

The Association of Nursing Workloads, Organizational, and Individual Factors with Adverse Patient Outcome

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Abstract

Introduction: Adverse patient outcomes have become a big concern in the quality of healthcare. Different factors can have an impact on the variety and rate of adverse patient outcomes.

Objectives: The present study aimed at determining the rate of patient safety during events and evaluating nursing workloads as well as identifying the main factors that affect the incidence rate of patient safety events among nurses.

Methods: This cross-sectional study was conducted on 293 nurses working in 24 wards of Baqiyatallah hospital in Tehran, Iran, in 2016. The sampling method was stratified random sampling. Data were collected using a self-administered questionnaire, which was classified into 4 subtitles: Individual and organizational characteristics, perceived subjective, objective workloads, and some patient safety events during the past 6 months. Binary and multiple regressions were used to survey the relationship between variables using the SPSS Version 23 software.

Results: Bloodstream infection, pressure ulcer, and patient falls were the most reported adverse outcomes during the past 6 months with 76.1%, 66.2%, and 59%, respectively. At least one of the 6 adverse outcomes was reported by nurses within the range of 45%-77%. Of all individual characteristics, the only significant relationship occurred between work experience and bloodstream infection (P value = 0.28 and 0.32). No significant relationship was detected between adverse patient outcomes and objective workloads. Regression models revealed that the subjective workload of adverse patient outcomes increased with making adjustments in the individual and organizational characteristics. The incidence rates of adverse outcomes were 5.69-9.78 times more than the fixed shifts in all rotational shift works.

Conclusions: The nurses reported a high incidence rate of all patient safety events, and the results revealed that the objective workload could not be a predictor for patient adverse events. According to the findings, subjective workload and work shift were significantly related to the incidence rate of adverse patient events. In conclusion, good regulation of sleep-wake cycles can be an important factor for decreasing the rate of adverse patient events.

Keywords: Workload, Patient Safety, NASA TLX, Incidence Rate

1. Introduction

Patient safety has become a hot topic for discussion among healthcare organizations worldwide (1, 2), and this affects all countries irrespective of their levels of development (3). Even though it was difficult to estimate the details of the problem, perhaps millions of patients suffered from disabilities, injuries, or even deaths (4). The incidence rate of adverse outcomes was used as an index for patient safety in hospitals (5). Patient safety incidents or adverse patient events were defined as any unintentional or unexpected event that could result from treatments provided by healthcare staff which was not related to the patient's main sickness (6). Those adverse outcomes result in injuries affecting one or several patients, or can be poten-

tially dangerous (7, 8). When adverse events are not controlled or prevented, they lead to long-term hospitalization, death, disability at discharge time, or changes in primary treatments (9, 10). In developed countries, the incident ranges from 3.5% in the U.S. (11), 9.2% in Canada (12), to 12.3% in Sweden (13).

In spite of the lack of studies in developing countries, more studies have been conducted in developed countries. A study conducted in 2012 has shown that at least one adverse event in 8.2% different developing countries, ranging from 2.5% to 18.4%, out of 15,548 reports in total was different; more than 30% resulted in a patient's death and three-fourth of them were preventable (14). The study showed that death and preventable adverse events in developing countries were considerably higher than in devel-

oped countries (15).

Infections, misdiagnosis, delay in treatment, injuries caused by improper utilization of medical equipment, and damages due to medication errors during the treatments are common preventable harms among patients (4). Some strategies have been designed to avoid, prevent, and minimize the adverse events (16, 17). Giles et al. (2015) in their review, found that organizational healthcare factors (staff workload, education/training, access/usage of equipment and supplies, environmental characteristics, political issues, administration/leadership), special hygiene factors (inexperience, stress, personal attitudes), and patients' individual factors (personality, multimorbidity) affected patient safety events (18).

Nurses play key roles in patient safety. Therefore, among organizational factors, level of nurse staffing, workload, and education are the most important items that are associated with patient safety outcomes (2, 19). Patient safety is important to all healthcare staff although nursing personnel have the most reports of adverse patient events due to their proximity and interaction with patients (20). During the previous year, Ausserhofer et al. found that 8.15 - 9.32 nurses of each 10 studied nurses had report at least one of seven patient adverse events (21).

In medical and nursing systems, workload is conceived in several levels. In addition, objective measurements such as attendance and hospitalization of patients in hospital wards provide useful information about healthcare staff's workload dimensions including physical, emotional, and cognitive ones (22). From the human factor point of view, excessive workload in healthcare shows its effect in two forms: First, patient-related outcomes and providing care including patient safety events and quality of healthcare; and second, healthcare staff-related outcomes such as quality of work, satisfaction, and job burnout (23, 24).

Although workload plays a key role in staff and patient's wellbeing, few researches have been conducted on the evaluation of workload effects and impacts on healthcare (25). The present study aimed at determining the rate of patient safety events, evaluating nursing workload as well as identifying the main factors that affect the incidence rate of patient safety events among nurses. Identifying and evaluating the factors affecting patient safety outcomes can be introduced as a guide to determine the type of intervention programs for improving working conditions, minimizing patient outcomes, and developing patient safety.

2. Methods

2.1. Design

This cross-sectional study was conducted in 2016 to determine the incidence rate of patient safety, evaluate workload, and identify factors that affect patient safety events among the nursing staff of Baqiyatallah hospital to determine the predictive variables of patient safety events.

2.2. Participants and Sample Size

The participants included the nursing staff who worked in 24 wards of Baqiyatallah hospital, Tehran-Iran. Inclusion criteria were working full-time and having at least 1 year of work experience in their current wards because patient safety events during the past 6 month were questioned. Because the patient safety events included the questions about the hospitalized patients, the exclusion criteria were the wards without hospitalized patients. Thus, paraclinical wards were excluded from this study. Baqiyatallah hospital as a 700-bed capacity hospital is one of the largest hospitals in Tehran. Also, it is the educational hospital of Baqiyatallah University of Medical Sciences as well.

Sample size was determined using patient's reported safety incidence rate as well as nurse's reported workload with 95% confidence interval and 3% errors. Finally, 291 nurses were selected as the least sample size. The nurses were selected from different wards using stratified random sampling. Of a total of 310 questionnaires distributed to the nurses of different wards and having considered their response rates, 295 questionnaires were returned. Those nurses who did not complete the questionnaires were replaced by other nurses. Based on the inclusion and exclusion criteria, 2 questionnaires were excluded from the study and finally 293 questionnaires were analyzed. The response rate was 95.2%.

2.3. Variables and Measures

The questionnaires including the incidence rate of safety events in the past 6 months, nursing workload, demographic information, and organizational information were completed by all the respondents. The questionnaire contained questions about the number of patient safety events in the past 6 months, workload perceived by nurses while performing their tasks, gender, age, educational level, weight, wards they worked in, work experiences in nursing wards, and shift work. Shift work is a regular or irregular work plan from 6:00 pm to 7:00 am (26). Work shifts were surveyed as rotational and fixed because the studied nurses ran shifts in the mornings, evenings, and nights during the week.

2.4. Patient Adverse Outcomes

Patient adverse outcomes were queried through the frequencies of adverse events including patient falls; nosocomial infections; bloodstream infection; and pressure ulcer and adverse drug events, which included the administering the wrong medication and reaction, and administering the wrong dose and frequency. Adverse drug events in previous researches were surveyed in “medication error” category due to its importance. Two separate questions about medication errors were put in the discussed questionnaire.

All mentioned incidents were in line with nurse’s treatment and they were asked to remember the number of such incidents during the past 6 months. Because safety incidents in Iranian hospitals have not been well documented, the authors had to use previously related researches as a proper estimation for nursing-related patient safety incidents. Nursing-related patient safety incidents have been pointed out in many international investigations and their reliability and validity have been proved and reported (9, 10, 21, 27-29).

Therefore, the perceived patient safety incidents during the past 6 months have been reported by nurses using 4-point Likert scale including never (0), very short time (1), occasionally (2), and frequently (3). Statistical analysis was inspired by Ausserhofer et al.’s study (21) as well as that of Kang et al. (30). Patient safety incidents reported by nurses were divided into dichotomous variables including never and very short time (0), occasionally, and frequently (1).

2.5. Workload

Perceived nursing workload was one of the explanatory variables employed in the present study. In previous studies, workload was measured using different methodologies including the conducted non-nursing duties, bed-to-nurse ratio that implies perceived objectives and subjective workloads. To assess nursing workloads, bed-to-nurse or nurse-to-bed ratios were used in many studies because perceived nursing workloads were due to not only objective and physical workloads but also several items as well. Moreover, according to individual differences in perceiving the workloads, bed-to-nurse and nurse-to-bed ratios were not proper scales for workload assessment.

In addition, this scale can measure unit-level workloads. On the other hand, inpatient bed occupancy ratio is an important variable in the level of effects of bed-to-nurse ratio on workloads. Thus, in the present study, NASA task load index was employed to assess the bed-to-nurse ratio as well as inpatient bed occupancy ratio. NASA TLX was developed over 20 years ago to measure the workloads in aviation. NASA TLX is a popular tool for assessing the overall subjective workload in different occupations including

healthcare staff (16). NASA TLX has been surveyed for its validity and reliability for different languages including Persian (31, 32).

NASA TLX is a multidimensional tool that scores task level workloads based on weighted average of rating results of 6 subgroups or factors including mental demand, physical demand, temporal demand, performance, effort, and frustration level. Twenty one-step bipolar scales were used to find the rate of dimensions that resulted in a score, ranging from 0 to 100. Combination of those 6 dimensions, as the main hypothesis of this tool, probably indicates the experienced workload by the operator. Overall workload score was calculated by the combination of the 6 mentioned dimensions (33).

2.6. Ethical Approval

Data were collected using self-administered questionnaires from February 14 to March 17, 2016. The present study was conducted after an approval by the vice chancellor for research of Baqiyatallah hospital in January 2016 (No 145, 21.1.2016). For data collection, the researchers entered into different wards and sought a permission letter from the nursing stations of the wards. Those in charge of each ward were convinced about the objectives of the study and provided written authorization. Survey was done after clarifying the objectives and participants’ rights, as well as the preservation of warranty, and anonymity of the information. Consents were signed by the participants and written agreements were documented. Participants were allowed to quit their participation upon request. After distributing the questionnaires, researchers were available to answer the probable ambiguities and questions.

2.7. Statistical Methods

Descriptive statistics, replication and percentage, alongside the mean and standard deviation were utilized for the analysis of individual and organizational information, subjective workload, and type of safety incidents, respectively. To test our hypothesis, we built logistic regression models for each of the 6 variables of patient outcomes. Explanatory variables included individual and organizational characteristics as well as workloads.

First of all, binary logistic regression models were calculated for each outcome. After that, multiple logistic regressions were done by entering all explanatory variables. Significance level was set at 0.05 ($P < 0.05$). All data analyses were conducted using IBM SPSS statistics (version 23; IBM Inc., Armonk, NY, USA).

3. Results

3.1. Participants Individual and Organizational Characteristics

Most of the participants were female (64.2%), aged 30 - 39 years (43.3%), with an average of 35.76 (+8.3) years. They were mostly married (77.1%) and had a bachelor's degree (70.6%). More than half of the nurses had 10 or less years of work experience (51.1%) and their average work experience was 11.88 years (+7.67). Most of the participants were nurses (87%) and two-third of them were working in rotational shifts. The demographic and organizational variables are demonstrated in [Table 1](#).

3.2. Patient Adverse Outcomes

Types of patient safety outcomes have been presented in [Table 2](#). Bloodstream infection and pressure ulcer were the most occurring adverse outcomes such that more than one-thirds of the nurses reported at least one of them in the past 6 months. Among the reported outcomes, administration of the wrong medication and reactions was the least frequent variable. Generally, adverse drug event was not as frequent as patient safety incidence. Bloodstream infection was frequently reported by nearly 10% of the nurses. However, the least frequently reported outcome was allocated to "pressure ulcer".

3.3. The Effect of Individual and Organizational Characteristics on Patient Adverse Outcomes

To determine the effect of workload and individual and organizational characteristics on the incidence of patient safety events, the frequency of adverse outcomes was converted to dichotomous variables and was entered into the binary and multiple logistic models. Binary logistic regression implied that shift work and workload had impacts on all patient safety incidents. When the effect of variables in multiple regression models on patient safety incidents was adjusted, shift work and workload were still associated with patient safety incidents. Among the individual characteristics, only the correlations between work experiences and some patient safety incidents including nosocomial infections, bloodstream infection, and administration of the wrong dose and frequency were significant. Among the organizational characteristics and workload indexes, shift work and NASA Task Load Index had relationships with all patient adverse outcomes ([Table 3](#)).

4. Discussion

According to our surveys, the present study was the first to assess the relationship between workload, individual, and organizational characteristics with incidents of

patient safety. The present study was designed to assess and compare the relationships between perceived nursing workloads, individual and organizational characteristics, and patient adverse outcomes. Findings revealed that out of each 10 studied nurses, 4.4 - 7.7 had a report of at least one of the 6 patient adverse events during the past 6 months, which was more than the reported rate in Kang et al.'s study. In Kang et al.'s study, of each 10 studied nurses, 3.6 - 5.7 had a report of at least one of the 4 patient adverse events during the previous year (30). However, it was less than the reported rate of Ausserhofer et al.'s study in which of each 10 studied nurses, 8.15 - 9.32 had a report of at least one of the 7 patient adverse events during the previous year (21).

Findings of this study were in line with those of Wang et al.'s in which of each 10 studied nurses 4.78 - 7.56 had a report of at least one of the 8 patient adverse events during the previous year (34). Results of this study revealed that the frequencies of patient adverse events as reported by nursing personnel ranged from administrating the wrong dose and frequency with 43.7%, administering the wrong medication and reaction with 52.3%, nosocomial infections with 57.7%, patient falls with 59% and pressure ulcer with 67.2% to bloodstream infection with 77.1%. Bloodstream infection was reported to be 83.2% - 85.2% frequent in other relevant studies (21, 35). Findings of Bogaert et al.'s study showed that the frequencies of patient falls, nosocomial infections, and medication errors were 82, 71.3, and 81.6, respectively (10). In Chao et al.'s study, which was carried out in 58 hospitals and on 4,864 nurses, 55%, 60%, and 67% of the studied nurses had a report of patient falls, pressure ulcer, and administering the wrong dosage, respectively (36). Hinno et al. in a survey on 535 Finish nurses and 333 Dutch nurses reported that 56% of the studied nurses (n = 300) had a report on patient falls during the past 3 months. Additionally, in their study, administrating the wrong dosage was reported by 48% of the Dutch and 36% of the Finish nurses. Nosocomial infections reported by Finish and Dutch nurses were 50% and 23%, respectively (37). In Wang et al. study, which was conducted on 436 nurses working in 7 hospitals, it was found that patient safety incidents including patient falls, medication errors, and pressure ulcer were 48%, 49%, and 67%, respectively (34). Kang et al. after a survey on 1,816 nurses working in 23 general hospitals, concluded that patient safety incidents as reported by nurses were patient falls, nosocomial infections, pressure ulcer, and medication errors with the frequencies of 57%, 52%, 45%, and 37%, respectively (30). Relevant results imply high rates of all patient safety incidents reported by nursing personnel such that several incidents were experienced by 50% of the nurses at least once in the previous year. Developing a system for recording and re-

Table 1. Characteristics of the Participating Nurses

Variables	Category	No. (%)
Individual Characteristics		
Gender	Female	188 (64.2)
	Male	105 (35.8)
Age, y	20 - 29	72 (24.6)
	30 - 39	127 (43.3)
	≥ 40	94 (32.1)
Marital status	Married	226 (77.1)
	Unmarried	53 (18.1)
	Other	14 (4.8)
Educational level	College and associate degree	80 (27.3)
	Bachelor's degree	207 (70.6)
	Graduate school	6 (2)
Clinical experience, y	10 ≥	151 (51.5)
	11 - 20	98 (33.4)
	≥ 21	2144 (15)
Organizational Characteristics		
Job position	Nursing Assistant	17 (5.8)
	Staff Nurse	255 (87)
	Head Nurse	21 (7.2)
Shift work	Fixed duty	98 (33.4)
	Shift duty	195 (66.6)
Ward	General ward	118 (40.3)
	Operating room	70 (23.9)
	Critical care unit	53 (18.1)
	Others	52 (17.7)
Workload Indices		
Bed- to- nurse ratio ^a		1.29 (0.63)
Inpatient bed occupancy ratio ^a		0.94 (0.076)
NASA TLX ^a		62.97 (14.4)

^a Values are expressed as mean ± SD.

Table 2. Nurses Reporting Patient Safety Incidents in their Units in the Last 6 Months (N = 293)

Outcomes Type	Never	Very Few Times	Occasionally	Frequently
Patient Safety Incidents				
Patient fall	120 (41)	152 (51.8)	17 (5.8)	4 (1.4)
Nosocomial infection	124 (42.3)	133 (45.4)	27 (9.2)	9 (3.1)
Bloodstream infection	67 (22.9)	136 (46.4)	61 (20.8)	29 (9.9)
Pressure ulcer	96 (32.8)	165 (56.3)	29 (9.9)	3 (1)
Adverse drug event				
Administration of the wrong medication and reaction	165 (56.3)	95 (32.4)	23 (7.8)	10 (3.4)
Administration of the wrong dose and frequency	139 (47.4)	125 (42.7)	20 (6.8)	9 (3.1)

porting patient safety incidents coupled with continuous training to reduce the high-rated patient safety incidents can be helpful. This study revealed that among the individual characteristics, only work experience had a signifi-

cant relationship with incidents of bloodstream infection and nosocomial infections (only in multivariable regression model and 11 - 20 years of work experience), and with administrating the wrong dose and frequency (only for 11

Table 3. Binary and Multiple Logistic Regressions: Predictors of Patient Outcomes

Variables	Patient Safety Incidents				Drug Adverse Events	
	Patient Falls	Nosocomial Infections	Bloodstream Infection	Pressure Ulcer	Administration of the Wrong Medication and Reaction	Administration of the Wrong Dose and Frequency
Individual Characteristics						
Gender	NS	NS	NS	NS	NS	NS
Age, y	NS	NS	NS	NS	NS	NS
Marital status	NS	NS	NS	NS	NS	NS
Educational level	NS	NS	NS	NS	NS	NS
Clinical experience, y						
10	1	1	1	1	1	1
11 - 20	NS	NS - 0.279 ^a	0.315 ^b - 0.281 ^b	NS	NS	0.366 ^a - 0.204 ^a
21	NS	NS	0.419 ^a - 0.321 ^a	NS	NS	NS
Organizational Characteristics						
Job position	NS	NS	NS	NS	NS	NS
Shift work	5.69 ^b - 5.69 ^b	7.85 ^b - 7.051 ^b	5.81 ^b - 4.09 ^b	7.29 ^a - 6.07 ^a	4.41 ^a - 9.78 ^a	4.842 ^b - 5.55 ^b
Ward	NS	NS	NS	NS	NS	NS
Workload Indices						
Bed-to-nurse ratio	NS	NS	2.646a - 3.564a	NS	NS	NS
Bed occupancy ratio	NS	NS	NS	NS	NS	NS
NASA TLX	1.077 ^b - 1.072 ^b	1.067 ^b - 1.062 ^b	1.047 ^b - 1.055 ^b	1.022 ^a - 1.038 ^a	1.103 ^b - 1.04 ^b	1.057 ^b - 1.064 ^b

Abbreviation: NS, not significant.

^aP < 0.05.

^bP < 0.01.

- 20 years of work experience). Kang et al. in their study concluded that even though work experience had a significant relationship with nosocomial infections, it did not have a significant relationship with medication error and pressure ulcer, as in line with this study. However, a significant relationship was found between work experience and patient falls, which is in contrast with the findings of the present study (30). In Park et al.'s study on 276 nurses having at least 6 months of work experience in general hospitals of Korea, no significant relationship was found between work experience and safety events. In their study, patient safety incidents were classified into incident group and non-incident group (38). A considerable number of patient safety incident reports were due to blemish, while facing patient safety incidents were reported by nurses with low numbers of work experience. However, this can be prevented through issuing sincere treatments to provide meticulous statistics of patient safety incidents and results in making preventable decisions about the incidents. Among organizational characteristics in the simple

variable regression model, significant relationships were found between all patient safety incidents. Significant relationships remained after the rest of the variables were adjusted. Multivariable regression model demonstrated that the reported adverse incidents among the nurses working on rotational shift works were 5.69 - 9.87 times more than those nurses with fixed shift works. In line with this study, Park et al. discussed that the experience of patient safety incidents in rotational shift work nurses was 6.85 times more than the fixed shift work nurses (38). In addition, investigations show that long-term working hours alongside shift work have adverse impacts on patient safety outcome, increase in medication errors, and injuries to the patients (17, 39). In Niu et al.'s survey on nursing personnel, the error rate of night shift workers (in rotational shift work) was 44% more compared to the fixed shift workers. Moreover, it was 62% more in night shift workers than in evening shift workers (40). Another study by Johnson et al. showed that sleeping an hour more resulted in 25% decrease in nursing errors while observing patient care (41). Nurses, due

to their inadequate number, might face more physical and mental demands during shift works (night and evening), and this could cause errors in type, dosage, and frequency of medication and less time for meticulous care, resulting in patient ulcer pressure. Shift work is a factor that affects the health and safety of the staff, and its short- and long-term occurrence could adversely affect the rhythms and cycles of mental activities. Action plans including proper arrangement of shift works for quick adaptation to mental rhythm as well as adjustment of rest/sleep times along with amendments of physical activities should be directed towards the rate of decreasing the incidence of shift workers.

In the present study, 3 indexes of bed-to-nurse ratio (as objective workload), inpatient bed occupancy ratio, and NASA Task Load Index (as subjective workload) were employed. The results revealed that bed-to-nurse ratio was significantly correlated with only bloodstream infection, so for a one-unit increase in bed-to-nurse ratio, bloodstream infection increases to 3.56 times. No significant relationship was observed between bed-to-nurse ratios with other adverse incidents, and findings of different surveys have been very inconsistent in this regard. Although recent investigations have found a relationship between the low rate of nursing staff and an increase in patient safety incidents (40, 42), according to findings of the present study, bed-to-nurse ratio could not predict patient safety events. In Cho et al.'s study, bed-to-nurse ratio was used to assess the workload, and their results showed that for a one-patient increase, the rate of patient falls, administering the wrong dose and frequency, and ulcer pressure increased to 2%, 1% and 1%, respectively (36). In Hinno et al.'s study on the Dutch nurses, a significant relationship was found between patient falls and bed-to-nurse ratio. Nevertheless, the results of post-hoc test revealed that "patient falls" in bed-to-nurse ratio of more than 10 was significantly more compared to the bed-to-nurse ratio of less than 9. The results proved a significant relationship between "medication errors" and "patient-to-nurse ratio" among patient safety incidents reported by the Dutch nursing personnel. However, no significant relationship was observed between the incidents reported by the Finish nursing personnel. Among the nurses in charge of more than 10 patients, nosocomial infections rose with $f(2.517) = 4.11$, $P = 0.017$ ratio, but it was within 5 - 9 in patient-to-nurse ratio, with no significant rise (37). Furthermore, Al-Kandari and Thomas in their survey found a significant relationship between patient-to-nurse ratio, patient falls, and pressure ulcer; however, they did not find any significant relationship between patient-to-nurse ratio, nosocomial infections, and medication errors (43). Furthermore, in Kang et al.'s study, no significant relationship was ob-

served between bed-to-nurse ratio and medication errors, patient falls, and nosocomial infections, but bed-to-nurse ratio had only a significant relationship with pressure ulcer (30). It is worth mentioning that in their study, bed-to-nurse ratio was less than 2.5 in only 30% of the wards, whereas in the present study, the average bed-to-nurse ratio was 1.29. In this regard, after conducting surveys on nurses, Ausserhofer et al. did not find a significant relationship between bed-to-nurse ratio and patient safety incidents (21). Al-Kandari and Thomas have demonstrated no significant relationships between in-patient bed occupancy ratio and patient falls as well as pressure ulcer. Accordingly, they did not reveal any relationship between in-patient bed occupancy ratio with nosocomial infections and medication errors (43). Inpatient bed occupancy ratio in their study was 0.85 which was less than the present study with 0.94. Based on these findings, neither bed-to-nurse ratio, nor patient-to-nurse ratio could be an efficient index for relationships between workload and patient safety incidents. In the current study, the inpatient bed occupancy ratio was even used to illustrate changes in patient ratio, which could unluckily not be identified as nursing workload as well. Findings of this study revealed that NASA Task Load Index, as perceived by the nursing personnel, had a significant relationship with all the 6 safety incidents including patient falls, nosocomial infections, bloodstream infection, pressure ulcer, and adverse medication errors. The findings of the present study revealed that for one-unit increase in workload, patient falls, nosocomial infections, bloodstream infection, pressure ulcer, administering the wrong medication and reaction, and administering the wrong dose and frequency have increased to 7.2%, 6.2%, 5%, 6.5%, 5.5%, and 8.1%, respectively. Few studies have been surveyed on patient adverse incidents and workloads using NASA Task Load Index (44-46). In an investigation by Holden et al. a significant relationship was found between perceived workload by nurses and medication errors. In their investigation, medication error could be predicted by task level workload measurement using NASA TLX, and unit level workload could not present a satisfactory prediction of medication errors (44). Having considered NASA TLX for its multidimensions of workload, it was the most preferred among the other indexes.

4.1. Limitations, Strengths and Suggestions

The current study had strengths and weaknesses/limitations. One of the strengths of this study was the use of NASA TLX to assess the subjective workload, with proven reliability and validity.

Accordingly, bed-to-nurse ratio was used to assess objective workload, which was proved incapable of predicting the incidence of patient safety. Furthermore, the stud-

ied nursing staff who had more than 10 years of work experience and constituted half of the participants, could be regarded as one of the strengths. The nursing staff with less experience usually hesitated to report patient safety incidents.

One of the limitations of this study was difficulties in shift classification. Since the studied nurses worked on three shifts of morning, evening, and night, they were compulsorily classified into rotational and fixed shift works. According to the findings, reports from rotational shift workers were considerably numerous compared to those of fixed shift workers. Moreover, frequency of patient safety events in each shift of morning, evening, and night was not obviously provided. In addition, reckless reports by nursing staff have caused unreliable reports of adverse patient incidents.

It is worth considering that the incidence of adverse events could be the result of items pertaining to the safety of patient climate, burnout, safety attitude, and a variety of factors that affect studies, for which their existence or non-existence could be a reason with different conclusions. For future research, it is recommended to consider supplementary factors that affect adverse patient safety outcomes and include a variety of nursing shift works to reach a more reliable assessment.

4.2. Conclusions

The high incidence rate of adverse patient events, which was reported by the nursing staff, implied that approximately 50% of the nursing staff had a report of at least one of the events during the past 6 months. Workload was one of the main reasons for adverse patient events and this can be surveyed on different levels including task and unit levels. Findings of the present study revealed that unit-level workload can be counted as a reliable predictor for all adverse patient outcomes, and complementarily, task-level workload is a reliable index for predicting the incidence rate of adverse patient events.

Importantly, in addition to workload, shift work is a vital factor in such outcomes and the incidence rate of adverse patient outcomes in rotational shift workers is nearly 10 times more than in fixed shift workers. This is caused by the low number of nurses in shift works, especially at night shifts. Moreover, the disruption in circadian rhythm in shift workers leads to excessive workloads and mental deconcentration upon different given tasks. In conclusion, amendment of shift work systems that aims at providing the most proper sleep-wake cycle associated with considerations on mental and physical dimensions of the given tasks to reduce patient adverse safety outcomes seems to be helpful.

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Footnote

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