Artículo

Evaluation of COVID-19 Patient Safety Compared to Non-COVID-19 Patients and Predisposing Factors of Nursing Errors

Leila Mohammad Nahal

https://orcid.org/0000-0002-0221-0381
Faculty of Health, University of Medical Sciences,
Islamic Azad University, Iran
mohammadnahall@yahoo.com

✉ **Abasat Mirzaei**

https://orcid.org/0000-0002-1422-5193
Faculty of Health,
Tehran University of Medical Sciences,
Islamic Azad University, Iran
amacademic@iautmu.ac.or

Mohammad Javad Khezeli

https://orcid.org/0000-0002-1865-7313
Faculty of Health, University of Medical Sciences,
Islamic Azad University, Iran
mj.khezeli@gmail.com

Theme: Promotion and prevention.

Contribution to the discipline: Nurses play a critical role in protecting and supporting patients because of the nature of their job. Acknowledging these safety factors is the cornerstone in improving the safety performance of healthcare providers. Therefore, improving the performance of nurses increases patient safety and quality of care. One of the ways to improve nurses' performance is empowerment and one of the ways to empower them is identifying the incidents and analyzing the trend of events and the possibility of errors and their effects. This article has been able to reveal the gaps in health system nursing by evaluating the basic indicators of patient safety and finding the predisposing factors of nursing errors in hospitals. Since the formation of the concept of nursing is made and paid by the educational system, it is possible to empower nurses to improve the quality of nursing care using this article in nursing education institutions and according to the predisposing factors of nursing errors and examining the strengths and weaknesses of nurses in the field of patient safety indicators.

Abstract

Objectives: The present study aims to determine Patient Safety in hospitalized patients with COVID-19 compared to non-COVID-19 ones and find predisposing factors of nursing errors according to nurses' perceptions. **Methods:** This descriptive-comparative research employed data from 800 nurses in eight Iranian hospitals in 2021 using three researcher-made questionnaires of sociodemographic, patient safety indicators, and predisposing factors of nursing errors, with high reliability and validity. The collected data were analyzed using ANOVA, independent t-test, and the SPSS22 software. **Results:** The mean patient safety scores in patients with and without COVID-19 were 3.42 ± 0.17 and 3.74 ± 0.06, respectively. The highest differences in patient safety were attributed to infection control (0.66) and patient fall (0.56) dimensions. The most common causes of nursing errors were related to management (2.67 ± 1.39), and the most common predisposing factors of nursing errors were high workload, low ratio of nurses to patients, and fatigue. **Conclusions:** COVID-19 patients have lower safety than non-COVID ones. Also, improper management and high workload lead to nursing errors. Therefore, the authorities must devise appropriate strategies to reduce the nurses' workload and improve patient safety, especially in COVID-19 patients.

Keywords (Source: DeCS)
COVID-19; medical errors; nurse; patient safety; patient isolation.

Evaluación de la seguridad del paciente con COVID-19 en comparación con pacientes sin COVID-19 y factores predisponentes de los errores de enfermería

Resumen

Objetivos: el presente estudio tuvo como objetivo determinar la seguridad en pacientes hospitalizados con covid-19 en comparación con los que no tenían covid-19 y encontrar factores predisponentes de errores de enfermería según la percepción de los enfermeros. **Métodos:** esta investigación descriptiva-comparativa empleó datos de encuestas de 800 enfermeros en ocho hospitales iraníes en 2021 mediante tres cuestionarios con alta confiabilidad y validez elaborados por investigadores que incluían datos sociodemográficos, indicadores de seguridad del paciente y factores predisponentes de errores de enfermería. Los datos recopilados se analizaron mediante ANOVA, prueba t independiente y el software SPSS22. **Resultados:** las puntuaciones medias de seguridad de los pacientes con y sin covid-19 fueron 3,42 ± 0,17 y 3,74 ± 0,06, respectivamente. Las mayores diferencias en seguridad del paciente se atribuyeron a las dimensiones de control de infecciones (0,66) y caída del paciente (0,56). Por otra parte, las causas más comunes de los errores de enfermería estuvieron relacionadas con el aspecto gerencial (2,67 ± 1,39), y los factores predisponentes más comunes de los errores de enfermería fueron la alta carga de trabajo, la baja proporción de enfermeros por pacientes y la fatiga. **Conclusiones:** los pacientes con covid-19 tienen menor seguridad que los que no presentan la enfermedad. Además, la gestión inadecuada y la alta carga de trabajo conducen a errores de enfermería. Por lo tanto, las autoridades deben diseñar estrategias adecuadas para reducir la carga de trabajo de los enfermeros y mejorar la seguridad del paciente, en especial en aquellos con covid-19.

Palabras clave (Fuente: DeCS)
Covid-19; errores médicos; enfermera; seguridad del paciente; aislamiento de pacientes.

Avaliação da segurança do paciente com covid-19 em comparação com o paciente sem covid-19 e fatores predisponentes de erros de enfermagem

Resumo

Objetivo: o objetivo deste estudo foi determinar a segurança em pacientes internados com covid-19 em comparação com os que não tinham covid-19 e encontrar fatores predisponentes de erros de enfermagem segundo a percepção de enfermeiros. **Materiais e método:** trata-se de pesquisa descritivo-comparativa, que utilizou dados de pesquisas com 800 enfermeiros em oito hospitais iranianos em 2021, com base em três questionários com alta confiabilidade e validade, elaborados por pesquisadores, que incluíam dados sociodemográficos, índices de segurança do paciente e fatores predisponentes de erros de enfermagem. Os dados coletados foram analisados com ANOVA, teste t independente e software SPSS22. **Resultados:** as pontuações médias de segurança dos pacientes com e sem covid-19 foram 3,42 ± 0,17 e 3,74 ± 0,06, respectivamente. As maiores diferenças em segurança do paciente foram atribuídas às dimensões de controle de infecções (0,66) e queda do paciente (0,56). As causas mais comuns dos erros de enfermagem estiveram relacionadas com o aspecto gerencial (2,67 ± 1,39) e os fatores predisponentes mais comuns dos erros de enfermagem foram a alta carga de trabalho, a baixa proporção de enfermeiros por paciente e a fadiga. **Conclusões:** os pacientes com covid-19 têm menor segurança do que os que não apresentam a doença. Além disso, a gestão inadequada e a alta carga de trabalho levam a erros de enfermagem. Portanto, as autoridades devem elaborar estratégias adequadas para reduzir a carga de trabalho dos profissionais de saúde e melhorar a segurança do paciente, em especial daqueles com covid-19.

Palavras-chave (Fonte: DeCS)
Covid-19; erros médicos; segurança do paciente; isolamento de paciente; enfermeira.

Introduction

Since March 2020, the world has faced a severe threat called COVID-19. According to the WHO, the COVID-19 pandemic is currently the most critical health crisis in the world and the most significant challenge and threat facing the world and humanity (1, 2). This disease is a public health problem that has claimed the lives of many men, women, and children worldwide. Until August 6, 2021 (when this article was written), over 201 million people worldwide had been diagnosed with the disease, and 4,284,467 had died, as confirmed by the WHO (3). The sudden increase in the demand for health care led to overload and the collapse of health systems (4). COVID-19 is an emerging disease with unknown clinical and therapeutic symptoms (5, 6) transmitted through close person-to-person contact. Infection control experts consider patient isolation an essential and straightforward way to control the infection and spread of the disease; therefore, hospitalized COVID-19 patients are isolated in separate wards. However, using such a precaution may not be totally safe (7). Isolation for infection control is a process that makes the patients subject to medical errors and side effects (8).

In addition, unmeasured organizational factors, such as the prevalence of new diseases, high patient turnover in medical centers, and unit-level workload, may contribute to the variance in missed nursing care, increased medical errors, and threaten safety of the patients (9). Nursing error is a type of error by healthcare team members that can result in irreparable and irremediable damage (e.g., permanent disability or death) (10).

Nurses comprise the largest group of healthcare professionals who interact most with patients. Promoting a safe environment is an essential nursing task and plays a significant role in care management (11). During the COVID-19 pandemic, nurses have been at the frontline of fighting against the disease, and critically-ill patients rely on them more than ever (12, 13). Studies have shown a significant relationship between the prevalence of COVID-19 and the problems such as stress, depression, burnout, anxiety, and reduced productivity in health workers (13-17). Medical workers' mental health problems impair their attention, cognitive functioning, and clinical decision-making (18), consequently increasing medical errors and incidents and, ultimately, putting the patients at risk (19).

Health worker safety and patient safety are inseparably connected domains. Health and safety risks to health workers can lead to risks for patients, patient harm, and adverse patient outcomes. The risks to patients and healthcare workers during this pandemic are more significant than usual (20, 21). Thus, health workers cannot provide quality and safe patient care in environments where their safety is threatened (22).

Error is inevitable in all professions, particularly health- and treatment-related jobs. Care provision in clinical settings is associated with var-

ious concerns, including adverse effects of treatment, accidents, and medical errors (23). The most common nursing errors in a hospital setting are falls, pressure ulcers, infections, medication errors, documenting errors, and equipment injuries (24). Every year, 134 million side effects occur in hospitals of low- and middle-income countries due to unsafe care, leading to 2.6 million deaths (25). In high-income countries, it is estimated that one-tenth of patients get injured while receiving hospital care (26), about 50 % of which are preventable (27). Failure to maintain patient safety significantly increases the cost of care, morbidity, and mortality. Patient safety is a priority in the healthcare system to improve treatment outcomes and prevent complications (23).

Patient safety is a critical element of quality in healthcare and is considered an indicator of the quality of care (28). Nurses' priorities include patient safety and improving the quality of delivered care to patients. Improving patient safety involves identifying the incidents, analyzing the trend of events, and developing corrective solutions for promoting the system. There are several mechanisms to reduce adverse events and improve patient safety, but implementing them requires studies to identify the current situation. Due to the novelty of COVID-19, the studies in this field are limited. To plan for preventing and decreasing the rate of nursing errors and increasing patient safety, especially for COVID-19 patients, evaluation of fundamental patient safety indicators and predisposing factors in nursing errors can reveal the gaps in this area in the health system and might be very helpful.

Therefore, the present study was conducted to determine the patient safety in hospitalized patients with COVID-19 compared to non-COVID patients and identify the predisposing factors of nursing errors according to the nurses' perceptions.

Methods

This descriptive-comparative research used convenient sampling to collect information from 800 frontline nurses of different levels in eight hospitals in Iran from April 1 to August 7, 2021. According to Cochran's formula and the studies conducted on limited populations using convenient sampling, one way to determine the sample size for confirmative factor analysis (CFA) is to use the number of parameters and assign at least five cases per parameter. Because the questionnaire has 100 parameters, we estimated 800 samples (eight cases per parameter) to be appropriate, but 880 individuals were selected as the sample size to be closer to the community distribution and random sampling, considering a loss rate of 10 % (29, 30). The exclusion criteria were staff reluctance to participate in the study, having less than six months of experience, and having a managerial position. To follow ethical considerations, necessary permission was obtained from the hospital authorities to conduct the

study. Anonymous questionnaires were provided to the nurses once the researcher explained the research objective, the optionality of participating in the study, and how to cooperate after obtaining their written consent. The confidentiality of the information was emphasized when distributing and collecting the research data. In this study, the nurses were divided into two groups: working in COVID-19 units (COVID-19 general units, COVID-19 intensive care units) and other units (inpatient non-COVID-19 units).

Data collection tools

This study used three questionnaires, the first dealing with the nurses' sociodemographic characteristics, and included nine items. The second questionnaire was on the patient safety indicators (self-designed) extracted upon reviewing the literature (31, 32). The patient safety indicators questionnaire included nine scales: pharmacological measures (14 questions), nursing care (22 questions), patient injury during care (seven questions), patient identification (seven questions), patient fall (seven questions), patient training (14 questions), diagnostic-therapeutic methods (seven questions), infection control (ten questions), and safe blood transfusion (12 questions). Five of the scales and their 60 subscales were adapted from Fakhrodin's research, four and 36 subscales were taken from the validation booklet of patient safety friendly hospitals (PSFHI), and four questions on oxygenation of patients were added. The questionnaire was designed to assess the number of nursing care errors during the previous month, and the items were measured based on the negative four-point Likert scale: never (score 1), 1-3 times (score 2), 3-5 times (score 3), and more than five times (score 4).

The third questionnaire addressed the predisposing factors of nursing errors (self-designed) extracted upon reviewing the literature (33). The questionnaire included five items: mental and physical conditions of nurses and their skills (six questions), team coordination (four questions), management (nine questions), patients (three questions), unit's physical and environmental conditions (seven questions), and the shifts in which medical errors occurred. The scoring method was as follows: very low (score 1), low (score 2), medium (score 3), high (score 4), and very high (score 5).

Ten faculty members confirmed the face validity and qualitative content of the questionnaire in this study. Cronbach's alpha was also used to measure the questionnaires' overall reliability, dimensions, and variables. To this end, the questionnaires were first provided to 30 people to measure overall and component reliability.

The reliability of the predisposing factors of the nursing errors questionnaire (0.87) and that of the Patient Safety indicators questionnaire (0.85) were obtained as well (Table 1). The Cronbach's alpha was more significant than 0.7, indicating the high reliability of the questionnaires. The Kolmogorov-Smirnov test was also used

to evaluate the normality of the research data. The significant numbers obtained were greater than 0.5, showing the normality of the data distribution.

The collected data were analyzed using the SPSS22 software. The analysis of variance, independent t-test, Spearman's correlation, and descriptive statistics such as frequency, mean, and standard deviation with a significance level of $p < 0.005$ were also used to analyze the data.

Table 1. Reliability coefficients of the Patient Safety indicator questionnaire components

Reliability coefficient	Dimensions
0/77	Pharmacological measures
0/83	Providing nursing care
0/73	Injury to the patient during care
0/75	Patient identification
0/77	Patient fall
0/76	Patient training by nurses
0/78	Diagnostic-therapeutic methods
0/82	Infection control
0/79	Safe blood transfusion
0/85	The whole questionnaire

Source: Own elaboration

Results

Of the 880 questionnaires, 80 were excluded from the study due to incomplete answers, and 800 individuals remained as the final samples. According to the demographic information, 502 (75.5%) of the participants were female, and 298 (24.5%) were male. Most participants were 31-35 years old ($n = 264$, 41%) and 434 were married (58.4%). Half of the participants ($n = 400$) were working in non-COVID-19 wards and caring for non-COVID-19 patients and 400 others (50%) were caring for the patients in COVID-19 wards, including general wards of COVID-19 ($n = 280$; 35%) and intensive care units of COVID-19 ($n = 120$; 15%). Of all the nurses, 408 (52%) had contracted the disease. The detailed personal information collected is listed in Table 2.

Table 2. Demographic characteristics of study participants (*n* = 800)

Variable	Categories	Frequency	Percentage (%)
Age (years)	30≥	247	36.8
	31-35	264	41
	36-40	163	15.7
	> 40	126	6.5
Gender	Male	298	24.5
	Female	502	75.5
Marital status	Single	366	42.6
	Married	434	58.4
Years of experience	≤ 5 years	250	31.25
	6-15 years	316	39.5
	> 15 years	234	29.25
Working unit	Non-COVID-19 units	400	50
	COVID-19 intensive care units	120	15
	COVID-19 general units	280	35
Employment status	Permanent	322	40.25
	Contractual	234	29.25
	Temporary	244	30.5
Highest level of education	Bachelor's	768	96
	Master's	32	4
Affected by COVID-19	Yes	408	52
	No	392	48
Number of patients cared for in shifts	≤ 5 patients	188	23.5
	6-10 patients	554	69.25
	> 10 patients	58	7.25

Source: Own elaboration

Analysis of nurses' sociodemographic factors on patient safety

The results of the study in terms of the effect of the nurses' gender on patient safety showed no significant difference between the safety of the patients and male (3.58 ± 0.22) and female (3.57 ± 0.22) genders.

Considering the effect of the nurses' disease on patient safety, the safety of the patients cared for by the nurses who previously contracted COVID-19 and those who did not contract the disease was 3.45 ± 0.25 and 0.65 ± 0.16, respectively. The patients receiving care from the nurses whom COVID-19 did not infect had higher safety than those under care by the nurses previously infected by the disease.

Patient safety was higher in the units where the number of patients under the care of a nurse was ≤ 5 (3.63 ± 0.15) compared to the units where more than five patients were cared for by a nurse (3.01 ± 0.23), and the independent t-test (*DF* = 413, *p* = 0.00, *t* = 4) showed a significant difference. According to the results, patient safety was

affected by the number of patients cared for by a nurse, and it was higher in the units with fewer patients.

The results also showed that working extra shifts affected patient safety, and the patients cared for by the nurses who worked overtime had lower safety (3.43 ± 0.23) than those under the care of the nurses who did not (3.61 ± 0.05).

Analysis of patient safety indicators in hospitalized patients with COVID-19 and patients without COVID-19

Table 3 shows the findings related to identifying different patient safety dimensions from the perspective of the nurses working in COVID-19 and non-COVID-19 units. As shown in the table, the mean score and standard deviation of patient safety in all hospitalized patients were 3.56 ± 0.22, while those of the patients admitted to non-COVID-19 units were 3.74 ± 0.06. In addition, the mean score and standard deviation of the patients admitted to COVID-19 units were 3.42 ± 0.17.

According to the results, the mean scores of patient safety indicators in COVID-19 and non-COVID-19 patients admitted to hospitals were 3.42 ± 0.17 and 3.74 ± 0.06, respectively, and the safety of the patients admitted to COVID-19 units was lower than those admitted to non-COVID-19 units. In this regard, the independent t-test (DF = 463; P = 0.00; t = 28) showed a significant difference.

The safety of the patients admitted to general units of COVID-19 was lower than those admitted to intensive care units of COVID-19, and the independent t-test (DF = 230; P = 0.00; t = 8.) showed a significant difference in patient safety based on hospitalization in intensive care and general units of COVID-19.

Blood transfusion (3.86) and pharmacological measures (3.18) respectively accounted for the highest and lowest patient safety scores of all the patients.

Table 3. Comparison of patient safety indicators scores of COVID-19 and non-COVID-19 patients

Patient safety indicators	Scores of all hospitalized patients	COVID-19 patients' safety scores			Non-COVID-19 patients' safety score	P-value
		Patients in COVID-19 general units	Patients in COVID-19 intensive care units	All COVID-19 patients		
	Mean.SD	Mean.SD	Mean.SD	Mean.SD	Mean.SD	
Pharmacological measures	0.42±3.18	0.38±2.87	0.38 ±3.07	0.39±2.97	0.22±3.40	**< 0.005**
Provide nursing care	0.35±3.52	0.33±3.22	0.22 ±3.47	0.33±3.34	0.18±3.76	**< 0.005**

Patient safety indicators	Scores of all hospitalized patients	COVID-19 patients' safety scores			Non-COVID-19 patients' safety score	P-value
		Patients in COVID-19 general units	Patients in COVID-19 intensive care units	All COVID-19 patients		
	Mean.SD	Mean.SD	Mean.SD	Mean.SD	Mean.SD	
Injury to the patient during care	0.17±3.56	0.22 ±3.46	0.12±3.48	0.19±3.47	0.07±3.68	**< 0.005**
Patient identification	0.16±3.82	0.18±3.71	0.12±3.80	0.19±3.75	0.09±3.92	**< 0.005**
Patient fall	0.27±3.61	0.21±3.40	0.13±3.81	0.26±3.60	0.12±3.96	**< 0.005**
Nurse-to-patient training	0.18±3.57	0.21±3.46	0.17±3.55	0.12±3.48	0.23±3.64	**< 0.005**
Diagnostic-therapeutic methods	0.31±3.56	0.32±3.44	0.29±3.58	0.32±3.51	0.13±3.60	**< 0.005**
Infection control	0.42±3.31	0.27±2.98	0.39±3.02	0.33±2.99	0.15±3.67	**< 0.005**
Safe blood transfusion	0.24±3.86	0.28±3.65	0.13±3.87	0.20±3.74	0.11±3.98	**< 0.005**
Patient safety	0.22±3.56	0.21±3.35	0.14±3.51	0.17±3.42	0.06±3.74	**< 0.005**

SD: Standard deviation. A four-point scoring method with points ranging from 1 to 4.

Source: Own elaboration.

The nurses determined that the highest mean differences between the patient safety scores of COVID-19 and non-COVID-19 patients were those of infection control (0.66) and patient fall (0.56), respectively.

The most significant mean differences between the patient safety scores of the patients admitted to non-COVID-19 units and intensive care units of COVID-19, determined by the nurses, were those of infection control (0.65) and pharmacological measures (0.33)

The results of the ANOVA test in Table 3 show a significant difference between the mean scores of pharmacological measures, provision of nursing care, injury to patients during care, patient identification, patient falls, nurse-to-patient training, diagnostic-therapeutic methods, infection control, and safe blood transfusion among COVID-19 and non-COVID-19 patients admitted to the hospitals.

Analysis of common causes of nursing errors

As shown in Table 4, the most and the least common predisposing factors of nursing errors determined by the nurses were mental and physical conditions of nurses and their skills (category 1), i.e., fatigue and lack of acquaintance with professional rules and regula-

tions, team coordination (category 2), i.e., inappropriate relationships between team members and lack of patient involvement in the care process, management aspects (category 3), i.e., high workloads for nurses and lack of policies and guidelines, patient conditions (category 4), i.e., a large number of patients and improper behavior of patients and their relatives, and physical and environmental conditions of the unit (category 5), i.e., working night shifts, drowsiness, and poor lighting.

From the nurses' viewpoint, the most and the least common causes of nursing errors were related to management aspects (2.67 ± 1.39) and the environmental conditions of the unit (2.38 ± 1.25), respectively. the most common reasons for nursing errors were high workload, low ratio of nurses to patients, and fatigue. According to the results, most errors occurred during night shifts (71%).

Table 4. Common causes of nursing errors from nurses' viewpoints

Items	Predisposing factors of nursing errors	very low Frequency (%)	low Frequency (%)	medium Frequency (%)	high Frequency (%)	very high Frequency (%)	Mean ± SD
Nurses' responses to items related to mental and physical conditions of nurses and their skills	Stress	128(16.1)	198(24.1)	178(22.3)	158(19.5)	138(17.3)	2.61 ± 1.09
	Fatigue	188(23)	208(25.3)	118(13.8)	148(18.5)	148(18.4)	2.83 ± 1.44
	Distraction	218(26.4)	261(32.6)	178(22.3)	88(11.5)	55(6.9)	2.44 ± 1.28
	Lack of adequate skills in performing some procedures	278(33.3)	178(22.3)	198(24.1)	128(16.1)	28(3.4)	2.33 ± 1.12
	Lack of personal motivation and interest in the profession	268(32.2)	178(22.3)	128(16.1)	88(11.5)	138(17.2)	2.59 ± 1.48
	Lack of acquaintance with the professional rules and regulations	338(40.2)	208(25.3)	148(18.5)	78(10.3)	28(3.4)	2.09 ± 1.05
Nurses' responses to items related to team coordination	Inappropriate relationships between team members	158(19.5)	148(18.4)	218(25.3)	138(17.2)	138(17.2)	2.72 ± 1.11
	Trust in others' judgments	138(17.2)	238(28.7)	228(27.6)	179(22.6)	31(3.9)	2.51 ± 1.46
	Improper division of duties beyond work abilities by the unit supervisor	148(18.5)	263(32.7)	198(24.1)	154(19.2)	37(4.6)	2.42 ± 1.06
	No involvement of patient in the care process	338(40.2)	208(25.3)	148(18.5)	78(10.3)	28(3.4)	2.09 ± 1.05
Nurses' responses to items related to management	Low ratio of nurses to patients	238(28.7)	138(17.2)	118(14.9)	128(16.1)	178(21.8)	2.84 ± 1.47
	Lack of policies and guidelines	178(21.8)	258(31)	188(23)	68(9.2)	28(3.4)	2.33 ± 1.15
	Inappropriate organization of nursing personnel in the unit	188(23)	198(24.1)	128(16.1)	168(20.7)	118(14.9)	2.80 ± 1.40
	Compulsion to perform several tasks simultaneously	128(16.1)	198(24.1)	218(26.4)	158(19.5)	28(3.4)	2.66 ± 1.40
	Long and burst shifts	158(19.5)	198(24.1)	178(22.3)	158(19.5)	108(13.5)	2.61 ± 1.19
	Lack of exact job description for nursing personnel	218(26.4)	218(26.4)	128(16.1)	98(12.6)	138(17.3)	2.67 ± 1.43
	High workloads for nurses	68(9.2)	138(17.2)	128(16.1)	198(24.1)	188(23)	2.89 ± 1.51
	Lack of proper education system in the hospital	268(32.2)	158(19.5)	148(18.5)	118(14.9)	108(13.8)	2.58 ± 1.46
	Absence of staff trained and expert in the specialized care	268(32.2)	178(22.3)	128(16.1)	98(12.6)	138(17.2)	2.59 ± 1.48

Items	Predisposing factors of nursing errors	very low	low	medium	high	very high	Mean ± SD
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
Nurses' responses to items related to conditions of patients	Unstable patient status	138(17.2)	238(28.7)	228(27.6)	98(12.6)	28(3.4)	2.51 ± 1.07
	Large number of patients	268(32.2)	108(13.8)	98(12.6)	158(19.5)	168(20.7)	2.82 ± 1.57
	Improper behavior of patients and their relatives	285(35.6)	239(29.9)	148(18.5)	108(13.8)	20(2.3)	2.12 ± 1.16
Nurses' responses to items related to the unit's environmental conditions	Working night shifts and drowsiness	118(14.9)	208(25.3)	208(25.3)	128(16.1)	138(17.2)	2.74 ± 1.14
	No visibility of all nursing units from the nursing station	218(26.4)	218(26.4)	128(16.1)	98(12.6)	138(17.2)	2.67 ± 1.43
	Lack of standard devices and advanced medical supplies	268(32.2)	158(19.5)	148(18.5)	118(14.9)	108(13.8)	2.58 ± 1.43
	Lack of sufficient time to evaluate and monitor patients	288(34.5)	168(21)	158(19.5)	140(17.5)	46(5.7)	2.39 ± 1.26
	Small area of medication room	338(40.2)	208(25.3)	148(18.5)	68(9.2)	37(4.6)	2.10 ± 1.16
	Poor lighting	338(4.2)	208(25.3)	148(18.5)	78(10.3)	28(3.4)	2.09 ± 1.16
	Inappropriate organization and placement of medical supplies	298(35.4)	248(31)	158(19.5)	59(7.5)	37(4.6)	2.13 ± 1.14

SD: Standard deviation. A five-point scoring method with points ranging from 1 to 5

Source: Own elaboration

Correlation analysis of patient safety questionnaire dimensions with each other and with the result of the study (patient safety)

In Table 5, the results of the Spearman's test show that all dimensions of the patient safety questionnaire significantly correlated with each other and with the study outcome (patient safety). The correlation scores of the questionnaire dimensions and patient safety ranged from $r = 0.46$ to $r = 0.87$.

Table 5. Findings on the correlation between the scores of safety dimensions and the total score of patient safety

J	I	H	G	F	E	D	C	B	A	Safety indicators
									1	A: Pharmacological measures
								1	0.571	B: Providing nursing care
							1	0.596	0.432	C: Injury to patient during care
						1	0.420	0.268	0.435	D: Patient identification
					1	0.483	0.596	0.689	0.471	E: Patient fall
				1	0.519	0.406	0.494	0.601	0.775	F: Nurse-to-patient training
			1	0.532	0.238	0.454	0.496	0.295	0.478	G: Diagnostic-therapeutic methods
		1	0.410	0.763	0.629	0.396	0.547	0.693	0.611	H: Infection control
	1	0.498	0.469	0.433	0.349	0.426	0.579	0.610	0.375	I: Safe blood transfusion
1	0.558	0.876	0.598	0.866	0.695	0.463	0.631	0.739	0.740	J: Total score of patient safety

Source: Own elaboration

Discussion

This study mainly discussed the patient safety indicators in hospitalized patients with COVID-19 compared to those without COVID-19 and the most common predisposing factors of nursing errors. Unfortunately, due to the novelty of the disease, the researcher could not find any domestic or foreign articles or research on the safety of hospitalized COVID-19 patients compared to other admitted ones to compare results.

The findings of this study showed a significant difference between the mean scores of patient safety indicators (pharmacological measures, providing nursing care, injury to the patient during care, patient identification, patient fall, nurse-to-patient training, diagnostic-therapeutic methods, infection control, and safe blood transfusion) in COVID-19 patients compared to non-COVID-19 ones admitted to hospitals.

According to the results, the mean score of safety indicators of the patients admitted to non-COVID-19 units was higher than those admitted to COVID-19 units, showing better observance of patient safety indicators in non-COVID-19 patients compared to the other group. Similar studies on COVID-19 patients hospitalized and isolated in the under-pressure health care system showed that isolation could be associated with patient safety incidents (34-36). In line with the results of this study, the study by Henry Thomas Stelfox et al. (2003) found out that isolated patients had experienced twice as many preventable side effects as non-isolated ones and expressed greater dissatisfaction with treatment (37). The findings of the study by Jiménez-Pericás et al. (2020) showed more adverse effects in isolated patients than non-isolated ones (38). In their study, Bruyneel et al. (2021) stated that COVID-19 patients admitted to the intensive care unit (ICU) required more nursing time than those without COVID-19 in the ICU (39). In addition, the findings by Hamamoto al. (2021) indicated that more nursing staff was required to care for patients critically ill with coronavirus disease in intensive care units (40).

Health care workers have struggled to connect, touch, engage, and communicate with COVID-19 patients behind their protective equipment (41). Lower safety of COVID-19 patients compared to non-COVID-19 patients could be due to the need for more nursing time and nurses' high workload and fear of getting the disease.

Based on the results, the mean score of patient safety indicators in the patients admitted to COVID-19 intensive care units was higher than those admitted to COVID-19 available units, showing better observance of patient safety indicators in intensive care units compared with the inpatient ones. The results of the study by Marzban et al. (2013) showed that the mean rate of injury to patients due to hospital errors was lower in inpatient units than

in ICUs, which is not consistent with the results of the present study on the safety of the patients hospitalized in inpatient units and special units (42). Lower safety of the patients admitted to general units of COVID-19 compared to those admitted to intensive care units of COVID-19 could be due to the lack of beds in ICUs and hospitalization of critically-ill patients in general units, and the inappropriate ratio of nurses to patients in general units compared to ICUs.

The results also showed that the number of patients under care by a nurse affected patient safety. In other words, patient safety was higher in the units where the number of patients under care by a nurse was smaller, and in ICUs, there was an optimal ratio between the number of nurses and patients. In their study, Saleh et al. (2015) stated that sufficient nursing personnel and appropriate nurse-to-patient ratios were related to improved patient outcomes, including lower mortality rates, which is consistent with the results of the present study (43).

The results of this study showed that blood transfusion and pharmacological measures accounted for the highest and the lowest scores of patient safety indicators in all admitted patients, respectively. Aranaz-Andre et al. (2008) studied the adverse effects of health care in Spain and stated that most errors were attributed to pharmacological care, which is consistent with the results of the present study (44).

The most remarkable mean differences in patient safety indicators among the patients admitted to non-COVID-19 units and those admitted to general units of COVID-19 were attributed to infection control and patient fall, respectively, which showed more errors in infection control and more falls of the patients admitted to general units of COVID-19 compared to other units. In previous studies, nosocomial infections and patient falls were the most common medical errors (45). Regarding infection control, decreased safety of the patients admitted to COVID-19 units compared with those in non-COVID-19 units could be due to the highly contagious nature of the disease and the fear of health care providers of getting infected. Thus, they did not spend sufficient time caring for the patients to avoid catching the disease, did not observe hand hygiene, and did not change gloves when going from one patient to another. Most patients admitted with COVID-19 were elderly and unaccompanied (46). Thus, the risk of falls in COVID-19 patients was higher than in other patients due to age and lack of companions.

The results showed that the safety of patients cared for by nurses who did not contract COVID-19 was higher than that of patients cared for by nurses who previously contracted the disease. Thus, the safety of the health workers directly affected patient safety. Health and safety hazards threatening health workers could be associated with patient risks. Mohammad Nahal et al. (2021) showed high

burnout and low productivity rates among the nurses infected with COVID-19 (13). The study by Magnavita et al. (2020) showed a higher rate of physical symptoms, anxiety, and depression in health care providers infected with COVID-19 (47). According to the results, if health care providers were not safe, they would not be able to provide quality and safe patient care.

Since all the processes of providing health services are associated with a degree of insecurity and risk, patient safety is one of the most basic principles of providing services in health centers. From nurses' viewpoint, the most and the least common causes of nursing errors were related to management aspects and the environmental conditions of the unit, respectively. Cause and effect models indicate that at least 98 % of accidents occur due to human error and poor management (48). Like the present study's findings, the most common cause of nursing errors determined by Zeighami et al. (2016) was related to management aspects. Managers played a crucial role in preventing nursing errors. They were usually responsible for guided and controlled use of protocols, policies, and standards to prevent nursing personnel errors (33).

In a similar study conducted in 2012, Baghaei et al. examined critical care nurses' perception of nursing errors and reported that environment was the most important predisposing factor in nursing errors. Their finding contrasts with the present study's results (49). The organizations have been created to achieve some goals, and the success rate in achieving the organizational objectives is directly related to the performance of labor, especially managers. As the prominent people deciding on facing various within and outside organization problems, managers play a considerable and determining role in the success and failure of the organization and performing their duty. The higher the governance and leadership in the hospital, the higher the patient safety performance will be.

The most common reasons for nurses' errors were high workload, low ratio of nurses to patients, and fatigue. In their study, Azarabadi et al. (2018) reported that high workload, a large number of patients, and fatigue were the most contributing factors to errors, which is consistent with the results of the present study (50). In line with the results of this study, Zarea et al. (2018) stated that the most common reasons for medical errors were low nurse-to-patient ratio, high workload, and fatigue caused by extra work (51).

According to the results, most nursing errors occurred during night shifts. In line with the results of the present study, Khammarnia et al. (2021) stated that the incidence of medical errors in night shifts was higher than in any other shifts (52).

Conclusion

The COVID-19 pandemic is a global crisis that has caused some gaps in the health systems and threatened the quality of patient care and the safety of the staff and patients. Evaluation of fundamental patient safety indicators and predisposing factors in nursing errors in this study revealed the gaps in this area of the health system. The results of this study showed that the safety of the patients admitted with COVID-19 was lower than that of other hospitalized patients, and they were more likely than other hospitalized patients to experience the adverse effects of health services. Therefore, the safety of COVID-19 patients needs to be seriously improved. It is advisable to develop strategies for better interventions and transformation procedures targeting the promotion of patient safety, especially in isolated patients.

From the nurses' viewpoint, the most common causes of nursing errors were related to management aspects. The hospital managers' performance weakness wastes the financial and human resources and reduces efficiency. If the system for evaluating the performance of the hospitals' managers were efficient and there were tangible and computable indicators for evaluating their work, many costs in the hospitals could be reduced, and better services provided to covered hospitals since providing adequate services is related to sound and effective management.

The results showed that the safety of nurses directly affected patient safety, and from the nurses' viewpoint, the most common predisposing factors of nursing errors were high workload, low ratio of nurses to patients, and fatigue. In addition, most nursing errors occur on the night shift. Therefore, by improving work processes, creating safe and appropriate work environments, training the staff, and increasing nurses' motivation and safety, the authorities should pave the way to reduce nursing errors and increase patient safety. Also, to reduce nurses' workload, the number of staff required to care for patients should be proportional to the number of patients, level of disease, care environment conditions, and work shifts.

To increase the safety of the patients admitted with COVID-19 and other infectious diseases, health officials need to be prepared and provide special wards to isolate such patients in appropriate conditions. Finally, we hope that the authorities will use this research to reduce the predisposing factors of nursing errors and increase the safety of patients and nurses in hospitals.

Limitations of the study

One limitation of the present research was the data collection method through a self-report questionnaire that might lead to over-reporting or under-reporting. We suggest that future studies review patient records and report errors to measure patient safety.

The research tool (Patient Safety indicators questionnaire and predisposing factors of nursing errors questionnaire) has been developed by the researcher; we recommend that the tool be validated in different ways in future studies.

Conflicts of interest: The authors declared no conflict of interest.

References

1. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J. Autoimmun. 2020;109:102433. DOI: https://doi.org/10.1016/j.jaut.2020.102433

2. Gorbalenya AE, Baker SC, Baric R, Groot RJd, Drosten C, Gulyaeva AA, et al. Severe acute respiratory syndrome-related coronavirus: The species and its viruses–a statement of the Coronavirus Study Group. 2020. DOI: https://doi.org/10.1101/2020.02.07.937862

3. World Health Organization. COVID-19 Coronavirus pandemic 2021. Retrieved from World meters, November 22, 2021. Available from: https://www.worldometers.info/coronavirus.

4. del Carpio-Toia AM, del Carpio LBM, Mayta-Tristan P, Alarcón-Yaquetto DE, Málaga G. Workplace violence against physicians treating covid-19 patients in peru: a cross-sectional study. Jt. Comm. J. Qual. Patient Saf.. 2021. DOI: https://doi.org/10.1016/j.jcjq.2021.06.002

5. Bulut C, Kato Y. Epidemiology of COVID-19. J. Med. Sci. 2020;50. DOI: https://doi.org/10.3906/sag-2004-172

6. Lai C-C, Wang C-Y, Wang Y-H, Hsueh S-C, Ko W-C, Hsueh P-R. Global epidemiology of coronavirus disease 2019: disease incidence, daily cumulative index, mortality, and their association with country healthcare resources and economic status. Int J Antimicrob Agents. 2020;55(4). DOI: https://doi.org/10.1016/j.ijantimicag.2020.105946

7. Gutiérrez-Cía I, Aibar-Remón C, Obón-Azuara B, Urbano-Gonzalo O, Moliner-Lahoz J, de Castro MG-V, et al. Aislamiento del paciente crítico:¿ riesgo o protección? J Healthc Qual Res. 2018;33(5):250-5. DOI: https://doi.org/10.1016/j.jhqr.2018.06.003

8. Teare E, Barrett S. Controversies: Is it time to stop searching for MRSA?: Stop the ritual of tracing colonised people. BMJ. 1997;314(7081):665. DOI: https://doi.org/10.1136/bmj.314.7081.665

9. Willis E, Harvey C, Thompson S, Pearson M, Meyer A. Work intensification and quality assurance: missed nursing care. J Nurs Care Qual. 2018;33(2):E10–E16. DOI: https://doi.org/10.1097/NCQ.0000000000000277

10. Anoosheh M, Ahmadi F, Faghihzadeh S, Vaismoradi M. Causes and management of nursing practice errors: a questionnaire survey of hospital nurses in Iran. International nursing review. 2008;55(3):288-95. DOI: https://doi.org/10.1111/j.1466-7657.2008.00623.x

11. Milos P, Larraín AI. The Ethical-Legal Link between Care Management and Risk Management in the Context of Patient Safety. Aquichan. 2015;15(1):141-53. DOI: https://doi.org/10.5294/aqui.2015.15.1.13

12. Butt C. Aspects of Palliative Care Nursing in the Time of COVID-19. Aquichan. 2021;21(1):1. DOI: https://doi.org/10.5294/aqui.2021.21.1.1

13. Mohammadnahal L, Mirzaei A, Khezeli MJ. The effect of caring for covid 19 patients on nurses'productivity and burnout. JNMS. 2021;18(11):859.

14. Al Maqbali M, Al Khadhuri J. Psychological impact of the coronavirus 2019 (COVID-19) pandemic on nurses. Japan Journal of Nursing Science. 2021:e12417. DOI: https://doi.org/10.1111/jjns.12417

15. Mo Y, Deng L, Zhang L, Lang Q, Liao C, Wang N, et al. Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. J Nurs Manag. 2020;28(5):1002-9. DOI: https://doi.org/10.1111/jonm.13014

16. Nemati M, Ebrahimi B, Nemati F. Assessment of Iranian nurses' knowledge and anxiety toward COVID-19 during the current outbreak in Iran. Arch Clin Infect Dis. 2020;15(COVID-19). DOI: https://doi.org/10.5812/archcid.102848

17. Wu Y, Wang J, Luo C, Hu S, Lin X, Anderson AE, et al. A comparison of burnout frequency among oncology physicians and nurses working on the front lines and usual wards during the COVID-19 epidemic in Wuhan, China. J Pain Symptom Manage. 2020;60(1):e60-e65. DOI: https://doi.org/10.1016/j.jpainsymman.2020.04.008

18. Panagioti M, Geraghty K, Johnson J, Zhou A, Panagopoulou E, Chew-Graham C, et al. Association between physician burnout and patient safety, professionalism, and patient satisfaction: a systematic review and meta-analysis. JAMA internal medicine. 2018;178(10):1317-31. DOI: https://doi.org/10.1001/jamainternmed.2018.3713

19. Li L, Sun N, Fei S, Yu L, Chen S, Yang S, et al. Current status of and factors influencing anxiety and depression in front-line medical staff supporting Wuhan in containing the novel coronavirus pneumonia epidemic. Japan Journal of Nursing Science. 2021;18(2):e12398. DOI: https://doi.org/10.1111/jjns.12398

20. World Health Organization (2020). health worker safety: a priority for patient safety. Available from: https://www.who.int/campaigns/world-patient-safety-day/2020

21. World Health Organization (2021). WHO Global Patient Safety Network Webinar. Patient safety implications during the COVID-19 pandemic. Available from: https://www.who.int/patientsafety/partnerships/GPSN-webinars/en/

22. Cook T, Kursumovic E, Lennane S. Exclusive: deaths of NHS staff from covid-19 analysed. HSJ. 2020. DOI: https://doi.org/10.1111/anae.15116

23. Zhao C, Chang Q, Zhang X, Wu Q, Wu N, He J, et al. Evaluation of safety attitudes of hospitals and the effects of demographic factors on safety attitudes: a psychometric validation of the safety attitudes and safety climate questionnaire. BMC health services research. 2019;19(1):1-11. DOI: https://doi.org/10.1186/s12913-019-4682-0

24. Rafiei H, Abdar ME, Iranmanesh S, Lalegani H, Safdari A, Dehkordi AH. Knowledge about pressure ulcer prevention, classification and management: A survey of registered nurses working with trauma patients in the emergency department. International Journal of Orthopaedic and Trauma Nursing. 2014;18(3):135-42. DOI: https://doi.org/10.1016/j.ijotn.2014.03.004

25. National Academies of Sciences E, Medicine. Crossing the global quality chasm: Improving health care worldwide. 2018. DOI: https://doi.org/10.17226/25152

26. Slawomirski L, Auraaen A, Klazinga NS. The economics of patient safety: Strengthening a value-based approach to reducing patient harm at national level. 2017;96:67. DOI: https://doi.org/10.1787/5a9858cd-en

27. de Vries EN, Ramrattan MA, Smorenburg SM, Gouma DJ, Boermeester MA. The incidence and nature of in-hospital adverse events: a systematic review. BMJ Qual Saf. 2008;17(3):216-23. DOI: https://doi.org/10.1136/qshc.2007.023622

28. Salih SA, Reshia FAA, Bashir WAH, Omar AM, Elwasefy SA. Patient safety attitude and associated factors among nurses at Mansoura University Hospital: A cross sectional study. International Journal of Africa Nursing Sciences. 2021;14:100287. DOI: https://doi.org/10.1016/j.ijans.2021.100287

29. Khalesi N, Arabloo J, Khosravizadeh O, Taghizadeh S, Heyrani A & Ebrahimian A. Psychometric properties of the Persian version of the "hospital ethical climate survey". Journal of Medical Ethics and History of Medicine 2014;7(1):15.

30. Gandra S, Barysauskas CM, Mack DA, Barton B, Finberg R, Ellison RT. Impact of elimination of contact precautions on non-infectious adverse events among MRSA and VRE patients. ICHE. 2018;39(10):1272-3. DOI: https://doi.org/10.1017/ice.2018.204

31. Ahmad Fkhrodin S, Salehi S, Nekavand M. Comparison of evaluation of patient safety assessment indicators in special sections hospitals private and educational ahvaz university of medical sciences in 2019. JNMS. 2021;18(11):832-9.

32. Ravaghi H, Sadat M, Mostofian F, Vazirian S, Heydarpoor P. Assessment of Patient Safety in Hospitals. 1st edition. Tehran: Minis health med edu. 2011.

33. Zeighami R, Shokati Ahmadabad M, Mohammadian A, Alipoor Heydari M, Rafiei H. Nursing errors and effect on health care: Perception of risk factors from view of nurse in Qazvin. International Journal of Epidemiologic Research. 2016;3(1):26-32.

34. Tran K, Bell C, Stall N, Tomlinson G, McGeer A, Morris A, et al. The effect of hospital isolation precautions on patient outcomes and cost of care: a multi-site, retrospective, propensity score-matched cohort study. J Gen Intern Med. 2017;32(3):262-8. DOI: https://doi.org/10.1007/s11606-016-3862-4

35. Guilley-Lerondeau B, Bourigault C, des Buttes A-CG, Birgand G, Lepelletier D. Adverse effects of isolation: a prospective matched cohort study including 90 direct interviews of hospitalized patients in a French University Hospital. Eur J Clin Microbiol. 2017;36(1):75-80. DOI: https://doi.org/10.1007/s10096-016-2772-z

36. Martin EM, Bryant B, Grogan TR, Rubin ZA, Russell DL, Elashoff D, et al. Noninfectious hospital adverse events decline after elimination of contact precautions for MRSA and VRE. ICHE. 2018;39(7):788-96. DOI: https://doi.org/10.1017/ice.2018.93

37. Stelfox HT, Bates DW, Redelmeier DA. Safety of patients isolated for infection control. Jama. 2003;290(14):1899-905. DOI: https://doi.org/10.1001/jama.290.14.1899

38. Jiménez-Pericás F, de Castro MTGV, Pastor-Valero M, Remón CA, Miralles JJ, García MdCM, et al. Higher incidence of adverse events in isolated patients compared with non-isolated patients: a cohort study. BMJ open. 2020;10(10):e035238. DOI: https://doi.org/10.1136/bmjopen-2019-035238http://dx.doi.org/10.1136/bmjopen-2019-035238

39. Bruyneel A, Gallani M-C, Tack J, d'Hondt A, Canipel S, Franck S, et al. Impact of COVID-19 on nursing time in intensive care units in Belgium. Intensive and Critical Care Nursing. 2021;62:102967. DOI: https://doi.org/10.1016/j.iccn.2020.102967

40. Hamamoto M, Unoki T, Tamoto M, Sakuramoto H, Kawai Y, Miyamoto T, et al. Survey on the actual number of nurses required for critical patients with COVID-19 in Japanese intensive care units: Preliminary report. Japan Journal of Nursing Science. 2021;e12424. DOI: https://doi.org/10.1111/jjns.12424

41. Sonis JD, Kennedy M, Aaronson EL, Baugh JJ, Raja AS, Yun BJ, et al. Humanism in the age of COVID-19: renewing focus on communication and compassion. West J Emerg Med. 2020;21(3):499. DOI: https://doi.org/10.5811/westjem.2020.4.47596

42. Marzban S, Maleki M, Nasiri pour A, Jahangiri K. Assessment of patient safety management system in ICU. J Qazvin Univ Med Sci. 2013;17(5):4-12.

43. Saleh AM, Darawad MW, Al-Hussami M. The perception of hospital safety culture and selected outcomes among nurses: An exploratory study. Nursing & health sciences. 2015;17(3):339-46. DOI: https://doi.org/10.1111/nhs.12196

44. Aranaz-Andrés JM, Aibar-Remón C, Vitaller-Murillo J, Ruiz-López P, Limón-Ramírez R, Terol-García E, et al. Incidence of adverse events related to health care in Spain: results of the Spanish National Study of Adverse Events. Journal of Epidemiology & Community Health. 2008;62(12):1022-9. DOI: https://doi.org/10.1136/jech.2007.065227

45. Alizadeh AM, Davari F, Mansouri M, Mohammadnia M. Analysis of medical errors: a case study. J Med Ethics. 2017;10(38):59-68. DOI: https://doi.org/10.21859/mej-103859

46. Guan W-j, Ni Z-y, Hu Y, Liang W-h, Ou C-q, He J-x, et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med Overseas Ed. 2020;382(18):1708-20. DOI: https://doi.org/10.1056/NEJMoa2002032

47. Magnavita N, Tripepi G, Di Prinzio RR. Symptoms in health care workers during the COVID-19 epidemic. A cross-sectional survey. Int J Environ Res Public Health. 2020;17(14):5218. https://doi.org/10.3390/ijerph17145218

48. Walleth, Yan. J. Translated, by: Lahijanian. Safety Systems. H. 1st Edition. Science and industry University. 2000, Page: 1-3 BASNEF model and its improvement in the Personnel working in production line of Kimia co. 2005; [1]. [Master Thesis]. Iran Medical University. Available from: http://www.echemica.com/

49. Bagaei R, Nadari Y, Khalkhali H. Evaluation of predisposing factors of nursing errors in critical care units of urmia medical science university hospitals. Nursing And Midwifery Journal. 2012;10(3):0-.

50. Azarabad S, Zaman S, Nouri B, Valiee S. Frequency, causes and reporting barriers of nursing errors in the operating room students. rme.gums. 2018;10(2):18-27. DOI: https://doi.org/10.29252/rme.10.2.18

51. Zarea K, Mohammadi A, Beiranvand S, Hassani F, Baraz S. Iranian nurses' medication errors: A survey of the types, the causes, and the related factors. International journal of Africa nursing sciences. 2018;8:112-6. DOI: https://doi.org/10.1016/j.ijans.2018.05.001

52. Khammarnia M, Ansari-Moghaddam A, Setoodehzadeh F, Rezaei K, Clark C, Peyvand M. A Systematic Review and Meta-analysis of the Medical Error Rate in Iran: 2005-2019. QMHC. 2021;30(3):166-175. DOI: https://doi.org/10.1097/QMH.0000000000000304