The Outcomes of Trauma for Older Adults

Shaun M. McMillan

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THE OUTCOMES OF TRAUMA FOR OLDER ADULTS

by

Shaun M. McMillan

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Sociology

Western Michigan University
Kalamazoo, Michigan
June 2002
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2002
ACKNOWLEDGMENTS

I would like to thank my thesis committee for allowing me to finish my degree after a substantial lapse in time! Their time and effort is greatly appreciated. I am thankful to attend a college with talented professors that have a vested interest in their students and completion of degree requirements. My sincere and heartfelt thanks to Dr. Van Valey, Dr. Sonnad (aka Shoebox) and Dr. Hartmann.

Special thanks to the Bronson Methodist Hospital Trauma Care Unit nurses, Sally, Amy and Karla for their work in providing the data for this study. They were an amazing team!

In addition, upon reading this thesis, it is important to bear in mind that it was written by an applied sociologist. There are references to sociological theory, however much of the emphasis was placed upon public health literature application for implementation of prevention programs and what public policy makers and health care professionals should do to prevent such trauma for this age cohort.

This thesis was written in honor of my dad.

Shaun M. McMillan
THE OUTCOMES OF TRAUMA FOR OLDER ADULTS

Shaun M. McMillan, M.A.
Western Michigan University, 2002

Previous sociological and public health studies were analyzed to determine the effects of age, gender, mechanism of injury (fall or motor vehicle crash accident), severity of the injury, length of stay and injuries sustained on three binary response variables of discharge disposition (discharged home, expired, or transferred to a rehabilitation facility) of older adult trauma patients. Three multiple logistic regression models were analyzed to handle the multiple predictors for the three binary response variables of discharge disposition. Over one-half (56%) of respondents were discharged home, whereas one in four patients were transferred to a rehabilitative facility, while the remaining 19% expired. Findings from the logistic regression models generally supported the study hypotheses. For instance, hospital length of stay was inversely associated with mortality and being sent home, but positively associated with a transfer to rehabilitation. These and other findings are discussed with the relation and contribution to the sociological and public health literature. Implications of the findings for policy makers are also discussed.
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CHAPTER ONE

INTRODUCTION

Older Adult Health-Related Issues

A well-known reality is that life expectancy for most Americans is steadily increasing (Dandan, 1992). Currently, one in every eight Americans, or 12.7% of the U.S. population is aged 65 or older (Administration on Aging, 1995). By the year 2020, 52 million Americans will be 65 or older, and the number is expected to increase to 68 million by the year 2040 (Dandan, 1992 and DeMaria, 1993). Meanwhile, persons 85 years of age and older will amount to 6.7 million by the year 2020 and increase to 12.2 million persons by the year 2040, doubling in size (Schwab, 1992).

Because of the rise in life expectancy for the older adult population, various types of physical trauma for this age cohort will increase (n.b. The term ‘trauma’ will be used to indicate physical trauma from this point forward in the thesis). Trauma includes any form of injury to the human body (DeMaria et al., 1987). Over 800,000 older adults utilize trauma services in the United States and are typically hospitalized for these injuries (Gubler, 1996 and Martin & Teberian, 1990). Trauma accounts for the fifth most common cause of death in people over the age of 65 (Schwab, 1992 and...
Martin & Teberian, 1990), and 28% of all older adults will die in some form of trauma (DeMaria, 1993).

The medical field, as well as other medical specialties and sub-specialties will continue to address issues facing older adults who utilize trauma services. Older adults who are injured differ physically, socially and emotionally from those who are injured when they are younger. It takes an increased amount of time for an older adult to recover from these injuries sustained in the hospital, and their bodies heal slower than younger adults. The evaluation of the older patient is critical to the assessment of their physical condition; this allows the physician to evaluate what the older adult has the capacity to perform and how he/she maintains this activity (Foley et al., 1990).

Older persons' injuries due to trauma may have different outcomes than the injuries experienced by their younger counterparts. Often, these patients have decreased functional capabilities and decreased muscular strength (Martin & Teberian, 1990 and DeMarest et al., 1990), which can result in disability and possible death (McLellan, 1997). Also, there are physiological, psycho-social and other age-related changes that affect an older adult's body (Rowe, 1985). For example, older adults may require longer hospitalizations for their injuries than younger adults. As a result of the increased length of stay, this yields higher costs for older adults. Indeed, these patients account for one-third of all trauma expenses (Gubler et al., 1996, DeMaria, 1993 and Martin & Teberian, 1990). It is necessary for trauma physicians to
treat the causes of and responses to injuries differently. The likelihood of a positive prognosis for full functional ability after a trauma injury is positive when the older adult patient is treated efficiently and aggressively (DeMaria et al., 1987).

More older adults who attempt to achieve better health and maintain healthy lifestyles will continue in many of the same activities or lifestyle as they did in their younger years. With this increase in activity, older adults may also be more susceptible to higher risk of injury, or even death. Currently, older adults account for 27.9% of deaths due to accidental causes (including falls, motor vehicle or pedestrian accidents, burns, or assault) (Schwab, 1992). The next section will discuss such trauma injuries for this age cohort.

Older Adult Injuries

Injuries are the fifth largest cause of death within the older adult population. Two of the major causes of these injuries for persons aged 65 and older are falls and motor vehicle accidents (Haber, 1994). Falls are the most frequent cause of injury for those 75 and over and the second most prevalent injury for those aged 65-74 years of age. Also, those 65 and older constitute 10.8% of all those involved in a motor vehicle crash (AAA, 1995). Because of the projected increase in the size of the older adult population in our nation, there will undoubtedly be a rise in the number of individuals requiring medical services to treat these forms of trauma. Preventative
care and intervention must be implemented for the older adult population in order to
decrease the numbers of persons utilizing trauma services (Gubler et al., 1996).

As the Baby Boomers continue to age, the numbers of trauma injury are
expected to rise (Graham & Firth, 1992). This age cohort will continue to live
independently as long as possible and meet their daily life needs. Therefore, they may
continue to live as they did when they were younger. This could lead to an increase in
accidents for this group if slight changes are not made in their lifestyles.

Health Promotion and Injury Prevention

Because injuries are the fifth leading cause of death in the older adult
population, preventative measures should be made for the two most common injuries
this age cohort faces, i.e., falls and motor vehicle accidents (Haber, 1994). Public
policymakers will need to provide more programs and educational material for this
age cohort. The field of public health must assist this population and provide
awareness for the prevalence and prevention of these injuries.

Socio-environmental factors play a large role in dealing with health promotion
among older adults (Kaplan, 1993). Individuals are living longer, healthier lives and
they recognize the importance of staying healthy and preventing possible injuries.
With only 5% of older adults institutionalized, preventative care should start in the
outpatient or community setting in order to prevent admission to the hospital or long-
term care institutions (Levkoff et al., 1996). Because of the recent shift in providing health promotion programs and preventative care to older adults, through healthy lifestyle changes, this can lead to a healthier aging process (Rakowski & Hickey, 1992).

Strategies for injury and disease prevention in the older adult population are a continued concern. Persons 65 and older are living longer, healthier and more independent lives through injury and disease prevention mechanisms. Such mechanisms include promoting knowledge of risk factors, using tutorials or programs explaining injury prevention efforts, and providing programs within the community which offer useful information about disease and injury prevention (Levkoff et al., 1996).

There are a growing number of health promotion and injury/disease prevention programs intended for older adults. Most of these programs incorporate some type of model or intervention strategy in the prevention of accidents more common to this population (Campanelli, 1990, Caserta, 1995, Hermanova, 1995, Hornbrook et al., 1993, Levkoff et al., 1996, Long, 1990, Reuben et al., 1996 and Wagner et al., 1991). These programs are important given the rising health care costs for older adults, as it is important to maintain a healthy lifestyle in order to prevent illness or disease (Campanelli, 1990).

According to some health care professionals, additional plans should be
developed for the protection of older adults against injuries (Campion, 1996). It is important for older adults to become aware of environmental hazards and preventative measures. In addition, they should recognize the types of circumstances that could lead to an injury. For example, exercise programs and other preventative plans lead to a healthy lifestyle and better chance of survival if an accident occurs. In fact, there are a growing number of older adults involved in weight training exercises in order to regain strength, as well as to maintain appropriate balance and movement. However, for older adults living alone, getting help can be difficult in case an accident happens. It is recognized that these individuals are at high risk. Assisted-living facilities should be made an option for this age cohort to aid in the prevention of injury for those currently living alone (Campion, 1996).

Such health promotion interventions suggest the possibility of an older adult having a minimal decline in functional activities. This minimal decline is called "successful aging" by some health professionals (Wagner et al., 1991). Many lifestyle factors for the older adult can be modified so successful aging can be achieved (Wagner et al., 1991) thus allowing older adults to maintain as much independence with their active lifestyles as possible (Kaplan, 1993).

In sum, because of this increase in life expectancy, there will be a greater need to address the seriousness of trauma related injuries that plague this age cohort. In addition, it is important to provide public health information to the older adult
population. Lifestyle changes and physical activities, including exercise, can decrease the number of accident or hospital-related injuries for this age cohort (O'Brien et al., 1990). This thesis will focus on the motor vehicle accidents and falls as they relate to the outcome of trauma. The next chapter will provide further discussion about how falling and motor vehicle accident trauma affect an older adult’s outcome with respect to discharge disposition.
CHAPTER TWO

OUTCOMES OF DISCHARGE DISPOSITION

Previous Research Surrounding Falls and Motor Vehicle Accidents

From previous medical research, falls appear to be the primary type of accident within the home and leading cause of injury and mortality (Graham & Firth, 1992, Alexander et al., 1992, Edwards et al., 1993 and Grisso et al., 1990). The literature about falling indicates that over half of older adults aged 65 and older will have an injury from a fall (Alexander et al., 1992 and Graham & Firth, 1992).

Falls account for 70% of the deaths from accidents in the older adult population (Schwab et al., 1992) and falling may lead to decreased independence, restricted mobility, fear of falling and lack of confidence (Alexander et al., 1992). In addition, most falls are from level surfaces (Schwab, 1992). About 50% of older adults will have a fall accident after age 80 (Dunn et al., 1992). It was found in a study that pre-existing illness or disease and functional disorders increase the risk of falling (Dunn et al., 1992). Falls from height may also occur with more independent living older adults; these persons receive multiple injuries as well (Schwab et al., 1992).
Discharge planning has become an important role for hospitals in the release of older adult patients (Wachtel et al., 1987). The longer length of stay for these patients increases their health care costs, and efficient discharge planning would result in possible reductions in costs for this population (Wachtel et al., 1987). The functional status of older adult patients appear to be a primary predictor in determining the discharge disposition for this population (Wachtel et al., 1984).

Rockwood (1989) found from 80 adults aged 65 and older that patients whose discharge was delayed from the hospital were older, had a mental condition such as dementia, were admitted from a long-term care facility or required transfer to such institutions and were dependent upon family or health care workers in functioning. Pre-existing conditions were not examined as a study variable in the scope of this thesis. Further research should be conducted to test these findings.

Other studies examined the long-term outcomes for older adult patients upon discharge from the hospital. DeMaria et al. (1987) found that patients who were transferred to a nursing home were more likely to be older, have severe neck, head and abdominal trauma injuries, and require some sort of surgery after their trauma incident. Of the 63 older adult patients studied, 89% returned to full functional capability post-trauma. These patients were younger, had shorter length of stay in the hospital and did not suffer as many complications as the patients transferred to a nursing home (DeMaria et al., 1987).

It has also been found that a very small number of trauma deaths occur post-
discharge (Morris et al., 1990). Over 50% of all individuals who expire do so before their re-admission back into the hospital (Morris et al., 1990). Other medical literature on older adult injury pertains to recurrent trauma incidents and what interventions should be made to prevent readmission for this population (Gubler et al., 1996).

Outcome of Injuries from Falls

Nationwide, falls are the most prevalent trauma cause among older adults, accounting for 40.6% cases according to one study (Champion et al., 1989). Falling is the most common cause of injury, leading to 30% of patient deaths (Cayten et al., 1991 and Haber, 1994). Many older adults fall each year and these accidents often lead to hospitalization, extended lengths of stay and limited movement for indefinite amounts of time (Bobb, 1993 and Edwards et al., 1993). Older adults living at home are at great risk for falling, and up to 75% of falls occur in the home (Haber, 1994). Hip fractures were the most common form of injury from falls, but fractures in the legs, arms, wrist and head also occur (Bobb, 1993). Falls from level surfaces appear to be less severe and occur more in the home than falls from a height, which tend to occur outside the home and result in more severe injury (Bobb, 1993). Most of these injuries result in death for older adults, and their mortality rate is extremely high compared to younger age cohorts (Haber, 1994).

In another study, discharges were analyzed and the authors found that 81.6% of persons 65 and older went home, 8.9% expired and the remainder were transferred
to nursing homes. Being female, over 85 years of age, and having mental illness were good predictors of transfer to nursing homes (Kane et al., 1983). Similarly, Lamont et al. (1983) found that increased lengths of stay in the hospital, transfer to nursing home or death were associated with age greater than 85 with comorbid mental disease. Also, it was found that older adult males with mental conditions were more frequently discharged home (Wachtel et al., 1984).

In older adults hospitalized for hip fracture injury, outcome at discharge for older patients who had shorter length of stay and less physical therapy were most likely to go to a rehabilitation facility than directly home post-injury (Myers et al., 1996).

In a study conducted by Dandan et al. (1992), pre-existing illness did not affect mortality, but did increase the number of medical complications. It was also found that the mortality of the older adult patients was 17% whereas 47% were discharged home and 36% were transferred to a nursing home (Dandan et al., 1992).

It was found that older adults admitted for fall injuries were discharged to nursing homes or facilities more often than other older adults admitted for other forms of trauma (Alexander et al., 1992 and Edwards et al., 1993). It was found that 36% of older adult trauma victims were transferred to a nursing home and 47% returned to independent living.

In a study conducted by Alexander et al. (1992), they found that older adults admitted for hospitalization constituted 5.3% for fall-related trauma and hospital
charges over $53 million. They also found that about 42% were transferred to a nursing home facility (Alexander et al., 1992).

The mortality rate for older adults is correlated with age and comorbidity. In a study conducted by Morris et al. (1990), the mortality rate increased for low falls if the older adult patient was male and had a pre-existing condition or suffered injuries to the head or abdominal regions. They found this relationship occurred once male patients turn 40 and death was influenced by those characteristics (Morris et al., 1990).

From the study conducted by Cayten et al. (1991), they evaluated deaths from trauma admissions. They found that 12% of the deaths studied were preventable and these preventable deaths did not differ by age or mechanism of injury. Hip fracture patients were found to increase mortality rate, especially if these patients had other pre-existing conditions. Also, early diagnosis and treatment for severe head trauma patients was a problem in identifying these cases, but there were fewer problems in the diagnosis and treatment of abdominal injuries (Cayten et al., 1991).

Hip fractures are a severe condition that correlate with mortality rates for older adults. About 1% of fall victims suffer from a hip fracture and half of those victims will have a 5-year mortality rate (Haber, 1994). Orthopedic injuries from minor falls are common. About 80% of older adults sustaining a hip fracture have osteoporosis and the rate of bone density loss for older women increases 9-10% every ten years (Levy et al., 1993). In determining the occurrence of hip fractures, Cumming et al.
(1994) studied older adult patients' histories of falling and characteristics that might be associated with a hip fracture. They found a significant relationship between the number of falls reported in the previous year and increased chance of hip fracture. There was an increase for falls that resulted in hip fracture for men over women, as well. This could have been due to the small number of cases under study. It was also found that falling while in a turning position led to hip fractures more than walking in a straight direction and falling (Cumming et al., 1994). Further research should be conducted regarding the incidence of falls and repeated hip fractures, especially with reference to older adults nutritional status and frequency of exercise.

Falls and related falling trauma accidents increase with age due to dizziness/vertigo, fear of falling/fall anxiety, balance and gait disorders, foot disorders, cognitive impairment, medication usage, vision and hearing problems, osteoporosis, arthritis, dementia, physiological weakness and pre-existing illness/disease (Burker et al., 1995, Dunn et al., 1992, Edwards et al., 1993, Graham & Firth, 1992, Haber, 1994, McIntosh et al., 1993, McMurdo et al., 1991, Salgado et al., 1994, Sheahan et al., 1995 and Van Dijk et al., 1993). It was also found by Edwards et al. (1993) that most falls occurred when the older adult was taking four or more different kinds of medications and if they had fallen in the past year. Falls appear to be more prevalent with increasing age (Day et al., 1994).
Motor Vehicle Accidents and Mortality

Older adult drivers are increasing both in numbers and in the amount of miles driven (Goggin & Keller, 1996). Adult drivers aged 65 and older comprise 14.8% of the licensed drivers in the state of Michigan. Motor vehicle accidents are more prevalent among this age cohort in our society and older adults have a lower chance of survival in comparison to younger adults (McCoy et al., 1989). In fact, motor vehicle accidents are the primary cause of death for drivers aged 65-74 and the second major cause of death for drivers over 75 (Persson, 1993).

Vision and physical capabilities used when driving start to decline after age 55 and decrease tremendously after age 75. Operating a vehicle demands fully intact senses, the ability to process information, and certain psycho-motor skills. There has been evidence of older adult drivers not having the appropriate abilities to drive and this may account for a majority of motor vehicle accidents (Kennie, 1993 and Persson, 1993). It was found that women experience more age-related changes in functional abilities than men; this is particularly true for psycho-motor skills (Laux et al., 1990). It is possible that women may experience more difficulty in driving in their later years than men (Laux et al., 1990).

Physiological changes in the older adult body can affect their driving capabilities (Haber, 1994). Flexibility of the head while checking for cars behind becomes difficult because of arthritis or other debilities. Slower reflexes and
decreased visual acuity in situations involving glare and night driving make older adults prime candidates for becoming involved in motor vehicle crashes (Haber, 1994).

The next section will focus on how the outcome of trauma from motor vehicle accidents affect the older adult with respect to discharge disposition.

Outcome of Injuries from Motor Vehicle Accidents

Young and older drivers have high numbers of motor vehicle crash incidents (Williams & Carsten, 1989). Motor vehicle accidents account for about 28.2% of all fatalities from older adult injuries (Champion et al., 1989). While older adult drivers do drive less frequently than all other age groups, they appear to be driving more than in past years. After 60 years of age, the number of crashes, injury severity and mortality rates all increase. Once drivers reach age 75, the more miles they travel, the higher the likelihood of an accident to occur (either for fatal or non-fatal accidents). The older adult driver accounts for 13% of all national traffic fatalities in the United States (Kennie, 1993).

In a study conducted by McCoy et al. (1989), older adult passengers and drivers of motor vehicles were more likely to sustain injuries to the head or lower extremities, rather than to any other part of the body. These individuals were more likely to sustain a serious injury for any road traffic accident. These injuries were also more severe in comparison with those experienced by younger age groups. The
median injury severity score (ISS) for expired older adult patients was 31, whereas it was 50 for the under-65 individuals. This is much too low for older adults, considering the scale goes up to 75 (ultimately meaning death). The mortality rate for older adults was 11% over age 70 and 1% for those persons under 20 years of age. Motor vehicle occupants constituted 11% of chest injuries from wearing seatbelts compared to the 20-30 year old group at 1.5%. Pre-existing illness or disease compounded by trauma resulted in most of the older adult patient deaths. Death rates for older adults with less severe injuries were higher than their under 65 counterparts (McCoy et al., 1989).

Motor vehicle accident injuries are also more severe than fall injuries and therefore tend to include multiple injuries to the body. Musculoskeletal, abdominal, thoracic and central nervous system injuries are predominant in these types of vehicle accidents (Bobb, 1993).

Previous literature about older adult drivers focused on understanding medical conditions that could possibly affect driving (Cooper et al., 1993, Dubinsky et al., 1992, Foley et al., 1990, Koepsell et al., 1994, McCloskey et al., 1994 and Warner, 1996). Drivers with dementia were reported having five times as many motor vehicle crashes as dementia-free individuals of the same age (Kennie, 1993). Older adults with Alzheimer’s Disease had problems in their motor skills and judgment, for any degree of difficulty (Dubinsky et al., 1992).
Older adults with certain conditions have posed concern for family members and health care providers regarding driving. When driving, one uses many different motor and mental skills, simultaneously. Making decisions while driving can be difficult and sometimes confusing. Older adults with Alzheimer’s Disease, dementia, cognitive impairment, and other forms of mental illnesses appear to be at higher risk for accidents than other individuals without these conditions (Dubinsky et al., 1992).

From a thorough review of the medical and sociological literature based on discharge disposition in the older adult population, the following hypotheses are tested:

1. Being older will be negatively associated with being discharged home, but positively associated with mortality and transfer to a rehabilitation facility.
2. Being female will be positively associated with being discharged home and to a rehabilitation facility, but negatively associated with mortality.
3. Injuries sustained to the head, neck, thorax, abdomen and lower extremities will be associated with a greater likelihood of mortality. There will not be any association with being discharged home or transfer to a rehabilitation facility.
4. More severe injuries will be positively associated with both death and transfer to a rehabilitation facility, but negatively associated with being discharged home.
5. Longer lengths of hospital stay will be positively associated with discharge to a rehabilitation facility, negatively associated with discharge to home and mortality.

6. Motor vehicle accidents will be negatively associated with being discharged home and to a rehabilitation facility, compared to those who have fallen from level surfaces. There will not be any association with mortality.

7. Falls from heights compared to falls from level surfaces will be positively associated with being discharged both home and to a rehabilitation facility. There will not be any association with mortality.
CHAPTER THREE

METHODS

Population and Sample

The participants used for this thesis were all older adult patients (i.e., age \( \geq 65 \)) from the Bronson Methodist Hospital Trauma Registry in Kalamazoo, Michigan from 1 January 1994 to 31 December 1996. The trauma registry provides information on those individuals admitted to the Trauma Care Unit (TCU) of the hospital. The registry includes, but is not limited to, such details as gender, age, date admitted, length of stay, injury severity score, discharge status and type of trauma. For the purpose of this thesis, information was available for 164 total number of cases. This number contains all older adults who were admitted to the hospital’s TCU after experiencing a fall (either from a level surface or from heights), motor vehicle crash accident, or a pedestrian accident.

During the time period of the study, a small number of patients (13) who entered the TCU sustained injuries from pedestrian accidents. Therefore, these 13 cases were deleted from the analysis, leaving the sample size for the present thesis at \( n=151 \). Table 1 shows all study variables, their coding schemes, their means or proportions, and standard deviations (if applicable). A brief description of the study variables follows.
Table 1
Variable Descriptions, Scoring, Means, and Standard Deviations (N=151).

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Mean or Proportion</th>
<th>Standard Deviation</th>
</tr>
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<tbody>
<tr>
<td>Age (65-95)</td>
<td>76.4</td>
<td>7.3</td>
</tr>
<tr>
<td>Gender (1=Female, n=88)</td>
<td>0.58</td>
<td>-</td>
</tr>
<tr>
<td>Mechanism of Injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Vehicle Crash (n=97)</td>
<td>0.64</td>
<td>-</td>
</tr>
<tr>
<td>Falls from Heights (n=27)</td>
<td>0.18</td>
<td>-</td>
</tr>
<tr>
<td>Falls from the Same Level (reference category)</td>
<td>0.18</td>
<td>-</td>
</tr>
<tr>
<td>Injuries Sustained</td>
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</tr>
<tr>
<td>Head (1=Yes) (n=82)</td>
<td>0.54</td>
<td>-</td>
</tr>
<tr>
<td>Neck (1=Yes) (n=38)</td>
<td>0.25</td>
<td>-</td>
</tr>
<tr>
<td>Thorax (1=Yes) (n=63)</td>
<td>0.42</td>
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<tr>
<td>Abdomen (1=Yes) (n=18)</td>
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<td>Lower Extremity (1=Yes) (n=48)</td>
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<td>Injury Severity Score (1-43)</td>
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<td>Injury Severity Score (1-8) (reference category) (n=36)</td>
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<td>Injury Severity Score (25-43) (n=21)</td>
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<tr>
<td>Hospital Length of Stay days (0-58)</td>
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<td>Discharge Disposition</td>
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<tr>
<td>Discharged Home (n=82)</td>
<td>0.54</td>
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</tr>
<tr>
<td>Mortality (n=28)</td>
<td>0.19</td>
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</tr>
<tr>
<td>Transfer to Rehabilitation Facility (n=41)</td>
<td>0.27</td>
<td>-</td>
</tr>
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</table>
Measures

Independent Variables

1. Age. Age was assessed in years. The minimum age of respondents was 65, while the maximum was 95 years of age. The average age of respondents was 76.4 years, a median of 76.00, and a standard deviation of 7.3 years.

2. Gender. Gender was coded as a dummy variable (Female=1 and Male=0). A majority (58%) of the respondents were female.

3. Mechanism of Injury. The mechanisms of injury included whether or not the patient suffered a motor vehicle crash accident (1=yes and 0=no), or a fall from both heights (1=yes and 0=no) and from a level surface (1=yes and 0=no). A majority (64%) suffered a motor vehicle crash (MVC), another 32% suffered from a fall, with 18% each experiencing a fall from both heights and level surfaces. For the purposes of the multiple logistic regression analyses listed below, “falls from level surface” was used as the referent category.

4. Injuries Sustained. The specific type of injury's sustained refers to the type of injury that a participant could experience from the trauma incident. It included an injury to the head, neck, thorax, abdomen, and lower extremity. Each type of injury was used as a dummy variable where 1 indicated that the injury occurred and 0 indicated that it did not. Over one half (54%) experienced a head injury, while 42% sustained an injury to the thoracic region. Approximately one-third had a lower extremity injury, whereas one in four suffered a neck injury. Only 12% had an
abdominal injury.

5. Injury Severity Score (ISS). The ISS assesses the level of severity to the injury that the patient experienced. The ISS is defined as the sum of the squares of the maximum Abbreviated Injury Score (AIS) of the three most severely injured body regions and has shown to correlate well with mortality (Baker et al, 1976). The ISS includes six body regions in totaling this score. The body regions include the head or neck, face, chest, abdominal or pelvic contents, extremities or pelvic girdle and external injuries. Either trauma physicians and nurses or computer calculate this score to assess a patient’s injuries. The score ranges from 1 to 75. The higher the score, the more severe the injury. In the present study, the minimum ISS score was 1, while the maximum was 43, with a mean of 14.0, a median of 12.5 and a standard deviation of 8.3.

To be consistent with recent research (e.g., see Covington et al., 1993 and Gubler et al., 1996) and to better assess the ISS relationship with discharge disposition, the ISS was divided into four categories: ISS=1-8; ISS=9-15; ISS=16-24; ISS=25-43. For the multivariate analysis, ISS was measured by creating three dummy variables that reflect the latter three categories. ISS one through eight served as the referent category. One-third had an ISS of 9-15, followed by nearly three in ten (29%) with an ISS of 16-24. Approximately 24% had an ISS of 1-8, while 14% had an ISS of 25-43, the most severe category.

Length of Stay (LOS). Length of stay reflects the total number of days each patient
stayed at Bronson Methodist Hospital in the Trauma Care Unit (TCU). This does not include the amount of time the patient spent in the emergency room or any stay elsewhere in the hospital. The LOS ranged from 0 to 58 days, with a mean of 6.6, a median of 4.0, and standard deviation of 7.8.

**Dependent Variable**

1. Discharge Disposition. The disposition of each of the patients upon discharge was indicated by what happened to the patient during their stay in the Trauma Care Unit at Bronson Methodist Hospital. Three different discharge dispositions were recorded for each patient: 1) discharged home (1=yes and 0=no), 2) transferred to a rehabilitation facility (1=yes and 0=no) and 3) mortality (1=yes and 0=no). Just over one-half of the patients (54%) were discharged home, 27% were sent to a rehabilitation facility, while the remaining 19% expired. The category ‘transferred to a rehabilitation facility’ encompassed those patients who were transferred to an acute care facility, intermediate or residential facility, inpatient rehabilitative care, or skilled nursing facility.

**Analyses**

Listed below are the multivariate results from the three logistic regression models. In logistic regression, the dependent variable is the natural log of the odds of a given response category (Hosmer & Lemeshow, 1989). The log odds are transformed into odds ratios, or exponentiated regression coefficients, allowing for an easier form of interpretation. The odds ratio (OR) represents the relative change in the
odds of either being sent home, expiring, or transferring to a rehabilitation facility given a one-unit increase in the independent variable, adjusting for all other variables in the model. Odds ratios involving ordinal- or interval-level independent variables are interpreted as the odds of being sent home, for example, with each unit increase in the independent variable. The independent variables were force-selected into the logistic regression models, and list-wise deletion was performed for missing data. Remarkably, only one case had missing data and was deleted from the analysis. Therefore, the final sample size for the multivariate analysis was 150. Furthermore, standardized statistical techniques were employed to assess the assumptions of logistic regression. No violations of assumptions occurred.

This study has several limitations. First, there was a small population size of older adults studied that led to limited statistical ability. Second, there may have been other differences, such as pre-existing conditions affecting mortality, but they could not be identified as this was not a study variable for this thesis. In addition, the subjectivity when determining the ISS may have been a limitation within the context of this study. Whether or not human or computer-generated scores, there is an uncertain amount of bias when these scores are created. Accurate and consistent application of this score should be utilized to prevent such bias. Also, due to the small sample size, race/ethnicity variables could not be analyzed. There is sparse literature regarding race and trauma outcome; this thesis would have been even more significant to public health professionals had this data been available for study.
CHAPTER FOUR

FINDINGS

Multiple Logistic Regression Models

Tables 2 through 4 present the findings from the multiple logistic regression models designed to evaluate the impact of age, gender, mechanism of injury (motor vehicle crash, falls from heights, and falls from same level), severity of injury, and hospital length of stay on the probability of being discharged home, mortality, and discharged to a rehabilitation facility, respectively. In addition to the impact of these variables, Table 3 incorporates the effects of type of injury sustained. Tables 2 through 4 present the odds ratios (ORs), the 95% confidence intervals (CIs), and the p-values for each independent variable.

1. Hypothesis 1. Being older will be negatively associated with being discharged home, but positively associated with mortality and transfer to a rehabilitation facility.

The results of the multiple logistic regression analysis found in Table 2 showed that each one-unit (one year) increment in age was associated with a 7% decrease in the likelihood of being discharged home (95% CI = .87-.98; p = .013). Table 3 shows that each one-unit increment in age was associated with a 13% increase in the odds of mortality (95% CI = 1.03-1.26; p = .015). Age was not significantly associated with
being discharged to a rehabilitation facility (OR = 1.03; 95% CI = .72-2.53; p = .291) (see Table 4).

2. Hypothesis 2. Being female will be positively associated with being discharged home and to a rehabilitation facility, but negatively associated with mortality. Results located in Table 4 demonstrated that women, as compared to men, were two and a half times more likely to have been discharged to a rehabilitation facility (95% CI = 1.02-6.17; p = .047). The findings regarding the relationship between gender and both mortality and being discharged home were not statistically significant.

3. Hypothesis 3. Injuries sustained to the head, neck, thorax, abdomen, and lower extremities will be associated with a greater likelihood of mortality. There will not be any association with being discharged home or transfer to a rehabilitation facility. Injuries to the head, neck, thorax, abdomen, and lower extremities were not significantly associated with a greater likelihood of mortality.

4. Hypothesis 4. More severe injuries will be positively associated with both death and transfer to a rehabilitation facility, but negatively associated with being discharged home. Respondents who scored between a 25 to 43, (the most severe injuries), on the ISS relative to those who scored between a 0 and 8, (the least severe injuries), were less likely to be discharged home (OR=.01; 95% CI=.001-.08; p=.000)(see Table 2). Table 3 showed that an ISS of 16-24 and an ISS of 25-43 was associated with a greater likelihood of death (OR=22.56; 95% CI=2.03-252.14;
p=.012; OR=914.66; 95% CI=45.60-18,398.05; p=.000, respectively) relative to the ISS of 0-8. The findings regarding injury severity as positively associated with transfer to a rehabilitation facility was not statistically significant (see Table 4).

5. Hypothesis 5. Longer lengths of hospital stay will be positively associated with discharge to a rehabilitation facility, but negatively associated with discharge to home and mortality. Each one-unit increment in hospital lengths of stay was associated with a decrease of 13% and 10% in the odds of being discharged home (95% CI = .79-.95; p = .002) and mortality (95% CI = .82-1.00; p = .056), respectively (see Table 2 and Table 3). As expected, each one-unit (one year) increment in hospital lengths of stay was associated with an 18% increase in the likelihood of being discharged to a rehabilitation facility (95% CI = 1.08-1.27; p = .000).

6. Hypothesis 6. Motor vehicle accidents will be negatively associated with being discharged home and to a rehabilitation facility, compared to those who have fallen from level surfaces. There will not be any association with mortality. Motor vehicle crash accidents compared with falls from the same level were associated with a 238% increase in the odds of being discharged home (95% CI = 1.12-10.28; p = .031) (see Table 2). The findings regarding the relationship between motor vehicle crash accidents and being discharged to a rehabilitation facility was not significant (OR = .44; 95% CI = .14-1.34; p = .144) (see Table 4).

7. Hypothesis 7. Falls from heights compared to falls from level surfaces will be positively associated with being discharged both home and to a rehabilitation facility.
There will not be any association with mortality. Tables 2 and 4 showed that falls from heights compared to falls from level surfaces were not significantly associated with being discharged home and to a rehabilitation facility.

Table 2

Odds Ratios for Older Adults' Likelihood of Being Discharged Home (Multiple Logistic Regression)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Discharged Home</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.93</td>
<td>.87-.98</td>
<td>.013</td>
</tr>
<tr>
<td>Female</td>
<td>.61</td>
<td>.26-1.42</td>
<td>.306</td>
</tr>
<tr>
<td>Mechanism of Injury</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Vehicle Crash</td>
<td>3.38</td>
<td>1.12-10.28</td>
<td>.031</td>
</tr>
<tr>
<td>Falls from Heights</td>
<td>2.05</td>
<td>.52-8.17</td>
<td>.306</td>
</tr>
<tr>
<td>Falls from Same Level</td>
<td>Reference Category</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Injury Severity Score (ISS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS (1-8)</td>
<td>Reference category</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>ISS (9-15)</td>
<td>.41</td>
<td>.13-1.32</td>
<td>.137</td>
</tr>
<tr>
<td>ISS (16-24)</td>
<td>.45</td>
<td>.13-1.57</td>
<td>.214</td>
</tr>
<tr>
<td>ISS (25-43)</td>
<td>.01</td>
<td>.001-.08</td>
<td>.000</td>
</tr>
<tr>
<td>Hospital Length of Stay</td>
<td>.87</td>
<td>.79-.95</td>
<td>.002</td>
</tr>
</tbody>
</table>

Note. OR = odds ratio; CI = confidence interval. \(^{a}n=150\)
Table 3
Odds Ratios for Older Adults' Likelihood of Mortality (Multiple Logistic Regression)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Mortality a</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.13</td>
<td>1.03-1.26</td>
<td>.015</td>
</tr>
<tr>
<td>Female</td>
<td>.63</td>
<td>.17-2.34</td>
<td>.489</td>
</tr>
<tr>
<td>Mechanism of Injury</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Vehicle Crash</td>
<td>.30</td>
<td>.05-1.86</td>
<td>.196</td>
</tr>
<tr>
<td>Falls from Heights</td>
<td>.92</td>
<td>.15-5.70</td>
<td>.925</td>
</tr>
<tr>
<td>Falls from Same Level</td>
<td>Reference Category</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Injury Severity Score (ISS)</td>
<td>Reference Category</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>ISS (1-8)</td>
<td>Reference Category</td>
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<td>-</td>
</tr>
<tr>
<td>ISS (9-15)</td>
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<td>.21-30.27</td>
<td>.467</td>
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<td>2.03-252.14</td>
<td>.012</td>
</tr>
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<td>ISS (25-43)</td>
<td>914.66</td>
<td>45.60-18398.05</td>
<td>.000</td>
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<tr>
<td>Hospital Length of Stay</td>
<td>.90</td>
<td>.82-1.00</td>
<td>.056</td>
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<td>Types of Injuries Sustained</td>
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<td></td>
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<tr>
<td>Head</td>
<td>.46</td>
<td>.11-1.93</td>
<td>.289</td>
</tr>
<tr>
<td>Neck</td>
<td>2.49</td>
<td>.56-11.02</td>
<td>.230</td>
</tr>
<tr>
<td>Thorax</td>
<td>1.05</td>
<td>.18-5.99</td>
<td>.955</td>
</tr>
<tr>
<td>Abdomen</td>
<td>3.35</td>
<td>.59-19.11</td>
<td>.173</td>
</tr>
<tr>
<td>Lower Extremity</td>
<td>1.12</td>
<td>.21-5.93</td>
<td>.893</td>
</tr>
</tbody>
</table>

Note. OR = odds ratio; CI = confidence interval. a n=150
Table 4
Odds Ratios for Older Adults' Likelihood of Being Discharged to Rehabilitation Facility (Multiple Logistic Regression)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Discharged to Rehabilitation Facility&lt;sup&gt;a&lt;/sup&gt;</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.03</td>
<td>.72-2.53</td>
<td>.291</td>
</tr>
<tr>
<td>Female</td>
<td>2.50</td>
<td>1.02-6.17</td>
<td>.047</td>
</tr>
<tr>
<td>Mechanism of Injury</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Vehicle Crash</td>
<td>.44</td>
<td>.14-1.34</td>
<td>.144</td>
</tr>
<tr>
<td>Falls from Heights</td>
<td>.59</td>
<td>.15-2.29</td>
<td>.444</td>
</tr>
<tr>
<td>Falls from Same Level</td>
<td>Reference Category</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Injury Severity Score (ISS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS (1-8)</td>
<td>Reference Category</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>ISS (9-15)</td>
<td>1.86</td>
<td>.56-6.17</td>
<td>.309</td>
</tr>
<tr>
<td>ISS (16-24)</td>
<td>.80</td>
<td>.33-4.85</td>
<td>.744</td>
</tr>
<tr>
<td>ISS (25-43)</td>
<td>.54</td>
<td>.10-3.00</td>
<td>.478</td>
</tr>
<tr>
<td>Hospital Length of Stay</td>
<td>1.18</td>
<td>1.08-1.27</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note. OR = odds ratio; CI = confidence interval. <sup>a</sup>n=150
Summary of Multiple Logistic Regression Results

All components of the hypothesis concerning the relationship between longer lengths of hospital stay and discharge disposition were supported by the data. Hospital lengths of stay was inversely related to being discharged home and mortality, but positively associated with likelihood of being discharged to a rehabilitation facility. The expected relationships between severity of injury and discharge disposition tended to be supported by the data. In general, the more severe the injury, the greater the odds of mortality, and the lower the likelihood of being discharged home. Partial elements of the study hypotheses concerning age, gender, and discharge disposition were supported. Older individuals were less likely to be discharged home, but more likely to have died. Moreover, being female rather than male increased the odds of being discharged to a rehabilitation facility. One finding was statistically significant, but in the unexpected direction. Geriatric patients who were injured from a motor vehicle crash, relative to those injured from falling from a level surface, were more likely to have been discharged home, which was the opposite of what was previously expected. The hypothesis regarding injuries sustained and discharge disposition was not supported by the data.
CHAPTER FIVE

RESULTS, DISCUSSION, AND CONCLUSIONS

Results

In support of the first hypothesis, research suggests that older adults over age 75 have increased risk and the highest mortality when it comes to trauma (Graham & Firth, 1992 and McMurdo et al., 1991). Research by Martin and Teberian (1990) found that older adults over 80 are more likely to be transferred to long-term care, rehabilitation facilities or expire. This research somewhat supports this as it approached statistical significance in the likelihood of older adults being sent to rehabilitation, transfer to other facilities or expiring. Therefore, as age increases, there is less likelihood of being discharged home. Previous research supports this study’s findings.

For Hypothesis 2, there is a limited amount of research regarding gender and mortality rates. The research conducted in this study supports this hypothesis, and research that has been conducted on hip fractures/falls also supports this research. They found that hip fracture mortality decreased for women and increased for men. Granted this study was not limited to the outcome of hip fractures, it would be an opportunity for future research to be conducted surrounding the subject of hip fractures and falls.
There was support for the third hypothesis by the literature, with the exception of head injuries. Previous literature stated head injuries are a good predictor of mortality and the main cause of death for older adults. The research found that most head injuries were associated with an increase in being transferred to a rehabilitation facility. This contradicts previous studies about head injuries. It was also found that abdominal injuries constitute 29.5% of fatality rates and thoracic injuries result in poor prognosis for survival. Older adults sustaining rib fractures (thoracic injuries) had higher mortality rates and increased lengths of stay (Cameron et al., 1996). In addition, head injuries resulted in a decreased likelihood of mortality. This is associated with this study, as injuries in these regions resulted in non-survival.

Hypothesis 4 is substantially supported by previous literature (Champion et al., 1989; Covington et al., 1993; Dandam, 1992; and DeMaria et al., 1987). As the ISS increases, so does the mortality. These individuals probably had more severe injuries and the research substantiates that these individuals were less likely to go home and more likely to die.

Hypothesis 5 was not supported by the literature. This research found that as length of stay increases, there is an increase in the probability of being discharged to a rehabilitation facility. The literature claimed that older adults with shorter lengths of stay were more likely to expire and the length of stay increased with injury severity, but not for the most severely injured; those older adults died (Covington et al., 1993 and Smith et al., 1990). Previous research also showed that the greater the age, the
longer the length of stay. The research cannot support the hypothesis because of the limited amount of information about transfer to other facilities.

Hypothesis 6 is not supported by this study. Previous literature supported the hypothesis with respect to fatality rates for motor vehicle accidents were higher than that of falls. Champion et al. (1989) found that fall victims had the lowest mortality rate when compared to those older adults in motor vehicle accidents. This contradicts again, the findings within the scope of this thesis. Fall victims had the highest mortality rate when compared with motor vehicle accidents. Motor vehicle accidents usually result in higher ISS and high death rates than compared to falls. This study contradicted previous literature and which possibly could be due to the fact that these vehicle injuries were less severe and fewer injuries sustained in these accidents. It is possible that younger older adults were driving, and therefore, more likely to be able to recover from the outcome of their injuries. In addition, vehicles are designed and built to sustain various forms of accidents. With dual air bags, side impact bags and the newer structural designs of motor vehicles, individuals are able to sustain a wide array of accidents. The older adults that fell may have been more frail, or had more pre-existing conditions that affected the outcome of their trauma. These individuals may not have been wearing proper shoes, or the surface that they were walking on could have been slippery. From the data, it is not known whether the fall accidents were inside or outside the older adults’ homes, so there are numerous sociological possibilities to explain why these individuals sustained higher mortality rates than
those older adults in motor vehicle accidents in the thesis findings.

With respect to Hypothesis 7, there was limited previous research regarding this subject. In this research, there was not any correlation to indicate that falls from heights versus falls from level surfaces resulted in mortality, transfer to a rehabilitation facility or discharge home. However, in one study, Zietlow et al. (1994) found that older adults admitted for falls (of any type) were more likely to be discharged home or transferred to a nursing home. Further research should focus in this area to determine if the relationship between various falls result in different trauma outcomes for this age cohort.

Discussion and Recommendations

In our society today, with people living longer, healthier lives, public health programs will be vital to sustaining this age cohorts way of life. To illustrate this point, there should be public health programs that assist in the prevention of falls and motor vehicle accidents.

With reference to falls, public health professionals may want to consider working with local health agencies that cater to the older adult age cohort. Through use of these agencies, written material can be distributed discussing the seriousness of a fall-related injury for an older adult. The documentation can contain information on how to get up after a fall and most importantly how to prevent falls in their homes. For example, throw rugs can be eliminated, hazardous electrical cords and wires can be taped above doorways, instead of on the floor, and so forth.
For motor vehicle accidents, the public health professionals must work with a broad range of local, state and federal organizations to collaborate in providing written material, as well as providing leaflets in the mail about the outcomes of trauma involving motorized vehicles. To date, there is plenty of information available, but the true question is whether or not the older adults are actually receiving it or even understanding the severity of trauma in this scenario. It will be necessary to educate this age cohort on a rolling basis to inform them of driving safety. This means that local Secretary of State offices must provide exams on a regular basis and provide an appropriate examination of older adults for vision, hearing and total comprehension of the driving rules and regulations. Due to the variations in each state's driving programs, it may be beneficial to have a plan from the federal government that would provide standards for all older adults in the U.S. There will need to be strong support from agencies such as the American Association for Retired Persons (AARP) and the American Automobile Association (AAA) to launch such an endeavor, however, lives could be saved as a result. Some states require eye exams when an individual turn 80 years old and every five years after turning this age. Other states require eye exams starting at age 40. There are broad differentials and with the 65 and older age cohort increasing by the number, it is imperative that such driving programs be standardized to accommodate for discrepancies in local government. Drivers tests vary on a state-by-state basis, so it will be essential that policy makers discuss the likelihood of completing this task, as well as review the social barriers involved for this implication.
as previously mentioned.

For both prevention of falls and motor vehicle accidents, exercise is the key factor in helping to decrease these forms of trauma. With daily stretches and muscle strengthening activities, this keeps an older adult agile, but more importantly, flexible. For example, if an older adult cannot crane his/her neck to check a blind spot due to decreased neck range of motion, the probability of an accident becomes higher, with each car ride. This poses a severe danger to the older adult, as well as those driving in close proximity to the older adult’s motorized vehicle.

With reference to recommendations from the thesis findings to policy-makers, changes in the lifestyle of older adults are critical when considering the prevention of trauma injuries and accidents (Wolf et al., 1992). The development of programs and other interventions are necessary to reduce the number of older adult trauma injuries from falls and motor vehicle accidents.

It will be important for health care professionals to provide some sort of counseling for older adults that have frequent home accidents, especially the older-old and disabled older adults (Graham & Firth, 1992). Other environmental hazards include vision problems, and household hazards like throw rugs and loose cords (Alexander et al., 1992). Prevention of these accidents should be the primary responsibility for health care professionals and public health recommendations for this age cohort might encourage behavior changes, less risk taking and home surroundings free of preventable hazards (Graham & Firth, 1992). The interventions
taken may not prevent all trauma-related injuries, but it could reduce the high number of these accidents for this population (Alexander et al., 1992).

Not all falls lead to death or severe injury, but many have problems in getting up after the fall. Most older adults are on the floor for extended periods of time and in some studies, they were on the floor for over an hour before receiving help (Simpson et al., 1993). In the prevention of fall injuries, a recommendation would be to teach older adults to get up from the floor properly after falling (Simpson et al., 1993). This includes teaching older adult patients how to handle the situation upon falling by learning how to get up from the floor, or providing information and education on how to prevent falls from happening (Simpson et al., 1993).

Recommendations for the Prevention of Injuries from Falls

There have been a number of programs developed to reduce falls among the older adult population (Clemson et al., 1996; Edwards et al., 1993; Gallagher et al., 1996; Ory, et al., 1992 and Parker et al., 1996). Other researchers have identified a variety of risk factors, that older adults should be aware of in order to reduce falling (Haber, 1994 and Kennie, 1993). These risk factors include:

(a) Provide appropriate lighting and easy to use light switches around areas such as the top and bottom of stairs, hallways, bedrooms and bathrooms. Use nightlights to avoid creating shadows.

(b) The bed should be adjusted closer to the floor for comfort in getting in and out.
(c) Wear supportive, sturdy shoes with low heels and rubber soles with proper traction, rather than slippers.

(d) Install handrails and grab bars on stairways or in bathrooms as supportive devices and place rubber treads on the floor in areas where slipping could occur. In the bathroom, use mats on the shower floor and wipe up water spills from the floor immediately.

(e) Exercise for the improvement of mobility, flexibility and coordination.

(f) Eliminate household hazards such as throw rugs and items that require the use of a step stool to reach. In the kitchen, use storage areas that are easily accessible. Use a non-slip polish for any tiled flooring.

(g) Any open cable or electrical wiring should be taped to the floor or carpet.

(h) Carpet should be tacked down appropriately, and it should have a thick padding underneath.

Other programs include a Falls Intervention Trials (FIT) project and a Study of Accidental Falls in the Elderly (SAFE) project (Stevens et al., 1992 and Gallagher et al., 1996). Many of the programs developed are interventions utilized in the prevention of falls and home hazards that increase the risk of falling (Campion, 1996; Clemson et al., 1996; Edwards et al., 1993; Graham et al., 1992; Parker et al., 1996; and Tinetti et al., 1989).

There have been some contradictions in the literature according to fall prevention by manipulating environmental hazards (Parker et al., 1996). From the
Parker study, it was found that in 46% of falls, there were no hazards causing the fall and poor health was the factor contributing to the hip fracture. These authors suggest emphasis be placed upon muscle and bone strengthening through exercise or wearing hip protectors to reduce the number of hip fractures occurring in older adults (Parker et al., 1996).

By the use of prevention mechanisms, morbidity and mortality rates from falls could be decreased. Wearing sturdy shoes could possibly reduce the risk of falling for this age cohort. In a study conducted by Dunne et al. (1993), it was found that only 26% of the older adult’s interviewed for their survey wore sturdy shoes. Many of the older adults interviewed did not understand the importance of wearing solid shoes, had difficulty putting these kinds of shoes on their feet, did not like the style or price of the shoes, or had foot problems which would require a different type of shoe to wear (Dunne et al., 1993).

Also, telephone emergency alert system devices can be worn around the neck, or waist by frequently falling older adults. These devices have been helpful in providing immediate attention, yet they are both high in cost (Haber, 1994) and needed before an emergency occurs (Campion, 1996). False alarms are possible, and the older adult must be fully functional to operate the device to get help (Campion, 1996).

With reference to the study conducted by Dunne et al. (1993), there are a number of social dis-incentives for the older adult age population to adjust to. For
instance, the shoes may have been given as a gift from a cherished loved one to wear. Also, how many older adults have beds with moveable legs? More than likely, these individuals have been sleeping in the same bed that was purchased 30 years prior and these beds do not have adjustable height settings. Due to socio-economic or education factors, many social barriers come to play upon implementation of these recommendations by hospital staff, occupational therapists and other health care professionals that work with this population.

Prevention of Injuries from Motor Vehicle Accidents

Specific interventions to limit the number of fatal motor vehicle crashes for older adults include restrictions for night driving, evaluation of older drivers skills for license re-newal and driving refresher courses (Williams & Carsten, 1989). Driving can also be limited by not driving at night or in rush hour traffic, if the older adult feels driving other times is too difficult (Haber, 1994).

For older adults, deciding when to put away the car keys can be a difficult task. A driver’s license means independence, convenience, mobility and competence for most older drivers. Many older adults feel they can drive their vehicles and be safe behind the wheel (Persson, 1993). In the year 2000, 28% of drivers were older adults. By 2050, the percentage of older drivers will increase to 39% (Persson, 1993).

In a study conducted by Miller and Morley (1993), over 60% of physicians had never referred any of their patients to a licensing department to be evaluated and assessed for driving. Also, few physicians kept their older adult patients driving
status on their medical files, even though 94% of physicians who responded to the questionnaire thought they had a legal responsibility to assess an older adult’s driving ability (Miller & Morley, 1993). In addition, these physicians rarely referred their patients to an older adult driver refresher course, such as the American Association of Retired Persons 55 Alive/Mature Driving class. Only 12% of physicians who responded to the questionnaire referred patients to such programs (Miller & Morley, 1993).

In another study, the decision for older adult drivers to stop driving included increasing age, being an older adult female, Parkinson’s disease, eye problems, stroke, being hospitalized within the past year and macular degeneration (Stewart et al., 1993).

Older Adult Driver Education Programs

In preventing motor vehicle accidents, there are two national programs available to older motorists. The American Association of Retired Persons Mature Driving program and the American Automobile Association’s Safe Driving for Mature Operators program sponsor approved, educational courses nationwide. These programs are educational, informative and each program addresses the deficiencies of older drivers.

The 55 Alive/Mature Driving program is an eight-hour class that addresses issues concerning drivers aged 50 and older. It is a prevention program aimed at limiting the number of car crashes and traffic violations for older adults. This
program started in 1979, and one % of older adult drivers complete the course annually. This program is open for members and non-members of the AARP and addresses older adult’s physical changes that accompany aging that, in turn, could affect driving. There are 34 states that offer auto insurance discounts for older adults who graduate from the course, also.

The Safe Driving for Mature Operators is a course designed by AAA for drivers who want to improve their understanding of driving knowledge. If the older adult driver completes this program, they have the opportunity to obtain a violation point discount or reduction in their cost of insurance. This program began in 1985 with objectives to address the physiological, psychological and sociological perspectives which accompany aging and employs techniques that this population cohort can use to be a safe driver in a faster-paced world. The course is comprised of eight instructional sessions, and a slide/tape or video format can be utilized to teach the presentation. Each session ranges in time from 17-25 minutes (video presentation) or 20 minutes (slide presentation). The sessions include an introduction, and sections on seeing, communicating, adjusting speed, margin of safety, driving emergencies, vehicle maintenance and psycho-social driving aspects.

The American Automobile Association also has many brochures about older adult drivers. These include brochures and pamphlets about pedestrian safety, alcohol use and driving, fatigue and emotions, flexibility fitness for driving improvements, self-tests and facts about safe driving and a guide for family and friends about older
adult drivers.

There are also some highway driving tips from the National Highway Traffic Safety Administration to aid older drivers (Hoffman et al., 1997). They suggest that older drivers:

(a) Keep enough space between the car in front of the driver. The suggested amount of space is one car length for each 10 mph the car is traveling.

(b) Adjust the mirrors in the car so the older driver has full view of their surroundings in their vehicle. Do not wear any type of glasses with side pieces that may possibly block vision or their blind spot.

(c) Drive the posted speed limit and stay in the right hand lanes. Driving under the speed limit can be just as dangerous as driving over the posted speed. Try not to drive during prime traffic hours.

(d) Drive on roads and highways that are not unfamiliar to the driver. It is a good idea to also know the road signs by shape or symbol.

(e) Talk with a doctor about taking medications and the side-effects of the drug(s) if it will affect their driving abilities.

(f) Make slow, cautious turns and use the turn signal. The turn signal should be off after the turn has been completed.

(g) Not driving at night if it becomes bothersome. Headlights should be clean and the driver should avoid looking at the glare.

Other suggestions from Haber (1994) include keeping the noise to a minimum
in the car, such as the air conditioner, radio, or heater and opening the window slightly to hear sounds around the vehicle. Also, wearing seatbelts at all times prevents many injuries, even for short trips from home. In addition, older adults should be aware of restricting their driving when their medications could slow their reaction time or affect their vision (Haber, 1994).

In addition, with motor vehicle accidents as the primary cause of accidental death for those aged 65-74, physicians and caregivers will continue to face decisions about older adult drivers (Persson, 1993). Older adults driving privileges should not necessarily be eliminated, but recommendations for safe driving should be stressed among this population (Miller et al., 1993). Guidelines will become necessary with this population increasing, in order to reduce the number of motor vehicle accidents (Miller et al., 1993). A patient assessment protocol for driving might become warranted in the near future as this population continues to grow and fatality rates increase due to motor vehicle accidents (Miller et al., 1993 and Persson et al., 1993).

Others have noted that physicians rarely referred older adult drivers to refresher courses to improve their driving skills (Miller et al., 1993). Laws vary from state to state about renewal procedures and physicians have a legal obligation to an individual's right to privacy, yet it is the public's right to know if an individual can harm someone else. So far, there has not been a consensus on what kinds of recommendations from physicians to their older adult patients can be made concerning their driving (Miller et al., 1993).
Conclusion

It will be highly important for policy makers and public health officials to continue studies on older adult trauma. With the increase in this age cohort, trauma will be on the rise and treating these individuals will be of utmost importance. Providing educational material and injury prevention programs will become vital for those older adults to sustain their daily living activities. The discussion and recommendations of this thesis are key elements for next action plans for the future.

In conclusion, public health professionals have a hefty load on their shoulders. There are a number of programs that should be implemented to assist in helping older adults with respect to preventing falls and motor vehicle accidents. From the findings in this study, it suggests that age, ISS and mechanism of injury are key indicators in determining the outcome of trauma. Further research should focus on these variables to determine the primary indicators of trauma and how to prevent these types of injuries in the future for this expanding age population.
Appendix A

Protocol Clearance from the Western Michigan University Human Subjects Institutional Review Board and Bronson Methodist Hospital Institutional Review Board
Date: 21 March 1997

To: Thomas VanValey, Principal Investigator
    Shaun Mcmillan, Student Investigator

From: Richard Wright, Chair

Re: HSIRB Project Number 97-01-06

This letter will serve as confirmation that your research project entitled "Motor Vehicle Crash and Pedestrian Accidents and Falls in the Older Adult Population. Age and Gender Differences in Trauma Care (with Bronson Methodist Hospital, Kalamazoo, Michigan)." has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: 21 March 1998
At the March 4, 1997 Meeting of the Expedited Review Committee, BMH1099 was approved with the following changes:

1. Include as part of the protocol a permission letter from the Trauma Services physician to review medical records from the BMH trauma registry.

2. Include data collection forms as part of the protocol to ensure that no patient identifiers are included.

3. The Expedited Review Committee determined the continuing review interval for this study to be set at 12 months.

4. Before this protocol can be implemented i.e., prior to a drug begin given or a procedure undertaken, all changes must be made and a corrected signed copy of the protocol and informed consent filed with the BMH Human Use Committee Chairman (or designee). The clinical investigator is required to receive approval from the BMH Human Use Committee prior to initiating any changes in approved research during the period for which BMH Human Use Committee approval has been given.

James W. Carter, M.D., Acting Chairperson
Bronson Methodist Hospital Human Use Committee
252 East Lovell Street
Kalamazoo, MI 49007
(616) 341-7988

cc: SOssewaarde
NRChumbler
Appendix B

Data Collection Tool
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<th>Sex</th>
<th>Mechanism of Injury</th>
<th>ISS</th>
<th>LOS</th>
<th>Discharge Disposition</th>
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