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Correlation between professional quality of life and alarm fatigue symptoms among intensive care unit nurses

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Abstract

Introduction: Medical devices and equipment are necessary for accurate and continuous monitoring of the patients admitted to intensive care units, one of which is alarm systems. Frequent sounds of alarms can affect nurses' concentration and accuracy when providing care. Complications such as headache, fatigue, and stress occur after repeated alarms, leading to poor quality of professional life among nurses. This study aimed to determine the relationship between quality of professional life and alarm fatigue syndrome among intensive care unit nurses.

Methods: This cross-sectional study used convenience sampling to select nurses working in intensive care units from three hospitals in southern Iran in 2021 ($n = 201$). Data were collected using three questionnaires, including sociodemographic form, the professional quality of life questionnaire (ProQOL), and the alarm fatigue symptom (AFS) scale.

Results: The mean scores of compassion satisfaction (CS), burnout, secondary traumatic stress (STS) (subscales of the ProQOL), and AFS were 34.66 ± 7.54, 28.98 ± 7.59, 27.69 ± 5.87, and 13.48 ± 7.32, respectively. The majority of them had no or mild AFS, moderate CS, burnout, and STS. Among the study variables, only AFS were a significant predictor of CS and STS among ICU nurses. In addition, work experience in ICU, AFS, and a second job were significant predictors of burnout among ICU nurses.

Conclusions: The study results showed a significant relationship between alarm fatigue syndrome, burnout, STS, and CS. Given that more than half of the nurses in the intensive care unit in the present study experienced some degree of alarm fatigue syndrome, it is necessary to plan and implement interventions to better manage the alarms in the intensive care unit.

KEYWORDS
alarm fatigue, burnout, compassion satisfaction, intensive care nurses, professional quality of life, secondary traumatic stress

1 | INTRODUCTION

Nurses working in intensive care units have to provide care for patients with critical and life-threatening conditions.[1] Nurses have to become aware of changes in the information of equipment and devices connected to patients and make the right decisions to manage their conditions.[2] They must ensure and maintain the normal function of damaged organs and prevent damage to healthy organs in patients admitting to the ICU,[3] so they require sufficient and safe facilities and equipment, one of which is alarm systems. If the measured parameters are lower or higher than the specified limit, the device starts alarming, which means that the patient needs to be checked for problems and disorders.[4] Nurses may not appropriately respond to alarms because of the increasing frequency of these alarms in various medical devices.[5] Complications such as headache, fatigue, and stress following repeated alarms cause nurses to ignore alarms, set alarms in a distant place regardless of the physiological needs of patients or even interrupt these alarms.[6] According to the report of the Joint Commission's National Patient Safety, clinical devices sound more than 100 times per patient per day, which will result in alarm fatigue and reduced patient safety.[7] Alarm fatigue negatively affects the quality of professional life of nurses. Quality of professional life refers to a person's feelings about her/his work.[8]

Factors related to the quality of professional life among nurses are divided into two parts: situational and intrinsic parts.[9] Compassion satisfaction (CS) and secondary traumatic stress (STS) are intrinsic factors; CS means the satisfying feeling that comes from helping others,[10] while STS refers to psychosomatic problems that are more common among nurses than others due to their high responsibilities.[11-13] Situational factors include burnout, which gradually discourages and forces individuals to retreat psychologically.[14] Burnout syndrome is defined as a response to chronic work-related stress.[8] Faraji et al. reported a significant inverse relationship between quality of professional life and job abandonment.[15] The low quality of professional life of nurses may reduce their quality of care.[16] Therefore, this study aimed to determine the relationship between quality of professional life and alarm fatigue among ICU nurses.

1.1 | Study objectives

Determine the mean professional quality of life and alarm fatigue symptoms (AFS) among intensive care nurses.

Examine the relationship between sociodemographic characteristics of the participants and professional quality of life.

Determine the correlation between professional quality of life and AFS among intensive care nurses.

Examine predictors of professional quality of life subscales among intensive care nurses.

2 | MATERIALS AND METHODS

2.1 | Study design and setting

This cross-sectional study (May to July 2021) was conducted in intensive care units of three educational hospitals in Kerman, southeastern Iran, with a population of more than 722,000.[17]

2.2 | Sampling and sample size

Convenience sampling method was used. Inclusion criterion were a bachelor's/higher degree in nursing, having at least 6 months' work experience in ICU, no self-reported hearing impairment and psychological disorders. Informed consent was obtained from all participants. Exclusion criterion was experience of severe stressful situation 1 month ago (death of relatives, divorce,... and incomplete questionnaires). The sample size was estimated to be 196 individuals using the Cochran formula ($d = 0.05$, $Z = 1.96$, $p = q = 0.5$), but 215 questionnaires were distributed and returned due to the dropout rate, of which 14 questionnaires excluded from the study due to high rate of missing values. Therefore, the effective response rate was 94%.

2.3 | Instrument

Data were collected using three questionnaires, including socio-demographic form, the professional quality of life questionnaire (ProQOL), and the AFS.

The sociodemographic form includes gender, age, marital status, education level, type of employment, work experience in ICU, and a second job.

The ProQOL developed by Stamm[18] consisted of 30 items and three subscales: satisfaction with compassion, burnout, and secondary trauma stress. Items 1, 4, 15, 17, 29 were scored inversely with a 5-point Likert scale ranging from 1 (never) to 5 (often). Each subscale is independent and subscale scores were not added. Scores ≤22 indicates low CS, lower burnout, or lower secondary trauma stress, scores 23−41 indicate moderate, and scores >42 indicate higher CS, more burnout, or more traumatic stress. To evaluate the instrument reliability by internal consistency method, Stamm calculated Cronbach's α coefficients of the CS (0.88), burnout (0.75), and secondary trauma stress (0.81).[18] In Iran, Gorji et al. calculated the Cronbach's α of 0.73 using internal consistency.[19]

The AFS scale was developed and validated by the researchers of the present study. We used comparative method, meaning that items were prepared by reviewing the texts with related keywords. The scale consists of 10 items and two subscales: psychosomatic symptoms and care-related symptoms. The scores were rated on a 5-point Likert scale from never (0) to always (4) (total score 0−40). The scores 0−10 indicate no/little alarm fatigue, 11−20 indicate mild,

21–30 indicate moderate, and 31–40 moderate severe alarm fatigue. The Cronbach's α values for the AFS and its subscales ranged from 0.85 to 0.875. The item-total correlations for the alarm fatigue scale ranged from 0.50 to 0.66.

2.4 | Ethical consideration

In the present study, the target population was intensive care nurses in three educational hospitals affiliated to Kerman University of Medical Sciences. After obtaining the code of ethics from the ethics committee of Kerman University of Medical Sciences (IR.KMU.R-EC.1400.137), the researcher referred to the educational hospitals in the morning, evening, and night shifts and explained participants the study purpose and the eligible samples who were willing to participate in the study were asked to complete the questionnaires carefully. We tried to give questionnaires to nurses when their workload was less and received the completed questionnaires on the next day. Samples were assured that all information would remain confidential.

2.5 | Data analysis

SPSS22 was used to analyze the data. The data were described using descriptive statistics (frequency, percentage, mean, and standard deviation). As the main variables of the study had normal distribution, Pearson's correlation coefficient was used to assess the correlation between CS, burnout, STS, and AFS. Parametric tests such as independent t-test and analysis of variance were used to compare CS, burnout, and STS according to the qualitative variables; otherwise, Mann–Whitney U and Kruskal–Wallis tests were used. The multivariate linear regression models were used to determine the predictors of CS, burnout, and STS. The significance level of 0.05 was used.

3 | RESULTS

Totally 201 questionnaires were analyzed. The mean age of the participants was 32.08 ± 6.28 years. The majority of the them were female, married, and with bachelor's degree. The majority of them had less than 5 years of work experience in ICU. Only 9.0% of the participants had a second job (Table 1).

The mean score of CS was 34.66 ± 7.54. Six-point five percent ($n = 13$) of the participants had low, 77.1% ($n = 155$) had moderate, and 16.4% (n = 33) had high CS. The mean score of burnout was 28.98 ± 7.59. Seventeen-point nine percent ($n = 36$) of the participants had low, 74.1% ($n = 149$) had moderate, and 8% ($n = 16$) had high burnout. The mean score of STS was 27.69 ± 5.87. Nineteen-point four percent ($n = 39$) of the participants had low, 79.6% ($n = 160$) had moderate, and 1% ($n = 2$) had high STS (Table 2).

The mean score of AFS was 13.48 ± 7.32. Thirty-nine-point eight percent ($n = 80$) of the participants had no AFS, 46.3% ($n = 93$) had mild, 10.9% ($n = 22$) had moderate, and 3% ($n = 6$) had severe AFS (Table 2).

We found a significant negative and weak correlation between CS, AFS, and its subscales, as well as a significant positive moderate correlation between burnout and the psychosomatic subscale of AFS ($r = 0.32$, $p < 0.001$). We observed a significant positive moderate correlation between STS and the psychosomatic symptoms subscale of AFS ($r = 0.44$, $p < 0.001$) but a positive weak correlation between STS and the care-related symptoms subscale of AFS ($r = 0.22$, $p = 0.002$) (Table 2).

The bivariate analysis showed a correlation between the CS and work experience in ICU, as well as between burnout, work experience in ICU, and a second job. Furthermore, none of the nurses' characteristics had correlation with the STS. For further analysis, we included all variables with p-value < 0.2 in bivariate analysis[20] in the multivariate linear regression models to determine the predictors of CS, burnout, and STS. The results showed that among the study variables, only the AFS was a significant predictor of the CS and STS among ICU nurses. In addition, work experience in ICU, the AFS, and a second job were significant predictors of the burnout among ICU nurses (Tables 3–5) ($F = 7.18$ ($p < 0.001$), $R = 0.32$, $R^2 = 0.10$, adjusted $R^2 = 0.09$).

4 | DISCUSSION

The present study investigated the relationship between the quality of professional life (CS, job burnout, and STS) and alarm fatigue among nurses working in intensive care units in Kerman, southeastern Iran.

4.1 | The mean compassions of satisfaction, burnout, STS, and alarm fatigue

The present study reported moderate CS among ICU nurses. Storm et al. in the United States of America and Salimi et al. in Iran supported this result.[2,21] CS occurs when healthcare providers feel satisfied with the relationship with patients as well as success in their work.[22] Therefore, CS affects the retention of nurses in their jobs, patient safety, and patient satisfaction.[22]

We reported moderate level of burnout among ICU nurses. Cañadas-de la Fuente et al. showed that more than one-third of ICU nurses experienced moderate levels of burnout.[23] Aghili et al. also reported that ICU nurses had the highest job burnout compared to other nurses.[24] The above studies were consistent with the present study because of the high workload and stress of nurses working in the ICU. Job burnout can appear in the form of insensitivity to the responsibility of caring for patients, which leads to negative care consequences.[25]

TABLE 1 Sociodemographic characteristics of the participants and their association with professional quality of life subscales ($n = 201$).

Variables	N (%)	Compassion satisfaction Mean (SD)	Statistical test (p value)	Burnout Mean (SD)	Statistical test (p value)	Secondary traumatic stress Mean (SD)	Statistical test (p value)
Age (year)							
23–30	108 (53.7)	33.90 (8.2)	$Z = -1.48$ (0.14)	28.0 (8.03)	$t = -1.98$ (0.05)	27.24 (6.51)	$Z = -0.70$ (0.49)
>30	93 (46.3)	35.55 (6.62)		30.11 (6.92)		28.21 (5.03)	
Gender							
Female	157 (78.1)	34.57 (7.46)	$t = -0.32$ (0.75)	28.54 (6.79)	$Z = -1.10$ (0.30)	27.94 (5.72)	$t = 1.16$ (0.25)
Male	44 (21.9)	34.98 (7.88)		30.53 (9.86)		26.78 (6.39)	
Marital status							
Married	116 (57.7)	34.10 (8.17)	$t = -0.90$ (0.37)	29.40 (8.27)	$t = 0.69$ (0.49)	27.70 (5.81)	$t = 0.04$ (0.97)
Single/divorced	85 (42.3)	35.07 (7.04)		28.66 (7.07)		27.68 (5.95)	
Educational level[a]							
BSc	168 (88.9)	34.81 (7.31)	$t = -0.82$ (0.41)	28.85 (7.55)	$t = -1.76$ (0.08)	27.60 (5.92)	$t = -0.81$ (0.42)
MSc	21 (11.1)	36.19 (6.76)		31.90 (7.05)		28.71 (6.46)	
Type of employment							
Hired	94 (46.8)	35.34 (7.13)	$t = 1.20$ (0.23)	29.41 (7.51)	$t = 0.76$ (0.45)	27.79 (5.22)	$t = 0.23$ (0.82)
Contract recruiters	107 (53.2)	34.06 (7.86)		28.59 (7.68)		27.60 (6.41)	
Work experience (year)[a]							
1–5	96 (48.5)	33.81 (8.14)	$F = 1.34$ (0.26)	28.29 (8.14)	$F = 1.78$ (0.15)	27.36 (6.24)	$F = 0.89$ (0.45)
6–10	30 (15.2)	34.78 (7.24)		27.40 (6.38)		27.17 (6.71)	
11–15	50 (25.3)	34.88 (6.67)		30.46 (6.76)		28.83 (4.15)	
>15	22 (11.01)	37.34 (7.13)		30.86 (8.32)		27.02 (6.61)	
Work experience in ICU (year)[a]							
1–5	131 (66.8)	33.99 (7.85)	$F = 3.14$ (0.045)	28.06 (7.66)	$F = 3.45$ (0.03)	27.38 (6.18)	$H = 0.20$ (0.90)
6–10	31 (15.8)	34.12 (7.78)		30.06 (6.52)		28.34 (5.15)	
>10	34 (17.4)	37.57 (5.83)		31.68 (8.06)		28.19 (5.66)	

TABLE 1 (Continued)

Variables	N (%)	Compassion satisfaction		Burnout		Secondary traumatic stress	
		Mean (SD)	Statistical test (p value)	Mean (SD)	Statistical test (p value)	Mean (SD)	Statistical test (p value)
Second job[a]							
Yes	18 (9.0)	32.60 (7.40)	t = −1.23 (0.22)	33.30 (10.21)	Z = −2.14 (0.03)	28.11 (5.96)	t = 0.30 (0.77)
No	182 (91.0)	34.88 (7.56)		28.60 (7.17)		27.68 (5.88)	

Note: The significance level of 0.05 was used.

Abbreviations: F, analysis of variance; H, Kruskal–Wallis test; ICU, intensive care unit; SD, standard deviation; t, independent t-test; Z, Mann–Whitney U test.

[a]Missing values.

Sharifi et al. showed that paying attention to mental health, reducing the workload of personnel through adjusting shift work, reducing job-related stress, and creating a healthy work environment could reduce or prevent burnout.[26] Zhang et al. and Gerami Nejad et al. agreed with us and showed moderate level of STS among the participants.[27,28]

Similar results of different studies in different times and research groups suggest that STS is not influenced by the organizational and managerial atmosphere and even the workload in different clinical situations. We also observed a mild alarm fatigue level among the participants, while Zhao et al. and Storm et al. did not agree with us maybe due to the difference in the number and type of medical equipment and devices of different societies, as well as the sensitivity of the alarms.[2,29]

4.2 | The relationship between alarm fatigue, CS, burnout, and STS

The present study indicated an inverse and significant relationship between CS and alarm fatigue. According to Kase et al., fatigue, recent involvement in a clinical situation, and absence of uncomfortable topics were significant predictors of low CS scores among nurses.[30] They supported our results; although, the clinical setting of the present study was different from that of the above study. Similar results may be due to the effect of psychological factors on the CS and similar psychological factors governing the clinical settings of nurses. CS is a positive outcome of care in which nurses enjoy their practice by providing quality care to patients.[25]

The present study reported a positive and significant relationship between the psychosomatic dimension of alarm fatigue, job burnout, and STS. Ogińska-Bulik et al. and Zhang et al. also reported a positive correlation between alarm fatigue, STS, and job burnout.[31,32] Storm et al. reported a positive correlation between alarm fatigue and job burnout.[2] Similar results confirm the relationship between the different dimensions of the quality of professional life and alarm fatigue.

4.3 | The relationship between sociodemographic characteristics and the professional quality of life subscales

Jakimowicz et al. agreed with our results and found a positive and significant relationship between CS and work experience in the ICU,[33] while other studies reported a positive and significant correlation between CS and shift work.[34,35] Comparing the study results with the results of the above studies suggests that the social difference, organizational culture, workload, and standard devices and equipment in the workplace can have a significant impact on the CS among nurses.

The current study found a positive and significant relationship between work experience in ICU, a second job, and job burnout,

TABLE 2 Data description and their correlation ($n = 201$).

Variables	Mean (SD)	Pearson's correlation coeficient (p value)					
		CS	Burnout	STS	AFS	PS	CRS
Compassion satisfaction (CS)	34.66 (7.54)	1					
Burnout	28.98 (7.59)	0.05 (0.46)	1				
Secondary traumatic stress (STS)	27.69 (5.87)	−0.58 (<0.001)	0.54 (<0.001)	1			
Alarm fatigue symptoms (AFS)	13.48 (7.32)	−0.27 (<0.001)	0.32 (<0.001)	0.39 (<0.001)	1		
Psychosomatic symptoms (PS)	8.24 (4.53)	−0.21 (0.003)	0.44 (<0.001)	0.44 (<0.001)	0.86 (<0.001)	1	
Care-related symptoms (CRS)	5.35 (4.38)	−0.22 (0.002)	0.10 (0.15)	0.22 (0.002)	0.84 (<0.001)	0.46 (<0.001)	1

Note: The significance level of 0.05 was used.

Abbreviation: SD, standard deviation.

TABLE 3 Predictors of compassion satisfaction by multiple liner regression analysis.

Predictors of compassion satisfaction	Unstandardized coefficients			Standardized coefficients		
	B	Standard error	95% CI for B	β	t	p Value
Constant	35.84	3.58	28.78 to 42.90		10.01	<0.001
Age (year)	0.07	0.13	−0.19 to 0.32	0.06	0.51	0.61
ICU working experience (year)	0.13	0.19	−0.24 to 0.50	0.07	0.68	0.50
Alarm fatigue symptoms	−0.31	0.07	−0.45 to −0.17	−0.30	−4.28	<0.001

Note: The significance level of 0.05 was used.

Abbreviations: ICU, intensive care unit.

TABLE 4 Predictors of burnout by multiple liner regression analysis.

Predictors of burnout	Unstandardized coefficients			Standardized coefficients		
	B	Standard error	95% CI for B	β	t	p Value
Constant	33.24	5.30	22.78 to 43.71		6.27	<0.001
Age (year)	−0.14	0.13	−0.40 to 0.12	−0.11	−1.04	0.30
Work experience in ICU (year)	0.56	0.18	0.20 to 0.93	0.32	3.04	0.003
Alarm fatigue symptoms	0.34	0.07	0.20 to 0.49	0.33	4.75	<0.001
Education	2.10	1.69	−1.25 to 5.45	0.09	1.24	0.22
Second Job	−4.95	1.91	−8.72 to −1.19	−0.18	−2.60	0.01

Note: $F = 9.31$ ($p < 0.001$), $R = 0.46$, $R^2 = 0.21$, adjusted $R^2 = 0.19$. The significance level of 0.05 was used.

Abbreviations: ICU, intensive care unit.

TABLE 5 Predictors of secondary traumatic stress by multiple liner regression analysis.

Predictors of secondary traumatic stress	Unstandardized coefficients			Standardized coefficients		
	B	Standard error	95% CI for B	β	t	p Value
Constant	23.48	0.80	21.90–25.06		29.23	<0.001
Alarm fatigue symptoms	0.31	0.05	0.21–0.42	0.39	5.96	<0.001

Note: $F = 35.55$ ($p < 0.001$), $R = 0.39$, $R^2 = 0.15$, adjusted $R^2 = 0.15$. The significance level of 0.05 was used.

Abbreviation: ICU, intensive care unit.

which is consistent with the results of Salimi et al., also reported high workload as the most stressor among nurses, leading to increased burnout in them.[21] Similar results between our study and above studies are due to the importance of burnout among nurses in intensive care units who involve with patients more.

4.4 | Predictors of the alarm fatigue and professional quality of life subscales

Among the study variables, alarm fatigue is a significant predictor of CS and STS in intensive care nurses. Work experience in the ICU, alarm fatigue, and a second job are significant predictors of burnout among ICU nurses. The above results are consistent with the results of various studies in Iran, China, and the US.[10,21,36–38] Considering the increasing progress of medical equipment for more accurate monitoring of patients and multiple alarms, we must pay more attention to the alarm fatigue among nurses. As the nursing community faces many concerns in the clinical environment, including limitations and responsibilities, a detailed examination of the various aspects of the quality of professional life will improve the quality of professional life and clinical care among nurses.

5 | LIMITATIONS

The limitation of the study is that it was conducted with a small group and in an area in the southeast region of Iran. The study used a convenience sample of ICU nurses in hospitals supervised by Kerman University of Medical Science that was thus not representative of all south-east Iranian nurses. The participants were female and worked in ICU wards, limiting the generalizability of the findings to male nurses and those working in other wards.

6 | CONCLUSION

The study results showed that alarm fatigue syndrome was significantly associated with burnout, STS, and CS. Given that more than half of the nurses in the intensive care unit in the present study experienced some degree of alarm fatigue syndrome, it is necessary to plan and implement interventions to better manage the alarms in the intensive care unit. This study helps to identify the effect of alarm fatigue on the quality of professional life, regulation, and management of known factors in the intensive care environment. In addition, it provides insights into better identifying factors related to the nursing profession to help clients. It is clear that nursing burnout and patient injury are important issues, especially when facing with alarm fatigue and desensitization. Therefore, upgrading and maintaining an ongoing intra-professional communication and alarm monitoring is crucial in reducing these potential problems.

7 | PRACTICE IMPLICATIONS

Knowledge of various factors of professional quality of life that may be effective in caring for patients, especially ICU patients leads to a safe care environment for patients and nurses. Therefore, these results can be used to implement institutional changes such as making policies and guidelines for the development of preventive interventions and psychosocial support for nurses.

CONFLICT OF INTEREST STATEMENT
The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT
The data sets generated and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

TRANSPARENCY DECLARATION
The lead author (Neda Asadi) affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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