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Evaluation of Fall Events and Fall Management Strategies in an Inpatient Care Facility

Arberesha Gurguri, Msc
Median Frankenpark Klinik, Germany

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Abstract

Introduction: Falls pose a significant risk to older people in nursing facilities. They can lead to serious health consequences, prolonged stays, and impaired quality of life. A systematic evaluation of falls can help identify causes and improve prevention strategies. **Objective:** The aim of this retrospective study was to analyze falls in a nursing facility over a three-year period. **Methods:** 290 documented falls were descriptively analyzed between 1 January 2021 and 31 December 2023. **Results:** The mean age of patients who experienced a fall was 81.26 years. A fall incidence of 5.21 falls per 1,000 patient cases was determined for the survey period. 142 males (48.96%) and 148 females (51.03%) fell. Among the 290 documented falls, 81,72% were single-occurrence events. Most falls (68%) occurred in the patient room, particularly between 6:00 a.m. and 8:00 a.m., 4:00 p.m. and 6:00 p.m., while using the toilet, and while walking without assistive devices. The most frequently documented injuries were abrasions (n=45), 15.51%, and bruises. Significant risk factors identified included limited mobility, the use of assistive devices, unsuitable footwear, and a lack of accessibility. **Conclusions:** The results reveal important focal points for individual prevention measures. The targeted use of aids, an adapted environment, and supportive guidance in high-risk situations appears particularly effective.

Keywords: Falling, fall protocol, risk of falling, prevention of falling, evaluation

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Introduction

Falls and their consequences are a major concern for the health and safety of older people in rehabilitation centers. Falls are defined as "the falling of the body from a higher to a lower level due to a disturbed balance of the body in various positions" (International Council of Nursing, 2003). According to the World Health Organization (2007), a fall is an event resulting in a person inadvertently landing on the floor or another lower level. As people age, the risk of sustaining an injury in a fall increases, resulting in immobilization-related limitations or even death (World Health Organization, 2015). Falls can occur at any age. Patients over 65 years old are at greater risk than other groups of people (Schoberer et al., 2012).

Falls can lead to physical consequences (such as fractures) and/or psychological consequences (such as loss of self-confidence). This, in turn, can lead to prolonged hospital stays and higher treatment costs (Breimeier & Lohrmann, 2015). The effects of a fall can impair the patient's independence and thus lead to a reduction in the patient's quality of life and even death (Schoberer et al., 2012). Falls tend to be more frequent in aged care and rehabilitation settings where patients often have transfer and mobility problems; risk factors consistently found to be important predictors of falls (Ganz et al., 2007). In a recent study, it was reported that 11% of older people fell during an inpatient rehabilitation stay (Campbell et al., 1989).

Approximately 42% of falls are associated with injuries (Hitcho et al., 2004). The consequences of falls or the fear of falling can limit people's independence and reduce their quality of life (Tideiksaar, 2008). The guidelines of the German Network for Quality Development (2013) identify intrinsic and extrinsic risk factors. Falls are often caused by a combination of several intrinsic (personal) and extrinsic (environmental) risk factors.

Intrinsic risk factors include, for example, functional limitations or impairments such as problems maintaining body balance or balance disorders. Visual impairments, cognitive impairments, and mood impairments, such as dementia, depression, and delirium, are also intrinsic factors. Incontinence and the fear of falls or the fear of the consequences of falls are also intrinsic risk factors. Extrinsic risk factors include inappropriate footwear and clothing, the use of inappropriate aids, and the use of medications and hazards within rooms, such as slippery floors, missing supports in corridors, and poor lighting (German Network for Quality Development, 2013). Many of these risk factors can be modified through targeted interventions, which can help maintain the independence and quality of life of older people in the long term (Brunner et al., 2021). Early identification of fall risk factors enables hospitals to tailor care and respond to each patient's individual needs. Moreover, identifying, exploring and addressing individual risk factors for falls will be of benefit to the older patients. The provision of mobility aids is intended to help minimize

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risk factors in the mobility of older and very old people and to prevent falls (German Network for Quality Development, 2013).

Climbing stairs, sitting down on a chair, and getting out of bed are mobility-related challenges that can be minimized with assistive devices such as walking frames, grab bars, and height-adjustable beds (Faust, 2012). Tideiksaar (2008) illustrates, based on studies in the United States, that despite routine fall prevention in subacute care or rehabilitation settings, up to 46% of patients fall. Of these hospitalized older adults, 50% even suffer more than one fall.

In a three-year prospective study by Von Renteln-Kruse and Krause (2004) in a German geriatric hospital, 17% of patients (n=5946) fell at least once, of which 0.56% suffered a fracture due to a fall. The highest fall rates, ranging from 9.1 to 17 falls per 1000 beds, were found in geriatric wards (Von Renteln-Kruse and Krause, 2004; Heinze et al., 2002; Hill et al., 2007; Kinne & Klewer, 2016).

Lee & Stokic (2008) retrospectively evaluated the fall statistics of a US rehabilitation clinic and found that 9.5% of patients admitted over a period of one and a half years had fallen at least once. This corresponds to a fall rate of 6.7 falls per 1,000 treatment days. Across all settings, however, the results indicate a higher risk of multiple falls among women. There is no association with age for the risk of experiencing a fall within a year, but the results demonstrate an increasing risk of multiple falls with age, regardless of the setting (Gostynski et al., 1999).

Methods

Aim

The aim of this study was to analyze falls among patients in a nursing facility over a three-year period. Our retrospective study was conducted in a post-acute rehabilitation center for orthopedics, internal medicine, and geriatrics. Orthopedic patients were excluded from the fall analysis and were not part of the study population. Data were collected only from the geriatric ward (45 beds). The evaluation of fall event protocols included the period from January 2021 to December 2023. The analysis comprised 55,614 patients. Falls were recorded in 237 unique patients**,** with a total of 290 fall events documented.

Data on fall events were manually extracted from fall event protocols documented within patient medical records by the author and subsequently entered into an Excel spreadsheet for analysis. Descriptive statistics were used to determine frequencies and percentages for variables, as well as to calculate medians, minimums, maximums and standard deviations. Data quality checks were performed, including independent verification of a randomly selected subset of records by the author.

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Those who experienced at least one fall during their stay were included in the study. These falls also included patients who fell two or more times. A standardized accident report for rehabilitation patients with a fall recording or fall protocol was established to record, document, and analyze all fall events. Due to the research questions and objectives, the following relevant variables were collected from the fall event protocols and then anonymized: age of the patient who fell, gender, date, place and time of day of the event, all circumstances of the fall (pre-existing signs, injuries if present, description of the location and type of injury, consequences of the fall as well as complaints or pain reported by the patient, X-ray examination, transfer to hospital, fall risk factors such as intrinsic or extrinsic factors, use of walking aids, measures for fall prevention). Each fall protocol was completed by the nursing staff after the event and reviewed and inspected by the responsible or consulted physician. Accordingly, the project is not subject to consultation with the ethics committee. Therefore, an ethics approval is not required.
This study gives rise to the following research questions:

- What is the incidence of falls on geriatric wards during this period in a rehabilitation facility?
- How frequently do geriatric patients fall, and what is the gender and age distribution of those who fall?
- What circumstances lead to falls?
- At what time/time of day do most geriatric patients fall?
- Where do most falls occur on geriatric wards?
- How many falls were presented for X-ray examination and hospital admission?
- What are the consequences of falls (injuries, complaints, etc.)?
- Can potential risk factors for falls be derived from the collected data?
- Which risk factors most influenced falls?
- What nursing measures did the nurses implement to prevent falls?

Results

Demograpfics data

During the three-year survey period, data from 290 patients (out of 55,614 geriatric patients) with at least one fall were included in the retrospective analysis. This represents a fall incidence on geriatric wards of 0.5%, or 5.21 falls per 1,000 patient cases and a total of 0.21% fell. However, these fall incidents also included patients who experienced two or more falls.

On average, the patients were 81.26 years old (SD=7.64) at the time of the study. Analysis of fall records showed that falls occurred most frequently in the 81- to 90-year-old age group (45.52%) and in the 71- to 80-year-old age group (37.59%). The lowest number of falls was documented in patients older than 90 (n=19) (6.55%) and in patients younger than 70 (10.34%).

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The median age of men (n=142) was 80 years (minimum 59, maximum 101, ±8.49 SD). The median age of women (n=148) was 84 years (minimum 60, maximum 98, ±6.389 SD). The average age of the fallers was 82.77 years for women and 79.69 years for men. Of the 290 cases, 142 were male (48.96%) and 148 were female (51.03%). Women were more frequently assessed as being at risk of falls than men.

Table 1: Distribution of falls according to age categories and gender, n=290

Demographic data	Characteristics	Year			
		2021	2022	2023	Total
Gender	Female	52(48.6)	48(47.1)	48(59.3)	148(51.0)
	Male	55(51.4)	54(52.9)	33(40.7)	142(49.0)
Age	<60 years old	8(7.5)	15(14.7)	7(8.6)	30(10.3)
	71-80 years old	44(41.1)	31(30.4)	34(42.0)	109(37.6)
	81-90 years old	47(43.9)	46(45.1)	39(48.1)	132(45.5)
	>90 years old	8(7.5)	10(9.8)	1(1.2)	19(6.6)

Location of Falls

Most falls (67.93%) occurred in patient rooms (n=197), followed by 55 falls (18.96%) in the bathroom. The hallway was the third most common fall location, with 20 falls (6.89%). Other falls occurred in the therapy room and dining room (n=5) (1.72%), and in other locations (n=8) (2.75%), such as the ground floor, balcony, cafeteria, reception, lounge, and underground parking garage. 63 patients were found sitting, 12 kneeling, and 74 lying down.

Causes of falls

12.06% (n=35) of patients reported falling or slipping from the toilet before falling. "Slipping or falling on the bed" was also frequently reported by patients as a cause of the fall (23 patients, 7.93%). 28 patients (9.65%) fell while walking unaided. In three patients, sitting down in a chair or wheelchair, or getting into bed, led to a fall. In 37.93% (n=110) of the falls, the cause of the fall could not be determined.

Consequences of falls

184 patients (n=63.44%) suffered no fall-related impairments or injuries after the fall. 11.03% of patients (n=32) complained of new pain immediately after the fall.

A total of 106 patients (36.55%) were injured in the fall described, and only 64.82% of patients (n=188) had no complaints after the fall. Of these, 38 patients (13.1%) suffered a minor injury such as bruises or abrasions (n=45), 15.51%, and hematomas (n=17), 5.86%. Five patients (1.72%) suffered a fracture as a result of a fall. However, 3.4% of falls (n=10) resulted in lacerations, and only 1 patient (0.3%) experienced bleeding. 6.55% (n=19) of

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falls were presented for X-ray examination and 11.4% (n=33) of falls required hospital admission.

Temporal distribution of falls and fall frequency

Most of the falls (n = 34, 11.7%) occurred between 6:00 and 8:00 a.m., while n = 15 (5.17%) and n = 14 (4.82%) were documented in the afternoon between 4:00 and 6:00 p.m (Figure 1). A slightly reduced fall frequency was observed in the middle of the night between 11:00 p.m. and midnight (n = 3, 1.03%). The frequency between 4:00 a.m. and 6:00 a.m. was n = 26 (8.96%). No time information was recorded for 13.8% of falls (n = 40).

The majority of patients, n=237 (81.72%), had one fall. Thirty-five patients (12.06%) experienced two falls, while 18 patients (6.2%) experienced three or more falls. These results indicate that recurrent falls, although less common, still occur in a significant proportion of cases and thus require special attention in fall prevention and aftercare. One patient fell the most frequently, 10 times.

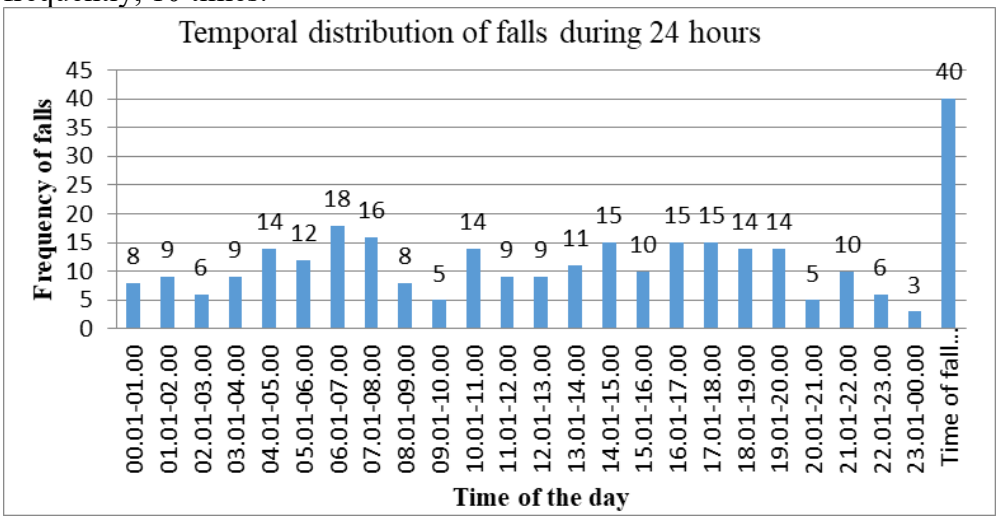

Figure 1: Temporal distribution of falls during 24 hours, n=290

Individual Risk Factors of Falling

As shown in **Table 2**, more than half of all 290 falls were due to the use of assistive devices and musculoskeletal impairments (68%). These included risk factors related to footwear and clothing (n=111, 38.2%).

(N=124, 42.75%) of falls resulted from incontinence that the patient was experiencing at the time of the fall. In addition, 35.51% of falls (n=103, 35.51%) had a fear of falling/history of falling, and only 23.8% of falls had conditions that led to brief fainting that led to a fall. Patient-related risk factors such as visual impairment, fear of falling/cognition impairment, and mood were present in every four falls.

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Table 2: Distribution of fall risk factors, n=290

Fall risk factors		Frequency	Percentage
Intrinsic Factors	Functional impairment of the musculoskeletal system	198	68.3%
	Visual impairment	62	21.4%
	Impairment of cognition and mood	77	26.6%
	Incontinence	124	42.8%
	Illnesses that can lead to short-term fainting	23	7.9%
	Fear of falling and previous fall history	103	35.5%
Extrinsic Factors	Use of aids	197	67.9%
	Schoes and clothing	111	38.3%
	Medication	72	24.8%
	Dangers in the area	87	30%

Fall Prevention Measures

The results show that targeted nursing measures for fall prevention were implemented to varying degrees by nursing staff. The most common measure was the use of assistive devices, which was documented in 74.48% of patients. This was followed by mobility support (62.4%), assistance with basic care (52.4%), the creation or maintenance of an accessible environment (56.9%), and mobility promotion measures (54.1%). Other supportive interventions included care and assistance with incontinence (47.9%), the provision of a mobile patient call system (8.6%), and the use of sensory floor mats (2.8%).

Discussion

Demographic data

During the three-year observation period, a total of 290 falls occurred among 55,614 geriatric inpatients. This represents a fall incidence of 0.52% of inpatients who experienced at least one fall, consistent with other studies reporting that just under 1% of inpatients experience falls (Kahl & Vogel, 2021; Brand & Sundararajan, 2010; Schlüter et al., 2016). Previous studies reported increased cumulative incidences of 4–8% with incidence rates of up to 10 falls per 1,000 patient days (Strutz et al., 2020; Schmid et al., 2010). The prevalence of falls increases with increasing age (over 70 years) to 32%–42% (World Health Organisation, 2015). Age is an important risk factor for falls. Patients in the 81–90 age group fell most frequently, accounting for 45.52% (n=132) of falls, which is consistent with previous studies (Strutz et al., 2020; Huser, 2025; Kobayashi et al., 2017). This finding can be explained, among other things, by age-related limitations in mobility and an increased prevalence of chronic diseases.

Analysis of fall records showed that women (51.03%) fell slightly more frequently than men. The difference between the sexes was therefore only moderate and could be due to both random fluctuations and gender-

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specific factors. These results are consistent with previous studies (Schlüter et al., 2016; Huser, 2025; Rapp et al., 2016), which found an increased incidence of falls in women. Community studies have also found women to be more likely to fall than men (Campbell et al., 1989; Strutz et al., 2020; Balzer et al., 2012).

Fall Location

As in other studies (Kinne & Klewer, 2016; Kobayashi et al., 2017; Schwendimann et al., 2008; Lohrmann, 2016; López-Soto et al., 2016; Rapp et al., 2012; Adner & Klewer, 2011), the location of the fall was the patient room (67.93%), followed by the second most common fall location, the bathroom (18.96%) (Kinne & Klewer, 2016; Lohrmann, 2016), and the remaining ward areas (13.11%). These results indicate that patient-related areas in inpatient rehabilitation, in particular, have an increased risk of falls and that targeted preventive measures should be implemented there. One possible reason why patient rooms are presented as the most common fall location is that people spend most of their time there, and nursing staff are not always present.

Time of fall and fall frequency

As in the comparative studies, the proportion of falls is highest between 6:00 and 8:00 a.m., at 11.7% (n=34), as well as in the early morning hours and in the afternoon from 4:00 to 6:00 p.m. (Klewer et al., 2008). This result is consistent with data from previous reports (López-Soto et al., 2016). These periods coincide with early nursing shifts, during which patients are frequently woken up, mobilized, or accompanied for personal care. Another explanation for daytime falls is the fact that more nursing or therapeutic treatments take place, especially during the day.

Similar results to a study showed that 81.72% (Huser, 2025) of the affected patients fell once, while 12.06% fell twice, and 6.2% fell three or more times. These results are in line with other studies investigating recurrent falls in similar patient populations (Becker et al., 2003; Heinze et al., 2002). In particular, the proportion of patients who experienced multiple falls (≥2 and 3 falls) underscores the relevance of targeted preventive measures for this high-risk group.

Causes and consequences of falls

The most common activity involved in falls was falling or slipping from the toilet (12.06%), followed by falling while walking without aids (9.65%) (Schwendimann et al., 2008; Leschke & Klewer, 2014). Slipping or falling on the bed was cited as the third most common cause (7.93%) (Kinne & Klewer, 2016; Schwendimann et al., 2008; Leschke & Klewer, 2014).

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The number of falls with consequences/injuries was 36.55% (n=106) (Klewer et al., 2008; Sawetzki & Klewer, 2012). These results are similar to a study by Schwendimann et al, (2008), where 30.1% resulted in minor injuries and 5.1% resulted in serious injuries. The most common types of injuries were abrasions (Leschke & Klewer, 2014; Schwendimann, 1998; Sawetzki & Klewer, 2012) and bruises. Based on the evaluated fall records, 63.44% (n=184) of the falls had no consequences (Kahl & Vogel, 2021; Weber & Klewer, 2010; Sawetzki & Klewer, 2012). Kinne & Klewer (2016) report in their study that 52% of patients suffered no injuries after the fall. Pain was recorded in 11.03% of fallers. Comparing the results of the literature review with the study by Schwendimann et al. (2008); Sawetzki & Klewer (2012), 1.72% of the five patients suffered a fracture as a result of a fall. Fractures account for 1-3% of the consequences of falls (Hitcho et al., 2004; Schwendimann et al., 2006; Halfon et al., 2001).

Individual risk factors

Use of assistive devices and impaired musculoskeletal function were only identified in 67.93% of cases. The most common risk factors, such as impaired mobility, are the greatest risk factor for falls, and have also been recorded in other studies (Kinne & Klewer, 2015; Schwendimann et al., 2008; Lohrmann, 2016). Extrinsic factors include unsuitable footwear and the use of assistive devices, which are the most common risk factors (Schoberer et al., 2012).

42.75% of falls were the result of incontinence, which the patient was suffering from at the time of the fall. Incontinence was also identified as a relevant risk factor for falls in one study (Wiedemann et al., 2018). The results demonstrate the need to systematically consider this factor in fall prevention through targeted toilet training, medication adjustments, or the use of assistive devices (Schoberer et al., 2012).

Fall Prevention Measures

The use of assistive devices was documented as the most common preventive measure, with a frequency of 74%, and in approximately half of the cases, this included support with basic care and adapting the environment for accessibility. Studies have shown that an appropriately selected and correctly used assistive device can significantly reduce the risk of falls. It is the responsibility of nursing staff to monitor whether assistive devices (such as visual aids or walking aids) are actually being used (Schoberer et al., 2012). A history of falls can also be a major risk factor and must therefore be recorded during the assessment. Documented support by nursing staff in 62% of cases reflects the preventive benefit of personal support (Klewer et al., 2008).

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Reduced insight and poor cooperation with nursing staff are also major risk factors (Faust, 2012).

Conclusions

The results reported that the location of falls is the patient's room. This could indicate self-initiated mobilization attempts or inadequate aids. The most common risk factors are walking without aids or moving the patient independently. Physical weakness is considered an intrinsic factor for falls. Extrinsic factors include inadequate footwear and unsuitable aids, incontinence, and external factors.

Since these risk factors are particularly common in falls, special attention should be paid to older patients. Especially in geriatric units, nurses should ensure that patients wear appropriate footwear and clothing and do not impede their ability to walk.

Based on these findings, there is a necessity for targeted nursing prevention measures, such as individualized fall risk assessments and structural and organizational adjustments. Particular emphasis should be placed on training nursing staff and educating patients about safe mobility in inpatient settings. Targeted fall prevention in the early morning hours, for example, through adequate lighting, early mobilization with assistance, and increased vigilance of nursing staff during these time windows. Documenting the time of falls is important for root cause analysis and targeted strategies.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: The Author gratefully acknowledges the data access approval provided by Median Frankenparkklinik Bad Kissingen, Germany. All data were anonymized before analysis, ensuring compliance with ethical standards.

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