	456	40.00%	1154	497	43.07%
	20%	1169	468	40.03%	1201	522	43.46%
	30%	1836	655	35.68%	1878	733	39.03%
	40%	1836	655	35.68%	1878	733	39.03%
	50%	1836	655	35.68%	1878	733	39.03%
	60%	1890	676	35.77%	1910	744	38.95%
	70%	1890	676	35.77%	1910	744	38.95%
	80%	1890	676	35.77%	1910	744	38.95%
	90%	1890	676	35.77%	1910	744	38.95%
	100%	2078	745	35.85%	2085	788	37.79%

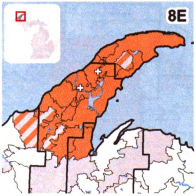
FSA 8D		2005		
		ALL	OUT	%OUT
	TOTAL	2068	743	35.93%
Percent of Overlap	Any	352	125	35.51%
	10%	1170	471	40.26%
	20%	1210	488	40.33%
	30%	1880	698	37.13%
	40%	1880	698	37.13%
	50%	1880	698	37.13%
	60%	1903	706	37.10%
	70%	1903	706	37.10%
	80%	1903	706	37.10%
	90%	1903	706	37.10%
	100%	2068	743	35.93%



FSA 8E		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5487	1587	28.92%	5763	1646	28.56%
Percent of Overlap	Any	4193	1127	26.88%	4078	1112	27.27%
	10%	4435	1224	27.60%	4329	1185	27.37%
	20%	4582	1273	27.78%	4618	1278	27.67%
	30%	5097	1454	28.53%	5316	1466	27.58%
	40%	5158	1475	28.60%	5316	1466	27.58%
	50%	5158	1475	28.60%	5316	1466	27.58%
	60%	5201	1489	28.63%	5357	1484	27.70%
	70%	5201	1489	28.63%	5357	1484	27.70%
	80%	5487	1587	28.92%	5763	1646	28.56%
	90%	5487	1587	28.92%	5763	1646	28.56%
	100%	5487	1587	28.92%	5763	1646	28.56%

FSA 8E		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5978	1702	28.47%	5806	1648	28.38%
Percent of Overlap	Any	4346	1193	27.45%	4112	1124	27.33%
	10%	4615	1274	27.61%	4373	1215	27.78%
	20%	4908	1368	27.87%	4725	1321	27.96%
	30%	5575	1555	27.89%	5402	1532	28.36%
	40%	5575	1555	27.89%	5402	1532	28.36%
	50%	5575	1555	27.89%	5402	1532	28.36%
	60%	5624	1572	27.95%	5452	1550	28.43%
	70%	5624	1572	27.95%	5452	1550	28.43%
	80%	5978	1702	28.47%	5806	1648	28.38%
	90%	5978	1702	28.47%	5806	1648	28.38%
	100%	5978	1702	28.47%	5806	1648	28.38%

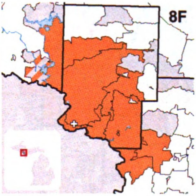
FSA 8E		2005		
		ALL	OUT	%OUT
	TOTAL	5909	1742	29.48%
Percent of Overlap	Any	4257	1203	28.26%
	10%	4521	1294	28.62%
	20%	4826	1406	29.13%
	30%	5496	1616	29.40%
	40%	5496	1616	29.40%
	50%	5496	1616	29.40%
	60%	5537	1636	29.55%
	70%	5537	1636	29.55%
	80%	5909	1742	29.48%
	90%	5909	1742	29.48%
	100%	5909	1742	29.48%



FSA 8F		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5448	1434	26.32%	5428	1658	30.55%
Percent of Overlap	Any	2255	595	26.39%	2118	612	28.90%
	10%	2255	595	26.39%	2118	612	28.90%
	20%	2255	595	26.39%	2118	612	28.90%
	30%	2255	595	26.39%	2118	612	28.90%
	40%	2255	595	26.39%	2118	612	28.90%
	50%	3343	907	27.13%	3373	1076	31.90%
	60%	5224	1337	25.59%	5201	1551	29.82%
	70%	5224	1337	25.59%	5201	1551	29.82%
	80%	5249	1344	25.60%	5240	1568	29.92%
	90%	5249	1344	25.60%	5240	1568	29.92%
	100%	5448	1434	26.32%	5428	1658	30.55%

FSA 8F		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	5202	1567	30.12%	5029	1605	31.91%
Percent of Overlap	Any	2011	642	31.92%	2001	682	34.08%
	10%	2011	642	31.92%	2001	682	34.08%
	20%	2011	642	31.92%	2001	682	34.08%
	30%	2011	642	31.92%	2001	682	34.08%
	40%	2011	642	31.92%	2001	682	34.08%
	50%	3265	1016	31.12%	3164	1058	33.44%
	60%	4971	1479	29.75%	4820	1507	31.27%
	70%	4971	1479	29.75%	4820	1507	31.27%
	80%	5014	1489	29.70%	4874	1534	31.47%
	90%	5014	1489	29.70%	4874	1534	31.47%
	100%	5202	1567	30.12%	5029	1605	31.91%

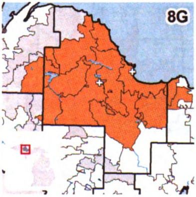
FSA 8F		2005		
		ALL	OUT	%OUT
	TOTAL	5132	1763	34.35%
Percent of Overlap	Any	2102	743	35.35%
	10%	2102	743	35.35%
	20%	2102	743	35.35%
	30%	2102	743	35.35%
	40%	2102	743	35.35%
	50%	3241	1165	35.95%
	60%	4913	1664	33.87%
	70%	4913	1664	33.87%
	80%	4967	1680	33.82%
	90%	4967	1680	33.82%
	100%	5132	1763	34.35%



FSA 8G		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	7272	440	6.05%	7581	481	6.34%
Percent of Overlap	Any	81	6	7.41%	0	0	0
	10%	1665	74	4.44%	1802	76	4.22%
	20%	1665	74	4.44%	1802	76	4.22%
	30%	1665	74	4.44%	1802	76	4.22%
	40%	5589	306	5.48%	5930	318	5.36%
	50%	6045	330	5.46%	6374	360	5.65%
	60%	6045	330	5.46%	6374	360	5.65%
	70%	6045	330	5.46%	6374	360	5.65%
	80%	6804	383	5.63%	7083	406	5.73%
	90%	6855	403	5.88%	7083	406	5.73%
	100%	7272	440	6.05%	7581	481	6.34%

FSA 8G		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	7710	480	6.23%	7754	495	6.38%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	1790	84	4.69%	1806	92	5.09%
	20%	1790	84	4.69%	1806	92	5.09%
	30%	1790	84	4.69%	1806	92	5.09%
	40%	5956	323	5.42%	5962	358	6.00%
	50%	6391	344	5.38%	6412	394	6.14%
	60%	6391	344	5.38%	6412	394	6.14%
	70%	6391	344	5.38%	6412	394	6.14%
	80%	7249	403	5.56%	7278	452	6.21%
	90%	7249	403	5.56%	7278	452	6.21%
	100%	7710	480	6.23%	7754	495	6.38%

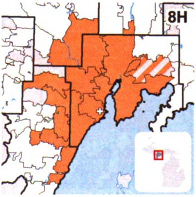
FSA 8G		2005		
		ALL	OUT	%OUT
	TOTAL	7782	527	6.77%
Percent of Overlap	Any	0	0	0
	10%	1752	110	6.28%
	20%	1752	110	6.28%
	30%	1752	110	6.28%
	40%	6108	393	6.43%
	50%	6468	411	6.35%
	60%	6468	411	6.35%
	70%	6468	411	6.35%
	80%	7340	482	6.57%
	90%	7340	482	6.57%
	100%	7782	527	6.77%



FSA 8H		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	9266	3531	38.11%	9099	3554	39.06%
Percent of Overlap	Any	108	43	39.81%	113	46	40.71%
	10%	108	43	39.81%	113	46	40.71%
	20%	1194	438	36.68%	1268	492	38.80%
	30%	1194	438	36.68%	1268	492	38.80%
	40%	1194	438	36.68%	1268	492	38.80%
	50%	1588	629	39.61%	1721	717	41.66%
	60%	1588	629	39.61%	1721	717	41.66%
	70%	1588	629	39.61%	1721	717	41.66%
	80%	1867	780	41.78%	2028	858	42.31%
	90%	1867	780	41.78%	2028	858	42.31%
	100%	2324	996	42.86%	2532	1109	43.80%

FSA 8H		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	9863	3931	39.86%	9625	3776	39.23%
Percent of Overlap	Any	108	53	49.07%	111	48	43.24%
	10%	108	53	49.07%	111	48	43.24%
	20%	1318	506	38.39%	1246	461	37.00%
	30%	1318	506	38.39%	1246	461	37.00%
	40%	1318	506	38.39%	1246	461	37.00%
	50%	1771	734	41.45%	1639	657	40.09%
	60%	1771	734	41.45%	1639	657	40.09%
	70%	1771	734	41.45%	1639	657	40.09%
	80%	2063	882	42.75%	1953	829	42.45%
	90%	2063	882	42.75%	1953	829	42.45%
	100%	2575	1136	44.12%	2437	1096	44.97%

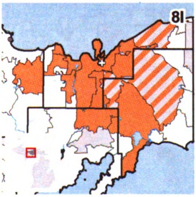
FSA 8H		2005		
		ALL	OUT	%OUT
	TOTAL	9260	3811	41.16%
Percent of Overlap	Any	88	29	32.95%
	10%	88	29	32.95%
	20%	1148	470	40.94%
	30%	1148	470	40.94%
	40%	1148	470	40.94%
	50%	1480	643	43.45%
	60%	1480	643	43.45%
	70%	1480	643	43.45%
	80%	1790	818	45.70%
	90%	1790	818	45.70%
	100%	2288	1089	47.60%



FSA 8I		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1831	1136	62.04%	1916	1193	62.27%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	0	0	0	0	0	0
	20%	532	315	59.21%	644	400	62.11%
	30%	618	377	61.00%	734	461	62.81%
	40%	618	377	61.00%	734	461	62.81%
	50%	1436	924	64.35%	1457	920	63.14%
	60%	1526	1002	65.66%	1564	1014	64.83%
	70%	1526	1002	65.66%	1564	1014	64.83%
	80%	1831	1136	62.04%	1916	1193	62.27%
	90%	1831	1136	62.04%	1916	1193	62.27%
	100%	1831	1136	62.04%	1916	1193	62.27%

FSA 8I		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	2087	1182	56.64%	1954	1132	57.93%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	0	0	0	0	0	0
	20%	626	346	55.27%	611	358	58.59%
	30%	726	410	56.47%	690	408	59.13%
	40%	726	410	56.47%	690	408	59.13%
	50%	1577	924	58.59%	1486	887	59.69%
	60%	1680	1010	60.12%	1585	969	61.14%
	70%	1680	1010	60.12%	1585	969	61.14%
	80%	2087	1182	56.64%	1954	1132	57.93%
	90%	2087	1182	56.64%	1954	1132	57.93%
	100%	2087	1182	56.64%	1954	1132	57.93%

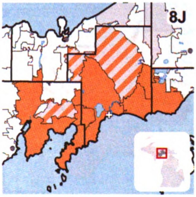
FSA 8I		2005		
		ALL	OUT	%OUT
	TOTAL	1864	1185	63.57%
Percent of Overlap	Any	0	0	0
	10%	0	0	0
	20%	561	378	67.38%
	30%	624	415	66.51%
	40%	624	415	66.51%
	50%	1431	931	65.06%
	60%	1528	1012	66.23%
	70%	1528	1012	66.23%
	80%	1864	1185	63.57%
	90%	1864	1185	63.57%
	100%	1864	1185	63.57%



FSA 8J		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	2316	1442	62.26%	2200	1332	60.55%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	59	40	67.80%	56	43	76.79%
	20%	59	40	67.80%	56	43	76.79%
	30%	139	89	64.03%	138	93	67.39%
	40%	139	89	64.03%	138	93	67.39%
	50%	1639	1061	64.73%	1460	901	61.71%
	60%	1639	1061	64.73%	1460	901	61.71%
	70%	1639	1061	64.73%	1460	901	61.71%
	80%	1734	1136	65.51%	1549	971	62.69%
	90%	1875	1243	66.29%	1700	1079	63.47%
	100%	2316	1442	62.26%	2200	1332	60.55%

FSA 8J		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	2486	1461	58.77%	2420	1470	60.74%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	71	55	77.46%	54	43	79.63%
	20%	71	55	77.46%	54	43	79.63%
	30%	136	101	74.26%	135	93	68.89%
	40%	136	101	74.26%	135	93	68.89%
	50%	1712	1019	59.52%	1647	983	59.68%
	60%	1712	1019	59.52%	1647	983	59.68%
	70%	1712	1019	59.52%	1647	983	59.68%
	80%	1835	1110	60.49%	1771	1085	61.26%
	90%	1981	1205	60.83%	1897	1181	62.26%
	100%	2486	1461	58.77%	2420	1470	60.74%

FSA 8J		2005		
		ALL	OUT	%OUT
	TOTAL	2392	1468	61.37%
Percent of Overlap	Any	0	0	0
	10%	50	32	64.00%
	20%	50	32	64.00%
	30%	148	86	58.11%
	40%	148	86	58.11%
	50%	1618	988	61.06%
	60%	1618	988	61.06%
	70%	1618	988	61.06%
	80%	1732	1079	62.30%
	90%	1859	1176	63.26%
	100%	2392	1468	61.37%



FSA 8K		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1407	808	57.43%	1571	917	58.37%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	0	0	0	0	0	0
	20%	0	0	0	0	0	0
	30%	241	160	66.39%	326	211	64.72%
	40%	324	223	68.83%	402	266	66.17%
	50%	1023	604	59.04%	1132	641	56.63%
	60%	1023	604	59.04%	1132	641	56.63%
	70%	1023	604	59.04%	1132	641	56.63%
	80%	1257	706	56.17%	1435	809	56.38%
	90%	1282	722	56.32%	1435	809	56.38%
	100%	1407	808	57.43%	1571	917	58.37%

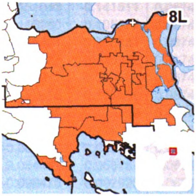
FSA 8K		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	1573	918	58.36%	1442	889	61.65%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	0	0	0	0	0	0
	20%	0	0	0	0	0	0
	30%	312	195	62.50%	239	164	68.62%
	40%	403	253	62.78%	337	234	69.44%
	50%	1145	657	57.38%	972	609	62.65%
	60%	1145	657	57.38%	972	609	62.65%
	70%	1145	657	57.38%	972	609	62.65%
	80%	1409	795	56.42%	1266	762	60.19%
	90%	1409	795	56.42%	1266	762	60.19%
	100%	1573	918	58.36%	1442	889	61.65%

FSA 8K		2005		
		ALL	OUT	%OUT
	TOTAL	1480	947	63.99%
Percent of Overlap	Any	0	0	0
	10%	0	0	0
	20%	0	0	0
	30%	303	222	73.27%
	40%	400	286	71.50%
	50%	1038	671	64.64%
	60%	1038	671	64.64%
	70%	1038	671	64.64%
	80%	1323	827	62.51%
	90%	1323	827	62.51%
	100%	1480	947	63.99%

FSA 8L		2001			2002		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	19667	6421	32.65%	20846	6944	33.31%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	91	28	30.77%	138	57	41.30%
	20%	18395	6115	33.24%	19359	6523	33.69%
	30%	18395	6115	33.24%	19359	6523	33.69%
	40%	18911	6173	32.64%	19870	6576	33.10%
	50%	18911	6173	32.64%	19870	6576	33.10%
	60%	18955	6189	32.65%	19944	6611	33.15%
	70%	18955	6189	32.65%	19944	6611	33.15%
	80%	19509	6358	32.59%	20651	6865	33.24%
	90%	19509	6358	32.59%	20651	6865	33.24%
	100%	19667	6421	32.65%	20846	6944	33.31%

FSA 8L		2003			2004		
		ALL	OUT	%OUT	ALL	OUT	%OUT
	TOTAL	18958	5990	31.60%	19631	6279	31.99%
Percent of Overlap	Any	0	0	0	0	0	0
	10%	96	29	30.21%	105	25	23.81%
	20%	17523	5512	31.46%	18136	5849	32.25%
	30%	17523	5512	31.46%	18136	5849	32.25%
	40%	18014	5576	30.95%	18619	5913	31.76%
	50%	18014	5576	30.95%	18619	5913	31.76%
	60%	18069	5614	31.07%	18675	5937	31.79%
	70%	**18069**	**5614**	**31.07%**	**18675**	**5937**	**31.79%**
	80%	18724	5879	31.40%	19396	6183	31.88%
	90%	18724	5879	31.40%	19396	6183	31.88%
	100%	18958	5990	31.60%	19631	6279	31.99%

FSA 8L		2005		
		ALL	OUT	%OUT
	TOTAL	20199	6858	33.95%
Percent of Overlap	Any	0	0	0
	10%	100	46	46.00%
	20%	18696	6397	34.22%
	30%	18696	6397	34.22%
	40%	19242	6481	33.68%
	50%	19242	6481	33.68%
	60%	19305	6509	33.72%
	70%	19305	6509	33.72%
	80%	19985	6765	33.85%
	90%	19985	6765	33.85%
	100%	20199	6858	33.95%



Appendix 9

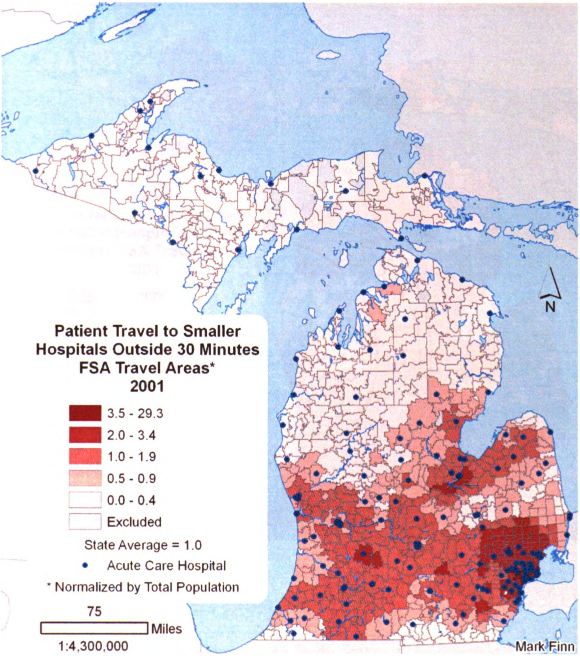
Results of T-test to compare the percentage of patients traveling longer than 30 minutes for acute care for FSA 30 minutes travel time service areas and the entire State of Michigan

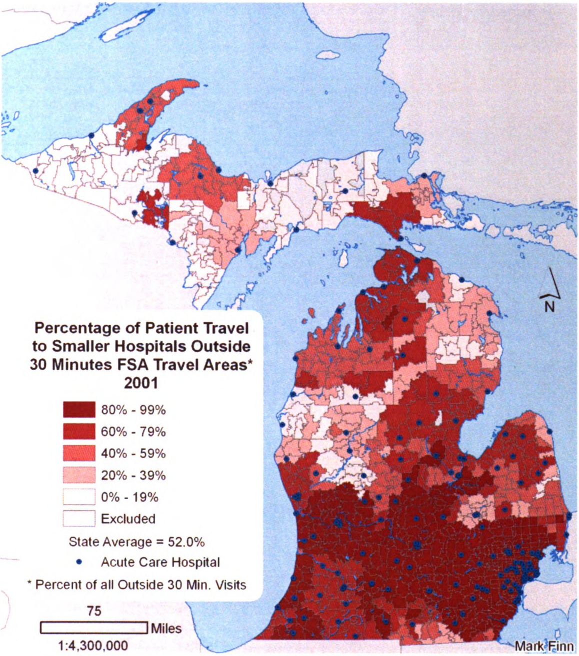
R results for Welch Two Sample t-test							
FSA	t	df	p	95% Conf. Interval		mean x	mean y
1A	52.316	70.097	< 2.2e-16	0.056138	0.060588	0.087497	0.029134
1B	57.683	65.599	< 2.2e-16	0.061012	0.065388	0.087497	0.024297
1C	46.703	84.444	< 2.2e-16	0.052800	0.057497	0.087497	0.032348
1D	52.660	83.177	< 2.2e-16	0.059531	0.064204	0.087497	0.025629
1E	53.543	77.179	< 2.2e-16	0.059142	0.063711	0.087497	0.026070
1F	53.320	60.300	< 2.2e-16	0.055015	0.059303	0.087497	0.030338
1G	-27.281	116.568	< 2.2e-16	-0.046787	-0.040454	0.087497	0.131117
1H	33.191	78.247	< 2.2e-16	0.035945	0.040532	0.087497	0.049258
1I	-44.542	100.708	< 2.2e-16	-0.058985	-0.053955	0.087497	0.143967
1J	-3.532	74.067	0.0007145	-0.017374	-0.004841	0.087497	0.098604
2A	6.357	113.986	4.39E-09	0.006055	0.011536	0.087497	0.078701
2B	-5.301	92.030	7.87E-07	-0.016046	-0.007299	0.087497	0.099169
2C	-57.141	85.874	< 2.2e-16	-0.143059	-0.133439	0.087497	0.225746
2D	-23.446	75.609	< 2.2e-16	-0.076518	-0.064535	0.087497	0.158023
3A	-6.266	88.367	1.32E-08	-0.009903	-0.005134	0.087497	0.095015
3B	-7.172	102.500	1.19E-10	-0.017658	-0.010007	0.087497	0.101329
3C	-44.838	99.957	< 2.2e-16	-0.093087	-0.085198	0.087497	0.176640
3D	-61.014	86.422	< 2.2e-16	-0.151043	-0.141511	0.087497	0.233774
3E	-42.372	81.636	< 2.2e-16	-0.115980	-0.105577	0.087497	0.198275
4A	-117.835	91.609	< 2.2e-16	-0.265431	-0.256631	0.087497	0.348527
4B	-102.312	93.928	< 2.2e-16	-0.223793	-0.215272	0.087497	0.307029
4C	-84.544	69.983	< 2.2e-16	-0.314913	-0.300398	0.087497	0.395152
4D	-78.037	104.630	< 2.2e-16	-0.150515	-0.143056	0.087497	0.234282
4E	-51.682	78.885	< 2.2e-16	-0.148785	-0.137749	0.087497	0.230763
4F	-83.503	116.402	< 2.2e-16	-0.121942	-0.116292	0.087497	0.206613
4G	1.176	99.774	0.2425	-0.001020	0.003988	0.087497	0.086013
4H	52.966	59.665	< 2.2e-16	0.054489	0.058767	0.087497	0.030869
4I	-58.141	114.701	< 2.2e-16	-0.099475	-0.092920	0.087497	0.183694
4J	36.677	62.899	< 2.2e-16	0.037578	0.041910	0.087497	0.047753
4K	-39.009	111.109	< 2.2e-16	-0.071319	-0.064423	0.087497	0.155368
4L	25.845	69.214	< 2.2e-16	0.026514	0.030949	0.087497	0.058765
5A	-0.119	68.496	0.9057	-0.002344	0.002080	0.087497	0.087629
5B	19.359	70.728	< 2.2e-16	0.019420	0.023881	0.087497	0.065846
5C	-8.683	99.544	7.78E-14	-0.013447	-0.008445	0.087497	0.098443
6A	-102.093	81.169	< 2.2e-16	-0.274691	-0.264189	0.087497	0.356937
6B	-69.021	104.792	< 2.2e-16	-0.133304	-0.125859	0.087497	0.217078
6C	-90.459	95.623	< 2.2e-16	-0.193989	-0.185658	0.087497	0.277320

R results for Welch Two Sample t-test cont.							
FSA	**t**	**df**	**p**	**95% Conf. Interval**		**mean x**	**mean y**
6D	-23.130	117.131	< 2.2e-16	-0.039605	-0.033358	0.087497	0.123978
6E	-5.241	106.105	8.18E-07	-0.009427	-0.004252	0.087497	0.094336
6F	-6.351	59.075	3.34E-08	-0.353880	-0.184316	0.087497	0.356594
6G	-138.280	111.817	< 2.2e-16	-0.190287	-0.184911	0.087497	0.275095
6H	-119.063	92.294	< 2.2e-16	-0.265585	-0.256870	0.087497	0.348724
6I	-127.310	116.660	< 2.2e-16	-0.185264	-0.179588	0.087497	0.269923
7A	-13.031	68.337	< 2.2e-16	-0.058989	-0.043323	0.087497	0.138653
7B	-16.685	89.383	< 2.2e-16	-0.042725	-0.033633	0.087497	0.125676
7C	-17.330	55.293	< 2.2e-16	-0.189516	-0.150233	0.087497	0.257371
7D	-41.136	72.826	< 2.2e-16	-0.141094	-0.128054	0.087497	0.222070
7E	-37.874	63.122	< 2.2e-16	-0.152111	-0.136865	0.087497	0.231985
7F	-3.221	112.030	0.001674	-0.007070	-0.001684	0.087497	0.091874
7G	-43.692	66.808	< 2.2e-16	-0.195119	-0.178069	0.087497	0.274091
7H	-46.843	64.735	< 2.2e-16	-0.241598	-0.221838	0.087497	0.319215
7I	-60.142	75.766	< 2.2e-16	-0.186107	-0.174175	0.087497	0.267638
8A	-36.339	57.180	< 2.2e-16	-0.293283	-0.262650	0.087497	0.365463
8B	-48.555	44.916	< 2.2e-16	-0.365660	-0.336531	0.087497	0.438592
8C	-41.290	60.952	< 2.2e-16	-0.361711	-0.328295	0.087497	0.432500
8D	-82.984	71.518	< 2.2e-16	-0.291031	-0.277375	0.087497	0.371700
8E	-143.202	112.934	< 2.2e-16	-0.198853	-0.193425	0.087497	0.283636
8F	-54.079	67.573	< 2.2e-16	-0.229138	-0.212828	0.087497	0.308479
8G	20.908	113.723	< 2.2e-16	0.027404	0.033141	0.087497	0.057224
8H	-75.951	66.934	< 2.2e-16	-0.330381	-0.313460	0.087497	0.409417
8I	-112.409	54.362	< 2.2e-16	-0.536095	-0.517310	0.087497	0.614199
8J	-69.871	55.958	< 2.2e-16	-0.574443	-0.542421	0.087497	0.645929
8K	-77.556	46.240	< 2.2e-16	-0.539099	-0.511827	0.087497	0.612959
8L	-64.038	63.439	< 2.2e-16	-0.247957	-0.232952	0.087497	0.327951

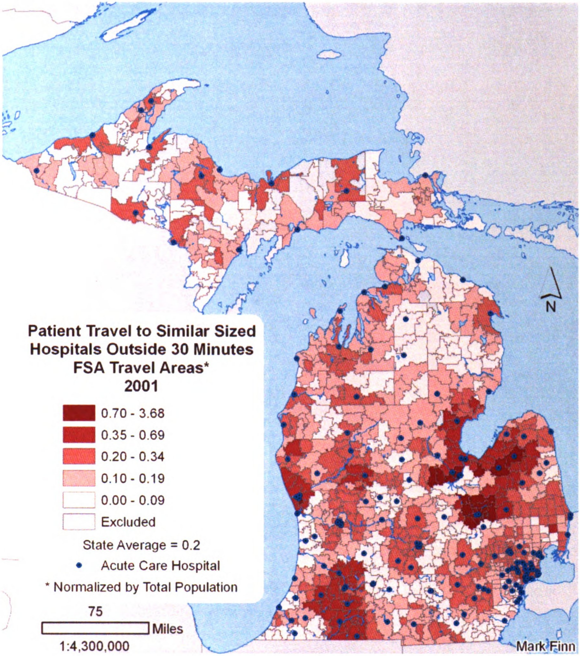
Appendix 10

Results of Hospital Hierarchical Movement Analysis of Patient Visits Outside 30 Minutes Travel Time

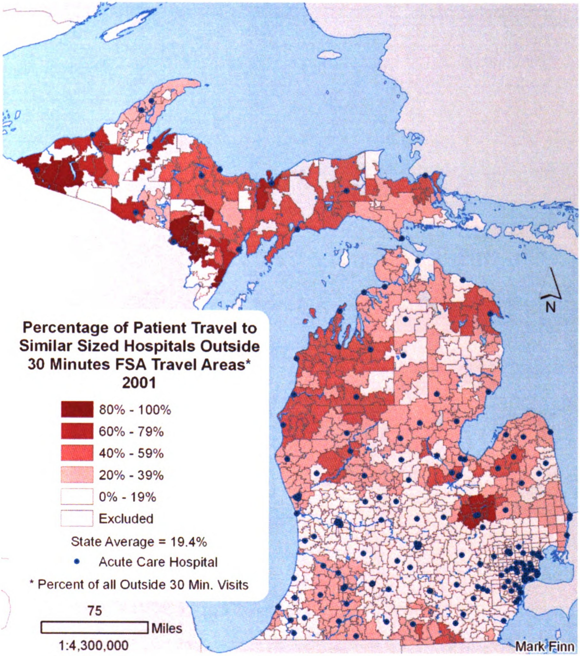


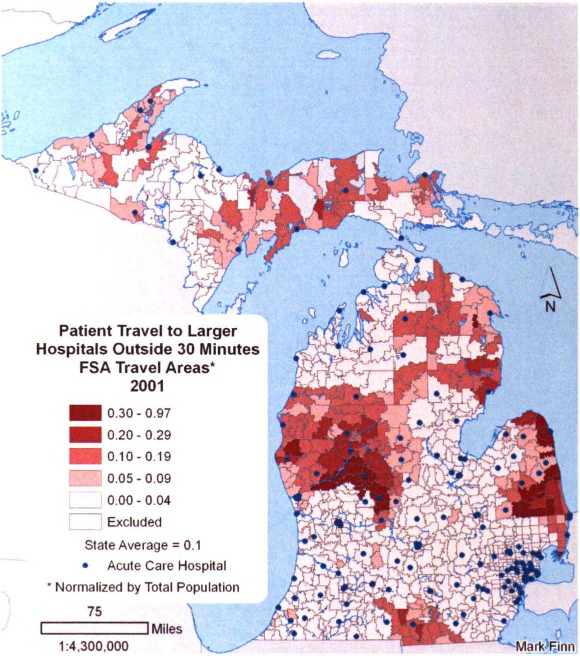


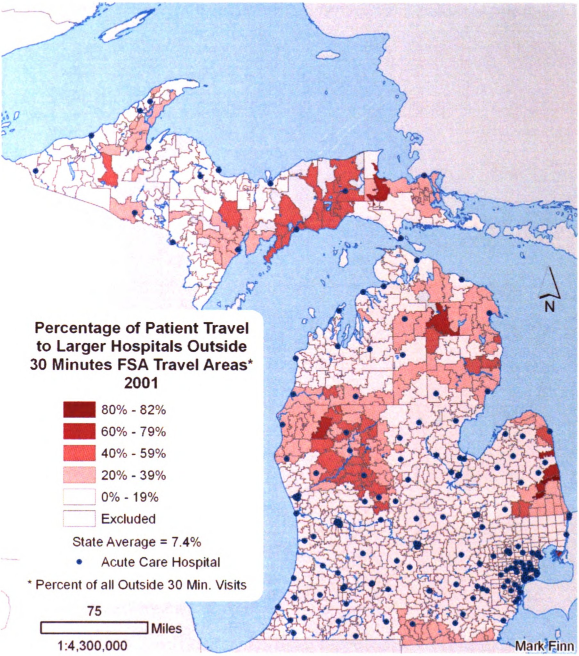
Percentage of Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas* 2001
80% - 99%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 52.0%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

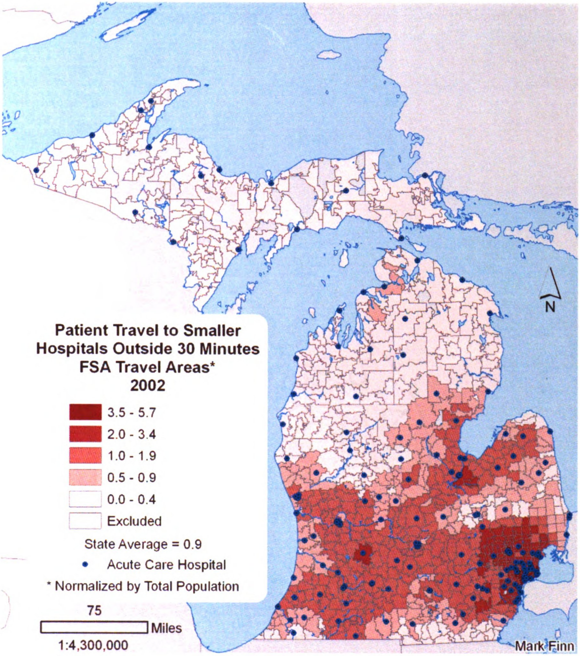


Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Areas* 2001
0.70 - 3.68
0.35 - 0.69
0.20 - 0.34
0.10 - 0.19
0.00 - 0.09
Excluded
State Average = 0.2
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

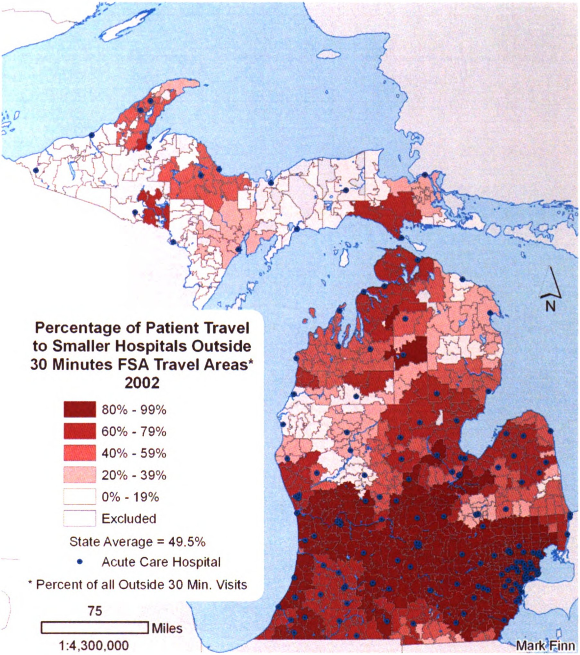

Percentage of Patient Travel to
Similar Sized Hospitals Outside
30 Minutes FSA Travel Areas*
2001
80% - 100%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 19.4%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn


Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas* 2001
0.30 - 0.97
0.20 - 0.29
0.10 - 0.19
0.05 - 0.09
0.00 - 0.04
Excluded
State Average = 0.1
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

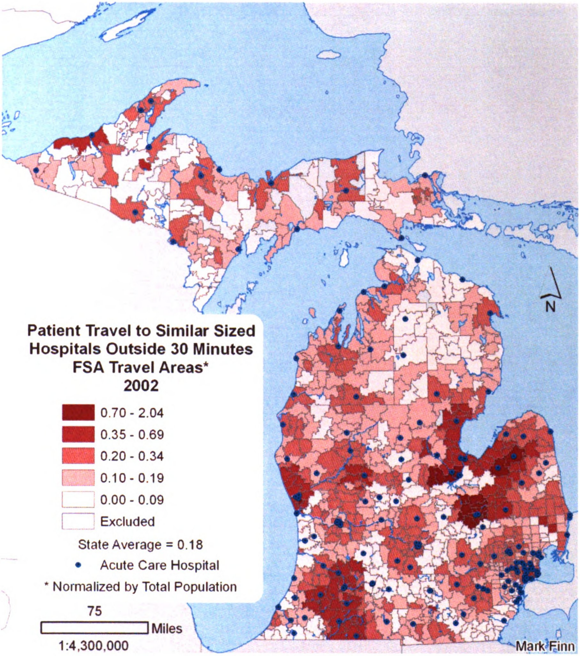

Percentage of Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas*
2001
80% - 82%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 7.4%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

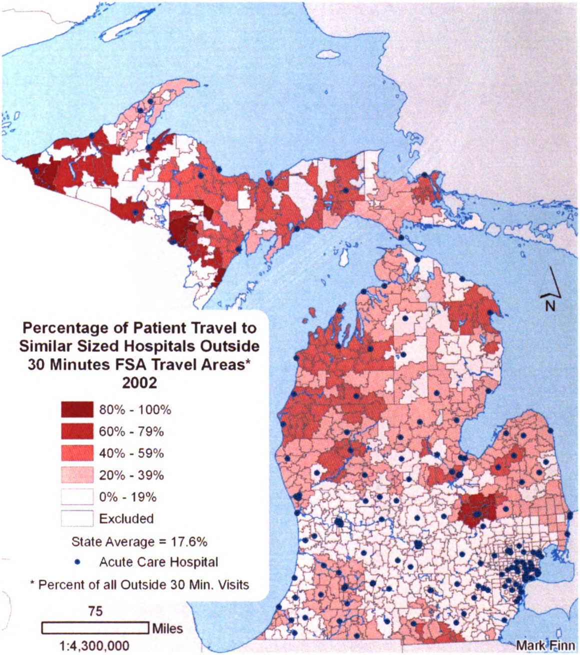


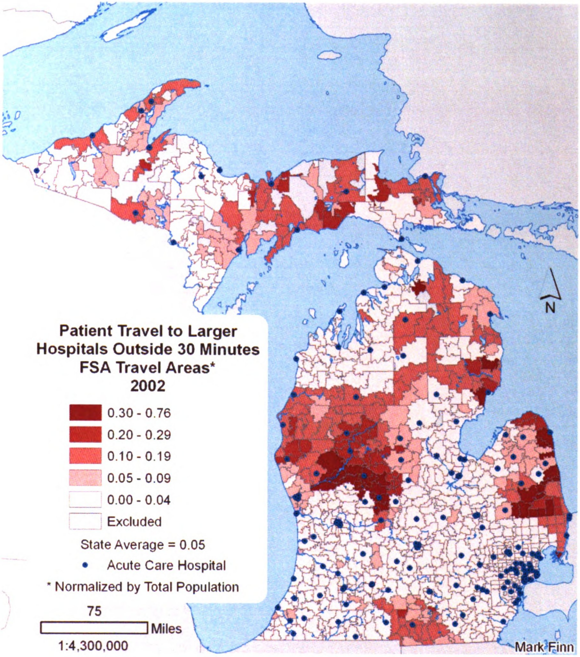
Patient Travel to Smaller
Hospitals Outside 30 Minutes
FSA Travel Areas*
2002
3.5 - 5.7
2.0 - 3.4
1.0 - 1.9
0.5 - 0.9
0.0 - 0.4
Excluded
State Average = 0.9
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

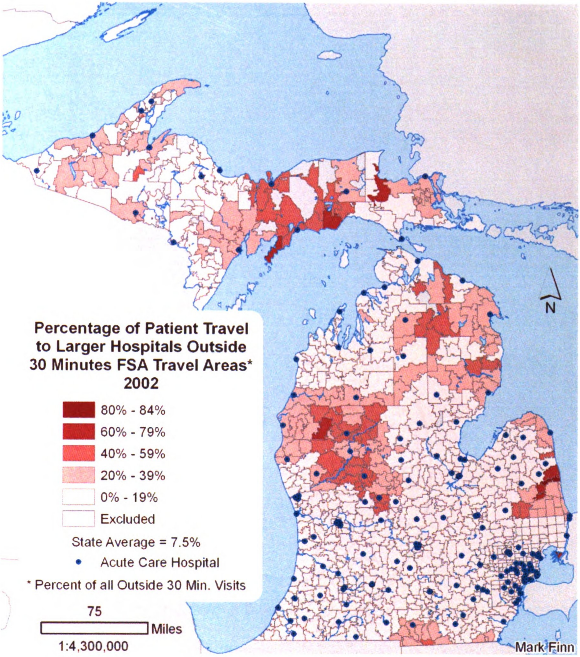


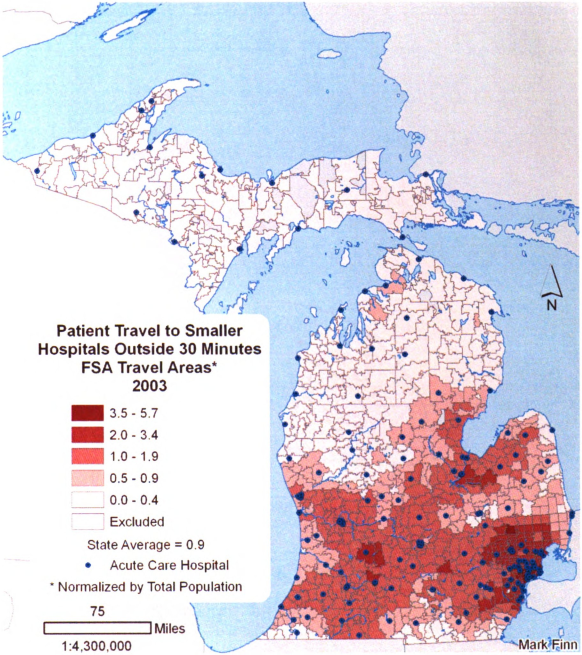
Percentage of Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas* 2002
80% - 99%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 49.5%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

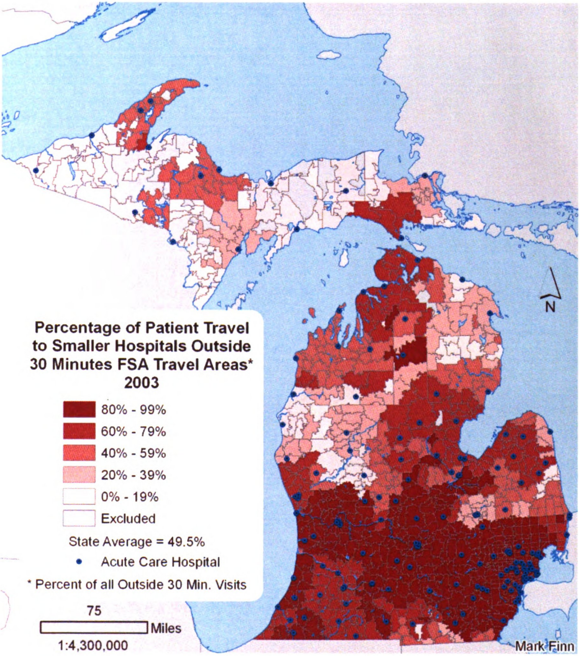

Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Areas*
2002
0.70 - 2.04
0.35 - 0.69
0.20 - 0.34
0.10 - 0.19
0.00 - 0.09
Excluded
State Average = 0.18
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

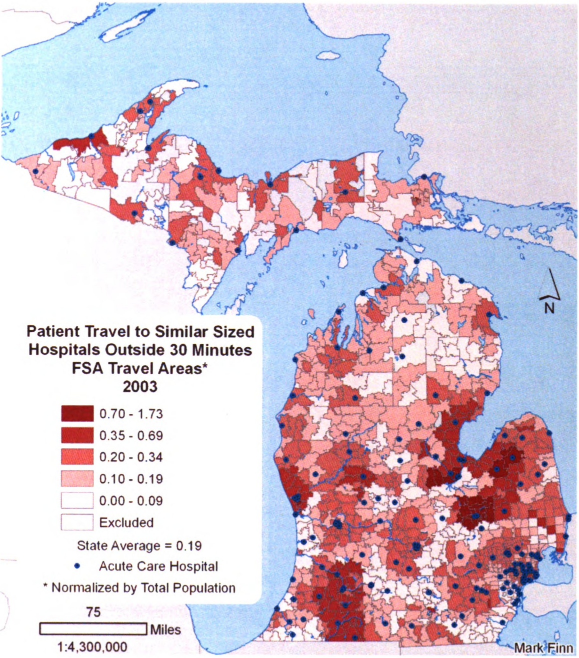

Percentage of Patient Travel to
Similar Sized Hospitals Outside
30 Minutes FSA Travel Areas*
2002
80% - 100%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 17.6%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

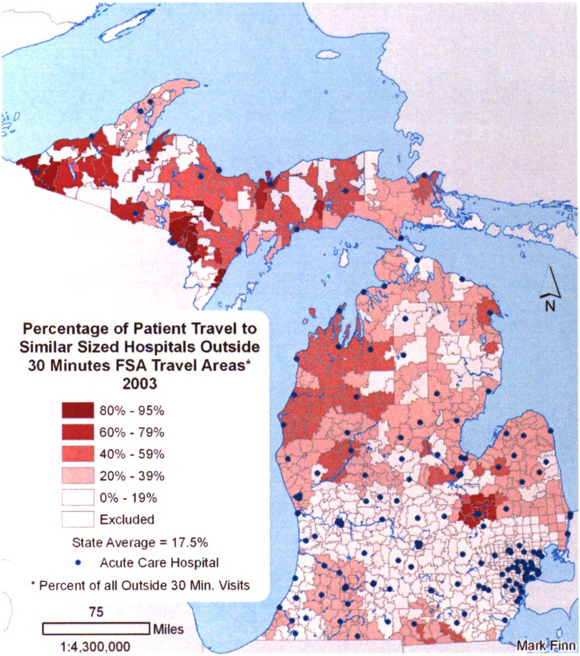

Patient Travel to Larger
Hospitals Outside 30 Minutes
FSA Travel Areas*
2002
0.30 - 0.76
0.20 - 0.29
0.10 - 0.19
0.05 - 0.09
0.00 - 0.04
Excluded
State Average = 0.05
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn


Percentage of Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas* 2002
80% - 84%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 7.5%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

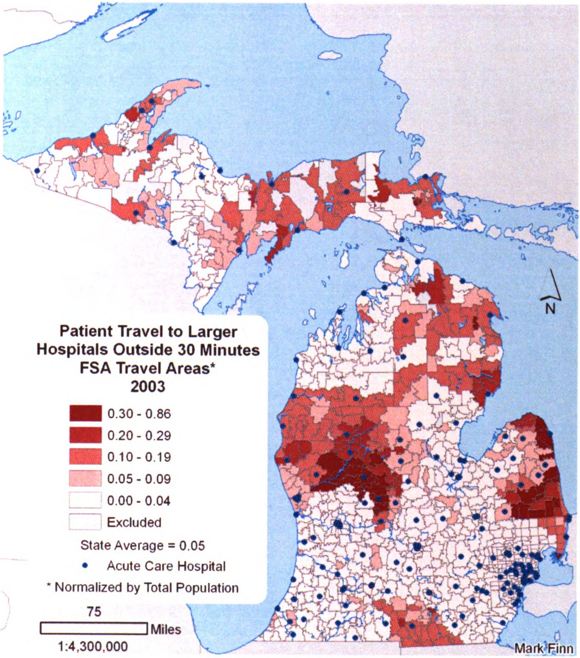

Patient Travel to Smaller
Hospitals Outside 30 Minutes
FSA Travel Areas*
2003
3.5 - 5.7
2.0 - 3.4
1.0 - 1.9
0.5 - 0.9
0.0 - 0.4
Excluded
State Average = 0.9
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

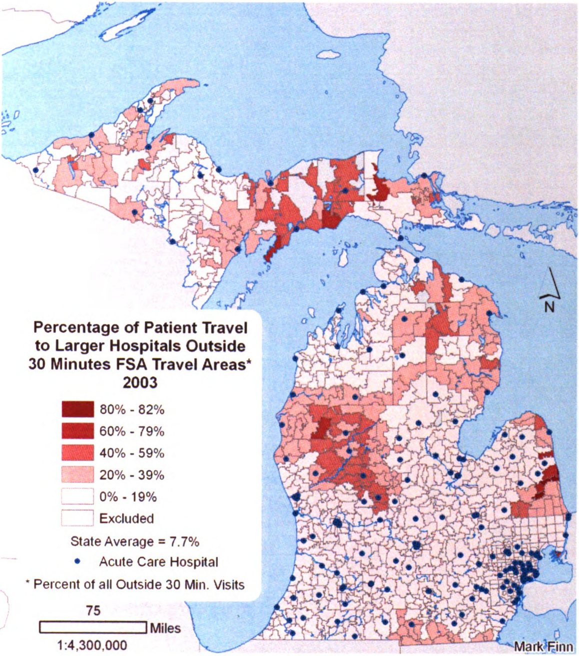

Percentage of Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas* 2003
80% - 99%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 49.5%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn


Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Areas* 2003
0.70 - 1.73
0.35 - 0.69
0.20 - 0.34
0.10 - 0.19
0.00 - 0.09
Excluded
State Average = 0.19
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

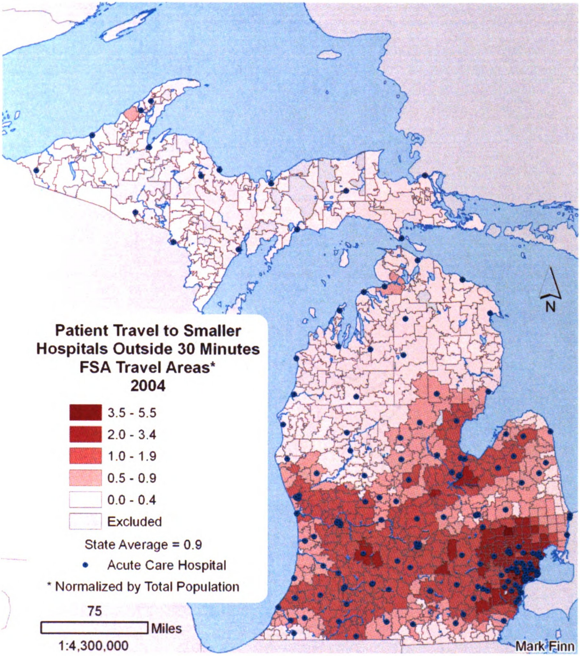


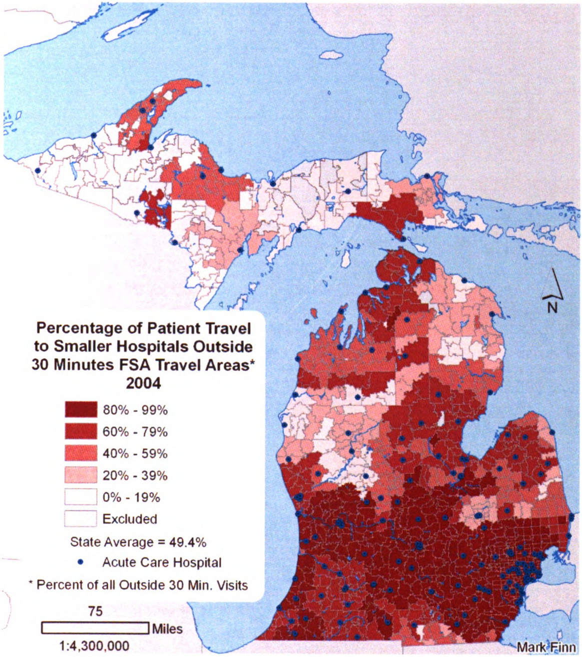
Percentage of Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Areas* 2003
80% - 95%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 17.5%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

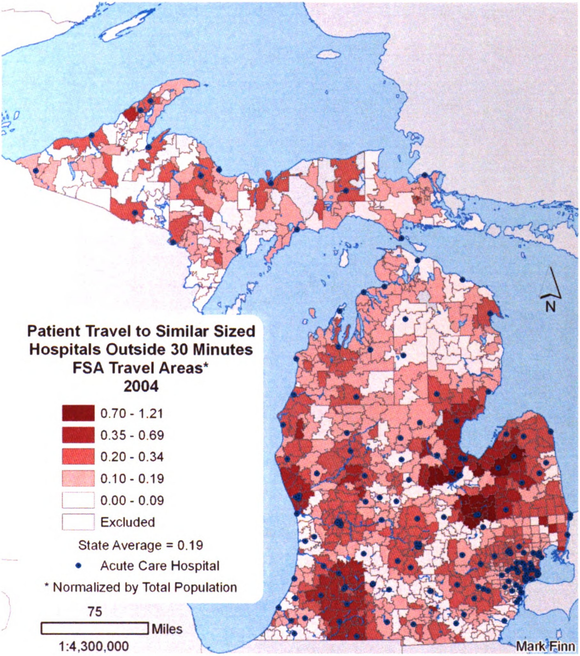

Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas* 2003
0.30 - 0.86
0.20 - 0.29
0.10 - 0.19
0.05 - 0.09
0.00 - 0.04
Excluded
State Average = 0.05
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

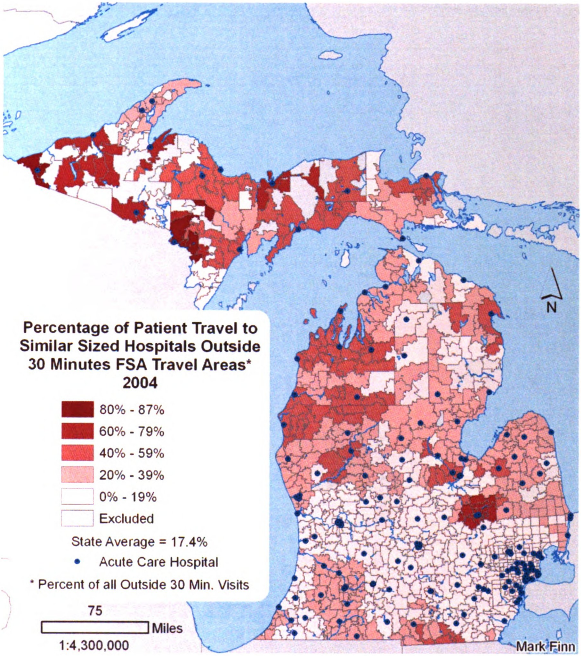


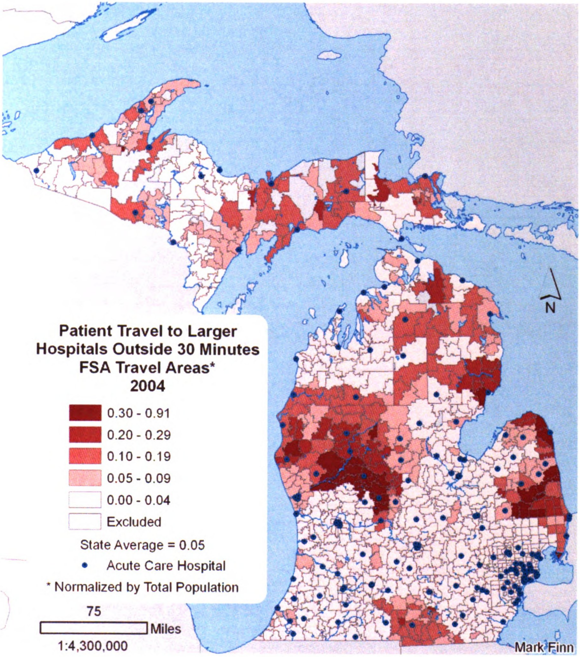
Percentage of Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas* 2003
80% - 82%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 7.7%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

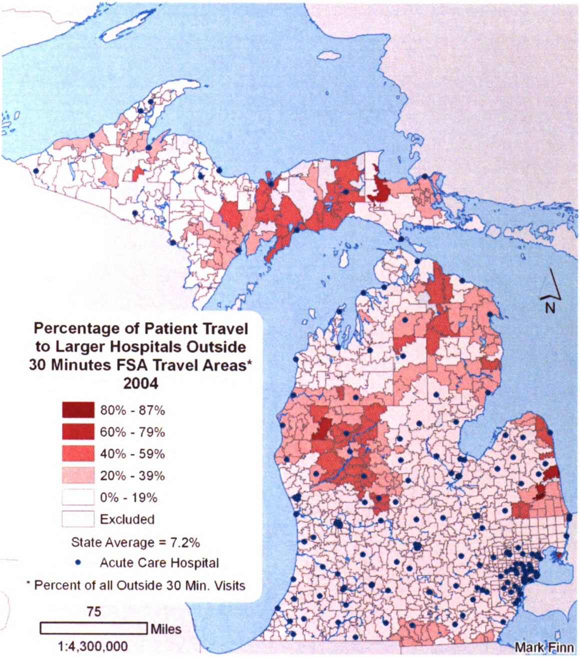

Patient Travel to Smaller
Hospitals Outside 30 Minutes
FSA Travel Areas*
2004
3.5 - 5.5
2.0 - 3.4
1.0 - 1.9
0.5 - 0.9
0.0 - 0.4
Excluded
State Average = 0.9
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

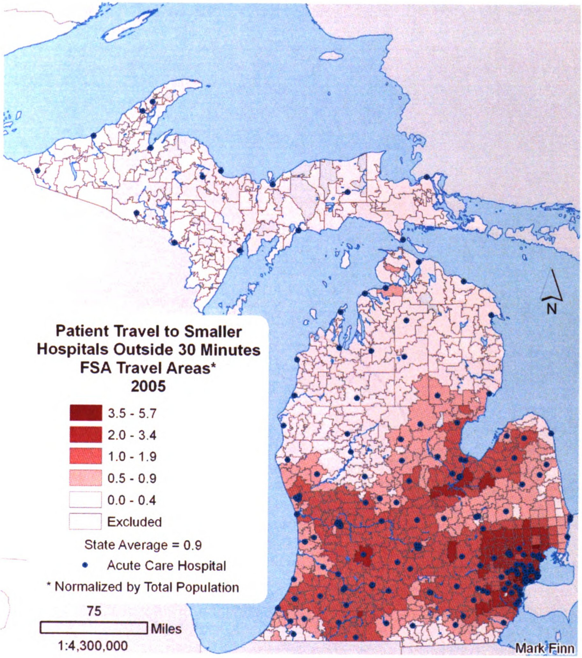

Percentage of Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas* 2004
80% - 99%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 49.4%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn


Patient Travel to Similar Sized Hospitals Outside 30 Minutes
FSA Travel Areas*
2004
0.70 - 1.21
0.35 - 0.69
0.20 - 0.34
0.10 - 0.19
0.00 - 0.09
Excluded
State Average = 0.19
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

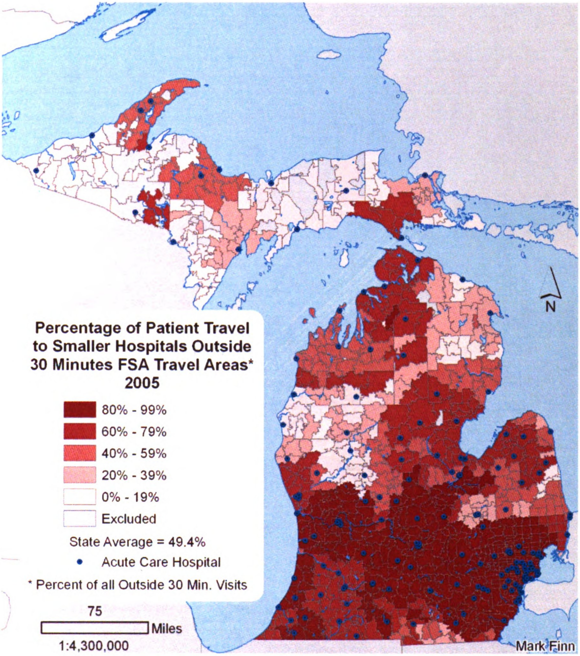

Percentage of Patient Travel to
Similar Sized Hospitals Outside
30 Minutes FSA Travel Areas*
2004
80% - 87%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 17.4%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

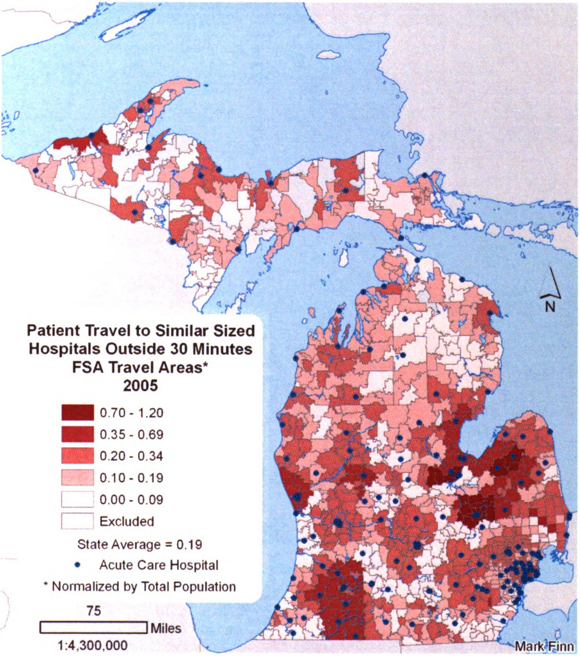

Patient Travel to Larger
Hospitals Outside 30 Minutes
FSA Travel Areas*
2004
0.30 - 0.91
0.20 - 0.29
0.10 - 0.19
0.05 - 0.09
0.00 - 0.04
Excluded
State Average = 0.05
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

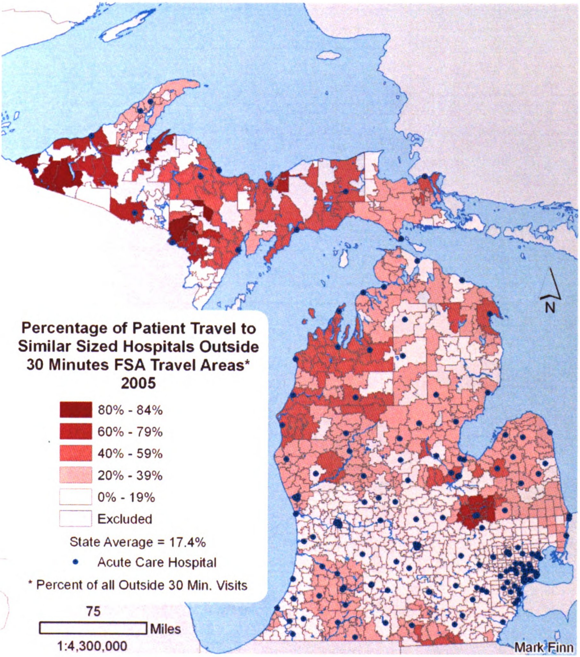

Percentage of Patient Travel to Larger Hospitals Outside 30 Minutes FSA Travel Areas* 2004
80% - 87%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 7.2%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn



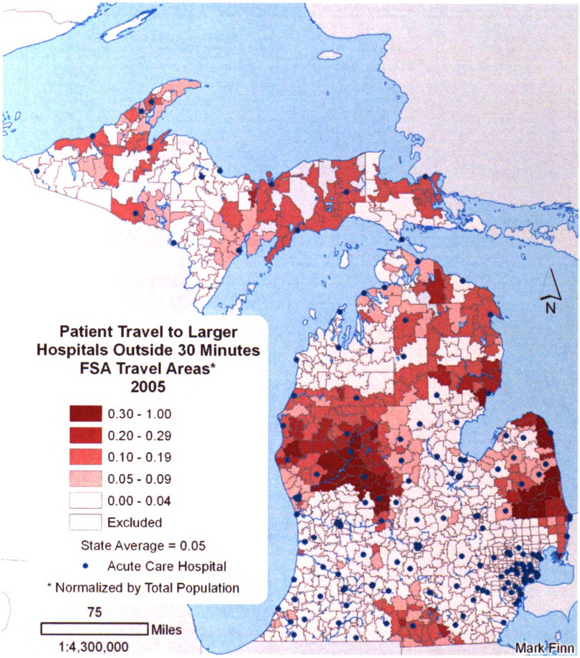
Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas* 2005
3.5 - 5.7
2.0 - 3.4
1.0 - 1.9
0.5 - 0.9
0.0 - 0.4
Excluded
State Average = 0.9
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn

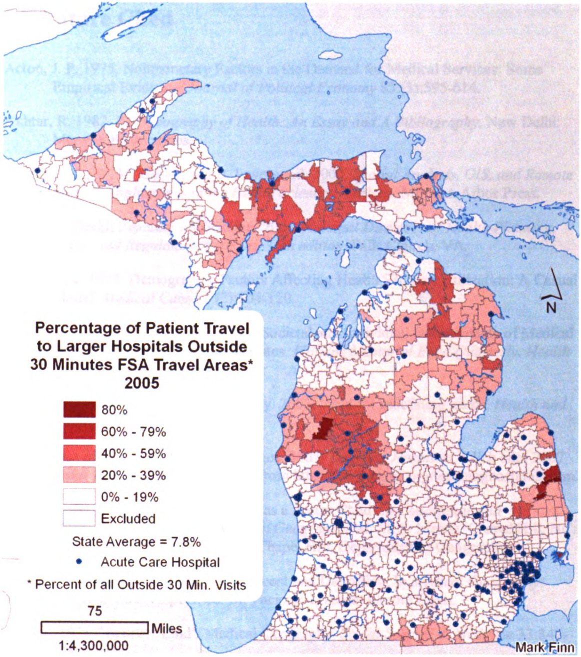

Percentage of Patient Travel to Smaller Hospitals Outside 30 Minutes FSA Travel Areas* 2005
80% - 99%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 49.4%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn


Patient Travel to Similar Sized
Hospitals Outside 30 Minutes
FSA Travel Areas*
2005
0.70 - 1.20
0.35 - 0.69
0.20 - 0.34
0.10 - 0.19
0.00 - 0.09
Excluded
State Average = 0.19
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn



Percentage of Patient Travel to Similar Sized Hospitals Outside 30 Minutes FSA Travel Areas* 2005
80% - 84%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 17.4%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn


Patient Travel to Larger Hospitals Outside 30 Minutes
FSA Travel Areas*
2005
0.30 - 1.00
0.20 - 0.29
0.10 - 0.19
0.05 - 0.09
0.00 - 0.04
Excluded
State Average = 0.05
Acute Care Hospital
* Normalized by Total Population
75
Miles
1:4,300,000
N
Mark Finn


Percentage of Patient Travel
to Larger Hospitals Outside
30 Minutes FSA Travel Areas*
2005
80%
60% - 79%
40% - 59%
20% - 39%
0% - 19%
Excluded
State Average = 7.8%
Acute Care Hospital
* Percent of all Outside 30 Min. Visits
75
Miles
1:4,300,000
N
Mark Finn

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