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Identification of Risk Factors Associated with Falls in the Long Term Care Setting

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Abstract

Background: Falls threaten the safety of older adults in long term care (LTC).

Objectives: To assess environmental, clinical and pharmacological causes of falls as well as compare Fall Risk Assessment Score, Brief Interview of Mental Status (BIMS) score, Activities of Daily Living (ADL) scores, age and gender of residents with one fall, recurrent falls, and no falls.

Methods: Using a descriptive-comparative design, we included a convenience sample of 290 adults ≥50 years old at our LTC facility. Fall and recurrent fall groups were matched to those with no falls. We assessed environmental, clinical and pharmacological variables, Fall Risk Assessment Scores, BIMS scores, ADL scores, age, and gender among those with one fall, recurrent falls, and no falls.

Results: Among 290 residents, patients who fell had significantly more modifiable environmental ($p<.05$), clinical ($p<.05$), and pharmacological ($p<.05$) causes of falls. Fall risk scores were significantly higher for the initial falls ($p=.02$) group and the recurrent falls group ($p<.001$) compared to no fall. BIMS scores were significantly lower for the initial fall group compared to the no fall group ($p=.03$). For ADL bed mobility ($p<.001$), transfer ($p=.01$), eating ($p<.001$), and toilet use ($p<.001$), significantly more residents in the no falls group required extensive assistance compared to the recurrent falls group. There was no significant difference in age or gender among fall groups.

Conclusions: Many of the significant variables found in the initial fall and recurrent fall groups are modifiable. LTC residents would benefit most from an ongoing multidisciplinary approach to falls risk reduction.

Background

Falls are the leading cause of both life-threatening and non-life-threatening injuries in older adults in the United States (National Council on Aging [NCOA], 2017). It is estimated that falls are responsible for approximately 36% of preventable emergency department visits by nursing home residents and this number continues to rise annually ("Nursing Home Abuse Guide," 2017). Falls not only threaten the safety and well-being of the individual, but they are an economic burden for society and the medical system at large (NCOA, 2017). In addition, as the total number of older adults in our population continues to grow, falls continue to increase (Centers for Disease Control and Prevention [CDC], 2016).

At my LTC institution, fall risk is assessed by the nursing staff on admission, quarterly, annually and after each fall. Multidisciplinary teams have been noted in the literature as beneficial to reducing falls, but the composition of such teams has not been reported (Vlaeyen et al., 2015). It has been demonstrated in the literature that fall risk interventions decrease the number of falls, but it is not clear if these interventions decrease the number of recurrent falls (Fonad, Wahlin, Emami, & Sandmark, 2008).

The Brief Interview for Mental Status (BIMS) is used in the nursing home setting to assess cognitive functioning (Heerema, 2017). The BIMS is administered by the social worker in my facility (see Appendix A). The BIMS can measure if individuals are improving, remaining the same or declining in their cognitive ability (Heerema, 2017). Of the many risk factors associated with falls, dementia has been identified as one that occurs frequently in the LTC setting (Kalin, Gustafson, Sandman, & Karlsson, 2005).

Activities of daily living (ADLs) are assessed on all nursing home residents at my facility on admission and every shift by the geriatric nursing assistant (GNA). Each shift, residents are

assigned a resident performance code and a staff support code for four areas of functional status (see Appendix B). These four areas include bed mobility, transfer, eating and toilet use. Impairment of ADLs is one of the most important risk factors for falling in the LTC population (Cigolle, Langa, Kabeto, Tian, & Blaum, 2007).

Problem Statement

Falls are a reportable occurrence in LTC facilities. At my LTC institution, there were on average twelve residents each month with a fall or a recurrent fall, defined as >1 fall in 180 days. The causes of these falls were thought to be multifactorial. Furthermore, we hypothesized that there was a causal relationship between the most recent BIMS score, most recent ADL assessment scores and/or age and gender. It was also hypothesized that there were environmental, clinical and pharmacological risk factors not captured on our initial Fall Risk Assessment that influenced falls in this population.

The identification of the influence of the BIMS score, ADL assessment scores and age/gender as well as other clinical, environmental and pharmacological factors on fall risk may assist in the reduction falls in the LTC setting through modifications that maximize resident safety.

Purpose

The purpose of our study was to assess the problem of falls and recurrent falls at my LTC facility and identify and compare risk factors for residents with one fall, recurrent falls and no falls so that overall fall rates could be reduced. Through the findings of this study, we intended to implement targeted strategies to affect sustained initiatives in falls prevention for LTC residents.

Specific Aims

The specific aims of our study were to:

1. Retrospectively compare the most recent fall risk scores among LTC residents with one fall, a recurrent fall and no falls.
2. Compare the relationship between the most recent BIMS scores and residents with one fall, a recurrent fall and no falls.
3. Compare the relationship between the most recent ADL assessment scores and residents with one fall, a recurrent fall and no falls.
4. Compare the relationship between age and gender of residents with one fall, a recurrent fall and no falls.

Research Question

1. What are the potential environmental, clinical, and pharmacologic risk factors among LTC residents with falls?

Research Hypotheses

1. There is a difference between the most recent calculated fall risk scores of LTC residents with one fall, a recurrent fall and no fall.
2. There is a difference between the most recent BIMS scores of LTC residents with one fall, a recurrent fall and no falls.
3. There is a difference between the most recent ADL assessment scores and LTC residents with one fall, a recurrent fall and no falls.
4. There is a difference in age of LTC residents with one fall, a recurrent fall, and no falls.
5. There is a difference in gender of LTC residents with one fall, a recurrent fall and no falls.

Significance

We believed the findings of our study might have the potential to improve the safety of LTC residents and assist in easing the economic burden associated with falls by examining and comparing the risk factors for LTC residents with one fall, recurrent falls and no falls. Falls with major injury are a quality measure that indicates how well LTC facilities are caring for their residents' clinical needs (Centers for Medicaid & Medicare Services [CMS], 2016). It was, therefore, imperative to identify risk factors associated with falls so that falls and recurrent falls could be reduced.

Literature Review

Falls and Dementia

Various risk factors for falls in nursing home residents have been suggested in the literature. Van Doorn et al. (2003) compared fall rates between 2, 015 nursing home residents with and without dementia and concluded that dementia was an independent risk factor for falls, however, they did not study dementia as a risk factor in recurrent falls. (Van Doorn et al., 2003).

A study by Meuleners, et al., (2016) examined risk factors for recurrent injurious falls in 32, 519 adults age 60 and older with dementia. The study identified females as having a 7% higher incidence of recurrent injurious falls than males, and recognized the impact of dementia in falls, but did not study the severity of dementia or medication use.

A prospective observational cohort study by Whitney, et al., (2012) identified notable risk factors for falls that could possibly be reduced with the appropriate interventions in individuals >60 with dementia living in LTC settings. A total of 109 participants which included male and female residents from seven nursing homes comprised the study sample.

Falls and Psychoactive Medications

Research conducted by Agashivala & Wu (2009) utilized logistic regression to understand the relationship between 11,940 elderly nursing home residents who fell in the past month and the risk factor of potentially inappropriate psychoactive medications (PIPMs). The study concluded that PIPMs are a significant risk factor for falls in nursing home residents and also identified that overall fall risk increased when the number of ADLs were impaired (Agashivala & Wu, 2009).

Similarly, Bozat-Emre, et al. (2015) assessed whether atypical antipsychotic drugs (AAD) increased risk of falls among nursing home residents. The study was conducted with 626 nursing home residents who were prescribed AADs during a two-year period and who had at least one fall. The study assessed the dose dependent risk of atypical drugs in isolation, but not the effects of polypharmacy, and the study did not assess medications and recurrent falls.

Huang, et al. (2012) conducted a comprehensive review of studies in the literature published between 1996 and 2011 on the issue of medication induced falls in the elderly. The authors identified medication use as the most modifiable risk factor for falls and recommended the importance of frequent medication review (Huang et al., 2012).

Falls and Extrinsic Risk Factors

Other extrinsic risk factors for falls have been mentioned in the literature such as staffing, administrative policies and nursing policies and procedures. Kehinde, et al. (2012) assessed the relationships between fall rates per 1000 resident days and structure and process related risk factors such as staffing and clinical and administration polices in nursing home residents with dementia. The perceptions of fifteen directors of nursing (DON) were assessed and suggested that the DON may be able to influence fall rates by targeting nursing home policies and by

addressing environmental concerns but did not compare these extrinsic factors among residents with an isolated fall versus recurrent falls.

The literature identifies overall risk factors for falls among older people living in LTC facilities. Fonad, et al. (2008) conducted a study over three years with 743 males and 1908 females aged 40-105 years of age from 21 nursing homes. The study identified common clinical and pharmacological risk factors for falls in the nursing home setting and found that the causes of falls are almost always multifactorial (Fonad, Wahlin, Emami, & Sandmark, 2008).

Previous research has explored the risk factors contributing to falls in the LTC setting. McArthur, et al., (2016) conducted a prospective, observational study of 101 male and female LTC residents over the age of 65 from four LTC homes in Canada that characterized the location, the time of day and the specific activity that resulted in falls. Residents were most likely to fall in the bedroom and while walking. Of falls that resulted in fracture, most occurred during the early morning hours, with dim lighting, and in females with a cognitive impairment. Medication use, age, environmental and clinical characteristics of falls were not studied.

Falls and Intrinsic Risk Factors

Medical diagnoses such as cardiovascular (CV) disease have been identified as a risk factor for falls in older adults, especially unexplained falls. Jansen, et al. (2016) conducted a systematic review of 86 studies which examined falls in older adults to identify specific CV disorders that are most associated with falls. The study identified several CV associations with falls in the elderly, however, additional understanding of the specific risk factors is needed to understand if CV risk is an independent or contributing risk factor for falls.

Dhargave & Sendhilkumar (2016) conducted a cross-sectional study in four LTC homes of 163 men and women ≥ 60 years of age to understand individual risk factors for falls among

elderly LTC residents. They found that a prior history of falls, visual impairment, polypharmacy, chronic diseases, vertigo, balance problems and female gender were associated with a higher incidence of falls. They did not, however, differentiate the impact that cognitive status has on these risk factors.

Theoretical Framework

The National Quality Forum (NQF), one of several organizations working to improve healthcare in the United States, recommends outcome, process, structure, and patient-centered measures be used for supporting internal healthcare quality improvement efforts (National Quality Forum [NQF], 2017). The theoretical framework for our study was based on Donabedian's theoretical framework of structure, process, and healthcare outcomes (see Figure 1). According to this framework, improvements in the structure of care should lead to improvements in clinical processes that should ultimately improve patient outcomes (NQF, 2017). We used this model to examine the relationship between identification of fall risk factors and the outcomes of falls and recurrent falls. These outcomes were conceptualized as patient-centered outcome indicators. Modification of environmental factors were conceptualized as a staff-centered process indicator because facility staff were able to adjust factors such as reduction of clutter in the patient environment, careful attention to spills and management of electrical cords and intravenous tubing.

The LTC facility and the unit type were conceptualized as system-centered structure indicators.

Study Variables

The demographic characteristics included race, marital status and education level. The sample was further described by the primary medical diagnosis as well as environmental, clinical, and pharmacological causes of falls.

The independent variables of the study were Fall Risk scores, BIMS scores, ADL scores for each of the four ADL categories, age and gender.

The dependent variables of the study were initial fall, recurrent fall, and no falls from May 1, 2016 to July 31, 2017. All variables were theoretically and operationally defined in Table 1.

Methods

Research Design

The study was a retrospective medical record review that used a descriptive-comparative design.

Sample

The sample was a convenience sample comprised of all records of LTC residents, male and female, ≥ 50 years of age who did and did not suffer a fall during their admission in our LTC facility between May 1, 2016 and July 31, 2017. Residents with one fall and recurrent falls were matched for comparison during the calendar quarter of when they sustained the fall to residents with no falls first, by gender. Then, within gender, residents with one fall and recurrent falls were matched to residents with no falls by age +/- 5 years.

Falls were defined as an "unintentional change in position coming to rest on the ground, floor, or onto the next lower surface (e.g., onto a bed, chair, or bedside mat). The fall may be witnessed, reported by the patient or an observer, or identified when a patient is found on the floor or ground. Falls are not a result of an overwhelming external force (e.g., a patient pushes

another patient). An intercepted fall occurs when a patient would have fallen if he or she had not caught him/herself or had not been intercepted by another person – this is still considered a fall." (Centers for Medicaid and Medicare Services [CMS], 2016, para. 1).

Inclusion criteria for the fall group included LTC residents with a history of a fall or a recurrent fall, ≥ 50 year of age, male and female, of all races and ethnic backgrounds, of all educational levels, married or not married and those with and without a cognitive impairment. Inclusion criteria for the no falls group included residents with a history of no falls within the last calendar quarter, ≥ 50 years of age, male and female, of all races and ethnic backgrounds, of all educational levels, married or not married and those with and without a cognitive impairment. Residents were excluded from the study if they were <50 years of age, had a fracture of either lower extremity, a history of vertigo or Parkinson's disease, were paraplegic, or had autonomic dysfunction.

Sample Size

A convenience sample of 290 residents who met the inclusion criteria were included in the study for the falls and no falls group during the period of May 1, 2016 to July 31, 2017. There were 145 falls and recurrent falls who met the inclusion criteria and they were matched to the no falls group during the calendar quarter in which they sustained the fall, first by gender then by age +/- 5 years to equal a total sample size of 290.

Setting

The study was conducted at our LTC facility located in the Mid-Atlantic area. The facility is comprised of two LTC units which have a total capacity of 88 beds and one transitional care unit. Only falls which occurred in the LTC setting were studied.

The medical definition of a LTC facility is “a facility that provides rehabilitative, restorative, and/or ongoing skilled nursing care to patients or residents in need of assistance with activities of daily living” ("MedicineNet.com," 2017, para. 1).

Instrumentation/Measurements

One tool, the Data Collection Spreadsheet, was used to collect data in this study (Table 2). The data collection tool was a medical record abstraction tool that coded demographic characteristics in addition to environmental, clinical and pharmacological characteristics of the sample. In addition, the tool coded data for each of the five independent variables – fall risk score, BIMS score, ADL score for each of the four ADL categories, age and gender.

Every resident was assessed for fall risk at the time of admission, quarterly, annually and with each change of condition (e.g., a fall with or without injury), and these assessments were available in the EHR. The most recent recorded fall risk score at the time of the fall was used for the falls group. It should be noted that a fall is considered a change in condition, and this prompts yet another fall risk score to be calculated. This score is after the fall and was not used for the data collection. The same procedure was followed for the no falls group. The Fall Risk Assessment that was used at our facility is a corporate developed tool. The range of the fall risk score is 1-22. See Table 3 for the Fall Risk Assessment, which notes the weighted value for each response. For example, the first question of the fall risk tool, B1F_b1, notes a weighted value of “6” for a response of “yes”. The only possible score for this question is a “6” for “yes”, otherwise, if the response was “no” the field was left blank, per the tool design.

The seven item BIMS, as noted in Appendix A was used to identify the presence and severity of cognitive impairment in LTC residents. The BIMS tests two domains of cognitive function, memory and orientation. The BIMS was conducted at the time of admission, annually

and with each change of condition, for example, after a fall. The most recent numerical BIMS score at the time of the fall was recorded for data collection for both the falls and no falls groups.

To better understand the BIMS, the range of scores for the BIMS is 0-15 with lower scores indicating an increasing likelihood of cognitive impairment. A score of 0-7 indicates severe cognitive impairment. A score of 8-12 points indicates moderate cognitive impairment and a score of 13-15 indicates that the resident is cognitively intact (Mansbach, Mace, & Clark, 2014). Mansbach, et al. (2014) found the BIMS "to have strong internal consistency reliability and construct validity" (Mansbach et al., 2014, para. 1). Mansbach, et al. (2014) addressed the utility of the BIMS for identifying cognitive impairment with analyses of sensitivity and specificity. They found the BIMS yielded a sensitivity of .66 and a specificity of .88 (Mansbach et al., 2014). The BIMS takes approximately three minutes to administer and can be administered by allied health professionals trained to do so (Mansbach et al., 2014). In our LTC facility, the BIMS was administered by a licensed social worker.

The ADL scores for each measured category – bed mobility, transfer, eating and toilet use was obtained from archived monthly ADL paper-based flowsheet records located in the medical records department. These ADL scores were measured three times daily by the GNA staff. The ADL scores closest to the date and time of the fall were utilized for data collection for both the falls group and no falls group. Each of the four areas assessed were scored from 0-4 with higher scores indicating more dependence to complete the task. The measurement values for each for the four assessed areas are noted in Appendix B. All four ADL categories were not totaled, but were independent of each other, understanding that residents may have a greater need in one area versus the other. The ADL assessment, based on the Resource Utilization Groups – Activities of Daily Living (RUG-ADL) is a case mix classification system for LTC developed in

the United States (Fries et al., 1994). There have been limited empirical efforts to explore the content validity of the RUG-ADL assessment, however, numerous papers and commentaries have criticized the RUG-ADL for failing to directly assess cognitive ability and account for the demands of caring for the cognitively impaired (Aronson et al., 1992). Many studies that have examined the concurrent validity of the RUG-ADL and found that it explained more significantly the variance in nursing resources than did other systems (Carpenter, Main, & Turner, 1995). Carpenter, et al. (1995) examined inter-rater reliability between two nurses on the RUG-ADL and found the same subgrouping in 74% of the subjects studied, giving it adequate inter-rater reliability. The RUG-ADL has been validated against several standardized instruments for assessing physical functional status and level of support needed (Frederikson, Tariot, & De Johge, 1996).

Other data such as age, gender, race, marital status, educational level and primary diagnosis were obtained from the EHR admission profile sheet, located in the EHR database. For a description of the coding used for each measure, refer to the data codebook (Appendix C).

The electronic data collection spreadsheet captured all measurements needed to answer the research questions. Data entry on the data collection tool aligned with the coding for each variable noted in the data codebook (see Appendix C). Furthermore, the data collection tool distinguished between missing, not assessed and zero values. Additional information in words provided further clarity for other environmental, clinical and pharmacological causes of falls, if appropriate. The data collection tool did not include patient names or patient identifiers but included medical record numbers until all data collection was completed, at which time the medical record numbers were deleted before analyses.

There were three levels of the dependent variable for this study. The first level, initial fall from May 1, 2016 to July 31, 2017, was identified from change of condition reports and progress notes, which were in the EHR. The definition of a fall for this study aligned with the Centers for Medicaid and Medicare Services Resident Assessment Instrument Manual version 3.0, as previously noted.

The second level of the dependent variable was recurrent fall(s) from May 1, 2016 to July 31, 2017. As with initial falls, the data source for recurrent fall(s) was obtained from change in condition reports and progress notes, located in the EHR. Recurrent falls were defined as one or more falls per resident for the duration of their admission in the facility during the 180-day reporting period. The operational definition of a recurrent fall was defined exactly as the definition of an initial fall. (Centers for Medicaid and Medicare Services [CMS], 2016, para. 1).

The third level of the dependent variable was no falls. The data source for no fall(s) was obtained from EHR progress notes.

Residents were identified for this study based on current eligibility criteria. Residents with one fall, recurrent fall(s) and no falls were identified based on facility falls report data obtained from the EHR. No strategies were needed to minimize non-respondents, drop-outs or those lost to follow up since this was a medical record review of retrospective data.

Data collection commenced after approval from the George Washington University Internal Review Board (IRB). In addition, a research request form, as required by the corporate management of my facility, was submitted for review by our research committee. There was not a corporate or facility-based IRB for my institution, however, after the research request form was submitted, reviewed and approved, a letter of permission from the corporate management of my

facility was issued granting permission to collect data. The data collection process commenced October 13, 2017 and lasted for approximately two months.

Data Collection Procedure

Data retrieved from the medical record from May 1, 2016 to July 31, 2017 for residents with one fall, recurrent falls or no falls who met inclusion criteria were entered into the data collection spreadsheet following the coding noted in the codebook. Only one investigator entered data into the electronic spreadsheet database. The data collector holds a Master of Science degree and has 25 years of clinical nursing experience working with adults and the frail elderly in addition to experience with medical record abstraction for other research studies.

To ensure that coding was consistent and reliable, a CITI trained, independent abstractor familiar with the current EHR checked 20% of the total sample of data. The independent abstractor, a nurse practitioner with a master's degree, was added to the IRB application. The data accuracy check demonstrated no inconsistencies of the sample that was reviewed.

Data Analysis Plan

A quantitative data analysis using IBM SPSS 23 predictive analytics software was used for data analysis. After data collection was completed and after the data accuracy check, the medical record (MR) number was deleted from the SPSS database and data analysis was performed.

For the research question 1, what are the potential environmental, clinical, and pharmacologic causes of falls among LTC residents with one fall and a recurrent fall, descriptive statistics were performed to summarize the results by frequency and percentage. A Chi square (χ^2) test was calculated for each demographic and clinical variable to understand the relationship between the variable and falls and no falls.

Data analyses using inferential statistics were performed to test the research hypotheses. For research hypothesis 1, there is a difference between the most recent fall risk scores of LTC residents with one fall, a recurrent fall and no falls, the analysis of variance (ANOVA) was performed. For research hypothesis 2, there is a difference between most recent BIMS scores of LTC residents with one fall, a recurrent fall and no falls, the actual numerical BIMS score for each fall group was collected and the ANOVA was performed. For research hypothesis 3, there is a difference between the most recent ADL scores and residents with one fall, a recurrent fall and no falls, a Chi square analysis was performed for bed mobility, transfer, eating and toilet use. For research hypothesis 4, there is a difference in age of long term care residents with one fall, a recurrent fall and no falls, the ANOVA was performed. For research hypothesis 5, there is a difference in gender among long term residents with one fall, a recurrent fall, and no falls, a Chi square analysis was performed. The level of significance for all analyses was set at 0.05.

Ethical Considerations

Data were securely maintained in a way that prevents inadvertent or inappropriate disclosures of participants' identifiable information. Only data needed to support the study aims were accessed, and no Health Insurance Portability and Accountability Act (HIPAA) protected health information (PHI) was included in the study database. Access to the data spreadsheet and codebook were available only to the principal investigator and co-investigator. All files containing electronic data were password protected and encrypted, and double locked in a private office on the premises of the facility. Files containing electronic data were closed and locked when the encrypted computer was not in use, which was utilized by the principal investigator only. Paper-based ADL flowsheets were accessed in the medical records department and did not leave the study facility.

Results

Demographic and Clinical Characteristics

Data were obtained retrospectively from 290 residents. Environmental, clinical, and pharmacological risk factors were assessed, among which 145 (50%) were in the falls group and 145 (50%) were in the no falls group.

For all groups, the mean age was 69.54 (SD = 9.63) and 150 (52%) were male, 140 (48%) female. Most of the total sample were black (n= 178, 61%), not married (n= 232, 80%) and did not finish high school (n= 178, 61.4%). The primary admitting diagnoses of the total group was coronary artery disease (CAD)/cerebrovascular disease (CVD)/peripheral vascular disease (PVD) (n=128, 44%) and was followed by liver disease (n=41, 14%) and chronic kidney disease (CKD) (n= 38, 13%, Table 4).

Research Question Results

We assessed potential environmental, clinical, and pharmacologic causes of falls among LTC residents within the total group and in patients with falls and no falls, as noted in Table 4. For the total sample (n=290, 100%), the environmental risk factors included wet floors (n=5, 1.7%), lights off/dim lighting (n=87, 30%), obstacles/tripping hazards (n=29, 10%), improper use of assistive device (n=12, 4%) and socks/bare feet on tile floor (n=53, 18%). More residents were noted to have wet floors in the falls group (n=5, 3.45%) compared to the no fall group (n=0, 0%; χ^2=5.09, p=.02). Lights off/dim lighting was similar and not significantly different between the falls group (n=46, 31.72%) and no falls group (n=41, 28.28%; χ^2=0.41, p=.52). Obstacles/tripping hazards were significantly higher in the falls group (n=26, 17.93%) compared to the no falls group (n=3, 2.07%; χ^2=20.27; p<.001). Improper use of assistive device as a risk factor for falls was significantly higher in the falls group (n=10, 6.90%) compared to the no falls

group (n=2, 1.4%; χ^2=5.56, *p*=.02). Socks/bare feet on tile floor was significantly higher in the falls group (n=47, 32.41%) compared to the no falls group (n=6, 4.1%; χ^2=38.81, *p*<.001).

For the total sample (n=290, 100%), clinical risk factors included muscle weakness (n=202, 70%), impaired balance/gait (n=221, 76%), visual impairment (n=92, 32%), sensory impairment (n=64, 22%), foot problems including transmetatarsal amputation (n=48, 17%), postural hypotension (n=16, 5.5%) and vertigo (n=13, 4%). Significantly more patients had muscle weakness in the falls group (n=110, 75.86%) compared to the no falls (n=92, 63.45%; χ^2=5.29, *p*=.02) group. Significantly more patients had impaired balance/gait in the falls group (n=122, 84.14%) compared to the no falls group (n=99, 68.28%; χ^2=10.06, *p*<.001). Significantly more patients had foot problems, including gout and transmetatarsal amputation, in the falls group (n=31, 21.38%) compared to the no falls group (n=17, 11.72%; χ^2=4.89, *p*=.03). Significantly more patients were affected by visual impairment in the no falls group (n=59, 40.69%) compared to falls group (n=33, 22.76%; χ^2=10.76, *p*<.001). More residents had postural hypotension in the no falls group (n=9, 6.21%) compared to the falls group (n=7, 4.83%; χ^2=.27, *p*=.61), but this difference was not significant. Likewise, more residents had vertigo in the no falls group (n=8, 5.52%) compared to the falls group (n=5, 3.45%; χ^2=.73, *p*=.40) but the difference was not significant. More residents had sensory impairment in the no falls group (n=37, 25.52%) compared to the no falls group (n=27, 18.62%; χ^2=2.01, *p*=.16), but the difference was not significant.

For the total sample (n=290, 100%), the pharmacological risk factors included psychotropic medications (n=65, 22%), benzodiazepines (n=73, 25%), atypical antipsychotics (n=50, 17%), antidepressants (n=169, 58%), antiepileptics (n=71, 24.5%), cholinesterase inhibitors/memantine (n=62, 21%), opioids (n=116, 40%), diuretics (n=118, 41%),

antihypertensives (n=248, 85.5%) and glucose control medications (n=175, 60%). Benzodiazepine use was significantly higher in the no falls group (n=46, 31.72%) compared to the falls group (n=27, 18.62%; χ^2=6.61, *p*=.01). Antidepressant use was significantly higher in the falls group (n=97, 66.90%) compared to the no falls group (n=72, 49.66%; χ^2=8.86, *p*<.001). Antiepileptic use was significantly higher in the no falls group (n=44, 30.34%) compared to the falls group (n=27, 18.62%; χ^2=5.39, *p*=.02). The use of antihypertensives was significantly higher in the falls group (n=137, 94.48%) compared to the no falls group (n=111, 76.55%; χ^2=18.821, *p*<.001). No significant differences were found in the use of psychotropic medications, atypical antipsychotics, cholinesterase inhibitors/memantine, opioids, diuretics and glucose control medications between the falls group and the no falls group.

Fall Risk Score

The falls risk score noted closest to the time of the fall/no fall was collected and used for data analysis. As noted in Table 3, a score of 0-4 was indicative of low risk for fall; followed by a score of 5-11 indicative of moderate fall risk and finally a score of 12-22 indicative of high risk for fall. The mean fall risk score (*M*=8.88, *SD* = 3.63) for all groups fell in the range of moderate risk. The no fall group had the lowest falls risk score (*M*= 7.67, *SD*= 2.63), followed by the initial fall group (*M*= 9.12, *SD*= 3.92). The recurrent fall group had the highest fall risk score (*M*= 10.78, *SD*= 4.08).

An ANOVA was calculated to determine the differences in fall risk scores among the initial fall, recurrent fall and no falls groups. There were significant differences among the three fall groups (*F*=22.4, *p*= <0.001; Table 5). Post-hoc analyses with a Scheffe test were completed to determine which groups' fall risk score was significantly different after obtaining a statistically significant result from the ANOVA. There were significantly higher mean fall risk

scores in the recurrent falls group compared to the initial fall group (p=.02); higher mean fall risk scores in the initial fall group versus the no falls group (p=.02) and a higher mean fall risk score in the recurrent fall group compared to the no fall (p<.001) group.

BIMS Score

The mean BIMS score of the total sample was 9.86 (*SD*=3.83), which is in the range of moderate impairment. A BIMS score of 0-7 indicates severe cognitive impairment, with a score of 8-12 indicating moderate impairment and a score of 13-15 indicating cognitively intact. The mean BIMS score for the initial fall group was 8.92 (*SD*=5.31). The recurrent fall group had a mean BIMS score of 9.49 (*SD*=4.31) and the no falls group had a mean BIMS score of 10.46 (*SD*=2.50).

An ANOVA was performed to determine the differences in BIMS scores for the initial fall, recurrent fall and no falls groups. There were significant differences among the three fall groups on BIMS scores (F=4.04, p=0.02; Table 5). Scheffe post-hoc tests showed that BIMS scores were significantly lower for the initial fall groups (M=8.9, *SD*= 5.3) compared to the no fall group (M= 10.5, *SD*= 2.5; p=.032). The difference in BIMS scores between the no falls group and recurrent fall group approached significance. There was no difference in BIMS scores between the initial fall and recurrent fall group.

ADL Score

Statistical analyses were calculated separately for each of the four ADL categories including bed mobility, transfer, eating and toilet use.

ADL – bed mobility. A Chi square statistic was calculated to determine if there was a significant difference among the three levels of dependence for bed mobility (independent, supervision/limited assistance, extensive assistance/totally dependent) among those with an

initial fall, recurrent fall, and no falls. Higher ADL scores indicate more dependence to complete the task. Among residents who were independent for ADL – bed mobility, 35 (20.2%) had an initial fall, 68 (39.3%) had a recurrent fall and 70 (40.5%) had no falls. Among residents who needed supervision/limited assistance, 15 (16.9%) had and initial fall, 14 (15.7%) had a recurrent fall and 60 (67.4%) had no falls. Among residents who needed extensive assistance or were totally dependent, 10 (37.0%) had an initial fall, 3 (11.1%) had a recurrent fall and 14 (51.9%) had no falls. Differences in the proportions of residents among the three groups were statistically significant (χ^2= 27.21, p< 0.001; Table 5). Post hoc analyses revealed significantly more residents were independent for bed mobility in the recurrent falls group (n=68, 66%) compared to the initial falls group (n=35, 34%; p=.006) and significantly more residents in the no falls group (n=15, 83.3%) needed extensive assistance or were totally dependent for bed mobility compared to the recurrent fall group (n=3, 16.7%; p<.001). No differences were found in ADL levels for bed mobility between the initial fall and the no falls group.

ADL – transfer. A Chi square statistic was calculated to determine if there was a difference among the three levels of dependence for transfer ability among those with an initial fall, recurrent fall and no falls. Among residents who were independent for ADL – transfer, 16 (17.6%) had an initial fall, 38 (41.8%) had a recurrent fall and 37 (40.7%) had no falls. Among residents who needed supervision/limited assistance, 26 (19.1%) had an initial fall, 33 (24.3%) had a recurrent fall and 77 (56.6%) had no falls. Among residents who needed extensive assistance or were totally dependent, 18 (28.6%) had an initial fall, 14 (22.2%) had a recurrent fall and 31 (49.2%) had no falls. Differences in the proportions of patients among the three groups were statistically significant (χ^2= 12.34, p = 0.02; Table 5). Post hoc analyses revealed significantly more residents were independent for transfer in the recurrent falls group (n=38,

70.4%) compared to the initial falls group (n=16, 29.6%; *p*=.046) and significantly more residents in the no falls group (n=77, 70%) needed supervision or limited assistance compared to the recurrent falls group (n=33, 30%; *p*=.01). No differences were found in ADL levels of dependence for transfer between the initial fall and the no falls group.

ADL – eating. A Chi square statistic was calculated to determine if there was a significant difference among the three levels of dependence for eating ability among those with an initial fall, recurrent fall and no falls. Among residents who were independent with ADL-eating, 31 (24.8%) had an initial fall, 56 (44.8%) had a recurrent fall and 38 (30.4%) had no falls. Among residents who needed supervision/limited assistance, 23 (16.5%) had an initial fall, 28 (20.1%) had a recurrent fall and 88 (63.3%) had no falls. Among people who needed extensive assistance or were totally dependent, 6 (23.1%) had an initial fall, 1 (3.8%) had a recurrent fall and 19 (73.1%) had no falls. Differences in the proportions of patients among the three groups were statistically significant (χ^2= 39.51, *p* <.001; Table 5). Post hoc analyses revealed significantly more residents required extensive assistance or were totally dependent for eating in the initial fall group (n=6, 85.7%) compared to the recurrent fall group (n=1, 14.3%; *p*=.03) and significantly more residents required supervision/limited assistance in the no falls group (n=88, 79.3%) compared to the initial falls group (n=23, 20.7%; *p*=.002) and significantly more residents required extensive assistance or were totally dependent in the no falls group (n=19, 95%) compared to the recurrent falls group (n=1, 5%; *p* <.001).

ADL – toilet. A Chi square statistic was calculated to determine if there was a significant difference among the three levels of dependence for toilet use among those with an initial fall, recurrent fall and no falls. Among residents who were independent for ADL – toilet use, 12 (19.9%) had an initial fall, 29 (46%) had a recurrent fall and 22 (34.9%) had no falls. Among

residents who needed supervision/limited assistance, 26 (21.8%) had an initial fall, 29 (24.4%) had a recurrent fall and 64 (53.8%) had no falls. Among residents who needed extensive assistance or were totally dependent, 22 (20.4%) had an initial fall, 27 (25%) had a recurrent fall and 59 (54.6%) had no falls. Differences in the proportions of patients among the three groups were statistically significant (χ^2= 11.52, p = 0.02; Table 5). Post hoc analyses revealed significantly more residents required supervision/limited assistance for toilet use in the no falls group (n=63, 69.2%) compared to the recurrent falls group (n=28, 30.8%; p=.004). No differences were found in ADL levels of dependence for toilet use between the initial fall and the recurrent fall group as well as the initial fall and no falls group.

Age

An ANOVA was conducted to determine differences in age among the three fall groups. The mean age of the total study sample was 69.54 (*SD* = 9.63) years. The mean age of the initial fall group was 67.67 (*SD*= 10.21) years, followed by the no falls group (*M*= 69.92, *SD*= 9.08) years, and finally the recurrent fall group (*M*= 70.2, *SD*= 10.05) years. There was no significant difference in age among the three fall groups (*F*=1.46, *p*=0.24).

Gender

A Chi square test of independence was performed to examine differences between gender and initial fall, recurrent fall and no falls. Among the total sample, there were 150 (52%) males and 140 females (48%). Among male residents, 32 (21.3%) had an initial fall, 43 (28.7%) had a recurrent fall and 75 (50%) had no falls. Among female residents, 28 (20%) had an initial fall, 42 (30%) had a recurrent fall and 70 (50%) had no falls. The difference in gender among the three fall groups was not statistically significant, (χ^2= 0.11, p=0.95).

Discussion

The demographic and clinical characteristics of a sample of 290 LTC residents were described, and environmental, clinical and pharmacological risk factors for falls were examined. The differences in fall risk scores, BIMS scores, ADL scores (bed mobility, transfer, eating and toilet use), age and gender among patients with an initial fall, recurrent fall and no falls were analyzed.

We found that several environmental, clinical and pharmacological causes of falls occurred more frequently in the falls groups compared to the no falls group.

We expected to find wet floors as a significant risk factor for falls, due to the obvious fall risk of slipping with such an alteration in the patient environment. Our study findings were similar to those of Alshammari, et al., (2018) who found that wet floors in addition to other alterations in the patient environment are a significant risk factor for falls, occurring in more than half of their study sample who sustained a fall.

As expected, obstacles/tripping hazards were found to be significantly higher in the falls group compared to the no falls group in our study. Our finding was similar to a study by Berg, et al. (1997), who found that hazards in the environment are one of the most significant risk factors for falls in the elderly. This finding supports the need for ongoing awareness of the patient environment by all members of the health care team.

Our study found that the improper use of assistive device was significantly higher in the falls group compared to the no falls group, which aligned with previous research findings by Roman de Mettelinge & Cambier (2015). They found that walking aids are often misused, improperly fitted or improperly selected (e.g. using a cane when a walker would be more appropriate) and are significantly related to falls in the elderly.

Significantly more residents in the falls group were noted to have socks/bare feet on the floor at the time of their fall. These results aligned with a review by Hatton, et al., (2013) who found bare feet, conventional socks and even gripper socks to be risk factors for falls in the elderly due to the lack of support to the foot bed. These findings do not support the current practice of gripper socks, which are the acceptable form of footwear in our LTC facility.

We anticipated lights off/dim lighting to be significantly different between the falls group and the no falls group, due to the obvious difficulty one would encounter while attempting to navigate with lack of or with diminished lighting. Surprisingly, the difference between residents of the falls group and the no fall group was not significant. This finding was similar to that concluded by Lim, et al. (2012) who found that most falls occur in the presence of adequate lighting, leading them to believe that it is visual impairment, not lighting, that is a greater risk factor for falls.

Similar to the results of our study, Bloem, et al., (2008) found significant support for the association between muscle weakness and falls in the elderly. They also demonstrated reduction in fall rates in the elderly who received ongoing muscle strength training.

Our study findings were similar to those of Wagner, et al., (2009) who found that impaired balance/gait was one of the most significant risk factors for falls, accounting for as many as 40% of falls in their study sample.

As expected, our study found that significantly more residents in the falls group had foot problems compared to those in the no falls group. Similarly, a study by Patil, et al. (2015) found that foot problems in the elderly significantly increase the rate of falls. We speculate that partial amputations of the foot as well as pain associated with gout and osteoarthritis affect gait stability and cadence which increases risk of falls.

Contrary to the study findings of Zaida & Alexander (2001), who found that sensory impairment is a significant risk factor for falls in the older adult, our study did not find a significant difference for sensory impairment between the falls group and the no falls group, leading us to wonder if sensory impairment is a unique characteristic of our patient population.

Unlike the findings of Lord & Dayhew (2001), our study found that significantly more residents in the no falls group were affected by visual impairment than the falls group. We suspect that more residents in the no falls group are bed bound and more debilitated than the falls group, with visual impairment one manifestation of their advancing disease progression and debility.

Our study found that significantly more residents in the no falls group were prescribed benzodiazepines compared to the falls group. This finding was surprising, given the long half-life and sedative properties of the benzodiazepine class. Our study findings are in contrast to the study findings of Woolcott, et al., (2010) who found that benzodiazepines significantly increase falls in elderly adults. However, Hartikainen, Lönnroos & Louhivuori (2007) found that benzodiazepines only increase risk of falls if newly prescribed, but the risk of fall is not significant when benzodiazepines are taken long term. We would need to assess length of medication use to fully understand if the findings of the above aforementioned study can be generalized to our resident population.

Our study results were similar to those by Leipzig, et al., (1999) who found that antihypertensives and antidepressants increase risk of falls likely by affecting gait stability. Another study by Huang (2012) concluded that medications are the most modifiable risk factor for falls. The findings of our study in addition to others support the importance of gradual dose

reduction of antidepressants and continuous monitoring of antihypertensives to maximize patient safety.

Unlike the study findings of Woolcott et al., (2010), who found that antiepileptics significantly increase risk of falls in the elderly population, we found that significantly more residents in the no falls group were prescribed antiepileptics compared to the falls group. This difference may be a unique characteristic of our patient population.

We expected to find a significant difference among the fall groups and no falls group for those individuals taking glucose control medications, as fluctuations in blood glucose are often associated with subjective complaints of weakness, dizziness and fatigue. Similar to the study by Waard, et al., (2016) our study did not find any significant difference between the two groups.

In addition, we did not find a significant difference for psychotropic medications, atypical antipsychotics, cholinesterase inhibitors/memantine and diuretics between the falls group and no falls group. The use of opioids was greater in the falls group compared to the no falls group, and this difference was approaching significance.

The Fall Risk Assessment is a measure of frailty that assess ones' risk for sustaining a fall. Across all groups, the mean fall risk score was in the range of moderate fall risk and the difference in fall risk scores among all groups was statistically significant.

As expected, the mean fall risk scores were higher in the recurrent fall group compared to the initial fall group and the no falls group, although they still fell in the range of moderate fall risk. Nilsson et al. (2016) demonstrated that a fall risk assessment is an independent predictor of injuries secondary to falls as well as all-cause mortality. The falls risk assessment at our facility identified fall risk with a weighted score, however, it did not include modifiable risk factors that would prompt immediate action. In contrast, a study by Meyer, et al., (2009) examined the use of

the Falls Risk Assessment in nursing homes compared to nursing judgement alone in identifying residents at risk for falls and supported nurses' judgement in placing precautions on those residents they felt were at high risk for falls.

As expected in any LTC population, dementia was prevalent as noted by the mean BIMS score falling in the range of moderate impairment across all groups. The differences in BIMS scores among residents with an initial fall, recurrent fall and no falls were statistically significant, specifically with a lower BIMS score noted between the initial fall group compared to the no fall group, which suggests that cognitive impairment is a positive risk factor for residents who sustain an initial fall. A study by Dhargave & Sendhilkumar (2016) noted the multifactorial nature of falls, but did not include measurement of cognitive status, which is important to know in the LTC population to fully understand cognitive impairment as a risk factor for falls in the elderly.

The difference between ADL scores for all four categories – bed mobility, transfer, eating and toilet use, and falls were examined. Significantly more residents were independent for bed mobility in the recurrent falls group compared to the initial falls group. Likewise, Patil, et al., (2015) found that increased mobility increases risk for falls, just by the fact that there are more opportunities to sustain a fall compared to those who are bed bound and more dependent for assistance. Our study found more residents in the no falls group required extensive assistance or were totally dependent for bed mobility and eating. In contrast, Agashivala & Wu (2009), found that fall risk is increased when ADLs are impaired. We speculate that residents with significant impairment in ADLs are not falling due to the advanced stage of their debility and deconditioning which confines them to the bed, so the opportunity to fall is less.

Unexpectedly, more residents were independent for bed mobility in the recurrent falls group compared to the initial falls group and more residents in the no falls group needed extensive assistance or were totally dependent for bed mobility compared to the recurrent fall group. We speculate that residents who require extensive assistance or are completely dependent for care receive additional staff surveillance because of the care required, and this maximizes patient safety compared to those that are more independent.

Significantly more residents were independent for transfer in the recurrent falls group compared to the initial falls group and significantly more residents in the no falls group needed supervision or limited assistance compared to the recurrent falls group. Unlike the study findings of Patil et al., (2015), who found that impairment of all ADLs increases risk of falls, we suspect that those who are more independent for transfer are falling simply because they have more opportunities to fall due to their increased mobility and that perhaps other risk factors such as those found in the environment are contributing to their falls.

Significantly more residents required extensive assistance or were totally dependent for eating in the initial fall group and no falls group compared to the recurrent fall group and significantly more residents required supervision/limited assistance in the no falls group compared to the initial falls group. This contrasts with the study findings of Patil, et al, (2015) who found that functional decline and dependence for all ADLs increases risk of falls. Again, we speculate that those requiring extensive assistance for eating and who also are not falling are due to decreased functional capacity which limits their ambulation opportunities.

Significantly more residents required supervision/limited assistance for toilet use in the no falls group compared to the recurrent falls group. This contrasts with the study findings of

Patil, et al., (2015) who found that impaired ADL for toilet use, which is often found in patients with osteoarthritis of the knee joint(s) and neuropathy, is a significant risk factor for falls.

Our study found that there was no significant difference in age or gender among residents with initial fall, recurrent fall and no falls. Lim, et al. (2012) and Bird, et al. (2013), demonstrated that falls markedly increase with age. Kitayuguchi, et al. (2015) found that falls occur more often in females than males. A study by (Rapp, et al., 2014) found an increase in falls with advancing age in men but not in women (Rapp, et al., 2014).

Limitations

The main limitation of our study was the retrospective medical record review. We were limited with the data recorded by nursing after each fall in the change of condition report, which would capture details of the environment. The probable underreporting of falls by residents in LTC due to dementia was another limitation of this study. In addition, we did not examine if medications are dose dependent or if polypharmacy has an impact on falls. Furthermore, we collected dichotomous data for initial fall and recurrent fall, which did not capture fall severity or if there was an injury associated with the fall.

Implications/Recommendations

We identified several environmental, clinical and pharmacological risk factors for falls, which underscores the importance of developing targeted strategies to minimize these hazards. Our fall risk assessment, like most used in LTC, does not assess for modifiable risk factors other than medication use. Due to the unique demographics and comorbidities of our facility population compared to others in our corporate region, it may not be prudent or cost effective at this time to suggest a change to the Fall Risk Assessment tool. Since risk factors for falls were found to be multifactorial, we are suggesting more input from the multidisciplinary team to

determine if additional precautions are needed. We also recommend educating all employees on modifiable risk factors in the environment and the interventions necessary to reduce falls, such as identifying wet spills, reducing clutter, properly selecting and fitting assistive devices and ensuring that all residents have appropriate slip resistant footwear.

Nursing management and administration at our institution will be guided by the study investigator on identified risk factors for residents that fall so that resources can be allocated to minimize fall risk. Furthermore, it is recommended that the physical therapy (PT) department attend weekly care plan rounds for patients not currently receiving PT, so that subtle changes in functional status can be detected and improved. In addition, we will coordinate with the recreation and physical therapy departments to develop a group exercise class that is fun, motivating and interactive for all resident skill levels, so that muscle strength and balance can be maintained or improved.

Conclusions

In summary, there are multiple intrinsic and extrinsic risk factors in residents who fall and those who do not. Falls in the LTC population have been studied extensively. Few studies, if any, have evaluated the environmental, clinical and pharmacological risk factors for falls and no falls in addition to fall risk scores, BIMS scores, age and gender, noting differences among initial fall, recurrent fall and no falls groups. This study underscores the importance of a multidisciplinary approach to fall risk reduction to modify risk factors and provide additional precautions for those risk factors that are not modifiable.

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Table 1

Theoretical and Operational Definitions of the Study Variables

	Data source	Theoretical definition	Operational definition
Race	The EHR and the electronic admission record profile sheet. (nominal)	The classification of individuals into groups based on ancestry, physical traits and genetics.	1 = White 2 = Black/African American 3 = Hispanic 4 = Other
Marital status	The electronic admission record profile sheet. (nominal)	Two or more individuals united legally in marriage.	1 = Married 2 = Not married
Education level	The EHR Social History section and the Social Work Assessment. (ordinal)	Level of education completed.	1 = < High School 2 = High School/GED 3 = > High School
Primary Diagnosis	Primary diagnosis as listed on the EHR admission profile sheet or in the EHR Admission History and Physical. (nominal)	Main medical problem requiring medical intervention.	1 = Cardiovascular disease (CAD)/Cerebrovascular disease (CVD)/Peripheral Vascular disease (PVD) 2 = Chronic kidney disease

			(CKD) 3 = Chronic obstructive pulmonary disease (COPD) 4 = Trauma 5 = Cancer 6 = Liver disease 7 = Blood disorders
Environmental causes of falls	Change of condition reports and nursing progress notes located in the EHR. (nominal)	Extrinsic risk factors that increase risk of falling (Centers for Disease Control and Prevention [CDC], n.d.)	Wet floor, 0=No; 1=Yes Lights off/dim lighting, 0=No; 1=Yes Obstacles and tripping hazards, 0=No; 1=Yes Improper use of assistive device, 0=No; 1=Yes Socks/bare feet on tile floor (lack of nonslip footwear), 0=No; 1=Yes Other environmental causes of falls – *noted in words
Clinical causes of falls	Change of condition reports, nursing progress notes and physical therapy/occupational therapy documentation located in the EHR. (nominal)	A physical condition or medical diagnosis which contributed to the fall (National Institute of Health [NIH], n.d.)	Muscle weakness, 0=No; 1=Yes Impaired balance/gait, 0=No; 1=Yes Postural hypotension, 0=No; 1=Yes

			Vertigo, 0=No; 1=Yes Foot problems (including gout and transmetatarsal amputation), 0=No; 1=Yes Sensory problems, 0=No; 1=Yes Visual impairment, 0=No; 1=Yes Other clinical causes of falls - *noted in words
Pharmacological causes of falls	Change of condition reports, nursing progress notes, medication administration record (MAR), pharmacy database and/or physician/provider order sheets. (nominal)	Fall risk increasing drugs (FRIDs) include psychotropic drugs, benzodiazepines, atypical antipsychotics, antidepressants, antiepileptics, cholinesterase inhibitors and memantine, opioids, antihypertensives, diuretics and glucose control medications (Huang et al., 2012).	Psychotropic medications, 0=No; 1=Yes Benzodiazepines, 0=No, 1=Yes Atypical antipsychotics, 0=No, 1=Yes Antidepressants, 0=No, 1=Yes Antiepileptics, 0=No, 1=Yes Cholinesterase inhibitors and Memantine, 0=No, 1=Yes Opioids, 0=No, 1=Yes Diuretics, 0=No, 1=Yes Antihypertensives, 0=No, 1=Yes Glucose control medications, 0=No, 1=Yes

Fall Risk Assessment Score May 1, 2016 to July 31, 2017	Most recent fall risk score as calculated in the EHR Minimum Data Set (MDS) Expanded Nursing Assessment. (ordinal)	The Fall Risk Assessment is completed on admission, quarterly, annually and after each change in condition (e.g. fall with or without injury). See Table 1 for the Fall Risk Assessment. *The responses noted in the EHR Fall Risk Assessment automatically calculate the overall fall risk score which populates in the Nursing Expanded Assessment. Any score 12 or greater is considered high risk and triggers the nursing care plan process for falls safety.	Fall Risk Assessment Score: *Recorded as an actual score, 0-22. 0 = Low risk 1 = Low risk 2 = Low risk 3 = Low risk 4 = Low risk 5 = Moderate risk 6 = Moderate risk 7 = Moderate risk 8 = Moderate risk 9 = Moderate risk 10 = Moderate risk 11 = Moderate risk 12 = High risk 13 = High risk 14 = High risk 15 = High risk 16 = High risk 17 = High risk 18 = High risk 19 = High risk 20 = High risk 21 = High risk 22 = High risk

Brief Interview for Mental Status (BIMS) score May 1, 2016 to July 31, 2017	Most recent BIMS score as noted in the EHR, located in the Social Services assessment. (ordinal)	The BIMS is a screening tool used to assess how an individual is functioning cognitively now. The score calculated by this tool can determine improvement, stability or decline in cognitive ability (Heerema, 2017). The range of the BIMS score is 0-15, with a score of 0-7 indicating severe cognitive impairment, a score of 8-12 indicating moderate cognitive impairment and a score of 13-15 indicating that the individual is cognitively intact. See Appendix B for the BIMS assessment.	BIMS Score: *Recorded as an actual score, 0-15. 0 = Severe impairment 1 = Severe impairment 2 = Severe impairment 3 = Severe impairment 4 = Severe impairment 5 = Severe impairment 6 = Severe impairment 7 = Severe impairment 8 = Moderate impairment 9 = Moderate impairment 10 = Moderate impairment 11 = Moderate impairment 12 = Moderate impairment 13 = Cognitively intact 14 = Cognitively intact 15 = Cognitively intact
Activities of Daily Living (ADL) score May 1, 2016 to July 31, 2017 • Bed mobility • Transfer • Eating • Toilet Use	Most recent ADL score as noted on the ADL flowsheet record for each of the four categories – bed mobility, transfer, eating and toilet use. See Appendix C for the ADL Record. (ordinal)	The ADL score is noted to determine the amount of care needed for residents to complete necessary everyday tasks such as bed mobility, transfer, eating and toilet use. It is an indirect measure of independence. A higher score	Bed mobility: 0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent

		indicates more dependency and need for more assistance by nursing staff. There are four areas assessed – bed mobility, transfer, eating and toilet use, each one with a maximum of 4 points ("MatchNursinghomes.org," 2017).	Transfer: 0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent Eating: 0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent Toilet Use: 0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent
Age (years)	The EHR and the electronic admission record profile sheet. (ratio)	Chronological age in years as reported in the electronic medical record and on the electronic admission record profile sheet.	A whole number measured in years
Gender	The EHR and the electronic admission record profile sheet. (nominal)	The behavioral, cultural and psychological traits associated with either male or female.	1 = male 2 = female

Initial fall May 1, 2016 to July 31, 2017	Change in medical condition reports, medical record nursing documentation and corporate falls report data. (nominal)	The definition of a fall in our LTC facility aligns with the CMS Resident Assessment Instrument version 3.0 manual. This resource defines a fall as an "unintentional change in position coming to rest on the ground, floor, or onto the next lower surface (e.g., onto a bed, chair, or bedside mat). The fall may be witnessed, reported by the patient or an observer or identified when a patient is found on the floor or ground. Falls are not a result of an overwhelming external force (e.g., a patient pushes another patient). An intercepted fall occurs when a patient would have fallen if he or she had not caught him/herself or had not been intercepted by another person – this is still considered a fall." (Centers for Medicaid and Medicare Services [CMS], 2016, para. 1)	0 = No 1 = Yes

Recurrent fall May 1, 2016 to July 31, 2017	Change in condition reports, medical record nursing documentation and corporate falls report data. (nominal)	Recurrent falls are defined as more than one fall per resident for the duration of their admission in the facility during the 180-day reporting period. A recurrent fall is defined as one or more "unintentional change in position coming to rest on the ground, floor, or onto the next lower surface (e.g., onto a bed, chair, or bedside mat). The fall may be witnessed, reported by the patient or an observer or identified when a patient is found on the floor or ground. Falls are not a result of an overwhelming external force (e.g., a patient pushes another patient). An intercepted fall occurs when a patient would have fallen if he or she had not caught him/herself or had not been intercepted by another person –this is still considered a fall." (Centers for Medicaid and Medicare Services [CMS], 2016, para. 1)	0 = No 1 = Yes
No fall May 1, 2016 to	EHR nursing documentation.	Absence of an "unintentional change in	1 = Yes

July 31, 2017	(nominal)	position coming to rest on the ground, floor, or onto the next lower surface (e.g., onto a bed, chair, or bedside mat). The fall may be witnessed, reported by the patient or an observer or identified when a patient is found on the floor or ground. Falls are not a result of an overwhelming external force (e.g., a patient pushes another patient). An intercepted fall occurs when a patient would have fallen if he or she had not caught him/herself or had not been intercepted by another person – this is still considered a fall." (Centers for Medicaid and Medicare Services [CMS], 2016, para. 1)

Table 2

Data Collection Spreadsheet

1= Initial fall **2= Recurrent fall** **3= No fall**	**Age (whole # in years)**	**Gender** 1=Male 2=Female	**Race** 1=White 2=Black 3=Hispanic 4=other	**Marital Status** 1=Married 2=Not married	**Educational level** 1= <High school 2=High school/GED 3=>High school	**Primary diagnosis** 1=CAD/CVD/PVD 2 = CKD 3 = COPD 4 = Trauma 5 = Cancer 6 = Liver disease 7 = Blood disorders 8 = other
Wet floors 0=No 1=Yes	**Lights off/dim lighting** 0=No 1=Yes	**Obstacles/ tripping hazard** 0=No 1=Yes	**Improper use of assistive device** 0=No 1=Yes	**Socks/ bare feet on tile floor** 0=No 1=Yes	**Other environmental causes (in words)**	**Muscle weakness** 0=No 1=Yes
Impaired balance/ gait 0=No 1=Yes	**Postural hypotension** 0=No 1=Yes	**Vertigo** 0=No 1=Yes	**Foot problems (including gout and transmetatarsal amputation)** 0=No 1=Yes	**Sensory problems** 0=No 1=Yes	**Visual Impairment** 0=No 1=Yes	**Other clinical causes (in words actual cause)**

Psychotropic medications 0=No 1=Yes	**Benzodiazepines** 0=No 1=Yes	**Atypical Antipsychotics** 0=No 1=Yes	**Antidepressants** 0=No 1=Yes	**Antiepileptics** 0=No 1=Yes	**Cholinesterase inhibitors/ memantine** 0=No 1=Yes	**Opioids** 0=No 1=Yes
Diuretics 0=No 1=Yes	**Antihypertensives** 0=No 1=Yes	**Glucose control medication** 0=No 1=Yes	**Other pharmacological causes (in words)**	**Fall Risk Score**	**BIMS Score**	**ADL score – bed mobility** 0=completely independent 1=supervision 2=limited assistance 3=extensive assistance 4=completely dependent
ADL score – transfer 0=completely independent 1=supervision 2=limited assistance 3=extensive assistance 4=completely dependent	**ADL score – eating** 0=completely independent 1=supervision 2=limited assistance 3=extensive assistance 4=completely dependent	**ADL score – toilet use** 0=completely independent 1=supervision 2=limited assistance 3=extensive assistance 4=completely dependent				

Table 3

Fall Risk Assessment, Nursing Assessment - Expanded (MDS Admission/Quarterly/Annual and Significant Change)

Item	Response/Value
B1F_b1 Did the resident have a fall any time in the last month prior to admission/entry or reentry?	Yes = 6
B1F_b2 Did the resident have a fall any time in the last 2-6 months prior to admission/entry or reentry?	Yes = 4
B1F_C Has the resident had any falls since admission/entry or reentry or the prior assessment (OBRA or Scheduled PPS), whichever is more recent?	Yes = 8
Medications received that factor into scoring of B3a7: • B3a1 – Antidepressant • B3a2 – Antihypertensive • B3a3 – Antiparkinson's • B3a4 – Sedative • B3a5 – Hypnotic • B3a6 – Diuretic • **B3a7 – Medication Fall Risk Status** 1. Not taking any of the above medications (a1-a6) 2. Taking only one of the above medications (a1-a6) 3. Taking two of the above medications (a1-a6) 4. Taking three or more of the medications (a1-a6)	**B3a7 Rule:** If 0 checked = 1 If 1 checked = 2 If 2 checked = 3 If 3 or more checked = 4

Note. A score of 12 or > = High Risk

Table 4

Demographic and Clinical Characteristics of the Sample by Falls and No Falls Groups

Variable	**Total Sample** n (%) 290 (100)	**Falls** n (%) 145 (50)	**No Falls** n (%) 145 (50)	**Statistic Chi Square**	**p Value**
Race				**6.86**	**0.33**
White	109 (38)	53 (36.55)	56 (38.62)		
Black	178 (61)	90 (62.07)	88 (60.69)		
Hispanic	2 (0.7)	1 (0.69)	1 (0.7)		
Other	1 (0.3)	1 (0.69)	0 (0)		
Marital status				**28.30**	**<.001**
Married	58 (20)	11 (7.59)	47 (32.41)		
Not married	232 (80)	134 (92.41)	98 (67.59)		
Educational level				**24.88**	**<.001**
<High school	178 (61.4)	106 (73.10)	72 (49.66)		
Highschool/GED	105 (36.2)	36 (24.80)	69 (47.59)		
>High school	7 (2.4)	3 (2.1)	4 (2.76)		
Primary diagnosis				**68.10**	**<.001**
CAD/CVD/PVD	128 (44)	69 (47.59)	59 (40.69)		
CKD	38 (13)	6 (4.14)	32 (22.07)		
COPD	34 (12)	12 (8.28)	22 (15.17)		
Trauma	13 (4.5)	8 (5.52)	5 (3.45)		
Cancer	5 (1.7)	1 (0.69)	4 (2.76)		
Liver disease	41 (14)	34 (23.45)	7 (4.83)		
Blood disorders	3 (1)	0 (0)	3 (2.07)		
Other	28 (9)	15 (10.34)	13 (8.97)		
Wet floors				**5.09**	**.02**
No	285 (98.3)	140 (96.55)	145 (100)		
Yes	5 (1.7)	5 (3.45)	0 (0)		
Lights off/Dim lighting				**.41**	**.52**
No	203 (70)	99 (68.28)	104 (71.72)		
Yes	87 (30)	46 (31.72)	41 (28.28)		
Obstacles/Tripping Hazards				**20.27**	**<.001**
No	261 (90)	119 (82.07)	142 (97.93)		
Yes	29 (10)	26 (17.93)	3 (2.07)		
Improper use of assistive device				**5.56**	**.02**
No	278 (96)	135 (93.10)	143 (98.62)		
Yes	12 (4)	10 (6.90)	2 (1.38)		

Socks/bare feet on tile floor				**38.81**	**<.001**
No	237 (82)	98 (67.59)	139 (95.86)		
Yes	53 (18)	47 (32.41)	6 (4.14)		
Muscle weakness				**5.29**	**.02**
No	88 (30)	35 (24.14)	53 (36.55)		
Yes	202 (70)	110 (75.86)	92 (63.45)		
Impaired balance/gait				**10.06**	**<.001**
No	69 (24)	23 (15.86)	46 (31.72)		
Yes	221 (76)	122 (84.14)	99 (68.28)		
Postural hypotension				**.27**	**.61**
No	274 (94.5)	138 (95.17)	136 (93.79)		
Yes	16 (5.5)	7 (4.83)	9 (6.21)		
Vertigo				**.73**	**.40**
No	277 (96)	140 (96.55)	137 (94.48)		
Yes	13 (4)	5 (3.45)	8 (5.52)		
Foot problems				**4.89**	**.03**
No	242 (83)	114 (78.62)	128 (88.28)		
Yes	48 (17)	31 (21.38)	17 (11.72)		
Sensory impairment				**2.01**	**.16**
No	226 (78)	118 (81.38)	108 (74.48)		
Yes	64 (22)	27 (18.62)	37 (25.52)		
Visual impairment				**10.76**	**<.001**
No	198 (68)	112 (77.24)	86 (59.31)		
Yes	92 (32)	33 (22.76)	59 (40.69)		
Psychotropic meds				**2.40**	**.12**
No	220 (78)	107 (73.79)	118 (81.38)		
Yes	65 (22)	38 (26.21)	27 (18.62)		
Benzodiazepines				**6.61**	**.01**
No	217 (75)	118 (81.38)	99 (68.3)		
Yes	73 (25)	27 (18.62)	46 (31.72)		
Atypical antipsychotics				**1.55**	**.21**
No	240 (83)	124 (85.52)	116 (80)		
Yes	50 (17)	21 (14.48)	29 (20)		
Antidepressants				**8.86**	**<.001**
No	121 (42)	48 (33.10)	73 (50.34)		
Yes	169 (58)	97 (66.90)	72 (49.66)		
Antiepileptics				**5.39**	**.02**
No	219 (75.5)	118 (81.38)	101 (69.66)		
Yes	71 (24.5)	27 (18.62)	44 (30.34)		
Cholinesterase inhibitors/Memantine				**1.72**	**.19**
No	228 (79)	127 (87.59)	101 (69.66)		

Yes	62 (21)	18 (12.41)	44 (30.34)		
Opioids				**3.68**	**.06**
No	174 (60)	79 (54.48)	95 (65.52)		
Yes	116 (40)	66 (45.52)	50 (34.48)		
Diuretics				**1.31**	**.52**
No	172 (59)	88 (60.69)	84 (57.93)		
Yes	118 (41)	57 (39.31)	61 (42.07)		
Antihypertensives				**18.82**	**<.001**
No	42 (14.5)	8 (5.52)	34 (23.45)		
Yes	248 (85.5)	137 (94.48)	111 (76.55)		
Glucose control meds				**1.74**	**.19**
No	115 (40)	63 (43.45)	52 (35.86)		
Yes	175 (60)	82 (56.55)	93 (64.14)		

Table 5

Hypothesis Testing Results Table

Variable	**Total n (%) 290 (100)**	**One Fall n (%) 60 (20.7)**	**Recurrent fall n (%) 85 (29.3)**	**No Falls n (%) 145 (50)**	**Analysis**	***p* Value**
Fall Risk Score					**ANOVA**	
	Mean (SD) 8.88 (3.63)	Mean (SD) 9.12 (3.92)	Mean (SD) 10.78 (4.08)	Mean (SD) 7.67 (2.63)	***F*=22.4**	**<0.001**
Brief Interview of Mental Status (BIMS) Score					**ANOVA**	
	Mean (SD) 9.86 (3.83)	Mean (SD) 8.92 (5.31)	Mean (SD) 9.49 (4.31)	Mean (SD) 10.46 (2.50)	***F*=4.04**	**0.02**
Activities of Daily Living (ADL) Score	**n (%)**	**n (%)**	**n (%)**	**n (%)**	χ^2	
ADL - Bed					**27.21**	**<.001**
Independent	173 (59.9)	35 (20.2)	68 (39.3)	70 (40.5)		
Limited assistance/supervision	89 (30.8)	15 (16.9)	14 (15.7)	60 (67.4)		
Extensive/complete assistance	27 (9.3)	10 (37.0)	3 (11.1)	14 (51.9)		
ADL - Transfer					**12.34**	**.02**
Independent	91 (31.4)	16 (17.6)	38 (41.8)	37 (40.7)		
Limited assistance/supervision	136 (46.9)	26 (19.1)	33 (24.3)	77 (56.6)		
Extensive/complete assistance	63 (21.7)	18 (28.6)	14 (22.2)	31 (49.2)		
ADL - Eating					**39.51**	**<.001**
Independent	125 (43.1)	31 (24.8)	56 (44.8)	38 (30.4)		
Limited assistance/supervision	139 (47.9)	23 (16.5)	28 (20.1)	88 (63.3)		
Extensive/complete assistance	26 (9.0)	6 (23.1)	1 (3.8)	19 (73.1)		
ADL - Toilet					**11.52**	**.02**
Independent	63 (21.7)	12 (19.0)	29 (46.0)	22 (34.9)		

Limited assistance/supervision	119 (41.0)	26 (21.8)	29 (24.4)	64 (53.8)		
Extensive/complete assistance	108 (37.2)	22 (20.4)	27 (25.0)	59 (54.6)		
Age (years)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**ANOVA**	
	69.54 (9.63)	67.67 (10.21)	70.2 (10.05)	69.92 (9.08)	***F*=1.46**	**0.24**
Gender	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**χ^2 =0.11**	**0.95**
Male	150 (52)	32 (21.3)	43 (28.7	75 (50)		
Female	140 (48)	28 (20)	42 (30)	70 (50)		

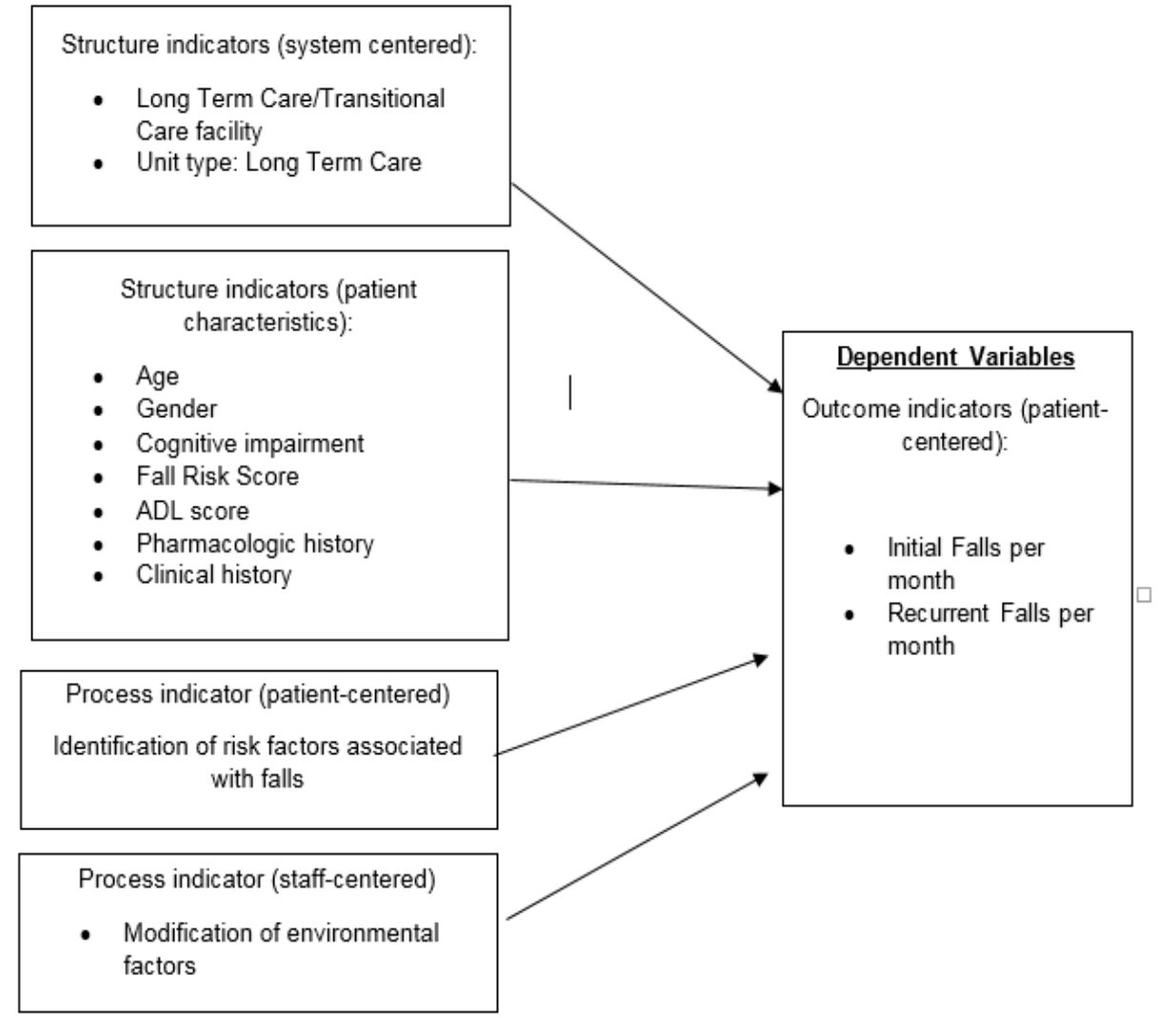

Figure 1. The Theoretical Framework of LTC Resident Falls Based on the Donabedian Model

Appendix A

Brief Interview for Mental Status (BIMS)

C0100. Should Brief Interview for Mental Status (C0200-C0500) be conducted?

1. No (resident is rarely/never understood)
2. Yes
3. -. Not assessed

C0200. Repetition of Three Words

0200a. Ask resident: "I am going to say three words for you to remember. Please repeat the words after I have said all three. The words are SOCK, BLUE, AND BED. Now tell me the three words".

C0200. Number of words repeated after first attempt

0. None
1. One
2. Two
3. Three
-. Not assessed

0200b. **After the resident's first attempt, repeat the words using cues ("SOCK, something to wear; BLUE, a color; BED, a piece of furniture"). You may repeat the words up to two more times.**

C0300. Temporal Orientation (orientation to year, month, day)

300a. Ask resident: "Please tell me what year it is right now" (If no response, code answer as 0)

0300A. Able to report correct year

0. Missed by >5 years or no answer
1. Missed by 2-5 years
2. Missed by 1 year
3. Correct
-. Not assessed

300b. Ask resident: "What month are we in right now"?

0300B. Able to report correct month

0. Missed by > 1 month or no answer
1. Missed by 6 days to 1 month
2. Accurate within 5 days
-. Not assessed

300c. Ask resident: "What day of the week is today"?

0300C. Able to report correct day of the week
0. Incorrect or no answer
1. Correct
2. -. Not assessed
3.

C0400. Recall

C0400. Ask resident: "Let's go back to an earlier question. What were those words that I asked you to repeat"? If unable to remember a word, give cue (something to wear; a color; a piece of furniture) for that word.

0400A. Able to recall "sock"
0. No – could not recall
1. Yes, after cueing
2. Yes, no cue required
-. Not assessed

0400B. Able to recall "blue"
0. No – could not recall
1. Yes, after cueing
2. Yes, no cue required
-. Not assessed

0400C. Able to recall "bed"
0. No – could not recall
1. Yes, after cueing
2. Yes, no cue required
-. Not assessed

Appendix B

ADL Record

BED MOBILITY

(4) - Total Dependence – Full staff performance during entire shift (**I DID EVERYTHING FOR THE RESIDENT WHO COULD NOT HELP)**

(3) – Extensive Assistance – Resident involved in activity, staff provided weight-bearing support **(I HAD TO PUSH/PULL/LIFT)**

(2) – Limited Assistance – Resident highly involved in activity; staff provided guided maneuvering of limbs or other non-weight-bearing assistance **(I TOUCHED, BUT DID NOT PUSH/PULL/LIFT)**

(1) – Supervision – Oversight, encouragement, or cueing **(I WATCHED/TALKED, BUT DID NOT TOUCH)**

(0) – Independent – No help or staff oversight at any time **(I DID NOTHING)**

TRANSFER

(4) - Total Dependence – Full staff performance during entire shift (**I DID EVERYTHING FOR THE RESIDENT WHO COULD NOT HELP)**

(3) – Extensive Assistance – Resident involved in activity, staff provided weight-bearing support **(I HAD TO PUSH/PULL/LIFT)**

(2) – Limited Assistance – Resident highly involved in activity; staff provided guided maneuvering of limbs or other non-weight-bearing assistance **(I TOUCHED, BUT DID NOT PUSH/PULL/LIFT)**

(1) – Supervision – Oversight, encouragement, or cueing **(I WATCHED/TALKED, BUT DID NOT TOUCH)**

(0) – Independent – No help or staff oversight at any time **(I DID NOTHING)**

EATING

(4) - Total Dependence – Full staff performance during entire shift (**I DID EVERYTHING FOR THE RESIDENT WHO COULD NOT HELP)**

(3) – Extensive Assistance – Resident involved in activity, staff provided weight-bearing support **(I HAD TO PUSH/PULL/LIFT)**

(2) – Limited Assistance – Resident highly involved in activity; staff provided guided maneuvering of limbs or other non-weight-bearing assistance **(I TOUCHED, BUT DID NOT PUSH/PULL/LIFT)**

(1) – Supervision – Oversight, encouragement, or cueing **(I WATCHED/TALKED, BUT DID NOT TOUCH)**

(0) – Independent – No help or staff oversight at any time **(I DID NOTHING)**

TOILET USE

(4) - Total Dependence – Full staff performance during entire shift (**I DID EVERYTHING FOR THE RESIDENT WHO COULD NOT HELP)**

(3) – Extensive Assistance – Resident involved in activity, staff provided weight-bearing support **(I HAD TO PUSH/PULL/LIFT)**

(2) – <u>Limited Assistance</u> – Resident highly involved in activity; staff provided guided maneuvering of limbs or other non-weight-bearing assistance **(I <u>TOUCHED,</u> BUT <u>DID NOT PUSH/PULL/LIFT)**

(1) – <u>Supervision</u> – Oversight, encouragement, or cueing **(I <u>WATCHED/TALKED</u>, BUT <u>DID NOT TOUCH</u>)**

(0) – <u>Independent</u> – No help or staff oversight at any time **(I <u>DID NOTHING</u>)**

Appendix C

Data Codebook

Race	1 = White 2 = Black 3 = Hispanic 4 = Other
Marital status	1 = Married 2 = Not married
Education level	1 = < High school 2 = High school/GED 3 = > High school
Primary diagnosis	1 = CAD/CVD/PVD 2 = CKD 3 = COPD 4 = Trauma 5 = Cancer 6 = Liver disease 7 = Blood disorders
Wet floor	0 = No; 1 = Yes
Lights off/dim lighting	0 = No; 1 = Yes
Obstacles and tripping hazards	0 = No; 1 = Yes
Improper use of assistive device	0 = No; 1 = Yes
Socks/bare feet on tile floor (lack of nonslip footwear)	0 = No; 1 = Yes
Other environmental causes of falls	(in words)
Muscle weakness	0 = No; 1 = Yes
Impaired balance/gait	0 = No; 1 = Yes
Postural hypotension	0 = No; 1 = Yes
Vertigo	0 = No; 1 = Yes
Foot problems (including gout and transmetatarsal amputation)	0 = No; 1 = Yes
Sensory problems	0 = No; 1 = Yes
Visual impairment	0 = No; 1 = Yes
Other clinical causes of falls	(in words)
Psychotropic medications	0 = No; 1 = Yes
Benzodiazepines	0 = No; 1 = Yes
Atypical antipsychotics	0 = No; 1 = Yes
Antidepressants	0 = No; 1 = Yes

Antiepileptics	0 = No; 1 = Yes
Cholinesterase inhibitors/Memantine	0 = No; 1 = Yes
Opioids	0 = No; 1 = Yes
Diuretics	0 = No; 1 = Yes
Antihypertensives	0 = No; 1 = Yes
Glucose control medications	0 = No; 1 = Yes
Other pharm causes of falls in words	
Fall Risk Assessment Score	*Record actual numerical score, 0-22
	Interpretation of score: 0 = Low risk 1 = Low risk 2 = Low risk 3 = Low risk 4 = Low risk 5 = Moderate risk 6 = Moderate risk 7 = Moderate risk 8 = Moderate risk 9 = Moderate risk 10 = Moderate risk 11 = Moderate risk 12 = High risk 13 = High risk 14 = High risk 15 = High risk 16 = High risk 17 = High risk 18 = High risk 19 = High risk 20 = High risk 21 = High risk 22 = High risk
Brief Interview for Mental Status (BIMS) score May 1, 2017 to April 30, 2017	*Record actual score 0-15
	0 = Severe impairment 1 = Severe impairment 2 = Severe impairment 3 = Severe impairment 4 = Severe impairment 5 = Severe impairment 6 = Severe impairment 7 = Severe impairment 8 = Moderate impairment

	9 = Moderate impairment 10 = Moderate impairment 11 = Moderate impairment 12 = Moderate impairment 13 = Cognitively intact 14 = Cognitively intact 15 = Cognitively intact
Activities of Daily Living (ADL) score – Bed Mobility	0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent
Activities of Daily Living (ADL) score – Transfer	0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent
Activities of Daily Living (ADL) score – Eating	0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent
Activities of Daily Living (ADL) score – Toilet use	0 = completely independent 1 = supervision 2 = limited assistance 3 = extensive assistance 4 = completely dependent
Age	Whole number in years
Gender	1 = male 2 = female
Initial fall May 1, 2016 to July 31, 2017	0 = No; 1 = Yes
Recurrent fall May 1, 2016 to July 31, 2017	0 = No; 1 = Yes
No fall May 1, 2016 to July 31, 2016	0 = No