Fall Injuries In Older Adults in a USA-Mexico Border Community: Personal Characteristics, Fall Event and Emergency Medical System Utilization

Lesiones por caídas en adultos mayores de una Comunidad fronteriza de EEUU- México: Características personales, eventos de la caída y la utilización del Sistema de Emergencias Médicas

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Abstract: **Unintentional falls are a major problem affecting the lives of older adults and considered a public health issue likely to escalate as the older adult population, 60 years old and older, grow exponentially. One out of every three older adults fall yearly with escalating severity of injury with each occurrence and it is the fourth leading cause of death and the most common cause of injury-related hospitalization. Older adults who sustain a fall injury find the need for immediate medical help and activate the emergency system where care is provided by Emergency Medical Services (EMS) whose immediate care influences injury outcome. A 12 month retrospective, quantitative study of unintentional fall injury related responses by EMS in El Paso, Texas was analyzed to determine personal characteristics, fall event, and resulting injury of older adults who received EMS care and ambulance transport to Emergency Department (ED). Majority of participants were Hispanic. Findings point to gender differences in males and females. Females had greater representation, were older than males, and had higher percentage of indoor falls that occurred in daytime, more hip and lower limb injuries but less acuity of injury as compared to males. Males fell outside and during the night more frequently, sustained more head injuries and had greater injury acuity level. This study provides a snap shot of injurious falls and the utilization impact in EMS and opens the forum for asking significant questions to further evaluate the multifactorial components of fall injuries and initiate multidisciplinary health prevention strategies at the most opportune time to create greatest impact. This is a perfect opportunity for social workers and other health care team member to work together and find solutions to this daunting problem.**

Key words: **Hispanics Older adults, Falls, Injuries, Emergency Medical System (EMS), Multidisciplinary Research.**

Resumen: Las caídas accidentales son un problema grave que afecta la vida de los adultos mayores y es considerado un problema de salud pública que puede escalar conforme la población de adultos mayores, 60 años o más, crece exponencialmente. Uno de cada tres adultos mayores cae cada año aumentando la gravedad de la lesión con cada ocurrencia. Además, las caídas accidentales son la cuarta causa principal de muerte y la causa más frecuente de hospitalización relacionada con lesiones. Los adultos mayores que sufren una caída y presentan lesiones, tienen la necesidad de buscar ayuda médica inmediata y activar el sistema de emergencia donde la atención es proporcionada por los Servicios Médicos de Emergencia (EMS), cuya atención inmediata influye en el grado de severidad de las lesiones. Un estudio cualitativo y retrospectivo de 12 meses sobre las llamadas atendidas por EMS a casos de lesiones por caídas en El Paso, Texas fue realizado para determinar las características personales, los eventos de la caída y el resultado de la lesión en adultos mayores que recibieron cuidados por parte de EMS y fueron transportados en ambulancia a la Sala de Emergencia (ED). La mayoría de los participantes eran hispanos. Los resultados muestran diferencias de género entre hombres y mujeres. Las mujeres tuvieron una mayor representación, eran mayores que los hombres, y tuvieron mayor porcentaje de caídas en interior y durante el día, también tuvieron más lesiones de cadera y en los miembros inferiores, pero la agudeza de la lesión fue menor en comparación con los varones. Los varones sufrieron caídas en el exterior y durante la noche con más frecuencia, sostenido más lesiones en la cabeza y con mayor gravedad. Este estudio proporciona una descripción fundamental de las caídas con lesiones y el impacto de la utilización del sistema de emergencia. Esto abre un foro de preguntas importantes para futuros estudios donde se evalúen los componentes multifactoriales de lesiones por caídas y así implementar estrategias multidisciplinarias para la prevención de estas en el momento más oportuno creando un mayor impacto. Esta es una oportunidad perfecta para que los trabajadores sociales y otros miembros del equipo de atención médica trabajen juntos para encontrar soluciones a este problema de enormes proporciones.

Palabras clave: Adultos Mayores Hispanos, Caídas, Lesiones, Sistema de Emergencia Médica (EMS), Investigación multidisciplinaria.

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1. INTRODUCTION

[A.M. is a 74-year-old woman who dreamed of her retirement and envisioned herself a life of leisure and family time. She had been caring for her husband and grandchildren until one day while preparing for her busy day; she lost her balance and fell when getting out of the bathtub. The severity of A.M.'s injury prompted her family to call 911 for help. In an instant her world crumbled and found herself intertwined in the complexity of the health care system, she became a care recipient instead of caregiver. Life after her fall was never the same; she now depends on her family to get through the day].

The life changing event experienced by A.M. is not uncommon. Stories like this are often heard by health care practitioners or those providing services to older adults. The exponential growth of the older adult population 60 years and older worldwide is challenging health services to evaluate potentially preventable health problems in order to save lives, prevent disability, and lessen cost. Unintentional falls are a major problem affecting the lives of older adults and are considered a public health issue likely to escalate if preventive programs are not focused on high-risk population (Gelbard et al., 2014). One out of every three older adults fall yearly with escalating severity of injury with each occurrence (CDC, 2014; Tinetti & Kumar, 2010). Unintentional falls is the fourth leading cause of death among older adults and the most common cause of injury-related hospitalization, resulting in physical and psychological disability leading to loss of independence and increase reliance on support systems such as families and local communities (Alamgir, et al., 2012; Heron & Smith, 2007; Stenhagen et al., 2014). A fall has been defined by the (World

Health Organization [WHO], 2012) as an unintentional incident where the person goes down to the floor or lower level.

Susceptibility to falls is associated with intrinsic and extrinsic factors (Ambrose et al., 2013; Tinetti & Kumar, 2010). Major intrinsic factors include the physiological changes of aging and the high prevalence of chronic illnesses that impacts physical function and predisposes this population to acute illness exacerbations and injuries (Mizukami et al., 2013; Reed-Jones et al., 2013). Extrinsic factors are conditions or circumstances in the person's environment and, or socioeconomic status that places the person at risk for fall and injuries such as lack of assistive devices, poor lighting, or faulty equipment (Tinetti et al., 2006). Falls trigger a domino effect extending beyond the individual, in that families experience additional task for providing assistance during acute and rehabilitation period that often extends for months or years. When familial support is lacking, community support becomes crucial to assist in the recovery process. Unfortunately, recovery seldom returns the affected person to a pre-fall state (Stenhagen et al., 2014). As the population in the world ages, the problem of unintentional falls and related injuries will continue to escalate creating a global problem. In the U.S., the direct health care cost from accidental falls has been reported to be as high as 36 billion dollars annually with emergency department care estimated at 9.2 billion (Stevens et al., 2006; Villaveces et al., 2013). Furthermore, projected growth of older adults in the next four decades, especially among the 80+ year olds, is expected to create greater financial burden in the already strained health care system (CDC, 2010; U.S. Census Bureau, 2011).

Older adults who sustain a fall injury find the need for immediate medical help and activate emergency systems where care is provided by Emergency Medical Services (EMS), which comprises the first responders during medical emergencies and are crucial for influencing outcomes of injury (U.S. National Library of Medicine (NLM), 2014). While the EMS was originally created for rendering immediate on-site care for victims of trauma and cardiac patients,

likely a younger population, its service has evolved to providing emergent medical care for all persons who call for help and need prompt evaluation and treatment with a possible transport to higher levels of medical care such as emergency department (ED) settings (Gray & Walker, 2008). The change evolved because of the prevalence of chronic illnesses, the aging population, and the overall health needs of the public. Older adults are receiving EMS service more than any other group (Simpson et al., 2014) due to the shifting of population demographics in the U.S. and the vulnerability to medical problems and injuries. The older adult population is a heterogeneous group identified by chronological age with potentially different health needs, fall risks, and outcomes (Kelsey et al., 2012; Rossat et al., 2010). It is imperative to evaluate the utilization trends, events influencing the fall, and its outcomes to understand this phenomenon to take into consideration fall intervention activities and collaborate with EMS on the needs of this population to influence care outcomes. The prevalence and devastation of fall injuries in older adults and the EMS crucial role in providing on-site care warrants an evaluation of service utilization that may positively impact preventive services. Evaluation of fall injuries in older adults requires multidisciplinary health team approach initiated at the scene of accident and continued in emergency departments and coordinated community care for prevention of recurrent events that augments seriousness of injury and heightens risk of disability (Brito et al., 2014).

The purpose of this study was to analyze the personal characteristics, examine the fall event, and resulting injury of older adults who received Emergency Medical System (EMS) care and ambulance transport to Emergency Department (ED). The aims of this study are: a) describe personal characteristics of older adults who sustained fall injuries, b) Identify injuries and immediate outcome; and c) analyze location and time of fall. Knowledge gained will serve to identify the impact of fall injuries in EMS utilization and facilitate a proactive multidisciplinary, culturally appropriate approach prevention programs tailored to population affected.

2. METHODOLOGY AND STUDY DESIGN

This was a quantitative, retrospective study of unintentional fall incident responses by EMS from January 1st to December 31, 2012, in El Paso, Texas. The data consisted of emergency response records maintained by The El Paso Fire Department, which connects simultaneously to emergency medical service (EMS) housed in the same site for immediate response. The study protocol was approved by the Institutional Review Board of the University of Texas at El Paso. In order to comply with Health Insurance Portability Accountability Act (HIPAA) privacy rule (U.S. Department of Health and Human Services, 1996) traceable personal identifiers were removed from the data prior to transfer to the investigators. The EMS personnel documented demographic information (i.e. age, gender, race) as part of their reporting protocol. Narrative notes recorded by EMS personnel detailed the fall incidence and on-site care provided to persons transported to the emergency department (ED).

Case selection criterion for this study included: a) service classified as "fall injury"; b) persons 55 years old and older who sustain fall injury; and c) Fall injury occurring within designated EMS service area. Nursing home and U.S. Customs port of entry where services were rendered for persons coming from Mexico were excluded. The reasoning for inclusion of persons a decade earlier than the standard 65 years for entry into Medicare for consideration as older adults is because of the high prevalence of chronic illness such diabetes, and its complications in the population where the study occurred which accelerates the physiological aging process ahead of chronological age. In total 1,116 cases of "fall injuries" fulfilled the inclusion criteria.

Selected variables

The following variables were included in the analyses: age, gender, ethnicity, time of fall, place of fall (indoor or outdoor), anatomical site of injury, type of injury, and recorded level of care. Income was identified as a measure of socioeconomic status inferred from the listed zip codes where incident

location using data from the U.S. Census Bureau (2010). Each case had narrative notes recorded by EMS personnel detailing the fall incident and on-site service provided.

The time of when fall occurred was categorized into four equally distributed times within the 24 hours in the following manner: "morning" (06:00-11:59), "afternoon" (12:00-17:59), "evening" (18:00-23:59), "night" (24:00-05:59). Place of fall was classified as either occurring "indoors" or "outdoors" based on the information recorded by EMS attendant. An "indoor fall" was defined as an event that occurred within the home of the person's usual residency. An "outdoor fall" was defined as an event that occurred outdoors or outside the person's customary residence. The EMS narrative record provided the detail of the on-site medical service, sustained injury, and circumstances surrounding the fall event. The on-site evaluation led to classification of patient's acuity level extending to ambulance transport urgency and named the following major Level of Care (LOC) categories: trauma level I-III or medical level I-III. Patients classified as Level I in either category are those in critical condition or unstable, Level II are those that are stable with potential deterioration, and Level III are those that do not meet criteria I or II. The determination of trauma vs medical categories is dependent on evaluation by on-site EMS personnel. Departmental policy didn't identify differentiation of terms, only of the levels of care.

Statistical analysis

Descriptive and inferential analyses were conducted using SPSS V20 (IBM Corp., 2011). Descriptive statiscial anlyses were conducted for frequencies and patterns of occurrences of the selected study variables. To determine association with selected variables, the following four age categories were used (Ortman, 2014): "younger old" (55-64 years), "young old" (65-74), "old" (75-84), and "old-old" (85 years old and older). Ethnicity was categorized as Hispanic, White, Other or Unknown.

Chi-square analyses were conducted to determine the association between demographic variables, place of fall, time of fall, level of care, and the fall

event. The fall event was designated as the predictive variable, statistical significance was established at α=.05. The outcome of the analysis assisted in drawing inferences to determine relationship between the listed variables.

3. RESULTS

The study sample included 1,116 persons 55 years old or older who met inclusion criteria. The majority were female (n=708, 63.4 %), and most self-identified as Hispanic (N=415, 37 %). The age ranged was between 55 and 102 years (*M* 76.1, *SD*11.5). More specifically the age representation was the following: 20.7 % (n=231) were 55-64 years old, 21.5 % (n=240) were 65-74, 30.5 % (n=338) were 75-84, and 27.5 % (n=307) were 85 years old or older. The age range in males was from 55- 98 years old (*M* 73.9, *SD* 11.8) compared to 55-102 years old (*M* 77.3, *SD* 11.1) for females. Most persons were classified as requiring Trauma Level III services, medical level I being the least identified. Trauma level I and II among males was nearly double than for females. The most reported time of fall was in the afternoon. In males, a greater number of falls occurred during the night from midnight to 05:59. Over half of falls occurred "indoors" with males reporting greater number of "outdoor" falls. Fall injuries more commonly reported were head trauma, hip involvement in females, and involvement of lower extremities. Table 1 details the fall event and its effect by gender. The "old" (75-84 years old) age category recorded the greatest number affected with one out of three sustained injuries documented in this age group. The difference in fall percentages between the "younger old" (20.5 %), and the "young old" (21.5 %) was non-significant. Table 2 describes the incidences per age group category and the census population representation for El Paso community.

Table 1. Description of fall events and EMS transport level of care by gender

Variable	Male		Female		Total	
	n	%	n	%	N	%
Time of Fall*						
Morning	123	30.1	225	31.8	348	31.2
Afternoon	122	29.9	241	34.0	363	32.5
Evening	109	26.7	162	22.9	271	24.3
Night	54	13.2	80	11.3	134	12.0
Place of Fall						
Indoor	197	48.3	393	81.9	590	77.0
Outdoor	89	21.0	87	18.1	176	23.0
Injury						
Head	119	33.1	149	23.4	268	26.9
Upper Extremities	48	13.4	91	14.3	139	13.9
Hip	34	9.5	67	9.5	101	10.1
Lower Extremities	65	18.1	147	23.0	212	21.3
Back	19	5.3	22	3.4	41	4.1
More than one part	74	20.6	162	25.4	236	23.7
Level of Care (EMS)						
Trauma	344	84.4	638	90.1	982	88.0
Medical	64	15.7	70	9.8	134	12.0

*06:00 am-11:59=Morning; 12:00-5:59pm=afternoon; 6 pm-11:59=evening; 24:00 midnight-05:59am=night.

Table 2. Fall injuries by age category & its proportion to sample and overall population

Age Category*	N	ELP
"Younger old" (55-64 years old)	231 (20.5%)	63,281 (0.4%)
"Young old" (65-74 years old)	240 (21.5%)	38,375 (0.6%)
"Old" (75-84 years old)	338 (30.5%)	25,555 (1.3%)
"Oldest Old" (≥85 years old)	307 (27.5%)	8,687 (3.5%)

*U.S. Census. El Paso City, TX. (2010).

Association among categorical variables was determined with Chi-square (χ^2) statistical analysis. Statistical significance was set with and alpha of 0.5 for examining age (categories), gender, time of fall, place of fall, type of injury, and level of care. The difference in age range between males and females was significant (df 3, N= 1116, p<0.002), females age range extended nearly

four years beyond males. Age was also associated with place of fall (df 3, N=766, p<0.001) with indoor falls more prevalent, and level of care (df 3, N=1116, p<0.029) with greater incidence of Trauma Level III which is the lowest acuity for ambulance transport. Gender had a significant association among several categories. For instance, there was a higher incidence of outdoor falls observed among males, whereas females were more likely to fall indoors (df 1, N=1116, p<0.001). Hip and limb injuries were more common among females (df 4, N=964, p<0.013). While males tended to require the highest level of care (Trauma Level 1) (df 5, N= 1116, p<0.004). Still, across the entire sample, the most assigned level of care was Trauma level III, which is the lowest acuity for medical ambulance transport.

4. DISCUSSION

The findings of this retrospective study are consistent with existing literature in the high number of women represented in falls research studies, higher fall prevalence than males (Bloch et al., 2011; Brito et al., 2014), and higher occurrence of indoor falls among older adults who sustained unintentional falls and related injuries (Bath & Morgan, 1999; Kelsey et al., 2010; Kelsey et al., 2012; Tinetti & Kumar, 2010). Because of the longevity of women and the important family roles, especially as caregivers, the impact of fall related injuries on older adult women and on those around them might be more severe than on older adult men. The impact of fall injuries might be further heightened among Hispanic families. As compared to other ethnic groups in the U.S.A., Hispanics tend to live and receive assistance from extended families nearly twice as frequently than other ethnic older adult groups (Administration on Aging [AoA], 2010). The decline in physical function of older adults after a fall injury creates family strains that may turn into caregiver burden (Ottenbacher et al., 2009). Due to the higher prevalence of falls and hip and lower extremity injury, it is speculated that greater pathological and psychological effect on women in our sample population, where a majority are Hispanic. Still, more research is necessary to determine an array of consequences that come from the downward spiral of health

effect that result from the decline in functional capacity that limits independence and leads to disability (Alamgir et al., 2012; Lebouthillier et al., 2013; Pannel on Prevention of Falls in Older Persons. American Geriatrics Society and British Geriatrics Society [AGS/BGS], 2011).

Where the fall incident occurs, indoor or outdoor, has been considered an indicator of health status with those who fall within their residence, indoor, are thought to have compromised health status and possible decline and confines the person to their home environment (Gomes et al., 2014; Kelsey et al., 2010). The large number of indoor falls may indicate poor health status associated with chronic illness and limited physical activity that influence the fall injury (Bath & Morgan, 1999; Decullier et al., 2010; Gomes et al., 2014; Kelsey et al., 2010). Prospective multidisciplinary studies are warranted to evaluate the specific intrinsic and extrinsic factors that have greatest influence in fall events in this population that has high prevalence of chronic illness (Morley, 2007; Rockett et al., 2012; Samper-Ternent et al., 2012).

There were significant personal and fall event characteristics of males and females in this sample that warrant further evaluation as the outcome may be graver among males who were younger than females, had higher incidence of falls during the night, more outdoor falls, and higher acuity in Level of Care during transport. In a health related quality of life (HRQoL) study post fall, males reported greater HRQoL than females (Stenhagen et al., 2014). However, males have been identified as having greater mortality from fall injuries attributed to risk-taking behaviors and dangerous activities (WHO, 2014).

The variance of age eligible case selection who received on-site care (1,877) and the number who were transported to ED (1,116, 61%) queries the differences between the two groups which is a larger group than other studies (Simpson et al., 2014). The on-site evaluation and multitasking that occurs during emergency care may contribute to the inconsistency of medical recording by EMS observed when listing fall event details and

omission of clinical information that may impact outcome. Consideration of uniformity of recording keeping and educational activities for EMS personnel on falls, aging changes, and intake of on-site essential information may enhance coordination of services and collaboration among health care team for providing culturally appropriate interventions (Pannel on Prevention of Falls in Older Persons. American Geriatrics Society and British Geriatrics Society [AGS/BGS], 2011). Finding solutions to the problem of requires interdisciplinary teams that will bring expertise and practicality to lessen the problem and increase safety among older adults.

The high representation of Hispanic older adults provides an opportunity to evaluate this ethnic group projected to be a majority in the near future with high utilization of health care services. The personal, health, and sociocultural characteristics need to be understood in order to identify specific fall risks and resources needed for returning older adults to a pre-fall state as close as possible to lessen the physical, psychological, and financial burden.

Implications

The prevalence of fall injuries in a "younger old" population and the large number of indoor falls highlights the likelihood that health status may be influencing the fall. The differences in personal characteristics and fall event in males and females brings attention needed approaches to identify specific risk factors that gender poses and incorporate its uniqueness in fall intervention programs. This study provides a snap shot of injurious falls and the utilization impact in EMS and opens the forum for asking significant questions to further evaluate the multifactorial components of fall injuries and initiate prevention strategies at the most opportune time to make greatest impact, this could be the ED. Ultimate goal would be to design and implementing comprehensive fall prevention programs to reach the most vulnerable and to incorporate the multiple health disciplines that could contribute in lessening the problem of falls and related injuries in older adults. The large percentage of ambulance transports to ED and the assigned acuity

level brings attention to need to evaluate tangible criteria for following this action and possibly leaving EMS transport to those with greater acuity and findings alternatives for decreasing EMS utilization.

Limitations

The analysis of retrospective study for evaluating fall injuries in older adults limits capturing the complex and multifactorial components the influences a fall event. Information available was generic to all EMS cases and not uniform in the documentation provided. The available information was limited and relied on the EMS narrative record. It was not possible to determine any preceding events or outcomes of the fall beyond ambulance transport and the determinants for trauma or medical level of care was not clearly defined. This study only included persons that were transported to ED leaving out approximately 38 % of persons that received EMS care and offers an opportunity for consideration of future studies.

5. CONCLUSION

This study provided significant information on older adults who sustained fall injuries and required EMS ambulance transport to ED for evaluation and treatment. It brings attention to the high rate of fall injuries in females and the devastation of such event exemplified by AM's story in the introduction. The disproportionate number of indoor falls may indicate a vulnerable health state in persons injured. Researchers need to identify the specific gender differences that may be deciphered through future prospective studies. It is crucial to look beyond EMS care and identify the outcome of ED evaluation to determine the impact of the injury and any changes made to prevent further injuries. Standardization of EMS records to capture details of fall event to identify risks that may influence care outcome and contribute to prevention program development needs consideration. This study is evidence that further studies are warranted.

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