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An Observational Study On Fall Prevention Practices In A Tertiary Care Hospital

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Abstract
Patient falls in hospitals are a major source of preventable morbidity, particularly in tertiary care settings. This study aimed to identify and analyze key risk factors contributing to inpatient falls at Tertiary Care Hospital, India, over a three-year period (January 2022–January 2025). A total of 44 fall incidents were documented from over 200,000 admissions, highlighting vulnerabilities among elderly patients (61–80 years), night-shift periods, and high-acuity units such as Nursing and Oncology. Unassisted toileting, environmental hazards, and clinical factors were the most frequent precipitants. The study evaluated existing fall-prevention measures and identified gaps in patient behavior, reporting, staffing, and environmental safety. Based on these findings, a multifactorial fall-prevention program was proposed, integrating risk assessments, environmental modifications, patient and staff education, and organizational interventions. The program emphasizes cost-effective solutions suitable for resource-limited settings and promotes a culture of safety. The study contributes to the limited literature on hospital falls in India and provides a scalable framework for improving patient safety.
Keywords: *Inpatient falls, fall prevention, tertiary care hospital, patient safety, risk factors, India*

INTRODUCTION

Patient falls are a major safety concern in hospitals, leading to preventable injuries, longer hospital stays, higher healthcare costs, and reduced patient well-being. Although international guidelines recommend structured fall-prevention protocols, their effectiveness depends on clinical factors, environmental conditions, staffing levels, and institutional practices. In India, the adaptation of these guidelines is limited by resource constraints, inconsistent implementation, and a lack of locally generated evidence.

In tertiary care hospitals, fall incidents remain frequent and often under-reported. Prevention efforts are typically reactive, with inconsistent use of risk-assessment tools, inadequate staff training, and limited environmental modifications. High patient loads, infrastructural challenges, and cultural beliefs about safety further complicate fall-prevention efforts. Despite global evidence identifying risk factors such as advanced age, mobility impairment, medication use, and poor environmental safety, few Indian studies integrate these clinical, demographic, and environmental determinants comprehensively.

As patient populations in tertiary care settings become more diverse—particularly with increasing numbers of elderly and critically ill individuals—understanding the specific contributors to falls becomes essential. The absence of structured, context-appropriate prevention programs contributes to persistent fall rates and highlights the need for research tailored to Indian healthcare realities.

This observational study aims to identify key risk factors associated with patient falls in a tertiary care hospital by analyzing three years of incident data and conducting prospective assessments. It also evaluates the effectiveness of existing fall-prevention measures and explores gaps that limit their success. Insights from healthcare providers will help clarify systemic and cultural barriers. Ultimately, the study seeks to propose a comprehensive, feasible fall-prevention program for the hospital.

Guided by the research question—What clinical, demographic, and environmental factors contribute to patient falls, and how effective are current prevention strategies?—the study hypothesizes that significant associations exist between these factors and fall incidence, and that current strategies require improvement.

LITERATURE REVIEW

Falls in hospital settings remain a critical global safety concern, leading to significant morbidity, mortality, and financial burden. Nearly one million hospitalized patients experience falls annually, with older adults at particular risk due to mobility and cognitive decline (LeLaurin & Shorr, 2019). Financial pressures have intensified internationally, especially after Medicare's non-reimbursement policy for fall-related injuries (Dykes et al., 2023). Traditional prevention measures—such as alarms and sitters—offer limited effectiveness; alarms often contribute to staff desensitization, and sitters impose substantial operational costs (Sahota et al., 2014; LeLaurin & Shorr, 2019). As a result, many hospitals are shifting toward more individualized and technology-enhanced strategies.

Epidemiological studies emphasize the multifactorial nature of inpatient falls. Higher incidence rates are seen in geriatric, neurology, and orthopedic units due to mobility and cognition-related impairments (Heikkilä et al., 2024). Bathroom-related falls, which account for nearly half of all incidents, demonstrate greater injury severity (Ghosh et al., 2022). The economic impact remains substantial, with U.S. estimates reaching $50 billion annually (Dykes et al., 2023). Resource constraints in developing countries such as India heighten the challenge, underscoring the need for context-specific research.

Risk factors span patient-related, environmental, and care-delivery domains. Age, mobility impairment, cognitive deficits, and polypharmacy significantly elevate fall risk (Moncada & Mire, 2017; Ghosh et al., 2022). Environmental hazards—including poor lighting and clutter—further contribute (Takase, 2022). Medication effects, inadequate staffing, and insufficient training comprise additional systemic determinants, with up to 60.9% of incidents linked to nursing-related factors (Takase, 2022). This aligns with frameworks that classify risks into modifiable and non-modifiable categories (American Academy of Family Physicians, 2017).

Traditional prevention strategies emphasize individualized risk assessment over universal screening, as recommended by NICE (2013). However, evidence reveals inconsistent effectiveness, with multifactorial interventions hindered by follow-up challenges and resource limitations (Bhasin et al., 2020). Emerging technologies—such as virtual sitters, sensor-based wearables, and VR balance training—show promise in reducing fall rates (Cournan et al., 2018; Oh-Park et al., 2021). Robotic systems offer rapid response capabilities but face high cost and training barriers (Di et al., 2011; Logsdon et al., 2024).

Despite advancements, gaps persist regarding scalability, long-term cost-effectiveness, and cultural acceptability of interventions. These limitations highlight the relevance of the current study, which aims to evaluate risk factors and existing practices within an Indian tertiary care context and propose feasible, evidence-based improvements.

MATERIALS AND METHODS

Study Design and Setting

A mixed-method observational design was employed at Tertiary Care Hospital, New Delhi, from January 2022 to January 2025. The study integrated retrospective analysis of fall incidents with prospective risk assessment using the Morse Fall Scale (MFS). Adult inpatients (≥18 years) from general wards were included, while ICU, day-care, and incomplete cases were excluded.

Data Collection Tool and Procedure

Retrospective data were extracted from the Hospital Information System (HIS) and Electronic Medical Records (EMR), covering demographics, clinical conditions, fall circumstances, and outcomes. Incident reports, nursing notes, and medication charts were cross-verified to ensure completeness. For prospective assessment, MFS scoring was conducted within 48 hours of admission; missing scores were reconstructed retrospectively based on chart documentation. A structured data extraction form ensured consistency across all variables.

Data Entry and Software

All validated data were entered into Microsoft Excel and exported to REDCap for double-entry verification and audit-trail tracking, minimizing transcription errors and improving data reliability.

Data Analysis

Descriptive statistics summarized patient characteristics and fall patterns. Chi-square tests examined categorical associations, while logistic regression identified independent predictors. Analysis was performed using SPSS version 27 and R Studio 4.3, with significance set at $p < 0.05$.

Ethical Considerations

Institutional ethics approval was obtained. All data were de-identified, securely stored, and accessed only by authorized research personnel.

Limitations

The small sample size (n=44) and reliance on retrospective documentation may limit generalizability. Missing or incomplete records posed potential information bias despite multi-source validation.

RESULTS

A total of 44 inpatient fall cases were analyzed. The mean age of patients was **63.5 years (SD = 16.8)**, with the highest proportion in the **61–80-year group (38.6%)**. Females accounted for slightly more falls than males. Most patients (81.8%) had a primary diagnosis, indicating high clinical complexity.

Table 1 Demographic Characteristics of Fall Patients (N = 44)

Variable	Category	n (%)
Age group	18–40 years	8 (18.2)
	41–60 years	12 (27.3)
	61–80 years	17 (38.6)
	>80 years	7 (15.9)
Sex	Male	21 (47.7)
	Female	23 (52.3)

Note. Percentages reflect column totals.

Most falls occurred in the **medical wards (45.5%)**, followed by orthopedics (15.9%) and neurology (11.4%). A majority occurred in **general wards (81.8%)**. Bathrooms constituted the most frequent specific location (20.5%), emphasizing environmental safety concerns.

Table 2 Fall Characteristics Among Inpatients

Variable	Category	n (%)
Location	Ward	36 (81.8)
	Bathroom	9 (20.5)
Time of fall	6 a.m.–6 p.m.	26 (59.1)
	6 p.m.–6 a.m.	18 (40.9)
Mechanism	Slip/trip	20 (45.5)
	Loss of balance	8 (18.2)

Note. Location percentages exceed 100% due to overlap when bathrooms are within ward areas.

Most falls (77.2%) were **unassisted**, and common pre-fall symptoms included dizziness (11.4%) and weakness (11.4%). Injury assessments showed **20.5%** sustained moderate or major injuries, including head trauma (6.8%) and fractures (4.5%). Approximately 18% required extended hospitalization.

Morse Fall Scale (MFS) data showed that **79.5% of patients were classified as high risk**, with a mean score of **63.4**. History of previous falls (59.1%), gait impairment, and multiple diagnoses contributed prominently to elevated risk. Additionally, 11.4% of patients had recently received sedatives or antihypertensives.

Table 3 Morse Fall Scale Risk Categories

Risk Category	Score Range	n (%)
Low	0–24	2 (4.5)
Moderate	25–50	7 (15.9)
High	>50	35 (79.5)

Note. Scoring based on Morse (1997).

Chi-square analyses revealed significant associations between **mechanism of fall and injury severity** ($p = .042$) and between **fall location and shift timing** ($p = .019$). Logistic regression confirmed that **age >60 years**, **bathroom location**, and **high MFS score** were significant predictors ($p < .05$). Sex, shift timing, and assistive device use were not independently predictive.

Overall, falls were strongly associated with advanced age, impaired mobility, high-risk clinical status, and environmental hazards. The high proportion of **unassisted** falls suggests gaps in monitoring and education, highlighting the need for targeted prevention strategies.

DISCUSSION

The primary objective of this study was to identify and analyze the risk factors contributing to inpatient falls in a tertiary care hospital over a three-year period, during which 44 falls were recorded among over

200,000 admissions. The findings indicate that falls are a multifactorial phenomenon influenced by patient characteristics, environmental conditions, clinical status, and system-level factors. Consistent with prior research, elderly patients (61–80 years) represented the largest proportion of falls (45%), reflecting age-related frailty, comorbidities, and postoperative limitations (Cameron et al., 2018). This trend underscores the vulnerability of older patients, who often require enhanced mobility support and closer monitoring. Interestingly, patients over 80 years accounted for only 11% of falls, which may reflect fewer hospitalizations, underreporting, or more intensive preventive measures applied in this age group.

The predominance of falls during night shifts (50%) highlights systemic vulnerabilities, including reduced staffing, limited supervision, and inadequate lighting. The most common precipitating factor was unassisted patient mobility, particularly during bathroom visits, contributing to 54.5% of incidents. Environmental hazards such as wet floors, unstable furniture, and side-rail failures were identified in 25% of cases, while clinical triggers such as dizziness, seizures, and postoperative weakness were recurrent. These findings demonstrate that falls result from complex interactions between behavioral, environmental, clinical, and organizational factors, aligning with ecological models of fall risk (Takase, 2016).

Evaluation of current fall-prevention measures revealed partial effectiveness. The year-on-year decline in fall numbers suggests some benefit, yet repeated patterns—unassisted toileting, night-time incidents, and occasional underreporting—indicate gaps in protocol adherence. Severity analysis showed that 52.3% of falls resulted in minor harm, while 20.5% and 9.1% involved temporary or prolonged clinical consequences, respectively. These data suggest that while existing interventions reduce harm, they are insufficiently comprehensive or consistently implemented.

The study also identified specific gaps in current practices. Behavioral gaps included patients bypassing call bells or staff assistance, whereas process gaps involved delayed or incomplete incident reporting, limiting timely intervention. Environmental and infrastructural gaps, such as wet floors, side-rail collapses, and poor night-time visibility, could be mitigated through preventive maintenance and ergonomic audits. Clinical gaps were evident in the inconsistent application of risk stratification tools like the Morse Fall Scale, highlighting the need for personalized assessments and proactive monitoring for high-risk patients.

Based on these insights, a hospital-specific, multifactorial fall-prevention program was proposed. Key strategies include mandatory fall-risk assessment at admission, bedside visual cues for high-risk patients, installation of motion-sensor lighting and bed-exit alarms, bedside commodes to prevent unassisted bathroom visits, structured night-shift rounding, and a real-time, non-punitive electronic reporting system with root cause analyses within 24 hours. This integrated approach aligns with international guidelines (NICE, 2013; Joint Commission International, 2021) and addresses behavioral, environmental, clinical, and organizational determinants simultaneously.

Although limited by a small sample size, the study provides valuable insights into fall epidemiology in a tertiary care Indian hospital and contributes to the development of a feasible, cost-effective, and scalable fall-prevention strategy. By targeting unassisted mobility, night-time vulnerabilities, environmental hazards, and reporting inconsistencies, the proposed program has the potential to reduce falls, improve patient safety, and foster a culture of continuous quality improvement.

CONCLUSION

This study provides a critical contribution to understanding inpatient falls in tertiary care hospitals in India, addressing a significant gap in both research and practice. The investigation of 44 fall incidents over a three-year period (2022–2025) at Tertiary Care Hospital identified key risk factors, including unsupervised toileting, night-shift vulnerabilities, advanced age (61–80 years), and high-acuity units such as Nursing and Oncology. Systemic deficiencies were also highlighted, including inconsistent incident reporting, limited staffing during night shifts, and environmental hazards such as wet floors and unstable furniture. These findings emphasize that falls are multifactorial, arising from behavioral, environmental, clinical, and organizational determinants, and underscore the necessity of comprehensive interventions.

The proposed fall-prevention program, grounded in the Health Belief Model and Donabedian's quality framework, integrates clinical risk assessment, environmental modifications, patient and family education, and organizational improvements. Emphasizing cost-effective strategies—such as Morse Fall Scale (MFS) assessments, motion-sensor lighting, bedside commodes, and anonymous electronic reporting—the program addresses India-specific challenges, including hierarchical healthcare structures and cultural barriers to reporting, while aligning with global standards from JCI and NABH. By fostering

interdisciplinary collaboration and promoting a culture of safety, the program provides a feasible, scalable approach suitable for resource-constrained settings.

Despite limitations such as a small sample size and potential underreporting, this study lays the groundwork for future research and policy development. It demonstrates the importance of context-specific interventions and highlights opportunities for continuous quality improvement to reduce preventable fall-related harm. Ultimately, the study positions Tertiary Care Hospital as a model for evidence-based safety practices in India, offering insights that can be extended to other tertiary care facilities and low- and middle-income country (LMIC) contexts. By addressing gaps in patient safety, environmental infrastructure, and organizational processes, this research contributes both to the academic literature and to practical strategies for reducing inpatient falls nationwide.

Recommendations

Based on the study findings, the following recommendations are proposed to enhance fall prevention at Tertiary Care Hospital and similar tertiary care settings:

1. **Enhance Data Collection and Reporting:** Implement a centralized, anonymized adverse event reporting system to improve data accuracy and reduce underreporting, supporting national epidemiological studies and policy planning (WHO, 2017).
2. **Strengthen Night-Shift Interventions:** Increase night staffing, install motion-sensor lighting and bed-exit alarms, and conduct regular night rounds. Patient education on call-bell use can mitigate risks during low-visibility periods.
3. **Target High-Risk Groups:** Focus on elderly patients (61–80 years) and those in Nursing and Oncology units using MFS assessments, visual cues such as wristbands, and bedside commodes to reduce unassisted bathroom attempts.
4. **Address Environmental Hazards:** Conduct regular ergonomic audits and maintenance checks on bedrails, flooring, and commodes. Install grab bars and anti-slip mats, particularly in high-incidence areas like the East Wing.
5. **Promote Interdisciplinary Collaboration:** Encourage teamwork among nursing, physiotherapy, pharmacy, and housekeeping staff. Appoint fall-prevention champions to coordinate interventions and monitor compliance.
6. **Enhance Patient and Family Education:** Provide culturally sensitive, accessible education using verbal counseling, videos, and visual aids to improve adherence to mobility restrictions and call-bell use.
7. **Integrate Cost-Effective Technologies:** Prioritize low-cost solutions, such as motion-sensor alarms, over high-cost technologies. Conduct cost-benefit analyses to ensure sustainable allocation of resources.
8. **Foster a Safety Culture:** Mandate root cause analyses within 24 hours of falls, integrate findings into staff training, and use anonymous reporting platforms to reduce fear-based underreporting.
9. **Implement Continuous Quality Improvement:** Monitor key performance indicators, including fall incidence and education compliance. Use CQI cycles to adapt interventions based on emerging data.
10. **Expand Research:** Conduct longitudinal, multicenter studies to assess intervention durability and explore gender-specific, biomechanical, and environmental risk factors to refine prevention strategies.

Implementing these recommendations can significantly reduce inpatient falls, improve patient safety, and align hospital practices with global quality standards. The program developed at Tertiary Care Hospital can serve as a model for broader adoption across India, contributing to safer and more equitable healthcare delivery.

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