Original Article

The Relationship between Alarm Fatigue and Patience Levels among Intensive Care Nurses

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Abstract
Background and aim: The alarms act as life-saving alerts while posing challenges for nursing staff due to their overwhelming frequency. This study investigated the relationship between alarm fatigue and patience levels among intensive care nurses
Material and methods: This cross-sectional and correlational study was conducted on 80 intensive care nurses in a public hospital in Turkey's Western Black Sea region.
Results: The nurses had an average score of 60.10±19.33 on the Patience Scale for Nurses and 24.42±5.86 on the Alarm Fatigue Scale. No statistically significant differences were observed between the nurses' alarm fatigue and patience levels and demographic characteristics of nurses ($p>0.05$). The significant difference was identified between alarm fatigue levels and factors such as years of professional experience, weekly working hours, and training in alarm management ($p<0.05$). The patience levels significantly differed based on the type of intensive care unit, years of work in intensive care, weekly working hours, and the number of patients cared for daily ($p<0.05$). No statistically significant relationship was found between patience levels and alarm fatigue ($p>0.05$).
Conclusion: These results suggest the importance of implementing awareness training programs to mitigate alarm fatigue among intensive care nurses.

Keywords: alarm fatigue, patience, intensive care unit, intensive care nurse

Introduction

Intensive care units (ICUs) are specialized environments designed to care for patients with critical conditions requiring continuous support to sustain vital functions (Alan et al., 2021). Due to the severity of their conditions, patients in ICUs necessitate 24-hour monitoring alongside ongoing treatment and care to ensure their safety. Consequently, a wide range of medical devices is employed, including bedside monitors for tracking vital signs, intravenous fluid and nutrition pumps, ventilators, and suction devices (Ali Al-Quraan et al., 2023; Alkubati et al., 2024). The alarms and warning systems integrated into these devices frequently produce a substantial number of false or clinically insignificant alarms (Alkubati et al., 2024; Aronsson et al., 2017; Asadi et al., 2022; Cho et al., 2016). Research indicates that the false-positive alarm rate in ICUs ranges from 64% to 99% (Ali Al-Quraan et al., 2023; Alkubati et al., 2024; Yang et al., 2024). Moreover, it has been reported that an individual ICU patient may trigger an average of over 700 alarms daily (Bach et al., 2018; Chesak et al., 2019).

In intensive care units, alarms generated by medical devices play a critical role in patient care, acting as life-saving alerts while

simultaneously posing challenges for nursing staff due to their overwhelming frequency. The high occurrence of false-positive alarms contributes to alarm fatigue, a condition characterized by sensory overload, delayed alarm responses, or even disregard for alarms by nurses working in alarm-intensive ICU environments (Ali Al-Quraan et al., 2023; Asadi et al., 2022; Aykut & Van Gıersbergen 2022). Research suggests that alarm fatigue is not solely attributable to the sheer volume of alarms. Other contributing factors include nurses' characteristics, patient-specific variables, features of the monitoring systems, job-related factors, and organizational dynamics (Bourji et al., 2020; Claudio et al., 2021; Hravnak et al., 2018). These findings underscore the multifaceted nature of alarm fatigue and the need for comprehensive strategies to mitigate its impact.

Alarm fatigue negatively impacts nurses' professional quality of life (Aronsson et al., 2017; Asadi et al., 2022). In the high-pressure, critical environment of ICUs, nurses must exert significant effort and energy to meet the needs of patients and their families (Azevedo et al., 2019). Excessive alarms can lead to stress and reduced focus among nurses, thereby jeopardizing patient safety (Chesak et al., 2019; Cho et al, 2016; Chromik et al., 2022). Alarm-related incidents have even been associated with patient deaths, as evidenced between 2009 and 2012. Recognizing its critical importance, alarm fatigue was identified as a top patient safety priority in 2013. Over the following decade, clinical alarm safety was included as an annual Joint Commission National Patient Safety Goal and frequently listed among the "Top 10 Health Technology Hazards" (Yang et al., 2024). Additionally, alarm fatigue can contribute to sleep disturbances in nurses, reduce collaboration, increase aggression, and impair the ability to process social cues (Dehghan et al., 2023; Yang et al., 2024).

Nursing is a profession that demands patience and involves significant physical and emotional challenges. Patience emerges as a significant theme in nurses' narratives about their emotional experiences in the workplace (Eldin et al., 2021; Flanders et al., 2020). Roitenberg (2021) stated that patience in the workplace was described as an emotional resource that is gradually depleted by staff members. Patience is generally defined as the ability to endure difficult circumstances calmly and sensibly, especially when waiting or under challenging conditions ((Eldin et al., 2021; Flanders et al., 2020). The nursing profession addresses healthcare needs by emphasizing efficiency and evidence-based interventions. Expressive care in nursing is patient-centered and rooted in interpersonal relationships, requiring compassionate attitudes that embody kindness and sensitivity (Friganović & Selič, 2021). However, the depletion of patience can lead to negative emotions such as anger and frustration, which may accumulate and adversely affect attitudes toward clinical practice (Flanders et al., 2020; Isik et al., 2022). The critical conditions of intensive care patients increase the caregiving burden on nurses, making patience a crucial factor for ensuring professional patient care and safety among intensive care nurses (Suzen & Cevik, 2020). A review of the literature reveals no studies investigating the relationship between alarm fatigue and patience. This study was designed to explore the relationship between alarm fatigue and patience levels among intensive care nurses.

Materials and Methods

Study Design: This study was conducted as a cross-sectional and correlational research.

Population and Sample: The study population comprised nurses working in the intensive care units of a public hospital in Turkey's Western Black Sea Region. The sample size was determined using G*Power 3.1.9.7 software. The effect size for the relationship between the Patience Scale for Nurses and the Alarm Fatigue Scale was set at 0.33. Based on this, the required sample size was calculated to be 72 nurses, using an effect size of 0.33, a significance level of α=0.05, and 90% statistical power.

The study included nurses who voluntarily agreed to participate, had at least one year of active ICU experience, had completed ICU orientation training, and did not have a diagnosed psychiatric disorder. Exclusion criteria included nurses who provided incomplete responses to the data collection tools or were on sick leave, annual leave, or maternity leave during the study period. Employing a convenience non-probability

sampling method, the study was finalized with a total of 80 nurses.

Instruments: The data for this study were gathered using three instruments: the Nurse Information Form, the Patience Scale for Nurses, and the Alarm Fatigue Scale.

Nurse Information Form: This form contains 12 items aimed at assessing the demographic and work-related characteristics of the participating nurses (Ka Can & Örsal, 2018; Knap et al., 2022; Lewandowska et al., 2020).

Patience Scale for Nurses (PSN): This scale was developed to assess the levels of patience demonstrated by nurses in coping with the challenges of their professional lives by Tezcan and Yilmaz (2020). The scale includes four sub-dimensions: Patience Toward Colleagues, Patience Toward Work Processes, Patience Toward Patients and Their Families, and Patience Toward Inadequacy. The total possible scores on the scale range from 24 to 120, with higher scores indicating higher levels of patience. The reliability coefficient (Cronbach's alpha) of the scale was reported as 0.840 in its original study (Tezcan & Yilmaz, 2020). In this current study, the Cronbach's alpha reliability coefficient was calculated as 0.963, demonstrating excellent internal consistency.

Alarm Fatigue Scale: The Alarm Fatigue Scale, developed by Torabizadeh et al. (2017) was designed to assess the psychological stress experienced by nurses working in intensive care units due to alarm sounds. The scale's validity and reliability for the Turkish population were established by Alan et al. in 2021 (Alan et al., 2021). The scale uses a 5-point Likert scale (0: Never to 4: Always), with higher scores indicating increased alarm fatigue, which in turn negatively impacts performance.

The scale consists of two sub-dimensions. The Positive Response Sub-Dimension reflects clinical practices aimed at reducing alarms, while the Negative Response Sub-Dimension reflects practices that contribute to an increase in alarms. In the original study, Cronbach's alpha coefficients for the sub-dimensions were found to be 0.63 for the Positive Response Sub-Dimension and 0.74 for the Negative Response Sub-Dimension, with an overall scale reliability coefficient of 0.71 (54). In the present study, the Cronbach's alpha reliability coefficient for the scale was calculated as 0.692.

Data Collection: The data for this study were collected between February 2024, and August 2024. The survey forms were distributed to the nurses by the researcher after visiting the intensive care units and providing the necessary instructions. A designated period was allocated for the nurses to complete the forms, during which they were reminded not to interact with one another while filling out the surveys. The completed surveys were collected on the same day.

Data Analysis: The data obtained were analyzed using SPSS 26.0 software. The normality of the data was assessed using the Shapiro-Wilk test. For normally distributed data, descriptive statistical methods were applied, along with independent t-tests, one-way ANOVA, Pearson correlation analysis, and the Bonferroni test. For non-normally distributed data, the Mann-Whitney U test, Kruskal-Wallis test, Spearman correlation test, and Tamhane's T2 test were used. A significance level of $p<0.05$ was set for all analyses, with a 95% confidence interval.

Ethical Considerations: Firstly, written institutional approval was obtained from the Ethics Committee of the Faculty of Social and Human Sciences on January 30, 2024 (approval number: 2024-SBB-0022).

Written consent was also obtained from the institution where the research was conducted. Informed written consent was collected from all participants. Permission for the use of the scales was granted via email by the authors who developed the scale and conducted the Turkish validity and reliability analysis.

Results

The demographic characteristics of the intensive care unit nurses are presented in Table 1. According to the data, 36.3% of the nurses were in the 30-34 age range, and 72.5% were female. Furthermore, 67.5% of the nurses were married, and 80% held a bachelor's degree (Table 1).

Table 2 presents the work-related characteristics of intensive care nurses. According to the table, 57.5% had 10 or more years of professional experience, 65% had worked in intensive care units (ICUs) for 1-5 years, and 53.8% were employed in tertiary-level ICUs. Additionally, 90% of the nurses

worked as ward nurses. Of the nurses, 56.3% worked 49 hours or more per week, 85% worked rotating night and day shifts, and 60% provided care for 3-4 patients daily. Furthermore, 63.7% had not received alarm management training, and 12.5% reported having negative experiences related to alarms (Table 2).

The intensive care unit (ICU) nurses achieved an overall mean score of 60.10±19.33 on the Patience Scale for Nurses. Breakdown by sub-dimensions revealed mean scores of 17.35±5.79 for the Patience Toward Colleagues sub-dimension, 18.81±6.33 for the Patience Toward Work Processes sub-dimension, 15.41±5.44 for the Patience Toward Patients and Their Relatives sub-dimension and 8.52±4.15 for the Patience Toward Insufficiency sub-dimension. Additionally, the total mean score of ICU nurses on the Alarm Fatigue Scale was 24.42±5.86, with sub-dimension scores of 9.37±1.99 for the Positive Response sub-dimension and 15.05±5.08 for the Negative Response sub-dimension (Table 3).

No statistically significant difference was found between the intensive care unit nurses' scores on the Alarm Fatigue Scale and their demographic characteristics ($p>0.05$).

According to Table 4**,** as the years of professional experience of the nurses decreased, the average scores on the Negative Response subscale and the total Alarm Fatigue Scale scores significantly increased ($p<0.05$). Nurses working 49 hours or more per week had significantly lower average scores on the Negative Response sub-dimension ($p<0.05$). Nurses who received alarm management training had significantly higher average scores on the Positive Response **s**ub-dimension compared to those who did not receive training ($p<0.05$). No statistically significant difference was found between other work-related characteristics and the average scores on the Alarm Fatigue Scale ($p>0.05$).

Table 5 compares the work-related characteristics of intensive care unit (ICU) nurses with their levels of patience. According to the results, statistically significant differences were found between the nurses' work unit levels and their patience towards colleagues, work processes, and inadequacy, as well as the total scale scores ($p<0.05$). Nurses working in tertiary level ICU units exhibited the highest levels of patience towards their colleagues. Nurses working in first level ICU units had the lowest levels of patience towards work processes and inadequacy, as well as the lowest total patience scores ($p<0.05$). Nurses with 10 or more years of experience in the ICU had the highest levels of patience toward patients and their families ($p<0.05$). Additionally, nurses working 40-48 hours per week had the highest levels of patience towards inadequacy ($p<0.05$). ICU nurses providing care to 1-2 patients daily exhibited the highest levels of patience towards colleagues, work processes, inadequacy, and general patience ($p<0.05$). No statistically significant differences were found between the nurses' other work-life characteristics and their levels of patience ($p>0.05$).

In Table 6, no statistically significant relationship was found between patience levels and alarm fatigue among intensive care nurses ($p > 0.05$). However, it was observed that decreases in nurses' patience towards

work processes, patients and their families, and tolerance for inadequacies were associated with increases in alarm fatigue levels. Conversely, the table shows a positive, albeit not statistically significant, correlation between increased patience towards colleagues and higher levels of alarm fatigue ($p > 0.05$) (Table 5).

Table 1. Demographic Characteristics of the Nurses

	n	%
Age		
18-24	8	10.0
25-29	18	22.5
30-34	29	36.3
35≥	25	31.2
Gender		
Female	58	72.5
Male	22	27.5
Marital Status		
Married	54	67.5
Single	26	32.5
Education Level		
High school	4	5.0
Associate degree	6	7.5
Bachelor's degree	64	80.0
Postgraduate degree	6	7.5

Table 2. Work- Related Characteristics of Intensive Care Nurses

	n	%
Professional Experience (year)		
≤5	21	26.2
6-9	13	16.3
10≥	46	57.5
Experience in the Intensive Care Unit (ICU) (year)		
1-5	52	65.0
6-9	12	15.0
10≥	16	20.0
Type of Intensive Care Unit		
First level	23	28.7
Second level	14	17.5
Tertiary level	43	53.8
Position		
Ward nurse	72	90.0
Charge nurse	8	10.0
Weekly Working (hours)		
<40	7	8.7
40- 48	28	35.0
49≥	45	56.3
Work Schedule		
Day shifts	9	11.2
Night shifts	3	3.8
Rotating day and night shifts	68	85.0
Number of Patients Cared for (daily)		
1-2	18	22.5
3-4	48	60.0
5≥	14	17.5
Alarm Management Training		
Yes	29	36.3

No	51	63.7
Negative Experiences with Alarms		
Yes	10	12.5
No	54	67.5
Partial	16	20.0

Table 3. Levels of Patience and Alarm Fatigue in Intensive Care Unit Nurses

Scale	Subscale	Mean ± SD	Min-max scores
Patience Scale for Nurses	Total Score	60.10 ± 19.33	25-120
	Patience Toward Colleagues	17.35 ± 5.79	7-35
	Patience Toward Work Processes	18.81 ± 6.33	7-35
	Patience Toward Patients and Their Relatives	15.41 ± 5.44	6-30
	Patience Toward Insufficiency	8.52 ± 4.15	4-20
Alarm Fatigue Scale	Total Score	24.42 ± 5.86	13-40
	Positive Response	9.37 ± 1.99	4-29
	Negative Response	15.05 ± 5.08	6-15

SD= Standard Deviation Min=Minimum Max= Maximum

Table 4. Comparison of Nurses' Work-Related Characteristics and Average Scores on the Alarm Fatigue Scale

	Positive Response Sub-dimension	**Negative Response Sub-dimension**	**Alarm Fatigue Total**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**
Professional Experience (year)			
≤5	9.71±2.34	16.90±5.59[a]	26.61±6.98[a]
6-9	9.46±2.02	16.53±6.48	26.00±7.26
10≥	9.19±1.83	13.78±4.04	22.97±4.41
	χ^2 =1.591 p=0.451	F =3.604 p=**0.032***	F =3.550 **p=0.034***
Experience in the Intensive Care Unit (ICU) (year)			
1-5	9.51±2.05	15.69±5.39	25.21±6.28
6-9	9.00±1.47	14.25±4.78	23.25±5.44
10≥	9.18±2.19	13.65±3.99	22.75±4.34
	χ^2 =1.533 p=0.465	F =1.255 p=0.291	F=1.373 p=0.260
Type of Intensive Care Unit			
First level	9.39±2.08	16.04±5.40	25.43±6.23
Second level	10.35±2.02	14.85±4.57	25.21±5.36
Tertiary level	9.04±1.87	14.58±5.10	23.62±5.83
	χ^2 =4.238 p=0.120	F=0.625 p=0.538	F=0.861 p=0.427
Position			
Ward nurse	9.40±1.99	15.16±5.12	24.56±5.88
Charge nurse	9.12±2.10	14.00±4.86	23.15±5.96

	Z=-0.138 p=0.890	t=0.613 p=0.542	t=0.658 p=0.512
Weekly Working (hours)			
<40	9.28±3.14	19.71±4.95	29.00±7.87
40- 48	9.17±1.94	14.64±5.03	23.82±5.50
49≥	9.51±1.85	14.57±4.87[b]	24.08±5.57
	χ^2 =0.679 p=0.712	F =3.425 **p=0.038***	F =2.435 p=0.094
Work Schedule			
Day shifts	8.11±1.83	15.33±5.45	23.44±6.55
Night shifts	10.33±0.57	17.66±10.26	28.00±10.14
Rotating day and night shifts	9.50±2.00	14.86±4.84	24.39±5.62
	χ^2 =5.300 p=0.071	F=0.435 p=0.649	F =0.678 p=0.511
Number of Patients Cared for (daily)			
1-2	8.77±2.04	15.83±4.38	24.61±5.38
3-4	9.45±1.99	14.68±4.95	24.14±5.77
5≥	9.85±1.87	15.28±6.47	25.15±7.06
	χ^2 =20.82 p=0.353	F=0.345 p=0.710	F=0.165 p=0.849
Alarm Management Training			
Yes	9.58±2.26[a]	13.62±5.13	23.20±6.35
No	9.25±1.84	15.86±4.92	25.11±5.51
	Z=-2.187 **p=0.029***	t=-1.928 p=0.058	t=-1.409 p=0.163
Negative Experiences with Alarms			
Yes	9.60±1.64	16.20±3.75	25.80±4.07
No	9.42±2.03	14.16±5.18	23.59±5.97
Partial	9.06±2.15	17.31±4.88	26.37±6.11
	χ^2 =0.827 p=0.661	F=7.090 p=0.272	F=1.733 p=0.184

Z= Mann Whitney U test t= Independent samples t-test χ^2= Kruskall Wallis test F= One way ANOVA *=p<0,05 SD= Standard Deviation a= The highest mean showing a difference among the groups b= The lowest mean showing a difference among the groups

Table 5. Comparison of Nurses' Work-Related Characteristics with Their Levels of Patience

	Patience Toward Colleagues Sub-dimension	**Patience Toward Work Processes Sub-dimension**	**Patience Toward Patients and Their Relatives Sub-dimension**	**Patience Toward Insufficiency Sub-dimension**	**Patience for Nurses Scale Total**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Professional Experience (year)					
≤5	16.95±6.76	18.76±7.15	14.23±6.15	7.47±4.27	57.42±21.65
6-9	19.46±5.02	20.46±6.27	16.38±3.86	9.00±3.34	65.30±16.48
10≥	16.93±5.50	18.36±6.01	15.67±5.50	8.86±4.29	59.84±19.08
	F=1.032 p=0.361	F=0.548 p=0.581	F=0.743 p=0.479	χ^2=3.363 p=0.186	F=0.670 p=0.515
Experience in the Intensive Care Unit (ICU) (year)					
1-5	17.13±6.21	18.69±6.91	15.44±5.69	8.19±3.97	59.46±20.30
6-9	15.58±3.94	16.66±4.39	12.41±2.99	7.33±2.60	52.00±9.90
10≥	19.37±5.18	20.81±5.14	17.56±5.24[a]	10.50±5.15	68.25±19.24[a]
	F=1.596 p=0.209	F=1.516 p=0.226	F=3.233 p=**0.045***	χ^2=3.464 p=0.177	F=2.604 p=0.080
Type of Intensive Care Unit					
First level	14.08±5.50	14.91±6.55[b]	13.78±4.87	6.60±2.85[b]	49.39±17.12[b]
Second level	17.85±3.23	22.28±2.97	16.21±5.35	8.50±3.34	64.85±10.51
Tertiary level	18.93±5.96[a]	19.76±6.07	16.02±5.69	9.55±4.64	64.27±20.66

	F=5.972 p= **0.004***	F=8.222 p=**0.001***	F=1.468 p=0.237	χ^2=7.714 p=**0.021***	F=5.522 p=**0.006***
Position					
Ward nurse	17.40±597	18.52±6.50	15.09±5.27	8.59±4.27	59.62±19.78
Charge nurse	16.87±4.08	21.37±3.81	18.25±6.54	7.87±2.94	67.37±15.04
	t=-0.243 p=0.809	t=-1.210 p=0.230	t=-1.567 p=0.121	Z=-0.073 p=0.942	t=-0.657 p=0.513
Weekly Working (hours)					
<40	15.00±4.89	16.57±5.12	11.57±5.59	6.00±3.31	49.14±12.04
40- 48	18.64±6.00	19.78±6.20	15.21±5.85	10.03±4.43[a]	63.67±20.60
49≥	16.91±5.71	18.55±6.58	16.13±5.01	7.97±3.82	59.57±19.06
	F=1.419 p=0.249	F=0.802 p=0.452	F=2.218 p=0.116	χ^2=8.041 p=**0.018***	F=1.646 p=0.199
Work Schedule					
Day shifts	16.00±4.89	16.66±4.74	12.33±5.07	7.44±3.90	52.44±13.86
Night shifts	18.00±5.00	15.33±2.88	14.33±3.21	6.66±3.05	54.33±6.35
Rotating day and night shifts	17.50±5.97	19.25±6.55	15.86±4.48	8.75±4.22	61.36±20.14
	F=0.281 p=0.756	F=1.136 p=0.327	F=0.767 p=0.178	χ^2=1.516 p=0.469	F=0.985 p=0.378
Number of Patients Cared for (daily)					
1-2	20.05±6.61[a]	21.27±6.93[a]	17.33±6.07	10.77±5.18[a]	69.44±23.19[a]
3-4	17.31±5.34	18.85±5.79	15.41±5.21	8.20±3.54	59.79±17.28
5≥	14.00±4.60	15.50±6.26	12.92±4.69	6.71±3.62	49.14±15.42
	F=4.711 p=**0.012***	F=3.487 p=**0.036***	F=2.683 p=0.075	χ^2=7.288 p=**0.026***	F=4.772 p=**0.011***
Alarm Management Training					
Yes	18.27±5.50	20.27±5.58	16.37±6.29	9.20±3.98	64.13±18.59
No	16.82±5.93	17.98±6.62	14.86±4.88	8.13±4.23	57.80±19.54
	t=1.079 p=0.284	t=1.573 p=0.120	Z=-1.104 p=0.270	t=1.200 p=0.234	t=1.417 p=0.160
Negative Experiences with Alarms					
Yes	16.20±5.20	18.20±6.71	14.00±4.96	6.90±3.03	55.30±15.95
No	16.77±5.97	18.37±6.35	15.24±5.57	8.22±3.94	58.61±19.55
Partial	20.00±4.99	20.68±6.05	16.87±5.27	10.56±4.88	68.12±19.12
	F=2.200 p=0.118	F=0.877 p=0.420	F=0.938 p=0.396	χ^2= 4.744 p=0.093	F=1.888 p=0.158

Z= Mann Whitney U test t= Independent samples t-test χ^2= Kruskall Wallis test F= One way ANOVA
*=p<0,05 SD= Standard Deviation a= The highest mean showing a difference among the groups b= The lowest mean showing a difference among the groups

Table 6. The Relationship Between the Levels of Patience and Alarm Fatigue in Intensive Care Nurses

Scales/Sub-dimensions	Patience Toward Colleagues Sub-dimension	Patience Toward Work Processes Sub-dimension	Patience Toward Patients and Their Relatives Sub-dimension	Patience Toward Insufficiency Sub-dimension	Patience for Nurses Total
Positive response Sub-dimension	rho=-0.148 p=0.189	rho=-0.125 p=0.271	rho= -0.074 p=0.516	rho=0.143 p=0.205	rho=-0.131 p=0.248
Negative response	r=0.059 p=0.605	r=-0.118 p=0.297	r=-0.122 p=0.282	rho=-0.025 p=0.825	r=-0.068 p=0.551

Sub-dimension					
Alarm Fatigue Scale total	r=0.013 p=0.908	r=-0.127 p=0.262	r=-0.127 p=0.263	rho=-0.042 p=0.714	r=-0.090 p=0.429

r= Pearson Correlation Analysis rho= Spearman Correlation Analysis

Discussion

This study examined the relationship between alarm fatigue and patience levels among intensive care nurses. The result revealed that the alarm fatigue of ICU nurses was at a moderate level. In previous studies conducted with ICU nurses, alarm fatigue was also found to be moderate in most cases. The current study results are consistent with the results of earlier studies (Asadi et al., 2022; Cho et al, 2016; Ding et al., 2023; Gundogan & Erdagı Oral, 2023; Seifert et al., 2021; Shaoru et al., 2023; Yahyaei et al., 2023). However, some studies conducted in Middle Eastern and African countries reported higher levels of alarm fatigue among ICU nurses (Ali Al-Quraan et al., 2023; Alkubati et al., 2024; Nyarko et al., 2024; Elhessewi & Eldin, 2017; Seifert et al., 2021). The high levels of alarm fatigue observed in ICU nurses in these countries may be attributed to a lack of knowledge regarding how to manage persistent alarms and the relationship between alarm fatigue and patient safety.

In this study, no statistically significant associations were found between the demographic characteristics of intensive care unit (ICU) nurses and their levels of alarm fatigue. This finding aligns with several previous studies (Ali Al-Quraan et al., 2023; Asadi et al., 2022; Cho et al., 2016; Ding et al., 2023; Kizilcik Ozkan et al., 2023; Seok et al., 2023; Sowan et al., 2016) However, the results revealed that alarm fatigue levels tended to be higher among male nurses (Alkubati et al., 2024; Bourji et al., 2020), female nurses (Salameh et al., 2024; Yahyaei et al., 2023), nurses over the age of 30 (Alkubati et al., 2024; Nyarko et al., 2024), and those with a bachelor's degree (Nyarko et al., 2024) or graduate-level education (Ding et al., 2023). These findings differ from some studies that reported lower alarm fatigue levels among ICU nurses with a bachelor's degree (Bourji et al., 2020; Yahyaei et al., 2023). A review of the existing literature suggests that the inconsistencies in findings related to gender, educational attainment, and age may stem from variations in the demographic composition of the sample groups across different studies

This study observed a significant increase in the mean scores for total alarm fatigue and its negative response sub-dimension as the years of professional experience among nurses decreased. Similarly, Nyarko et al., (2024) and Elhessewi et al., (2017) reported a statistically significant rise in mean alarm fatigue scores associated with fewer years of professional experience ($p < 0.05$). However, these findings are inconsistent with studies that have found no statistically significant relationship between professional experience and alarm fatigue (Ding et al., 2023; Kizilcik Ozkan et al., 2023; Seok et al., 2023) or reported an increase in alarm fatigue as professional experience increases (Alkubati et al., 2024). These variations are likely attributable to differences in the time nurses spend working in intensive care units (ICUs). While some studies included nurses who spent the majority of their careers in ICUs, others involved nurses with limited ICU experience or those with similar durations of ICU experience.

In the present study, nurses had relatively fewer years of ICU experience. Although a trend of increased alarm fatigue with decreasing ICU experience was noted, this finding did not reach statistical significance. Previous research has also suggested that ICU experience does not significantly influence alarm fatigue levels (Asadi et al., 2022; Cho et al., 2016; Ding et al., 2023; Salameh et al., 2024; Seok et al., 2023; Yahyaei et al., 2023). Conversely, some studies have reported a statistically significant association between shorter ICU experience and higher levels of alarm fatigue (Bourji et al., 2020; Kizilcik Ozkan et al., 2023; Nyarko et al., 2024),

highlighting a discrepancy with the findings of this study.

In this recent study, it was found that alarm management training among intensive care unit (ICU) nurses had a significant impact on the positive response sub-dimension of alarm fatigue. Additionally, ICU nurses who received training were observed to implement practices aimed at reducing alarms more frequently. However, no statistically significant differences were identified between receiving alarm management training and total alarm fatigue scores or the negative response sub-dimension scores. Nyarko et al., (2024) and Seok et al., (2023) similarly reported that alarm management training did not influence alarm fatigue among ICU nurses. Kizilcik Ozkan et al., (2023) aligned with the present study in showing no relationship between alarm management training and alarm fatigue. However, their results diverged by indicating no variability in the positive response sub-dimension, contrasting with the current findings. Conversely, Bi et al., (2020), in a randomized controlled trial, found that a 12-week alarm management training program significantly reduced alarm fatigue among ICU nurses. In both this study and previous studies, nurses' training status was assessed based on self-reports, without evaluating the duration or depth of the training programs.

In this study, nurses working 49 or more hours per week were found to have the lowest mean scores in the negative response sub-dimension of alarm fatigue ($p < 0.05$). Contrary to these findings, Yahyaei et al., (2023) reported no significant relationship between the monthly working hours of ICU nurses and alarm fatigue. In their study, 48.1% of nurses worked 50–100 hours per month, whereas in the present study, 56.1% of nurses worked 49 or more hours per week. This discrepancy may reflect differences in work schedules and sampling characteristics between the two studies.

Some studies have reported that nurses working rotating shifts experience statistically significantly lower levels of alarm fatigue (Alkubati et al., 2024; Asadi et al., 2022; Bourji et al., 2020). In contrast, one study (Shaoru et al., 2023) found that alarm fatigue was highest among nurses working night shifts. Similarly, in the present study, although the difference was not statistically significant, alarm fatigue was found to be at its highest level among nurses working night shifts.

Other work-life characteristics of ICU nurses mentioned in this study were not found to have an impact on alarm fatigue. This finding is consistent with the results of many previous studies (Cho et al., 2016; Ding et al., 2023; Kizilcik Ozkan et al., 2023; Nyarko et al., 2024; Salameh et al., 2024; Seok et al., 2023).

Patience serves as a buffer against emotions in stressful situations, enabling individuals to cope more effectively with frustrations and facilitating positive interpersonal interactions (Ratchford et al., 2023; Schnitker, 2012). Intensive care units (ICUs) are environments characterized by intense workloads, high-stress factors, and significant physical and emotional demands. In these settings, ICU nurses are frequently exposed to constant stimuli and stress due to the continuous physiological monitoring and care demands associated with critically ill patients. High levels of patience among nurses can positively contribute to their ability to manage these stressful situations and stimuli. However, factors such as an increased number of critically ill patients requiring constant care during a single shift and working more than 48 hours per week can negatively impact nurses' physical, mental, and emotional well-being, exacerbating stress levels (Ahmadi et al., 2024; Thapa et al., 2024). This study found that ICU nurses had a moderate level of patience. Working in a primary-level ICU was associated with lower mean scores for patience related to work processes, inadequacies, and overall patience. Conversely, nurses working in tertiary-level ICUs demonstrated the highest levels of patience toward their colleagues. Providing care for 1–2 patients daily positively influenced nurses' patience levels toward colleagues, work processes, and inadequacies, as well as their overall patience scores. Nurses working 40–48 hours per week exhibited significantly higher levels of patience toward inadequacies compared to other groups. Furthermore, working in an ICU for 10 or more years contributed to increased patience levels, although this increase was statistically significant only in the sub-dimension of

patience toward patients and their relatives. Similarly, Turen et al. (2024) found that compassion increased among nurses with more than six years of ICU experience.

No significant relationship was found between alarm fatigue and patience levels among ICU nurses in this study. However, as ICU nurses' patience toward work processes, patients and their families, and inadequacies decreased, their alarm fatigue levels increased. The high incidence of false-positive alarms commonly observed in ICU settings is known to contribute to a decline in nurses' patience levels. This occurs because nurses spend a significant amount of time responding to alarms, which leads to increased anxiety and stress, ultimately contributing to desensitization in responding to alarms over time (Bi et al., 2020; Chesak et al., 2019; Cho et al., 2016; Chromik et al., 2022, DA, 2018). This result aligns with research linking high levels of alarm fatigue to elevated anxiety and stress levels among ICU nurses (Bourji et al., 2020; Nyarko et al., 2024; Salameh et al., 2024).

Limitations: The limitations of this study include its reliance on self-reported data from nurses, the use of a limited sample size, and the fact that it was conducted at a single-center state hospital located in the Western Black Sea region of Turkey. Consequently, the findings of the study may not be generalizable.

Conclusion: This study showed that intensive care unit (ICU) nurses have moderate levels of patience and alarm fatigue. The study also revealed that the demographic characteristics of ICU nurses did not significantly affect their levels of alarm fatigue and patience, while job-related factors were found to have a more frequent impact. Although statistically insignificant, it was observed that nurses with lower levels of patience tended to have higher levels of alarm fatigue.

In line with these results, it is suggested that the awareness of alarm fatigue among ICU nurses be increased, alarm management training be provided, workplace factors that may increase alarm fatigue and reduce patience levels be improved, and further research be conducted with larger sample sizes to evaluate the relationship between alarm fatigue and patience levels.

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