

Characteristics of adverse events recorded in various hospital wards: a case study of a level II referral specialist hospital

Charakterystyka zdarzeń niepożądanych zarejestrowanych w różnorodnych oddziałach szpitalnych na przykładzie szpitala specjalistycznego II stopnia referencyjności

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STRESZCZENIE

CHARACTERISTICS OF ADVERSE EVENTS RECORDED IN VARIOUS HOSPITAL WARDS: A CASE STUDY OF A LEVEL II REFERRAL SPECIALIST HOSPITAL

Cel pracy. Celem pracy była ocena częstości występowania wybranych zdarzeń niepożądanych i ich charakterystyka w oddziałach szpitalnych o różnej specyficy w jednym z krakowskich szpitali o II stopniu referencyjności.

Materiał i metody. Badanie przeprowadzono w Szpitalu Specjalistycznym im. Józefa Dietla w Krakowie w grupie 1272 pacjentów, u których w latach 2013–2020 odnotowano wystąpienie zdarzenia niepożądanego. W celu odpowiedzi na pytania badawcze dokonano w 2022 roku retrospektywnej analizy dokumentacji medycznej i wykonano analizy statystyczne przy użyciu pakietu IBM SPSS Statistics w wersji 29.

Wyniki. Najczęściej występującymi zdarzeniami niepożądanymi były upadki, odleżyny oraz oddalenia się pacjenta. Nie zaobserwowano istotnych statystycznie różnic w wieku pacjentów doświadczających zdarzeń niepożądanych. Kobiety częściej doświadczały upadków bez urazu i powstawania odleżyn natomiast mężczyźni częściej oddalali się ze szpitala. Wyższe BMI obserwowano u pacjentów doświadczających upadków bez urazu. Pacjenci, którzy oddalili się ze szpitala, przyjmowali mniej leków niż ci z innymi zdarzeniami niepożądanymi. Pora wystąpienia zdarzenia niepożądanego była związana z jego rodzajem.

Wnioski. Ryzyko upadków, zarówno z urazem, jak i bez, jest poważnym problemem w szpitalach. Odleżyny, choć rzadziej występujące niż upadki wiążą się z dłuższym czasem hospitalizacji i częściej dotyczą kobiet. Sezonowość i pora dnia mają wpływ na rodzaj i częstotliwość zdarzeń. Różnice między oddziałami mogą wskazywać na specyficzne wyzwania związane z charakterem pacjentów i opieką w poszczególnych jednostkach.

Słowa kluczowe: zdarzenia niepożądane, częstość występowania, hospitalizacja

ABSTRACT

CHARAKTERYSTYKA ZDARZEŃ NIEPOŻĄDANYCH ZAREJESTROWANYCH W RÓŻNORODNYCH ODDZIAŁACH SZPITALNYCH NA PRZYKŁADZIE SZPITALA SPECJALISTYCZNEGO II STOPNIA REFERENCYJNOŚCI

Aim. The aim of the study was to assess the incidence of selected adverse events and their characteristics in hospital wards with varying specialties at a Level II referral hospital in Kraków.

Material and methods. The research was conducted at the Józef Dietl Specialist Hospital in Kraków on a group of 1272 patients who experienced an adverse event between 2013 and 2020. In order to answer the research questions, a retrospective analysis of the available medical records was performed in 2022 and statistical analyses were performed using the IBM SPSS Statistics package version 29.

Results. The most frequent adverse events included falls, pressure sores and patient absconding. There were no statistically significant differences in the age of patients experiencing adverse events. Women were more likely to experience falls without injury and the

formation of pressure sores, while men were more likely to abscond from hospital. Higher BMI was observed in patients experiencing falls without injury.

Conclusions. The risk of falls, both with and without injury, is a serious problem in hospitals. Although less common than falls, pressure sores are associated with longer hospitalisation and more frequently affect women. Seasonality and time of the day affect the type and frequency of adverse events. Differences between wards may indicate specific challenges related to the nature of patients.

Key words: adverse events, incidence, hospitalisation

INTRODUCTION

According to the Joint Commission for Accreditation of Healthcare Organizations (JCAHO), an adverse event is not only harm that arises during diagnosis and/or treatment, unrelated to the patient's underlying disease, but also the potential risk of such harm occurring. According to the Institute of Medicine, an adverse event is any action that results in harm – such as death, life-threatening illness, disability, or extended hospitalisation – caused by a medical intervention that has led to the patient's injury [1].

It is estimated that over 420 million hospitalisations occur globally each year, with more than 47 million of these involving adverse events. The World Health Organisation reports that approximately 134 million adverse events occur each year in low- and middle-income countries and that approximately 2.6 million deaths occur each year due to adverse events. In high-income countries, 1 in 10 patients suffer an injury during hospitalisation, but almost half of them could have been prevented [2-4]. In Poland, which, according to the World Bank, is one of the high-income countries, the number of adverse events is yet to be confirmed, as there is no uniform system for reporting and recording them, nor is this required of healthcare facilities [4]. According to the Patient Ombudsman, in January 2022, patients and their families reported 125 incidents of adverse events during hospitalisation [5]. Research by the National Centre for Quality Assessment in Healthcare, on the other hand, indicates that in Poland, adverse events occur in 7.2% of all hospitalised patients, 47.37% of which could have been prevented [6].

The World Health Organisation divides adverse events into:

- preventable – events resulting from errors or other events caused by system or equipment failures;
- Adverse events that might have resulted from serious errors or accidents but were not detected by chance – often referred to as potential adverse events [7].

Some of the most common adverse events that need to be monitored include: foreign body left in the operated site, postoperative sepsis, incorrectly administered medication (incorrect drug, incorrect dose, patient, time of administration, route of administration), patient fall in the hospital, reoperation, readmissions, patient's absconding from hospital [8].

Analysis of the literature on the subject shows that adverse events are associated with a wide variety of risk factors. These include: circumstances, legal status, facts, actions, omissions, any external and internal events that may or may not cause irregularities, but can increase the

likelihood of an adverse event occurring. According to the World Health Organisation, risk factors are categorised into demographic, physiological, behavioural, environmental, and genetic [9]. Commonly cited risk factors not related to the patient include: errors by healthcare staff, their health and competency levels, high complexity of the treatment process, and shortcomings in healthcare systems [10]. The risk of adverse events is also linked to the unreliability of the medical staff, team conflicts, poor interpersonal communication and malfunctions in medical equipment. Non-ergonomic technical or systemic solutions – such as failure to align minimum staffing requirements with the number of hospitalised patients and the level of nursing care required – can also lead to an increased risk of adverse events [11,12]. Patient-related risk factors include their sex, underlying medical conditions, comorbidities, and the medications taken. They also encompass functional impairments, such as issues with vision, memory, hearing, or balance [13].

MATERIALS AND METHODS

The research was conducted at the Józef Dietl Specialist Hospital in Kraków on a group of 1272 patients who experienced an adverse event between 2013 and 2020. The retrospective study was based on available documentation from the Quality Team - Adverse Event Registration Forms and patients' medical records. The necessary materials were collected in 2022. Approval for the study was obtained from the Bioethics Committee of the Jagiellonian University (opinion no. 1072.6120.42.2022 of 23 February 2022).

The selection of the specialist hospital was guided by the project's objectives, which focused on analysing adverse events within a diverse study group, i.e. different departments operating in one hospital. The selection of the facility took into account its referral level (Level II), location, and urban setting. Using purposive sampling, the medical records of patients hospitalised in nine hospital departments were analysed. These included: I Internal Medicine and Allergology Ward, II Internal Medicine and Gastroenterology Ward, Neurology Ward, III Internal Medicine, Metabolic Diseases and Geriatrics Ward, Rehabilitation Ward, Cardiology Ward, Rheumatology Ward, Orthopaedics Ward and Central Emergency Room.

In order to answer the research questions and verify the research hypotheses, statistical analyses were performed using the IBM SPSS Statistics package version 29. The classic threshold of $\alpha = 0.05$ was used as the level of statistical significance. To examine the differences based on the

type of adverse events for the year of their occurrence, age of the patients, number of medications taken, and hospitalisations, the Kruskal-Wallis test with Dunn-Bonferroni correction was performed. Other relationships were tested using the chi-square test of independence. For comparing column proportions, a test with Bonferroni correction was used. Descriptive statistics methods, such as arithmetic mean (\bar{x}), standard deviation (SD), minimum (Min), maximum (Max), median (Me), were used in the presentation of results for quantitative variables. For qualitative variables, frequency (n) and percentage (%) were used.

RESEARCH RESULTS

There were 1,272 adverse events recorded at the specialist hospital between 2013 and 2020, representing 1.16% of all hospitalised patients during that period. In the study group, male patients were 45% (n = 573) and female patients were 55% (n = 699). The mean age of patients in the study group was 74.57 years, with a minimum age of 19 years and a maximum age of 105 years.

The largest group of adverse events recorded at the hospital between 2013 and 2020 were falls without injury that accounted for 47.5% (n = 604) of all events. This was followed by pressure sore formation (17.6%; n = 224), falls with injury (16.4%; n = 209), change in patient's severity of pressure sore (6.4%; n = 81) and patients absconding from the ward (5.0%; n = 64). Other adverse events included: inflammation at the site of an intravenous cannula, injury during the hospitalisation, transfusion reaction, aggression toward staff, skin abrasion, drug extravasation, alcohol consumption, allergic reaction, equipment malfunction, medication administration error and suicide attempt. However, due to their small number in the study, only the most numerous events were analysed in detail (Fig. 1).

In the next step, the correlation between the type of selected, most frequently recorded adverse events and their characteristics, as well as the sociodemographic variables of the patients, were examined (Tab. 1).

The research covered eight different groups of adverse events, of which falls without injury were the most common (47.5%). Falls with injury occurred almost three times less frequently (16.5%), as did pressure sores (17.6%). What was noted were differences in the predominant years of adverse events. In earlier years, falls – both with injury (Me = 2019) and without injury (Me = 2016) – were more common compared to other adverse events. Differences were also observed between the years in which

falls occurred. Falls without injury occurred in earlier years than with injury. In earlier years, the occurrence of pressure sores was more common than changes in their severity or instances of patient absconding. A correlation was also observed between the types of adverse events and the quarter of their occurrence. Falls and theft were more common in the first quarter. In the second quarter, falls without injury were more common, while falls with injury were less common. In this quarter, there was also a higher frequency of changes in the severity of pressure sores. In the third quarter, a lower proportion of incidents involved theft. The fourth quarter was characterised by a higher proportion of falls with injury and less frequent instances of theft.

The analysis of the age of patients who experienced adverse events did not reveal statistically significant differences. When it comes to sex, though, it was shown that in the adverse event of a fall without injury and the development of a pressure sores, women comprised the majority – 59.2% (n = 357) compared to 56.7% (n = 127) of men. Similarly, the adverse event of changes in the severity of pressure sores was more frequently observed among women – 61.3% (n = 49) – compared to men – 38.8% (n = 31). The majority of cases of absconding from the hospital concerned men (78.1%; n = 50). The test results indicate a statistically significant effect for sex: $\chi^2(4) = 35.09$; $p < 0.001$; $V_c = 0.17$ against the incidence of adverse events. Column proportion comparisons with Bonferroni correction showed that patient absconding was observed more frequently in the male group (78.1%; n = 50) compared to females (21.9%; n = 14).

For BMI, a higher level of this indicator was recorded in the group of patients who experienced a fall without injury compared to those who developed or had a change in the severity of pressure sores. Detailed data is shown in Tab. 1.

Taking into account the category of nursing care, falls (both with and without injury) occurred mainly in patients classified by nursing staff in care categories I and II. The reverse was true for the onset and change in severity of pressure sores (category III was predominant for these events). In contrast, patient absconding were exclusively related to nursing category I patients.

The respondents – depending on the type of adverse event – differed in the number of medications taken. Patients absconding from the hospital took significantly less medication than those who had suffered a fall or had problems with pressure sores. Significantly more medications were taken by individuals experiencing the development or progression of pressure sores compared to those who had suffered falls.

Duration of hospitalisation also varied by type of adverse event. The pattern of differences was similar to that for medication use. Patients absconding stayed in hospital significantly shorter than those after falls or with pressure sore problems. In turn, patients who experienced the development or progression of pressure sores had longer hospital stays compared to other patients.

The time of occurrence of an adverse event was also correlated with the type of adverse event: $\chi^2(16) = 253.07$; $p < 0.001$; $V_c = 0.23$. Pressure sore formation was signi-

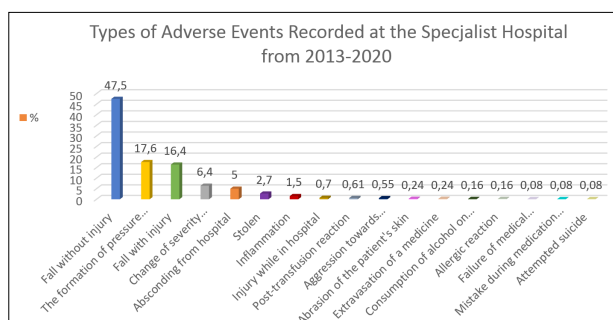


Fig 1. Types of adverse events recorded in a specialist hospital in 2013-2020
Source: own elaboration.

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■ Tab. 1. Characteristics of adverse events recorded in the specialist hospital

Variables	Fall without injury	Fall injury	Formation of pressure sores	Change of severity of pressure sores	Abscending from hospital	p / strength of the effect
	A	B	C	D	E	
Total	603 (47.5%)	209 (16.5%)	224 (17.6%)	80 (6.3%)	64 (4.8%)	
Years <i>Me (IQR)</i> Range: 2013-2020	2016 (2)	2019 (2)	2018 (0)	2020 (0)	2020 (0)	A vs B, C, D, E, F, G, H: p < 0.001 B and C vs D, E, F, H: p < 0.001 B vs G: p = 0.001 C vs G: p = 0.002 η ² = 0.79
Quarter						
I	199 ^{ab} (32.9%)	74 ^b (35.4%)	68 ^{ab} (30.4%)	21 ^{abc} (25.9%)	17 ^{abc} (27.4%)	p < 0.001; Vc = 0.17
II	150 ^a (24.9%)	29 ^b (13.9%)	54 ^{ab} (24.1%)	28 ^a (34.6%)	15 ^{ab} (24.2%)	
III	134 ^{a-1} (22.3%)	50 ^{fghi} (23.9%)	58 ^{dehi} (25.9%)	14 ^{a-1} (18.5%)	19 ^{egij} (29%)	
IV	120 ^{ab} (19.9%)	56 ^{bc} (26.8%)	44 ^{ab} (19.6%)	17 ^{abc} (21.0%)	13 ^{abc} (19.4)	
Sex						
Women	357 (59.2%)	108 (51.7%)	127 (56.7%)	49 (61.3%)	14 (21.9%)	p < 0.001; Vc = 0.17
Men	246 (40.8%)	101 (48.3%)	97 (43.3%)	31 (38.8%)	50 (78.1%)	
Age						
<i>Me (IQR)</i>	78	78	80	83	67	p = 0.073
Category of nursing care						
Category I	255 ^a (42.3%)	97 ^a (46.4%)	2 ^b (0.9%)	0 ^b (0.0%)	64 ^c (100%)	p < 0.001; Vc = 0.57
Category II	266 ^a (44.1%)	86 ^a (41.1%)	10 ^b (4.5%)	2 ^b (2.5%)	0 ^b (0.0%)	
Category III	82 ^b (13.6%)	26 ^{ab} (12.4%)	212 ^c (94.6%)	78 ^c (97.5%)	0 ^b (0.0%)	
Amount of medication taken						
<i>Me (IQR)</i>	15 (10)	16 (10)	22 (11)	26 (13)	10 (9)	E vs A, B, C, D: p < 0.001 E vs G: p = 0.019 C and D vs A, B, F, H: p < 0.001 G vs D: p = 0.047 η ² = 0.18
Hospitalisation						
<i>Me (IQR)</i>	14 (14)	14 (15)	22 (17)	23 (23)	8 (11)	E vs A, B, C, D: p < 0.001 C and D vs A, B, F: p < 0.001 G vs C: p = 0.020 G vs D: p = 0.022 H vs C: p = 0.005 H vs D: p = 0.009 η ² = 0.11
Time of event						
Morning	152 ^a (25.2%)	56 ^a (26.8%)	121 ^b (54%)	29 ^{ab} (36.3%)	26 ^{ab} (40.6%)	p < 0.001; Vc = 0.23
Noon	55 ^{ab} (9.1%)	14 ^{ab} (6.7%)	11 ^b (4.9%)	4 ^{ab} (5.0%)	6 ^{ab} (9.4%)	
Afternoon	91 ^{a-h} (15.1%)	27 ^{efgh} (12.9%)	12 ^{cdgh} (5.4%)	8 ^{bdhi} (10.0%)	19 ^{ab} (29.7%)	
Evening	73 ^a (12.1%)	32 ^a (15.3%)	69 ^{bc} (30.8%)	38 ^c (47.5%)	10 ^{ab} (15.6%)	
Night	232 ^a (38.5%)	80 ^a (38.3%)	11 ^b (4.9%)	1 ^b (1.3%)	3 ^{bc} (4.7%)	
Ward						
I	176 ^a (29.2%)	58 ^a (27.%)	115 ^b (51.3%)	67 ^c (83.8%)	24 ^{ab} (37.5%)	p < 0.001; Vc = 0.27
II	122 ^a (20.2%)	25 ^{ab} (12.0%)	3 ^c (1.3%)	1 ^{bc} (1.3%)	11 ^a (17.2%)	
III	72 ^a (11.9%)	37 ^a (17.7%)	8 ^b (3.6%)	0 ^b (0.0%)	4 ^{ab} (6.3%)	
Cardiology	41 ^a (6.8%)	13 ^{ab} (6.2%)	34 ^b (15.2%)	9 ^{ab} (11.3%)	6 ^{ab} (9.4%)	
Neurology	35 ^a (5.8%)	39 ^b (18.7%)	64 ^b (28.6%)	0 ^a (0.0%)	12 ^b (18.8%)	
Rehabilitation	88 ^a (14.6%)	22 ^a (10.5%)	0 ^b (0.0%)	3 ^{ab} (3.8%)	1 ^{ab} (1.6%)	
Rheumatology	42 ^a (7.0%)	12 ^a (5.7%)	0 ^b (0.0%)	0 ^{ab} (0.0%)	4 ^a (6.3%)	
Orthopaedics	22 ^{ab} (3.6%)	1 ^{ab} (0.5%)	0 ^b (0.0%)	0 ^{ab} (0.0%)	0 ^{ab} (0.0%)	
Central Emergency Room	5 ^b (0.8%)	2 ^b (1.0%)	0 ^b (0.0%)	0 ^b (0.0%)	2 ^b (3.1%)	

ificantly more frequently reported in the morning (54%), and least frequently reported in the afternoon (4.9%). In the afternoon, patients were most likely to abscond from the hospital (29.7%), while in the evening, a higher proportion of changes in the severity of the pressure sore were recorded than other events, apart from their formation, which was, in turn, more frequent than falls at that time. Falls were most common during the night (38.5%), while patient absconding was less common then (4.7%).

The correlation between wards where incidents occurred and the type of incident was found to be statistically significant: $\chi^2(32) = 350.11$; $p < 0.001$; $V_c = 0.27$. In Ward I, changes in the degree of pressure sores occurred more frequently than other reported adverse events. Moreover, patient absconding was reported more frequently than falls and the development of pressure sores. In contrast, the development and progression of pressure sores were less frequent than other adverse events in Wards II and IV. In Ward VI, pressure sore formation was more frequent than falls. In Ward V, on the other hand, no instances of pressure sore formation was recorded at all, with a change in their severity significantly more frequent. Patients in this ward absconded from the hospital less frequently than they experienced falls; however, falls without injury were the most common occurrences. In Ward VII, the formation and change in severity of pressure sores were reported least frequently. Other events occurred similarly frequently. In contrast, in Ward III, a higher proportion of adverse events were pressure sore formation, falls with injury and absconding. These occurred more frequently than a fall without injury or a change in the severity of pressure sores. At the same time, there was no case of pressure sore formation in Ward VIII, with falls without injury being significantly more frequently observed. No other correlations between wards and type of adverse events were noted.

DISCUSSION

Despite the immense interest in adverse events, medical advancements, and numerous studies and publications, the issue of adverse events (AEs) remains a challenge in many healthcare facilities worldwide. Identifying the frequency, risk factors, and characteristics of adverse events in healthcare is essential for understanding the scope of the problem and developing strategies to mitigate the occurrence of new adverse events and improve the safety and quality of patient care [15-17].

Based on a review of the literature on the subject, there is variability in the incidence of adverse events, as evidenced by the varying frequencies reported in several studies in hospitalised patients – between 1% and 17%. Discrepancies in the results primarily stem from the following reasons: the lack of a unified reporting system in medical institutions, ongoing fear among healthcare staff of reporting adverse events and the limitation of research studies to single departments or healthcare facilities. The percentage of adverse events can vary depending on the patient population included in the study, the location where the research was conducted, the organisational safety culture

of the hospital and the scope of the reviewed documentation. In the available studies analysing hospitals for the occurrence of adverse events, a significantly higher percentage of such events was recorded in hospitals with a higher level of referral and in university hospitals, especially those with a surgical profile. This fact is due to these medical units having more advanced technology, which enables them to provide highly specialist services and treat patients with severe conditions and rare diseases [18,19]. The research expands the topic of adverse events to include various hospital departments with different specialisations.

Jose de Lima classified adverse events in his study into moderate and severe AE. He concluded that severe adverse events predominantly occur in intensive care and surgical departments [20]. However, limited information on the variability in the frequency of adverse events between hospitals and hospital departments complicates the identification of areas needing improvement at both the hospital and departmental levels.

According to reports from the World Health Organisation, the most commonly recorded adverse events are falls and pressure sores. The frequency of falls ranges from 3 to 5 per 1,000 patient days, with more than one-third of these incidents resulting in injury [21]. The research found that falls accounted for 63.9% of all adverse events recorded between 2013 and 2020, with falls without injury representing 47.5% and falls resulting in injury making up 16.4% of all events. In contrast, 17.6% of all recorded events were related to the development of pressure sores. One study conducted in geriatric hospitals in Poland found that the rate of falls affected 3.3% of patients, which translates into 4.4 falls per 1000 patient days. Grochans et al. showed that 21.7% of patients hospitalised in a geriatric ward experienced a fall [22]. In Sousa et al.'s studies, nearly 40% of the identified adverse events were hospital-acquired infections, 30% were related to surgical procedures, about 10% were due to medication errors, and 7% were attributed to falls. The remaining adverse events involved pressure sores, accidental burns, and diagnostic errors [18]. Pressure sores are considered one of the top five most common causes of adverse events occurring during hospitalisation. According to the World Health Organisation, pressure sores affect more than 1 in 10 adult patients admitted to hospitals. The average incidence of pressure sores in Europe is around 10.8% [23,24]. Older patients, compared to younger ones, receive more medications, undergo more procedures, and have longer hospital stays. Additionally, older patients often do not exhibit typical symptoms of diseases, which makes timely and accurate diagnosis more challenging. They also take more medication than younger patients. Furthermore, due to impaired physiological compensatory mechanisms, they are at greater risk of harm from medical care errors. In a comparative analysis of adverse events, it was found that patients who absconded were significantly younger than those who experienced other types of adverse events. However, patients who experienced a fall (with or without injury) were significantly younger than those who had a change in the stage of a pressure sore (but not its development) [25].

Somella et al. found a higher frequency of adverse events among elderly individuals (≥ 65 years), with 58.7% experiencing such events compared to 49.3% among patients without adverse events [26]. In this research, a statistically significant difference was found between sex and the type of adverse event when analysing specific types of adverse events in detail. In the case of falls without injury and the development of pressure ulcers, women were the majority. In the adverse event of a change in the severity of pressure sores, women also predominated. In contrast, patient absconding from hospital was significantly more common among men. The test results indicate a statistically significant effect for sex. The study by Mazur et al. [27,28] confirms the results obtained in our study. In contrast, the study by Kamińska et al. [29] presents different results.


CONCLUSIONS

The risk of falls, both with and without injury, is a serious problem in hospitals and requires further attention, especially in groups with higher BMI. Although less common than falls, pressure sores are associated with longer hospitalisation and more frequently affect women. This points to the need for better preventive procedures and risk management in this group. Seasonality and time of the day affect the type and frequency of adverse events, suggesting the need to adjust staffing and procedures according to the season and time of day. These results suggest the need to adapt the organisation of medical staff work to the specific characteristics of different shifts and times of the day in order to better address these challenges. Differences between wards may indicate specific challenges related to the nature of patients and care in individual units. They suggest the need for developing more individualised preventive programs tailored to the specific characteristics of patients in each department. Departments with more mobile patients may require increased attention to fall prevention, while units with chronically ill patients should focus on preventing pressure sores.

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