
ADDRESSING MICHIGAN'S PUBLIC SERVICE GAPS FOR PERSONS WITH TRAUMATIC BRAIN INJURY

SEPTEMBER 2004



Report of the MDCH TBI Project

*Michigan Department
of Community Health*



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¹ Members of the Advisory Council comprised six workgroups. Appendix G is a list of all workgroups’ members.

EXECUTIVE SUMMARY

A brain injury is any injury that results in brain cell death and loss of function. A *traumatic* brain injury (TBI) is an injury to the head caused by blunt or penetrating trauma or from acceleration-deceleration forces, such as from a fall, car crash, or being shaken (Thurman et al., 1994). TBI may or may not be combined with loss of consciousness, an open wound, or skull fracture. TBI is complex and unpredictable in its outcomes. Both mild and severe TBI can result in lifelong impairments – requiring long term care services.

Within the public sector, the State of Michigan has almost no specialized services for individuals with TBI. Rather, individuals with TBI may be served through local agencies and state and federal programs that focus on physical health, behavioral health, and other social services – each with their own referral processes, scope of services, eligibility rules, and payment sources. This can be confusing for survivors, caregivers, family members, and even agency workers to navigate or otherwise assist individuals to obtain needed services.

In order to better understand these diverse and complex systems, improve access by sharing what was learned, and improve public services for individuals with TBI, the Michigan Department of Community Health (MDCH) applied for and received a TBI Planning Grant in 1998 and a TBI Implementation Grant in 2000 from the federal Health Resources and Services Administration – Maternal and Child Health Bureau. For the past five years, the grants have funded a study of the state's TBI needs and how services could be improved. The state projects also developed and tested training materials, analyzed data, provided outreach, and set up ways to get people needed services.

With use of these funds, **Michigan** has become **the recognized leader** in data linkage and analysis regarding incidence and cost of TBI (Connors, 2004). The **non-partisan, multiple-agency, consumer-involved, data-driven efforts** of this project have culminated in the compilation of this report.

This report, *Addressing Michigan's Public Service Gaps for Persons with Traumatic Brain Injury*, contains data on:

- Incidence and risk factors of TBI;
- Medicaid Fee for Service, Medicaid Health Plan, Home Help, and Community Mental Health service use;
- Provider feedback on access to public services by individuals with TBI;
- Case studies of individuals with TBI; and
- Evaluation of piloted efforts to improve service delivery.

Most importantly, policy recommendations are made to address service gaps for this population.

FINDINGS

A. Every year about 10,600 serious traumatic brain injuries occur to Michigan residents.

Of this number, TBI contributes to almost 1,600 deaths and more than 9,000 TBI-related hospitalizations that do not result in death. Reliable data are not available to count the number of traumatic brain injuries that are not treated in hospitals. Not everyone who experiences a TBI will suffer long-term harm, but many will. The Centers for Disease Control and Prevention estimate that 2% of Americans are living with a disability due to TBI – approximately 200,000 Michigan residents.

B. Annually, Michigan Medicaid covers nearly 1,500 TBI-related hospitalizations.

Overall, 67,000 people received treatment services for TBI (including an annual average of 1,500 hospitalizations, other clinical care, and nursing home care among others) through the Michigan Medicaid Fee for Service or a Medicaid Health Plan during the four year period October 1, 1998 – September 30, 2002. Of these people, about 3,500 individuals also received Home Help personal care services, and over 12,000 received services from the Community Mental Health Services Programs during the same timeframe.

C. Michigan Medicaid Fee for Service component pays at least \$11 million dollars a year for TBI-related services.

The study identified this amount based on services provided during the fiscal years 1999-2002. Actual costs to the State from TBI are much greater because those clients whose care was covered by the Michigan Medicaid Fee for Service program account for only one third of all identified cases of TBI – the rest are enrolled in a (managed care) Medicaid Health Plan. This \$11 million in costs only covers services that are specifically identified as resulting from the diagnosis of TBI. Actual direct treatment services related to TBI are believed to be even greater and, if counted, would add significantly to the costs identified. In addition to Medicaid Fee for Service, \$9 million was paid for Home Help personal care services for individuals with TBI during FY2002.

D. There are gaps in public services for individuals with TBI.

Over the course of the project, key features of a comprehensive service system for individuals with TBI have been identified as:

- ✓ Service providers trained and knowledgeable about brain injury
- ✓ A screening method to identify people suffering from TBI-related injury so they do not remain misdiagnosed or undiagnosed
- ✓ A rehabilitation program that helps people with TBI recover lost abilities to the greatest extent possible, and that helps them develop a way of dealing with lost abilities

- ✓ Coordination and planning of services to help people with TBI identify their service needs, develop a person-centered care plan, and access and coordinate needed public services
- ✓ Appropriate residential placement so those with severe disabilities are not forced into nursing homes
- ✓ Community living supports so that those with less severe disabilities can live and work independently
- ✓ Assistive technology to support function and independence – especially cognitive aids such as timers, tape recorders, and planners
- ✓ Personal care to provide supervision, reminding, or hands-on assistance in meeting basic needs (cooking, eating, and personal hygiene among others)
- ✓ Vocational rehabilitation to assist with finding and maintaining employment over the long term
- ✓ Counseling and behavioral management to treat occasional symptoms that may reoccur

Coordination of services, appropriate residential placement, community living supports, counseling, and behavioral modification services are all **available to some populations with disabilities** in Michigan. These populations may include people who qualify for services from Community Mental Health Services Programs and individuals able to access Michigan's Medicaid Home and Community Based Waiver for Elderly and Disabled. **Many individuals with TBI do not have access to these programs** because they do not meet the legal requirements of having a developmental disability or serious mental illness (populations served by Community Mental Health Services Programs). In addition, there are only 800-1000 yearly openings statewide in Michigan's Medicaid Home and Community Based Waiver for Elderly and Disabled. The limited number of openings does not make room to include many people with TBI.

Interviews with **individuals with TBI, their family members, and public service providers** revealed that, from **their perspective**:

- Case Management – which would provide appropriate referrals, help individuals bridge all the public service programs, and assist them to follow through with the required paperwork – would “vastly improve” their lives.
- There is a great need for education about TBI among both public agency staff and consumers.
- Accessing public services that do exist is difficult for people with TBI because of restrictive eligibility criteria for Medicaid and Community Mental Health Services Programs.

E. People who have survived TBI tend to be too young to be placed in a nursing home for the rest of their lives.

Analysis of the demographic characteristics of TBI survivors in Michigan finds more than 60% of people who have been hospitalized for TBI are male. More than 50% of Michigan residents hospitalized for TBI are under age 45. People treated and released for TBI from emergency departments are even younger, with over 40% being children under age 15. An unknown

percentage of individuals with TBI apparently so “mild” that they were not hospitalized, will nevertheless suffer long-term impairments.

RECOMMENDATIONS

In light of the findings contained in this report, a panel of experts on Michigan’s public programs and TBI issues was assembled during the Spring of 2004 to propose recommendations to state policy makers and legislators that could alleviate these problems and fill service gaps for individuals with TBI. Overall, the recommendations address long-term, medium-term and short-term policy goals to support the structure of an integrated rehabilitative system of care.

Recommendation # 1: Michigan’s long term care system should have enough flexibility to provide appropriate services to those who need them (including people with cognitive deficits), and have a single point of entry into the system.

Recommendation # 2: In order to address the needs of individuals with moderate to severe TBI-related impairments, *in the medium term*, Michigan should consider creating a TBI specific Home and Community Based Medicaid Waiver as 25 other states have done.

Recommendation # 3: The Governor or the MDCH needs to appoint a TBI Services and Prevention Council to monitor and advise regarding the implementation of services for persons with TBI and the promotion of prevention efforts, which would lessen the incidence and cost of TBI in Michigan.

Recommendation # 4: The MDCH should designate one full-time equivalent position to oversee the implementation of the report and staff the activities of the TBI Services and Prevention Council.

Recommendation #5: The MDCH should provide continued support for ongoing collection, analysis, and reporting of injury and service use data; and for the development and measurement of service outcomes for individuals with TBI.

Recommendation # 6: It is essential that the State of Michigan and local communities continue to support and promote prevention efforts. Areas and ways to address TBI prevention include:

- a. Maintenance of Michigan’s motorcycle helmet law;
- b. Education of students, parents, coaches, physical education teachers, and playground monitors in public schools, local recreation programs, and health clubs about concussion and other sports-related TBI; and
- c. Support for injury prevention efforts, especially as related to transportation, violence, and falls.

Recommendation # 7: Departments, organizations, and agencies must adopt effective screening procedures to identify clients who may have TBI-related impairments. These include, among others: FIA, CMHSPs, Substance Abuse AARs, public schools, MRS, MI Choice Program, and the Michigan justice system.

Recommendation # 8: Michigan public human service providers, as well as staff in other public systems (such as the justice system), must be educated about TBI and the issues surrounding TBI. Materials for this training were developed and evaluated by the TBI Project.

Recommendation # 9: Local interagency teams of public service providers should be created and authorized to take referrals of individuals with TBI and identify and advocate for appropriate local services.

Recommendation #10: Medicaid reimbursement rates for neuropsychological examinations should be increased.

Recommendation # 11: The State of Michigan should establish a licensing category for AFC providers that have obtained accreditation and/or certification to care for people with TBI.

Recommendation # 12: The MDCH should review reimbursement policies related to AFC facilities licensed to provide TBI services to support services needed, and/or allow additional reimbursed services to be offered in such facilities.

Recommendation # 13: Home Help Services accessed through FIA should be provided to those who need supervision to accomplish activities of daily living, in addition to those who need “hands-on” assistance.

Recommendation # 14: Medicaid should consider funding cognitive aids as durable medical equipment when warranted in terms of cost effectiveness and medical necessity; *in addition*, the definition of “Medical Necessity” should be expanded to include consideration of abilities and independence so that individuals can remain in the community and have full access and independence.

Recommendation # 15: The Physical Disability Services (PDS) Fund needs to include the provision of assistive technology for cognitive disabilities as well as physical disabilities.

Recommendation # 16: Transportation issues are of great importance in many areas of Michigan and must be addressed.

- a. Michigan’s Medicaid Program should consider increasing Medicaid reimbursement for transportation to medical appointments; and
- b. Access to transportation by individuals unable to drive due to TBI requires further study.

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1

INTRODUCTION

While traumatic brain injury (TBI)¹ is not a new concern, the chances of surviving TBI have improved dramatically over the past twenty years. This improvement in the survival rate frequently results in lifelong physical and cognitive impairments and the need for many services to support life after injury.

What is Traumatic Brain Injury?

A brain injury is any injury that results in brain cell death and loss of abilities. A *traumatic* brain injury is an injury to the head caused by blunt or penetrating trauma or from acceleration-deceleration forces, such as from a fall, car crash, or being shaken (Thurman et al., 1994). TBI may or may not be combined with loss of consciousness, an open wound, or skull fracture.

The Centers for Disease Control and Prevention (CDC) estimate that nationwide over 50,000 individuals die from TBI each year, and 5.3 million people or two percent of the population, live with a disability resulting from TBI (CDC, 1999).

Effects of TBI

The brain is a very complex organ, so every injury is different. Recovery after injury can range from complete recovery to total loss of function. Depending on the severity of the injury, long-term effects of TBI in both children and adults *may* include:

1. Cognitive and Sensory Problems: such as problems in memory, judgment, concentration, learning new information, communication, and organization;
2. Behavioral and Emotional Problems: such as irritability, impatience, impulse control, difficulty with anger management, increased stress and anxiety, inability to read social cues, excessive mood swings or personality changes, and depression; and
3. Physical Problems: such as headaches or severe head pain, lack of coordination/balance, problems with sleep/fatigue, slurred speech, trouble swallowing, and seizures.

These problems *may* affect an individual's ability to live independently, drive a car, go to school, maintain employment, maintain social relationships, and accomplish activities of daily living (ADLs). Findings from the Colorado TBI Registry and Follow-up System (Whiteneck et al., 2004) indicate that one year post injury, 37% of those hospitalized with TBI report an activity limitation requiring the need for assistance from another person and 71% reported experiencing one or more symptoms more frequently than before their injury (including headaches, sensory changes, seizures, fatigue, irritability, and

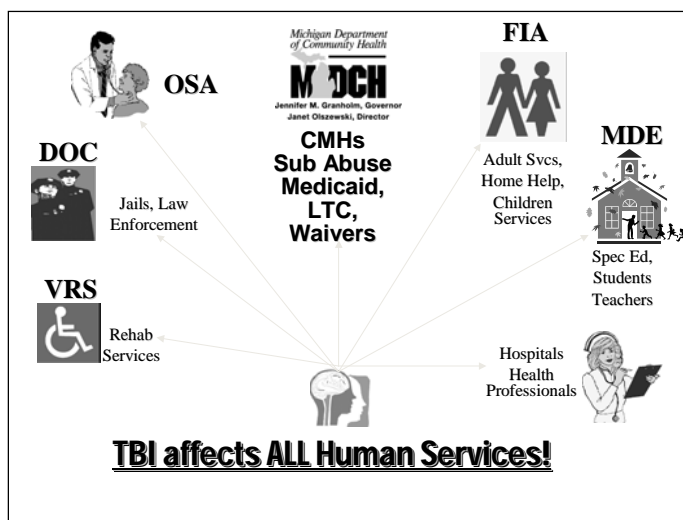
¹ Please refer to "Appendix A: Glossary" for definitions of terms and a list of acronyms used in this report.

dizziness). Because of the range of possible outcomes, an individual with TBI may need an assorted set of services from many agencies, for a short time or for the rest of his/her life. Moreover, individuals with TBI often do not have physical signs of disability.

Michigan's Efforts to Improve Service Delivery for Individuals with TBI

Current Programs

Michigan has a population of more than ten million persons. In December 2002, 1.27 million persons were enrolled in the Medicaid program, while more than 1 million persons had no health insurance at all (Citizens Research Council of Michigan, 2003). It is these individuals and many more with inadequate private health insurance who are or may be dependent upon the services and supports provided by public agencies. Within the public sector, the State of Michigan has almost no specialized services for individuals with TBI. Rather, individuals with TBI may be served at the local level through health care, mental health, and social service agencies depending on their needs. This creates a confusing mix of agencies and eligibility processes for survivors, family members, and even agency workers trying to refer individuals for services.



In contrast to the public system, Michigan is unique in that complete, comprehensive, life-long resource support is available through the no-fault automobile insurance system, which covers individuals who sustain injury in an automobile crash. Through the no-fault system, auto insurance companies provide payment up to \$350,000 for services needed as a result of an auto crash. Insurance companies are reimbursed by the Michigan Catastrophic Claims Association (MCCA) for each case in which lifelong costs are expected to exceed \$350,000. The MCCA was created in 1978 to spread the cost of this benefit across all Michigan motorists. All auto insurance policy premiums in Michigan contribute to the MCCA fund. While the MCCA is a valuable source of funding for services for many individuals with TBI, an estimated 60%-70% of Michigan residents with TBI are *not* injured in an auto crash (see Section 2 of this report). For many of these individuals, Medicaid often becomes the payment source for services needed over the long term.

The main state and local public agencies and programs that provide services appropriate for individuals with TBI include Medicaid, Community Mental Health Services Programs (CMHSP), Family Independence Agency (FIA), the MI Choice Program, Early

Intervention and Special Education Services, and Michigan Rehabilitation Services (MRS).

Medicaid. The state administered federal health care program will pay for services for people of low income who have a need. Beneficiaries must meet the income eligibility requirement to receive Medicaid benefits. Eligibility is determined through the FIA – Eligibility Services. A person without adequate personal health insurance or personal funding who needs continuing nursing home level of care services may be eligible to receive Medicaid funding for residential care.

FIA. If a nursing home is not an appropriate placement for a client, and if there are openings in other facilities, FIA may assist in placing Medicaid eligible persons in an Adult Foster Care Home or in a Home for the Aged. Home Help services are offered through FIA to individuals in need of help with ADLs to remain in an independent living situation. FIA also determines eligibility for other financial assistance programs such as the Family Independence Program, the Food Assistance Program, and the Adult Medical Program.

CMHSP. CMHSP is a Medicaid program that provides behavioral health services and community supports to eligible individuals. Individuals with TBI may be eligible for CMHSP services through the Developmental Disabilities program if their brain injury occurred before the age of 22, they have a qualifying developmental disability (DD) and they meet income and asset eligibility requirements. Persons who sustain a brain injury after the age of 21 can receive services from CMHSP only if they are diagnosed with a qualifying mental illness (MI). Whether classified as developmentally disabled or mentally ill, individuals must also meet severity criteria to qualify for services. Some CMHSP services relevant to individuals with TBI include: mental health counseling, applied behavioral therapy, physical therapy, occupational therapy, speech therapy, supported independent living, and case management.

MI Choice Program. Michigan’s Medicaid Home and Community Based Waiver (HCBW) for Elderly and Disabled (MI Choice Program) offers long term care services to allow individuals to remain in their home. A qualifying consumer must require nursing facility level of care services, meet income and asset criteria, and require one or more waiver service. Some services provided by the MI Choice Program include: homemaker and chore services, adult day care, modifications to the home, counseling, and respite care.

Early Intervention and Special Education Services. Federal and State laws and regulations require that a broad range of services are available to any child through age 25, as long as the child has not graduated from high school. Needs are assessed and a treatment plan is decided upon by an interdisciplinary team. Services provided may include: speech and language services, occupational and/or physical therapy, orientation and mobility training, assistive technology (AT), hearing, vision, sensory and behavioral assistance, vocational skills, and transition planning.

Brain Injury Rehabilitation Program. The Michigan Department of Community Health (MDCH) offers a Brain Injury Rehabilitation Program for Medicaid eligible persons who have experienced a brain injury within the previous 15 months and meet medical eligibility criteria. Additional income and asset criteria may be required for eligibility. The program offers comprehensive rehabilitation services for individuals with a brain injury for three to six months. This program does not offer a cognitive rehabilitation (retraining) program for persons who do not also need physical therapy. Moreover, at any given time, there are few individuals in Michigan who meet the eligibility criteria.

MRS. Vocational services are available to persons with a permanent disability with the need for services and the capacity to benefit from services. MRS services assist persons in the achievement of vocational goals and may include: vocational guidance and counseling, training, job-related AT, job placement assistance, tools and equipment, and other support services such as interpreters or transportation.

Improvement Activities

In order to better understand these varied and complex systems, improve access by sharing what was learned, and improve public services for individuals with TBI, the Michigan Department of Community Health applied for and received a TBI Planning Grant in 1998, and a TBI Implementation Grant in 2000 from the Health Resources and Services Administration (HRSA) – Maternal and Child Health Bureau (MCHB). As part of the planning grant, the TBI Project conducted a State Needs Assessment, collecting information from consumers, providers, and state agencies. Consumers and their family members reported that care received while in the acute care setting was excellent; however, little guidance was available upon moving to community-based programs, and that identifying and accessing ongoing treatment was difficult. Providers from all arenas identified the following problem areas for community-based TBI care:

- 1) Funding restraints;
- 2) Staffing shortages;
- 3) Lack of specialized training;
- 4) Little awareness of service provision and eligibility requirements; and
- 5) Family issues (i.e., lack of support and knowledge regarding TBI).

From this needs assessment, challenge areas and goals were developed that led to the current TBI Project activities. Challenges included:

- To develop and provide educational materials about TBI and available services in Michigan to both consumers and providers;
- To recommend improved service delivery models and consideration of assistive technologies to improve quality of life and independence of individuals with TBI;
- To collect, analyze, and report data relative to individuals with TBI, service utilization, cost, and outcomes.

This report is the product of the latter two challenge areas, and policy recommendations are made in light of three years of data collection and analysis on the incidence of TBI, cost and service use, and interaction with public agencies in three pilot sites in Michigan.

Organization of this Report

Section 2 of this report presents data on the incidence and risk factors for TBI in Michigan. Additional detail on the methodology and results of these analyses are presented in Appendix B. Section 3 presents an analysis of claims and encounter data from the public system (Medicaid Fee for Service (FFS), Medicaid Health Plans (MHP), Home Help, and CMHSPs). Highlights of service provision and costs are presented, with additional detail in Appendix C. Section 4 presents specific data on how public services in Michigan are serving individuals with TBI. Two perspectives are presented: service providers and consumers.

Section 5 presents the results of project pilot sites in making improvements to the local service delivery system. These pilot sites included the Upper Peninsula (UP), Southwest Michigan (SW), and Southeast Michigan (SE), with associated CMHSPs, FIA Offices, MI Choice Program agents, and other participants in each region. In certain cases, participants also included representatives from local school districts and Intermediate School Districts (ISDs), MRS, Substance Abuse Access, Assessment and Referral Agencies (AARs), hospitals, the Veterans Administration, and other local groups.

Section 6 contains information on the use of AT by individuals with TBI, including a literature review and a case study illustrating how AT can have dramatic effects on the productivity and independence of someone with fairly severe impairments.

Finally, resulting Policy Recommendations are listed and explained in Section 7.

The Appendices contain additional materials for reference and materials that present greater detail on subjects presented in the body. Appendix A provides a list of all acronyms used in the report. Appendices B and C provide additional data on incidence of TBI and service use. Appendix D provides a more detailed review of evaluation results from the provider training sessions piloted in participating regions. A copy of the TBI HELPS screening tool tested by the project is provided in Appendix E. Referenced sources are listed in Appendix F. Members of the project workgroups are listed in Appendix G.

Report of the MDCH TBI Project

2

PROFILE OF TBI IN MICHIGAN

The CDC¹ estimates that approximately 1.5 million Americans are involved in motor vehicle crashes, falls, sports and recreation-related activities, and intentional violence incidents that result in a TBI each year. Nationwide, more than 50,000 people die annually due to TBI, representing more than one-third of all injury-related deaths. Annually, 230,000 people are hospitalized and survive, 1 million people are treated and released from hospital emergency departments, and ultimately 5.3 million US citizens, or 2% of the total population, live with a disability resulting from TBI at any given time (CDC, 1999).

A data-based knowledge and understanding of the incidence, nature, causes, severity, and the financial and service provision demands of TBI in Michigan is very important in order to understand the impact of TBI on the health care system. Injury prevention programs can be better focused to reduce these injuries. This section presents information about the following:

- 1) Numbers and rates for TBI-related deaths, hospitalizations, and emergency department (ED) visits in Michigan;
- 2) Differences in risk for TBI-related death, hospitalization, and ED visit by age, sex, and race; and
- 3) The leading external causes of TBI-related deaths, hospitalizations and ED visits.

A detailed description of the methodology and more detailed tables can be found in Appendix B.

Methods

The three data sources on which this section of the report is based contain information about Michigan deaths, hospitalizations, and ED visits. These sources provide information on TBI roughly corresponding to the severity of injury, with death obviously being most severe, and ED visits being least severe. Hospitalization data cover a range of severity levels in between death and an ED visit only. It should be noted that this report still provides an incomplete picture of individuals who survive a TBI as it does not include information regarding nonfatal, TBI-related cases treated outside hospitals, or those not treated at all. Please see Appendix B for a discussion of other limitations of the data and analyses.

All calculations and definitions for data presented in this section are discussed in Appendix B. Two different types of numbers are presented: rates of injury by demographic group (such as age and sex) and percentage distribution of TBI by demographic group. Rates are calculated based on Michigan's population. Percentages in this report provide a characterization of people who have experienced a TBI. Both statistics are important for different reasons. Rates are more important from a prevention point of view because rates indicate relative risk of injury. The demographic distributions of TBI are important since they are an indication of the composition of the population of TBI survivors and therefore represent who will need to be served.

¹ Please refer to "Appendix A: Glossary" for definitions of terms and a list of acronyms used in this report.

Please note that the data are subject to limitations, especially the correctness with which TBI-related diagnoses are coded. The Michigan Emergency Department Community Injury Information Network (MEDCIIN) data are subject to additional limitations since they are unweighted data - derived from a stratified random sample of EDs throughout the state rather than all EDs in Michigan.

These and other limitations are discussed in more detail in Appendix B. Despite the limitations, the data provide very useful information about TBI.

Fatal TBI Cases

Mortality data from January 1, 1999 to December 31, 2002 from the MDCH Division of Vital Records and Health Statistics were analyzed for the project. These mortality data were gathered based on information obtained from death certificates, including the cause(s) of death recorded on the death certificate by the attending physician or medical examiner. Cases were included in analyses when a diagnosis indicating TBI was included in the conditions contributing to death.

Hospitalized TBI Cases

TBI-related hospital discharges from January 1, 1999 through December 31, 2002 from the Michigan Inpatient Database (MIDB) were analyzed for this report. The MIDB is a collection of hospital discharge data voluntarily provided to the Michigan Health and Hospital Association (MHA) by all but one small acute care hospital in Michigan. Hospitals in neighboring states (Indiana, Ohio, and Wisconsin) submit data on hospitalized Michigan residents to MHA as well.

This set of analyses focused on individuals who were hospitalized and survived a TBI. Cases were identified using the presence of ICD-9-CM codes indicating the possibility of a TBI in any diagnostic field (primary or secondary). Cases in which the disposition was death were excluded from analysis. It is possible that in some cases of TBI-related hospitalization, the TBI itself may not be the actual reason for hospitalization (for instance if the individual sustained a mild TBI but very serious internal injuries in the same accident, s/he could have been hospitalized primarily for treatment of the non-TBI injuries). For this reason the term “TBI-related hospitalization” will be used throughout. Because of the methods used to select cases, numbers presented here will not match statistics on Michigan injuries in other published sources. The methodology used here was chosen to best meet the aims of the project and to be consistent with guidance from the CDC.

While it is tempting to think of cases of TBI-related hospitalization as people, they are actually visits. Some people could have a TBI-related hospitalization more than once in a year, either because issues related to the TBI were not resolved with one hospitalization, or because an individual sustained multiple injuries.

Nonfatal and Non-hospitalized TBI-ED Cases

An injury surveillance system, MEDCIIN, was established in 1999 using data collected from 23 EDs in the state. Participating hospitals were chosen using a random sample stratified by geographic location and hospital size in each of the eight MHA regions and the City of Detroit. Urban, rural, and suburban hospitals are represented. The number of all injury visits in an individual hospital per year range from 1,300 to over 40,000. Data in this report are presented from 2001, which is the first year for which all hospitals in the sample contributed data.

Cases in the MEDCIIN database were identified using the presence of TBI ICD-9-CM codes in either primary or secondary diagnosis fields. ED patients with a TBI diagnosis who were admitted to the hospital, transferred to another hospital, or died in the ED (as identified by the discharge disposition) were excluded from the analysis.

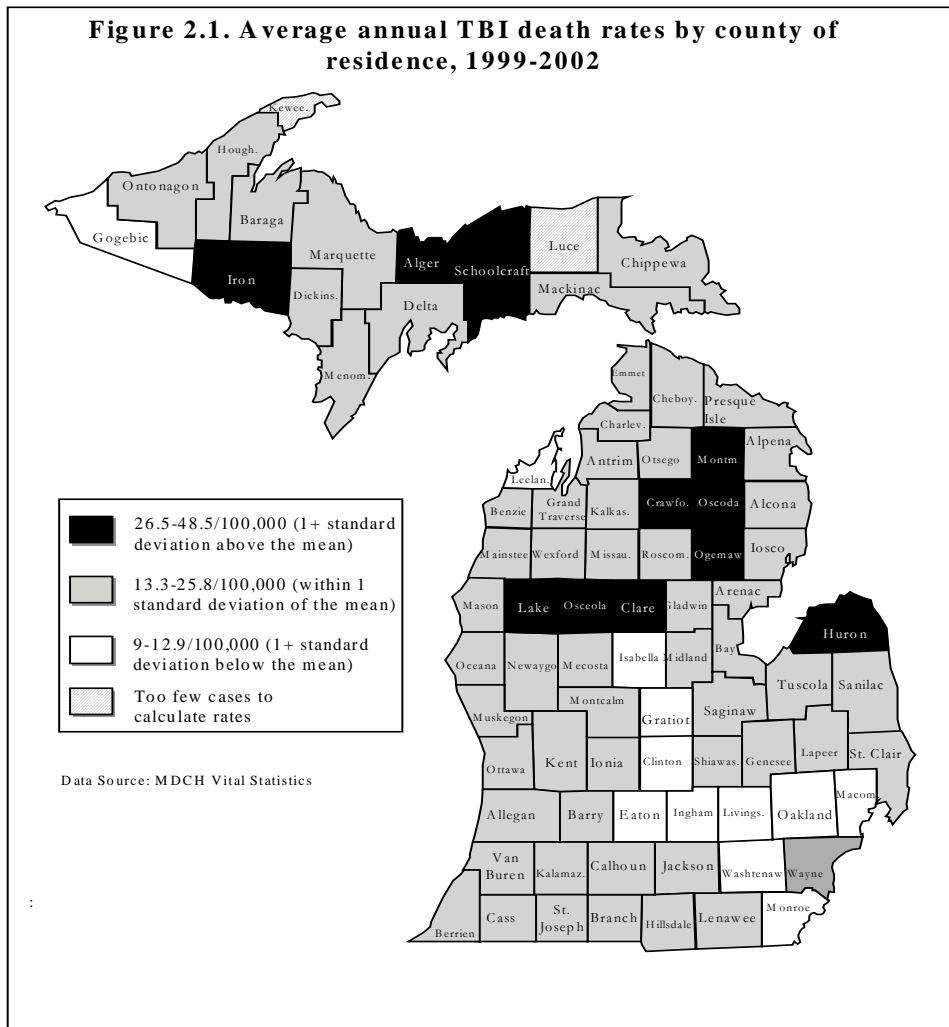
Results

Between 1999–2002, an average of 1,566 TBI deaths and 9,065 nonfatal, TBI-related hospitalizations occurred annually in Michigan. These numbers as well as rates/100,000 are presented in Table 2.1. Every year, nearly 16 of every 100,000 people in Michigan experience a TBI resulting in death, and 91 of every 100,000 people experience a TBI resulting in nonfatal hospitalization. Table B1 in Appendix B presents TBI death rates by sex and year. Table B2 in Appendix B presents TBI-related hospitalization rates by sex and year. In the sample of 23 participating hospitals during 2001 there were 8,116 ED visits related to TBI.

TBI-related fatalities		TBI-related nonfatal hospitalizations	
Annual avg. no.	Rate/100,000	Annual avg. no.	Rate/100,000
1,566	15.71	9,065	90.94

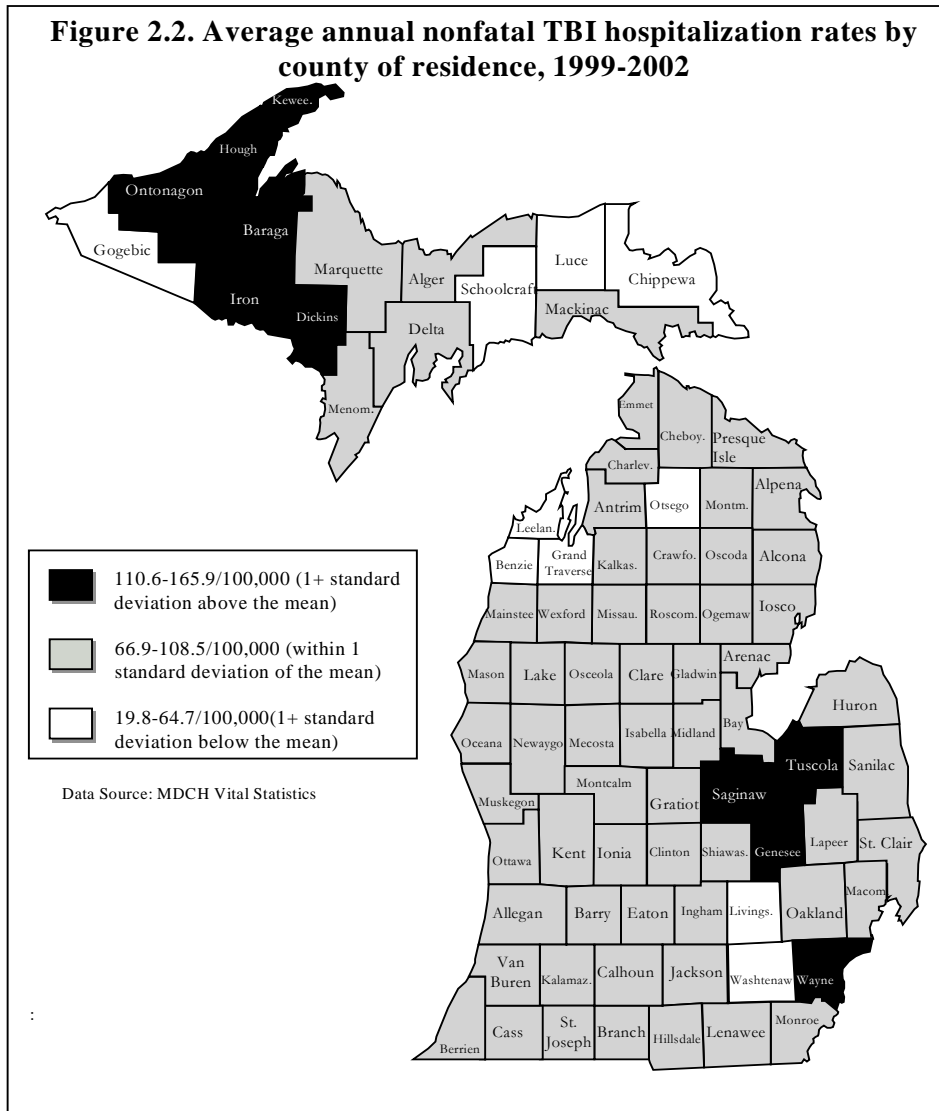
Source: Michigan Vital Statistics and Michigan Inpatient Database, Calendar Years 1999-2002; Rates were calculated using population estimates from the US Census.

Figure 2.1 shows average annual TBI death rates during 1999-2002 by county of residence. Note that the county of residence may be different from the county where the injury occurred and where the individual died.



Counties shaded in black have death rates one or more standard deviations above the average TBI death rate across counties. Lake, Schoolcraft, and Oscoda Counties, in particular have very high TBI death rates: (48.5, 39.5, and 37.1, respectively). Counties with the lowest death rates are clustered in Southeast (excluding Wayne County) and Mid Michigan. Luce and Keweenaw Counties had fewer than 5 deaths during the four years analyzed, therefore rates are not calculated. Table B3 in Appendix B lists the rates and average annual number of TBI-related deaths and nonfatal hospitalizations for each county in Michigan.

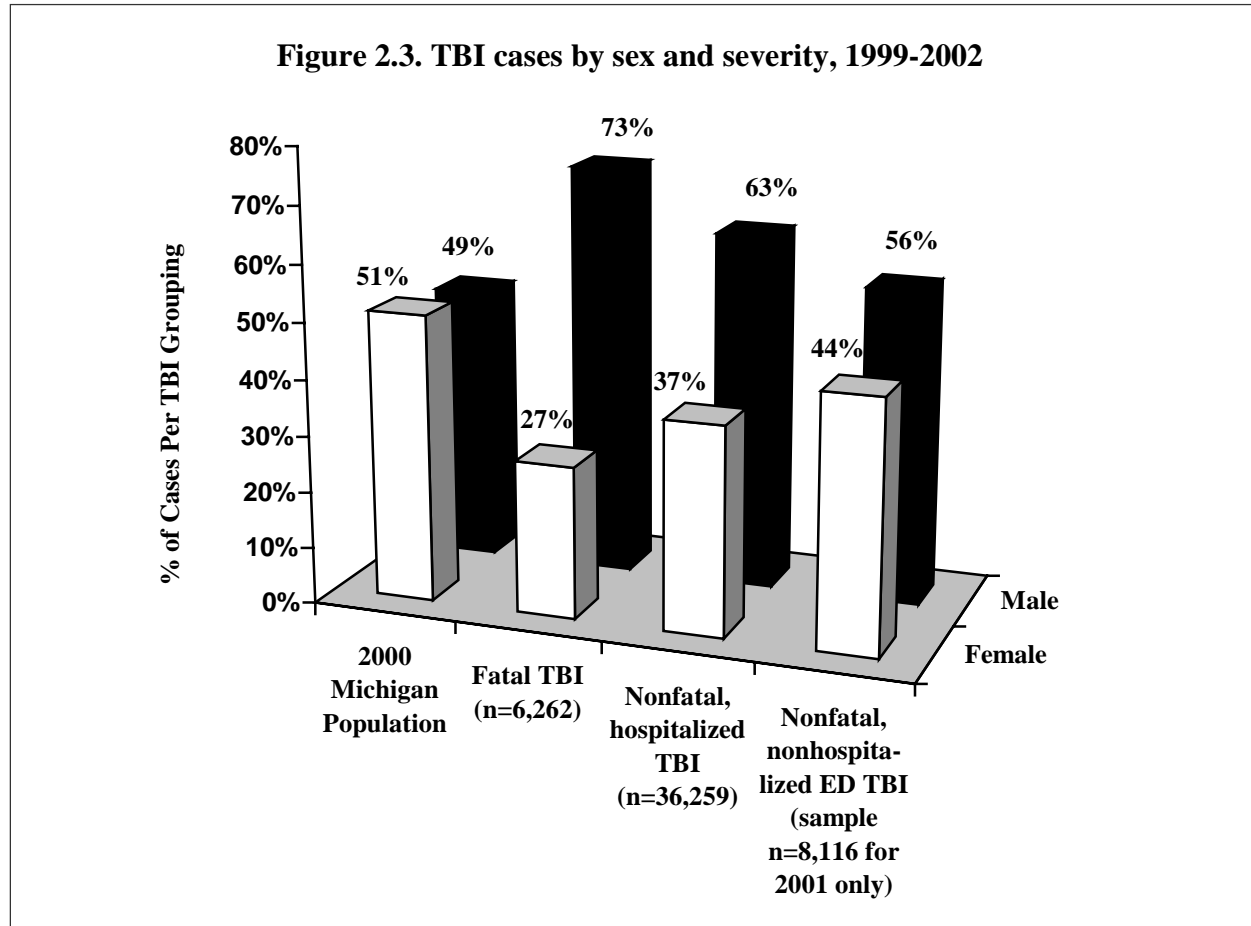
Figure 2.2 shows average annual TBI-related hospitalization rates during 1999-2002 by county of residence. County of residence may be different from the county where the injury occurred and/or where the individual was hospitalized. Counties shaded in black have hospitalization rates one or more standard deviations above the average resident hospitalization rates across counties.



Keeweenaw, Iron, and Ontonagon Counties in particular have very high TBI-related hospitalization rates: (165.9, 157.9, and 151.2 respectively). Counties with the highest hospitalization rates are clustered in the western Upper Peninsula and below the “thumb” in Lower Michigan.

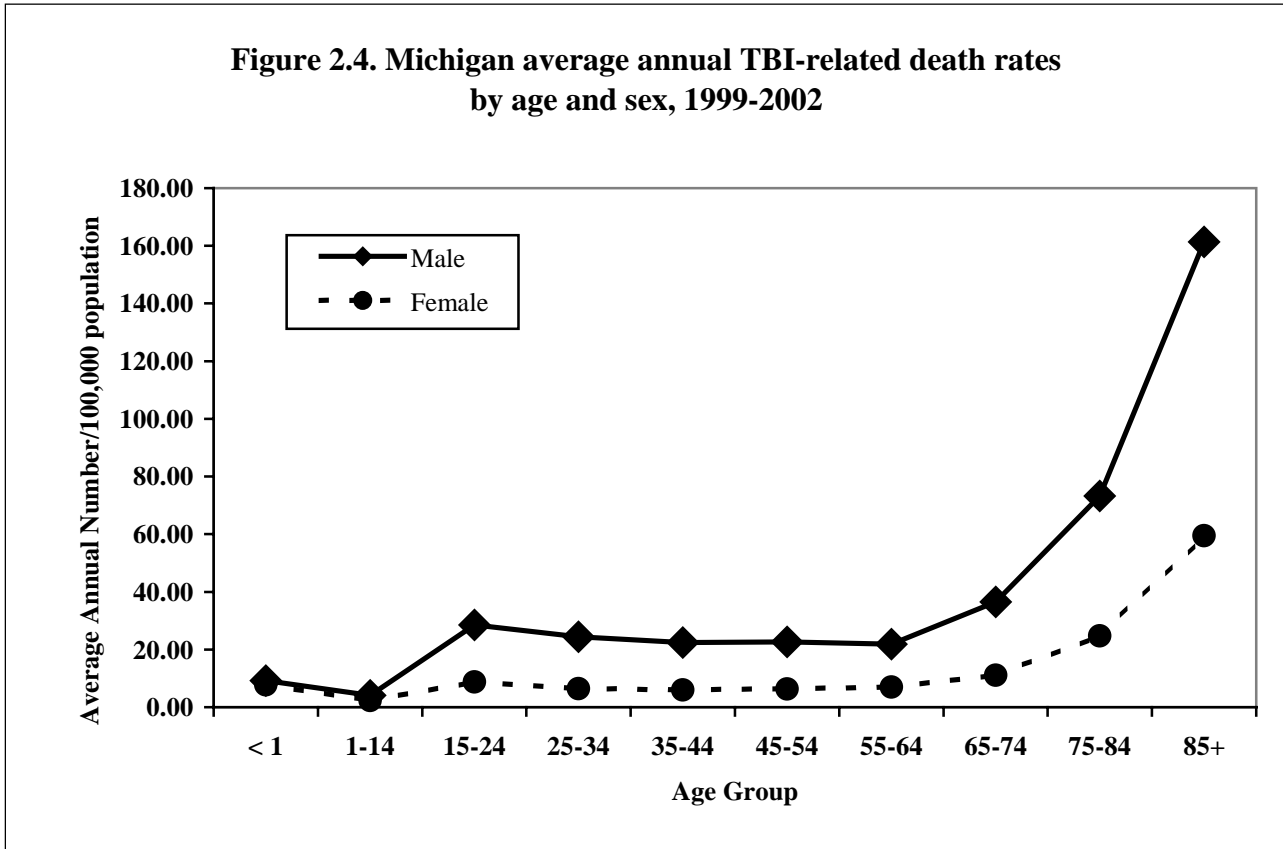
Incidence of TBI by Sex

Figure 2.3 presents the percentage of TBI cases by sex in each data source. The proportion of males increases with increasing TBI severity. Males have the most traumatic brain injuries overall and compose an especially larger proportion of deaths and TBI-related hospitalizations when compared to females. The first two bars in Figure 2.3 represent the year 2000 Michigan population. (For further analysis of TBI-related deaths and hospitalizations by sex and year, see Tables B1 and B2 in Appendix B.)



Incidence of TBI by Age and Sex

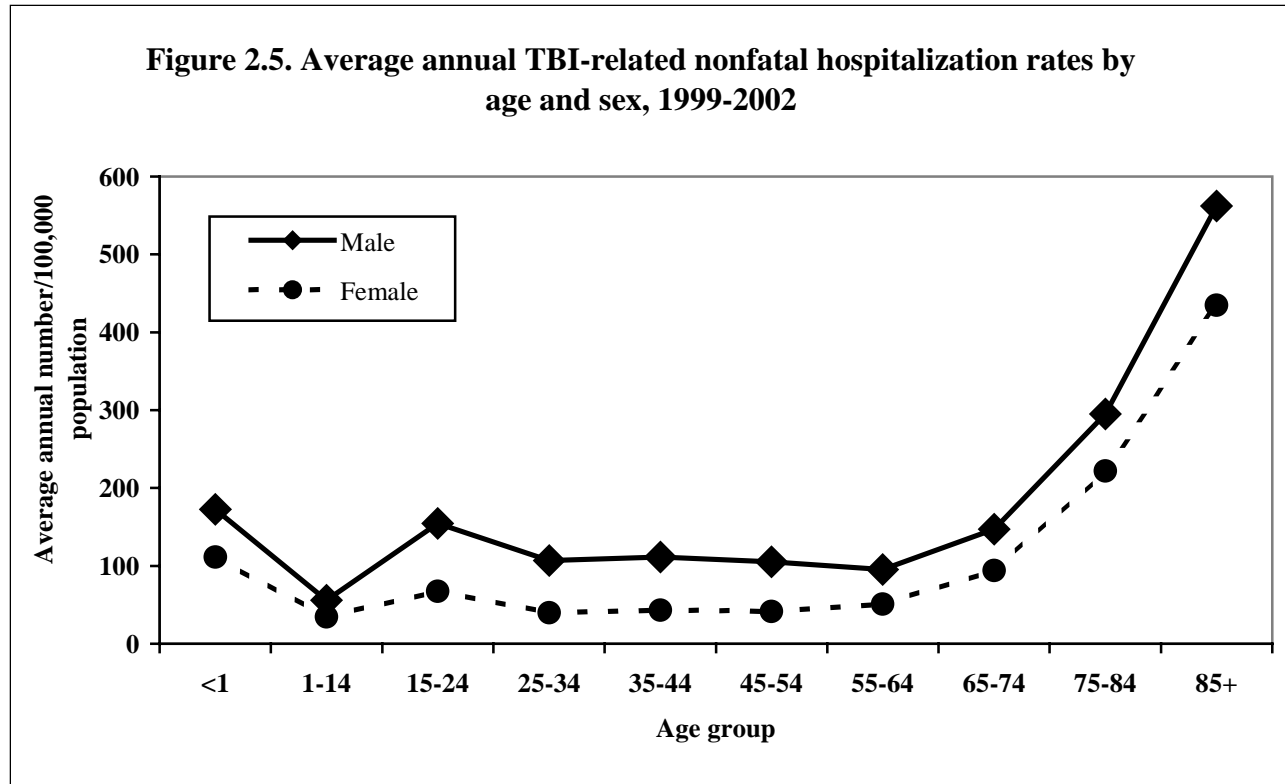
Figures 2.4 and 2.5 present rates for TBI by sex and age. Rates for TBI can be considered an indication of the relative risk for TBI faced by each demographic group. Infants are presented separately from other children because of higher rates. This information is available in somewhat more detail in tabular form in Appendix B (Tables B4 and B5).



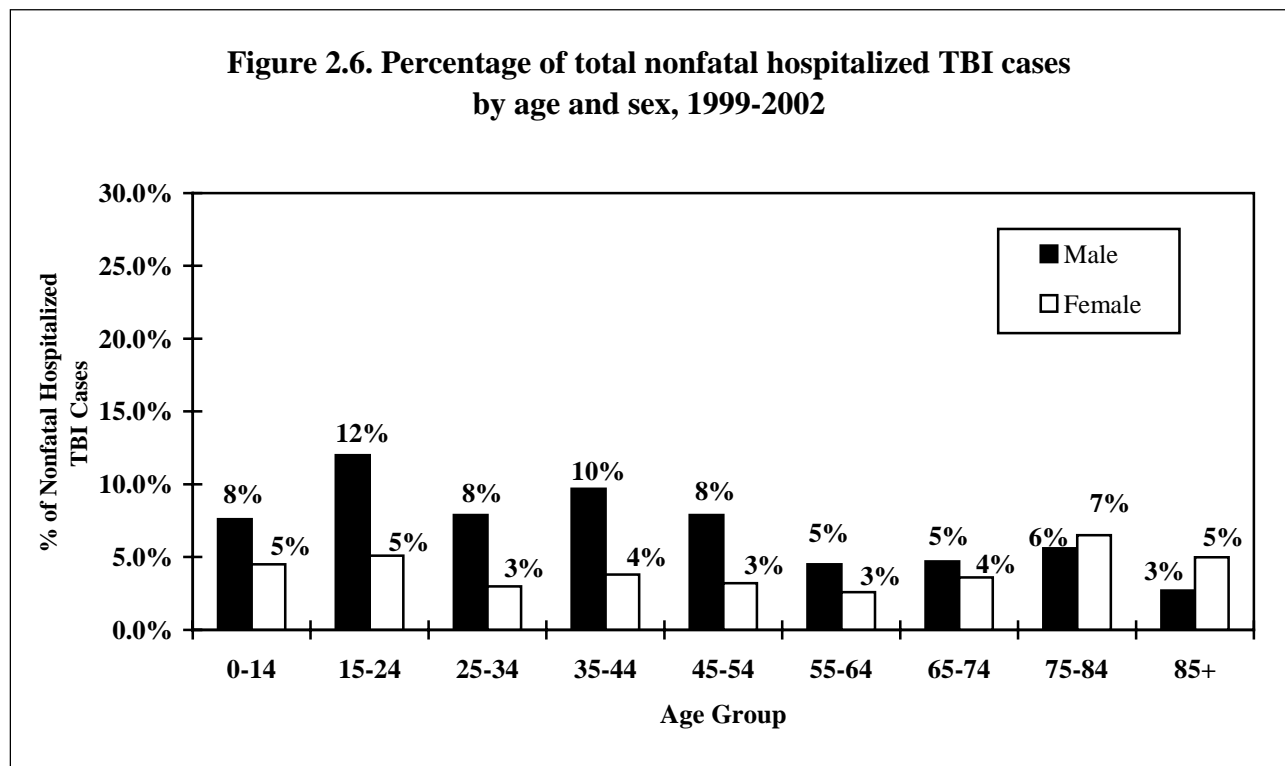
In terms of TBI deaths, one notices that starting with the age group 15-24 years, when the male death rate jumps to over 28/100,000, males are at much greater risk for TBI death than females. The TBI death rate for males declines moderately to about 22/100,000 for the age group 55-64 and then increases sharply to more than 36/100,000 for the age group 65-74, 73/100,000 for the age group 75-84, and 161/100,000 for the age group of 85 and above. In contrast, the female TBI death rate remains under 10/100,000 for all age groups until 65-74 and is lower than males for all ages.

The data show that elderly people are at much greater risk for TBI-related death than younger people. Still much more frequent causes of death for people age 65 and over nationwide are heart disease (1,651.2 deaths / 100,000 people 65+) and cancer (1,105.7 deaths / 100,000 people 65+) (Anderson & Smith, 2003).

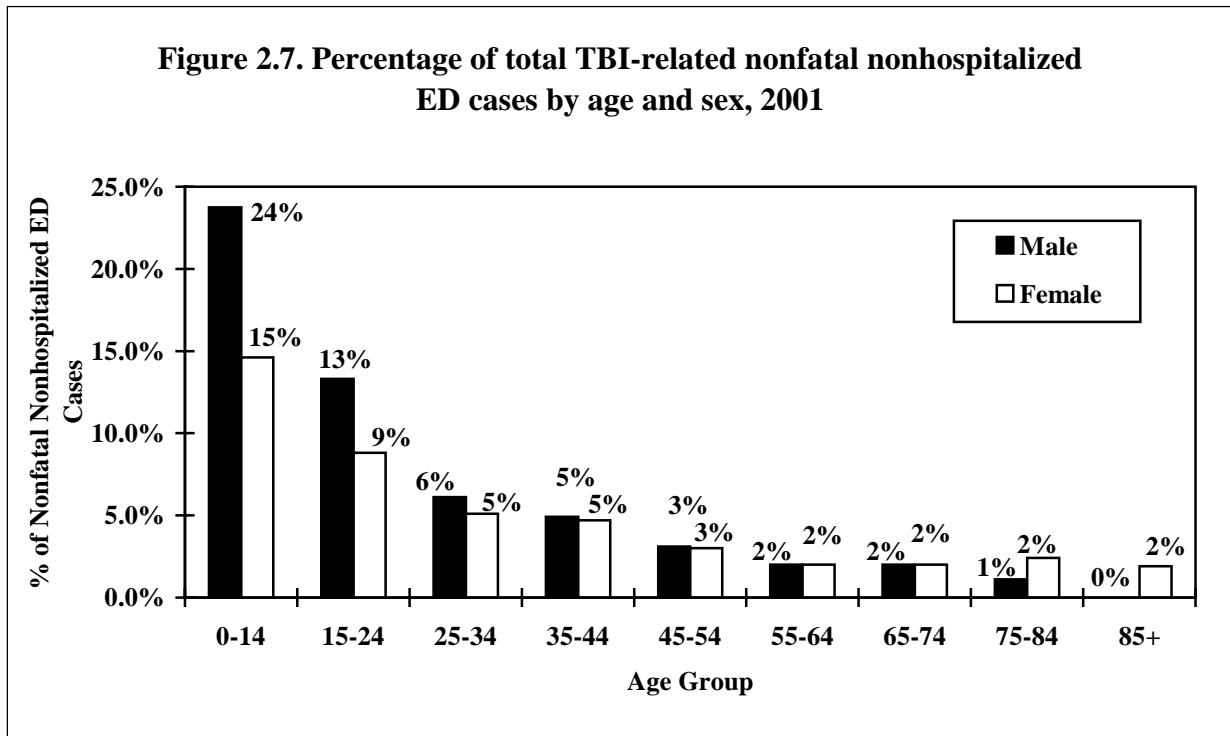
Figure 2.5 shows TBI-related hospitalization rates in Michigan. These are the number of nonfatal hospitalizations with a TBI-related diagnosis for every 100,000 people in each age/sex group. One can see from this figure that age groups at greatest risk of experiencing a TBI that results in hospitalization are infants, people aged 15-24, and people aged 65 and older. In every age category the male rate for TBI is higher than the female rate.



The demographic composition, such as the age and sex, of the population of TBI survivors in Michigan is presented in Figures 2.6-2.8. These are the people who *may* need long-term services following injury. Figure 2.6 presents the demographic composition of survivors of a TBI-related hospitalization. One of the first things to notice is that although a large proportion of the elderly (75 and older) suffer TBI-related hospitalization, they are not the largest age group represented among TBI survivors (because there are not as many of them in the population as a whole). Among survivors of TBI-related hospitalization, the largest single age group is 15-24 (comprising 17% of individuals hospitalized with TBI). Summing age and sex categories through age 34, we find that *40% of individuals with a TBI-related hospitalization are under the age of 35*. Young people with long-term impairments from TBI may need services for a long time.

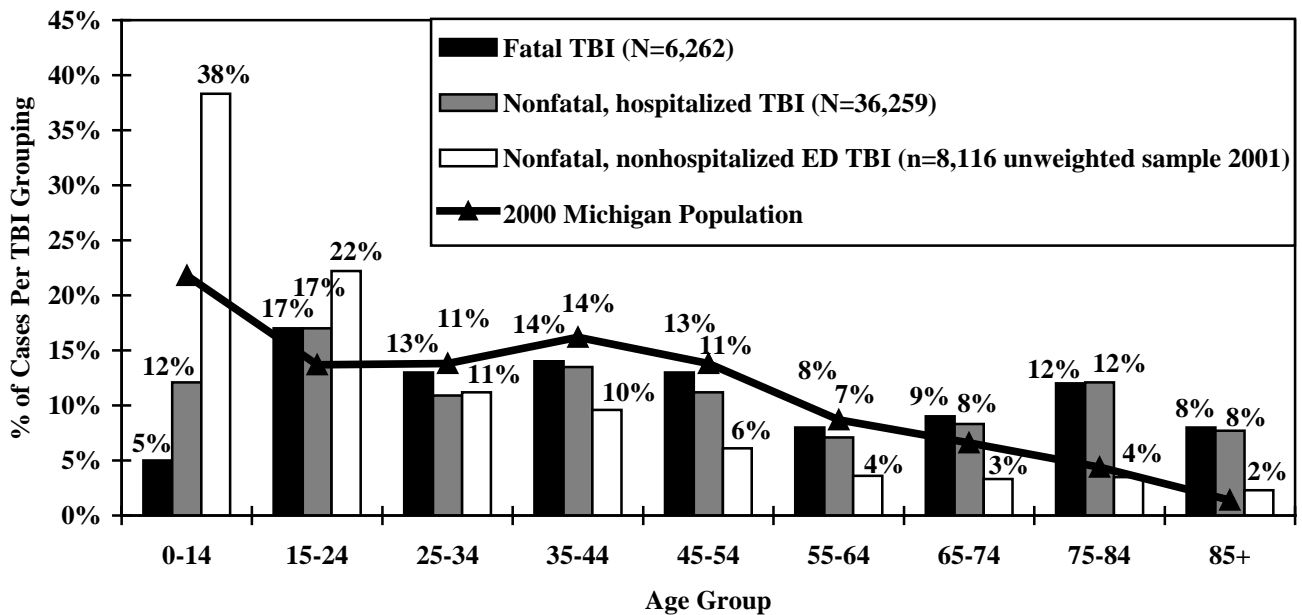


Survivors of a TBI treated in an emergency department are young (Figure 2.7). Males and females under age 15 make up 41% of all cases. An unknown percentage of survivors of mild TBI will have lifelong problems as a result of their injuries. In the case of children, some problems might be to executive functions that are not fully developed at the time of injury, in which case the impairments may not be noticed until years later when the child would be expected to be using those functions. Another noticeable difference between ED and inpatient visits is that beginning with the 25-34 year old age group, women are seen in emergency departments for TBI nearly as frequently as men. This could mean that while women are much less likely than men to sustain a moderate to severe TBI, they sustain more 'mild' injuries at rates similar to men.



Fatal, hospitalized, and ED TBI cases are shown together by age in Figure 2.8. The solid line indicates the percentage of each age group in the Michigan population. As has been discussed, young people are over-represented in ED TBI cases, while the elderly are over-represented in TBI-related hospitalizations and deaths.

Figure 2.8. TBI cases by age and severity, 1999-2002



Incidence of TBI by Race

Race data are only available for mortalities and should be considered with caution. In the mortality data, race/ethnicity data might be incorrect in some cases, as this information is determined by whoever completes the death certificate. US Census figures for Michigan are used as the denominator when calculating TBI rates. As shown in Table 2.2, TBI-related death rates were higher among black males than white males during the years 1999-2002. TBI death rates for black and white women were similar throughout the time period.

Census classification methods for race underwent a major change between 1999 and 2000 and could account for some apparent trends in Table 2.2. Specifically, beginning in 2000, census respondents had the option to specify multiple races, whereas before they had to choose one. In 2000, 130,291 Michigan residents listed multiple races. These people are included in the ‘other’ category below, and constitute 35% of the “other” race category. This should not affect the “Black” category as drastically since only 56,334 of the 1,482,674 (under 4%) people who listed race as “Black/African American” checked more than one race.

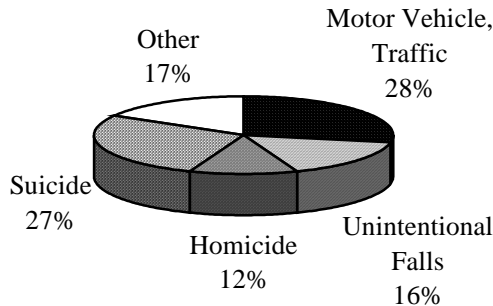
Table 2.2. TBI-related deaths, by year, sex, and race							
Year	Sex	White		Black		Other	
		No.	Rate	No.	Rate	No.	Rate
1999	All	1,255	15.26	302	21.34	27	-*
	F	353	8.41	65	8.63	11	-*
	M	902	22.40	237	35.78	16	-*
2000	All	1,298	15.95	262	18.37	27	7.21
	F	373	9.04	70	9.32	10	5.30
	M	925	23.06	192	28.43	17	9.15
2001	All	1,314	16.07	231	16.09	17	4.29
	F	353	8.52	52	6.88	7	3.50
	M	961	23.82	179	26.34	10	5.10
2002	All	1,268	15.47	226	15.67	28	6.81
	F	338	8.15	52	6.85	9	4.33
	M	930	22.98	174	25.46	19	9.35

Source: Michigan Vital Statistics, calendar years 1999-2002. Rates were calculated using population estimates from the US Census.

*Rates are not presented for the ‘other’ category of 1999 because the category is not comparable with later years. In 2000-2002, people who checked multiple races are included as ‘other’.

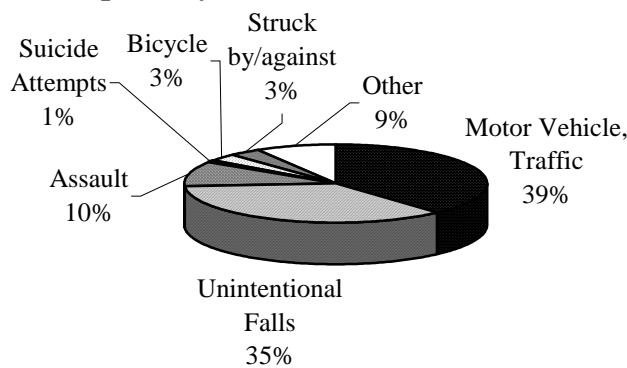
Causes of TBI

Figure 2.9. TBI-related deaths by cause, 1999-2002



Cause of injury information is presented in Figures 2.9-2.11 for TBI-related deaths, hospitalizations, and ED visits. Please refer to Appendix B for discussion of the cause information in these data sources as well as for definitions of various cause categories.

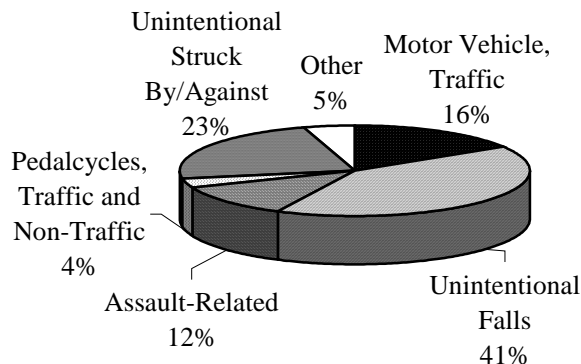
Figure 2.10. Nonfatal hospitalized TBI cases by primary external cause, 1999-2002



As presented in Figure 2.9, the top four causes of TBI deaths in Michigan are: motor vehicle traffic (28%), suicide (27%), unintentional falls (16%), and homicide (12%).

The top three causes of hospitalization related to TBI are (Figure 2.10): motor vehicle traffic (39%), unintentional falls (35%), and assault (10%).²

Figure 2.11. Nonfatal and nonhospitalized TBI cases by primary external cause, 2001 sample EDs (n=5,299)



The top four causes of TBI treated and released in EDs are (Figure 2.11): unintentional falls (41%), unintentional struck by/against (23%), motor vehicle traffic (16%), and assault (12%).

² Cause of injury coding is not complete for inpatient and ED data. Percentages in Figures 2.10 and 2.11 are calculated based on the 86% of inpatient TBI cases and 65% of ED TBI cases that had a cause recorded.

Table 2.3. Causes of fatal TBI by age – males (rates/100,000 in parentheses)

Rank	Age <1	1-14	15-24	25-44	45-64	65+
1	Homicide (4.43)	Motor vehicle, traffic (2.36)	Motor vehicle, traffic (12.69)	<i>Suicide (9.19)</i>	<i>Suicide (9.57)</i>	Unintentional falls (19.25)
2	Motor vehicle, traffic (2.22)	Homicide (0.68)	<i>Suicide (8.07)</i>	Motor vehicle, traffic (6.71)	Motor vehicle, traffic (4.45)	<i>Suicide (16.28)</i>
3		<i>Suicide (0.37)</i>	Homicide (5.23)	Homicide (3.98)	Unintentional falls (3.17)	Motor vehicle, traffic (6.73)

Source: Michigan Vital Statistics calendar years 1999-2002; rates are per 100,000 people in each age group, averaged over the four years.

The leading causes of TBI deaths are presented by age category for males in Table 2.3 and for females in Table 2.4. The fonts and shading have been adopted to help the reader identify the various causes and their rankings at a glance. Motor vehicle traffic crashes were a leading cause of TBI-related death for nearly all age and sex groups. Homicide is the leading cause of fatal TBI among infants of both sexes. The frequency of homicide as a cause of TBI then declines as age increases, disappearing from the top three causes of TBI beginning with the age group 45-64. Suicide is a prominent cause of fatal TBI, particularly for males over the age of 15. Elderly males and females are at risk for fatal TBI due to falls and other accidents.

Table 2.4. Causes of fatal TBI by age – females (rates/100,000 in parentheses)

Rank	Age <1	1-14	15-24	25-44	45-64	65+
1	Homicide (4.65)	Motor vehicle, traffic (1.66)	Motor vehicle, traffic (5.61)	Motor vehicle, traffic (2.53)	Motor vehicle, traffic (2.33)	Unintentional falls (11.04)
2	Motor vehicle, traffic (1.94)	Homicide (0.33)	Homicide (1.61)	Homicide (1.52)	<i>Suicide (1.36)</i>	Motor vehicle, traffic (3.02)
3		Struck by/against (0.10)	<i>Suicide (0.92)</i>	<i>Suicide (1.15)</i>	Unintentional falls (0.95)	<i>Suicide (0.94)</i>

Source: Michigan Vital Statistics calendar years 1999-2002; rates are per 100,000 people in each age group, averaged over the four years.

Causes of TBI-related hospitalizations are presented in Tables 2.5 and 2.6. Motor vehicle crashes and falls are the leading causes of TBI-related hospitalizations for both males and females. Infants and the elderly are particularly at risk of falling and sustaining a TBI that leads to hospitalization. Males aged 15-44, and infants of both sexes, are more at risk of assault-related TBI hospitalization. Bicycle crashes are the third leading cause of TBI-related hospitalization for children aged 1-14.

Table 2.5. Causes of nonfatal TBI-related hospitalization by age – males (rates/100,000 in parentheses)

Rank	Age <1	1-14	15-24	25-44	45-64	65+
1	Unintentional falls (78.31)	Motor vehicle, traffic (15.51)	Motor vehicle, traffic (77.38)	Motor vehicle, traffic (41.25)	Unintentional falls (29.57)	Unintentional falls (125.13)
2	Assault (39.90)	Unintentional falls (14.19)	Assault (20.34)	Assault (20.28)	Motor vehicle, traffic (29.39)	Motor vehicle, traffic (34.09)
3	Motor vehicle, traffic (10.34)	Bicycle (8.25)	Unintentional falls (12.73)	Unintentional falls (17.15)	Assault (12.72)	Assault (4.30)

Source: Michigan Vital Statistics calendar years 1999-2002; rates are per 100,000 people in each age group, averaged over the four years.

Table 2.6. Causes of nonfatal TBI-related hospitalization by age – females (rates/100,000 in parentheses)

Rank	<1	1-14	15-24	25-44	45-64	65+
1	Unintentional falls (50.01)	Motor vehicle, traffic (12.37)	Motor vehicle, traffic (45.17)	Motor vehicle, traffic (22.56)	Motor vehicle, traffic (17.51)	Unintentional falls (117.25)
2	Assault (27.52)	Unintentional falls (9.10)	Unintentional falls (4.04)	Unintentional falls (5.22)	Unintentional falls (12.60)	Motor vehicle, traffic (21.87)
3	Motor vehicle, traffic (8.53)	Bicycle (3.02)	Assault (2.61)	Assault (4.20)	Assault (2.00)	Unintentional Struck by/against (1.98)

Source: Michigan Vital Statistics calendar years 1999-2002; rates are per 100,000 people in each age group, averaged over the four years.

The leading causes of TBI ED visits are displayed by age for males in Table 2.7 and for females in Table 2.8. Note that percentages are presented rather than rates as rates cannot be calculated

from unweighted data. These more mild injuries have different causes than fatal TBI cases as described above. Injury cause patterns for TBI cases treated and released from EDs were fairly similar for males and females.

Unintentional struck by/against is the third most common cause of TBI ED visits, although it only accounted for 3% of individuals hospitalized with TBI. Many of these injuries are likely sports and recreation-related. Falls are the most common cause of TBI for younger and older individuals, eclipsed by motor vehicle crashes and unintentional struck by/against for ages 15-44. Bicycle crashes are a main cause of ED cases of TBI for children age 14 and under, but only appear in the top three causes for males aged 1-14.

Table 2.7. Causes of ED cases of TBI by age category - males

Rank	Age <1 (n=116)	1-14 (n=1,085)	15-24 (n=804)	25-44 (n=601)	45-64 (n=236)	65+ (n=131)
1	Unintentional falls (81.9%)	Unintentional falls (48.5%)	Unintentional struck by/against (31.2%)	Motor vehicle, traffic (23.1%)	Unintentional falls (39.0%)	Unintentional falls (78.6%)
2	Unintentional struck by/against (12.1%)	Unintentional struck by/against (31.1%)	Motor vehicle, traffic (21.4%)	Unintentional struck by/against (22.8%)	Motor vehicle, traffic (21.2%)	Motor vehicle, traffic (8.4%)
3	Motor vehicle, traffic (1.7%)	Pedalcycles, traffic & non-traffic (8.4%)	Assault-related (21.3%)	Unintentional falls (22.5%)	Unintentional struck by/against (16.5%)	Unintentional struck by/against (5.3%)

Source: MEDCIIN 2001 unweighted data from 23 hospitals.

Table 2.8. Causes of ED cases of TBI by age category - females

Rank	Age <1 (n=84)	1-14 (n=650)	15-24 (n=531)	25-44 (n=533)	45-64 (n=247)	65+ (n=281)
1	Unintentional falls (84.5%)	Unintentional falls (56.0%)	Motor vehicle, traffic (29.6%)	Unintentional falls (27.6%)	Unintentional falls (59.1%)	Unintentional falls (86.1%)
2	Unintentional struck by/against (11.9%)	Unintentional struck by/against (21.5%)	Unintentional falls (23.0%)	Motor vehicle, traffic (25.7%)	Motor vehicle, traffic (15.8%)	Motor vehicle, traffic (6.8%)
3	Motor vehicle, traffic (2.4%)	Motor vehicle, traffic (9.2%)	Unintentional struck by/against (22.0%)	Unintentional struck by/against (21.2%)	Unintentional struck by/against (13.0%)	Unintentional struck by/against (5.3%)

Source: MEDCIIN 2001 unweighted data from 23 hospitals.

To conclude, as identified through analysis of Michigan data, some risk factors for TBI include: being male, being an adolescent or young person, and being elderly. These different groups are at risk for TBI for different reasons. Elderly people and young children are both at risk because of the potential for falling; however, falling appears to have more devastating consequences for the former. Falls rank below the top three most common causes of TBI death for children, but they are *the* most common cause of TBI death for the elderly.

The data presented here show that males tend to experience TBI more often for violent behaviors and suicide-related events. Motor vehicle crashes are a leading cause of TBI-related ED visits, hospitalizations, and deaths for all sexes and age groups. However, serious car crashes are more likely to involve males – especially between 15 and 24 where the TBI death rate due to motor vehicle crashes is 12.7/100,000, and the hospitalization rate is 77.4/100,000. The female death rate for the same age category is less than half the male rate at 5.61/100,000, while the hospitalization rate is 45.17. Similarly, while falls are a common cause of TBI-related hospitalizations and ED visits for everyone, males in all age categories are at greater risk for falls resulting in hospitalization with TBI.

Both female and male infants are at risk of homicide and assault. Assault is the leading cause of TBI-related death and the second leading cause of TBI-related hospitalization for children under one year.

Discussion

To understand traumatic brain injury, it must be put in context with other major causes of injury and death. Table 2.9 compares TBI to common disease-related deaths in Michigan for calendar year 2002. The number of deaths related to TBI is less than that for heart disease and cancer, but higher than the number of deaths in Michigan for liver disease and AIDS. Table 2.10 presents the number of injury deaths by cause, the number of TBI deaths in those categories, and the percent of TBI to the total for each cause category. Data indicate that a large percentage of injury-related deaths in Michigan involve TBI.

Cause of death	Number of deaths in 2002
All Deaths	87,534
Heart Disease	26,447
Cancer (all)	19,831
Stroke	5,740
Chronic Lower Respiratory Diseases	4,389
Diabetes	2,753
Pneumonia	2,007
TBI	1,523
Chronic Liver Disease and Cirrhosis	975
Atherosclerosis	564
AIDS	237

Source: TBI deaths are those as pulled from Vital Statistics for the current project, deaths due to diseases are available at: <http://www.mdch.state.mi.us/pha/osr/index.asp?Id=4>

	All injury deaths	TBI-related deaths	TBI as % of all
Motor Vehicle	1,323	404	31%
All Other Accidents	1,919	425	22%
Suicide	1,095	443	40%
Homicide	689	163	24%

Source: Injury deaths for 2002 are available: <http://www.mdch.state.mi.us/pha/osr/index.asp?Id=4>. TBI-related deaths in each category were those pulled from Vital Statistics for the current analysis.

While TBI was a contributing cause for only 2% of all Michigan deaths in 2002, TBI turns out to be a much more prominent cause of death for certain age groups (MDCH, 2004):

- Age group 1-14: 13% of all Michigan deaths in 2002 were TBI-related;
- Age group 15-24: 22% of all Michigan deaths in 2002 were TBI-related;
- Age group 25-34: 13% of all Michigan deaths in 2002 were TBI-related;
- Age group 35-44: 7% of all Michigan deaths in 2002 were TBI-related.

Data analysis done by MDCH finds that injury accounted for 4.4% of all hospitalizations in 1999 and 2001. TBI accounted for approximately 10% of all injury hospitalizations in Michigan during these years (Largo and Scarpetta 2003; Largo et al 2002). Analysis of 1999 data by age, finds that TBI was the most frequent type of injury among hospitalized infants, and the second or third leading type of injury for people in age groups 1- 44 and 65 and over (Largo et al 2002).

A second question arising from the incidence data presented in this report is: How is Michigan doing compared to the rest of the country in terms of the number of TBI cases? The CDC (2004) compared TBI-related hospitalization rates using 1999 data from 22 states, and TBI-related death rates using 1999 data from 21 states. Michigan reported 1,585 TBI-related deaths in that year, for an age-adjusted rate per 100,000 of 16.8. The average reported rate across the 21 reporting states was 19.8 – Michigan’s TBI-related death rate was more than 0.5 standard deviation below average.

- Only four reporting states had a lower TBI death rate than Michigan: Massachusetts-9.0, North Dakota-11.0, Hawaii-11.1, and California-13.4.
- Minnesota reported approximately the same death rate for TBI-17.1.
- Fifteen other states reported a TBI death rate higher than Michigan’s: Texas-18.0, Florida-18.3, Vermont-19.5, Wisconsin-19.6, Kentucky-19.7, Washington-20.8, Kansas-21.3, Georgia-21.8, Utah-22.2, North Carolina-22.5, Nebraska-23.7, Colorado-24.5, Oklahoma-26.1, South Carolina-27.5, and Louisiana-31.2

In terms of TBI-related hospitalization rates, the average reported rate during 1999 from 22 states was 67.5 (CDC, 2004). Michigan appears to have a somewhat higher rate than the average from this group of states – 87.3/100,000 during 1999.

One might want to conclude that states with more nonfatal hospitalizations on average have fewer deaths due to TBI (reasoning that they may have better emergency services and survival rates may be higher). However, this appears unwarranted. TBI-related hospitalization and death rates as reported by the CDC (2004) for 22 states are not correlated (Pearson correlation coefficient=-.12, not statistically significant).³

³ Correlation coefficients have a possible range from -1 to 1. A correlation coefficient of -1 indicates a perfect negative correlation (the higher one value, the lower the other); a correlation of +1 indicates a perfect positive correlation (the higher one value, the higher the other); a coefficient near zero indicates no correlation.

3

USE AND COST OF HEALTH CARE BY PEOPLE WITH TBI IN MICHIGAN

To better understand what public services and supports are currently provided to persons with TBI¹ this project studied TBI-related care as paid through Medicaid Fee for Service (FFS), Medicaid Health Plans (MHP), Home Help, and CMHSPs during fiscal years 1999-2002 (October 1, 1998 to September 30, 2002). The first step was to search the FFS and MHP electronic records for diagnostic codes that identify treatment for TBI during the timeframe. General information (such as age and sex) about the people receiving these services is summarized in this report. Also summarized is some general information about the services received. Medicaid FFS costs are presented for services with TBI diagnostic codes. In addition, a subgroup of cases was studied - those with a hospitalization for TBI followed by two full years of Medicaid enrollment. Following the Medicaid FFS analysis, this section provides information on the number of people who received TBI-related treatment services through Medicaid FFS or MHP *and* who also received Home Help and CMHSP services. Information on type and amount of services received is presented for those people with a TBI-related hospitalization.

Methods

Most information presented in this section is based on a study of services received during October 1, 1998 and September 30, 2002. However, Home Help information is summarized only for a three year period: October 1, 1999 – September 30, 2002. This is because some earlier data had already been deleted from the Data Warehouse. (Old records are deleted to free up space to store more recent information.) In contrast to the Section 2, findings are presented for fiscal (rather than calendar) years (FY) 1999-2002.

Medicaid Fee for Service and Medicaid Health Plans

There are two service plans for people enrolled in Medicaid: the managed care MHPs and the regular FFS plan. Most people are required to enroll in a MHP in which the Plan is paid a monthly capitated rate to provide specific services. There are a few groups of people who may choose between MHP and FFS. People who are eligible for both Medicare and Medicaid, people with long-term service needs at the nursing facility level, and certain other groups *must* enroll in Medicaid FFS.

Data files from Medicaid FFS in the form of claims records were analyzed. The relevant cases were identified by selecting those claims with a diagnosis code indicating a TBI. These are the same ICD-9-CM codes used to identify hospitalizations in the MIDB and are listed in Appendix B. Similarly, cases are identified in the MHP encounter data by ICD-9-CM codes.

¹ Please refer to “Appendix A: Glossary” for definitions of terms and a list of acronyms used in this report.

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The cases analyzed include all severity levels. Some individuals have been identified on the basis of a single emergency department or outpatient medical visit. Others have extended hospitalizations and/or nursing home services related to TBI. It should not be assumed that the numbers of individuals with Medicaid services all have long-term impairments. *Indeed, the majority of cases receiving only outpatient care may have no long-term effects from their injury whatsoever.*

Several limitations to the results presented here are important. First, other than for a limited sub-sample of cases, the only data analyzed were claims with a TBI diagnosis. There are some classes of services, such as long term care and professional visits, in which diagnostic codes are not important for billing. People familiar with analysis of medical claims data therefore tend to regard diagnostic coding for services not provided by a hospital to be incomplete or inaccurate. *It is very likely that the data presented here underestimate such types of services.*

Home Help

Home Help data were pulled from the MDCH Data Warehouse using Medicaid ID numbers of individuals who received Medicaid FFS or MHP services for TBI during the four-year time frame, FY1999-2002. Payments for Home Help services for each such individual were summed for each fiscal year FY1999-2002.

Community Mental Health Services Programs (CMHSPs)

TBI is not a DSM-IV² diagnostic category and therefore is not captured in the CMHSP data. Rather, the methodology used to identify people with TBI in the CMHSP system involved matching CMHSP service records to individuals identified with a TBI-related diagnosis in the Medicaid FFS or MHP system. Services received from the CMHSPs may or may not be directly related to the TBI.

The CMHSP data used in this report were gathered from administrative data provided by a CMHSP for each individual during a fiscal year. Generally, an individual should have only one record per fiscal year. Only individuals who received services through more than one CMHSP would have had more than one record. Each record included information about individual demographics, diagnoses, and a summary of all services received within that fiscal year. There are no dates for individual services.

Results

Medicaid FFS and MHP Beneficiaries Treated for TBI

About 1.4 million individuals were enrolled in either Medicaid FFS or MHP for each year during the time period studied. This number increased from 1.32 million enrollees in FY1999 to 1.58 million enrollees in FY2002. Using both the FFS claims and the MHP administrative data, 67,489 unique individuals were identified as receiving medical services for TBI at some point

² Diagnostic and Statistical Manual of Mental Disorder: Fourth Edition

during the 4 year time period (that is, they received Medicaid services in which TBI was recorded as a diagnosis). As shown in Table 3.1, the annual rates of individuals receiving TBI services ranged from about 11/1,000 to 14/1,000 cases, or an overall annual average of about 18,000 people a year. Nearly 65% of these cases were enrolled in a MHP, 33% in Medicaid FFS, and just over 2% were enrolled in both plans during the four years analyzed (meaning that they changed from FFS to MHP or vice versa during the time period). A summary of this information is presented in Figure 3.1.

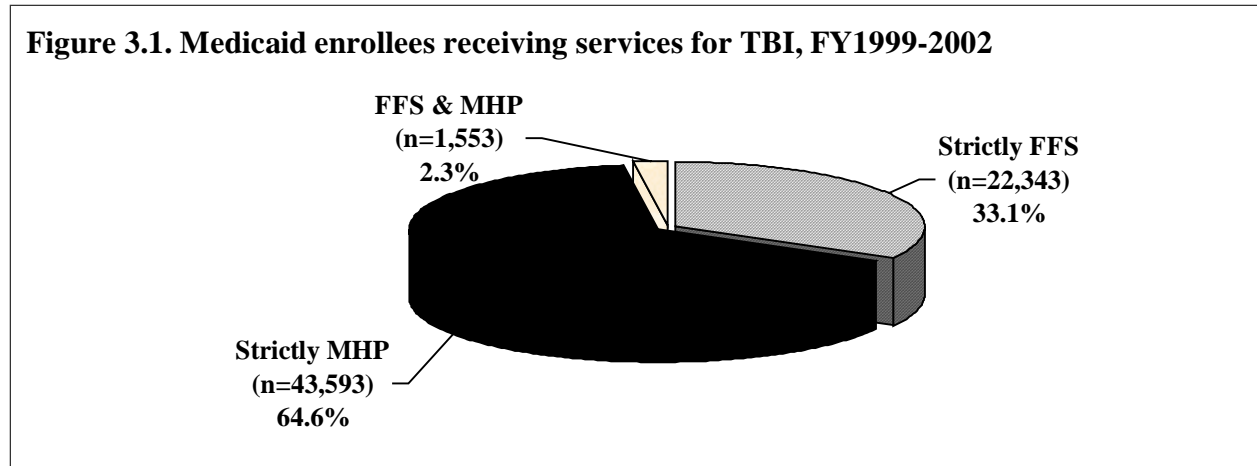


Table 3.1 shows the number of people receiving services through Medicaid FFS and/or MHP with a TBI diagnosis. In FY1999, 15,704 people received (at least one) Medicaid reimbursed service with an identified TBI diagnosis (about one third of these individuals received services through FFS and two thirds through MHP). The number of people receiving TBI services grew throughout the time period and in FY2002, 22,427 people received services with an identified TBI diagnosis. *The number of individuals receiving TBI services should be considered an underestimate as it is very likely that many people received services for TBI that were not identified by a TBI diagnosis.* TBI-related services are especially likely to be missed if the TBI occurred far in the past or if the beneficiary has comorbid conditions that may have been listed instead of the TBI.

The growth in the number of people receiving TBI-related services was faster than the growth in the Medicaid caseload. For every one thousand Medicaid enrollees in FY1999, nearly 12 people received a directly identifiable TBI treatment service. By FY2002, this rate had grown to 14 per thousand. *Further study is required to determine whether this apparent growth in rates of TBI cases within Medicaid is a long-term trend or merely a random rise which will fall again in future years.*

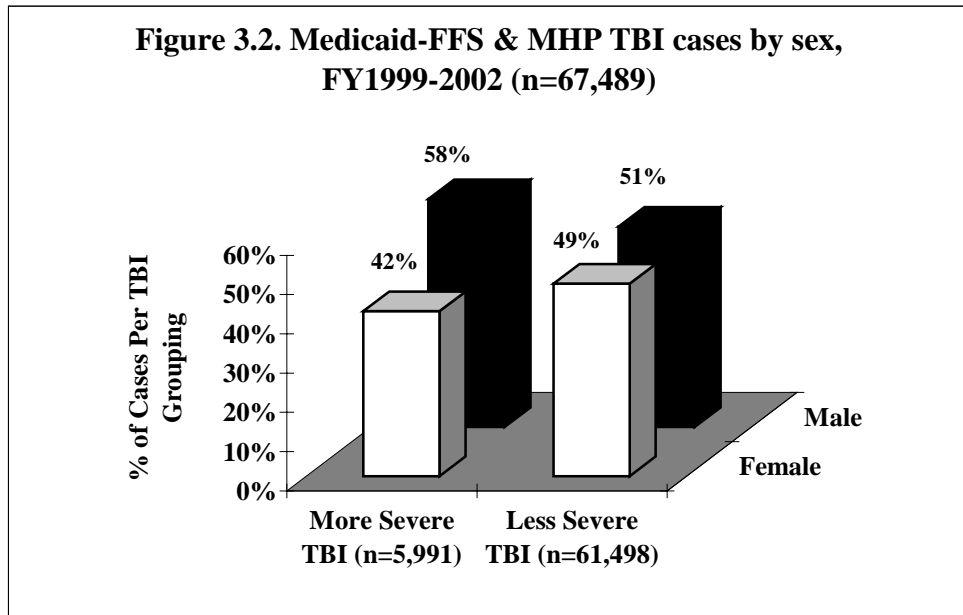
Of all the Medicaid FFS and MHP covered individuals receiving services for TBI, only about 8% also experienced an identified TBI-related hospitalization during the four years analyzed (Table 3.1). The non-hospitalized population received other types of services, mostly in an outpatient or clinic setting. Based on these findings, it appears that the vast majority of Medicaid cases analyzed experienced a milder TBI injury. Some individuals with mild TBI may have long-term problems as a result of their injury; but many will have no long-term effects.

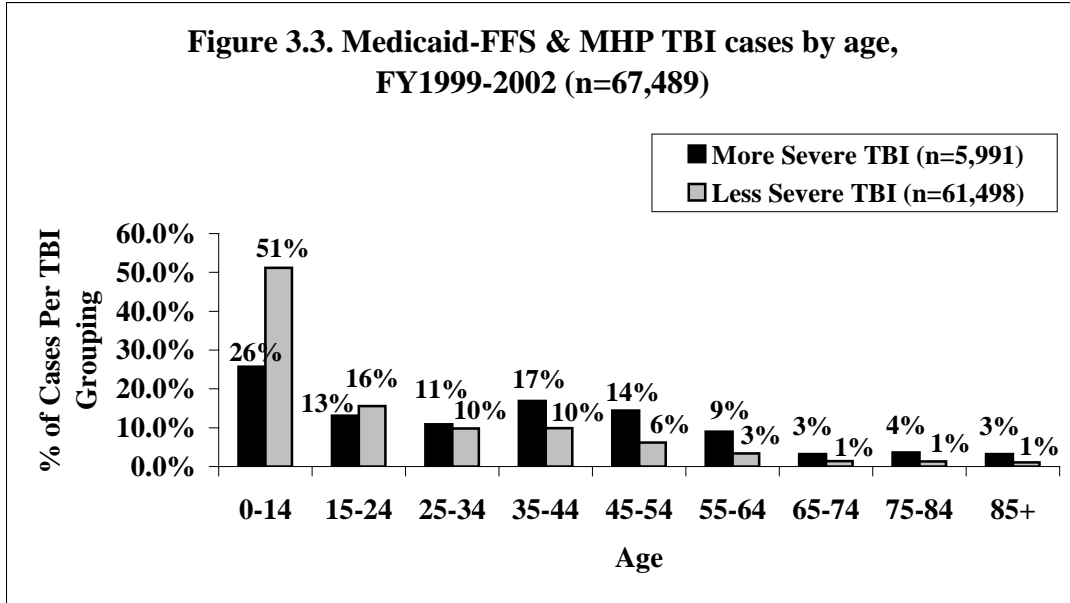
Table 3.1. Michigan Medicaid TBI cases: people receiving care for TBI diagnosis only, FY1999-2002

	FY1999	FY2000	FY2001	FY2002	FY1999 to FY2002	Average number of cases per fiscal year
All Medicaid (all fiscal year data is on unique individuals – those enrolled in both FFS & MHP during the timeframe were only counted once)						
Number of beneficiaries	1,315,958	1,409,998	1,484,637	1,578,494		1,447,272
Number receiving services for TBI	15,704	15,758	18,807	22,431	67,489	18,175
Rate of TBI cases per 1,000 Medicaid enrollees	11.93	11.18	12.67	14.21		12.56
Number hospitalized with TBI (percent of TBI Medicaid cases in parentheses)	1,272 (8.1%)	1,385 (8.8%)	1,512 (8.0%)	1,733 (7.7%)	5,738 (8.5%)	
Medicaid Fee for Service (FFS) beneficiaries						
Number of beneficiaries	745,208	729,046	878,312	943,873		824,110
Number receiving services for TBI	5,324	4,866	6,989	8,285	23,896	6,366
Rate of TBI cases per 1,000 Medicaid FFS enrollees	7.14	6.67	7.96	8.78		7.72
Number hospitalized with TBI (percent of FFS TBI cases in parentheses)	489 (9.2%)	514 (10.6%)	690 (9.9%)	653 (7.9%)	2,305 (9.6%)	
Medicaid Health Plan (MHP) beneficiaries						
Number of beneficiaries	1,001,477	1,036,365	1,020,412	1,110,062		1,042,079
Number receiving services for TBI	10,540	11,055	12,044	14,381	45,146	12,005
Rate of TBI cases per 1,000 Medicaid MHP beneficiaries	10.52	10.67	11.80	12.96		11.52
Number hospitalized with TBI (percent of MHP TBI cases in parentheses)	810 (7.7%)	913 (8.3%)	865 (7.2%)	1,089 (7.6%)	3,571 (7.9%)	
Source: Medicaid MHP Data and FFS Claims, for dates of service October 1, 1998 - September 2002, as extracted from the MDCH Data Warehouse						

It should be noted that the individuals receiving MHP services tended to be younger than those receiving FFS services. The median age for the MHP beneficiaries was 12 in contrast to 23 for the FFS beneficiaries. This may be due to the requirement that people who are eligible for both Medicare and Medicaid are required to enroll in FFS. More than half of the MHP enrollees were children less than 15 years of age, compared to one-third of the FFS beneficiaries. Both MHP and FFS beneficiaries had similar proportions of male (52%) and female (48%) beneficiaries.

In terms of demographic groups and severity of TBI, patterns in the Medicaid data are similar to those in the data presented in Section 2 on all TBI cases in Michigan. Figure 3.2 displays more and less severe cases of TBI by sex. Cases that resulted in hospitalization or skilled nursing facility claims with a diagnosis of TBI are considered to be more severe cases. Less severe cases are defined as those that have only outpatient claims during the time period. As with the incidence data presented in Section 2, males and females are more equally represented among the less severe injuries, whereas there are more males among the more severe injuries. Similarly, as presented in Figure 3.3, children under the age of 15 are more numerous among the less severe cases.





Medicaid Cost & Service Use Analysis: Fee for Service Only

Cost information can only be presented for individuals enrolled in Fee for Service Medicaid since MHP files contain administrative data only. *For this and other reasons, cost estimates presented in this section should be considered an underestimate of the TBI-related costs to Michigan's public service system.* Other reasons include the fact that only those cases with a TBI diagnosis are included, leaving out many costs in which the TBI was not recorded as a diagnosis on the claim. And of course, only direct Medicaid charges are summarized, leaving out the cost of service provision by CMHSPs, public schools, and MRS among others.

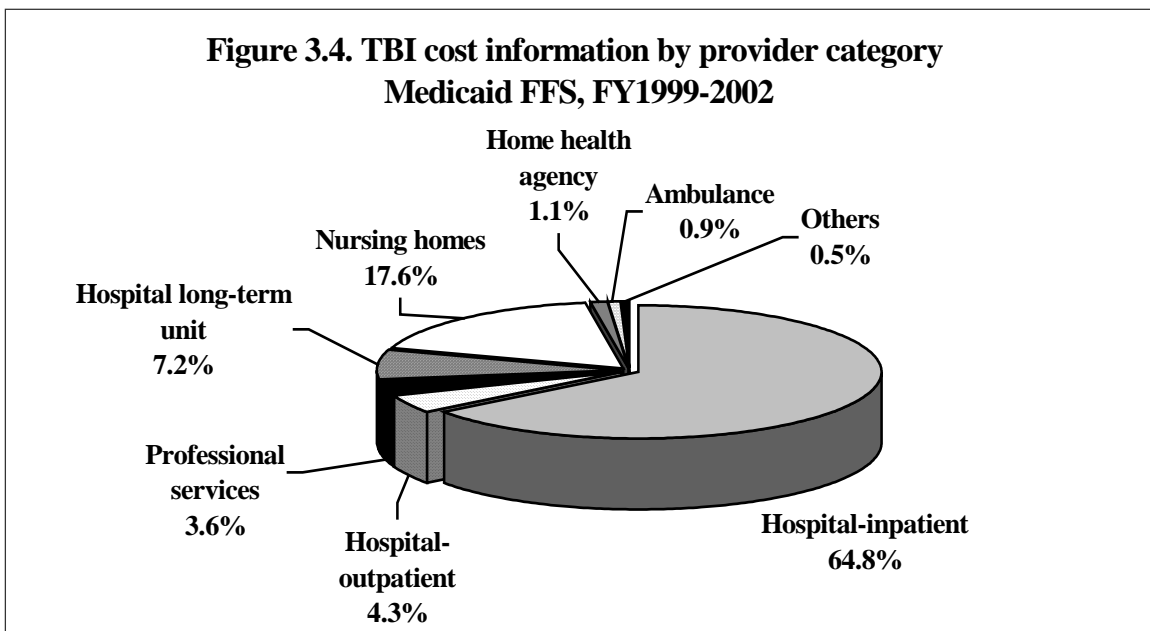


Table 3.2. TBI cost information by provider category – Medicaid FFS, FY1999-2002

	FY1999	FY2000	FY2001	FY2002	FY1999-2002	% of Total Cost
Hospital – inpatient	\$ 6,845,172	\$ 6,918,046	\$ 7,927,015	\$ 6,698,726	\$ 28,388,959	64.8%
Hospital – outpatient	\$ 370,463	\$ 321,524	\$ 561,416	\$ 645,488	\$ 1,898,891	4.3%
Professional services	\$ 352,015	\$ 332,369	\$ 417,396	\$ 473,922	\$ 1,575,702	3.6%
Hospital long term care units	\$ 884,259	\$ 777,510	\$ 755,531	\$ 719,554	\$ 3,136,854	7.2%
Nursing homes	\$ 1,450,189	\$ 1,996,294	\$ 2,080,270	\$ 2,191,532	\$ 7,718,285	17.6%
Home health agency	\$ 107,435	\$ 120,313	\$ 39,990	\$ 210,431	\$ 478,169	1.1%
Ambulance service	\$ 11,079	\$ 74,589	\$ 167,828	\$ 160,140	\$ 413,637	0.9%
Other claim categories	\$ 1,048	\$ 3,573	\$ 11,521	\$ 208,613	\$ 224,755	0.5%
Annual total cost	\$ 10,021,659	\$ 10,544,219	\$ 11,960,968	\$ 11,308,406	\$ 43,835,253	

Figure 3.4 and Table 3.2 display the provider categories to which Medicaid FFS payments for a TBI diagnosis were made between FY1999 and 2002. According to these data, 65% of the total payments (more than \$7 million per year on average) were made for hospital inpatient stays, despite the fact that only 8% of cases analyzed experienced an inpatient stay during the time frame. The second largest dollar amount was accounted for by nursing home expenditures (18%). On average, Michigan Medicaid FFS paid out about \$11 million annually for claims in which TBI was a primary or secondary diagnosis.

Longitudinal Study of Hospitalized Medicaid FFS Cases

In order to better understand what services people with TBI receive through Medicaid, claims were analyzed for a subgroup of FFS beneficiaries. The group chosen for analysis included cases identified with a TBI-related hospitalization sometime during fiscal years 1999-2001 with two full years of Medicaid eligibility following the hospitalization for TBI, and who were enrolled in FFS during at least part of that period. One hundred sixty-six such individuals were identified. This selection methodology means that those cases selected were the most likely to be severely injured and possibly disabled. (Please see Appendix C for more discussion of the methodology and limitations.) All claims were analyzed – those with and without a TBI diagnosis.

Table 3.3. FFS Medicaid services received by subset of individuals with TBI, during the first and second year following injury (n=166*)

Provider Category	Year 1		Year 2		Year 1 or 2	
	No.	Percent	No.	Percent	No.	Percent
Hospital – inpatient [†]	152	92%	17	10%	152	92%
Hospital – outpatient	122	73%	60	36%	126	76%
Professional services	160	96%	84	51%	161	97%
Hospital long term care units	1	1%	1	1%	2	1%
Nursing homes	18	11%	15	9%	20	12%
Home health agency	22	13%	4	2%	23	14%
Ambulance service	52	31%	19	11%	60	36%
Independent laboratory	42	25%	21	13%	45	27%
Medical clinic	33	20%	28	17%	38	23%
MI Choice program	2	1%	2	1%	2	1%
Community Mental Health board	17	10%	15	9%	18	11%
Other claim categories	48	29%	49	30%	62	37%

Source: Medicaid FFS data are analyzed for a subset of individuals with a TBI-related hospitalization during FY 1999-2000, and were subsequently eligible for Medicaid for 2 continuous years, and who received services through Medicaid FFS at some point during those two years, and for whom Medicaid was primary (no other insurance).

*Note that some of the individuals in this table might have been enrolled in a MHP sometime during the 2 years.

Therefore it is possible that some services are not summarized here because they were received during MHP enrollment.

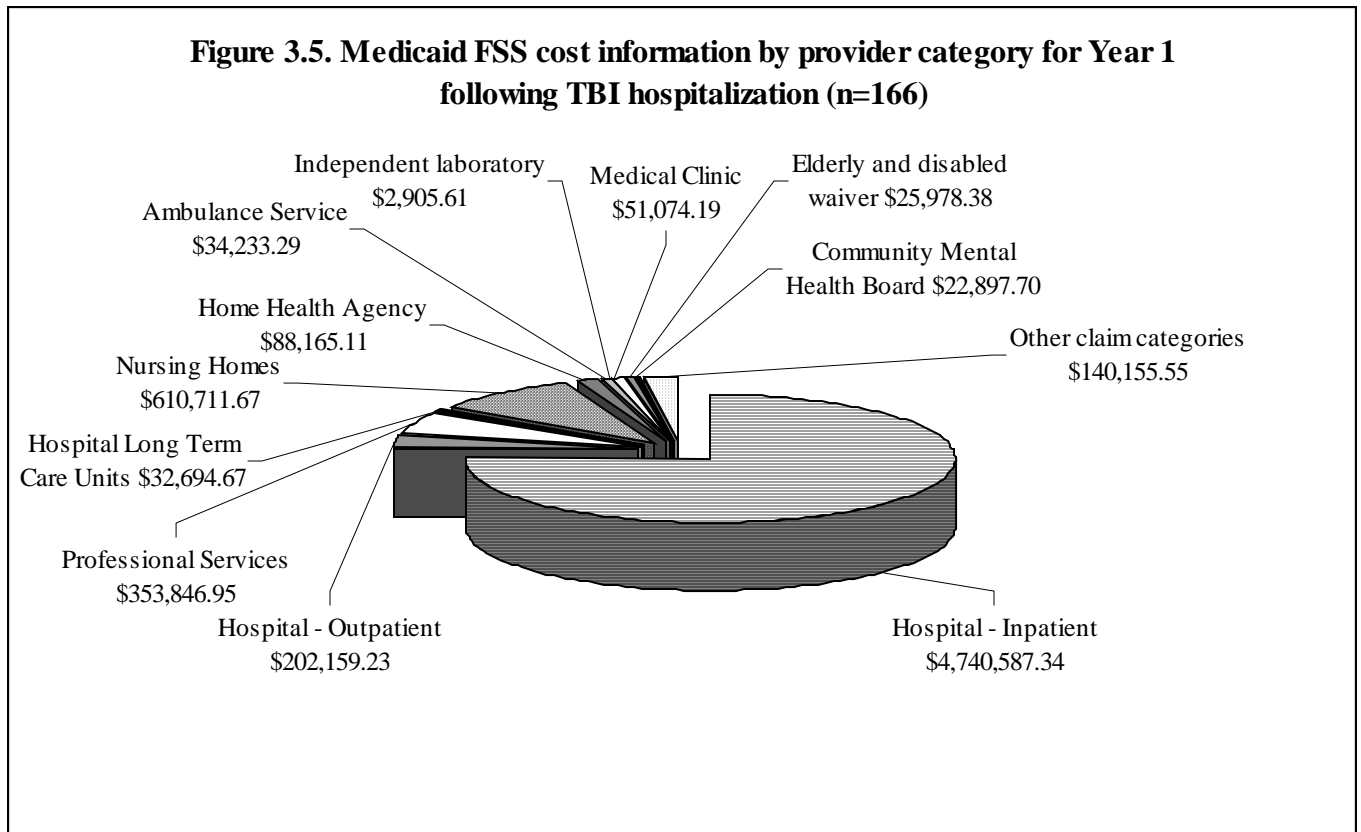
[†] All individuals summarized in this table were hospitalized once at the beginning of the two year period. Only 152 of the 166 individuals had cost information on this hospitalization in the Medicaid FFS database. This means that 14 people had their initial hospitalization paid for by their MHP.

Table 3.3 presents the number and percentage of the 166 people who received Medicaid FFS services following a TBI-related hospitalization by provider category of service received. However, it is possible that not all of these services are directly linked to a TBI diagnosis. Service categories are presented for one and two years post injury. The second year of services is more likely to reflect the long-term service needs of the individual with TBI. During the second year post injury:

- 60 people (36%) required hospital outpatient services;
- 17 people (10%) experienced another hospital stay;
- 15 (9%) received nursing facility care;
- 15 (9%) received services through a CMH; and
- 2 (1%) were enrolled in the MI Choice Program.

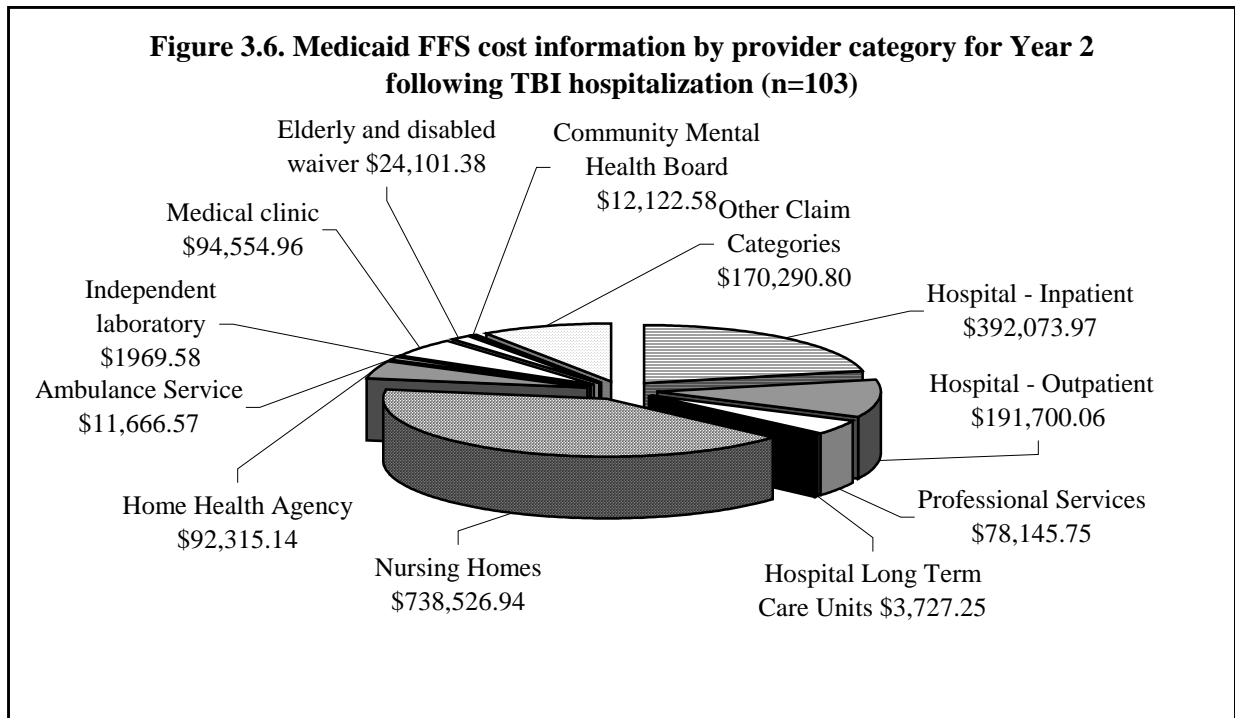
Figures 3.5 and 3.6 summarize total Medicaid FFS costs by provider category for the first and second years after a TBI for the entire subgroup of 166 people with a Medicaid-paid, TBI-related hospitalization and two continuous years of Medicaid eligibility. As expected the first year is very expensive since it includes the acute care in the hospital.

- Total costs during the first year post injury for the 166 individuals studied were \$6,254,335.50.
- Hospitalization accounted for three quarters of these costs at over \$4.7 million.



Of the 166 people studied, only 103 of them had Medicaid FFS costs during the second year after their injury (all were eligible for Medicaid).

- Total costs during the second year post injury were much lower: \$1,716,640.02.
- The largest cost category during the second year following injury was for nursing homes, accounting for \$738,526.94, or 43% of the total.



Individual costs were summarized for years 1 and 2 post injury for these 166 individuals by calculating means and medians. The mean is the average cost (the total cost divided by the number served). The mean is not necessarily typical, since a small number of high cost cases can drive up the mean. Therefore, the median cost was calculated. The median can be regarded as a more “typical” of the group.

- The *median* amount paid through Michigan Medicaid FFS for these 166 people during the first year post injury (which includes their initial hospitalization) was \$13,594.50.
- The *average* amount paid for these individuals during their first year was \$37,676.
- The *median* year two amount paid through Michigan Medicaid FFS for the 103 people who had second year costs post injury was \$1,200.04.
- The *average* amount paid for year two was \$16,666.41.

Home Help Service Use by Individuals with Identified TBI

Home Help Services are unskilled, non-specialized services performed in the beneficiary’s home or other community setting *to assist* individuals in accomplishing activities of daily living (ADLs) and instrumental activities of daily living (IADLs). ADLs include: eating, bathing, toileting, grooming, dressing, transferring, and moving about. IADLs include: taking medication, preparing meals, laundry, housework, shopping and errands. As of February 2004, 45,896 individuals were receiving Home Help services in Michigan.

Medicaid ID numbers of Home Help beneficiaries during FY2000-2002 were matched with Medicaid ID numbers of people with an identified TBI treatment service through Medicaid FFS or MHP during fiscal years 1999-2002.

- Of the 67,489 Medicaid beneficiaries with an identified TBI, 3,577 (5%) received Home Help services between October 1, 2000 – September 30, 2002.

The age of Home Help beneficiaries with TBI ranged from 3 years to 104 years, with a mean age of 50 years. Yearly cost data for these 3,577 Home Help beneficiaries with a TBI are summarized in Table 3.4. Home Help costs and number of people served are broken down by fiscal year. Costs for all three years are summarized in the final column. During the most recent year analyzed (FY2002), 2,869 individuals with an identified TBI in the Medicaid FFS and MHP databases received Home Help services, for a total cost of over \$9 million. The median annual amount paid for Home Help services for an individual with an identified TBI during FY2002 was \$2,706.

Cost	FY2000	FY2001	FY2002	FY2000- FY2002
Total cost	\$5,191,736	\$8,321,264	\$9,253,256	\$22,776,256
Median cost/ beneficiary	\$1,995	\$2,731	\$2,706	\$2,415
Maximum cost/ beneficiary	\$27,404	\$45,414	\$47,831	\$47,831
Minimum cost/ beneficiary	\$18	\$6	\$16	\$6
Number of cases with charges*	2,324	2,621	2,869	3,577 (unique individuals)
*Cases with charges of \$0.00 were not included in the analysis. These individuals were approved for Home Help – but did not receive services.				

Home Help Service Use by Individuals with Identified TBI Hospitalization

Analysis of Home Help service use was also conducted separately on the 5,738 Medicaid beneficiaries who had a TBI-related hospitalization during FY1999-2002.

- Of these 5,738 individuals with a TBI-related hospitalization, 640 (12%) received Home Help services during the three-year period October 1, 1999 – September 30, 2002.

Analysis was also conducted comparing date of TBI hospitalization to first date of Home Help service use. Only the years that services were provided to individuals with TBI were available in the Home Help data provided for analysis. Years of initial service provision were compared to the year of hospital admission for those with TBI hospitalizations in the Medicaid data. For most cases with a TBI hospitalization, it can be reasonably assumed that this hospitalization marks the approximate date of their injury. However, it could not be determined for sure from the data

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whether Home Help services were received as a result of a TBI. Therefore, the purpose of this analysis was to determine whether people with a TBI hospitalization were injured first and then needed Home Help, or whether individuals already receiving Home Help experienced a TBI.

There were 570 individuals with TBI that received Home Help services between October 1, 1999 and September 30, 2002 with dates of hospitalization between FY1999 and FY2002. Of these 570 individuals:

- 194 individuals (34%) received Home Help services during the fiscal year prior to TBI hospitalization in 2001 or 2002 (Home Help data for 1999 were not available to compare with 2000 hospitalization data, and 2003 hospitalization data were not available to compare with 2002 Home Help data.)
- 233 individuals (41%) received their first Home Help service during the same fiscal year as their TBI – it is unclear whether the TBI came first or second
- 143 individuals (25%) had their first Home Help service during the fiscal year after their TBI hospitalization.

The numbers show that about one-third of individuals with TBI were receiving Home Help Services during the year prior to their TBI-related hospitalization. The remaining two-thirds of the individuals received Home Help services during the year of their TBI-related hospitalization or during the year following their TBI-related hospitalization, although it is not possible to determine if these individuals received services as a result of their TBI.

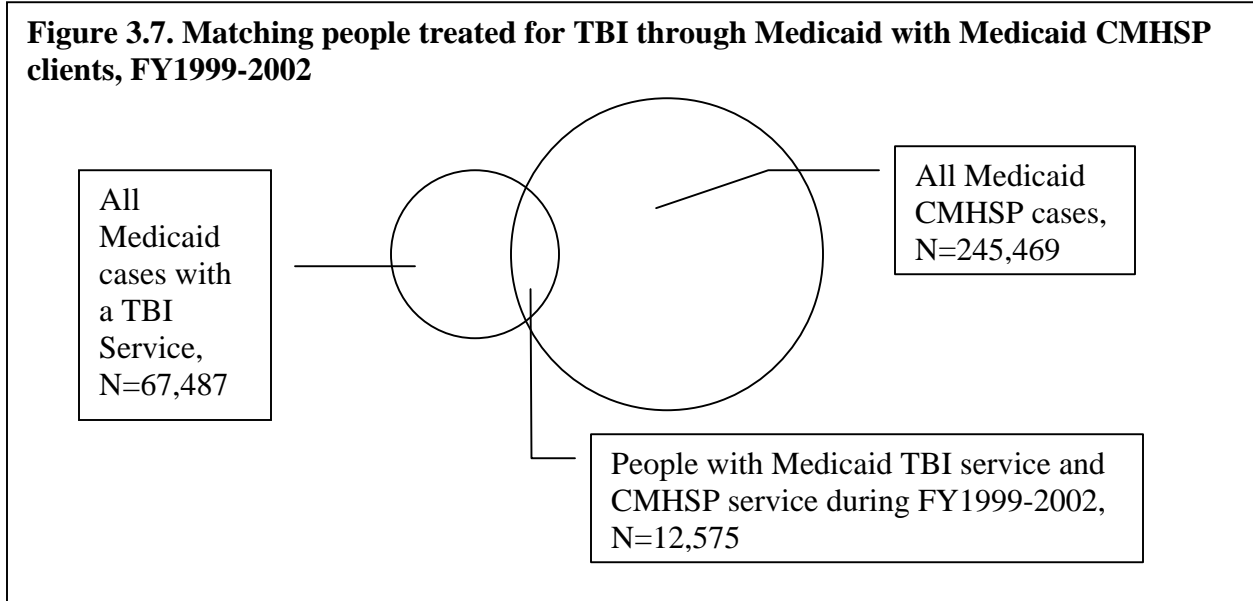
Costs of Home Help services were analyzed for the subgroup of people with a TBI hospitalization. Median costs were slightly higher for this subgroup than for those with TBI but no identified hospitalization; however, the differences were not considered substantial enough to present separately.

Community Mental Health Services Programs

This section presents the information about CMHSP services utilized by those individuals identified as being treated for TBI in the Medicaid data.

The methodology involved matching those cases identified in the Medicaid data who received TBI-related services with those in the CMHSP database. This process is illustrated below in Figure 3.7. (Searching the CMHSP database for a diagnosis of TBI would not yield information for multiple reasons, including the use of DSM-IV diagnostic categories and the fact that TBI is not a priority diagnosis in the CMHSP system.)

Figure 3.7. Matching people treated for TBI through Medicaid with Medicaid CMHSP clients, FY1999-2002



As depicted in Figure 3.7, out of 67,487 people identified as having been treated for TBI in the Medicaid database and 245,469 Medicaid clients receiving CMHSP services, 12,575 individuals were in both databases during FY1999-2002. These individuals accounted for 18.6% of the people identified as being treated for TBI through Medicaid in the timeframe. Individuals with an identified TBI in Medicaid during FY1999-2002 accounted for 5% of all CMHSP clients during the same years.

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Table 3.5 provides demographic information on CMHSP consumers with an identified TBI. For comparison, demographic information on the rest of the Medicaid CMSHP population is also presented. The CMHSP clients with a Medicaid-identified TBI are more likely to be younger (aged 0-44), and receiving services as a person with a mental illness as compared to the CMHSP clients with no identified TBI. Individuals with a Medicaid-identified TBI receiving CMH services were about half males and half females.

Table 3.5. Demographic overview of CMH cases by Medicaid-TBI status, FY1999-2002				
	CMH & Medicaid-Identified TBI		CMH, No Medicaid-Identified TBI	
	Number	Percent	Number	Percent
Age Categories				
0-14	3,148	24.9 %	53,791	23.1 %
15-24	2,203	17.4 %	37,535	16.1 %
25-34	2,033	16.2 %	34,553	14.8 %
35-44	2,496	20.0 %	42,859	18.4 %
45-54	1,481	11.8 %	29,382	12.6 %
55-64	688	5.6 %	13,242	5.7 %
65-74	262	2.0 %	7,182	3.1 %
75-84	181	1.4 %	5,572	2.4 %
85+	83	0.6 %	3,518	1.5 %
Unknown	0	-	5,260	2.3 %
Total	12,575	100.0 %	232,894	100.0 %
Gender				
Male	6,297	50.1 %	107,033	46.0 %
Female	6,278	49.9 %	120,102	51.6 %
Unknown	0	-	5,759	2.5 %
Total	12,575	100.0 %	232,894	100.0 %
Race				
White	7,658	60.9 %	133,923	57.5 %
Black	3,012	24.0 %	53,255	22.9 %
Other	762	6.1 %	13,573	5.8 %
Unknown	1,143	9.1 %	32,143	13.8 %
Total	12,575	100.0 %	232,894	100.0 %
CMH Category				
MI Only	9,971	79.3 %	159,772	68.6 %
DD Only	1,093	8.7 %	28,392	12.2 %
DD & MI	822	6.5 %	33,785	14.5 %
Neither DD or MI	689	5.5 %	10,945	4.7 %
Total	12,575	100.0 %	232,894	100.0 %

Race is also available in the CMHSP dataset. The racial composition of the individuals receiving both Medicaid TBI and CMHSP services is about 61% white, 24% black, and 6% other.

Seventy-nine percent (9,971) of the people with a TBI identified through Medicaid data who also received CMH services qualified for CMH services as a consumer with a mental illness (MI). Consumers classified as “developmentally disabled” (DD) include those classified as DD only, as well as those classified as both DD and MI. About 15% (n=1,915) of the individuals with a TBI identified through the Medicaid data receiving CMH services qualified for services by being classified DD.

CMHSP Service Use by Medicaid Beneficiaries with a TBI-related Hospitalization

The remainder of this section presents CMHSP service use for those individuals who experienced a TBI severe enough to require hospitalization. (Please note that these are cases with a medical hospitalization for TBI as identified in the Medicaid database – these do not necessarily include cases with a psychiatric hospitalization as identified in the CMHSP data.) These cases may be a more uniform group: because they were hospitalized with a TBI, they are more likely to have sustained long-term TBI-related impairments. As presented in Table 3.1, there were 5,738 people in the Medicaid database with a TBI-related hospitalization during FY1999 to FY2002. Of these, 1,262, or 22%, were also receiving services through a CMHSP during the same timeframe. Of the 1,262 individuals with a TBI-related hospitalization also receiving CMHSP services during the timeframe analyzed, 167 (13%) were classified as DD and 1,011 (80%) were classified as MI. (Seven percent had no information on whether they were classified as DD or MI – only those classified as one of these will be summarized in Tables 3.6 and 3.7 below.)

It could not be determined from the data whether a TBI occurred first and necessitated services from a CMHSP or whether existing CMHSP clients experienced a TBI. Without service dates in the CMHSP data or dates of injury in the Medicaid data, this question is difficult to answer with certainty. However, we were able to compare the first year in which CMHSP services were obtained to hospital admission dates for those with TBI hospitalizations in the Medicaid data. It was assumed that most TBI-related hospitalizations occur close to the date of injury.

Only 686 individuals were identified with dates of hospitalization in the Medicaid datasets who also received CMH services during the four years. Of these:

- 295 (43%) received CMHSP services during the fiscal year prior to their TBI hospitalization
- 202 (29%) received their first CMHSP service during the same fiscal year as their TBI – it is unclear whether the TBI came first or second
- 189 individuals (28%) had their first CMHSP service during the fiscal year after their TBI hospitalization

These numbers indicate that a very large number of those who are hospitalized for TBI and received CMH services may not necessarily be in the CMHSP system because of a TBI. Further research would be required to determine the number of people with TBI who are served by a CMHSP specifically because of impairments or symptoms resulting from the TBI. Nevertheless, the following tables present service use information on individuals with a TBI-related hospitalization.

Table 3.6 presents a comparison of the types of services used for Medicaid CMHSP clients with a TBI hospitalization and those with no evidence of TBI. Results are also presented for those classified in the CMHSP system as DD, MI-children, and MI-adults. Twenty-nine classes of services are present in the CMHSP database during the years 1999-2002. Of these, the only services presented in Table 3.6 are those accessed by at least 10% of any service category of Medicaid CMHSP clients with a TBI-related hospitalization.³

The following key findings are presented in Table 3.6:

- People with a TBI-related hospitalization appeared more likely to receive community inpatient services, and supports and services coordination.
- People with a TBI-related hospitalization in the service category MI-Adults appeared more likely to receive the following services: Emergency services/Crisis stabilization (64%), Crisis residential (11%), and Specialized residential (10%).
- People with a TBI-related hospitalization and classified as DD appeared less likely to receive Enhanced health care-staff.
- People with TBI in all service categories commonly received mental health clinic services, but people with a TBI-related hospitalization seemed less likely to do so than CMHSP clients with no identified TBI (particularly in the DD category).

In addition to summarizing the number of people who received services, the quantity of services received can also be summarized for 2001 and 2002. These results are presented in Appendix C, Table C2.

³ Other services not likely to be accessed and thus not presented are: state inpatient, supported independent housing, outpatient partial hospitalization services, clubhouse programs, intensive crisis stabilization services, family support/skills-DD, family skills development-MI, community living equipment-DD, community living environmental modification-DD, enhanced health care-pharmacy-DD, extensive observation beds-MI, wraparound, and prevention services.

Table 3.6. Most frequently used CMHSP services by Medicaid beneficiaries with TBI hospitalization, FY1999-2002

Services	Medicaid CMHSP cases with TBI hospitalization						Medicaid CMHSP cases - no identified TBI					
	DD (n = 167)		MI Adults (n = 850)		MI Children (n = 161)		DD (n = 62,177)		MI Adults (n = 104,841)		MI Children (n = 51,360)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Mental health clinic	70	41.9	657	77.3	132	82.0	37,530	60.4	88,018	84.0	42,872	83.5
Emergency services/Crisis stabilization	51	30.5	541	63.6	52	32.3	23,270	37.4	42,922	40.9	14,063	27.4
Community inpatient	26	15.6	393	46.2	33	20.5	5,006	8.1	20,245	19.3	4,587	8.9
Supports & services coordination	122	73.1	377	44.4	44	27.3	40,663	65.4	37,973	36.2	10,776	21.0
ACTC	6	3.6	106	12.5	4	-*	1,919	3.1	9,016	8.6	490	1.0
Crisis residential	4	-*	97	11.4	1	-*	896	1.4	5,647	5.4	337	0.7
Specialized residential	53	31.7	82	9.6	2	-*	12,545	20.2	5,651	5.4	765	1.5
Day programs	38	22.8	82	9.6	2	-*	15,809	25.4	5,313	5.1	464	0.9
Community living - staff	37	22.2	48	5.6	4	-*	13,091	21.1	5,865	5.6	1,261	2.5
Skill building assistance-Supported integrated employment	33	19.8	29	3.4			9,818	15.8	5,040	4.8	281	0.5
Housing assistance	16	9.6	29	3.4			4,936	7.9	3,181	3.0	173	0.3
Enhanced health care - Staff - DD	98	58.7	20	2.4	3	-*	47,293	76.1	8,383	8.0	3,760	7.3
Skill building assistance - All other	37	22.2	19	2.2	1	-*	13,827	22.2	2,542	2.4	296	0.6
Home-based services	11	6.6	17	2.0	31	19.3	2,301	3.7	2,693	2.6	8,171	15.9
Respite care	33	19.8	5	0.6	8	5.0	8,074	13.0	461	0.4	4,387	8.5
Assistance for challenging behaviors - DD	26	15.6	3	-*			8,739	14.1	291	0.3	145	0.3

* Percentages are not calculated when number < 5.

Considering all 29 possible services, analysis was conducted to determine whether people with a TBI-related hospitalization who were also receiving CMH services tended to receive a wider variety of CMH services than people with no identified TBI. The number of different CMH services each individual had throughout the four-year period was counted. Individuals classified as DD tended to receive the greatest number of services and children with mental illnesses the least number of services. As shown in Table 3.7, adults with a TBI hospitalization classified as MI received close to four different CMH services on average, whereas their counterparts with no identified TBI received closer to three different CMH services on average. In the service categories, DD and MI-children, average differences in the number of services received by those with and without a TBI hospitalization were slight.

Table 3.7. Average number of different CMHSP services received during FY1999-2002

	DD			MI-Adults			MI-Children		
	n	Ave.	S.D.	n	Ave.	S.D.	n	Ave.	S.D.
TBI Hospitalization	167	5.2	3.2	850	3.8	2.4	161	2.8	1.6
No identified TBI	62,177	5.1	2.6	104,841	3.1	2.0	51,360	2.5	1.5

Discussion

The data presented here provide a first look into public service use by people with TBI in Michigan. Approximately 18,000 individuals receive direct TBI-related services per year through Medicaid FFS and/or MHP. Also, we now have a bottom estimate for the cost to Medicaid FFS (*only*) of over \$11 million per year spent on services for TBI. (In other words, these are only the identified costs – the limitations of the data analyzed prohibit identifying complete TBI-related costs.) Based on provider categories presented here, it appears that much of that amount is spent on acute care rather than post acute or community based care. However, it is very likely that many of the long-term costs of caring for people with TBI are not captured in this analysis because claims for those services may not contain complete diagnostic coding. *Note also that the \$11 million figure does not include costs for the 65% of Medicaid clients with a TBI who are enrolled in a MHP.*

In order to better understand long-term costs for those individuals with serious TBI, all claims were analyzed for a subset of cases: those with a TBI hospitalization, two continuous years of Medicaid eligibility, and costs paid for by FFS. Once these selection criteria were imposed on the data, 166 cases were identified – who no doubt had the most serious, debilitating injuries. First year Medicaid FFS costs for these 166 people were in excess of \$6 million. Second year costs were \$1.7 million. Forty-three percent of all second year costs were spent on the 10% of the group that required nursing home services.

Analysis also shows that about 4% of all Medicaid beneficiaries with an identified TBI used Home Help services sometime during October 1, 2000 – September 30, 2002. In FY2002, Home Help costs for the 2,869 individuals with a TBI totaled over \$9 million.

In terms of CMH service use, nearly 19% of Medicaid beneficiaries with an identified TBI accessed CMH services during the four years analyzed. This amounts to about 5% of the total CMH population served during this four-year period.

In order to have a better understanding of Home Help and CMHSP service use by a more uniform group of TBI survivors, those with an identified TBI hospitalization were analyzed separately.

- About 12% of individuals with a TBI hospitalization accessed Home Help during the years analyzed
- About 22% of individuals with a TBI hospitalization accessed a CMH during the years analyzed.

