Research Paper

Investigating the Prevalence, Severity, and Nature of Adverse Events in an Inpatient Rehabilitation Hospital

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Citation Rahimi S, Khankeh HR, Arsalani N, Fallahi-Khoshknab M, Ebadi A, Layeghi F. Investigating the Prevalence, Severity, and Nature of Adverse Events in an Inpatient Rehabilitation Hospital. Iranian Rehabilitation Journal. 2023; 21(2):291-300. http://dx.doi.org/10.32598/irj.21.2.1854.1

http://dx.doi.org/10.32598/irj.21.2.1854.1

Article info:
Received: 07 Jun 2022
Accepted: 26 Sep 2022
Available Online: 01 Jun 2023

Keywords:
Adverse events, Medical errors, Patient safety, Rehabilitation, Hospital

ABSTRACT

Objectives: This study aims to evaluate the prevalence, severity, and nature of adverse events (AEs) and provide suggestions on how to prevent AEs recurrence in an inpatient rehabilitation hospital in Iran.

Methods: This retrospective descriptive-analytical study was conducted in 2021 at Rofaydeh Rehabilitation Hospital in Tehran City, Iran. AEs associated with rehabilitation services and nursing care, which were reported in the hospital's voluntary reporting system from 2018 to 2021 were evaluated. A standard checklist codified by the Ministry of Health of Iran was used to collect the data from the medical error documentation. The data were analyzed by the SPSS software, version 21, using descriptive statistics, the chi-square, and the Fisher exact tests.

Results: A total of 5642 patients had been hospitalized in the study setting and 517 AEs had been documented during the 4 years of the study. The most common AEs in descending order were as follows: falls 288(55.7%), pressure ulcers 57(11.02%), medication errors 50(9.67%), clinical process 49(9.47%), clinical administration (issues with admission process 10(1.93%) and wrong patient identification 5(0.96%). Among 58(11.21%) cases of hospital-acquired infections, 45(77.58%) cases were urinary tract infections. There was a significant relationship between age and fall (P=0.026), pressure ulcer (P=0.006), and hospital-acquired infection (P=0.001), and between gender and fall (P=0.01), pressure ulcer (P=003), and hospital-acquired infection (P=0.01). The severity of identified AEs was categorized into mild 431(83.36%), moderate 61(11.79%), and severe 25(4.83%). The most common causes of AEs were limited supervision of patients by healthcare providers.

Discussion: This study showed that patient fall, pressure ulcer, and hospital-acquired infection were the most prevalent AEs in the rehabilitation hospital. Future efforts to improve patient safety in these settings should focus on reducing such AEs along with removing barriers to voluntary incident reporting.

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Highlights

• This study confirmed that fall, pressure ulcer, and hospital-acquired infection were major contributors to AEs in the rehabilitation hospital.

• To improve the quality of care and reduce patient safety costs, the focus should be on reducing the incidence of ulcer, fall, and hospital-acquired infection during hospitalization.

Plain Language Summary

Adverse events (AEs) occur frequently in our medical system. AEs in rehabilitation hospitals can negatively affect patient satisfaction and trust, in addition to increasing healthcare-related costs. This study aimed to evaluate the prevalence, severity, and nature of AEs and also provide suggestions on how to prevent AEs recurrence in an inpatient rehabilitation hospital in Iran. The study's findings showed that patient fall, pressure ulcer, and hospital-acquired infection as the most common types of preventable AEs in the rehabilitation hospital.

Introduction

According to a report by the World Health Organization (WHO), patient safety (PS) is a global health priority and is called for urgent action to improve PS in healthcare [1]. Adverse events (AEs) are a serious issue for PS [2]. AEs refer to any unwanted damage to patients that results in temporary or permanent disability or dysfunction, and or increases the length of hospitalization or causes death because of the inefficient management of medical processes [3, 4]. The first step toward improving PS is to obtain accurate data on PS. The current PS status must be assessed by acquiring data, such as the incidence, common types, severities, and preventability of AEs to determine how to take steps toward improving PS [5].

There are differences between inpatient rehabilitation hospitals and acute care settings in terms of care objectives and patient groups [5]. The complexity of care in a rehabilitation hospital may increase the risk of AEs related to the lack of communication and coordination of care because of service delivery by different provider groups and the higher involvement of non-nurse healthcare providers, patients, and patients' family members [6, 7].

Moreover, clients in inpatient rehabilitation hospitals are usually patients with different disabilities and problems, such as traumatic or non-traumatic head and spinal injuries, stroke, amputation, weakness, disability, joint replacement, cognitive and memory impairments, walking disorders, swallowing problems, and functional disorders [8, 9]. These characteristics put clients at a greater risk of PS events [8, 9], such as falls, pressure ulcers, wound infection, documentation errors, ineffective communication, intentional harm, abuse, and infections [5, 8].

According to the results from previous studies, between 17.42% to 29% of patients in rehabilitation hospitals experience AEs [5, 10]. Both significant data on critical aspects of hospital performance and impetus for the development of patient safety programs are provided in these studies [7].

AEs in rehabilitation hospitals can negatively affect patients' satisfaction and trust, increase healthcare-related costs [11], prolonged hospitalization, increase the need for transfer to other healthcare settings, alter the normal process of life, and lead to problems, such as pain, discomfort, permanent injuries, and even death [10]. Accordingly, it is essential to seek strategies to prevent AEs, particularly among at-risk patients [12].

The literature has highlighted the issues of reporting AEs in acute care settings but few studies have examined the frequency and consequences of AEs, in addition to factors that predict their occurrence in the IRHs [5, 9]. For example, a retrospective study in a rehabilitation hospital in Canada showed that the most prevalent AEs for patients with acquired brain injuries were falls, pressure ulcers, and bedsores (56.72%), as well as patient negligence, assault, and sexual abuse (16.42%) [5]. Another retrospective cross-sectional study examined the types of AEs associated with rehabilitation therapies in 9 years in rehabilitation hospitals in the United States. The most prevalent AEs were delay in care provision (32.0%) and patient fall (28.0%) with 3 cases of death [13]. A retrospective study on elderly people referring to a post-acute rehabilitation hospital in France also found that 12%

of this population group experienced AEs and the most common AE, particularly among participants over 75 years, were fall and nosocomial infections [14]; however, these studies focus on one specific population of patients and provide no comprehensive data about all patients who are hospitalized in inpatient rehabilitation hospitals.

Given that PS is considered the main challenge for healthcare providers in hospitals [5], failures in healthcare systems should be understood through the identification and analysis of AEs. When the evaluations of AEs are possible, the strategies that are aimed at improving the quality of health care become feasible and achievable [4]. In addition, to the best of our knowledge, no study had yet evaluated AEs in rehabilitation hospitals in Iran. Hence, this study aims to provide an estimate of the incidence, severity, and nature of AEs in an inpatient rehabilitation hospital in Iran.

Materials and Methods

Study design and setting

This retrospective descriptive-analytical study was conducted at Rofaydeh Rehabilitation Hospital in Tehran City, Iran. This rehabilitation hospital provides a variety of core patient care services and it is the only inpatient rehabilitation center in Iran. In this facility, patients are usually hospitalized for 4 weeks and receive rehabilitation services from a specialized rehabilitation team consisting of physicians, nurses, audiometrists, and occupational, speech, and physical therapists. Patients in this hospital are adult and elderly patients with central nervous system disorders, such as epilepsy and multiple sclerosis as well as children with cognitive, mental, and behavioral disorders.

Study population and sampling strategy

The study population included all patients who were hospitalized at Rofaydeh Hospital from 2018 to 2021. All the AEs reports during the study period were reviewed by accessing both computerized records and paper files to determine the number of events reported in the year, the nature of the incidents, and the circumstances surrounding them. Total patients were included and no sampling was carried out. Initial screening was done to exclude non-clinical incidents.

Data collection and analysis

To collect the data, we referred to the PS department of the study setting and retrieved the documents related to AEs from 2018 to 2021. A standard checklist codified by the Ministry of Health of Iran was used for data collection from the medical error documentation [15]. AEs in the checklist were identified and classified for severity and type, using the WHO international classification for patient safety [16]. This checklist, which is available online on the hospital's website since 2017, has grouped questions on the type, degree of harm, location, cause, and staff involved in AEs, contains suggestions to prevent AEs recurrence, and afflicted patients' characteristics. The hospital staffs voluntarily complete this checklist when an error occurs.

AEs included in this study were all caused by the faulty management of the rehabilitation process and nursing care. In this study, the 4 main types of AEs included hospital-acquired infections (such as infections related to nosocomial, urinary tract wounds, and blood), patient incidents (such as falls and fractures in hospital, pressure ulcers, transfusion-related reactions, transfusion of wrong blood type, surgery at an erroneous site, medication errors, and AEs due to medical equipment), clinical process (such as errors or delays in diagnosis or treatment), and clinical administration (such as patient identification, issues with admission process).

The degrees of harm were classified as mild, moderate, severe, and death. They are defined by the WHO as follows:

Mild: Asymptomatic or mild symptoms, clinical or diagnostic observations only, intervention not indicated;

Moderate: Minimal, local, or noninvasive intervention indicated, limiting age-appropriate instrumental activities of daily living;

Severe: Medically significant but not immediately life-threatening, hospitalization or prolongation of hospitalization indicated, disabling;

Death: Death related to AE [16, 17].

The collected data were entered into the SPSS software, version 21 and were described through the measures of descriptive statistics, absolute frequency, and relative frequency. The chi-square and Fisher exact tests were used to compare the frequency of disease diagnosis, age, and gender. The level of significance used for the study was P=0.05.

Results

A total of 5642 patients had been hospitalized in the study setting and 517(9.1%) AEs had been documented during the 4 years of the study. The highest and the lowest prevalence of AEs were in the first year with 168(32.50%) and in the fourth year with 81(15.67%) cases (Figure 1), respectively. Of these, only the age and the gender of 403(78.4%) AEs (fall, pressure ulcer, and hospital-acquired infection) afflicted patients have been documented and correlation was performed only for these 3 AEs.

The most common AEs were falls (288(55.7%)), hospital-acquired infections (58(11.21%)), pressure ulcers (57(11.02%)), medication errors (50(9.67%)), clinical process (49(9.47%)), and clinical administration (issues with admission process (10(1.93%)), and wrong patient identification (5(0.96%)), respectively. The characteristics of AEs-afflicted patients are shown in Table 1.

Based on the results, there was a significant correlation between types of AEs (fall, pressure ulcer, and hospital-acquired infection) and age (Table 2), and gender of patients (Table 3).

Falls were most common among patients at the age of 50 years or more (32%) (x^2=11.02, degree of freedom (df)=4, P=0.026). Men (153(53.1%)) were more likely to experience falls during the study period than women (135(46.9%)), (x^2=8.62, df=4, P=0.003). Additionally, the patients diagnosed with stroke showed the highest incidence of falling (74(25.6%)). Most of the fall events occurred in the morning (168(58%)). Falls were more common when patients independently did their activities and occurred mostly in patient rooms and during transfer to bed or wheelchair.

There was a significant relationship between the pressure ulcer events and age along with patients' gender. Pressure ulcer was most common among patients at the age of 50 years or more (48.2%) (x^2=14.61, df=4,

Table 1. The characteristics of adverse events-afflicted patients

Characteristics		No. (%)
Age (y)	10-20	68(13.2)
	20–29	51(9.92)
	30–39	80(15.56)
	40–49	72(14)
	≥50	132(25.67)
Gender	Male	230(44.7)
	Female	173(33.6)
Diagnosis at hospital admission	Spinal cord injuries	94(18.3)
	Stroke	65(12.6)
	Musculoskeletal disorders	8(1.6)
	Seizure	9(1.7)
	Cerebral paralysis	3(0.6)
	Multiple sclerosis	31(6)
	Other neurologic conditions	54(5.10)
Underlying condition	Diabetes mellitus	75(14.6)
	Hypertension	14(4.3)
	Others	32(6.2)

Table 2. The relationship between types of adverse events and age group in hospitalized patients

Adverse Events	Mean±SD					P
	Age Group (y)					
	10-20	20–29	30–39	40–49	≥50	
Fall	56±19.7	33±11.3	59±20.6	46±16.0	94±32.4	X^2=11.02 df=4 P=0.026
Pressure ulcer	2±3.6	8±14.3	13±23.2	`7±10.7	27±48.2	X^2=14.61 df=4 P=0.006
Hospital-acquired infection	10±17.24	10±17.24	8±13.79	19±32.75	11±18.95	X^2=18.74 df=4 P=0.001

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P=0.006). Men (42(73.68%)) were more likely to experience pressure ulcers during the study period compared to women (15(26.31%), (x^2=8.94, df=2, P=0.003).

Pressure ulcers were most frequent in spinal cord injury patients (35(61.40%)). The causes of pressure ulcers were inattention to position change, late change of diaper in patients with urinary incontinence, skin erosion because of patient transfer, hitting the edges of a bed or using a stationary bike, and pressure caused by inappropriate prostheses. The most common sites of pressure ulcers were the ischium and the sacrum.

Among 58(11.21%) cases of infections, 45(77.58%) cases were urinary tract infections among spinal cord injury patients, and 13 cases were other types of infections. Moreover, infections were most common among patients in the age range of 40 to 49 years, (19(32.75)) (x^2=18.74, df=4, P=0.001). Men (32(57.1)) were more likely to experience infections during the study period than women (26(42.9); x^2=0.007, df=2, P=0.01)).

The most common type of medication error was the administration of the wrong medication (4.3%). The most identified AEs were mild in severity 431(83.36%). The rest of the moderate case was 61(11.79%) while the severe ones were at 25(4.83%). No death AEs were identified during the study period. The most common root causes of AEs were limited supervision of patients and patient negligence by healthcare providers. Nurses were the most common staff involved in AEs (212[41%]), while speech therapists were the least common staff involved in AEs (3[0.58%]).

Discussion

This study aimed to evaluate the prevalence, severity, and common types of adverse events and also provide suggestions on how to prevent AEs recurrence in inpatient rehabilitation hospitals in Iran. The results revealed that 517(9.1%) AEs had been documented from 2018 to 2021. In a study in New Zealand [20], the AE rate among patients admitted to acute care hospitals was 12.9%, and

Table 3. The relationship between type of adverse events and gender in hospitalized patients

Adverse Events	Mean±SD		No. (%)	P
	Gender			
	Male	Female		
Fall	153±53.1	135±46.9	288(55.7)	X^2=9.27 df=2 P=0.01
Pressure ulcer	42±73.68	15±26.31	57(11.02)	X^2=8.94 df=2 P=0.003
Hospital-acquired infection	32±57.1	26±42.9	58(11.21)	X^2=0.007 df=2 P=0.01

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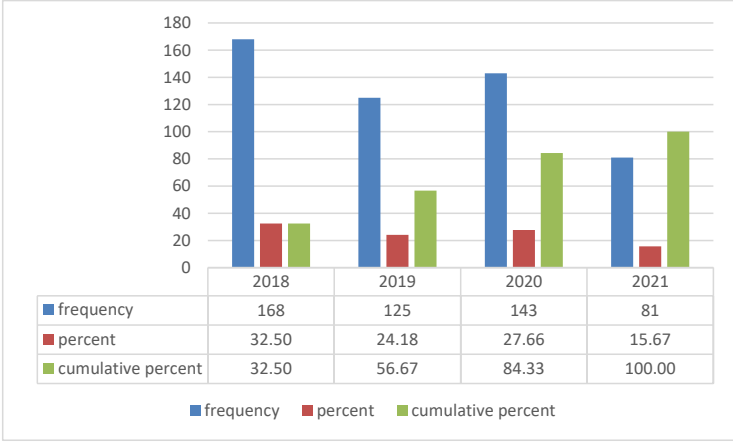

Figure 1. The prevalence of adverse events in a rehabilitation hospital for 4 years

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in the Canadian AEs study [7], the rate identified in the 5 acute care hospitals was 10.9% which is almost close to our study.

The most common AEs were patient fall that mostly occurred in patients aged 50 years or more, and more in the male gender. Most of the fallers recovered after the stroke. In addition, most of the recorded falls happened in the morning. This issue can be related to the workload of the hospital in the morning compared to the evening or night. Our results are in line with previous studies. For example, Saverino et al. who reported 40 fall events among 320 patients hospitalized for rehabilitation during 7 months-period found that 55% of the patients were males [19]. Mirapeix et al. also reported falls as the most prevalent AEs in inpatient rehabilitation hospitals, particularly among individuals above 75 years [14]. Additionally, Mandy et al. demonstrated that fall was highly prevalent among patients with stroke and affected their daily lives [20]. Tsur et al. reported 65% of fall events (n=52) in the daytime, 55% (n=44) during transfer, 65% (n=52) in the patient's room, and only 18.8% (n=15) in the toilet or bathroom. Most of the fallers recovered after the stroke and brainstem or cerebellar stroke (n=31/33) [19]. As most patients in rehabilitation hospitals suffer from cognitive and sensorimotor problems, careful patient supervision and monitoring by committed rehabilitation staff can reduce fall rate [21, 22].

Our study also revealed that the prevalence of pressure ulcers was 11.02%. Those admitted for spinal cord injury were at a high risk of pressure ulcers. In the present research, 42(73.68%) males and 15(26.31%) 50 years of age or more patients with pressure ulcers. The major causes of pressure ulcers were prolonged immobility, humidity, and skin erosion during patient transfer. Similarly, a study on patients with spinal cord injury in France reported humidity, urinary incontinence, prolonged immobility, poor mental status, poor nutrition, and prolonged hospital stay as the main risk factors for pressure ulcers during rehabilitation [23]. Moreover, the most common anatomical site of pressure ulcers in the present study was the lower extremities which are in line with the findings of a former study into pressure ulcers among patients with stroke in rehabilitation settings [24]. These findings may be due to the rehabilitation staff's limited knowledge about pressure ulcers and highlight the necessity of quality education about pressure ulcer preventive measures, such as position change, healthy nutrition, no use of faulty equipment, and assessment of pressure ulcer risk factors.

Our findings also showed urinary tract infections as the most common hospital-acquired infections. The mean age of the infected patients was 40 to 49 years. Meanwhile, 19(32.75%) and 32(57.1%) of the patients were males. A previous study also reported the same finding [25]. Another study in Canada documented urinary tract infection as the most common health problem following spinal cord injury that adversely affects the quality of life and often results in rehabilitation goals interruptions [26]. Patients in rehabilitation hospitals are at risk for infections because of sensorimotor problems, problems in the perception of bladder filling and evacuation, frequent use of antibiotics [26], impaired immunity, and lengthy hospitalizations [27]. Therefore, financial support for infection prevention programs, close collaboration of physicians and nurses, and continuous patient assessment for infections are recommended [28, 29].

The prevalence of medication error in the present study was 9.67% and the most prevalent medication error was the administration of wrong medication. A review study on medication errors in Iran showed that the prevalence

of medication errors was 14.3% [30] and a systematic review study on medication errors in outpatient centers in Austria revealed that the prevalence of medication errors was 16.5% with inappropriate communication among healthcare providers as a major cause [31]. Medication errors are a major threat to patient life and have negative effects on patients, nurses, and other healthcare providers; therefore, healthcare managers need to consider incentives for error reporting, use strategies to improve interpersonal communication, provide education to nurses about medication errors, and carefully supervise the process of medication therapy to minimize medication errors.

We also found that the prevalence of clinical process errors due to faulty processes and unclear job specifications was 9.47%. Similarly, a study in hospitals in Iran reported that the prevalence of clinical process errors was 11.6% [32]. Clinical process error assessment is difficult because these errors continuously happen over time and in different places and may not cause obvious patient- or care-related consequences [33]. Therefore, careful attention to organizational factors contributing to errors is needed to minimize clinical process errors.

The incidence of errors in the patient admission process in the present research was 10(1.93%). The most common causes of admission process errors that were expressed in a previous study [34] included insufficient space, not having a written form of processes for each ward, a lack of an appropriate recording system, not holding educational sessions for patients at the time of their admission to the center, a lack of focus in reception staff, and mistakes in recording the information in the system by the reception staff. The incidence of admission process errors can pose problems and risks and the personnel should take the necessary measures to eliminate and reduce these errors.

The prevalence of wrong patient identification in the present study was 5(0.96%). This error was related to other errors, such as the administration of medication to the wrong patient, doing the wrong procedure, and wrong documentation of orders and reports in medical records. The use of two or more identifiers for medical or therapeutic interventions, accurate identification of patients before each medical procedure, training of hospital staff, application, and encouraging the investment of technological resources to enhance the safety of the identification process are all recommended by recent studies [35, 36].

In this study, the AEs rate would have been mild in severity by more than half. Most of the patients who experienced AEs recovered without permanent disability, and the level of harm caused by AEs was low in severity. One possible explanation is that hospital staff felt that they were not supported for reporting serious AEs and their ward blamed them for error reporting, hence they are less likely to voluntarily report such errors. Using combinatory methods, such as providing constructive feedback on errors, avoiding punishment, and engagement of patients as partners in identifying AEs can help enhance PS [37].

Our findings also demonstrated that nurses were the most common healthcare providers involved in AEs. Two former studies also reported the same results [11, 38]. Accordingly, nurses are responsible for providing most care services and they mostly report their errors; therefore, educational programs about PS and voluntary error reporting for all rehabilitation staff are needed to improve error reporting and PS. Additionally, the hospital staff, especially nurses, should pay more attention to their activities.

This study was conducted in a single rehabilitation hospital because there was only one inpatient rehabilitation hospital in Iran at the time of the study. Moreover, the reports of some AEs in the study setting were incomplete documentation and the number of hospitalizations in the last year of the 4 years of the study was significantly less than the first 3 years because of the COVID-19 pandemic. This study was conducted retrospectively and it relies heavily on patient records. It is dependent on the quality of documentation. AEs may not have been documented in the patient's records properly, and they could not be detected by this method. These limitations can reduce the generalizability of the findings.

Conclusion

This study provides a starting point for understanding the incidence of AEs in inpatient rehabilitation hospitals in Iran. This study showed patient fall, pressure ulcer, and hospital-acquired infection as the most common types of preventable AEs in a rehabilitation hospital. Educational and motivational interventions for healthcare and rehabilitation providers are necessary to motivate them to use standards in their practice and thereby reduce AEs in patients. On the other hand, considering the multidisciplinary approaches in rehabilitation hospitals, improving the organizational culture, modifying the work environment of health care professionals, and encouraging voluntary incident reporting can be useful to

improve patient safety and voluntary reporting of AEs in these settings. Further research help to develop a voluntary reporting system of AEs that is capable of providing an accurate picture of the type, nature, and severity of incidents at a reasonable cost is also recommended.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran, on May 20, 2020 (Code: IR.USWR.REC.1399.058) At first, the necessary permissions for data collection were obtained from the authorities of Rofaydeh Hospital. The participants were also informed about the nature and objectives of the study. The confidentiality of the patient's data was also observed throughout the research.

Funding

This study was extracted from the PhD dissertation of Shoeleh Rahimi, aprroved by Department of Nursing University of Social Welfare and Rehabilitation Sciences.

Authors' contributions

Conceptualisation and study design: Hamid Reza Khankeh and Shoeleh Rahimi; Supervision: Hamid Reza Khankeh; Data collection, and writing the manuscript: Shoeleh Rahimi; Data interpretation, data analysis and final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors would like to thank the Research and Technology administration of the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran, for financially supporting this study as well as the authorities of Rofaydeh Hospital, Tehran City, Iran for providing the permission to use medical records in that hospital.

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