Falls are a significant health problem in community-dwelling older adults, resulting in injuries, deaths, and increased healthcare costs. Falls were a quality concern for a Northeastern home care agency and this project aimed to evaluate the falls prevention process for older adults receiving home care services by determining potential root causes of falls and to identify a practice change. This quality improvement project used a root cause analysis methodology with a retrospective matched case-control design. Records of patients with falls were assessed for falls prevention process fidelity and compared with patients without a fall matched on the Missouri Alliance for Home Care-10 (MAHC-10) assessment, examining plan of care accuracy and patient fall risk factors. Findings indicated fidelity concerns in the fall prevention process, with gaps in care planning aligned with identified risk factors. Interventions to mitigate identified MAHC-10 risk factors on care plans were present less than 50% of the time for four of the six factors. Polypharmacy (7.46%) and pain affecting function (9.21%) were most frequently unaddressed risk factors in the care plan. Recommendations included implementation of a falls prevention pathway, including standardized falls risk assessment, universal falls precautions in the care plan with tailored interventions based on risk factors, and referral initiation when necessary.

Using Root Cause Analysis to Inform a Falls Practice Change in the Home Care Setting

Falls are a significant health problem in community-dwelling older adults (Hester & Wei, 2013). In 2014, more than 29 million adults over 65 years of age fell in the United States, with almost 40% requiring medical intervention and 33,000 deaths (U.S. Preventive Services Task Force [USPSTF], 2018). In 2015, over 3 million emergency room visits were related to falls, accounting for 64% of all emergency room visits and 54% of injury-related deaths, costing the United States approximately 50 billion dollars (Florence et al., 2018; Haddad et al., 2019).

Multiple chronic conditions (MCC) can directly impact the risk of falls. Individuals over age 65 years are at particular risk, given the expected age-related increase in the prevalence of MCC (Leslie & St. Pierre, 2009). Diagnoses associated with increased falls risk include heart failure, anemia, depression, diabetes, hypertension, vertigo, and arthritis (Velegraki et al., 2020; Zhao et al., 2020). These conditions and their treatment can compromise physical functioning, placing individuals at greater risk for falling especially when combined with environmental risk factors (Kruschke & Butcher, 2017). Treatment may require polypharmacy, potentially leading to adverse drug events, further increasing the risk of falls (Dhalwani et al., 2017; Leslie & St. Pierre).

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Several therapeutic medication classes contribute to a higher risk of falls, including antianxiety, antidepressant, antipsychotic, and diabetes medications (Hughes et al., 2003; Ming & Zecevic, 2018).

Falls occur at least once annually in 30% to 50% of community-dwelling older adults (Leslie & St. Pierre, 2009). This is likely an underestimate as most home care benchmarking is driven by claims data or agency records that rely on self-report (Hester & Wei, 2013). Falls prevention is a top priority for home care agencies because falls are a potentially avoidable event that may lead to hospital readmission. With more than 3.5 million Medicare beneficiaries receiving home care benefits annually and projected to grow, home care plays a crucial role in preventing falls (Alhuwail & Koru, 2016).

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Falls prevention has been well studied, with evidence suggesting appropriate mitigation of risk factors such as mobility issues, poor balance, and impaired vision can prevent falls (Stevens & Lee, 2018). Other contributing factors such as medication side effects and environmental hazards may also be suitable targets (Stevens & Lee). Evidence-based practice in home care includes screening for falls using a comprehensive falls risk assessment combined with customized falls prevention interventions (Alhuwail & Koru, 2016; Kruschke & Butcher, 2017). Guidelines recommend assessment, multifactorial interventions, an interdisciplinary care team approach, and may additionally include home modification, exercise, and referrals to specialists or community resources (USPSTF, 2018).

Local Problem

In New York State, falls are the leading cause of deaths resulting from injury, hospitalizations, and emergency room visits in adults over 65 years of age (New York State Department of Health [NYSDOH], 2010). This equates to 1,202 annual deaths, 52,309 hospital admissions, and 111,045 emergency room visits for New Yorkers (NYSDOH, 2016). In addition, community falls represent 60% of all falls among NYS older adults (NYSDOH, 2015).

In 2018, as part of the New York Medicaid Redesign Team, emphasis was placed on reducing costs and improving outcomes of community-dwelling health plan members. Health plans were mandated to engage in outcomes driven value-based contracting with providers across settings including home care (NYSDOH, 2018). One of seven qualifying outcomes was "the number of members who did not experience falls that resulted in major or minor injury" (NYSDOH, 2018, p. 4). A licensed home care agency in Northeastern United States implemented the Missouri Alliance

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Falls prevention is a top priority for home care agencies because falls are a potentially avoidable event that may lead to hospital readmission.

for Home Care-10 (MAHC-10), an evidence-based falls risk assessment, as a required element of the in-home nursing assessment (Calys et al., 2013). Additionally, a falls prevention education program was implemented with teams focused on improving patient balance issues (El-Khoury et al., 2015). Postintervention falls increased by 2.2 per 1,000 patients during the first quarter of 2020, comprising over 75% of all reported patient incidents, along with an 5% increase in hospitalization and nearly 6% increase in emergency room visits. These data suggested the need to better understand the root causes of falls in this population.

Aims

This project aimed to evaluate the current falls prevention process for community-dwelling older adults receiving home care services. The objectives were to:

1. To determine fidelity to the established agency initial assessment and reporting process.
2. To identify the root causes of falls in community-dwelling older adults receiving home care services within the agency.
3. To apply the results of the root cause analysis to make recommendations for evidence-based practice change.

Methods

This quality improvement project used a root cause analysis (RCA) with a retrospective matched case-control design within a licensed home care agency in the Northeastern United States to meet the identified aims. SQUIRE 2.0 guidelines served as a guide for project reporting (Ogrinc et al., 2016).

Population

The population was defined as those 65 years of age and older who had a fall documented in an event tracking database in the agency's electronic medical record (EMR) during 2019. Only patients who were documented as falling in 2019 were included in the first aim. The second aim also included a randomly selected subsection of patients who fell in 2019. For each patient with a fall, a control patient was randomly selected among patients without a fall with equivalent MAHC-10 scores on the most recent assessment. As an RCA, the analysis was powered for one-sided tests of positive associations. A minimum sample size of 95 patients per group was determined to provide 80% power to detect a 2.5 odds ratio, and a type I rate of 5%, given a 10% probability that a case was not exposed, and the matched control was exposed. A final sample of 110 patients per group was drawn to accommodate unforeseen data collection issues.

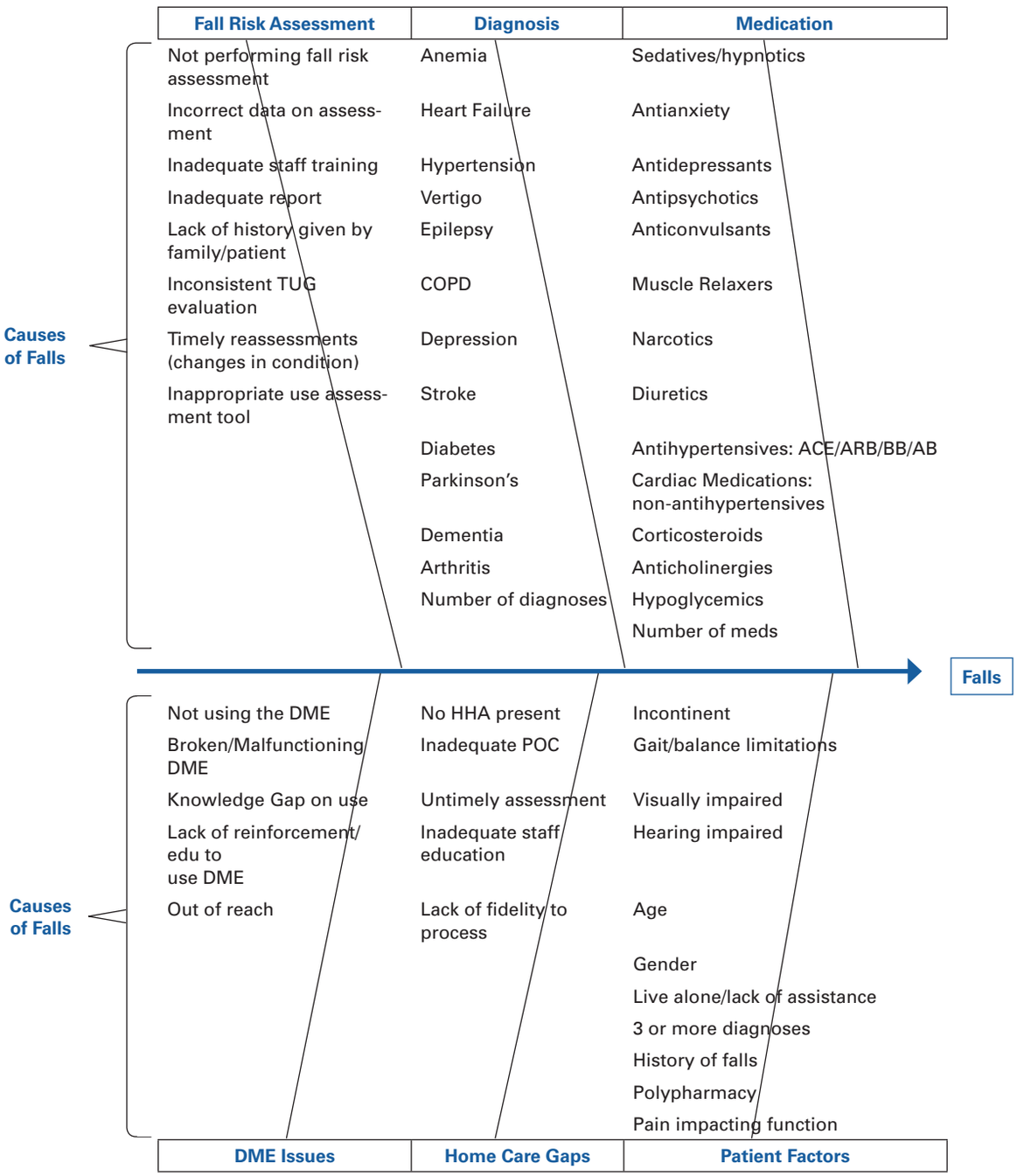
Root Cause Analysis

Contributing causes to a problem require identification to effectively institute change, and RCA leverages a standardized approach to identifying the underlying causes with a current process and works toward potential solutions (Lee et al., 2012; Mahoney et al., 2016). This project was deemed exempt by the agency's institutional review board.

The RCA methodology was utilized to understand the causes of falls and inform practice changes (Mahoney et al., 2016; Sluggett et al., 2020). A literature review identified various processes for RCA, including retrospective medical records reviews, incident reports, fishbone diagrams, 5 whys methodology, and staff and patient interviews. These studies identified practice changes such as EMR alerts, staff and patient education, service access, improved falls risk assessment, and improved screening or community falls programs (Mahoney et al., 2016; Sluggett et al.; Stoeckle et al., 2019).

The Institute for Healthcare Improvement (IHI, n.d.-a) guided the RCA process and outlined the following steps as common to performing RCAs: identify what happened, determine what happened, determine causes, develop causal statements, generate a list of recommendations, and dissemination. Below, we discuss the six steps used to frame our review.

Figure. Fishbone Diagram of Potential Causes of Community Based Falls



Note. The figure describes factors identified as potentially contributing to the risk of falls in our population. Abbreviations are defined as follows: AB=alpha blockers; ACE=Angiotensin-converting enzyme; ARB=angiotensin receptor blocker; BB=Beta blocker; COPD=chronic obstructive pulmonary disease; DME=Durable medical equipment; EDU=education; HHA=Home health aide; TUG=Timed up and go.

After the agency identified an increase in falls, we determined what should be occurring in the falls prevention process through process mapping. The map included assessment (initial and ongoing), plan of care (POC) development aligned with risk factors, and formal falls investigation post fall

as key steps. Variations in the expected falls investigation process were identified through chart review. During the review, we noted that while falls reporting processes were followed 100% of the time, gaps in the falls prevention process were likely, determining the next steps in prevention process evaluation through detailed chart reviews.

The third step was to identify contributing factors. A decision was made to review elements of MAHC-10 including total score as well as other contributing risk factors which may not be in the falls risk assessment and may be unique to the organization's population. To determine the additional causes of falls, the literature review was conducted to identify potential direct and contributory causes and two traditional RCA tools, a fishbone diagram (Figure) and 5 whys were selected to guide the root causes analysis (IHI, n.d.-b). After completing the fishbone diagram and 5 whys with the agency's internal stakeholders, it was determined gaps might exist between the agency's falls prevention process and implementation. More specifically, the stakeholders identified potential fidelity concerns with care plan alignment of interventions to individual patient risk factors. As a next step, data related to contributing factors were collected through a retrospective chart review of the matched selected patients with a fall event and those without. Additionally, the individualized POC was also reviewed via retrospective chart review to evaluate compliance of the risk factors identification on the MAHC-10 with the included interventions.

Data Analysis

Descriptive statistics were used to describe fidelity to the care plan development process when falls risks were identified, the frequency of identified risk areas on the MAHC-10, and the frequency of individual fall risk factors identified from the RCA. McNemar's test was used to assess whether the distribution of the prevalence of the RCA factor was higher in patients who fell than controls, where the odds ratio estimate described the discordant proportion ratio. McNemar's test was also used to test association of fall status with components of fidelity to the falls prevention process among patients who fell and controls.

Results

The annual falls rate for all patients served by the agency in 2019 was 12.3 per 1,000 patients. All patients received a nursing assessment that included the completion of the MAHC-10 falls risk assessment. Table 1 displays descriptive statistics of the elements of MAHC-10 items extracted from the EMR for both the patients who fell and matched controls who did not. The most frequently identified risk factors for both groups included polypharmacy (88%), impaired functional mobility (85%), and three or more diagnoses (82.7%). The frequency of risk factors followed the same pattern for the patients who fell and those who did not fall.

Table 2 presents the distribution of individual risk factors from the RCA of patients and matched

Table 1. MAHC-10 Risk Category Frequency

	All	Patients Without a Fall	Patients Who Fell
Risk Factor	***n*** **(%)**	***n*** **(%)**	***n*** **(%)**
Polypharmacy	195 (88.6%)	98 (89.1%)	97 (88.2%)
Impaired functional mobility	188 (85.5%)	94 (85.5%)	94 (85.5%)
3 or more diagnoses	182 (82.7%)	91 (82.7%)	91 (82.7%)
Incontinence	139 (63.2%)	75 (68.2%)	64 (58.2%)
Visual impairment	87 (39.5%)	45 (40.9%)	42 (38.2%)
Pain impacting function[a]	69 (31.8%)	35 (32.1%)	34 (31.5%)
Cognitive impairment	68 (30.9%)	33 (30.0%)	35 (31.8%)
History of falls[a]	28 (12.8%)	12 (10.9%)	16 (14.7%)
Environmental hazard[a]	18 (8.18%)	11 (10.0%)	7 (6.36%)
Overall MAHC-10 Score	5.36 (1.65)	5.35 (1.66)	5.36 (1.66)
Total number	*n* (220)	*n* (110)	*n* (110)

[a]indicates missing data for one patient

Table 2. Individual Risk Factor Frequency & McNemar's Test

	All	Patients Without a Fall	Patients Who Fell						
Risk Factor	***n* (%)**	***n* (%)**	***n* (%)**	**Odds Ratio**	***p* value**	**a**	**b**	**c**	**d**
Drugs									
Antianxiety	12 (5.45%)	5 (4.55%)	7 (6.36%)	1.5	0.38	99	6	4	1
Anticholinergics	16 (7.27%)	9 (8.18%)	7 (6.36%)	0.75	0.79	95	6	8	1
Anticonvulsants	53 (24.1%)	27 (24.5%)	26 (23.6%)	0.94	0.64	67	16	17	10
Antidepressants	58 (26.4%)	23 (20.9%)	35 (31.8%)	1.71	0.05	58	29	17	6`
Antihypertensives	166 (75.5%)	80 (72.7%)	86 (78.2%)	1.35	0.21	7	23	17	63
Antipsychotics	18 (8.18%)	8 (7.27%)	10 (9.09%)	1.29	0.4	93	9	7	1
Cardiac medications: non-antihypertensives	23 (10.5%)	7 (6.42%)	16 (14.5%)	2.8	0.03	89	14	5	2
Corticosteroids	16 (7.34%)	6 (5.45%)	10 (9.26%)	1.67	0.23	94	10	6	0
Diuretics	84 (38.4%)	40 (36.7%)	44 (40.0%)	1.16	0.34	41	29	25	15
Hypoglycemics	68 (30.9%)	36 (32.7%)	32 (29.1%)	0.83	0.77	54	20	24	12
Muscle relaxers	14 (6.39%)	9 (8.26%)	5 (4.55%)	0.5	0.93	97	4	8	1
Narcotics	26 (11.8%)	12 (10.9%)	14 (12.7%)	1.18	0.42	85	13	11	1
Sedatives/hypnotics	19 (8.64%)	8 (7.27%)	11 (10.0%)	1.43	0.31	92	10	7	1
Total number	*n* (220)	*n* (110)	*n* (110)						
Diagnoses									
Anemia	8 (3.64%)	5 (4.55%)	3 (2.73%)	0.6	0.86	102	3	5	0
Arthritis	46 (20.9%)	20 (18.2%)	26 (23.6%)	1.35	0.21	67	23	17	3
COPD	11 (5.00%)	7 (6.36%)	4 (3.64%)	0.5	0.91	100	3	6	1
Depression	25 (11.4%)	10 (9.09%)	15 (13.6%)	1.63	0.19	87	13	8	2
Dementia	40 (18.2%)	18 (16.4%)	22 (20.0%)	1.29	0.3	74	18	14	4
Diabetes	83 (37.7%)	42 (38.2%)	41 (37.3%)	0.96	0.61	44	24	25	17
Epilepsy	6 (2.73%)	3 (2.73%)	3 (2.73%)	1	0.66	104	3	3	0
Heart failure	29 (13.2%)	16 (14.5%)	13 (11.8%)	0.8	0.78	82	12	15	1
Hypertension	174 (79.1%)	85 (77.3%)	89 (80.9%)	1.27	0.3	6	19	15	70
Parkinson's	11 (5.00%)	2 (1.82%)	9 (8.18%)	4.5	0.03	99	9	2	0
Stroke	19 (8.64%)	10 (9.09%)	9 (8.18%)	0.9	0.68	91	9	10	0
Total number	*n* (220)	*n* (110)	*n* (110)						
Total diagnoses	4.64 (2.43)	4.65 (2.44)	4.63 (2.42)						
Living alone	101 (45.9%)	44 (40.0%)	57 (51.8%)	1.65	0.05	33	33	20	24
Gender				1.21	0.32	8	23	19	60
Male	58 (26.4%)	31 (28.2%)	27 (24.5%)						
Female	162 (73.6%)	79 (71.8%)	83 (75.5%)						
Total number	*n* (220)	*n* (110)	*n* (110)						

Note. p values shown represent lower bound probabilities for McNemar's test of homogeneity. a, b, c, and d in the table below represent the paired 2 × 2 cross tabulation used for McNemar's test; b is the discordant pair where the factor was present for the faller but not for the control; c is the other discordant where the factor is present for the control but not the case; a represents the pair when the factor is absent for both case and control; and d when the factor is present for both. The odds ratio is represented by taking b/c in McNemar's test.

controls. In addition, the incidence of each factor by fall status along with the odds ratios and associated *p*-values from McNemar's test are shown. The distribution of risk factors between patients who fell and matched patients without a fall was similar. However, patients who fell were 2.8 times (p = .03) more likely to be taking cardiac medications (non-antihypertensives) than those who did not fall. Similarly, patients who fell were 4.5 times (p = .03) more likely to have Parkinson's than matched controls. Several medications (e.g., antidepressants, corticosteroids) and diagnoses (e.g., arthritis, depression) had estimated odds ratio greater than one, but this difference was not statistically significant. Furthermore, we found evidence that patients who fell had a 1.65 (p = .05) greater odds of living alone as those who did not fall. Of the patients who fell in this study, 73.6% were female; patient gender was unrelated to falling. Additionally, of patients who fell in this study, 73.6% fell while the home health aide was not present in the home.

Although risk assessment was completed and the POC was initiated for all patients, some gaps in risk factor alignment with care planning for both patients who fell and those who did not were identified. Two-thirds of MAHC-10 risk assessment factors had less than 50% compliance with risks aligned with specific POC interventions (Table 3). Polypharmacy (7.46%) and pain affecting function (9.21%) were the most frequently unaddressed risk factors. In addition to the data detailed in Table 3, we found that in 57.1% of the instances when the home health aide was present during the fall, the aide did not correctly follow the patient POC, indicating additional fidelity concerns of the falls prevention process. Fidelity for each risk factor on the POC was similar for patients who fell as for controls, and no association between process fidelity and fall status was found.

Discussion

We conducted an RCA to determine the root causes of falls to make practice change recommendations for the agency. Additionally, we reviewed the agency's current falls prevention program including fidelity to reporting processes, assessment of risk factors, POC alignment of interventions with identified risk, and the effectiveness of these strategies on falls reduction. We identified statistically significant positive associations between patient falls and individual risk factors of cardiac medications, Parkinson's disease, and living alone. We found that certain medications (e.g., antidepressants, corticosteroids) and diagnosis (e.g., arthritis, depression) were positively related to falls; however, the study was not powered to detect or infer an association at this level.

The retrospective chart review and analysis indicated a lack of fidelity with the POC alignment to risk for patients who fell as well as those who did not. A search of the literature indicated limited home care research or data on this particular finding. This RCA project identified deficiencies in the falls prevention process, specifically with the failure of the care plan initiation process targeting

Table 3. Fidelity to Falls Care Planning Procedures

	All	Patients Without a Fall	Patients Who Fell						
Risk Factor	*n* (%)	*n* (%)	*n* (%)	Odds Ratio	*p* value	a	b	c	d
Impaired functional mobility	189 (100%)	95 (100%)	94 (100%)	0.9	0.68	6	9	10	85
Incontinence	139 (95.2%)	74 (97.4%)	65 (92.9%)	0.62	0.95	21	15	24	50
Cognitive impairment	30 (41.1%)	15 (42.9%)	15 (39.5%)	1	0.58	84	11	11	4
Environmental hazards	7 (35.0%)	4 (33.3%)	3 (37.5%)	0.75	0.77	103	3	4	0
Pain affecting function	7 (9.21%)	5 (15.2%)	2 (4.65%)	0.4	0.94	103	2	5	0
Polypharmacy	15 (7.46%)	9 (9.00%)	6 (5.94%)	0.62	0.87	96	5	8	1
Total number	220 (100%)	110 (100%)	110 (100%)						

Note. p values shown represent lower bound probabilities for McNemar's test of homogeneity. a, b, c, and d in the table below represent the paired 2 × 2 cross tabulation used for McNemar's test; b is the discordant pair where the factor was present for the faller but not for the control; c is the other discordant where the factor is present for the control but not the case; a represents the pair when the factor is absent for both case and control; and d when the factor is present for both. The odds ratio is represented by taking b/c in McNemar's test.

interventions for identified patient risk factors. The risk factors most neglected were polypharmacy and pain affecting function. Studies have shown that failure to assess and mitigate falls risk with specific interventions leads to falls (O'Keeffe et al., 2020). Research has shown risk assessment combined with care planning and falls prevention measures, including interventions aligned with identified risks, can reduce falls frequency (Moyer & U.S. Preventive Services Task Force, 2012; Soncrant et al., 2020).

Despite the interventions of education and risk assessment tool implementation, there continues to be room for improvement. The primary area identified by this RCA is improvement in care planning. To reduce clinical practice variations and improve patient outcomes, the agency will need to adopt a clinical pathway for falls. Clinical pathways are used to guide evidence-based practice by defining steps and interventions clinicians will use to guide patient care (Plishka et al., 2019). Clinical pathways are highly effective at reducing falls, especially in older adults, when pathways include assessing and identifying patients at risk for falls, tailored interventions, and referral opportunities (O'Keeffe et al., 2020). Fall pathways may include interventions such as medication education for polypharmacy, changes to the home, referrals for durable medical equipment for impaired mobility, or physician specialties or other resources (Kruschke & Butcher, 2017; O'Keeffe et al.; USPSTF, 2018).

Studies have also demonstrated significant cost savings and improved outcomes when patients are cared for using falls pathways compared with those who do not (Franklin & Hunter, 2019). Specifically, we recommended the home care agency implements a falls prevention pathway that includes a standard falls risk assessment, universal falls precautions in the patient care plan with tailored interventions based on the patient's individual risk factors, and identification of when referrals for other services may be necessary (Agency for Healthcare Research and Quality, 2013). Using a fall pathway will support selecting and aligning the best interventions for patient risk factors, which is currently problematic in the agency's fall prevention process.

Limitations

This QI project has several limitations. First, the project was a retrospective review. This leads to potential data inadequacies, such as missing or incomplete data, inaccurate data, and variance in data quality, although this occurred in few instances with less than one case for three risk factors. The project also was conducted at a single agency, which limits generalizability. The project focused on data from 2019 rather than more recent data due to the impact of the COVID-19 pandemic, which constrained the agency's ability to complete in-home assessments and skewed the traditional patient mix for the agency. There were also limitations with identification of clinical factors or potential patient changes immediately preceding the fall event due to the biannual nature of the nurse assessments as dictated by state regulation and payer contracting terms, as well as staggered paraprofessional visits. Lastly, falls reporting mainly relies on patient or caregiver self-reporting unless agency personnel were present at the time or were contacted by a hospital or physician. Therefore, the total number of falls was likely underreported.

Conclusion

Despite the home care agency's focus on falls prevention, implementing an evidence-based risk assessment, and clinician education, patients continued to experience poor outcomes related to falls. The RCA process revealed gaps in the falls prevention process related to implementing universal falls precautions and targeted interventions based on patients' individual falls risk factors. Evidence strongly supports the use of clinical falls pathways to guide and standardize practice for falls prevention to address this gap; therefore, we recommend this agency would greatly benefit from implementing a falls pathway.

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