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Fall Risk Assessment of Elderly Community-Dwelling Individuals

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FALL RISK ASSESSMENT OF ELDERLY COMMUNITY-DWELLING INDIVIDUALS

By

Jha'Meisheia Michelle Griffin

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ABSTRACT

INTRODUCTION: Falls in the elderly population occur quite frequently, which happens to be a major factor that threatens their independence. Due to this, many older individuals are admitted into nursing-homes once the dependency status gets to be too much. While policies and programs exist to prevent the dilemma of falls, reported data and studies reveal that the prevalence of fall-related deaths within nursing-homes is on the rise. More information is needed to thoroughly understand the association between mortality due to fall and the epitome of healthcare surveillance within nursing-homes.

AIM: To assess the mortality risk of elderly individuals who have fallen within community-dwelling establishments while being under healthcare surveillance.

METHODS: To preliminarily query this topic, the primary utilized search engine to conduct research was Google Scholar. This allowed a plethora of similar studies to be examined in a meta-analysis approach. Along with this, sources such as the CDC and Georgia Health Department website, garnished significant intel on the many policies and procedures in place to avoid falls, especially ones that can ultimately lead to fatality. Data was obtained from the DeKalb County Medical Examiner's Office of nursing home fatalities, which was requested through the Public Health Information Portal (PHIP), an online system where data can be requested through the Georgia Department of Public Health. This data was organized within Excel spreadsheets.

RESULTS:

Having performed several procedural calculations, it is safe to conclude that the younger age group, which consists of deceased patients younger than 80, account for more unnatural deaths as opposed to those 80 and older. This includes ~52% accidental, ~81% Homicide, and ~75% suicidal deaths. Although women account for the majority of the population, men ultimately have more unnatural deaths. This includes ~54% accidental, ~59% Homicides, and ~83% suicidal deaths.

Even though ethnicity and race were not significant factors, there were greater odds of homicidal deaths within the Non-White group in relation to the White group.

DISCUSSION/CONCLUSION: There is a need to focus on reliable procedures and policies to enforce equal care for all community-dwelling residents. Differences in sex, age, and in some instances, race, can contribute to an increase of maltreatment and/or malpractice within community-dwelling establishments.

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APPROVAL PAGE

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Author's Statement Page

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Jha'Meisheia Michelle Griffin

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1   INTRODUCTION

1.1   Background

Falls in community-dwelling establishments within the elderly population, individuals aged 65 or greater, has been a prevalent dilemma for decades. The harsh truth – falls are a common and devastating complication of care, with millions of older people falling each year. While studies have discovered that falls typically occur at a rate of 3-5 per day, there is an estimation of approximately one-million annual hospitalized fall incidents within the United States. Patients who reside in long-term care are at greater risk of experiencing a fall occurring. Falls are a common, but serious health threat to the elderly community, which can ultimately lead to an increased dependency upon others. With everyday life, work, spouses, and possibly even children, it can become quite difficult to balance caring for an elderly family member as well. Due to this, families tend to enroll their loved ones into a community-dwelling environment, such as a nursing home facility. The healthcare providers residing in nursing homes, along with families of the elderly person, tend to apply various interventions and strategies to ensure that fall prevention in the elderly is significant. In just 2019 alone, nearly 3 million elderly individuals were submitted to the emergency room pertaining to fall related incidents. Of the annual 28.7% incidents, one out of five falls causes a serious injury such as head damage or broken bones. Unfortunately, as alarming as this may sound, there is an additional 11% mortality rate amongst these individuals (Bergen, 2016). It was established that falls contributed to approximately 34,000 deaths among adults who are aged 65 or older, which serves as the leading cause of injury death among this age group.

Even though falls seem to be annually increasing, many studies have proven that there are ways to, not only reduce, but prevent them from proceeding. Considerable studies have assessed falls via implementations by targeting community-dwelling individuals with multifactorial clinical

approaches. With differing procedures and strategies in place, it is probable to acknowledge the margin of error. Therefore, there will potentially be instances where the policies set in place will fail. When evaluating why these unintentional mishaps occur, it is best to thoroughly apprehend all possible circumstances. The quandary of neglect and malpractice that has been proven to seldom occur within nursing homes can sometimes be unfathomable. Evaluating if falls are potentially stemmed from malpractice issues can strongly alter life-changing decisions for many. Via a meta-analysis study, it has been concluded that healthcare workers in nursing home facilities often utilized inappropriate equipment for the task-at-hand (Greener, 2020). Assessment of fall risks, specifically within nursing homes, are exceptionally valuable as this is a vital component in establishing effective fall prevention programs.

Despite knowing elderly falls are the primary cause of increased morbidity and mortality rates in individuals aging 65 years and older, there have been few studies regulated towards internally examining dwelling establishments where many of these individuals inhabit. The final proposed product will consist of qualitative and quantitative data collection targeting examinations of mortality that occurred from elderly falls, both in and outside of community-dwelling establishments. Therefore, this capstone will further scrutinize in determining, on a case-by-case scenario due to differing circumstances, if submitting elderly family members into a nursing home facility is the preeminent opportunity. In particular, this will be looked into by examining mortality in nursing homes based on the causes and potential predictors for those causes.

1.2 The Prevalence of Falls in the US

There is greater awareness that elderly falls are widespread in the US and worldwide. Elderly falls are directly related to an annual approximation of 1,800,000 admissions into emergency departments of hospitals and nearly 16,000 deaths within the United States. Unfortunately, falls

can be classified as the leading cause of injury-related hospital admissions of people aged 65 years and older (Fasano et al., 2012).

Nursing home complaints and violations of regulations and policies have rapidly increased by 33%, with roughly 60% being immediate jeopardy or high priority complaints. The most common deficiencies of US nursing homes were 45% for violations of infection control, 43% for fall accidents and/or mortality, 40% unsanitary food, 34% poor quality, 25% unnecessary drugs, 25% inadequate care plans due to negligence, 23% of improper record keeping, 21% violations of resident dignity, and 18% unqualified personnel. In addition to this, 18% of nursing home facilities typically receive violations for failure to prevent pressure ulcers, 8% for abuse or improper treatment of residents, and over 20% for medication errors (Harrington et al., 2020). Fundamentally, the majority of these factors ultimately contribute to an increase of fall risk, which can eventually lead to accidental death.

1.3 The Neurobiology of Falls

Falling is a major clinical problem for elderly individuals. Falls often lead to fractures, poor quality of life, life-span reduction, and even immobilization. Research has identified many risk factor conditions that contribute to falling. These risk factors can be altered or modified to aid in the prevention of falls. This includes lower body weakness, Vitamin D deficiency, difficulties with walking and balance, and use of medicines, such as tranquilizers, sedatives, or antidepressants. Furthermore, even a select few of over-the-counter medications can affect balance, which tends to decrease with age as well. Alternative key contributors include vision problems, foot pain or poor footwear, home hazards or dangers such as broken or uneven steps and throw rugs or clutter that can be tripped over. Most falls are caused by a combination of risk factors. Therefore, the more risk factors a person develops, the greater their chances are of falling. Specific conditions can be

classified as level A (stroke, dementia, and gait/postural instability impairment) or level B (Parkinson's disease, neuropathies, lower limb weakness, and poor visual acuity). Healthcare providers can help decrease one's risk by reducing the fall risk factors listed above. From a neurological perspective, a multifactorial process plays a complex role into the pathophysiology of falling. Determinants include the role of motor impairment, especially elderly with detected signs of mild parkinsonian, the role of executive and attentive resources when coping with obstacles, the role of vascular lesions in the highest-level gait disorder, and the role of the failure of inter-limbs coordination during walking. This is habitually common within the identification of "idiopathic fallers," which are elderly individuals who typically fall in the absence of a blatant cause or due to underlying diseases (Fasano et al., 2012)**.**
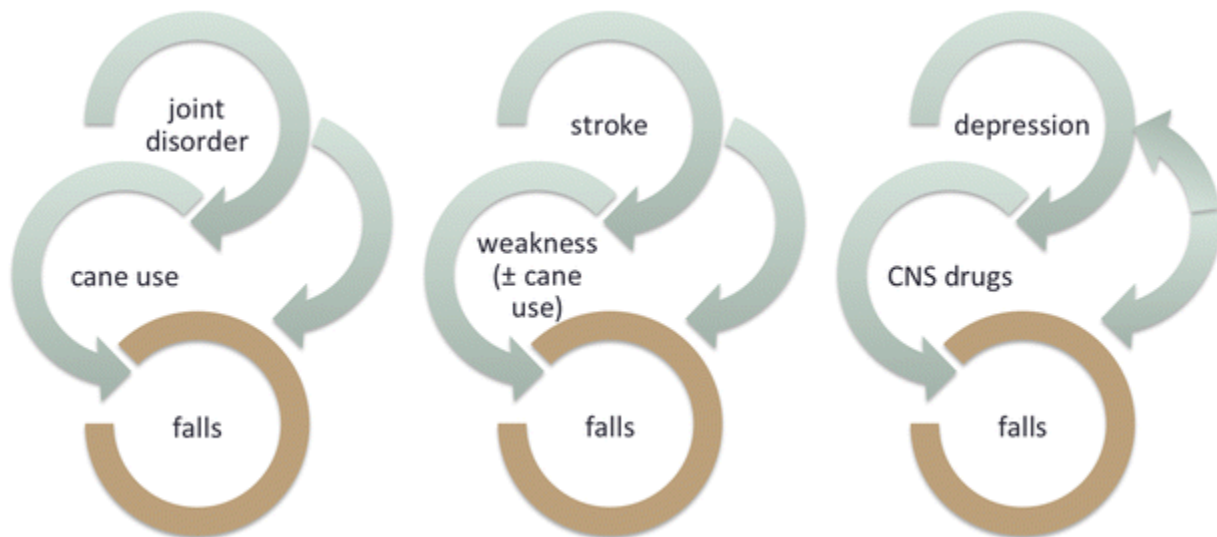
Figure 1. Complex interplay of Risk Factors

Note: This model was produced to highlight the complex interplay of risk factors for elderly falls. From Fasano, A., Plotnik, M., Bove, F. *et al.* The neurobiology of falls. *Neurol Sci* 33, 1215−1223 (2012). https://doi.org/10.1007/s10072-012-1126-6.

Neural science reveals how established risk factors of falling contribute to the complex interplay between the varying factors. For example, Figure 1 illuminates how depression, stroke, and joint disorder are established risk factors, but they may also be a consequence of falling itself. Therefore,

subjects are often treated for these factors with psychoactive drugs, which are also ultimately related to an increased risk of falling.

These psychoactive drugs are often utilized for the tranquil and neuropsychiatric treatment of patients with dementia, where the prevalence of neuropsychiatric symptoms are extremely high with approximately 82% of residents exhibiting this. Within community-dwelling individuals, these drugs are often inappropriately prescribed. Research indicates that only 10% of psychotropic drug prescriptions are fully appropriate for residents with dementia. These drugs are severely associated with significant side effects, especially when used long-term. Not only this, but they often increase the risk of stroke and mortality. Furthermore, the use of sedatives, hypnotics, antidepressants, and other drugs are also all associated with falls (Groot Kormelinck et al., 2019). The Human Rights Watch Organization has also concurred substantial evidence that human rights are being violated in regard to antipsychotic drugging of nursing home residents. Governmental officials suggest considering a national emergency that needs urgent governmental action to, not only increase nursing home staffing levels, but to also enforce the current laws and regulations. As prior stated, a continuous unnecessary use of drugs significantly alters the neurology of the brain which drastically causes adverse effects on balance, impaired cognition, and even vision (Harrington et al., 2020).

1.5   Purpose of the Present Study

The number of people living beyond 65 years of age is increasing rapidly, and they are at increased risk of falls. Falls-related injuries and hospitalizations are steadily increasing. Falls can lead to fear of repeated falls, loss of independence, institutionalization, which inevitably poses a significant burden to the health care system and may eventually cause death of individuals. Therefore, screening of people at risk of falls and comprehensive assessment of older people at high risk of

falls are critical steps toward prevention. This review evaluates the current knowledge relating to falls, with particular focus on rapid screening, assessment, and strategies to prevent falls in the community. In particular, the following questions are considered for the falls:

- Can Underlying Health Conditions Disturb Fall Prevention?

- Can Malpractice/Treatment Inflict Falls and Other Injuries?

The subsequent data analysis has a focus on individuals who deceased in nursing homes and the corresponding causes of death for those individuals together with the demographic and other characteristics of those individuals.

2   LITERATURE REVIEW

2.1 The Social Burden of Falls

It may not seem like it, but falls can take a toll on an elderly individual physically and mentally, which can highly affect the social aspect of their lives. As adults age, decreased cognitive function often increases. This often interferes with how one is able to both, verbally and nonverbally, communicate with others. Along with this, the majority of adults aged 65 years or older experience incontinence to some degree, mainly after a fall due to a severe increase of stress and deteriorating organs. Incontinence, which occurs when the bladder leaks urine during physical activity or extortion, in older adults causes an incredible amount of stress, depression, and certain limitations. This can impede interpersonal relationships, decrease sexual function, increase the risk of devastating falls, and even increase the risk of mortality (Farage et al., 2008).

2.2 The Economic Burden of Falls

Falls among adults aged 65 and older are very costly. Each year about $50 billion is spent on medical costs related to non-fatal fall injuries and $754 million is spent related to fatal falls within the US. Non-fatal falls are often annually divided as: $29 billion is paid by Medicare, $12 billion is paid by private or out-of-pocket payers, and $9 billion is paid by Medicaid (Florence et al., 2018) . As the number of Americans aged 65 and older grows, we can expect the number of fall injuries as well as the cost to treat these injuries to soar. Direct medical costs include fees for hospital and nursing home care, doctors and other professional services, rehabilitation, community-based services, use of medical equipment, prescription drugs, and insurance processing. Direct costs may not account for the long-term effects of these injuries, such as disability, dependence on others,

lost time from work and household duties, and reduced quality of life (Haddad et al., 2019) . One of the most serious fall injuries is a broken hip. It is hard to recover from a hip fracture and afterward many people are not able to live on their own. As the U.S. population gets older, the number of hip fractures is likely to go up. Each year over 300,000 older people—those 65 and older—are hospitalized for hip fractures(Bergen, 2016). More than 95% of hip fractures are caused by falling, usually by falling sideways. (O'Loughlin, 1993).

2.3 The Need for Policies and Programs Addressing Falls and Fall Mortalities

The necessity of the legislature for fall prevention policies and programs is not peculiar. There are current laws and regulations in place that address decades of controversies pertaining to poor nursing home practices, but there are few that address fall specific protocols. The Nursing Home Reform Act in 1987, which originates from the Omnibus Budget Reconciliation Act of 1987, aids in strengthening the regulatory standards, procedures, and processes governing community-dwelling establishments that participate in Medicare and Medicaid insurance policies. Residents who are unable to adequately pay for nursing home expenses, are aged, disabled, or even simply uninsured, often rely on governmental programs to ease that burden. Unfortunately, these individuals are typically the ones who experience extreme negligence, maltreatment, malnourishment, and malpractice. Therefore, more rigorous inspection procedures that require surveyors to focus on quality of care and established intermediate sanctions for regulatory violations were mandated. Along with this, the federal law requires mandatory assessments of all nursing home residents. This allows provision for sufficient nursing, medical, and psychosocial service in order to maintain sufficient mental and physical functional health status of community-dwelling establishment residents. These policies also engage the protection of residents' rights and quality of life (Harrington et al., 2020).

2.4 Assessing Risk Factors

2.4.1 Can Underlying Health Conditions Disturb Fall Prevention?

Minimal studies have evaluated fall prevention among the community-dwelling older adult population to examine the association amid falls and mortality. Despite this, further research has been conducted to establish how persistent underlying health conditions, which can ultimately lead to a fall, contribute to the toll. In a clinical trial conducted by the Annals of Internal Medicine, it was established that falls are a great indicator of an underlying health disorder, but if the condition is improperly treated, it can cause more harm than good. It is quite common to prescribe drugs to elderly nursing-home patients as a simple method of making them more manageable. As a result of drugging patients, personnel demands are reduced with hopes that the nursing home facility may be able to reduce its staffing headcount. Consequently, drugs serve the same purpose as restraints once did – keeping patients tractable and confined. Additionally, they prevent patients from complaining, who are too heavily medicated to do so (Sember, 2016). Therefore, patients are often being treated for nuisance rather than their current health complications, which strenuously deteriorates due to maltreatment and practice. This can cause patients to, not only become dehydrated, but also malnourished. Furthermore, patients receiving subpar treatment due to nursing home negligence typically increase the patient's risk of falling and reduce their quality of life (*Nursing Home Falls,* 2021).

2.4.2 Can Malpractice/Treatment Inflict Falls and Other Injuries?

The Centers for Disease Control and Prevention (CDC) reports that Medicare claims for fallen seniors are on the rise, with more than a third of people falling each year in nursing homes. 50-75% of nursing home residents experience an annual fall. The CDC also estimates that the number of injuries and deaths due to nursing home falls has been steadily increasing (*Facts about Falls*,

2021). A recent study released by the Center for Medicare Advocacy reports that a mere 57.5% of major injury falls are reported to hospitals and/or insurance claims. With a plethora of these cases going unreported, 70% of elderly individuals who experienced a fall are subjected to reoccurrences. This is often due to a combination of enhanced intrinsic risk factors such as increased muscle weakness, chronic disease, cognitive decline, and side effects of medication established through prior experience. Researchers conferred, through questionnaires and alternative research methodology, that inconsistencies within nursing home facilities heavily contributed to increased morbidity and mortality rates within this community. Within five years, the mortality rate of older individuals who had fallen grew to be three times more likely than not. Nursing home deaths and injuries are primarily attributed to understaffing, a lack of supervision, or inexperienced staff (*Nursing Home Falls,* 2021). Even with several policies and procedures in place, if not executed correctly, consequences can become detrimental.

Abuse and neglect of residents and enduring quality issues in community-dwelling establishments are frequently stressed in the press, numerous governmental reports, and within various research studies. Although there have been numerous laws implemented and extensive regulations to protect the human rights of nursing home residents, these laws have not always achieved their goals. The core objective of the International Covenant on Economic, Social, and Cultural Rights (ICESCR) is to require states to protect the civil and political rights of individuals. This consists of freedom from torture, cruel, inhumane, or degrading treatment or punishment. This is extremely implemented within nursing homes due to falls being the leading cause of death related injury for elderly aged 65 and older. Nearly 43% of nursing homes received deficiencies for violations of environmental safety and failure to prevent fall accidents. In 2019, the federal government issued roughly 11,000 nursing homes citations for avoidable hospital readmission of patients. Not only

this, but nearly 11% of community-dwelling residents were admitted into hospitals for conditions that could have been circumvented with proper nursing home care (Harrington et al., 2020).

Not only does maltreatment entice falls, but other quality problems may also arise. Severe weight loss and dehydration are also common problems within nursing homes, which are directly related to inadequate nursing care and lack of patient assistance. In particular, 5.6% of residents usually lose extreme weight during their duration residing within a nursing home, 17.9% of long-term residents often experience immobility issues, 14.8% experience an increase in the need for assistance with regular daily activities, and 6.9% often experience moderate to severe pain (Harrington et al., 2020). Similar to preventable falls, dehydration, and weight loss, these dilemmas are directly related to inadequate staffing and lack of care within community-dwelling establishments.

3 METHODS AND PROCEDURES

3.1 Data Collection

Data was obtained by utilizing the resources of the DeKalb County Medical Examiner's Office (*Medical Examiner's Office | DeKalb County GA*., 2019). The confidential information of deceased nursing homes individuals was requested by a staff member of the Medical Examiner's Office for further research. The request was made viable through the Public Health Information Portal (PHIP), which is an online system where one can request public health data from the Georgia Department of Public Health (*PHIP Data Request*, 2015). Information was requested in collaboration with the Medical Examiner's Office in order to obtain the desired information about elderly death. The obtained data were depersonalized, and no individual identifiers were stored and used in the analysis. The Georgia State University Institutional Review Board (IRB) approval was received for this study of the depersonalized data (IRB Number: H23424, Reference Number: 373571).

A substantial master list of an excessive number of deceased nursing home patients throughout the state of Georgia was collected. The collected and analyzed attributes included age (in years), race, sex, ethnicity, manner of death, any underlying cause of death, and any contributing conditions. This data is housed in a protected Excel spreadsheet in the DeKalb County Medical Examiner's Office. For the analysis of this project, *only de-identified data were analyzed* in order to secure personal information. In particular, only variables age, race, sex, ethnicity, and manner of death were used and analyzed. The Georgia State University Institutional Review Board (IRB) approval was received for this study of the depersonalized data (IRB Number: H23424, Reference Number: 373571).

3.2 Search Engines Utilized

Various resources were utilized to assess federal policies, legislatures, Acts, and regulations pertaining to nursing home violations and domestic human rights standards. Each of the below resources included varying information on topics.

Google Scholar Search Engine: One main source primarily used to obtain advanced scholastic journal articles about the various legislatures put in place to protect the human rights of the elderly community-dwelling establishment population. Google Scholar was also used to find community-dwelling establishment fall prevention specific interventions. Not only this, but this search engine was used to find the prevalence of falls within the elderly population.

PubMed: This specific search engine consists of biomedical literature from MEDLINE, life science journals, and online books. It was utilized to identify peer-reviewed articles on policies and programs related to elder negligence and abuse, specifically within nursing homes.

Centers for Disease Control and Prevention (CDC) website: This website was also utilized to find the prevalence of falls within the elderly population. Along with this, the economic impact originating from falls was conducted from this website. Important, stable facts about falls were also given. Not only this but fall prevention strategies were also garnished from the CDC website.

3.3 Analysis

First and foremost, the data were de-identified, cleaned, and pre-processed in collaboration with the DeKalb County Medical Examiner's Office for a consistent analysis. By utilizing the obtained data, a chi-square test procedure was processed via proc freq in SAS to identify the potential associations between the categorical variables of interest. Summary statistics for continuous data were produced by using proc means, proc univariate, and also proc freq. Bivariate relationships using proc freq were investigated to investigate the relationship between manner of death (MOD)

and the individual characteristics of the individuals. In addition to that, multinomial regression models were also applied to study the MOD relationship with characteristics such as race, ethnicity, gender, age. Multinomial regression has the significant benefit of revealing the associations between MOD and numerous predictor variables included in the data set. The goal was to study how individual characteristics (age, group, sex, ethnicity) are associated with manner of death (MOD).

4   RESULTS

4.1 Data Exploration

Indicator variables in data such as gender, race, ethnicity, and manner of death were represented using SAS formats which were defined to explain the meaning of the corresponding categories. As shown below, Table 1 displays the relationships between the numerical indicators and the corresponding formatted values.

Race	Sex	MOD	Ethnicity
0 = Black	0 = Male	0 = Accident	0 = Not Hispanic
1 = White	1 = Female	1 = Natural	1 = Hispanic or Latino
2 = American Indian/ Alaska Native	6 = Unknown	2 = Pending Investigation	6 = Unknown
3 = Asian		3 = Homicide	
4 = Multiracial		4 = Suicide	
5 = Native Hawaiian/ Pacific Islander		5 = Could not be Determined	
		6 = Unknown	

Table 1. Categorical Variable Numerical Indicators

For the analysis a categorical age variable was created which divided individuals into two groups who were younger than 80 and 80 and older. This aids in a more fluid analysis as these two age groups typically have varying factors which can contribute to falls. In particular, this can be underlying health factors or age itself.

4.1 Statistical Summaries

Univariate statistical summaries such as minimum, maximum, mean, and standard deviation were calculated for age, as this was the lone numerical variable. Since age was the only relevant numerical feature for this dataset analysis, it was the only numerical attribute evaluated and the results of these observations are shown in Figure 2, Table 2.1, and Table 2.2.
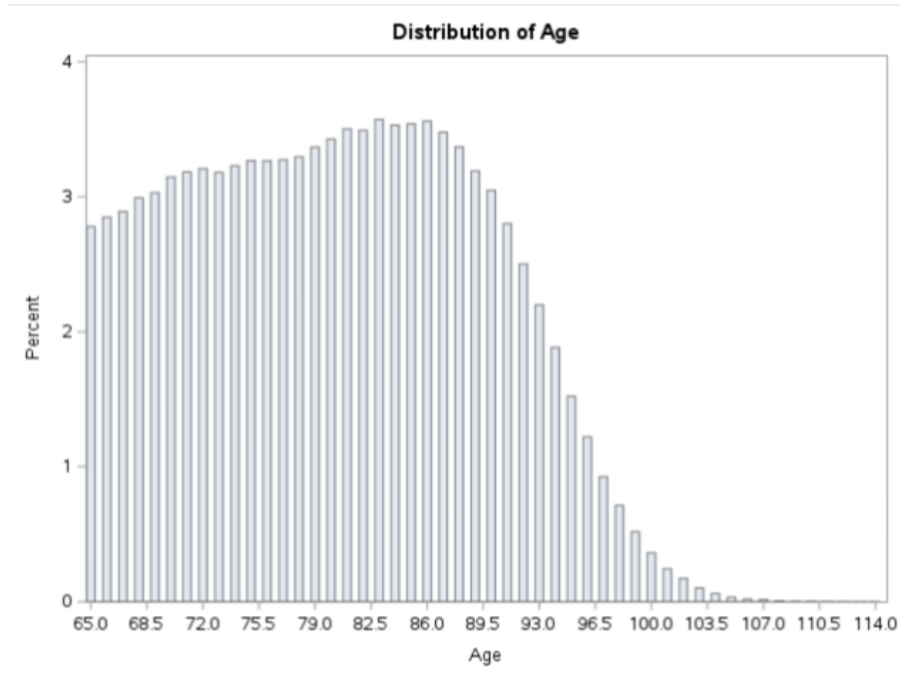
Figure 2. Distribution of Age

The distribution displays the great range of ages of the deceased individuals in Georgia nursing home facilities, along with the prevalence percentage of each individual age. The smallest age in the studied data was 65, which was consistent with such information. The graph also illuminates a right-skewness which aligns with the majority of deceased patients being in the younger category. As previously stated, statistical measures of the age variable reveal the mean, median, mode, standard deviation, range, and much more. This information is displayed in Tables 2.1 and 2.2. As previously addressed, age variable was created which divided individuals into two age groups, younger than 80 and 80 and older. A vital factor into this is the median of the data being exactly

80, which is a great numerical standpoint for this particular dataset. An interesting finding is that even though the majority of deaths occurred within the younger age group, the mode age happened to be 83, which is within the older group.

Basic Statistical Measures			
Location		**Variability**	
Mean	80.38653	**Std Deviation**	9.06831
Median	80.00000	**Variance**	82.23416
Mode	83.00000	**Range**	49.00000
		Interquartile Range	14.00000

Table 2.1. Basic Statistical Measures

Quartiles (Definition 5)	
Level	Quantile
100% Max	114
99%	100
95%	95
90%	93
75% Q3	87
50% Median	80
25% Q1	73
10%	68
5%	66
1%	65
0% Min	65

Table 2.2. Quartiles of Age

4.2 Univariate Summaries

Univariate data summaries do not specifically answer research questions about relationships between variables and their correlation, but rather describe the variable attributes. In particular for categorical variables, univariate summaries aid in the observation of frequencies for each individual variable.

MOD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Accident	7526	1.94	7526	1.94
Natural	370424	95.6	377950	97.54
Pending Investigation	73	0.02	378023	97.56
Homicide	295	0.08	378318	97.64
Suicide	1636	0.42	379954	98.6
Could not be Determined	365	0.09	380319	98.16
Unknown	7148	1.84	387467	100.00

Table 3.1. MOD Univariate

With the manner of death, we can see that natural deaths account for 95.6% of the total data. This observation is not too alarming as the majority of patients in community-dwelling establishments tend to die of disease, negative health indicators, and old age. Accidental deaths range second with a mere 1.94% of the total data. Along with this, the third leading manner of death is homicide at a mere 0.08%. Could not be determined deaths were 0.09%, but since this is unspecified information, this was not included in the analysis. Accidental, homicide, and suicidal deaths were the primary focus for further analysis, with an emphasis on accidental and homicide. Since the data do not specifically differentiate and isolate deaths caused by falls, this data form a subset within the accidental and homicide deaths. Among these, the all-cause mortality, unnatural causes of death were inspected. Among the unnatural causes, the three primary specific manner of deaths were

observed to determine if there are any associations between manner of death with gender, age

group, race, and ethnicity.

MOD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Male	180372	46.55	180372	46.55
Female	207095	53.45	387467	100.00

Table 3.2. Sex Univariate

Moving along to the univariate summary for sex, women account for more than half of the entire

population with 53.45%. Meanwhile, men contribute 46.55%

MOD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Black	88747	22.9	88747	22.9
White	293393	75.72	382140	98.63
American Indian/ Alaska Native	215	0.06	382355	98.68
Asian	4562	1.18	386917	98.68
Multiracial	403	0.1	387320	98.68
Native Hawaiian/ Pacific Islander	147	0.04	387467	100.00

Table 3.3. Race univariate

Since there are many races, such as American Indian/Alaska Native, Asian, Multiracial, and Native

Hawaiian/Pacific Islander, with a very slim percentage of data contribution, the race category was

separated into two groups for further analysis. In particular, White and Non-White groups were identified. The White population consisted of 75.72% of the data. Black individuals soared in 22.9% of deaths which is almost the same as all Non-White.

Ethnicity	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Not Hispanic	382912	98.82	382912	98.82
Hispanic or Latino	4411	1.14	387323	99.96
Unknown	144	0.04	387467	100.00

Table 3.4 Ethnicity Univariate

The ethnicity category consisted of three varying groups: Hispanic or Latino, Not Hispanic, and Unknown. Similar to Race, the ethnicity category was separated into two groups. This is due to Hispanic or Latino and the Unknown group to only accumulate a combined 1.18% of the population.

4.1 Bivariate Relationship

Moving one step forward, the bivariate relationship, which is an analysis to observe the empirical relationship between two variables, was processed. This procedure reveals multiple associations between manner of death and age, sex, race, and ethnicity.

Table of Age by MOD								
Age	Accident	Natural	Pending Investigation	Homicide	Suicide	Could not be Determined	Unknown	Total

	Accident	Natural	Pending Investigation	Homicide	Suicide	Could not be Determined	Unknown	Total
Younger than 80	3872 1.00 2.13 51.45	172397 44.49 94.73 46.54	51 0.01 0.03 69.86	238 0.06 0.13 80.68	1230 0.32 0.68 75.18	236 0.06 0.13 64.66	3963 1.02 2.18 55.44	181987 46.97
80 and Older	3654 0.94 1.78 48.55	198027 51.11 96.37 53.46	22 0.01 0.01 30.14	57 0.01 0.03 19.32	406 0.10 0.20 24.82	129 0.03 0.06 35.34	3185 0.82 1.55 44.56	205480 53.03
Total	7526 1.94	370424 95.60	73 0.02	295 0.08	1636 0.42	365 0.09	7148 1.84	387467 100.00

Table 4.1. Manner of Death versus Age Groups, Bivariate Relationship

From the manner of death versus age results, we can concur that more than 50% of the community-dwelling establishment patients were 80 or older, being the eldest group of the population. The younger than 80 age group contributed 46.97% of the total data. Table 4.1 also shows that even though the eldest age group populates majority of the data, the younger age group accounts for more accidental, homicide, and even suicide deaths. The homicides in the younger age group weigh an alarming 80.68%. This is relevant to the study as a percentage of these homicides can be fall-related. With accidental deaths, which can be fall-related as well, 51.45% of such deaths occurred in the younger age group.

Table of Sex by MOD								
Sex	**Accident**	**Natural**	**Pending Investigation**	**Homicide**	**Suicide**	**Could not be Determined**	**Unknown**	**Total**
Male	4068 1.05 2.26 54.05	170953 44.12 94.78 46.15	38 0.01 0.02 52.05	173 0.04 0.10 58.64	1355 0.35 0.75 82.82	175 0.05 0.10 47.95	3610 0.93 2.00 50.50	180372 46.55

	Accident	Natural	Pending Investigation	Homicide	Suicide	Could not be Determined	Unknown	Total
Female	3458 0.89 1.67 45.95	199471 51.48 96.32 53.85	35 0.01 0.02 47.95	122 0.03 0.06 41.36	281 0.07 0.14 17.18	190 0.05 0.09 52.05	3538 0.91 1.71 49.50	207095 53.45
Total	7526 1.94	370424 95.60	73 0.02	295 0.08	1636 0.42	365 0.09	7148 1.84	387467 100.00

Table 4.2. Manner of Death versus Sex, Bivariate Relationship

The manner of death versus sex results reveals that there are more female elderly individual deaths than males. Even though females account for most of the data, males consume more of the accidental, homicide, and even suicide deaths. This procedure reveals that males are potentially more involved in fall-related deaths than women, even though women make up 53.45% of the population.

Table of Ethnicity by MOD								
Ethnicity	**Accident**	**Natural**	**Pending Investigation**	**Homicide**	**Suicide**	**Could not be Determined**	**Unknown**	**Total**
Not Hispanic	7427 1.92 1.94 98.68	366197 94.51 95.63 98.86	72 0.02 0.02 98.63	292 0.08 0.08 98.98	1621 0.42 0.42 99.08	362 0.09 0.09 99.18	6941 1.79 1.81 97.10	382912 98.82
Hispanic or Latino	99 0.03 2.24 1.32	4183 1.08 94.83 1.13	1 0.00 0.02 1.37	3 0.00 0.07 1.02	14 0.00 0.32 0.86	3 0.00 0.07 0.82	108 0.03 2.45 1.51	4411 1.14

	Accident	Natural	Pending Investigation	Homicide	Suicide	Could not be Determined	Unknown	Total
Unknown	0 0.00 0.00 0.00	44 0.01 30.56 0.01	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.00 0.69 0.06	0 0.00 0.00 0.00	99 0.03 68.75 1.39	144 0.04
Total	7526 1.94	370424 95.60	73 0.02	295 0.08	1636 0.42	365 0.09	7148 1.84	387467 100.00

Table 4.3. Manner of Death versus Ethnicity, Bivariate Relationship

Table 4.3 reveals that Not Hispanics account for 98.82% of the population and all categories of

manner of death are greater than 97%. Therefore, this relationship was not very informative for

the analysis and corresponding results.

Table of Race by MOD								
Race	**MOD**							
	Accident	**Natural**	**Pending Investigation**	**Homicide**	**Suicide**	**Could not be Determined**	**Unknown**	**Total**
Black	1303 0.34 1.47 17.31	86073 22.21 96.99 23.24	14 0.00 0.02 19.18	104 0.03 0.12 35.25	97 0.03 0.11 5.93	130 0.03 0.15 35.62	1026 0.26 1.16 14.35	88747 22.90
White	6078 1.57 2.07 80.76	279290 72.08 95.19 75.40	58 0.01 0.02 79.45	184 0.05 0.06 62.37	1514 0.39 0.52 92.54	226 0.06 0.08 61.92	6043 1.56 2.06 84.54	293393 75.72
American Indian/ Alaska Native	5 0.00 2.33 0.07	200 0.05 93.02 0.05	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.00 0.47 0.06	1 0.00 0.47 0.27	8 0.00 3.72 0.11	215 0.06

Asian	129 0.03 2.83 1.71	4339 1.12 95.11 1.17	1 0.00 0.02 1.37	5 0.00 0.11 1.69	22 0.01 0.48 1.34	7 0.00 0.15 1.92	59 0.02 1.29 0.83	4562 1.18
Multiracial	7 0.00 1.74 0.09	380 0.10 94.29 0.10	0 0.00 0.00 0.00	2 0.00 0.50 0.68	2 0.00 0.50 0.12	1 0.00 0.25 0.27	11 0.00 2.73 0.15	403 0.10
Native Hawaiian/ Pacific Islander	4 0.00 2.72 0.05	142 0.04 96.60 0.04	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.00 0.68 0.01	147 0.04
Total	7526 1.94	370424 95.60	73 0.02	295 0.08	1636 0.42	365 0.09	7148 1.84	387467 100.00

Table 4.4. Manner of Death vs Race, Bivariate Relationship

As previously discussed in section 4.2, since the Black, American Indian/Alaska Native, Asian, Multiracial, and Native Hawaiian/Pacific Islander ethnicity groups are very slim opposed to the White group, these groups were integrated as one. The Non-White individuals made up less than 25% combined as opposed to the 75.72% White individuals. Similar to ethnicity, race was not necessarily a contributing factor of the analysis. Therefore, it could be determined that race does not significantly contribute to the manner of death within the elder community-dwelling establishment patients. The only exception can potentially be a suicide group which has the overwhelming number of White individuals.

4.1 Multinomial Regression

What is multinomial regression? Multinomial regression is a model which is used to study relationships and for predictive analysis. In particular, it is used to explain the relationship between one dependent variable and one or more independent variables. For this procedure, each

categorical variable has a pre-selected value which serves as a specified reference for that variable while all other values of that variable and corresponding relationships are shown in relation to that pre-selected value. To easily distinguish the reference (pre-selected) group in the present summaries it will always be the group within a category that is the majority. I. e. the reference groups are the largest groups in their respective categories. For example, the manner of death 's reference group will consistently be "natural" since this is the most populated group.

Odds Ratio Estimates				
Effect	MOD	Point Estimate	95% Wald Confidence Limits	
Age1 Younger than 80 vs 80 and Older	Accident	1.217	1.163	1.274
Age1 Younger than 80 vs 80 and Older	Homicide	4.788	3.586	6.391
Age1 Younger than 80 vs 80 and Older	Suicide	3.479	3.109	3.893

Table 5.1. Manner of Death vs Age Groups, Multinomial Regression

Multinomial regression gives the output of Odds Ratio Estimates and the corresponding 95% Wald Confidence Limits. To thoroughly interpret this chart, the point estimate of the odds ratio is generated. Therefore, the odds of accidental deaths in relation to the odds of natural deaths were 1.217 times larger for the younger group in relation to the older age group. We know that this is significant because the Confidence Interval (CI) does not include 1.000. The odds of homicide deaths in relation to odds of natural deaths were 4.788 times larger for the younger group in relation to the older age group. The odds of suicidal deaths in relation to natural deaths were 3.479 times

larger for the younger group in relation to the older age group. Therefore, we can determine that the younger age group has higher odds of deaths than the older group.

Odds Ratio Estimates				
Effect	MOD	Point Estimate	95% Wald Confidence Limits	
Sex Female vs Male	Accident	0.729	0.696	0.763
Sex Female vs Male	Homicide	0.604	0.479	0.762
Sex Female vs Male	Suicide	0.178	0.156	0.202

Table 5.2. Manner of Death vs Sex, Multinomial Regression

Based on the results, we can interpret that the odds of accidental deaths in relation to the odds of natural deaths were 0.729 times less for females in relation to males. The odds of homicide deaths in relation to the odds of natural deaths were 0.604 times less in females in relation to males. The odds of suicidal deaths in relation to the odds of natural deaths were 0.178 times less in females in relation to males. All data is significant as the CI does not contain 1.000.

Odds Ratio Estimates				
Effect	MOD	Point Estimate	95% Wald Confidence Limits	
Race 1 Non-White vs White	Accident	0.730	0.689	0.774
Race 1 Non-White vs White	Homicide	1.849	1.461	2.340

Race 1 Non-White vs White	Suicide	0.247	0.205	0.297

Table 5.3. Manner of Death vs Race, Multinomial Regression

Based on the results, we can interpret that the odds of accidental deaths in relation to the odds of natural deaths were 0.730 times less in the Non-White group in relation to the White group. The odds of homicide deaths in relation to the odds of natural deaths were 1.849 times less in the Non-White group in relation to the White group. The odds of suicidal deaths in relation to the odds of natural deaths were 0.247 times less in the Non-White group in relation to the White group. All data is significant as the CI does not contain 1.000. We can concur that accidental and suicidal deaths are different between the groups, where the Non-White group tends to have more deaths than the White group. In particular, more homicide and suicide deaths are occurring in the Non-White group but less accidents.

Odds Ratio Estimates				
Effect	**MOD**	**Point Estimate**	**95% Wald Confidence Limits**	
Ethnicity Hispanic or Latino vs Not Hispanic	**Accident**	1.167	0.955	1.426
Ethnicity Hispanic or Latino vs Not Hispanic	**Homicide**	0.899	0.288	2.806
Ethnicity Hispanic or Latino vs Not Hispanic	**Suicide**	0.756	0.446	1.281

Table 5.4. Manner of Death vs Ethnicity, Multinomial Regression

Based on the results, we can interpret that the odds of accidental deaths in relation to the odds of natural deaths were 1.167 times greater in the Hispanic or Latino group in relation to the Not Hispanic group. The odds of homicide deaths in relation to the odds of natural deaths were 0.899

times less in the Hispanic or Latino group in relation to the Not Hispanic group. The odds of suicidal deaths in relation to the odds of natural deaths were 0.756 times less in the Hispanic or Latino group in relation to the Not Hispanic group.

5   DISCUSSION AND CONCLUSION

5.1 Study Limitations

This study was subject to limitations. One key limitation was the severe lack of underreporting of falls, but especially those that led to major injuries. Typically, 3.4% of community-dwelling individuals have falls that result in major injuries [Citation error], but the entirety of this small percentage is not reported, so the numbers may actually be greater than what officials assume. Without proper reporting, it can be extremely difficult to assess the necessary components and attributes that contribute to fall risks. Not only this, but various legislations, acts, and others stem from the data accumulated from within community-dwelling establishments. With improper reporting of data, correct legislative implementations are no longer accessible, which can lead to an even greater increase of falls. Legislature is set to aid in the prevention of severe sickness, injuries, and mortalities. With these casualties, illnesses, and injuries not being reported, the phenomenon will be stagnant. This can also prevent further advancements within the healthcare field. With limited data, the correct treatment and updated procedures are not able to be fully implemented. This can unfortunately lead to a continuation of negligence, maltreatment, and malpractice within elderly community-dwelling establishments. Other limitations include available resources, local services, policies, and protocols, particular patient's circumstances, and clinical experience of healthcare providers (*The Assessment and Prevention of Falls in Older People*, 2013). The manner of death (MOD), which was presented in this analysis, can only serve as an indirect measure of falls and does not necessarily address the underreporting of falls.

5.2 Conclusions

Having performed several procedural calculations, there is some evidence that the younger age group, which consists of deceased patients younger than 80, account for more unnatural deaths as

opposed to those 80 and older. This includes ~52% accidental, ~81% Homicide, and ~75% suicidal deaths. Although women account for the majority of the population, men ultimately have more unnatural deaths. This includes ~54% accidental, ~59% Homicides, and ~83% suicidal deaths. Even though ethnicity was not a significant factor, race was.

5.3 Future Directions for Research in This Area

In the 2013 report, The National Institute for Clinical Excellence (NICE) commissioned the National Collaborating Centre for Nursing and Supportive Care (NCC-NSC) to develop guidelines on the assessment and priority of prevention of falls in elderly individuals. Recommendations were also provided for policymakers for implementations and evaluations of clinical guidelines (*The Assessment and Prevention of Falls in Older People*, 2013). Developing a clear presentation to convey fall prevention strategies and implications to enhance elderly health, not only on a national level, but global as well. Considering elderly fall risks in community-dwelling establishments as a global phenomenon increases awareness, which may ultimately cause a positive effect.

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