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Determinants and Warning Signs of Inpatient Falls and Fall-Related Injuries in Tertiary Hospitals, Chennai

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Abstract: ***Background****: Inpatient falls are among the most common adverse events in hospital settings and can lead to serious injuries, increased hospital stays, and higher healthcare costs. Identifying the determinants and warning signs of falls is essential for effective prevention strategies in tertiary care hospitals.* ***Methods & Materials****: A retrospective cohort study with an analytical case-control design was conducted at Apollo Main Hospitals, Chennai. The study included adult inpatients (≥18 years) who experienced falls or fall-related injuries during their hospital stay over a two-year period. Patients with falls occurring before admission, after discharge, or in outpatient settings were excluded. Data were retrospectively extracted from Electronic Health Records (EHR), fall incident reports, nursing notes, and Morse Fall Scale assessments. Key variables collected included patient demographics, clinical diagnoses, treatments, medications, environmental circumstances, and fall-related outcomes. Statistical analysis was conducted to identify significant predictors and risk factors for inpatient falls and injuries.* ***Results****: The Morse Fall Scale proved effective in stratifying patients into high- and low-risk categories. A higher incidence of falls was observed during night shifts and in patients with prolonged hospital stays.* ***Conclusion:*** *This retrospective analysis underscores the importance of continuous fall risk assessment and targeted intervention strategies in tertiary care hospitals. Identification of key determinants and warning signs can help formulate tailored fall prevention protocols, improve patient safety, and reduce the burden of fall-related injuries in hospitalized adults.*

Keywords: Inpatient falls, Fall-related injuries, Retrospective cohort study Case-control design , Tertiary care hospitals.

I. INTRODUCTION

According to World health organization (WHO) globally, falls are a major public health problem. An estimated 684 000 fatal falls occur each year, making it the second leading cause of unintentional injury death, after road traffic injuries (2021).Falls in inpatient settings represent a critical issue in healthcare, posing significant risks to patient safety and leading to adverse outcomes, including injuries, prolonged hospital stays, and increased healthcare costs. Despite advancements in medical care and safety protocols, the incidence of falls within hospitals remains alarmingly high, affecting patient recovery and overall quality of care.

Inpatient falls are often influenced by a combination of factors such as patient health status, medication effects, environmental hazards, and inadequate staffing levels. Understanding these contributing factors is essential for

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developing and implementing effective fall prevention strategies tailored to the unique environment of healthcare facilities.This research aims to investigate the prevalence and causes of falls in inpatient settings, assess the effectiveness of current fall prevention programs, and identify areas for improvement. By analyzing data from hospital records, fall analysis data (Quality monitors) and staff feedback, the study seeks to provide a comprehensive overview of the fall risk landscape in hospitals.The prevalence of inpatient falls, frequently resulting in serious harm or fatality, underscores the need for improved predictive tools. Current assessments, such as the Morse Fall Scale, generate a risk score but lack the granularity to pinpoint the most influential risk factors.

The ultimate goal is to enhance patient safety by proposing evidence-based interventions that can be integrated into hospital protocols to reduce the incidence of falls and improve patient outcomes. Through this research, we hope to contribute to the ongoing efforts to create safer healthcare environments and promote best practices in fall prevention.

STATEMENT OF THE PROBLEM

A Retrospective Study to Identify the Determinants and Warning Signs of Inpatient Falls and Fall-Related Injuries in Tertiary Hospitals, Chennai..

OBJECTIVES

Primary Objective:

- To identify the determinants (patient-related, environmental, and treatment-related factors) of inpatient falls and fall-related injuries in tertiary hospitals in Chennai.

Secondary Objectives:

- To explore the warning signs observed before inpatient falls and fall-related injuries.
- To determine the relationship between fall risk assessments and actual fall incidents.
- To assess the severity and outcomes of fall-related injuries in hospitalized patients.

II. REVIEW OF LITERATURE

Inpatient Falls: Prevalence, Risk Factors, and Consequences

A study conducted by **Kenny et al. (2019)** explored the prevalence of inpatient falls in a large cohort of hospitals across the United States. The research identified key patient-related factors, such as age, cognitive impairment, and the use of sedative medications, as significant determinants of falls. Environmental factors, including hospital room design and lack of fall prevention protocols, were also highlighted. The study found that falls were responsible for extended hospital stays, higher treatment costs, and increased mortality. This research supports the need for better fall risk assessments and more comprehensive fall prevention programs. (Kenny et al., 2019, *Journal of Geriatric Care*)

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The Impact of Medication on Fall Risk in Hospitalized Patients

A study by **Kim et al. (2020)** investigated the role of medication in increasing the risk of falls in hospitalized patients. It was found that patients on high-risk medications such as sedatives, antihypertensive, and opioids were more prone to falls and fall-related injuries. The study also noted that polypharmacy, or the use of multiple medications, significantly raised the risk of falls due to medication interactions that caused dizziness, hypotension, or altered mental states. The authors suggest regular medication reviews to minimize fall risks and recommend integrating pharmacological assessments into fall prevention programs. (Kim et al., 2020, *Journal of Hospital Medicine*)

Fall Risk Assessment Tools in Hospital Settings

In a comprehensive review, **Smith et al. (2018)** assessed various fall risk assessment tools, such as the Morse Fall Scale and Hendrich II Fall Risk Model, used in hospitals worldwide. The review concluded that while these tools are useful for identifying high-risk patients, they often fail to predict falls accurately in certain populations, especially those with cognitive impairments or patients in critical care units. The study recommended the incorporation of more

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individualized risk assessments, including nursing observations and patient-reported concerns, alongside existing fall risk models. (Smith et al., 2018, *Journal of Clinical Nursing*)

III. MATERIALS AND METHODS

This retrospective cohort analytical case-control study was conducted to identify the determinants and warning signs of inpatient falls and fall-related injuries in a tertiary care setting. The study took place at Apollo Main Hospitals, Chennai, a multispecialty tertiary care hospital with robust inpatient services and a centralized electronic health record (EHR) system. The study was carried out over a period of six months, analysing data collected from a two-year timeframe prior to the study period. The study population comprised all adult inpatients aged 18 years and above who were admitted during the two-year window. Patients who experienced at least one documented fall or fall-related injury during hospitalization were included as cases. Patients who had falls prior to hospital admission, after discharge, or in outpatient settings were excluded. Controls were selected from among inpatients who did not experience any falls, matched based on age, length of stay, and ward of admission.A total enumeration sampling technique was used to include all eligible cases of inpatient falls, and a case-control approach allowed for comparative analysis. Data collection involved a thorough retrospective review of multiple data sources including electronic health records, incident reports, nursing notes, and fall risk assessment tools such as the Morse Fall Scale. Variables extracted included patient demographics (age, gender), clinical information (diagnosis, comorbidities, medication history, mobility status, and cognitive condition), and environmental and situational factors at the time of the fall (such as lighting, floor condition, and use of assistive devices). Each fall incident was analysed based on time, location, severity of injury, and fall risk level as documented in the Morse Fall Scale. The data were entered and analysed using SPSS software. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize patient characteristics and fall details. Inferential statistical methods including chi-square tests for categorical variables and independent t-tests for continuous variables were applied to assess associations. Logistic regression analysis was used to identify independent predictors of inpatient falls, and odds ratios with 95% confidence intervals were calculated to quantify risk factors. Ethical approval for the study was obtained from the Institutional Ethics Committee of Apollo Hospitals. As the research was retrospective in nature, no direct patient contact was involved. The confidentiality and anonymity of all patients were strictly maintained, and data were used exclusively for research purposes by authorized personnel.

IV. RESULTS AND DISCUSSION

Most patients (67.6%) were independently mobile at the time of the fall (Table 6), suggesting that even ambulatory patients were vulnerable, especially during high-risk situations like night-time bathroom use. A total of 40.5% of falls were assisted, and 59.5% were unassisted (Table 6). Regarding medication use, 54.1% of patients were on anti-hypertensives, while only 2.7% were on sedatives or diuretics. 13.5% had a previous history of falls, and 91.9% did not use assistive devices at the time of the fall (Table 6).Environmental assessments revealed that 91.9% of rooms had adequate lighting, yet only 29.7% of patients had access to safety rails or assistive devices. While 86.5% had accessible call lights, the lack of assistive equipment and safety rails may have contributed to unassisted falls. Other notable symptoms before the fall included dizziness (24.3%), drowsiness (24.3%), and weakness (13.5%) (Table 6). Cognitive status showed that 89.2% of patients were alert, but 8.1% were confused and 2.7% disoriented. The majority of falls occurred at night (51.4%), mostly during elimination-related activities (54.1%), particularly in the bathroom (40.5%) or bedside (54.1%) (Table 6).These findings suggested that while demographic and medical conditions contributed to fall risk, situational and environmental factors—such as night-time elimination, lack of assistive support, and inadequate supervision—played a critical role in triggering falls. Furthermore, cognitive impairment, altered consciousness, and neurological symptoms were strongly associated with higher fall risk and severity (Table 6). These insights reinforced the need for proactive risk identification, timely assessment using structured tools like the Morse Fall Scale, and targeted fall prevention strategies including environmental modifications, patient education, and supervised mobility for at-risk inpatients.

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Table 1. Frequency & Percentage Distribution of Background Variables of Patients
N=37

Demographic factor	Frequency & Percentage
Gender	
Male	24 (64.9)
Female	13 (35.1)
Comorbidities	
Diabetic mellitus	21 (56.8)
Hypertension	22 (59.5)
CAD	6 (16.2)
Ward/Unit	
Medical	26 (70.3)
Surgical	10 (27)
General	1 (2.7)
Reason for admission	
Medical	24 (64.9)
Surgical	12 (32.4)
Trauma	1 (2.7)

The present retrospective study analyzed data from 37 inpatient fall cases to identify the demographic, clinical, and environmental determinants and warning signs associated with inpatient falls and fall-related injuries in a tertiary care hospital setting. Among the 37 patients, 64.9% were male and 35.1% were female (Table 1), indicating a higher incidence of falls among male patients. The majority had comorbid conditions, with 59.5% diagnosed with hypertension, 56.8% with diabetes mellitus, and 16.2% with coronary artery disease (Table 1). Falls were most frequently reported in the medical wards (70.3%), and the primary reason for admission was medical in nature (64.9%).

Table 2: Frequency and Percentage of Warning Signs Observed Prior to Falls (n = 37)

Warning Signs	Frequency	Percentage%
Dizziness/ Light-headedness	10	27
Confusion/Disorientation	7	18.9
Unsteady Gait	6	16.2
Attempt to go to bathroom unaided	5	13.5
Improper use of assistive device	3	8.1
Slurred speech/Altered consciousness	2	5.4
Visual impairment	1	2.7
No identifiable warning sign	3	8.1
Total	**37**	**100**

The analysis of pre-fall warning signs among inpatients revealed that dizziness or lightheadedness was the most commonly reported indicator (27%), followed by confusion or disorientation (18.9%) and unsteady gait (16.2%). Notably, 13.5% of the patients attempted to go to the bathroom unaided, indicating a lack of timely assistance. Other signs included improper use of assistive devices (8.1%), slurred speech or altered consciousness (5.4%), and visual impairment (2.7%). No identifiable warning signs were present in 8.1% of patients (Table 2). These findings suggested that recognizing subtle clinical cues and providing supervision—particularly during high-risk activities like toileting—could be critical in preventing falls.

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Table 3: Frequency and Percentage distribution of Fall Incidents Based on Fall Risk Score

Fall Risk Category	Total Patients Assessed (n)	Patients Who Fell (n)	% of Falls per Category
Low Risk (0–24)	5	2	5.4
Moderate Risk (25–44)	10	7	18.9
High Risk (≥45)	22	22	59.5
Total	**37**	**31(with documented scores)**	**83.8**

Note: 6 patients may not have had a documented risk score at the time of fall.

The distribution of falls based on Morse Fall Scale scores indicated a strong correlation between high fall risk scores and actual fall incidents. Among patients classified as high risk (≥45), 22 out of 22 patients (59.5%) experienced a fall. In the moderate-risk category, 7 patients (18.9%) fell, and in the low-risk category, 2 patients (5.4%) experienced falls. Approximately 83.8% of fall incidents occurred among patients who had a documented fall risk score (Table 3). This indicated that while risk assessments were useful, they should be complemented by staff vigilance and environmental safety measures.

Table 4: Frequency and Percentage distribution of Severity of Fall-Related Injuries

Type of Injury	Number of Patients (n)	Percentage (%)
No Injury	8	21.6
Minor Injury (bruises, abrasion)	15	40.5
Moderate Injury (lacerations)	7	18.9
Severe Injury (fracture/head)	7	18.9
Death	0	0
Total	**37**	**100**

Regarding injury severity, the majority of falls resulted in minor injuries (40.5%), followed by no injury (21.6%), and moderate injuries (18.9%). Severe injuries occurred in 18.9% of cases, and no deaths were recorded (Table 4). This highlighted the potential seriousness of inpatient falls and emphasized the need for preventive interventions and post-fall evaluations, especially in older or medically fragile patients.

Table 5: Patient Outcomes Following Fall (n = 37)

Outcome	Number of Patients (n)	Percentage (%)
Recovered Fully	12	32.4
Prolonged Hospital Stay	9	24.3
Required Surgical Intervention	5	13.5
Transferred to ICU	3	8.1
Increased Dependency/Post-Fall	8	22
Mortality	0	0
Total	**37**	**100**

In terms of outcomes, 32.4% of patients fully recovered, while 24.3% experienced prolonged hospitalization due to fall-related complications. Surgical interventions were necessary in 13.5% of cases, and ICU transfers occurred in 8.1%, reflecting the clinical and financial burden of inpatient falls. Additionally, 22% of patients developed increased dependency or reduced mobility, underlining the long-term impact on quality of life (Table 5).

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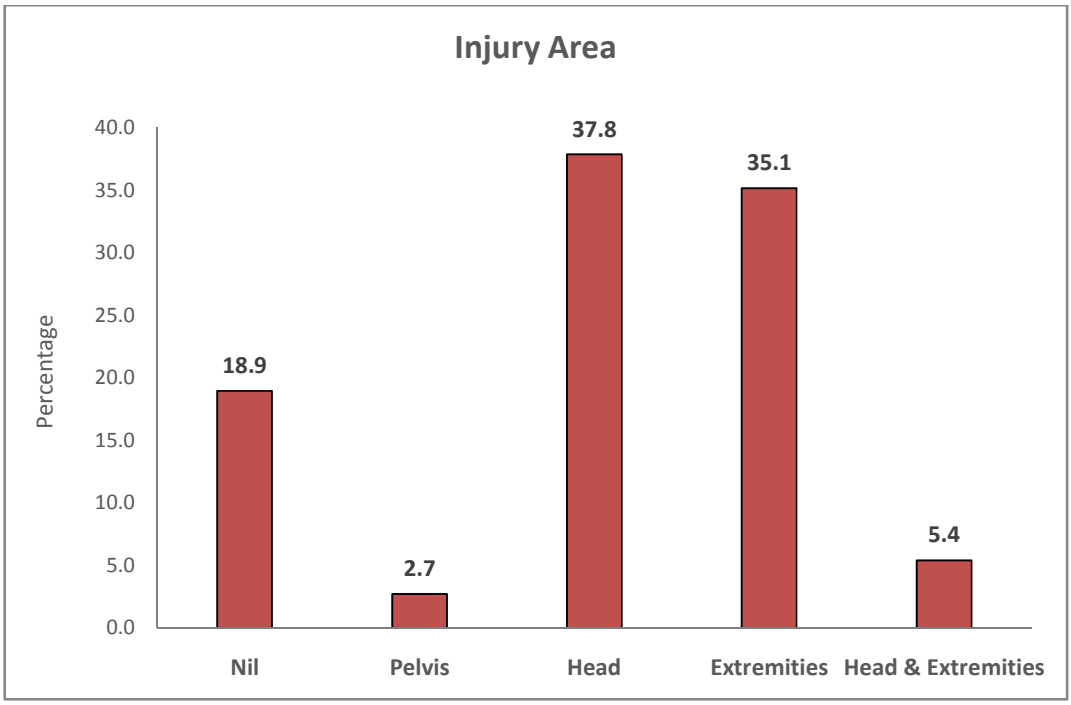

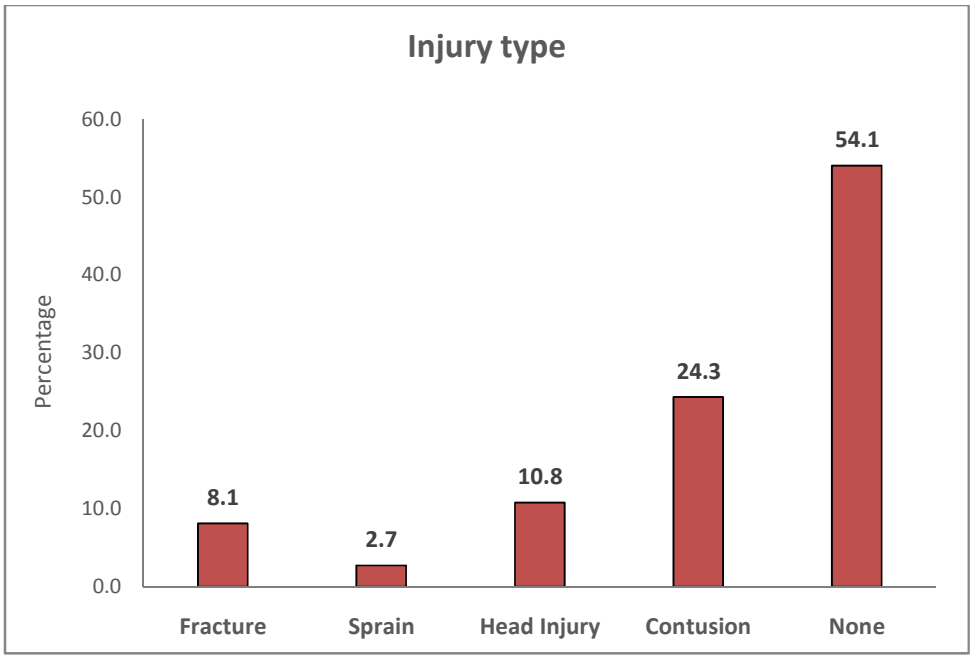

V. CONCLUSION

This retrospective analytical study highlights that inpatient falls remain a significant safety concern in tertiary care hospitals, often resulting in injuries, prolonged hospitalization, and increased healthcare burden. The findings reveal

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that factors such as advanced age, poly-pharmacy, cognitive impairment, impaired mobility, and environmental hazards are major contributors to inpatient falls. Implementation of proactive strategies based on identified risk factors can greatly enhance patient safety and reduce the incidence of falls and related injuries in hospital settings.

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