Does Using a Provider Admission Medication Screening Policy Reduce the Percentage of Falls in the SNF?

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Abstract

Falls are the leading cause of fatal and nonfatal injuries among adults ≥65 years of age, although many do not report falling (Bergen, Stevens, & Burns, 2016). By 2030, 20% of the world's population will be comprised of adults 65 years of age or older (Ortman, Velkoff, & Hogan, 2014). A systematic literature review was done to isolate variables associated with falls: cognitive impairment, Parkinson's disease, Multiple sclerosis (MS), polypharmacy (≥7 medications), a blood pressure <100/70, hyponatremia (Na <135), and various medications. As adults live longer and develop more comorbidities, residents may have medications that are no longer needed, have adverse medication interactions or a greater risk than benefit ratio which all may contribute to increased falls. A 112-bed skilled nursing facility (SNF) endorsed a policy supporting the use of a newly developed evidence-based provider admission medication screen (PAMS) due to a 42% fall rate in its resident population for 2 months despite many non-pharmacologic interventions. The purpose of this project was to see if the PAMS would reduce the percentage of falls in older adults ≥65 residing in the SNF setting. Fall percentage data was compared between residents who had been admitted 4-8 months prior to the project with those who had the tool utilized within 48 hours of admission. Although there was no reduction in falls post admission between the two groups, more study is needed as some benefits were observed.

Key terms: elderly, falls, polypharmacy, Beers criteria, STOPP/START criteria, fall variables, aging, skilled nursing facility (SNF), extended care facility (ECF), long term care facility (LTCF), deprescribing, prescribing cascade, PIMS, FRIDS, FRADS, direct/indirect effects of medication

Table of Contents

Introduction

Background of the problem

One third of those over 65 years of age fall each year (Campbell et al., 1990). A leading cause of morbidity and mortality (Bergen et al., 2016), falls reduce quality of life and increase the utilization of healthcare resources, thus driving up health costs (Quigley et al., 2012). The adjusted medical cost of falls in our country is approximately 30 billion dollars per year (Quigley et al., 2012).

Despite having a fall risk committee and the use of numerous non-pharmacological interventions, a SNF noted an increase in falls to 42% per month. Etiologies for falls among the SNF resident population are complex, but the association between falls and polypharmacy and potentially inappropriate medications is very high in the skilled nursing facility population (Grace et al., 2014; AGS, 2015). Polypharmacy is prevalent for multiple reasons, including the presence of multiple comorbidities and providers who prescribe medications on the same resident, some without considering interactions with other medication the resident is taking. Medications are not metabolized the same in the elderly population due to changes in body fat percentage, muscle mass, kidney /liver function, and decreases in gastrointestinal absorption, therefore prescribers should be cautious (Jacobson, 2013). Medications with high liver clearance should be reduced by 40% and medications with low clearance through the liver should be reduced by 30% (Woodhouse & Wynne, 1988).

One of the most significant issues with an admission to a skilled nursing facility is the breakdown of communication between the hospital discharge providers and those doing the SNF admissions (King et al., 2013). New medications prescribed in the hospital should have close surveillance for efficacy, any side effects, and whether they are still necessary for the resident.

Priorities may shift once a resident is in the skilled care setting which may also influence whether all medications should be continued. STOPP/STARTfrail criteria using Adelphi-review list 27 medications that should be stopped in the frail older adult (Lavan

Deprescribing medications can be very challenging (Cesari et al., 2016), is not done consistently among providers. No form was found via literature review which isolated multiple fall variables and specific medications that contribute to falls (Brandt, 2016; Potter, Flicker, Page, & Etherton-Beer, 2016; Reeve, Wiese, Hendrix, Roberts, & Shakib, 2013; Frank & Weir, 2014). Providers who visit residents at SNFs do not always take time to edit medications or question why residents are on these medications (Reeve, et al., 2013; Frank & Weir, 2014). Providers tend to be hesitant in modifying medications, or may make decisions that are not based on most recent scientific evidence (Palagyi, Keay, Harper, Potter, & Lindley, 2016).

The intent of this project was to reduce incidence of falls, but it was also felt that there were multiple other quality issues for residents that could result, such as cost savings with reduction of unnecessary medications and reduction in other adverse drug reactions (Skinner, 2015). Variables that were most commonly associated with falls identified in the literature were also gathered through a systematic literature review to ensure as much data symmetry as possible between the groups that were to be compared, those residents who had the policy applied vs the historical group admitted 4-8 months before the policy was established.

PICO Question

The PICO question for this project was "Is using an evidence-based Provider Admission Medication Screen (PAMS) within 48 hours of admission to the SNF successful in reducing fall percentages among residents?" The other considerations during the project were:

1. Does reducing the number of medications reduce falls;
2. Does reduction of fall risk associated medications reduce falls; and
3. What variables are most commonly associated with falls

Operational definitions

Polypharmacy has multiple definitions, but for the purposes of this project was defined as ≥ 7 medications including non-prescription, based on expert opinion in the literature (Hudhra et al, 2016). A **skilled nursing facility** (SNF) is typically an alternative to a rehabilitation facility following elderly resident's hospitalization. It may also be referred to as a "nursing home", "extended care facility", or "long term care facility".

Specific medications associated with falls among the elderly are sometimes referred to as "**potentially inappropriate medications**" (PIMS) (Milos et al., 2013), "**fall risk-increasing drugs**" (FRIDS), or **fall risk associated drugs** (FRADS). **PIPMS** are potentially inappropriate psychoactive medications as defined within the Beers and STOPP/START criteria, which contain peer-reviewed and evidence-based lists of medications that should not be used in the elderly (Barry et al., 2007; Gallagher et al., 2008; O'Mahony et al., 2015; American Geriatrics Society (AGS, 2015).

Deprescribing refers to removing medications with more risk than benefit **(**Reeve, Gnjidic, Long, & Hilmer, 2015). **Elderly** residents are greater than 65 years of age. A **fall** is defined as an unintentional loss of balance, tripping, or sliding onto the floor. **Early pharmacologic review** is defined as a medication analysis done within 48 hours of admission. **Hyponatremia** associated with falls is defined as a "sodium less than 135" (Ahamed et al., 2014; Rittenhouse et al., 2014). **Hypotension** is defined as a blood pressure less than 100/60. The **Beers criteria** list medications that are inappropriate for use in the elderly. It was originally published by a geriatrician (Dr. Beers) in 1991 but has been updated in 1997, 2003, 2012, and 2015 (AGS, 2015). The **STOPP/START criteria,** another well respected high risk medication data set exists. The title stands for Screening Tool in Older Persons for Potentially

Inappropriate Prescribing (STOPP) and Screening Tool to Alert Doctors to the Right Treatment (START). The original START list was developed by Barry et al., in 2007, the START/STOPP by Gallagher et al., in 2008. A more recent update was done in 2015 (O'Mahony et. al).

Prescribing cascade refers to medications that are ordered to treat side effects from other medications. **Direct effects of medication on falls** are defined as when a medication is given and the resident falls but has a normal blood pressure, did not feel dizzy, and did not have any symptoms. **Indirect effects of medication on falls** include dizziness or vertigo, blurred vision, gait instability, or low blood pressure, all known to be associated with falls.

Rationale for Project

By 2030, 20% of the United States population will be comprised of adults 65 and older, projected to continue to increase (Ortman et al., 2014). With advancing age, increased comorbidities and frailty, residents are likely to be prescribed more medications (Cesari et al., 2016). Because many medications can contribute to falls and subsequent injury, continued research on the relationships between medications and falls in this population is needed. Initiatives to reduce the overuse of inappropriate medications in the elderly can be generalized to those who reside in skilled nursing facilities but should also be continue to be addressed in the primary care and hospital settings so that those admitted to the SNF will have a more appropriate medication list.

Falls lead to increased morbidity, mortality, and significant health care costs in any setting (Bergen et al, 2016). Twenty-five percent of falls in the SNF setting lead to hospitalization, and multiple medications are associated with this problem (Tamura et al, 2012). Falls are one of the leading causes of death in this population internationally (Bergen et al, 2016) and can lead to hip fractures (Leland et al., 2015; Quigley et al., 2012; Campbell et al., 1990).

The skilled nursing facility where the project took place has a falls committee comprised of nurses, physical therapists, occupational therapists, administration, certified nursing assistants and a dietician. They have implemented non-pharmacological interventions such as regular toileting, a rounding model (systematic planned scheduled surveillance done by nursing assistants to check on residents), group activities, 1-on-1 care for restless residents, alarms when residents try to stand alone, and a fall risk screening on admission that leads to increased surveillance for those with high scores. Despite these extensive efforts, falls rates have remained at 42% monthly for two months prior to study implementation.

Assumptions

Healthcare providers may reduce or modify medications as they deem appropriate, but early review of medications is time consuming so is not done consistently. Providers may not be familiar with the family or resident, so it is assumed that having a scripted tool may facilitate consistent medication review. Due to regulations (CMS, 2013), a nurse practitioner (NP) cannot do admissions for skilled nursing residents, so this project will presumably enhance earlier communication between the NP and the resident. Medication simplification may reduce drug interactions and side effects. Residents and families would like to see fewer medications used, and it is possible that falls will be reduced from reductions in the number of medications and those that are associated with falls (AGS 2015; O'Mahony et al., 2015).

Literature Review

As the percentages of adults ≥65 continues to rise (Ortman et al., 2014), nursing home utilization is expected to increase similarly. With shorter hospitalizations, medications may be missed or added upon transfer to SNF without a thorough evaluation of the effects of these changes due to short hospital stays. The incidence of falls can be either indirectly or directly

related to certain medications (AGS 2015; Montali et al., 2015). Studies were examined that isolated associations between falls and polypharmacy and various classes of medications.

Polypharmacy and Association with Elderly Falls

Systematic reviews cite several studies utilizing seven or more medications as a guideline for defining polypharmacy in the elderly population (Hudhra et al., 2016; Tamura et al., 2012). Numerous definitions of polypharmacy exist in the literature. Falls have been associated with as few as five medications (Ramsey, Hin, Prado, & Fernandez, 2015). Removing or reducing fall-risk associated medications has a greater benefit than risk ratio among the elderly population, nevertheless this should be done carefully (AGS 2015; O'Mahony, 2015).

Polypharmacy contributed to falls in both a case controlled study (Laflamme, Monárrez-Espino, Johnell, Elling, & Möller, 2015) and a randomized controlled trial done in Sweden using a sample of residents 65 and older in the community (Olazarán et al., 2013). In this study, taking ten or more medications was associated with almost twice the likelihood of falls in this population (Olanzaran et al.) A study by Bennett and colleagues (2014) done in Australia demonstrated that a high number of medications was associated with falls. A retrospective study of 342 residents discharged from a hospital in Albania determined over 53% of these residents also had polypharmacy, taking 7 or more medications (Hudhra et al., 2016). Fifty-three percent of those who fell prior to emergency room visits to an Irish hospital had polypharmacy (McMahon, Cahir, Kenny, & Bennett, 2014). A prospective study done in the US also demonstrated an association between falls and polypharmacy (Freeland et al., 2012). Although the definition of polypharmacy varies, many sources agree that older adults are simply on too many medications.

Inappropriate Medications in the Elderly

Two well-known lists of medications which are inappropriate for older adults exist: The Beers Criteria (AGS, 2015) and the STOPP/START list. (Gallagher et al., 2008; O'Mahony et al., 2015). Within these lists, some medications were also identified as fall risk associated medications (AGS, 2012, 2015), and contributing to fractures or hospitalization (Dalleur et al., 2012; Levy & Marcus, 2016). Multiple studies support a strong association between falls in the elderly and medications listed in the Beers criteria (Agashivala & Wu, 2009; McMahon et al., 2014). Some medications in the STOPP/START criteria have also been associated with falls (McMahon et al., 2014; O'Mahony et al., 2015).

Medications Classes Associated with Falls in Other Studies

Research supports an association between specific classes of medications and falls among the elderly (AGS, 2012, 2015; Woolcott, et al., 2009; Vaapio et al., 2015; Gallagher et al., 2008; O'Mahony et al., 2015). Many medications used to treat hypertension, anxiety, depression, diabetes, urinary retention, heart failure, arrhythmias, allergies, insomnia, and psychosis can promote fall risks among residents (Table 1). Medications can lead to gait instability, cognitive impairment, hypotension, and hypoglycemia, all factors known to contribute to falls. A case control study done by Nace et al (2017), determined that three or more central nervous system medications that are administered at the standard doses are associated with falls.

Table 1. Research literature-based medications associated with falls.

Medication or Class associated with falls	Reference of study
Anti arrhythmics, selected beta blockers	Ham, et al, 2014,
digoxin & alpha adrenergics not recc. vs other study-digoxin was better for Afib	AGS, 2015; Callisaya et al., 2014; Gallagher et al., 2008 Price, Holman, Sanfilippo, & Emery, 2014
Generalized antihypertensive medications ACE best choice for htn less fall risk. Hctz increases risk due to low Na.	Tinetti et al., 2014; Hudhra et al., 2016 Wong et al., 2013 Callisaya et al., 2014, Rittenhouse et al., 2014
Antipsychotics, antidepressants, & insomnia medications Psychotropics hardest to modify: benzodiazepines Do not increase dosage if possible Long acting less chance falls this study Short acting less chance falls this study Must taper slowly Low doses best if risperdone, quetiapine Antipsychotics- due to sedating properties *Stopping did not reduce falls in 1 study* haloperidol, quietaprine, risperadone, olanziprine prolong QT leading to falls 3 or more CNS standard dose drugs contribute to falls. *Amitriptyline, Clomipramine, Desipramine, Doxepin, nortriptyline, Citalopram, Ecitalopram, Fluoxetine, Fluboxamine, Paroxetine, Sertraline, Desvenlafaxine, Duloxetine, Milnacipran, Venlafaxine, Barbamaepine, Gabapentin, Lamotrigine, Levetiracetam, Oxcoarzepine, Phenytoin, Pregabalin, Primidone, Topiramate, Valproic acid, Zonisamide, Chlorpromaine, Fluphenazine, Haloperidol, Perphenazine, Thioridazine, Thiothixene, Trifluoperazine* Not helpful for delirium Tricyclic antidepressants Avoid amitryptyline SSRI not associated with falls Paxil highest fall risk SSRIs SSRI less fall risk than TCA bupropion optimal over duloxetine, mirtazapine, venlafaxine or trazadone	Ham et al., 2014; Vaapio et al., 2015; Wu, Tsai, & Tsai, 2015; Echt et al., 2013 Pasina et al., 2016; O'Connor et al., 2016 Berry et al., 2016; Dalleur et al., 2012; O'Mahony et al., 2015; Woolcot et al., 2009 Echt et al, 2013 Agashivala & Wu, 2009 Echt et al., 2013 Vaapio et al., 2015 Bozat-Emre et al., 2015 Berry et al., 2016; O'Connor et al., 2016 Cadwell, Dearmon, & VandeWaa, 2016 Wu, Tsai, & Tsai, 2015 Neufeld et al., 2016 Nace et al., 2017 Agashivala & Wu, 2009; Woolcott et al., 2009 Gebara et al., 2015 Gebara et al., 2015 Landi et al., 2014 Agashivala & Wu, 2009 Naples et al., 2016
Sedative/hypnotic anticonvulsant Sedatives	AGS 2015, O'Mahony, 2015; Agashivala & Wu, 2009; Echt et al., 2013; Olazarán et al., 2013; Woolcott et al., 2009 Landi, 2014; Wilson, 2011
Anticholinergics alpha blockers, A5 receptor agonists	Landi, 2014, Wilson, 2011, Crispo et al., 2016 AGS 2015
Dementia medications	Epstein, Guo, Farlow, Singh, & Fisher, 2014
Sulfonylureas	Lapane et al., 2015; AGS, 2012
Opioids	O'Connor et al., 2016; AGS, 2015

Cardiac Medications Associated with Falls

Antiarrhythmic medications and non-selective beta blockers were associated with increased fall risk in a study published in 2014 by Ham et al., in a population of 2407 residents aged 65 or older. Updated Beers criteria (AGS, 2015) used Adelphi measures to isolate digoxin and alpha-adrenergic drugs as contributing to orthostatic hypotension and potentially causing falls. Digoxin was considered superior to amiodarone for the treatment of atrial fibrillation in the elderly population (Price, Holman, Sanfilippo, & Emery, 2014). Digoxin was no longer the first line recommendation for control of atrial fibrillation in the STOPP START criteria (Gallagher et al., 2008; Callisaya, Sharman, Close, Lord, & Srikanth, 2014).

Tinetti et al., (2014) found anti-hypertensives to be associated with falls among skilled care residents. A retrospective study conducted on 342 residents in Albania noted 80% of residents who fell post hospital discharge were taking anti-hypertensives (Hudhra et al., 2016). Another study of 409 community-dwelling adults aged 60 to 86 found that of the 39% who fell were on a higher daily dose of antihypertensive medication than those who did not fall (Callisaya et al., 2014). A study by Wong et al., (2013) demonstrated residents taking angiotensin converting enzyme (ACE) medication were less likely to fall than those not taking them. Hydrochlorothiazide can cause hyponatremia, which is also associated with falls (Rittenhouse et al., 2014). Vasodilators such as beta blockers were associated with orthostatic hypotension in another study, which can lead to falls (O'Connor et al., 2016).

Fall associated with Antipsychotics, Antidepressants, and Insomnia Medications

Benzodiazepines are considered one of the most overused medications (Dalleur et al., 2012; Gallagher et al., 2008; O'Mahony et al., 2015) associated with falls (Echt et al., 2013; San-Jose et al., 2015; Berry et al., 2016; O'Connor et al., 2016; Hanlon & Rowe, 2016), but they can

be the most difficult to discontinue due to withdrawal effects (Vaapio et al., 2015). One study suggested that a long acting benzodiazepine would be a better option (Agashivala & Wu, 2009), but another study refuted this, finding no association between short acting benzodiazepines and falls (Echt, Samelson, Hannan, Dufour, & Berry, 2013). Regardless, they should not be stopped suddenly (Vaapio et al).

A systematic review and meta-analysis revealed that antipsychotics do not serve to prevent or treat delirium, but they continue to be utilized inappropriately for this condition (Neufeld, Yue, Robinson, Inouye, & Needham, 2016). Antipsychotics were associated with falls in numerous studies due to sedating properties (Echt et al., 2013; Ham et al., 2014; Vaapio et al., 2015; Ames et al., 2016), but two other studies (Cadwell, Dearmon, & VandeWaa, 2016; Berry et al., 2016)), demonstrated no improvement in fall reduction after reducing antipsychotics in dementia residents. According to a study by Bozat-Emre et al., (2015), high doses >2 mg of risperidone and > 150 mg of quetiapine had significant fall risk, but low doses were less likely to lead to falls. A case-crossover study using a sample of 17, 718 residents (89% of these were aged 65 or older) revealed that antipsychotic drugs were associated with a 1.53-fold increased risk of ventricular arrhythmia or sudden cardiac death, related to a prolonged QT when medications such as clothiapine, haloperidol, prochlorperazine, thioridazine, olanzapine, quetiapine, risperidone, and sulpiride (Wu, Tsai, & Tsai, 2015). An irregular heart rate can lead to dizziness which is associated with falling. Psychotropic medications are probably one of the most challenging medications to reduce and modify (Pasino et al., 2016). Psychotropic medication should not be increased whenever possible (Echt et al).

Tricyclic antidepressants were directly associated with falls in one study, and selective serotonin reuptake inhibitors (SSRIs) were found to have less side effects than TCDs

(Agashivala & Wu, 2009; Echt et al., 2013). In a recent systematic review of the association between SSRIs and falls, no strong correlation was established (Gebara et al., 2015). Paxil is noted to have the highest fall risk among all SSRIs (Landi et al., 2014), and amitriptyline should be avoided in the elderly (Agashivala & Wu, 2009; Gebara et al., 2015; AGS 2015). A large Canadian study done by Naples, Kotlarcyk, Perera, Greenspan, & Hanlon (2016), demonstrated increased risk of falls in residents using duloxetine, mirtazapine, venlafaxine, and trazadone, which may be due to modulation of the serotonergic system. Bupropion was not found to be independently associated with falls, so should be considered as a substitute in this population (Naples et al).

Sedative hypnotics, anticonvulsant medications

Not only are these drug classes on the Beers and STOPP/START list but are directly linked to falls in numerous studies (Agashivala & Wu, 2009; Echt et al., 2013; Olazarán et al., 2013; O'Connor et al., 2016; Nace et al., 2017). Sedatives were associated with falls significantly in studies done by Landi et al., (2014), and Wilson et al., (2011). Some of these medications overlap the anticholinergic category for they have the same properties (Landi et al., 2014). Before making medication changes, the resident's history must be thoroughly reviewed (Skinner, 2015). In cases of true seizure history, risk vs. benefit should always be evaluated.

Anticholinergics/BPH

Landi et. al. (2014) did a longitudinal study of 1,490 SNF residents. In this study, the residents taking anticholinergic medications had an increased rate of falls. Anticholinergics had a significant association with falls in a randomized controlled trial by Wilson et al., (2011). Anticholinergic medications given to those with Parkinson's disease greatly increased occurrence of falls leading to fractures (Crispo et al., 2016). Anticholinergic medications are

used to treat an enlarged prostate, allergies, and even irritable bowel syndrome. Alpha blockers and alpha 5 receptor agonists are two additional categories that are associated with falls, and a long acting alpha agonist is preferred over a short acting (AGS 2015).

Dementia medications

Dementia medications were associated with 63% increased falls in a retrospective cohort study done by Epstein, Guo, Farlow, Singh, & Fisher, (2014). The efficacy of this group of medications is variable in this population so discontinuation should be considered, with a slow taper. Families and residents may be reluctant to reduce this medication category despite evidence demonstrating a limited number of cases where these medications slow progression of dementia severity.

Sulfonylureas

Lapane, Jesdale, Dubé, Pimentel, & Rajpathak (2015), did a propensity-matched retrospective new user cohort study of 12,327 Medicare nursing home residents. Residents with only moderate impairment of activities of daily living using sulfonylureas had a higher rate of falls associated with higher incidence of hypoglycemia. Sulfonylureas are listed in the Beers 2012 criteria as a fall risk medication and are not recommended in older adults (AGS, 2012), but falls are not listed as a concern in the updated criteria (AGS, 2015). The Beers criteria suggested avoiding all diabetic oral medications except for Metformin if possible (AGS, 2015).

Other medications that can be reduced or eliminated

Many medications are more harmful than helpful in the elderly population (Frank & Weir, 2014). Optimal management of atrial fibrillation is done with rate control so perhaps anticoagulants should be avoided (Wutzler et al., 2015). Coumadin is not indicated for use in residents with a high fall risk, or history of GI bleed. A study by Westaway et al., 2016,

suggested that statins are not indicated for use in older adults (AGS 2015; Wilson et al., 2011), but this is subject of much controversy. Proton pump inhibitors (PPIs) have been in the literature a great deal regarding long term use and associated side effects, including clostridium difficile diarrhea and renal impairment (Hoffman et al., 2016; Rane, Guha, Chatterjee, & Aparasu, 2016). The study by Rane and colleagues found that in the skilled nursing facility setting that 48.9% of residents taking PPIs had no clinical indication for being on it. There are safer alternatives to dyspepsia such as antacids, H2 blockers, weight management, and not eating late at night. Another medication class prescribers can consider discontinuing are bisphosphonates. After bisphosphonates are taken for greater than five years, femur fracture risk is increased. Stopping this medication for at least 2 years is prudent (Adler, Fuleihan, & Bauer et al., 2016).

Deprescribing Safely

Deprescribing is a system of reducing medications providing the best benefit to the resident and reducing risk (Reeve et al., 2015). Although some variables related to falls are not controllable, reduction of polypharmacy and fall-risk increasing medications can be done safely (Skinner, 2015; Frank & Weir, 2014; Reeve et al., 2013; Palagyi et al., 2016; Potter et al., 2016; Garfinkel & Mangin, 2010; DeJong, Van der Elst, & Hartholt, 2013; Jetha, 2015). Multiple deprescribing algorithms provide consistent and important questions a health care provider must consider when evaluating medications in elderly SNF residents. These questions pertain to risk versus benefit, interactions with other medications, necessity of medication, safer alternatives, and effectiveness of medication and relevance due to age. As noted in Kolcaba's comfort theory (2013), a component of comfort is to give our patients the abiity to be informed of health care decisions. Thus, communicating medication changes with the resident (or power of attorney if

the resident is not deemed capable of decision making) is important to reduce powerlessness (Theurer et al., 2015). Lastly, the provider needs to adjust medications using a process that will allow for as few side effects as possible. Benzodiazepines should not be stopped abruptly (Galazzi et al., 2015; Frank & Weir, 2014; Reeve et al., 2013; Brandt, 2016; Skinner, 2015).

Withdrawal of bisphosphonates, aspirin, iron supplements, angiotensin II antagonists, vitamins, supplements, and statins yielded no adverse effects in one study (Potter et al., 2016). with a small sample size (47 in retrospective, 48 in prospective). Antidepressants, anti-convulsants, pain medications, proton pump inhibitors and benzodiazepines were more challenging to withdraw in this study and required a slower taper. Because this population has multiple comorbidities, careful screening of which medications have a greater risk than benefit must be done prior to stopping medications (Blanco-Reina, Ariza-Zafra, Ocaña-Riola, León-Ortíz & Bellido-Estévez-Reina, 2015). A review of multiple tools (Skinner, 2015) utilized in the past revealed common aspects of pharmacology screens considered important when reducing medications. (Table 1). New studies continue to emerge that support the need for fewer medications and better interaction for monitoring (Price et al., 2014). Prescribers must utilize evidence-based research to ensure best practices are followed (Wallace & Paauw, 2015).

Table 1. Considerations When Reducing Medications (Skinner, 2015).

Questions to direct medication adjustments	
Use of over the counter products?	YES☐ NO☐
Specialists seen, or recent hospitalization	YES☐ NO☐
Recent medication addition to treat side effect of another medication?	YES☐ NO☐
Any medication duplications on list?	YES☐ NO☐
Taking Fall Risk Medications?	YES☐ NO☐
Each drug clearly needed?	YES☐ NO☐
Any meds contraindicated in the elderly	YES☐ NO☐
Is the resident on the lowest therapeutic dose of each medication?	YES☐ NO☐

Other variables associated with falls

Non-pharmacological variables commonly associated with falls are gait instability secondary to neuromuscular diseases such as Parkinson's disease (Voss et al., 2012; Gazibara et al., 2014), and Multiple sclerosis (Hoang, Cameron, Gandevia, & Lord, 2013), hyponatremia (Ahamed et al., 2014; Rittenhouse et al., 2014), hypotension which was found in 30% of those who fell in one study (Dhargave & Sendhilkumar, 2016), cognitive impairment/dementia (Taylor et al., 2013), and a history of falls three months prior to admission (AGS/BGS, 2010; Dhargave & Sendhilkumar, 2016).

Neuromuscular disorders

Any generalized musculoskeletal disorders can lead to falls, but all are not common in older adults (Jamebozorgi, Kavoosi, Shafiee, Kahlaee, & Raei, 2012). Gait abnormalities are the chief cause of falls in those with these diseases, as well as altered proprioception (Hoang et al., 2013). Two randomized controlled trials, one prospective study, one retrospective study, and a systematic review article support a strong association between Parkinson's disease and falls (Voss et al., 2012; Gazibara et al., 2014; Hoskovcova et al., 2015; Hiorth, Larsen, Lode, & Pedersen, 2014; Allen, Schwarzel, & Canning, 2013). Numerous other studies support the strong link between Parkinson's and falls (Cheng et al., 2014; Gazibara et al., 2014; Jorgensen et al., 2015).

Cognitive impairment

Cognitive impairment is associated with increased falls (Taylor et al., 2013). Mental health issues (Bunn et al., 2014), brain injury due to CVA, (Dean & Kautz, 2015) and dementia (Olazaran et al., 2013) can lead to impulsive decisions which lead to falls. Residents may forget to use their walkers, or walk on wet or inappropriate surfaces. Hyponatremia may lead to unclear thinking and result in falls (Ahamed et al., 2014; Rittenhouse et al., 2014). Impaired

cognition can also be from medications, leading to falls (Vaapio et al., 2015).

Conceptual Framework

Residents do not always understand what medicines they are taking or the purpose for them (Kalogianis et al, 2016). SNF residents have a decreased locus of control and lose ability to be self-advocates. Medications are changed without their knowledge (Theurer et al., 2015). Multiple variables contribute to powerlessness, including delirium and dementia (Theurer et al., 2015). Health care providers are to advocate for those who cannot help themselves, thus seeking the best care for their patients/clients. As medication prescribers, providers should communicate concerns regarding resident medications and allow them to guide medication modification decisions if they are cognitively capable (Kalogianis et al, 2016) which can help resident comfort (Kolcaba, 2015). To follow the resident-centered care model, providers must educate the resident or power of attorney (POA) regarding why they are on their medications, empowering them to understand subsequent proposed medication changes (AGS, 2015; Cordeiro, deLima Paulino, Bessa, Borgess, & Leite, 2015).

The Comfort Theory, proposed by Katharine Kolcaba (2015), was used as a framework for this project (Table 2). The components of this theory examine health care needs, intervening variables, health-seeking behaviors, institutional integrity, and best policies/practices. According to Kolcaba, resident comfort should be the immediate desirable outcome of nursing care. Residents in skilled nursing facilities have significant health care needs, and based on statistical evidence, the rate of falls among this population is staggering (Ortman et al., 2014). The pain, financial loss, complications, and potential loss of life associated with falls in skilled nursing facilities affect comfort significantly (Jorgensen et al., 2015; Leland et al., 2015; Quigley et al., 2012). The health care needs of elderly residents are complex in a skilled care setting due to

balancing best care practices with evaluating risk.

Table 2. Kolcaba's Comfort Theory Applied to this Project

Kolcaba's Theory Component	Application to Older Adult Care	Comments
Health Care Needs	Residents need advocacy on their behalf	They are not always aware of risk of medications or rationale for taking
Intervening Variables	Functional decline with aging, increases in prevalent diseases associated with falls	As variables are identified associated with falls, this should increase monitoring of residents with those variables.
Health Seeking Behaviors	Those who reside in long term care are vulnerable and are dependent on caregivers to help them achieve optimal health	Therapies, activities, and medication reviews can help residents
Institutional Integrity	Accountability for resident safety and comfort	Fall Committee in place
Best Policies/Practices	Ongoing evaluation necessary for evidence based practice	Literature review, ongoing assessment of efficacy of interventions to prevent falls

Kolcaba's Comfort Theory reinforces the need for providers to modify any variables that interfere with comfort. This project will address the health care needs of this population and intervening variables, as well as the implementation of a policy intended to help medication use to be optimal for residents, which supports all components of Kolcaba's Comfort Theory.

Methodology

Using systematic literature review, a provider admission medication screen (PAMS) was developed (Appendix A). The tool was approved and adopted as a policy titled "Medical Staff Admission Medication Screen Implementation" in the SNF to require providers to use the tool on all new admissions within 48 hours of admission. The policy was utilized by the researcher on

all residents admitted to the SNF during the project time who met inclusion criteria, with intent to determine if it reduced the percentage of falls in that population.

Research design

The researcher did a quasi-experimental comparative study to evaluate whether falls were reduced in those residents who had the tool utilized by their provider. This study evaluated a newly implemented policy for the use of the PAMS.

Instrumentation

A Provider Admission Medication Screen (PAMS) (Appendix A) was developed by the researcher to catalogue the variables on each resident who presented for admission to the SNF. Demographics included age, gender, and the multiple variables associated with falls. This tool was created to summarize fall risk associated medications and those that are overused in the elderly as evidenced by the Beers criteria (AGS, 2012, 2015), and the STOPP/START criteria (Gallagher et al., 2008; O'Mahony et al., 2015). Many studies were utilized which provided evidence-based support of medications associated with falls (McMahon et al., 2014). A study by Price et al., (2014) demonstrated that use of the Beers list medications increased unplanned hospitalizations and adverse drug reactions, especially when more than one medication listed had been administered to residents. The medications were listed with guidelines to determine choices of action for the prescriber to follow based upon literature review.

Medications were also listed on the tool that are known to be of greater risk than benefit in this age group, such as statins especially after age 80, proton pump inhibitors, and bisphosphonates, with the intent to reduce the number of medications each resident is on. Two board-certified gerontologists, and two geriatric pharmacists who worked in long term care reviewed, evaluated, and approved of the tool to be used.

The Brief Interview for Mental Status (BIMS) test was administered to all residents at the facility within three days of admission. The test typically takes less than ten minutes to complete. The results are sorted according to numeric scoring as follows: 13-15 cognitively intact, 8-12 moderately impaired, and 0-7 severe impairment. Based upon a study of 229 residents in a SNF in Maryland, the BIMS was found to have strong internal consistence reliability and construct validity but did not differentiate between normal cognition and mild cognitive impairment (Mansbach, Mace, & Clark, 2014).

The Timed Get Up and Go test (TGUG) was administered by physical therapy to all new admitted residents at the SNF. a valid measurement tool for gait assessment (Gine-Garriga et al., 2009). This is also a simple test which measures the number of seconds it takes for a resident to walk ten feet away and return to starting location. The scoring for this test are as follows: very high risk of falls is 30 or more seconds, high risk 21-29 seconds, moderate risk 13-20 seconds, and low risk of falls less than 12 seconds.

Setting

The study took place in a 112 bed, skilled nursing non-profit facility located in a rural setting in Lancaster County, PA. The building had two floors, the cognitive support unit, and the regular skilled care floor. Resident numbers varied somewhat throughout the project, but ultimately the census was evenly distributed between the floors. The average number of admissions per week at this facility during the time of the study was three. Residents at this facility are predominantly caucasian Catholics. Most families of residents are from the local area and remain interactive in their care.

Sample

The average age of the residents at the facility when the project was initiated was 86, with a census of 106 residents, 79 females and 26 males. The goal was to achieve sample sizes of 40 during the study period in each group with an age of 65 or greater. Sample size was determined by the availability of new residents who were admitted to the SNF during the project timeframe who were not blind and who could complete the TGUG test. Despite extending the length of time for the project, only 39 residents in each group were utilized for policy evaluation.

Historical group

The historical cohort sample size mirrored the size of the admission sample during the project timeframe who met specifications as noted and had the same exclusion and inclusion criteria. The SNF medical records clerk compiled a list of residents admitted 4-8 months before the project began. To ensure freedom from bias, the list was utilized in retrospective fashion, using the most recent admission 4 months prior to project start date and going backwards. With each new SNF admission, the next chart on the list was utilized to maintain symmetry in sample size.

Admission group

The residents who were newly admitted had their medications reviewed using the tool by the nurse practitioner within 48 hours of admission. All data were recorded in the same manner. The admission medication tool was placed inside each admission chart and nurses recorded resident falls as they occurred. The chairperson of the agency's Falls Committee also validated the falls that took place and ensured that data were recorded accurately. Confidentiality was maintained by no use of patient names on the spreadsheet or tool.

The admission group had discontinuation or reduction of medications done if medications could be modified safely, based on upon the PAMS (Appendix A). Medications were removed if

no longer needed. Certain medications, such as benzodiazepines or SSRI's were titrated downward slowly. In many cases the medication changes were not implemented at once, which was better tolerated by the resident. The nurse practitioner called the SNF at least every other day to monitor for adverse events.

Group similarities

Both groups were assigned an alphanumeric identifier. Admissions were referred to as A1, A2, and so forth, and the historical group was referred to as H1, H2. Both groups had the same exclusion criteria: blindness or the inability to perform the TGUG test. An LPN who records fall data for the Falls Committee validated the falls that were recorded on both spreadsheets. The admission group had falls post admission recorded on Provider Admission Medication Tool. The data from the chart review for the historical group was recorded anonymously on a spreadsheet.

Both the admission and historical group data were kept on a personal laptop which was password protected. No identifying factors were attached to the data. Upon completion of tracking falls in residents four months after their admission, a statistical analysis was conducted to compare fall data between both groups including the percentage of variables and falls post admission.

Exclusion criteria

Residents with poor vision are unable to see objects, which may lead to falls (Kaniewski, Stevens, Parker, & Lee, 2015). Residents in both cohorts who had legal blindness were excluded from the project. Many residents with blindness do very well but this characteristic could potentially skew data because of a wide spectrum of degrees of blindness and resident adaptation depending upon the length one has had this condition. Visual data were obtained from the

diagnosis list and prior PCP information.

Gait instability is also a well-known cause of falls among the elderly (Jing et al., 2014; Giné-Garriga, Guerra, Marí-Dell'Olmo, Martin, & Unnithan, 2009). Residents in either sample who could/did not complete the TGUG test were excluded from the project. The rationale for this was that if someone could not perform this simple test, the data could potentially be skewed; however, this did reduce the sample size significantly.

Ethical considerations

Upon admission to the project site facility all residents must sign an agreement allowing use of their health information for quality improvement or research. The Institutional Review Board (IRB) from Edinboro University approved the study. Because the use of the Provider Admission Medication Screen (PAMS) was a policy of the SNF, resident consent was not necessary. Changes that were made in medications were not outside of the scope of practice and were appropriate for care of residents in a skilled nursing facility. All residents and families were informed of the policy for medication review and were enthusiastic about medication screening with the intent to improve resident care.

Risks and benefits were explained thoroughly. Medications were modified if unnecessary, or associated with fall risk, with care taken not to cause the resident any harm. Medication reduction and elimination were reviewed with an off-site gerontologist as well as geriatric pharmacist to ensure no researcher bias in prescribing/deprescribing of medications existed. All changes were shared with the resident or power of attorney, and residents were monitored for falls. Confidentiality was maintained by an alphanumeric labeling system and historical data was maintained in locked files in the medical records department at the facility. Recorded data were free of any personal identification. Admission screening tools were inserted

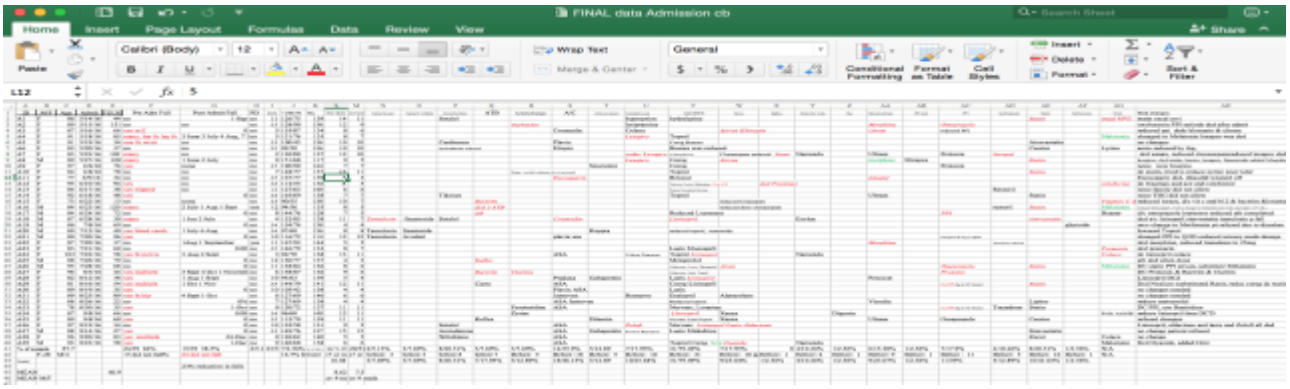
inside the charts of the admission cohort. Outcomes of medications changes were monitored and if warranted, medications were adjusted based upon resident responses.

Residents still residing at the SNF in the historical group also had their medications adjusted to reduce falls if this was found to be appropriate. This did not skew the study data since the historical group fall tracking was related to 4 months after their admission, a time that had passed. As with the admission group any change was discussed with the resident or POA.

Data Collection

The Provider Admission Medication Screening tool was utilized to collect data from interviews regarding falls, chart review, and evaluation by physical therapy for gait instability using a timed-get-up-and-go test. Staff notified the physician and nurse practitioner when new admissions were scheduled so that the tool was implemented within 48 hours of admission as per policy. The Falls Committee at the facility was given ongoing updates throughout the project and provided input to ensure fall incidence was monitored accurately. The absence or presence of polypharmacy as defined as 7 or more oral medications (Hudhra et al., 2016) was recorded on the PAMS. An excel spreadsheet was then utilized to record variables in both groups (Figure 1).

Figure 1. Excel Spreadsheet for Data Collection



Some non-pharmacological conditions associated with falls such as Parkinson's disease, Multiple sclerosis, gait instability, hypotension, and previous fall history were also recorded with

intent to increase validity of the data obtained when historical and admission groups were compared. Falls post-intervention were recorded on this tool as well. Residents who expired prior to four-months post admission were noted on the form and those who were discharged were called to be record whether a fall took place within four-months post admission to the facility.

Timeframe for Study

The timeframe for evaluation of the policy that utilizes the PAMS for all admissions meeting criteria was initially intended to be three months but was extended to four months (19 weeks). The intent was to get as large a sample size as possible.

Follow up monitoring

After medication changes were done on new admissions as appropriate, using the tool, the researcher called the SNF routinely to check on residents. They were monitored for falls for four months following their admission. Phone calls were made at least every other day to those who were discharged prior to the four months to determine if they fell. The nurse practitioner (researcher) typically rounded at the SNF twice a week, but occasionally an increase in rounding frequency was done to ensure that the tool was utilized within 48 hours of admission. Interprofessional collaboration was essential to lead to success in program implementation and to affect change. For example, if a certified nursing assistant did not report that one of the residents was acting more depressed, it would negate the attempts to evaluate responses to medication change. The residents were monitored carefully for adverse effects of medication changes.

Mechanism for data analysis

Data were reviewed with a statistician for accuracy after analysis by the researcher. Variables were tabulated as well as the number of falls either with or without intervention, and a comparison and contrast which isolated which variables were associated with the greater number

of falls in the skilled nursing facility. Comparison of fall rates was not only made between the historical group and admission group, but fall rates were also compared within both groups pre/post admission. Data were analyzed via SPSS using the Pearson Chi square and Fisher Exact test for analysis of variables. A two sample t-test was used to measure p-value regarding averages ages between samples. The only screening variable absent in all residents was Multiple sclerosis. Only one resident admitted during the project was excluded due to blindness; although the inability for some to complete the TGUG test significantly reduced sample size.

Methodology Summary

After IRB approval was granted and the administration at a local SNF approved a policy for each admitted resident to have an evidence-based Provider Admission Medication Screen (PAMS) utilized within 48 hours of admission with the intent to demonstrate if this was effective in reducing falls. The policy was implemented and all changes in medication were reviewed with an off-site collaborating gerontologist peer-reviewing each completed PAMS, as well as permission received from the resident/power of attorney for medications. A geriatric pharmacist was consulted as needed. Data were collected by using alpha numeric identifiers for both the historical group and the admission group. With each admission, another historical chart was reviewed for all variables utilizing residents who had been admitted at least four months prior to project implementation. Falls were tracked for four-months post admission in both groups.

Sample selection criteria

Residents were utilized for the project if they were at least 65 years of age, did not have legal blindness, and could perform the Timed Get Up and Go (TGUG) Test. The admission sample was limited mostly due to inability of many admission residents to perform the TGUG test. The sample size for both groups was 39.

Analysis of Study Results

Homogeneity of group variables

The historical group and the admission group were homogenous in many aspects, such as race, gender, absence of Multiple sclerosis, and fall rate post admission. The number of residents who expired prior to four-months post admission was the same in each group (12%). The ratio of males to females was similar in both groups. There was not complete homogeneity between groups, with significant differences in two variables, TGUG scores, and a blood pressure lower than 100/70. Although the age was not a categorical variable the admission group was potentially more frail (Table 3).

Table 3. Comparison of Historical Group and Admission Group Fall Variables (N=39)

Characteristic	**Historical Group**		**Admission Group**		**P value**	**Homogeneity**
Mean Age	85.89 years		87.69 years		0.1812	N/A
	Frequency	Percentage	Frequency	Percentage		
Gender- Male	10	26%	11	23.8%	0.8433	YES
Gender- Female	29	74%	28	71.8%	0.8281	YES
Race- Caucasian	39	100%	39	100%	1.0	YES
BIMS <13	19	39%	23	59%	0.3655	YES
BP <100/70	1	2.6%	7	18%	***0.0262***	NO
Falls- pre-Admit	21	54%	24	64%	0.5053	YES
Falls- post-Admit	15	38.5%	15	38.5%	1.0	YES
TGUG ≥30 sec	23	59%	36	92%	***0.0008***	NO
Hyponatremia <135	6	15.4%	5	13%	0.7629	YES
PD	1	2.6%	2	5.2%	0.5557	YES
≥ 7 meds	33	85%	28	71.8%	0.1650	YES
≥ 7 meds post admit	N/A	N/A	20	51%	N/A	N/A

Historical sample variables

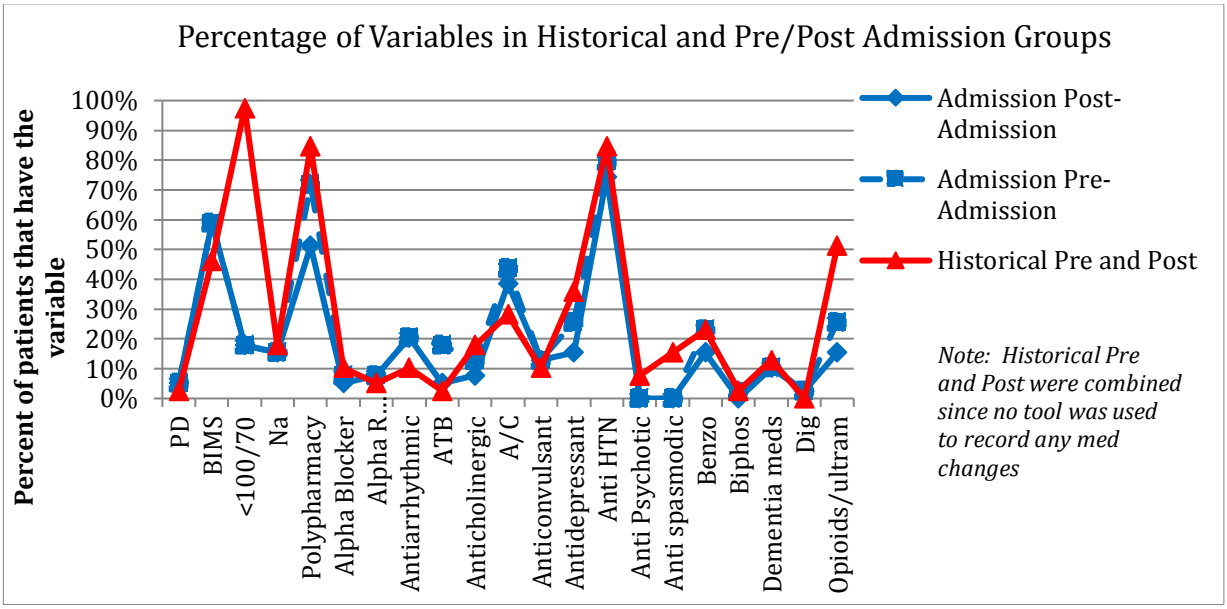
The historical sample (n=39) consisted of 29 females (74 %) and 10 males (26%) with a mean of 85.89 years of age. Fifty-four percent of this sample fell prior to admission, and only 39% fell during the four-months post admission. Cognitive impairment was present in 46% of the sample. Low BIMS scores were present in those that fell pre-admission (26%) yet 66% of

those who fell up to four-months post admission had low BIMS scores. Only one resident had Parkinson's disease.

Admission sample variables

The admission sample (n=39) consisted of 28 females (71.8 %) and 11 males (23.2%) with a mean of 87.72 years of age. Cognitive impairment was present in 59% of the sample. Of those who fell prior to admission, 63% had low scores on the BIMS test, and 87% of those who feel post admission had low BIMS scores, close to the historical group findings. Only 2 residents had Parkinson's disease in this sample. Both groups had very similar percentages of specific medication categories (Figure 2).

Figure 2. Prevalence of Variables in Historical and Admission Groups

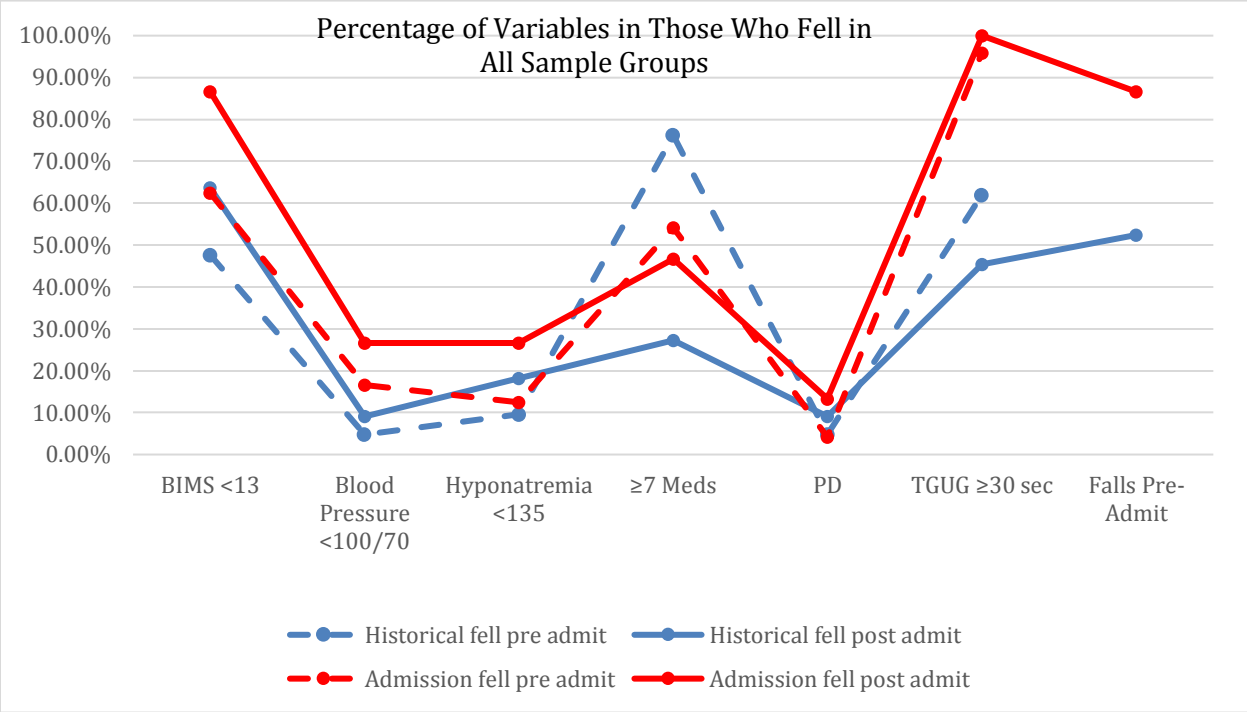


Relationship of Sample Variables to Literature Review

Based on this project, variables associated with falls in the literature were not all clinically significant among those who fell in this study (Figure 3). The most prevalent variables associated with falls in this study were a history of previous falls, and cognitive impairment, specifically noted with a BIMS score of less than 13. Literature does support that once someone

has fallen the variables that contributed to falling may still be present and they will fall again (Dhargave & Sendhilkumar, 2016). Cognitive impairment can lead to poor judgement and impulsive decisions. If a resident is cognitively impaired he or she may not be able to think through choices such as walking on a wet floor, or getting out of bed without assistance or a walker.

Figure 3. Variables Present in Fallers Pre/Post Admission, Historical & Admission Groups



According to literature, residents on multiple medications (polypharmacy) are more likely to fall. This was not evident in this project using SPSS but 76% of those who fell prior to admission in the historical group were on seven or more medications. As noted below the mean number of medications residents were taking who fell either post or pre-admission was not significantly different when compared with non-fallers in each group (Table 4). The association between polypharmacy and falls was not significant in this study but 85 % of the historical

sample and 72% of the admission sample were taking seven or more medications. Polypharmacy was reduced 20% after using the tool in the admission sample, however.

Table 4. Comparison of Average Number of Medications in Fallers and Non-Fallers

COMPARISON OF MEAN NUMBER OF MEDICATIONS BETWEEN FALLERS AND NON-FALLERS IN BOTH GROUPS		
SUB GROUPS	**Historical Group N=39 Average # of meds**	**Admission Group N=39 Average # of meds**
PRE-ADMIT FALLERS	9.76 meds n=21 fell	8.8 meds n=24 fell
PRE-ADMIT **NON**-FALLERS	10.7 meds n=18 no fall	8.3 meds n=15 no fall
POST-ADMIT FALLERS	10.07 meds n=15 fell	7.2 meds n=15 fell
POST-ADMIT **NON**-FALLERS	10.21 meds n=24 no fall	7.4 meds n=24 no fall

Although there are multiple studies associating various medications with falls, only some of them were associated with falls in this project. In the historical group the primary medications that were present in those who fell were anticoagulants, anticonvulsants anticholinergics, and antispasmodics. The admission group fallers had anticholinergics, anticoagulants, anticonvulsants, PPIs, and dementia medications the most prevalent (Figure 4). Only two residents in the admission group were taking alpha blockers, which are associated with falls in the literature. One of these residents fell and one did not.

Inversely, fallers and non-fallers had many similar percentages of specific medications (Figure 5); for example, despite support in the literature that antihypertensives can contribute to falls, there was homogeneity in percentage of antihypertensives between the fallers and non-fallers in this study. The most significant difference seen between fallers and non-fallers post admission was in BIMS score percentages, with lower BIMS scores in those who fell post admission.

Figure 4. Medication Percentages Among Fallers

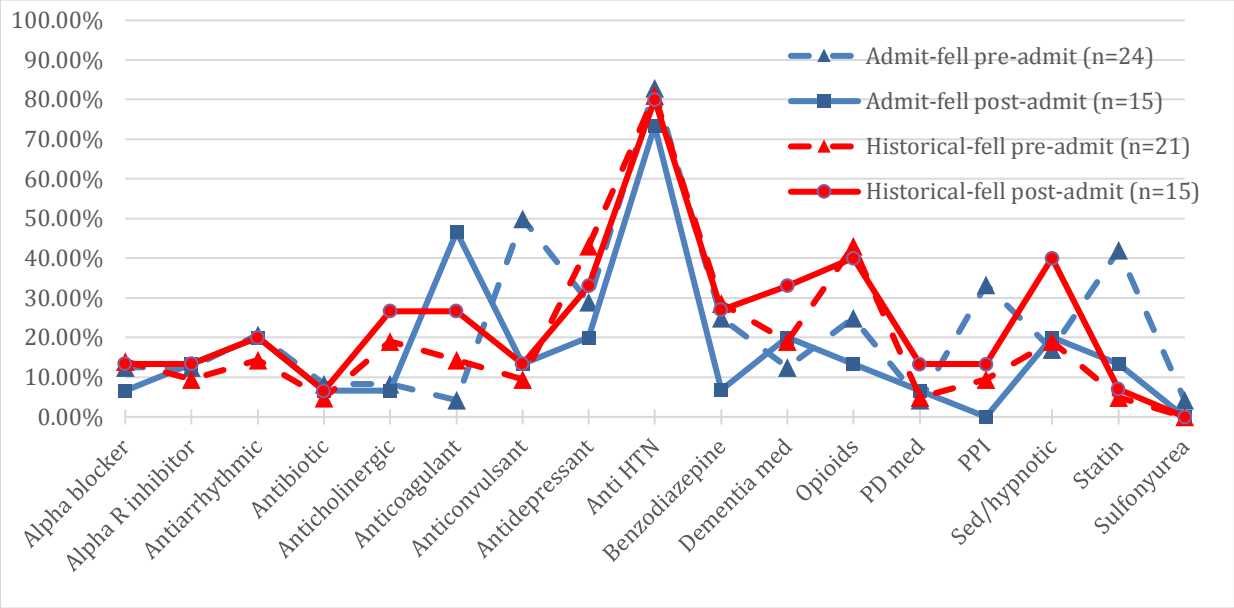
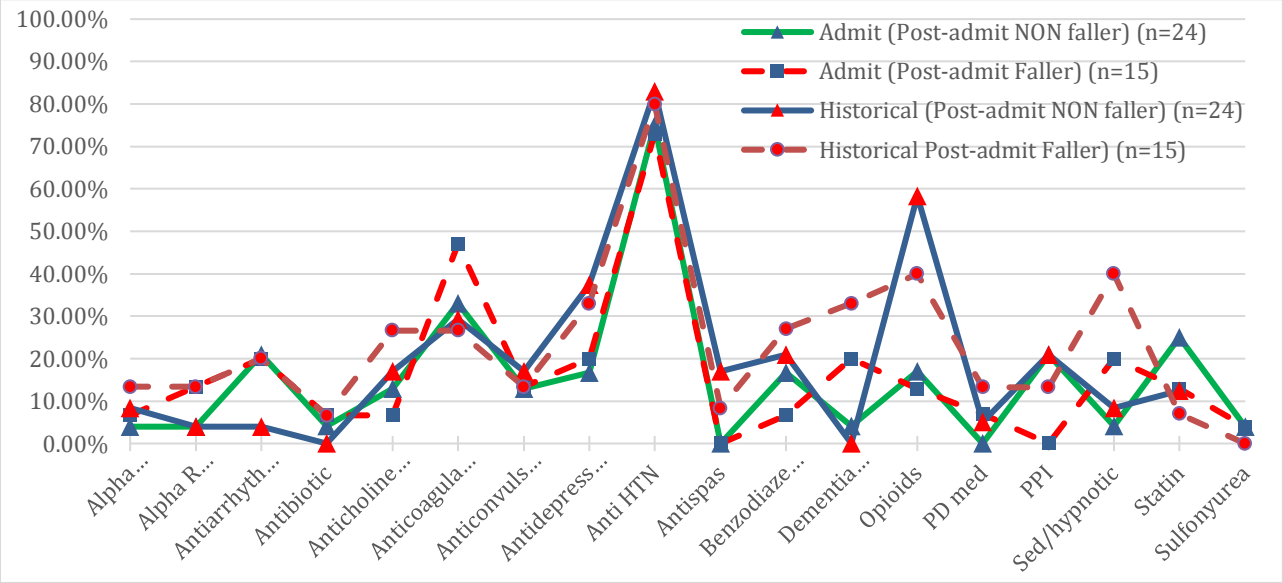


Figure 5. Medication percentages between fallers and non-fallers post admission



The correlation between falls and TGUG scores was not significant, perhaps since all groups had closely similar scores (Table 5). The historical group had identical scores (40 sec) between those who fell pre-or post-admission. A score of thirty or above indicated a very high risk of falls. Historical pre-admit non-fallers had a mean score of 33 seconds, closely matching

the mean score of those who did not fall post admission (34 seconds). The admission group had an average TGUG score of 63 seconds in those who fell prior to admission, and 61 in those who fell post admission. The admission group pre-admission non-fallers had a mean score of 57 seconds, close to the score of 61 seconds in those who did not fall post-admission.

The average TGUG scores in all populations averaged greater than 30, placing them in the category of very high risk, even in those who did not fall pre/post admission in both groups (Table 5). No residents scored in the "no risk of falls" category. Those in the admission group demonstrated mean TGUG scores that were at least 21 points higher than those in the historical group. The TGUG scores were not a statistically relevant variable associated with falls in this project since there was only one resident who had moderate risk of falls, two residents that were high risk, and the remainder were all scored as very high risk. As with other variables, if both fallers and non-fallers share almost equal proportions of the variable, they cannot be associated with the resident falling.

Table 5. Comparison of average TGUG scores between Fallers/Non-Fallers in both cohorts

COMPARISON OF TGUG SCORES BETWEEN FALLERS/NON-FALLERS IN BOTH GROUPS		
Scoring system for TGUG test: Very High risk of fall is 30 or more seconds**,** High risk 21-29 seconds**,** Moderate 13-20 seconds, Low risk of falls less than 12 seconds		
SUB GROUPS	**Historical Group N=39**	**Admission Group N=39**
PRE-ADMIT FALLERS	Mean score 40 sec n=21 fell	Mean score 63 sec n=24 fell
PRE-ADMIT **NON-** FALLERS	Mean score 33 sec n=18 no fall	Mean score 57 sec n=15 no fall
POST-ADMIT FALLERS	Mean score 40 sec n=15 fell	Mean score 61 sec n=15 fell
POST-ADMIT **NON-** FALLERS	Mean score 34 sec n=24 no fall	Mean score 61 sec n=24 no fall

Those who fell both in the historical group and the admission group did demonstrate lower BIMS scores than those who did not fall (Table 6). The study demonstrated a statistically significant association between BIMS scores <7 and falling. This is supported in the literature as

being associated with falls but it is significant to note that the admission group had a much lower average BIMS score overall than the historical group, almost in the severely impaired category. Also BIMS scores were significantly lower in those who fell in the study.

Table 6. Comparison of BIMS scores between fallers and non fallers in both groups

COMPARISON OF BIMS SCORES BETWEEN FALLERS/NON-FALLERS IN BOTH GROUPS		
BIMS scoring system: 13-15 cognitively intact 8-12 moderately impaired 0-7 severe impairment		
SUB GROUPS	**Historical Group N=39** AVERAGE BIMS SCORE	**Admission Group N=39** AVERAGE BIMS SCORE
PRE-ADMISSION FALLERS	11.19 moderate impairment n=21	7.5 moderate to severe impairment n=24
PRE-ADMISSION **NON**-FALLERS	12.22 moderate impairment n=18	11.4 moderate impairment n=15
POST-ADMISSION FALLERS	9.6 moderate impairment n=15	7.66 moderate impairment n=15
POST-ADMISSION **NON**-FALLERS	12 moderate impairment n=24	7.46- moderate to severe impairment n=24

Kolcaba's Comfort Theory Utilized in Study

The components of Kolcaba's theory can be applied to the skilled nursing facility setting Table 7). There were many changes made to improve quality of care for residents, including better communication about medications, reduction in medications that were no longer necessary or potentially harmful, continued monitoring of residents for falls, and ongoing exploration of interventions to reduce falls. Residents in the SNF received earlier assessment of their medications by the nurse practitioner, when previously only the physician reviewed medications. The nurse practitioner added another layer of care by meeting residents earlier and helping the physician with early medication review.

Table 7. Kolcaba's Comfort Theory Applied to this Project

Kolcaba's Theory Component	How Utilized
Health Care Needs	Residents were informed about their medications
Intervening Variables	Medications were reduced where prudent
Health Seeking Behaviors	Those who reside in long term care are vulnerable and are dependent on caregivers to help them achieve optimal health
Institutional Integrity	Ongoing assessment of fall variables will be continued
Best Policies/Practices	The PAMS was revised and will be continued as policy

Discussion

Reducing medications is always prudent if a resident does not need a medication since a condition is no longer present, for example if they were obese in the past and had high blood pressure but lost weight and no longer need a blood pressure medication. Although no reduction existed in fall percentages between the historical and admission groups, prescribers should still review medications to potentially provide other benefits. Since both groups had a reduction in falls among those who fell prior to admission with and without the use of the PAMS, the SNF clearly benefits residents.

Many providers already simplify medications for residents admitted to skilled care, but all who care for the older adult do not necessarily have experience in caring for this population. The intent for the tool was to have a means by which screening could be standardized and scripted to remind the provider to thoroughly review and adjust medications if warranted. While the policy did not reduce falls significantly, it did allow for closer monitoring of medications and adverse effects.

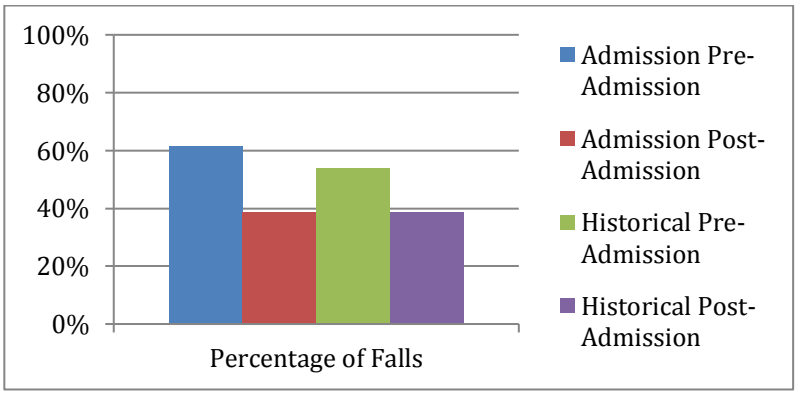
Summary, Conclusions and Recommendations

Description of Project Findings

The historical group had a pre-admission fall rate of 54% and a post-admission fall rate of 39%, which was a 15% reduction even without the use of the PAMS. This occurrence may be related to other variables such as the non-pharmacological interventions done by the facility, the experience levels of the admitting physician who is also board certified in gerontology, or having more surveillance than residents may have had in previous settings. Because so many variables contribute to falls, certainly the various efforts the Falls Committee utilized may have contributed to this reduction.

Within the Admission group (group that had the PAMs utilized upon admission), 62% fell prior to admission, a higher percentage than the historical group. Having an admission medication screening tool utilized, this group had the identical number of falls post admission that the historical group had (15/39%). This demonstrated a 23% reduction in falls among those who had a history of falling in the admission group. This reduction in falls was 18% better than the reduction in the historical group that did not have the tool utilized (Figure 6). This finding was not statistically significant and may have resulted from the small sample size.

Figure 6. Percentage of Falls in Both Groups Pre and Post Admission



The use of a provider admission medication screen did not demonstrate statistically or clinically significant reductions in falls in the SNF population. Anecdotal benefits such as

reduction of unnecessary medication, cost savings, resident happiness about taking fewer medications, and enhanced earlier communication with families and residents with the nurse practitioner were, however, reported by residents.

Descriptive Analysis

Variables associated with falls pre-admission and post admission

Residents in the admission group were asked if they had fallen during the three months prior to admission. Data from both groups were tabulated to identify variables associated with falls. Ultimately SPSS was utilized to analyze data and the following statistical conclusions were made using the Pearson Chi Square and Fisher's exact test to determine significance. Variables were only listed if at least one p value was less than 0.20. As noted in tables 8-11, the variables with the highest confidence interval associated with falls were anticoagulants, a BIMS score less than 7, antispasmodics, dementia medications, and sedative hypnotics.

Table 8. Admission cohort- variables associated with **pre-admission** falls.

Variable	Pearson chi square statistic	Pearson p value	Fisher's Exact Test p value	Confidence Interval
A/C (expected cell counts >5, can use Pearson)	2.839	0.092	0.112	91%
Anticonvulsant	3.585	0.058	0.136	84%
Dementia meds	2.786	0.095	0.146	85%
Other medication (expected cell counts >5, can use Pearson)	1.950	0.163	0.185	83%

Table 9. Admission cohort-variables associated with **post-admission** falls

Variable	Pearson chi square statistic	Pearson p value	Fisher's Exact Test p value	Confidence Interval
PD (expected cell counts >5, can use Pearson)	3.373	0.066	0.142	85%
BIMS <7 (expected cell counts >5, can use Pearson)	7.726	0.005	0.008	95+%
PPI	3.585	0.058	0.136	86%
History of falls	6.503	0.011	0.017	95+%

Table 10. Historical cohort- variables associated with **pre-admission** falls.

Variable	Pearson chi square statistic	Pearson p value	Fisher's Exact Test p value	Confidence Interval
7 or more meds	2.481	0.115	0.190	81%
Anticoagulants	4.353	0.037	0.072	95%
Antispasmodic	3.994	0.047	0.077	92%

Table 11. Historical cohort- variables associated with **post-admission** falls

Variable	Pearson chi square statistic	Pearson p value	Fisher's Exact Test p value	Confidence Interval
BIMS score <7 (can use Pearson)	4.127	0.042	0.055	95%
Dementia meds (can use Pearson)	9.176	0.002	0.005	95%
PD meds	3.373	0.066	0.142	85%
Sedative/hypnotic	5.677	0.017	0.037	95%
History of falls	3.725	0.054	0.098	94%

Limitations

Various limitations associated with this project will help any ongoing use of the tool and policy. One limitation was the limited sample size due to exclusion criteria and time limitations. Accurately predicting the number of admissions in any skilled care setting is challenging. The original fall data collected, which led to implementation of the policy and use of the tool at the facility, had a 42% fall rate. This included all residents, including those with exclusion criteria (blind or could not complete the TGUG test). The final fall percentages were 39% in both groups post admission with exclusion of those who were blind or could not perform the TGUG.

The PAMS had not been piloted prior to this project. Utilization of the tool in other SNF settings would increase interventional validity and generalizability. This is under consideration after modifications are made to the screening tool. One resident did not allow the provider to reduce or stop medications. Healthcare providers must also avoid under-prescribing, because the population in skilled nursing have multiple comorbidities. (Ervin, 2016; Gallagher, O'Connor, &

O'Mahony, 2015) PPI was reduced in one patient by substituting an H2 blocker instead since it has fewer side effects. Using the PAMS wold lead to eliminating all medications due to the comorbidities of older adults.

The variables between the samples were not 100% homogenous. The two variables that were statistically different between groups using a p score were a blood pressure less than 100/70 and a TGUG score greater than 30 seconds. The historical group did not have as many in the sample with a low blood pressure, nor did it have as high a TGUG score as the admission group. The historical group may have had less risk of falling than the admission group, so it is possible that the tool did assist in managing fall risk.

Another limitation was the lack of evidence regarding any medication reduction prior to admission in the historical sample. That data was not easily available and rationale for medication changes are not always documented in hospital discharges. In addition, the historical group may have had reduction in medications upon arrival since that is not unusual for the rounding providers. There are providers who reduce medications without using a tool so it cannot be assumed that everyone needs to use a tool to do so.

Only one resident in the admission group did not agree to modifications of medication, and another asked to have her Loratadine resumed due to concerns about her allergies. Another limitation is that the BIMS score is not 100% reliable. Residents with dementia may have wide fluctuations in cognitive function, depending on the time of day the test is administered. The benefit of the test is that it can be completed quickly; however, other tests of cognitive ability exist that may demonstrate higher reliability.

Conclusions

Based upon this project, an admission screening tool did not reduce falls in this specific, small, and limited population. A history of previous falls and a BIMS score less than 13 were both associated with falls in this study. Both the historical group and the admission group demonstrated fewer falls post admission than they had pre-admission. The group using the tool had 8% more of a reduction in pre-admission falls than the group not using the tool, but this was not statistically significant. This finding may imply that the skilled nursing facility has some efficacy with their non-pharmacological interventions to decrease falls.

Practical application

Although no statistically significant reduction in falls occurred given the sample size, use of the PAMS provided an evidence-based scripted form to guide admission medication review to ensure consistency in medication evaluation. Forty-three medications were reduced in 29 residents in the admission group which was a 20% reduction in polypharmacy in this sample. The use of the PAMS produced a monthly cost savings of $2350.00, which over a year would save $28,200.00 in health care costs for the institution/residents. Another ancectdotal benefit was that since nurse practitioners (NP) do not currently perform admissions on skilled nursing residents, this policy enabled the NP to have earlier contact with the resident and families which increased the number of providers knowing the resident's medical profile. Families expressed gratitude for medication review. There were no adverse effects noted from any withdrawal of medications, other than one resident who asked that her allergy medicine be resumed due to allergy symptoms recurring with its withdrawal.

Considerations for revisions to tool/policy

The BIMS test is quick and easy to administer, but is not considered reliable except in those with significant dementia (score less than 7). Other tests should be considered. Checking residents for orthostatic blood pressures is not done routinely on admission to some SNFs and might provide more useful data than measuring admission blood pressures while sitting. Recording medication changes made when in the hospital prior to the admission to the SNF would be helpful. This information would more accurately assist in noting patterns in possible etiologies of falls prior to SNF admission. Other variables that may be associated with falls that can be added for consideration are depression and peripheral neuropathy. Multiple sclerosis was removed as a variable.

The revised tool (PAMS) was simplified to be less cluttered and included the addition of tracking adverse effects of medications including readmissions to the hospital (Appendix B). A checkbox was placed on the top of the form stating that the medication changes were approved by the resident, or in the case of cognitive dysfunction, the power of attorney. This allowed for more room for comments regarding actions to take if residents are on certain medications. The terms "cognitive dysfunction" and "gait instability" were removed from the tool since the BIMS and TGUG tests are already quantifying whether these variables exist.

New studies are emerging regarding the possible helpfulness of genetic testing to determine effects and tolerance of medications in the elderly population, reducing risk of and costs of medications (Heitz, 2014; Brixner et al., 2016). The Provider Admission Medication tool should be adjusted every year to reflect new evidence-based data. Ongoing revisions as more studies become available are expected, which is noted in the institutional policy.

Recommendations for Future Research

The PAMS can facilitate a standardized approach to medication review in skilled nursing facilities, hospitals, or office settings. It can serve to continue data collection to isolate variables associated with falls. In this study, the prevalent variables were a low BIMS score/dementia, and a history of falls, so perhaps these residents should have closer surveillance or higher staff-to-resident ratios. Although many healthcare providers are aware of the risks of falls with certain medications, educating primary care providers and hospitalists is still of value.

The Provider Admission Medication Screening (PAMS) could feasibly be added to electronic medical record systems. Diagnosis codes for the STOPP/START criteria have been developed (DeGroot et al., 2014) to facilitate data collection regarding fall risk associated medications utilized by residents. Ultimately if various electronic medical record systems become integrated, this would facilitate the providers in multiple settings to know the rationale for any medication additions or subtractions, enhancing care and ongoing analysis of which medications are associated with falls.

Since NPs are not currently permitted to complete admissions on residents in the SNF setting (CMS, 2013), use of this tool may have impact on quality measures such as enhancing person-centered care within this setting. Using a patient satisfaction questionnaire should be considered regarding use of the tool and its impact on quality.

Falls are a significant concern among residents of skilled nursing facilities and more work must be done to reduce fall rates to improve quality of life for this population. Those who care for residents in this setting must carefully review their risk variables associated with falls and modify or implement measures to change these variables as possible, increase interventions, and monitor to enable a reduction in falls in this population.

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APPENDIX A- Provider Admission Medication Screen

Resident ID A_____ Admit Date _____ Date of review_____

Age: ☐M ☐F **Excluded from study** Y N Due to: ☐ Blindness ☐Inability to perform TUG ☐Reviewed w/Gero

Changes implemented/monitored: ☐None

Fall Risk Variable Screening	**Action Plan where applicable**
History of fall pre SNF admit ☐Y ☐N	More closely monitored by SARC staff
PD ☐Y ☐N MS☐Y ☐N	Avoid anticholinergics if possible with PD
TGUG score _____BIMS score_____	Gait instability ☐Y ☐N Cognitive impairment ☐Y ☐N
Hyponatremia (Na< 135)_____ ☐Y ☐N	Look for causes and treat
Hypotension (BP < 100/60)_____☐Y ☐N	Assess for dehydration, over medication, sepsis

MEDICATION *maybe appropriate to d/c to reduce #meds	**PRESENT ?**	Risk > Benefit ?	**ADR ?**	**Still Need?**	**Safer Choice?**	**Ok w Resident**	**Recommendations Based on Research- Taper, D/C, Reduce, or Switch to Safer alternative. Include rationale for change on D/C summary ☐**
Polypharmacy- ≥ 7 meds	Y N	Y N	Y N	Y N	Y N	Y N	Does each medication have a clear justification for use? If indications are not clear, consider d/c of med
Alpha blocker	Y N	Y N	Y N	Y N	Y N	Y N	Consider d/c/taper esp if for BP or if urinary catheter present
Alpha inhibitor	Y N	**Y N**	**Y N**	**Y N**	**Y N**	**Y N**	D/C if using Foley. Reduce dose if possible.
Antiarrhythmic	Y N	Y N	Y N	Y N	Y N	Y N	Consider alternatives. Avoid Amiodarone or reduce. If BB, taper slowly, Discuss with Cardiology if pt sees them.
Antibiotics*	Y N	Y N	Y N	Y N	Y N	Y N	Don't use for asymptomatic bacteriuria, or viruses. Avoid Macrodantin if GFR <30, reduce doses if renal impairment
Anticholinergics	Y N	Y N	Y N	Y N	Y N	Y N	Look to d/c unless compelling reasons to continue, long acting less fall risk if absolutely needed or essential for comfort ex: Oxybutynin, Detrol, Zyrtec
Anticoagulant- AF, DVT, PE	Y N	Y N	Y N	Y N	Y N	Y N	Review Risk/benefit (age, recurrent falls, bleeding, anemia, goals of care) D/C if 89 or older, anemia, frequent falls D/C 3 mos post DVT if first one- do imaging
Anticonvulsants	Y N	Y N	Y N	Y N	Y N	Y N	Review why used, consider alternative
Antidepressants	Y N	Y N	Y N	Y N	Y N	Y N	Paxil- higher rate of falls. Celexa- do not exceed 20 mg if ≥ 65. Consider SSRI over Tricyclics, but avoid with floroquinolones (prlolongs QT). Taper slowly if dc
Antihypertensive	Y N	Y N	Y N	Y N	Y N	Y N	consider ACE, lower dose to improve cerebral circulation, follow JNC latest guidelines for target goals. Avoid Inderal
Antipsychotics	Y N	Y N	Y N	Y N	Y N	Y N	Consult with psych/gero, taper carefully, Avoid w delirium LBD, PD, use with schiz and bipolar. Low slow taper, Seroquel no >150 mg Risperdone no > 12.5 mg. Watch QTc
Antispasmodics	Y N	Y N	Y N	Y N	Y N	Y N	Very high risk. Short term use, taper, D/C. Consider topical heat/ice, massage, therapy, ROM
Benzodiazepines	Y N	Y N	Y N	Y N	Y N	Y N	Avoid if possible, consider SSRI, taper dose down slowly, short term use
Bisphosphonate	Y N	Y N	Y N	Y N	Y N	Y N	D/C if > 5 yrs (fx risk) hold 2-3 yrs **Start Vitamin D**
Dementia meds	Y N	Y N	Y N	Y N	Y N	Y N	Taper then D/C if tolerated; rarely helpful, fall risk.
Digoxin *	Y N	Y N	Y N	Y N	Y N	Y N	D/C if rate controlled, if normal systolic function. Don't use > 0.125 daily if ≥ 65
Opioids/Ultram	Y N	Y N	Y N	Y N	Y N	Y N	Taper try to wean; short term use for acute pain. Alternative options: Cymbalta, non pharm alternatives
Parkinson's med	Y N	Y N	Y N	Y N	Y N	Y N	Weigh risk vs benefit. Monitor closely. Sinemet has less fall risk than dopamine agonists (Requip, Mirapex, etc).
PPI	Y N	Y N	Y N	Y N	Y N	Y N	Can cause cdiff. Use no > 8 wks unless →Keep if Barretts or recent GI bleed. Consider H2B, monitor CBC 2-4 wks after
Sedative/hypnotic	Y N	Y N	Y N	Y N	Y N	Y N	Taper, consider Melatonin for sleep, less S/E or Trazadone. Avoid Temazepam, Diazepam. Ambien if possible taper and d/c
Statin*	Y N	Y N	Y N	Y N	Y N	Y N	Not as beneficial if >age 80- aches. Review w/cardiology
Sulfonylurea	Y N	Y N	Y N	Y N	Y N	Y N	Consider Metformin as alternative, allow higher A1c, monitor

Post Intervention Follow up

Falls #	Fractures?	Other S/E from med change if known

APPENDIX B- (Revisions in red) Provider Admission Medication Screen (PAMS)

Resident ID _____ Admit Date _____ Date of review_____

Age: ☐M ☐F **Excluded from study** Y N Due to: ☐Blindness ☐Inability to do TGUG Reviewed w/Gero/Pharm ☐

Changes implemented/monitored: ☐None ☐Change(s) Ok with Resident/POA

Fall Risk Variable Screening	**Action Plan where applicable**
Fell pre SNF admit ☐Y ☐N # falls___	More closely monitored by staff
PD ☐Y ☐N Peripheral neuropathy ☐Y ☐N	Avoid anticholinergics if possible with PD
TGUG score ____ BIMS score_____ Dx dementia pre adm ☐Y	Hyponatremia (Na< 135) _____ ☐Y ☐N Look for causes and treat Ortho Hypo (BP >10mm_____☐Y ☐N Assess for dehydration, over medication, sepsis

MEDICATION *maybe appropriate to d/c to reduce #meds	IN USE ?	Side Effects from med?	Risk > Benefit?	Still Need?	Safer Choice	**Recommendations Based on Research- Taper, D/C, Reduce, or Switch to Safer alternative. Include rationale for change on D/C summary** ☐
Polypharmacy- ≥ 7 meds[2,9,17,20] #____	☐	☐	☐	☐		Does each medication have a clear justification for use? If indications are not clear, consider d/c of med **Meds were reduced to** # _____
Alpha blocker[3,4] ex:Tamulosin	☐	☐	☐	☐		Consider taper or d/c especially if for BP or if urinary catheter present
Alpha reductase inhibitor* Finasteride, Dutasteride	☐	☐	☐	☐		D/C if using Foley. Reduce dose if possible.
Antiarrhythmic[9,10 ,17]	☐	☐	☐	☐		Avoid Amiodarone or reduce dose especially if Afib not resolved. Consider alternatives.. If BB, taper slowly, Discuss with Cardiology if pt sees them.
Antibiotics[4,9]	☐	☐	☐	☐		Don't use for asymptomatic bacteriuria, or viruses. Avoid Macrodantin if GFR <30, reduce doses if renal impairment any stage. Monitor for c diff.
Anticholinergic meds[3,4,9 ,12] ex:Oxybutynin, Tolterodine, Solifenacin, Trospium, Fesoterodine, Drifenacin	☐	☐	☐	☐		Look to d/c unless compelling reasons to continue, long acting less fall risk if absolutely needed or essential for comfort. D/C if using Foley. Reduce dose if possible.
Anticoagulant[24] -AF, DVT, PE	☐	☐	☐	☐		Review Risk/benefit (age, recurrent falls, bleeding, anemia, goals of care) D/C if 89 and older, anemia, or frequent falls, D/C after 3 mos for DVT if first one- do imaging
Anticonvulsants[5,4,9,16,17] neuroleptics	☐	☐	☐	☐		Review why used, consider alternative if used for pain
Antidepressants[2,3,4,7,8,9,10, 11,16]	☐	☐	☐	☐		Paxil- higher rate of falls. Celexa- do not exceed 20 mg if >65. Consider SSRI over Tricyclics, but both need to be tapered. Avoid SSRI with Floroquinolones, prolongs QT
Antihypertensive[6,10,11,14, 18,19,20,22]	☐	☐	☐	☐		Consider ACE, lower dose to improve cerebral circulation, use recent JNC guidelines for target goals. Avoid Inderal, NSAIDS. Monitor vasodilators for orthostatic hypotension. Check GFR.
Antipsychotics[2,3,4,9,14,16,17, 24]	☐	☐	☐	☐		Consult with psych/gero, taper carefully, Avoid w/delirium LBD, PD, use with schiz and bipolar. Low slow taper, Seroquel no >150 mg (12.5 best). Risperdone no > 2 mg. Watch QTc
Antispasmodics[3,4,9,16,17]	☐	☐	☐	☐		Very high risk. Short term use, taper, D/C. Consider topical heat/ice, massage, therapy, ROM
Benzodiazepines[3,4,7,9,11,17]	☐	☐	☐	☐		Avoid if possible, use short term and **lowest possible dose.** Taper down slowly, consider SSRI
Bisphosphonate[1]	☐	☐	☐	☐		D/C if > 5 yrs (fx risk) hold 2-3 yrs **Start Vitamin D if not taking already**
CNS Med Burden[15]	☐	☐	☐	☐		Defined as 3 or more standard dosing anieplileptic, antidepressant, antipsychotic, benzo, receptor agonists, opiod receptor agonists. Goal-taper dose, d/c if possible
Dementia meds[8]	☐	☐	☐	☐		Taper then D/C if tolerated; rarely helpful, fall risk.
Digoxin[9,11]	☐	☐	☐	☐		D/C if rate controlled, if normal systolic function. Don't use > 0.125 daily if > 65 yo
Opioids/Ultram[3,4,9,14,16]	☐	☐	☐	☐		Taper try to wean; short term use for acute pain. Alternative options: Cymbalta, non-pharm alternatives. Evaluate for depression
Parkinson's drugs[4,11]	☐	☐	☐	☐		Weigh risk vs benefit. Monitor closely. Sinemet has less fall risk than dopamine agonists (Requip, Mirapex, etc).
PPI[4,9,20]	☐	☐	☐	☐		Can cause cdiff, renal failure. Use no > 8 wks unless →**Keep** if Barretts or recent GI bleed and monitor BMP. Consider H2 blocker, monitor CBC 2-4 wks after change
Sedative/hypnotic[2,3,4,7,9,16,17]	☐	☐	☐	☐		Taper, consider Melatonin for sleep, less S/E or Trazadone. Avoid Temazepam, Diazepam or Ambien if possible. Taper and d/c Zolpidem, Temazepam, Diazepam
Statin[4,5,21,23]	☐	☐	☐	☐		Not as beneficial if >age 80-achiness, liver. Review 2/cardiology if seeing them
Sulfonylurea[5,13]	☐	☐	☐	☐		Consider Metformin instead, more lenient A1C guideline, check renal function and accucheck

Post Intervention Follow up

Falls # Dates BP <100/70? BS <90?	Fractures? Gene testing done ☐	Other S/E from med change if known Med chg since adm:	Readmit to hospital? ☐Y ☐N ☐Expired before 4-months post adm_____ ☐If D/C before 4-months post adm, call resident- any falls at home? _____

References for PAMS Tool (see previous reference list for complete information)

1. Adler
2. Agashivala
3. AGS 2012 Beers Criteria
4. AGS 2015 Beers Criteria
5. AGS 2013 Diabetes
6. Callisaya
7. Echt
8. Epstein
9. Gallagher START/STOPP
10. Gebara
11. Ham
12. Landi
13. Lapane
14. Montali
15. Nace
16. O'Mahony START STOPP version 2015
17. Olanzaran
18. Price
19. Rane
20. Tinetti
21. Vaapio
22. Wong
23. Westaway
24. Wu
25. Wutzler