Archives of ISPRM 2026;1(x):i-xiii

Original Article

OPEN ACCESS

Reducing inpatient falls in a tertiary rehabilitation unit using a multicomponent fall prevention program: A quality improvement initiative

Krystal Song[1,2], Mitchell Evans[1], Joey Tan[1], Jennifer Langford[1], Adrianne Natoli[1], Ruth Harper[1], Bhasker Amatya[1]

[1]Royal Melbourne Hospital (RMH), Department of Rehabilitation, Melbourne, Australia
[2]Department of Medicine, Royal Melbourne Hospital (RMH), University of Melbourne, Victoria, Australia

Abstract

Objectives: This study aims to reduce inpatient falls over a six-month implementation period through a multicomponent fall prevention program which incorporates interdisciplinary fall safety huddles and workflow redesign.

Patients and Methods: A single-center quality improvement initiative using the Model for Improvement framework and iterative Plan-Do-Study-Act (PDSA) cycles was conducted between November 2025 and April 2026 in a 30-bed inpatient rehabilitation unit at a tertiary hospital in Melbourne, Australia. Interventions included structured interdisciplinary fall safety huddles, standardized electronic documentation tools, staff and patient education, visual reminders, and proactive fall reviews for selected high-risk patients introduced during later implementation cycles. The primary outcome measure was reduction in inpatient falls. Staff surveys at baseline and three months evaluated perceptions regarding implementation feasibility, communication processes, and barriers and facilitators to implementation.

Results: During the 12-month pre-implementation period, a total of 54 patients experienced 79 inpatient falls in the inpatient rehabilitation unit, corresponding to a mean of 6.6 falls per month and an estimated fall rate of 7.2 falls per 1,000 bed days. Of the 54 patients, 35 (64.8%) were male and 19 (35.2%) were female. Thirty-eight patients (70.4%) experienced a single fall, while 16 (29.6%) experienced recurrent falls. The mean age associated with fall events was 60.0 ± 15.5 (range, 20.9 to 83.9) years. During the six-month implementation period, 27 inpatient falls were recorded among 20 rehabilitation inpatients, comprising 16 males (80.0%) and four females (20.0%). The estimated mean age was 59.3 ± 16.4 (range, 20.5 to 82.5) years. This represented a 32% reduction in the mean monthly number of falls compared with baseline. Post-fall interdisciplinary fall safety huddles were completed following all recorded fall events during implementation. Staff surveys demonstrated perceived improvements in team communication regarding patient safety, interdisciplinary teamwork and accountability for implementation of fall prevention strategies. Common implementation barriers included competing clinical demands, sustaining engagement, and meeting burden. Refinement of huddle processes and documentation templates improved feasibility and integration into workflows. No major fall-related injuries occurred during the implementation period.

Conclusion: Integration of a multicomponent fall prevention program incorporating communication-focused workflow redesign, education and standardized post-fall management processes is associated with reduced inpatient falls within a tertiary rehabilitation setting. Embedding structured communication and post-fall management processes within routine interdisciplinary rehabilitation workflows may represent a feasible and scalable approach to fall prevention in rehabilitation environments.

Keywords: Fall prevention, implementation science, inpatient rehabilitation, multicomponent intervention, patient safety, PDSA cycles, quality improvement, safety huddles.

Submitted: June 15, 2026
Accepted: October 09, 2026
Published: October 27, 2026

Correspondence: Krystal Song, MD. Department of Medicine, Royal Melbourne Hospital (RMH), University of Melbourne, Victoria, 3050 Australia.

E-mail: krystal.song@mh.org.au

Doi: https://doi.org/10.5606/archisprm.2026.83

Citation:
Song K , Evans M, Tan J, Langford J, Natoli A, Harper R, et al. Reducing inpatient falls in a tertiary rehabilitation unit using a multicomponent fall prevention program: A quality improvement initiative. Arch ISPRM 2026;1(x):i-xiii. https://doi.org/10.5606/archisprm.2026.83.

© 2026 The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0), which permits non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited and is not modified. https://creativecommons.org/licenses/by-nc-nd/4.0/

Falls remain the most frequently reported adverse events in hospitals, with particularly high rates within inpatient rehabilitation settings, where patients often present with impaired mobility, neurologic deficits, cognitive dysfunction, fatigue, multimorbidity and polypharmacy.[1,2] Rehabilitation patients experience higher fall rates than many acute hospital populations, with reported fall rates ranging from 10.9 to 13.8 falls per 1,000 patient-days.[1] Approximately 30% of hospital falls result in injuries, ranging from minor soft tissue injuries to more serious injuries including head injuries, fractures and death.[1] Falls are associated with increasing morbidity, prolonged hospitalization, reduced confidence, fear of falling and substantial healthcare costs.[2-5] In the United States (US) alone, healthcare expenditure attributable to older adult non-fatal falls was approximately US$80 billion annually.[4] Patients who experience an in-hospital fall have significantly longer hospital stays (mean increase of 8 days) and incur mean additional hospital costs of $6,669 compared to non-fallers.[2]

Falls among rehabilitation inpatients are often multifactorial, reflecting a combination of intrinsic and extrinsic risk factors. Common contributors include older age, cognitive impairment, balance and gait disorders, paresis, fear of falling, polypharmacy and environmental hazards such as wet or cluttered environments, poor lighting, inappropriate footwear.[1,6] Rehabilitation patients also have a unique fall risk profile compared with acute hospital populations. Rehabilitation programs aim to engage patients in progressively challenging activities and increasing levels of mobility. Consequently, an element of therapeutic risk-taking is inherent within rehabilitation practice as patients work towards achieving meaningful functional goals. In tertiary rehabilitation settings, prolonged hospitalization, complex medical and psychosocial needs, cognitive impairment and discharge delays, may further increase the risk of falls.[1]

Traditional hospital fall prevention strategies have largely focused on patient-level risk interventions, such as fall risk screening tools, bed/chair alarms, supervision requirements, mobility aids, non-slip footwear and environmental modifications, with limited effectiveness.[7] However, increasing evidence suggests that systemic level factors need to be equally addressed including interdisciplinary communication, workflow integration, documentation processes, staff education, and consistent implementation of prevention strategies across disciplines and shifts.[1,7] Despite established guidelines, implementation of evidence-based fall prevention measures remains variable in routine clinical practice.[1]

Safety huddles are brief, structured interdisciplinary meetings designed to improve situational awareness, communication and proactive management of patient safety risks. Evidence has demonstrated the effectiveness of safety huddles in reducing adverse events in healthcare settings.[8,9] A stepped-wedge cluster randomized trial demonstrated that multidisciplinary safety huddles reduced adverse events and improved safety culture across oncology, surgery and rehabilitation programs.[8] A scoping review of 158 studies found that hospital-based safety huddles positively improved team process outcomes in 67.7% of studies and clinical care outcomes in 44.3% of studies, including decreased medical errors and reduced adverse drug events.[9] A quasi-experimental study involving rural hospitals found that repeat fall rates were negatively associated with the proportion of falls followed by a post-fall huddle, improved staff perception upon safety culture and teamwork support for fall-risk reduction.[10]

Education-based interventions, either as single intervention or as part of multi-factorial intervention programs for fall prevention, have also been described.[1,7] Australian studies demonstrated that individualized patient and staff education reduced fall rates by 40% (adjusted rate ratio [ARR] = 0.60, 95% confidence interval [CI]: 0.42-0.94) and injurious falls by 35% in eight rehabilitation units, with a median of two education sessions per patient and approximately 2 h per week of staff education at each unit.[7] A 2026 Cochrane review confirmed that tailored education (patient, staff or multicomponent) reduced the rate of falls (RaR = 0.73, 95% CI: 0.56-0.94; moderate-certainty evidence) and risk of falling (RR = 0.61, 95% CI: 0.40-0.92; moderate-certainty evidence).[1] Service model

changes with changes in models of care or organizational systems targeted at fall reductions probably reduce the rate of falls in acute settings (RaR = 0.45, 95% CI: 0.27-0.74; moderate-certainty evidence).[1] Staff education may improve adherence to evidence-based fall prevention measures and interdisciplinary accountability.[1]

Furthermore, patient education materials including pamphlets and written resources have been evaluated as components of fall prevention programs.[1] Well-designed education programs can improve knowledge and self-perception of risk enabling patients to reduce their risk of falling whilst in hospital. More importantly, interventions that integrate with local settings, tailor approaches to individual patient needs and engage both patient and families demonstrate greater effectiveness than those that do not.[1] Electronic medical record (EMR)-integrated workflow tools and standardized checklists may further improve communication and consistency of implementation of prevention strategies across disciplines and shifts.[11] Digital education resources integrated into patient portals, and visual prompts may additionally reinforce patient engagement in fall prevention strategies.[12]

Despite increasing recognition of the importance of communication and workflow processes, evidence regarding rehabilitation-specific multicomponent interventions integrating post-fall huddles, workflow redesign, EMR modifications, and education still remains limited.[1] To address this gap, this quality improvement initiative aimed to implement and evaluate an interdisciplinary, rehabilitation-specific multicomponent fall prevention program adapted to the local clinical environment using iterative Plan-Do-Study-Act (PDSA) cycles within a tertiary inpatient rehabilitation unit. In the present study, we aimed to reduce inpatient falls while supporting functional recovery and to examine the implementation processes and staff perceptions.

PATIENTS AND METHODS

Study design and study population

A single-center quality improvement initiative using the Model for Improvement framework and iterative PDSA cycles was conducted between November 2025 and April 2026 within a 30-bed inpatient rehabilitation unit at a tertiary metropolitan hospital in Melbourne, Australia. The unit provides interdisciplinary rehabilitation for patients with neurological, multi-trauma, orthopedic, amputation, cancer-related and general deconditioning disabilities. Despite existing fall prevention measures, including admission fall risk assessment, mobility recommendation boards, mobility aids, non-slip footwear and incident reporting processes, the unit continued to experience a high fall burden. Consequently, the project was undertaken in response to a high incidence of inpatient falls and aligned with organizational patient safety priorities. The six-month implementation period was selected to allow iterative PDSA cycles and sufficient time to embed the intervention into routine practice. Initially, a retrospective review of incident reports identified 79 inpatient falls over a 12-month period (November 2024-October 2025), corresponding to an estimated fall rate of 7.2 falls per 1,000 bed days. Local interdisciplinary review identified several contributing factors including inconsistent communication regarding evolving fall risk, delayed recognition of changes in functional status, variability in implementation of fall prevention strategies across disciplines and shifts, limited patient engagement in fall prevention, inconsistent bedside handover processes, and absence of a routine standardized EMR post-fall documentation process. The study received Quality Assurance acknowledgement through the institutional Quality Improvement governance process and was determined not to require Human Research Ethics Committee (HREC) approval (QA2026004). The study was conducted in accordance with the principles of the Declaration of Helsinki. The study is reported in accordance with the Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) guidelines.

Intervention

The intervention comprised a rehabilitation-specific multicomponent fall prevention program co-designed by rehabilitation physicians, nursing staff, and allied health clinicians.

Baseline audit findings and staff survey feedback identified communication gaps, inconsistent implementation of prevention strategies, and limited standardization of post-fall management processes as key areas for improvement.

The intervention consisted of several integrated components, including:

1. Structured post-fall interdisciplinary huddles: 10-min structured interdisciplinary meetings were held within 24 h of fall events. Huddles occurred immediately after daily progression-of-care huddles to ensure attendance of involved staff and reduce additional workflow burdens. Huddles were attended by relevant rehabilitation team members (medical, nursing, allied health staff) and focused on reassessment of fall risk, updating supervision/assistance requirements, identifying contributing factors, agreeing on targeted interventions, and implementing individualized prevention strategies.[10] During later implementation cycles, proactive fall huddles were introduced for selected high-risk patients to facilitate preventative review of modifiable risk factors before falls occurred.

2. Redesign of EMR documentation and fall prevention checklists: A standardized EMR template was designed to guide systematic discussion of recent falls, new or changing risk factors, collaborative problem-solving, and assignment of specific actions with clear accountability for implementation of bedside strategies.[11] Enhanced use of standardized fall prevention checklists enabled systematic evaluation of seven key modifiable risk factors (mobility problems, confusion/agitation, hearing/visual impairment, urinary problems, dizziness/orthostatic hypotension, use of restraints, and fall-risk increasing drugs), environmental assessment, medication review, functional assessment, and tailored intervention selection.[11]

3. Immediate bedside implementation of tailored prevention strategies following fall events: Following each fall, comprehensive bedside reassessment was conducted and tailored prevention plans were implemented immediately, including environmental modifications (bed height, mobility aids placement, lighting, call bell access), mobility and supervision/assistance adjustments, medication review, individualized risk factor management, and footwear assessment. Bedside visual displays of updated changes to fall prevention plan ensured consistent implementation across shifts and disciplines.[12]

4. Enhanced handover communication processes: Structured interdisciplinary bedside handovers included explicit discussion of fall risk status, recent fall events, current prevention strategies and supervision/assistance requirement changes. Handovers focused on individual modifiable risk factors rather than generic risk categories, combined with face-to-face communication and included patient and/or family participation.[10]

5. Education resources: Visual displays placed in patient rooms, corridors, and staff areas reinforced key fall prevention messages for patients, families and staff, including reminders about call bell use, appropriate footwear, mobility aid use, and asking for assistance. Purpose-designed pamphlets providing information about risk factors related to falls, personalized prevention strategies, safe mobilization techniques and active participation in fall prevention were distributed to all patients on admission. Digital education resources were made available through the Health Hub patient portal, allowing repeated access and patient and/or family engagement.[12] Patients and/or carers received individualized education on admission by interdisciplinary team tailored to specific risk factors, with ongoing reinforcement throughout admission and targeted post-fall education for 100% of fall events.

6. Staff education: Staff fall prevention education sessions for all rehabilitation unit staff were carried out to raise awareness about the quality improvement initiative and increase knowledge about baseline fall data, evidence-based fall prevention strategies, multifactorial risk assessment, effective interdisciplinary communication, and new workflow processes. Initial 1-h structured training session with ongoing brief refresher education at three-monthly cycles were integrated into huddles and team meetings.[1,7]

Implementation strategy (PDSA Cycles)

The multicomponent fall prevention program was implemented over a six-month period using three sequential PDSA cycles (Figure 1). The intervention components were progressively introduced and refined in response to audit findings, staff feedback and ongoing evaluation to facilitate integration into routine clinical practice.

PDSA cycle 1 (Months 1-3)

Initial stakeholder engagement established leader accountability and interdisciplinary collaboration involving rehabilitation doctors, nursing leadership and allied health leads (physiotherapist, occupational therapist, pharmacist, dietetics and prosthetics/orthotics). Baseline retrospective audit findings and staff survey feedback informed intervention design and identified barriers and facilitators to implementation. The multicomponent fall prevention program was, then, introduced across the rehabilitation unit (Figure 1), supported by staff education, an interdisciplinary working group with discipline champions, reinforcement of standardized fall risk assessment and reporting processes, and implementation of structured post-fall huddles and EMR documentation templates.

Early implementation identified several barriers, including variable staff engagement across disciplines and shifts, particularly during periods of increased clinical demand. There was perceived duplication of communication processes, limited visibility of fall prevention plans across the interdisciplinary team, and documentation burden associated with the initial EMR template. In response, post-fall huddles were aligned with existing ward workflows, shortened to approximately 10 min, and focused on immediate review of contributing factors and updating of individualized prevention strategies. The EMR templates and checklists were simplified to reduce documentation burden and improve usability.

PDSA Cycle 2 (Months 4-5)

The second cycle focused on improving consistency and sustainability of intervention processes. Review of recurrent falls identified opportunities for earlier intervention in high-risk patients, leading to the introduction of proactive fall huddles. Reinforcement education was delivered following review of staff survey findings, with emphasis on post-fall management, communication processes and use of EMR templates. Regular audit feedback, ward safety

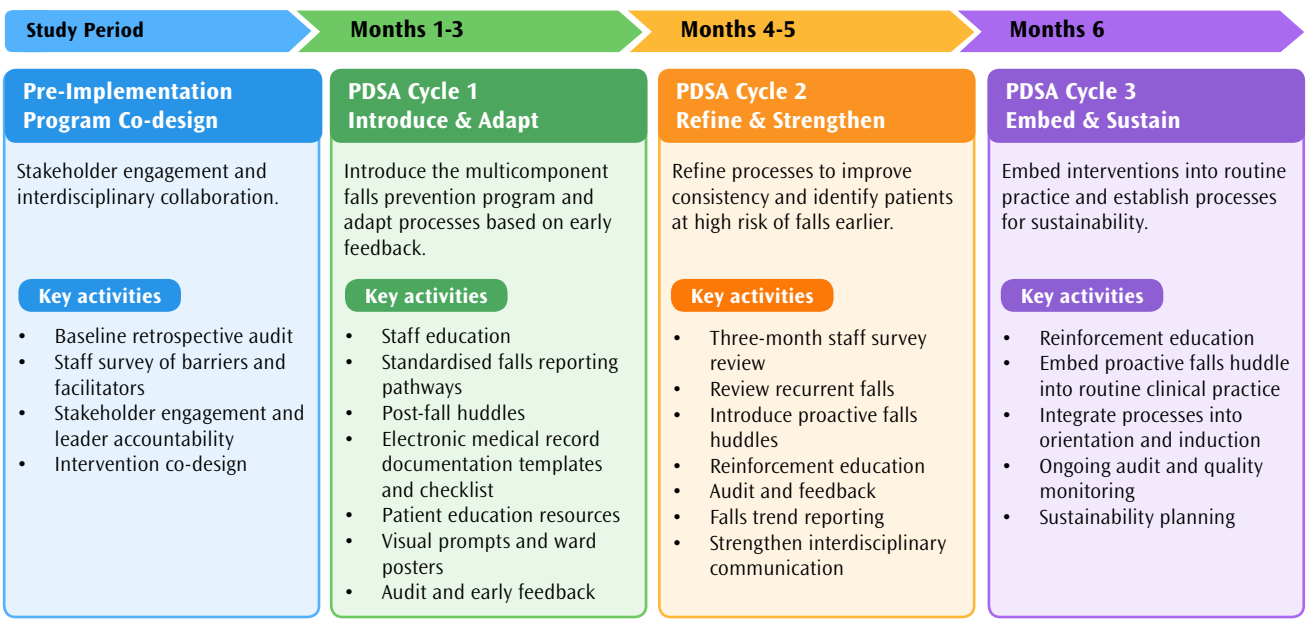

Figure 1. Implementation timeline of the multicomponent fall prevention program using sequential PDSA cycles.
PDSA, plan-do-study-act.

updates and team meetings were used to reinforce adherence and support ongoing refinement of the interventions.

PDSA cycle 3 (Month 6)

The final cycle focused on embedding the interventions into routine ward practice. Proactive fall huddles were incorporated into routine management of selected high-risk patients, while fall prevention workflows, EMR templates and post-fall huddles were integrated into staff orientation, induction resources and ongoing ward quality activities. Additional reinforcement education supported sustainability, and staff increasingly perceived the interventions as enhancing interdisciplinary communication, teamwork and accountability for fall prevention.

Outcome and process measures

The primary outcome measures were the number of inpatient falls per month and the estimated fall rate per 1,000 bed days. Fall-related injury was also evaluated as an outcome measure. The project aimed to reduce inpatient falls during the six-month implementation period. A fall was defined according to the World Health Organization (WHO) as *"an event which results in a person coming to rest inadvertently on the ground, floor or other lower level."*[13] Fall-related injury severity was classified according to the hospital's Incident Severity Rating (ISR) system, as ISR 1 (severe harm or death), ISR 2 (moderate harm), ISR 3 (mild harm), or ISR 4 (no harm or near miss). Recurrent falls were defined as patients who experienced two or more falls during a single admission. High-risk patients were defined as those identified by the interdisciplinary team through routine clinical fall risk assessment, considering previous falls, cognitive impairment, impaired mobility or balance, impulsivity, continence needs and polypharmacy. Fall data were identified through the hospital incident reporting system and verified through review of EMR records.

Process measures included completion of post-fall interdisciplinary safety huddles, documentation of fall prevention plans and checklists, delivery of patient fall prevention education, and staff perceptions regarding intervention feasibility, communication processes, and usefulness of the intervention.

Prospective balancing measures were not collected during the implementation period. As part of the baseline characterization of patients who experienced falls, functional outcomes were assessed using the Functional Independence Measure (FIM), including admission, discharge and change scores across motor and cognitive domains. These data were used to characterize functional recovery in the baseline fall cohort and were not evaluated as a balancing measure of the intervention.

Data collection

A retrospective baseline audit was undertaken for the 12-month period preceding implementation. Baseline data included fall frequency, patient characteristics associated with fall events, documented fall prevention practices, functional outcomes, and rehabilitation service utilization. Prospective data collection was undertaken throughout the six-month implementation period and included fall frequency, fall severity, completion of post-fall huddles, implementation of prevention strategies, and patient education delivery. Fall rates per 1,000 bed days were estimated for both periods using available bed days, calculated from the 30-bed operational capacity and duration of each study period.

Staff surveys were administered at baseline and three months using anonymous Research Electronic Data Capture (REDCap) questionnaires. Surveys explored previous fall prevention training, communication processes, perceptions regarding post-fall huddles, and barriers and facilitators to implementation. Qualitative feedback informed ongoing refinement of intervention processes throughout successive PDSA cycles.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were presented in mean ± standard deviation (SD) or median (min-max), while categorical variables were presented in number and frequency. Fall frequency, mean monthly

Table 1. Baseline characteristics associated with 79 falls occurring among 54 rehabilitation inpatients during the pre-implementation period

Characteristics	n	%	Mean ± SD	Range
Demographics				
Age (year)			60.0 ± 15.5	20.9-83.9
Sex				
Male	52	65.8		
Ethnicity-caucasian	69	87.3		
Married/partnered	27	34.2		
Living alone	41	51.9		
Living with partner/family	35	44.3		
Carer involvement	21	26.6		
Diagnosis				
Stroke	23	29.1		
Musculoskeletal disorders	23	29.1		
Cancer	9	11.4		
Other diagnoses	24	30.4		
Length of stay (day)			45.8 ± 30.2	
Polypharmacy (on ≥ 5 medications)	64	81.0		
Analgesic use	43	54.4		
Comorbidities				
Hypertension	31	39.2		
Diabetes	24	30.4		
Depression	21	26.6		
Ischemic heart disease	4	5.1		
Falls-related characteristics				
Falls prevention plan documented	63	79.7		
Falls education on admission	26	32.9		
Falls education following falls event	54	68.4		
Referral to Falls & Balance Clinic	3	3.8		
Functional impairments				
Upper limb impairment	43	54.4		
Lower limb impairment	66	83.5		
Fatigue	74	93.7		
Cognitive impairment	37	46.8		
Bladder dysfunction	37	46.8		
Bowel dysfunction	15	19.0		
Pain	41	51.9		
Sensory impairment	32	40.5		
Visual impairment	23	29.1		
Hearing impairment	12	15.2		
Postural hypotension	9	11.4		
Inpatient rehabilitation services received				
Physiotherapy	77	97.5		
Occupational therapy	78	98.7		
Social work	72	91.1		
Dietitian	50	63.3		
Psychology	44	55.7		
Speech pathology	6	7.6		
Podiatry/Prosthetics & Orthotics	34	43.0		
Discharge destination				
Home	60	75.9		
Other hospital	16	20.3		
Residential care	3	3.8		

SD: Standard deviation. Data are reported at the fall-event level (n = 79 falls) rather than the patient level. The 79 falls occurred among 54 individual patients. Consequently, patients with recurrent falls contributed multiple observations to the dataset and may be represented more than once within reported characteristics.

fall rates, and estimated fall rates per 1,000 bed days were compared descriptively between the pre-implementation and implementation periods. Monthly falls were plotted using a run chart to examine temporal variation over time, with the timing of the sequential PDSA cycles

indicated. Given the quality improvement design and small number of monthly observations, formal hypothesis testing of fall outcomes was not undertaken. Outcomes were evaluated using descriptive comparison of pre- and post-implementation periods. As a balancing measure, functional outcomes were evaluated using paired t-tests comparing admission and discharge FIM scores. A p value of <0.05 was considered statistically significant.

RESULTS

Baseline characteristics

During the 12-month pre-implementation period (November 2024 - October 2025), a total of 54 patients experienced 79 inpatient falls in the inpatient rehabilitation unit (Table 1). Of the 54 patients, 35 (64.8%) were male and 19 (35.2%) were female with a mean age of 60.0 ± 15.5 (range, 20.9 to 83.9) years. Most patients experienced a single fall (38/54, 70.4%), while 16 patients (29.6%) experienced recurrent falls (≥ 2 falls). Among recurrent fallers, 12 patients experienced two falls, three patients experienced four falls, and one patient experienced five falls.

The mean rehabilitation length of stay was 45.8 ± 30.2 days. Stroke (29.1%) and musculoskeletal conditions (29.1%) were the most common rehabilitation diagnoses, followed by cancer (11.4%) and other neurological or medical conditions (30.4%). Polypharmacy was present in 81.0% of fall events, while lower limb impairment (83.5%), fatigue (93.7%), upper limb impairment (54.4%), pain (51.9%) and cognitive impairment (46.8%) were common impairments identified in this fall cohort.

Fall prevention plans were documented in 79.7% of fall events; however, fall prevention education on admission was documented in only 32.9%. Following a fall, education was documented in 68.4% of cases. Physiotherapy (97.5%), occupational therapy (98.7%) and social work (91.1%) were the most commonly documented rehabilitation services associated with fall events. Home was the most common discharge destination among patients who experienced falls (75.9%).

Functional outcomes - baseline fall cohort

Among patients who experienced falls during the baseline period, functional status significantly improved during rehabilitation as measured by the FIM (Table 2). The mean total FIM scores increased from 71.3 ± 20.0 to 87.8 ± 27.0 at discharge, representing a mean gain of 16.6 ± 19.9 points (p < 0.001). Improvements were primarily observed within motor FIM domains, including self-care, sphincter control, mobility and locomotion (p < 0.001 for all). Less pronounced, but statistically significant improvements were also observed in overall cognitive FIM scores (26.2 ± 7.6 *vs.* 27.8 ± 6.9, p = 0.034). Among cognitive subdomains, psychosocial function improved significantly (5.3 ± 1.6 *vs.* 5.8 ± 1.3, p = 0.007), while communication (p = 0.07) and cognition (p = 0.056) did not demonstrate statistically significant change (Table 2).

Outcome measures – implementation period

During the six-month implementation period (November 2025 - April 2026), prospective

Table 2. Functional independence measure (FIM) scores at admission and discharge

	T0 Admission	T1 Discharge	FIM Change		
Scales	Mean ± SD	Mean ± SD	Mean ± SD	t score	p
FIM total (18-126)	71.3 ± 20.0	87.8 ± 27.0	16.6 ± 19.9	–7.33	**< 0.001**
FIM motor total (13-91)	45.0 ± 15.5	60.0 ± 21.7	15.0 ± 15.1	–8.78	**< 0.001**
Self care (6-42)	23.4 ± 7.3	30.0 ± 9.3	6.5 ± 7.3	–7.93	**< 0.001**
Sphincter control (2-14)	8.8 ± 4.2	10.6 ± 4.1	1.8 ± 4.2	–3.85	**< 0.001**
Mobility (3-21)	9.2 ± 4.8	13.2 ± 6.1	4.0 ± 4.0	–8.79	**< 0.001**
Locomotion (2-14)	3.6 ± 2.0	6.2 ± 3.7	2.6 ± 2.7	–8.53	**< 0.001**
FIM cognition total (5-35)	26.2 ± 7.6	27.8 ± 6.9	1.6 ± 6.5	–2.16	**0.034**
Communication (2-14)	11.0 ± 3.0	11.5 ± 2.7	0.5 ± 2.4	–1.80	0.07
Psychosocial (1-7)	5.3 ± 1.6	5.8 ± 1.3	0.5 ± 1.6	–2.79	**0.007**
Cognition (2-14)	9.9 ± 3.3	10.5 ± 3.1	0.6 ± 2.6	–1.94	0.056

SD: Standard deviation; T0, admission to inpatient rehabilitation; T1, discharge from inpatient rehabilitation.

data collection identified 27 falls in in 20 rehabilitation inpatients, comprising 16 males (80.0%) and four females (20.0%). The estimated mean age was 59.3 ± 16.4 (range, 20.5 to 82.5) years. Sixteen patients (80.0%) experienced a single fall, while four (20.0%) experienced recurrent falls, accounting for 11 (40.7%) of all recorded falls. This corresponded to a mean of 4.5 falls per month and an estimated fall rate of 5.0 falls per 1,000 bed-days. This represented a 32% reduction in the mean monthly number of falls compared with baseline. Monthly falls throughout the study period are shown in Figure 2, demonstrating temporal variation before and during implementation of the multicomponent fall prevention program and across the three sequential PDSA cycles.

Process and implementation measures

Post-fall interdisciplinary huddles were completed following all recorded fall events during implementation. Workflow refinements included simplification of EMR templates, introduction of standardized fall prevention checklists, alignment of huddles with existing progression-of-care workflows and reduction of huddle duration to approximately 10 min to improve feasibility and staff participation. Proactive fall huddles for selected high-risk patients were introduced during the second PDSA cycle and subsequently incorporated into routine ward practice to support early identification and management of modifiable risk factors. Staff reported greater situational awareness of fall risk factors and more consistent implementation of prevention strategies across disciplines and shifts.

Fall posters, patient pamphlets and Health Hub digital education resources improved visibility and reinforcement of fall prevention messaging throughout the rehabilitation unit. Patient education on admission increased from 32.9% at baseline to 100% during implementation, and post-fall education was delivered for all fall events.

No major fall-related injuries occurred during the implementation period. Three patients experienced recurrent falls during implementation.

Staff survey findings

Thirty-three staff completed the baseline survey (Table 3) and 46 completed the three-month survey (Table 4). Respondents included medical, nursing and allied health staff, with nursing staff representing the largest respondent group across all survey periods.

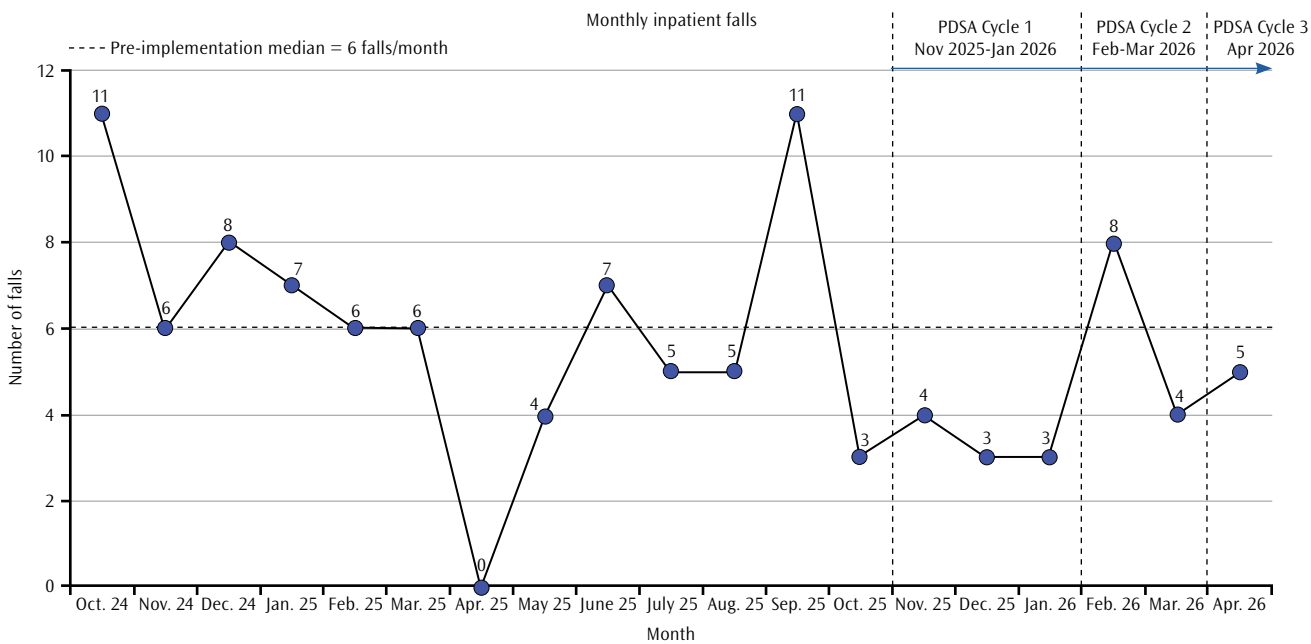

Figure 2. Run chart of monthly inpatient fall before and during implementation of the multicomponent falls prevention program.
PDSA, plan-do-study-act.

Table 3. Pre -implementation staff survey responses by rehabilitation staff (n = 33)

Pre-implementation staff survey questions	Staff response	n	%
Have you completed any training in fall prevention in the last five years?	Yes	15	45.5
Have you participated in a fall safety huddle meeting before?	No	25	75.8
I think the number of fall in the rehabilitation unit is a serious problem.	Yes	23	69.7
I think I have already had enough training about how to prevent fall.	No	29	87.9
I think I have sufficient information on the rehabilitation ward on how to prevent patients from having a fall.	No	30	90.9
I think we need better ways to prevent fall in patients identified as high risk or those who have had a fall.	Yes	33	100
I am keen to prevent patients from falling in this unit.	Yes	33	100
I think 10 minutes for a fall huddle is just right.	Yes	31	93.9

Table 4. Post-implementation staff survey responses by rehabilitation staff at three months (n = 46)

Post-implementation staff survey questions	Staff response	n	%
The falls huddle and documentation templates support individualized care	Yes	43	93.5
Participated in a fall safety huddle	Yes	19	41.3
Preferred communication method*			
Being present at huddle	Yes	17	37.0
Verbal handover	Yes	15	32.6
EMR documentation	Yes	27	58.7
Written summary	Yes	8	17.4
Participation in the falls prevention program has helped develop my critical thinking skills around falls risk and prevention	Yes	17	37.0

EMR, Electronic medical record. * Respondents could select more than one preferred communication method; percentages may, therefore, not sum to 100%.

Baseline survey identified several perceived barriers to fall prevention, including competing clinical priorities, meeting burden and absence of standardized post-fall documentation processes, inconsistent interdisciplinary communication and variable bedside implementation of strategies. Staff also identified a need for improved fall prevention education and clearer communication processes. Key facilitators included collaborative problem-solving, involvement of relevant disciplines, and integration of prevention strategies into existing workflows.

Post-implementation surveys demonstrated high staff acceptability of the intervention, with 93.5% of respondents reporting that the fall huddle and documentation templates supported individualized patient care. Staff perceived the intervention as enhancing shared decision-making, interdisciplinary collaboration, and ownership of fall prevention strategies. The EMR-based communication of prevention strategies was the preferred method of communication following fall huddles. Staff also reported increased confidence in identifying and mitigating fall risks and perceived post-fall huddles as useful in supporting post-fall management and bedside handover processes.

Persistent barriers included meeting fatigue, patient complexity, inconsistent attendance of key disciplines at huddles and maintaining engagement over time. Concerns regarding workload reduced following refinement and integration of intervention processes into routine ward workflows, including simplification of EMR templates, shorter huddle duration, and improved workflow alignment.

DISCUSSION

In the present study, we attempted to reduce inpatient falls while supporting functional recovery and examined the implementation processes and staff perceptions. Our study results showed that the implementation of a multicomponent fall prevention program was feasible within a tertiary inpatient rehabilitation setting and was associated with a 32% reduction in the mean monthly number of falls, from 6.6 to 4.5 falls per month. The intervention

integrated workflow redesign, interdisciplinary safety huddles, education and structured communication processes. These findings also support growing evidence regarding the importance of addressing fall prevention as a systems-level and interdisciplinary process rather than relying solely on individual patient risk assessment.[1,14]

Traditional fall prevention approaches have largely focused on identifying individual risk factors and implementing targeted interventions. However, rehabilitation patients often experience dynamic changes in mobility, cognition, continence, fatigue, medication burden, and functional status throughout admission.[5] As a result, fall prevention strategies require ongoing reassessment and consistent communication across disciplines and shifts. The findings suggest that structured communication processes, combined with standardized documentation and education, may strengthen implementation of prevention strategies within routine rehabilitation practice.

A key implementation finding was the value of integrating fall prevention activities into existing clinical workflows. Early implementation identified barriers including documentation burden, competing clinical priorities, and concerns regarding meeting fatigue. Progressive refinement through successive PDSA cycles supported feasibility and staff engagement, facilitating integration of post-fall huddles into routine ward practice. These findings are consistent with implementation science literature demonstrating that interventions are more likely to be adopted and sustained when they align with existing workflows and minimize additional workload for clinicians.

Improvements were also observed in implementation fidelity for key fall prevention processes. Documentation of patient education increased substantially during the implementation period, and post-fall education was delivered following all recorded fall events. Staff survey findings demonstrated high acceptability of the intervention, with respondents reporting that the huddle process and documentation templates supported individualized patient care and facilitated communication of prevention strategies. Consistent communication is particularly important in rehabilitation settings where patients are managed by large interdisciplinary teams and mobility recommendations may change frequently throughout admission.

The significant functional gains observed among patients who experienced falls during the baseline period highlight an important rehabilitation-specific consideration. Fall prevention within inpatient rehabilitation must be balanced against the promotion of mobility, independence and functional recovery rather than unnecessarily restricting activity. However, functional outcomes were not prospectively assessed during the implementation period and, therefore, could not be evaluated as a balancing measure of the intervention. Future evaluation should incorporate functional outcomes as a balancing measure to determine whether reductions in falls are achieved without adversely affecting functional recovery.

The intervention also evolved during implementation through iterative PDSA cycles, with proactive fall huddles introduced for selected high-risk patients to facilitate earlier identification and mitigation of modifiable risk factors. This extended the huddle process from post-fall review towards proactive risk management and provide an additional mechanism for interdisciplinary communication and supported targeted fall prevention planning.

Nonetheless, several limitations to this study should be acknowledged. The pre-post design without a concurrent control group limits causal inference, and observed improvements may have been influenced by temporal trends, changes in patient case-mix, reporting practices, or increased staff awareness during the implementation period. The study was conducted within a single tertiary rehabilitation unit, which may limit generalizability to other rehabilitation settings with different patient populations, staffing structures, and organizational processes. Baseline data were collected retrospectively, although the same incident reporting system was used throughout both study periods. As actual occupied bed-day data were unavailable, fall rates were estimated consistently across both study

periods using operational bed capacity. This may not fully account for differences in occupancy between study periods. Functional outcomes were available for the baseline fall cohort but were not prospectively assessed during implementation as a balancing measure.

Furthermore, baseline characteristics were analyzed at the fall-event level rather than the patient level. Consequently, patients with recurrent falls contributed multiple observations to the dataset and may be overrepresented within baseline characteristics. The multicomponent nature of the intervention precluded determination of the relative contribution of individual components, including structured post-fall huddles, staff education, documentation tools and proactive fall huddles introduced during later PDSA cycles. Staff surveys were developed for local quality improvement purposes and were not validated instruments, creating the potential for response bias. Patient-reported outcomes, including fear of falling, confidence with mobility, and satisfaction with fall prevention strategies, were not evaluated. Cost-effectiveness was also not assessed, although the intervention was intentionally designed to utilize existing staffing structures and routine clinical workflows.

Future research should evaluate whether reductions in falls are sustained over longer follow-up periods and whether similar approaches are observed across other rehabilitation settings. Further evaluation should examine effects on recurrent falls, fall-related injuries, functional outcomes as a balancing measure, patient-reported outcomes, staff time requirements, and cost-effectiveness. Understanding the relative contribution of individual intervention components may enable more targeted and efficient fall prevention approaches while supporting implementation across rehabilitation settings.

In conclusion, this quality improvement initiative suggests that a rehabilitation-specific multicomponent fall prevention program combining workflow redesign, interdisciplinary safety huddles, education and structured interdisciplinary communication processes can be feasible to implement and is associated with a clinically meaningful reduction in inpatient falls in a tertiary inpatient rehabilitation setting. Improvements in implementation fidelity, patient education delivery, and coordination of interdisciplinary fall prevention activities indicate that system-level approaches may complement traditional patient-focused strategies. Further studies involving broader rehabilitation populations and longer follow-up periods are warranted to assess the sustainability, generalizability, and cost-effectiveness of the intervention, as well as its effects on functional outcomes as a balancing measure, recurrent falls, and fall-related injuries.

Declaration of Conflicting Interests

The authors declare that there are no conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

K.S., M.E., J.L., R.H., A.N.: Study conception and design, quality improvement project development; M.E., J.T., J.L., A.N.: Data collection; K.S., A.N.: Survey tool development and data collection; K.S., M.E., B.A.: Data analysis and interpretation. All authors contributed to manuscript drafting and critical revision, reviewed and approved the final manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

AI Disclosure

The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

REFERENCES

1. McLennan C, Dyer SM, Kwok WS, Suen J, Marin TS, Haley M, et al. Interventions for preventing falls in older people in hospitals. Cochrane Database Syst Rev 2026;5:CD016065. doi: 10.1002/14651858.CD016065.

2. Morello RT, Barker AL, Watts JJ, Haines T, Zavarsek SS, Hill KD, et al. The extra resource burden of in-hospital falls: A cost of falls study. Med J Aust 2015;203:367. doi: 10.5694/mja15.00296.
3. Montero-Odasso M, van der Velde N, Martin FC, Petrovic M, Tan MP, Ryg J, et al. World guidelines for falls prevention and management for older adults: A global initiative. Age Ageing 2022;51:afac205. doi: 10.1093/ageing/afac205.
4. Haddad YK, Miller GF, Kakara R, Florence C, Bergen G, Burns ER, et al. Healthcare spending for non-fatal falls among older adults, USA. Inj Prev 2024;30:272-6. doi: 10.1136/ip-2023-045023.
5. Lee SW, Elsakr C, Ayutyanont N, Lee S, Oh-Park M. Clinical characteristics and outcomes of inpatient falls during inpatient rehabilitation: A case-control study. Am J Phys Med Rehabil 2023;102:715-9. doi: 10.1097/PHM.0000000000002262.
6. Vieira ER, Freund-Heritage R, da Costa BR. Risk factors for geriatric patient falls in rehabilitation hospital settings: A systematic review. Clin Rehabil 2011;25:788-99. doi: 10.1177/0269215511400639.
7. Hill AM, McPhail SM, Waldron N, Etherton-Beer C, Ingram K, Flicker L, et al. Fall rates in hospital rehabilitation units after individualised patient and staff education programmes: A pragmatic, stepped-wedge, cluster-randomised controlled trial. Lancet 2015;385:2592-9. doi: 10.1016/S0140-6736(14)61945-0.
8. Guo M, Bayley M, Ye XY, Dunbar-Yaffe R, Fortin C, Go K, et al. Impact of medical safety huddles on patient safety: A stepped-wedge cluster randomised study. BMJ Qual Saf 2026;35:326-33. doi: 10.1136/bmjqs-2025-019170.
9. Pimentel CB, Snow AL, Carnes SL, Shah NR, Loup JR, Vallejo-Luces TM, et al. Huddles and their effectiveness at the frontlines of clinical care: A scoping review. J Gen Intern Med 2021;36:2772-83. doi: 10.1007/s11606-021-06632-9.
10. Jones KJ, Crowe J, Allen JA, Skinner AM, High R, Kennel V, et al. The impact of post-fall huddles on repeat fall rates and perceptions of safety culture: A quasi-experimental evaluation of a patient safety demonstration project. BMC Health Serv Res 2019;19:650. doi: 10.1186/s12913-019-4453-y.
11. Schmitz LM, Hakos P, Kirsch M, Palmer J, Poltorek B, Stives CJ. The development and implementation of a postfall template to improve the content of provider documentation related to falls in the hospital setting. J Healthc Risk Manag 2020;40:25-32. doi: 10.1002/jhrm.21401.
12. Johnson AM, Brimhall AS, Johnson ET, Hodgson J, Didericksen K, Pye J, et al. A systematic review of the effectiveness of patient education through patient portals. JAMIA Open 2023;6:ooac085. doi: 10.1093/jamiaopen/ooac085.
13. World Health Organization. Step safely: strategies for preventing and managing falls across the life-course. Geneva: World Health Organization; 2021.
14. Ayton DR, Barker AL, Morello RT, Brand CA, Talevski J, Landgren FS, et al. Barriers and enablers to the implementation of the 6-PACK falls prevention program: A pre-implementation study in hospitals participating in a cluster randomised controlled trial. PLoS One 2017;12:e0171932. doi: 10.1371/journal.pone.0171932.