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Exploring Frequency of Event Reporting as Perceived by Intensive Care Unit Nurses in the Sultanate of Oman

A quality improvement project

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ABSTRACT: *Objectives:* Little is known about the factors affecting the perceived frequency of event reporting among healthcare workers, especially registered nurses in Oman. This study aimed to assess whether fatigue, workload, burnout and work environment as independent variables have a relationship with frequency of event reporting as the dependent variable and to what extent the independent variables predict the frequency of event reporting between nurses working in different intensive care units (ICU) in selected hospitals in Oman. *Methods:* This cross-sectional study used standardised questionnaires of hospital survey on patient safety culture, a fatigue assessment scale, the Maslach burnout inventory-human services survey, the NASA task load index and the practice environment scale of the nursing work index. Registered nurses working in ICU participated in this study from two referral hospitals in Oman between June and September 2018. *Results:* A total of 270 nurses were included in this study (response rate: 90%). There was a statistically significant positive relationship between personal accomplishment and the frequency of event reporting (r = 0.132, *P* <0.05). Regression analysis showed that nurses' feedback and communication about errors predicted the frequency of event reporting among ICU nurses in Oman (R^2 = 0.214, adjusted R^2 = 0.046; F = 12.82, *P* <0.01). *Conclusion:* Personal accomplishment and feedback and communication about error of ICU nurses had a positive impact on perceived frequency of event reporting whereas no relationship was found between fatigue, workload, work environment and frequency of event. Strategies need to be in place in health organisations to encourage nurses to report errors.

Keywords: Burnout; Intensive Care Units; Nurses; Fatigue; Incident Reporting; Workplace; Oman.

Advances in Knowledge
- *The study found a positive relationship between personal accomplishment and frequency of event reporting among intensive care units' nurses.*
- *Feedback and communication about error had a positive impact on the frequency of event reporting by nurses.*

Applications for Patient Care
- *These findings provide policy-makers and managers in intensive care units with a better understanding of the factors that affect the frequency of event reporting by nurses and maintain patient safety.*
- *The results of this study may be considered as the foundation and a valuable resource of knowledge for forthcoming studies and might be used for developing strategies to tackle these factors and identify other factors.*

Patient safety is the field of interest of healthcare organisations around the world when advancing the standard of care delivered.[1] Worldwide safety is a crucial health issue because of the impact on patients' outcome and the healthcare system.[2] Approximately 43 million patient safety incidences occur every year worldwide and medication errors cost an estimated 42 billion USD annually.[3] Several facts have been identified and published by the WHO regarding patient safety statistics, including that one in 10 patients may be injured or harmed during the hospitalisation period due to lack of safe practice and 14 of 100 patients get infected in the hospital owing to lack of safe practice.[3] Several indictors for patient safety have been identified, including rates for pressure ulcers, in-hospital falls with hip fractures, postoperative sepsis, medication errors and central line-associated bloodstream infection.[4] In intensive care units (ICU), cases of patients are critical and complicated where a simple mistake can lead to negative patient outcomes, such as death.[5] Around 30% of patients admitted to ICU are affected by at least one healthcare-associated infection in countries with high income.[2] The Institute of Medicine (IOM) report estimated errors in healthcare institutions as the eighth major cause of death in the United States of America due to preventable causes; thus, there is a need to find out the factors that lead to these errors and modify them.[6]

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Event reporting usage can be a sign of an affirmative safety culture within healthcare institutions.[7] Reporting patient safety events are a beneficial method for improving patient safety.[8] A positive safety culture may be linked to a lower rate of adverse events.[9] On the other hand, underreporting of adverse events impedes organisational learning and advancement in patient care.[10] The main reason behind underreporting errors by nurses is fear of being blamed in the health organisation.[11,12] Several strategies working toward patient safety, such as creating an environment of non-blaming culture to encourage nurses to report any errors or near-happening errors, have been performed with the aim to decrease mistakes in healthcare.[11] A major barrier for not reporting incidents was punishment cited by a study conducted among ICU nurses who were working in provincial hospitals in KwaZulu-Natal.[13]

Internationally, some studies have been done on healthcare workers, including nurses, to identify the factors that affect patient safety, such as nurse work environment and nurses' fatigue. For example, a cross-sectional, quantitative study assessed the effect of nurses' work environment on patient safety outcomes in 30 hospitals in Ireland, with 1,397 participants. Results showed that a positive nurse work environment was associated with increased patient safety measures and increased reporting rates of adverse events.[14] In addition, a recent systematic review in the United States showed an association between a good work environment and quality of nurses' care and improved patient safety outcomes such as reporting of errors.[15] Another study assessed the effect of hospital working hours on nurses and patient safety (n = 393 nurses). The results showed that long shift hours and overtime are strongly linked to difficulties in being awake through a shift, which leads to the increased risk of making an error; however, the study did not assess the effect of fatigue on reporting errors.[16] Another study has reached the same conclusion of increasing frequency of errors as a result of fatigue.[17]

Frequency of event reporting in any healthcare institution is important for positive patient safety culture. Limited studies were conducted regarding identifying the factors that affect patient safety culture and frequency of event reporting among nurses in gulf countries. In Oman, only two studies had been conducted up to the time of conducting this study. The first study was conducted by Al-Mandhari *et al.* to assess the perception of patient safety culture among healthcare workers from different units and the results were consistent with international findings of the presence of blaming culture in healthcare institutions.[12] The second descriptive

study was conducted in Oman in 2015 to explore the perception of patient safety and identify elements that affect patient safety culture between nurses recruited from four hospitals.[11] Results identified some factors that might contribute to frequency of event reporting such as organisational learning and continuous improvement, teamwork within units, hospital support for patient safety and feedback and communication about the error.[11] The different work environments of each hospital may have influenced the perception about patient safety because workplace culture can influence the predictors for frequency of event reporting. Although limited studies have been conducted in Oman regarding this important aspect of patient safety, it is considered a critical indicator for the quality of healthcare according to the Ministry of Health in Oman.[18] In Oman, a national patient safety team was founded in 2007 to conduct workshops addressing patient safety issues at multiple centres, to be arranged by departments of quality assurance and patient safety.[18] Recently, the Directorate General of Quality Assurance Center was established; it works on continuous improvement and monitoring in performance at all levels and in various units of the Ministry and to raise the quality of healthcare services and patient safety in all institutions.[19] Also, this centre formed policies and procedures that will help in maintaining high level of quality of healthcare services provided by health institutions such as policy and procedure of incident reporting and learning system which was created in 2017.[20] In addition, a majority of hospitals in Oman adopted an electronic system for reporting incidents and seeking international accreditation.[19]

In ICU, nurses have to be alert in providing safe care without errors as any simple error can lead to the death of a patient. In addition, it is important for nurses to report any errors that happened as a study showed reporting errors lead to improved patient safety.[21] From the aforementioned, there is a need to do research on this important aspect among ICU nurses to find out the factors affecting frequency of event reporting. So far, no study has been conducted among nurses working in ICU in Oman to find out if there is a relationship between frequency of event reporting and the hypothesised factors (fatigue, workload, burnout and work environment). With regard to paucity of information, this study first aimed to identify whether factors in ICU nurses, namely fatigue, burnout, workload and work environment, were related to the frequency of event reporting. The second aim was to explore to what extent the selected aforementioned variables predicted the frequency of event reporting in Oman. Identifying these factors that affect frequency

of event reporting among nurses who are working in ICU will help the higher administration stakeholders and decision-makers establish management protocols to modify these factors to enhance patient safety and increase reporting of any events and, consequently, increase the quality of care and minimise the incidence of adverse events. Furthermore, the subsequent costs associated with adverse event incidence will be reduced.

Methods

A cross-sectional descriptive design was utilised to assess if there is a relationship between independent variables (fatigue, workload, burnout and work environment) and the dependent variable (frequency of event reporting) and to identify the predictors of the frequency of event reporting among ICU nurses in Oman.

This study was carried out in two main referral hospitals in Oman – Royal hospital and Sultan Qaboos University Hospital. These hospitals specialise in critical care treatment. Nurses who were working in different ICUs: neonatal, paediatric and adult ICUs, a coronary care unit and post cardiac surgery unit, were asked to take part in the study, totalling approximately 500 potential participants. Slovin's formula was utilised to estimate the sample size.[22] The estimated sample size was 222 participants; yet, the study's questionnaire was distributed to 300 participants and 270 responses were received.

The authors discussed and provided the leaders of ICUs with an overview of the study purposes, methods and significance. The authors communicated with potential nurses who had worked in ICUs for at least 6 months and consented to participate. A package including an information sheet, consent form and the survey was given to participants who met the eligibility criteria (Omani and non-Omani nurses, who had worked in ICUs for at least 6 months and agreed to participate). Consenting participants were asked to complete the survey, which would later be coded to enable the authors to complete the data collection process. The time-frame for data collection was between June and September 2018.

Ethical approval was secured from the research ethical committees of the Royal Hospital ethical committee (SRC#46/2018) and college of Medicine and Science at Sultan Qaboos University (SQU-EC/030/18). Also, permissions to use the tools were gained by the authors. Participation was optional and no identifying data was obtained. Documentary assent was secured from all the participants prior to filling the survey.

In the current study, five original instruments in the English language were used, including the Hospital Survey on Patient Safety Culture (HSOPSC), Maslach Burnout Inventory-Human Services Survey (MBI-HSS), Fatigue assessment scale (FAS), NASA task load index (NASA TLX) and Practice Environment Scale of the Nursing Work Index (PES-NWI)[Table 1].[23–27]

Statistical Package for the Social Sciences (SPSS) version 23 (IBM Corp., Chicago, Illinois, USA) was used to manage and analyse the data. Before conducting the analysis, the data was cleaned and verified. To describe the sample characteristics, descriptive analysis was used that included the mean, standard deviation, frequency and percentage. In addition, inferential statistics was used, including correlation and regression analyses. Pearson's product-moment correlation coefficient was used to assess the relationship between selected variables (fatigue, burnout, work environment and workload) and frequency of event reporting. Standard multiple regression analysis was used to find the relative contribution of the predictors (nurses' workload, fatigue, work environment and burnout) on frequency of event reporting. To obtain the parsimonious regression model, a three phased method was used. First, the statistical assumptions in relation to normality, linearity, heteroscedasticity and independence of residuals were examined. Next, independent variables with a significant relationship to frequency of event reporting were entered into the first linear regression model. Lastly, variables that had significant correlation in the first linear regression analysis were included in the parsimonious regression model. This type of regression analysis was done to locate the size of the interactions of independent variables in relationship to the correlation matrix, beta weights and their significance level (P value).

Results

A total of 270 nurses participated (response rate: 90%) from Sultan Qaboos University Hospital (SQUH) and Royal Hospital. Of these, 38 were male and 232 were female. The majority of participants had bachelor's degrees (BSN) while 4.1% had a postgraduate degree (any degree after BSN). The mean working hours per week for critical care nurses was 36.8 ± 3.19 hours [Table 2].

The results indicated a small positive relationship between personal accomplishment (PA) and the frequency of events reported among ICU nurses in Oman (r = 0.132; P = 0.030), which was statistically significant. In addition, there was no significant relationship between fatigue and the frequency of events reported (r = −0.069; P = 0.256). The HSOPSC

Table 1: Details of the scales used in current study

Scale	Description	Items	Cronbach's alpha coefficient of previous study	Cronbach's alpha coefficient for current study
HSOPSC23	- Used to evaluate staff perception about patient safety culture in the healthcare setting. - The survey tool includes two questions asking participants to provide an overall patient safety score for their unit and to state the number of adverse events they have reported over the past 12 months. The outcome dimensions include 'overall perceptions of safety' and 'frequency of event reporting'. - Most of the dimensions are scored on a 5-point Likert-type scale to reflect the level of agreement, ranging from 1 ('I strongly disagree') to 5 ('I strongly agree'), with 3 scoring a neutral ('I neither agree nor disagree'). Other items are scored on a 5-point frequency scale, ranging from 1 ('never') to 5 ('always'). The survey includes both positively and negatively worded items, so the negative items were reverse coded.	42 items grouped into 12 composites	0.91	0.85
MBI-HSS24	- Used to measure burnout among participants - The seven-point frequency scale for all MBI scales is as follows: 0-Never,1-A few times a year or less, 2-Once a month or less, 3-A few times a month, 4-Once a week, 5-A few times a week, 6-Every day. - The scoring: •EE: high, 27 or over; moderate, 17–26; low, 0–16. •DP: high, 13 or over; moderate, 7–12; low, 0–6. •PA: high, 39 or over; moderate, 32–38; low, 0–31. - The combination of high EE, high DP and low PA indicates high burnout.	22 items and it has three dimensions: EE which consists of 9 items; DP which consists of 5 items; and PA which consists of 8 items	EE (0.80); PA (0.77); and DP (0.73)	PA (0.74); EE (0.86); and DP (0.66).
FAS25	- Used to measure fatigue. - Five questions on the scale reflect physical fatigue and five reflect mental fatigue. The 5-point scoring ranges from 1 ('never') to 5 ('always'). - The total score ranges from 10 to 50. A total FAS score <22 indicates no fatigue; a score ≥22 indicates fatigue.	Ten items	0.90	0.76
NASA TLX26	- Used to measure subjective workload. - It provides an overall workload score based on a weighted average of ratings on six subscales: mental demands, physical demands, temporal demands, performance, effort and frustration. Each dimension is scored over a 100-point scale, which is subdivided into 20 steps of 5 points each. Overall workload is represented by a combination of the six dimensions	Six items	0.72	0.71
PES-NWI27	- Used to measure work environment. -The scoring is based on a 4-point Likert scale: 1 ('strongly agree'), 2 ('agree'), 3 ('disagree') and 4 ('strongly disagree'). The composite is calculated as the mean of the five subscale scores.	31 items	0.935	0.96
Demographic data	Age, gender, education level, income, nationality, hospital type, experience in years and weekly working hours.	Eight items		

HSOPCS = hospital survey on patient safety culture; MBI-HSS = Maslach burnout inventory-human services survey; EE = emotional exhaustion, definition: The feeling of being emotionally exhausted at work; DP = depersonalisation, definition: An unfeeling and impersonal response toward patients; PA = personal accomplishment, definition: Feelings of competence and successful achievement in one's work; FAS = fatigue assessment scale; NASA TLX = NASA task load index; PES-NWI = practice environment scale of the nursing work index.

composites that had a positive relationship with frequency of event reporting were organisational learning-continuous improvement (r = 0.122; P = 0.046), feedback and communication about error (r = 0.214; P <0.001), communication openness (r = 0.128; P = 0.036) and non-blaming response to errors (r = 0.155; P = 0.011) [Table 3].

The results of the initial linear regression showed that only the feedback and communication about errors had significant variance for the frequency of events reported; thus, it was inserted in the parsimonious regression model. The results of this parsimonious regression analysis indicated that the feedback and communication about errors predicted

Table 2: Characteristics of study participants (N = 270)

Variable	n (%)	Mean (SD)
Gender		
Male	38 (14.1)	
Female	232 (85.9)	
Nationality		
Omani	50 (18.5)	
Non-Omani	220 (81.5)	
Working hospital		
Sultan Qaboos University Hospital	130 (48.1)	
Royal Hospital	140 (51.9)	
Level of education		
Diploma	90 (33.3)	
BSc	169 (62.6)	
Postgraduate studies*	11 (4.1)	
Working hours per week		36.84 (3.19)
Age		33.06 (5.82)
Work experience		7.01 (5.05)
Frequency of events reported		10.99 (3.07)
NASA TLX		67.90 (17.7)
Fatigue assessment scale		18.20 (5.4)
Maslach burnout inventory subscales		
EE		16.9 (11.3)
DP		6.1 (5.46)
PA		32.0 (9.32)

EE = emotional exhaustion; DP = depersonalisation; PA = personal accomplishment.
*Any degree after BSN.

the frequency of event reporting between ICU nurses in Oman and it accounted for 21.4% of the variance, with $R^2 = 0.214$, F = 12.82 (P <0.01) [Table 4].

Discussion

This study was the first to investigate the relationship between the selected variables—including fatigue, workload, burnout and work environment—and the frequency of event reporting among ICU nurses in Oman. In addition, it was the first study to identify the extent to which the selected variables predicted the frequency of event reporting. Results from this study revealed a positive correlation between personal accomplishment (subscale of burnout) and frequency of event reporting. This is in line with a previous

Table 3: Pearson's r correlation coefficient between selected variables (fatigue, burnout, work environment, workload), HSOPCS composites and frequency of event reporting (N = 270)

Variable	Frequency of event reporting (Pearson's r)	P value
Fatigue Assessment Scale (FAS)	−0.069	0.256
NASA workload index	−0.062	0.312
Work environment	0.070	0.252
Burnout subscales		
EE subscale	−0.097	0.113
DP subscale	−0.057	0.349
PA subscale	0.132	0.030*
Teamwork within units	0.046	0.456
Supervisor/manager expectations and actions promoting patient safety	0.101	0.097
Organisational learning-continuous improvement	0.122	0.046*
Management support for patient safety	0.047	0.441
Feedback & communication about error	0.214	≤0.001[†]
Communication openness	0.128	0.036*
Teamwork across units	0.089	0.144
Staffing	0.018	0.774
Handoffs & transitions	0.007	0.905
Non-punitive response to errors	0.155	0.011*
Patient safety grade	0.116	0.057
Overall perceptions of patient safety culture	0.047	0.438
Number of events reported	0.011	0.862

HSOPCS = hospital survey on patient safety culture; EE = emotional exhaustion; DP = depersonalisation; PA = Personal accomplishment.
*Correlation is significant at P ≤0.05 (2-tailed).
[†]Correlation is significant at P ≤0.01 (2-tailed).

study that showed scoring a low grade for patient safety culture was linked to a high level of burnout.[28] Therefore, nursing managers have to focus on sending their staff for education programmes that specialise in accomplishment motivation, decision-making and stress reduction that will strengthen personal and professional capability and accomplishments. Moreover, managers have to address those nurses with good achievement in their monthly unit meeting and reward them. They also have to encourage a sense of accomplishment such as realistic and achievable

Table 4: Regression model of independent variables that predict frequency of event reporting* (N = 270)

					95% Confidence Interval	
Predictor[†]	β	SE	B	T	Lower	Upper
Feedback and communication about errors	0.214	0.104	0.371	3.58	0.167	0.575

Dependent variable is frequency of event reporting.
[†]*Total R^2 = 0.214.*

targets, constructive feedback, praise and rewards.

The current study found that depersonalisation (subscale of burnout) was not correlated with frequency of event reporting. This result was not in line with a study conducted in a United States hospital that assessed the relation between burnout among nurses and patient safety measures involving safety perceptions and reporting behaviour. It showed that burnout among nurses was linked to minimal chances of notifying an incident that could have happened but had been averted and also with less perception of patient safety culture.[29] The discrepancy between the current study and the previous study was linked to the ratio of nurses-to-patients in ICUs. In the current study, the ratio was 1:1 and, in addition, participants reported that they had enough staff to take care of patients. The results of the current study were not in line with the study that showed a high level of burnout was associated with increased adverse patient related events and reduction in quality of care.[30] This discrepancy between the current study and the previous study was related to staff-to-patient ratio and type of patients that nurses were caring for.

Findings from the current study showed that emotional exhaustion was not correlated to frequency of event reporting. The result was in line with a study that showed no correlation between burnout and event-reporting behaviour.[29] This result might be due to adequate staffing and ratio of patient-to-staff. As reported, an increase in patient-to-nurse ratio was linked to increased chances of nurses' burnout.[31] Results of the current study were inconsistent with the previous study in which there was an association between nurses' burnout and achieving a bad grade for patient safety culture.[14] This inconsistency is related to the ratio of nurse-to-patient reaching 1:3 in some shifts. Therefore, managers in ICUs have to maintain adequate staffing in order to maintain patient safety.

The current study results showed that there was no association between nurses' work environment and frequency of event reporting. This finding was not consistent with a previous study that showed correlation between positive workplace and increased reporting of adverse events by nurses.[14] This might be due to adequate staffing, which was reported to have an effect on decreasing the frequency of event reporting;[32] in the current study, around 80% of participants reported that they had enough staff to provide high quality of patient care. Another reason was the short working hours in each week as the mean of the working hours each week was less than 40 hours in the current study. The nurses' work environment has been connected to patient safety outcomes through prior research study.[33] Therefore, administration backing is important and demanding the utilisation of a tool for notifying events in order to foster patient safety instead of punishing nurses for reporting incidences.[34]

The current study showed that nurses' workload was not correlated to frequency of event reporting. This finding might be a result of adequate staffing and a majority of nurses (95.9%) reported that they had good teamwork in ICUs. This finding was not consistent with other studies that linked workload with raised incidences of patient falls, central venous catheter infections as well as an increase in medication errors.[35,36] The discrepancy between the current study and others might be due to the nurse-to-patient ratio of the current study, which followed the international standard of one staff to one patient in ICUs.[37] Therefore, administrators need to maintain a positive work environment through maintaining adequate staff for each shift by following the international ratio of one staff to one patient to enhance cooperation between each unit in a hospital.

The current study indicated that nurses' fatigue was not correlated with frequency of event reporting. This is because of the short mean working hours per week (37 hours), which is within the recommended working hours for nurses per week to not exceed 40 hours.[38] The current study result was not consistent with the study that linked nurses' fatigue with increased rate of infection that impedes patient safety.[39] Therefore, administrators need to maintain a positive work environment through putting strategies for assessing nurses' fatigue in place, not allowing staff to exceed working above 40 hours each week and introducing courses to help staff deal with their fatigue.

Findings of the current study showed a positive significant statistical correlation between institutional learning continuous improvement, feedback and communication about errors, communication openness, non-blaming responses in relation to errors and frequency of event reporting among ICU nurses (P <0.05). They were in line with a study that assessed the relationship between composites of patient safety culture and the perceived frequency of event reporting among registered nurses.[40] This similarity was linked to the extent that all staff in both studies perceived that improvement in previously mentioned items will lead to improvement in patient safety. Nursing managers may look at communication techniques in promoting event reporting in patient safety approaches, with a focus on feedback about error and open communication. Moreover, the current study showed that discussion and telling others about incidences or errors was a predictor of frequency of event reporting between ICU nurses in Oman. A study done in Oman in 2015 assessed perceived patient safety culture and identified elements affecting this perception among nurses and reported similar results to the current study; although that study also recruited nurses from different wards.[11] Results of the present study were not in complete agreement with the results of a research done in 2014 that showed that almost all elements of patient safety were predictors for perceived frequency of event reporting;[41] in the present study, only feedback and communications about error was a predictor. Furthermore, this study showed the importance for all health institutions to create an environment free from retribution after reporting incidences to boost reporting of incidences, which will improve patient safety; this was in line with other studies that showed the same findings.[11,42] In addition, the current study showed that increasing communication openness led to increased frequency of event reporting. It indicated that unambiguous, simple and well-constructed language with the right communication skills is vital to enhance safety of patient.[43]

The results of this research have some implications for top management, decision-makers, leaders and nurses to create policies and work instructions that are needed to make changes, where the current culture of blame should be replaced by a blame-free one that allows nurses to learn from errors and shared experiences. It is recommended that hospital management run symposiums and workshops on strategies, policies and expertise needed to reduce job linked burnout among staff and to study their effect. The current study's results might be considered as the foundation and a source of data for future research in this field. Further research to study other factors that might affect patient safety culture either negatively or positively, such as accreditation and collaboration, is recommended.

The current study has some limitations such as using cross-sectional descriptive design. This limits the ability of explaining the cause and effect of association among study variables and the use of non-probability convenience sampling, which might make the study suffer from risk of selection bias.

Conclusion

This study highlights the need to focus on feedback and communication about errors, communication openness and personal accomplishment of staff as it had a direct positive effect on the frequency of event reporting among ICU nurses. Also, it highlights the emergent need to find solutions to overcome the blame culture that presents in response to reporting errors. The current study's results indicate that there is a need to work on developing new strategies and guidelines to enhance patient safety and find other factors that might have an effect on the frequency of event reporting by leaders, decision-makers and policy-makers. To enhance patient safety practices, countries around the world and specifically in the Arab region, should investigate the patient safety culture in their healthcare organisations. Indeed, a method of reporting incidences needs to be enhanced and made more flexible.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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AUTHORS' CONTRIBUTION

QA collected the data. LA analysed the data. QA, OA and LA drafted the manuscript and approved the final version of the manuscript.

References

1. Farzi S, Moladoost A, Bahrami M, Farzi S, Etminani R. Patient safety culture in intensive care units from the perspective of nurses: A cross-sectional study. Iran J Nurs Midwifery Res 2017; 22:372–6. https://doi.org/10.4103/ijnmr.IJNMR_150_16.

2. World Health Organization. Patient safety assessment manual (2nd ed.). From: http://www.who.int/iris/handle/10665/249569 Accessed: Nov 2020.

3. World Health Organization. 10 facts on patient safety. From: http://www.who.int/features/factfiles/patient_safety/en/ Accessed: Nov 2020.

4. Agency for Healthcare Research and Quality. Patient safety indicators From: http://www.qualityindicators.ahrq.gov/Downloads/Modules/PSI/V50/PSI_Brochure.pdf Accessed: Nov 2020.

5. Eltaybani S, Mohamed N, Abdelwareth M. Nature of nursing errors and their contributing factors in intensive care units. Nurs Crit Care 2019; 24:47–54. https://doi.org/10.1111/nicc.12350.

6. Wolfe A. Institute of Medicine report: Crossing the quality chasm: A new health care system for the 21st century. Policy Polit Nurs Pract 2001; 2:233–5. https://doi.org/10.1177/152715440100200312.

7. Macrae C. The problem with incident reporting. BMJ Qual Saf 2016; 25:71–5. https://doi.org/10.1136/bmjqs-2015-004732.

8. Pronovost PJ, Morlock LL, Sexton JB, Miller MR, Holzmueller CG, Thompson DA, et al. Improving the value of patient safety reporting systems. In: Henriksen K, Battles JB, Keyes MA, Grady ML, eds. Advances in Patient Safety: New Directions and Alternative Approaches (Vol. 1: Assessment). Rockville: Agency for Healthcare Research and Quality, 2008.

9. Najjar S, Nafouri N, Vanhaecht K, Euwema M. The relationship between patient safety culture and adverse events: A study in palestinian hospitals. Saf Health 2015; 1:16. https://doi.org/10.1186/s40886-015-0008-z.

10. Wafer MA. The relationship among organizational structures, patient safety practices, and patient safety event reporting among nurses in hospitals in the United States. The State University of New Jersey. PhD Dissertation. 2015.

11. Ammouri AA, Tailakh AK, Muliira JK, Geethakrishnan R, Al Kindi SN. Patient safety culture among nurses. Int Nurs Rev 2015; 62:102–10. https://doi.org/10.1111/inr.12159.

12. Al-Mandhari A, Al-Zakwani I, Al-Kindi M, Tawilah J, Dorvlo ASS, Al-Adawi S. Patient safety culture assessment in oman. Oman Med J 2014; 29:264–70. https://doi.org/10.5001/omj.2014.70.

13. Mjadu TM, Jarvis MA. Patients' safety in adult ICUs: Registered nurses' attitudes to critical incident reporting. Int J Africa Nurs Sci 2018; 9:81–6.

14. Kirwan M, Matthews A, Scott PA. The impact of the work environment of nurses on patient safety outcomes: A multi-level modelling approach. Int J Nurs Stud 2013; 50:253–63. https://doi.org/10.1016/j.ijnurstu.2012.08.020.

15. Wei H, Sewell KA, Woody G, Rose MA. The state of the science of nurse work environments in the United States: A systematic review. Int J Nurs Sci 2018; 5:287–300. https://doi.org/10.1016/j.ijnss.2018.04.010.

16. Rogers AE, Hwang W-T, Scott LD, Aiken LH, Dinges DF. The working hours of hospital staff nurses and patient safety. Health Aff (Millwood) 2004; 23:202–12. https://doi.org/10.1377/hlthaff.23.4.202.

17. Barker LM, Nussbaum MA. Fatigue, performance and the work environment: a survey of registered nurses. J Adv Nurs 2011; 67:1370–82. https://doi.org/10.1111/j.1365-2648.2010.05597.x.

18. WHO. Patient safety. Oman. From: http://www.emro.who.int/patient-safety/countries/country-activities-oman.html Accessed: Nov 2020.

19. Ministry Of Health. Directorate General of Quality Assurance Center. From: https://www.moh.gov.om/en/web/directorate-quality-assurance-center/introduction Accessed: Nov 2020.

20. Ministry Of Health. Directorate General of Quality Assurance Center. Policy and procedure of incident reporting and learning system. From: https://www.moh.gov.om/en/web/directorate-quality-assurance-center/policy-and-procedure Accessed: Nov 2020.

21. Scott LD, Arslanian-Engoren C, Engoren MC. Association of sleep and fatigue with decision regret among critical care nurses. Am J Crit Care 2014; 23:13–23. https://doi.org/10.4037/ajcc2014191.

22. Ellen S. Slovin's formula sampling techniques. From: https://sciencing.com/slovins-formula-sampling-techniques-5475547.html Accessed: Nov 2020.

23. Sorra JS, Dyer N. Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture. BMC Health Serv Res 2010; 10:199. https://doi.org/10.1186/1472-6963-10-199.

24. Maslach C, Jackson SE, Leiter MP, Schaufeli WB, Schwab RL. Maslach burnout inventory sampler set manual, general survey, human services survey, educators survey, & scoring guides. Mind Garden. 1986.

25. Michielsen HJ, De Vries J, Van Heck GL. Psychometric qualities of a brief self-rated fatigue measure: The fatigue assessment scale. Journal of Psychosomatic Research 2003; 54:345–52. https://doi.org/10.1016/s0022-3999(02)00392-6.

26. Hoonakker P, Carayon P, Gurses A, et al. Measuring workload of ICU nurses with a questionnaire survey: The NASA Task Load Index. IIE Trans Healthc Syst Eng 2011; 1:131–43. https://doi.org/10.1080/19488300.2011.609524.

27. Lake ET. Development of the practice environment scale of the nursing work index. Res Nurs Health 2002; 25:176–88. https://doi.org/10.1002/nur.10032.

28. Vifladt A, Simonsen BO, Lydersen S, Farup PG. The association between patient safety culture and burnout and sense of coherence: A cross-sectional study in restructured and not restructured intensive care units. Intensive Crit Care Nurs 2016; 36:26–34. https://doi.org/10.1016/j.iccn.2016.03.004.

29. Halbesleben JR, Wakefield BJ, Wakefield DS, Cooper LB. Nurse burnout and patient safety outcomes: Nurse safety perception versus reporting behavior. West J Nurs Res 2008; 30:560–77. https://doi.org/10.1177/0193945907311322.

30. Van Bogaert P, Kowalski C, Weeks SM, Van Heusden D, Clarke SP. The relationship between nurse practice environment, nurse work characteristics, burnout and job outcome and quality of nursing care: A cross-sectional survey. Int J Nurs Stud 2013; 50:1667–77. https://doi.org/10.1016/j.ijnurstu.2013.05.010.

31. Aiken LH. Workforce staffing and outcomes. 7th Annual conference of the International Medical Workforce Collaborative. Oxford, England, 2003.

32. Mark BA, Harless DW, McCue M, Xu Y. A longitudinal examination of hospital registered nurse staffing and quality of care. Health Serv Res 2004; 39:279–300. https://doi.org/10.1111/j.1475-6773.2004.00228.x.

33. Friese CR, Lake ET, Aiken LH, Silber JH, Sochalski J. Hospital nurse practice environments and outcomes for surgical oncology patients. Health Serv Res 2008; 43:1145–63. https://doi.org/10.1111/j.1475-6773.2007.00825.x.

34. Arabi YM, Owais SMA, Al-Attas K, Alamry A, AlZahrani K, Baig B, et al. Learning from defects using a comprehensive management system for incident reports in critical care. Anaesth Intensive Care 2016; 44:210–20. https://doi.org/10.1177/0310057X1604400207.

35. Carlesi KC, Padilha KG, Toffoletto MC, Henriquez-Roldán C, Juan MAC. Patient safety incidents and nursing workload. Rev Lat Am Enfermagem 2017; 25:e2841. https://doi.org/10.1590/1518-8345.1280.2841.

36. Magalhães AMMd, Dall'Agnol CM, Marck PB. Nursing workload and patient safety: A mixed method study with an ecological restorative approach. Rev Lat Am Enfermagem 2013; 21:146–154. https://doi.org/10.1590/s0104-11692013000700019.

37. Salesman F, Jap J. Analysis of professional health provider need in east Nusa Tenggara until 2018. Health Syst Policy Res 2018; 5:68.

38. Geiger-Brown J, Trinkoff AM. Is it time to pull the plug on 12-hour shifts? Part 1. The evidence. J Nurs Adm 2010; 40:100–2. https://doi.org/10.1097/NNA.0b013e3181d0414e.

39. Montgomery VL. Effect of fatigue, workload, and environment on patient safety in the pediatric intensive care unit. Pediatr Crit Care Med 2007; 8:S11–6. https://doi.org/10.1097/01.PCC.0000257735.49562.8F.

40. Brown JK. Relationship between patient safety culture and safety outcome measures among nurses. Nursing Theses and Capstone Projects 2015; 247.

41. El-Jardali F, Sheikh F, Garcia NA, Jamal D, Abdo A. Patient safety culture in a large teaching hospital in Riyadh: Baseline assessment, comparative analysis and opportunities for improvement. BMC Health Serv Res 2014; 14:122. https://doi.org/10.1186/1472-6963-14-122.

42. AL Ma'mari Q, Abu Sharour L, Al Omari O. Predictors of perceptions of patient safety culture and frequency of event reporting by critical care nurses in Oman: A model-building approach. Crit Care Shock 2019; 22:230–42.

43. Sammer CE, Lykens K, Singh KP, Mains DA, Lackan NA. What is patient safety culture? A review of the literature. J Nurs Scholarsh 2010; 42:156–65. https://doi.org/10.1111/j.1547-5069.2009.01330.x.