

The Influence of Alarm Fatigue on Work Role Functioning among Staff Nurses in Private Hospitals in Davao City

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Abstract

This study investigates the influence of alarm fatigue and work role functioning among nurses in private hospitals in Davao City. A predictive-correlational design was used to determine the causal relationships between variables. A total of 70 nurses were selected via sampling technique. Data were collected using adopted questionnaires for alarm fatigue and work-role functioning. Data revealed a predominant age group of thirty-five to forty years, with a significant majority being female. Findings also indicate that nurses had moderate levels of alarm fatigue, which, while significant, does not lead to complete desensitization. Moreover, it revealed high mental and social demands placed on nurses, emphasizing the need for strong support networks to enhance their well-being. Significantly, there is a positive correlation between alarm fatigue and work role functioning, implying that higher levels of alarm fatigue may be associated with improved role functioning as nurses develop adaptive strategies to cope with the demands of their environment. Alarm fatigue significantly influences work role functioning in health care, causing desensitization. Furthermore, these findings underscore the need for targeted interventions to manage alarm fatigue effectively, thereby enhancing nurse's work role functioning and well-being.

Keywords: *Social Science, Alarm Fatigue, Predictive-Correlational, Davao City*

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Introduction

Nurses in a busy hospital ward deal with the constant assault of alarms that reverberate through the corridors. They can barely distinguish important signals from the constant barrage of background noise. When the constant buzzing of alarms finally becomes background noise, alarm fatigue sets in (Jeong, 2023). Based on the researcher's preliminary investigation, it was observed while on clinical duty in the intensive care unit, telemetry unit, emergency room, or even in regular wards that alarms were burdensome among nurses. As a result, nurses frequently experience alarm fatigue, reducing their ability to respond. A study by Cvach (2020) found that alarm fatigue puts patients at risk and makes nurses more stressed and burned out, making it harder for them to carry out their jobs

well and deliver high-quality care. In a study conducted in Montana, USA, by Claudio et al. (2021), nurses experience increased mental workload when an alarm sounds. This creates a distraction, negatively impacts nurses' ability to prioritize, and is likely to increase alarm fatigue. The study by Elhessewi (2019) showed alarm fatigue had the highest mean of 66.9% among nurses surveyed in four hospitals in Egypt, and newly hired nurses scored the highest mean percentage. Furthermore, a study by Akturan et al. (2022) showed evidence of a correlation between alarm fatigue and moral distress among nurses who worked in COVID ICU compared to any other ICU.

Meanwhile, a complete list of studies addressing alarm fatigue in the Philippines does

not exist. There is a study, though, about work role functioning; according to a study by De Leon (2020), fatigue is brought on by a large workload, and on certain days, nurses experience fatigue before they even start work and after the shift is finished, nurses often feel fatigued and exhausted. Nurses who experienced frequent exhaustion were less motivated and engaged at work, which eventually affected them emotionally (Labrague, 2023). Nurses must be free from stress and in optimal health to effectively address their roles' physical and emotional demands (Soriano et al., 2024). Locally, in Davao City, no recently published studies have examined the influence of alarm fatigue and the functioning of the work role among nurses.

Specific research gaps have been found from the previous study of Seok et al. (2023), in which they examined alarm fatigue but failed to establish its influence on the functioning of nurses in the work role. They only found a significant relation to the well-being of the patients. Moreover, a previous predictive study by Alkubati et al. (2024) recommends looking for other influential factors related to alarm fatigue that would help nurses create an efficient work environment. Similarly, Nyarko et al. (2023) found only 12% of the total variance of alarm fatigue, indicating 88% influencing factors that must be explored. In the study of Yoonhee et al. (2023), the use of medical devices In the Intensive Care Unit is becoming louder and more constant in noisier environments in the current setting, causing psychological burdens for nurses, so research on the reduction of alarm fatigue still is necessary despite of nurses' awareness of this phenomenon. This study aims to explore the influence of alarm fatigue on work role functioning among staff nurses in a private hospital in Davao City

Methods

The study utilized a quantitative predictive-correlational design, where information was gathered between two variables: alarm fatigue and work role functioning, which

includes work scheduling demands, output demands, physical demands, mental and social demands, and flexibility demands. The study employed a predictive correlation to investigate the association between parameters and forecasted the probability of alarm fatigue incidents among nurses. The study was conducted among private Davao City hospitals with acute care settings in a 250-bed capacity hospital. This setting was chosen for the study due to its proximity to the researcher's employment. The nurses in this setting are exposed to several alarms from numerous devices in the hospital.

The participants were chosen based on the criteria set by the researcher and the participants consisted of 70 staff nurses through convenience sampling, a nonprobability sampling technique that involved gathering data from a readily accessible and available population (Magnone 2024). To ensure coherence and clarity in the study, the following inclusion criteria have been established for participants: individuals working in Intensive Care Units, Telemetry Units, Emergency Units, and regular floors who are 21 or older. Participants must be willing to take part in the study and sign an informed consent form indicating their understanding of the study's purpose, procedures, and rights as participants.

In this study, the researcher distributed a three-part questionnaire to the respondents. The first part collects demographic information including age, gender, assignment area, and clinical experience length. The second part is an adopted questionnaire on the level of Alarm Fatigue developed by Torabizadeh et al. (2017). The validity of this questionnaire was confirmed by the Content Validity Index (S-CVI/Ave=0.92). The questionnaire was already reliable regarding its internal homogeneity as its Cronbach's alpha was 0.91. This unidimensional questionnaire consists of 13 questions in a 5-point Likert scale. One important instrument in healthcare research is the Torabizadeh Questionnaire for Alarm fatigue, which was

created primarily to evaluate the issue of alarm fatigue among medical personnel, especially nurses. The third part of the questionnaire includes an adopted form developed by Abma et al (2017) to measure the work role functioning level. Its validity was confirmed with a multi-group model (RMSEA= 0.063, CFI =0.972). The Cronbach's alpha was 0.96 for the total scale of the same questionnaire (Dorland et al., 2021). This dimensional questionnaire consisted of five indicators: work scheduling demands, output demands, physical demands, mental and social demands, and flexibility demands. The Work Role Functioning Questionnaire consists of 27 questions on a five-point Likert scale. The Work Role Functioning Questionnaire (WRFQ), created by Abma and associates, is an essential instrument for evaluating nurses' work role

functioning, tackling an important but sometimes disregarded area of healthcare. Understanding how these elements affect performance is crucial in demanding nursing, as practitioners balance various obligations and health issues.

Frequency and percentage were used to determine the socio-demographic profile of the respondents. Furthermore, mean and standard deviation were used to summarize the level of Alarm fatigue and the level of Work Role Functioning among staff nurses. Spearman-rho, a nonparametric correlation test, was used to determine if alarm fatigue significantly correlates with nurses' level of work role functioning while Kernel Regression, a nonparametric regression, was used to determine whether alarm fatigue significantly influences the level of work role functioning among nurses.

RESULTS AND DISCUSSION

Table 1. The Demographic Profile of the Respondents.

Demographic Profile	Frequency (n=70)	Percentage
Age:		
23-28 yo	10	14.3%
29-34 yo	13	18.6%
35-40 yo	25	35.7%
41-46 yo	5	7.1%
47-52 yo	9	12.9%
53-58 yo	6	8.6%
59-64 yo	1	1.4%
65 yo & above	1	1.4%
Total	70	100%
Sex:		
Male	16	22.9%
Female	54	77.1%
Total	70	100%
Area of Assignment:		
Intensive Care Unit	30	42.9%
Emergency Room	13	18.6%
Medical Surgical Ward	1	1.4%
Regular Floor	17	24.3%
Telemetry Unit	7	10.0%
Post-Anesthesia Care Unit	1	1.4%
Pediatric Ward	1	1.4%
Total	70	100%
Length of Hospital Experience:		

1-5 years	21	30.0%
6-10 years	12	17.1%
11-15 years	23	32.9%
16-20 years	8	11.4%
21-25 years	1	1.4%
26-30 years	3	4.3%
31-35 years	2	2.9%
Total	70	100%

Table 1 shows the respondents' demographic profile, including age, gender, area of assignment, and length of service (tenure). Regarding age, most respondents are between 35 and 40 years old, comprising 35.7 %. This is in stark contrast to the respondents between 59 to 64 years old and 65 years old and above, which have 1.4 % each. In terms of gender, the majority of the respondents are female, which comprises 77.1 %. Regarding the area of assignment, 42.9% of respondents are from the Intensive Care Unit, in contrast to the Pediatric ward and Post Anesthesia Care Unit, with each having 1.4 %. Regarding length of service, 31.9% comprises those with 11 to 15 years of experience. The minority of the respondents, 21-25 years of experience, comprised 1.4 % of the total respondents.

SOP 2: What is the level of alarm fatigue among nurses?

Table 2. The Nurses' Level of Alarm Fatigue.

Alarm Fatigue	Mean	SD	Interpretation
Overall	3.37	1.02	Moderate
<i>Note:</i> 4.21-5.00---Very High;3.41-4.20---High; 2.61-3.40---Moderate; 1.81-2.60---Low; 1.00-1.80---Very Low; SD- Standard Deviation.			

Presented in Table 2 is the level of alarm fatigue of the respondents, with an overall mean of 3.37, which is described as a *moderate level*. This result means that the level of alarm fatigue among staff nurses is noticeable. On average, staff nurses experience a fair amount of alarm fatigue, but it is not at an extreme level. A moderate level implies that while respondents are somewhat affected by alarm fatigue, it is not severe enough to impact their ability to respond or perform tasks. However, it still suggests a noticeable level of stress or diminished awareness, potentially leading to errors or delayed reactions in critical situations.

Likewise, in a study by Salameh et al. (2024), nurses reported moderate levels of alarm fatigue, with a mean total score of 23.36. However, nurses were particularly prone to alarm fatigue due to prolonged time in nursing care; nurses remained watchful and responded promptly to alarms. In another study, Asadi (2022) showed that the mean score of alarm fatigue in ICU nurses was moderate, consistent with Miljeteig et al. (2024). However, a study conducted in Ghana (Nyarko, 2022) found that most nurses experience severe alarm fatigue with a mean score of 76.43, which may be attributed to the lack of training on how to deal with constant alarms among nurses. Additionally, a study by Ceylan (2023) found that alarm fatigue rose for younger nurses but dropped for older nurses with more professional experience.

Among the 13 items in the Alarm Fatigue questionnaire, the highest score is "Generally, I hear a certain amount of noise in the ward," with a mean score of 3.86 and a standard deviation of 0.75, considered high. The study of Nyembre (2023) supports the findings and conclusions of several ICU noise studies by demonstrating that the noise levels observed in the ICUs are higher than the WORLD Health Organization recommendations. In addition, according to the study by Lo Castro (2022), hospital employees experience stress, decreased performance, and alarm fatigue due to noise pollution in the workplace. The lowest item

is "At visiting hours, I pay less attention to the alarms of the equipment," with a mean score of 2.91 and a standard deviation of 1.18. In a study by Ferrara (2023) with nursing students, the statement mentioned explains unfavorable feelings regarding the indifference brought on by alarms, which may impact clinical practice and patient safety. Most alerts generated are unrelated to the patient's clinical status, and even if the nurses responded right away, this did not aid in the patient's evaluation and tired the nurses, as per the findings of the Simpson study (2019). In a qualitative study by Akturan et al. (2022), the nurses reported difficulty dealing with alarms. The inability to set alarm sounds, alarm desensitization, and trouble obtaining technical support were the reasons given by the nurses. In an ICU study by Ruppel et al. (2019), nurses reported that while they felt compelled to handle alarms, they did not want to handle alarm responses alone. Instead, they expected assistance from other team members.

SOP 3: What is the level of a nurse's role functioning in terms of work scheduling demands, output demands, physical demands, mental and social demands, and flexibility demands?

Indicators	Mean	SD	Interpretation
Work Scheduling	3.75	0.84	High
Output Demands	3.84	0.74	High
Physical Demands	3.81	0.82	High
Mental and Social Demands	4.34	0.57	Very High
Flexibility Demands	4.27	0.57	Very High
Overall	4	0.71	High

Note: 4.21-5.00---Very High; 3.41-4.20---High; 2.61-3.40---Moderate; 1.81-2.60---Low; 1.00-1.80---Very Low; SD- Standard Deviation.

Table 3 shows the nurse's role functioning level regarding work schedule, output, physical, mental, and social demands, and flexibility demands. A score of 4.34 with a standard deviation of 0.57 for "Mental and Social Demands" reflects a **very high level** of these demands in the work role functioning of nurses. It implies that nurses face various mental and social difficulties or demands in their work, some very demanding or draining. Given the high score, it is clear that nurses are often required to navigate intense mental workloads, multitask in high-pressure environments, and manage emotional and social interactions, which can lead to stress or fatigue over time.

Numerous factors contribute to elevated stress among healthcare workers, which may contribute to psychological stress leading to burnout, depression, and anxiety disorders (Woo et al., 2020). During the pandemic, the study done by Vizheh (2020) demonstrated that some variables were linked to mental strains that healthcare professionals faced. Moreover, Sovold et al. (2021) emphasized prioritization and ensuring healthcare workers' mental health and well-being.

A study by Lu, S.F. et al. (2024) showed experienced nurses could manage stress effectively, which supports their professional sustainability and positively impacts their overall quality of life, consistent with the Lopez-Espuela et al. study (2022). However, ICU nurses react to stressful situations in different ways. Instead, they would not visit the patient's bedside and provide care despite their wishes. They feel a sense of exhaustion and aggravation when they are caring for patients Asadi (2020).

Among the seven items under mental and social demands, the highest item is the concentration of nurses in their work, which impacts their concentration and overall well-being. The lowest level is work schedule: a mean value of 3.74 with a standard deviation of 0.84, reflecting a high level. Despite this being the lowest, it is still considered High, suggesting nurses often face challenges with significant pressure

related to their work schedules, which may include long shifts and on-call responsibilities. Shift work is vital to meet social and economic demands, and it is especially prevalent in hospitals. (Cheng & Drake 2019) Because they offer care around the clock, shift nurses have proven to be especially crucial. Eight-hour and 12-hour shifts are the two most common types of shift work (Cheng et al., 2022). Previous studies have shown that women who engaged in shift work reported a much higher level of mental distress than women who worked day shifts (Dai et al., 2019). One finding in the study of Cheng et al. (2022) was that those who had worked for 5-10 years exhibited worse mental problems and burnout compared to others. How the scheduling in a healthcare setting is organized impacts employees' health, and working shifts is a significant risk factor for ill health (Persolija, 2023). Nurses typically work in shifts. Shift work may cause disruptions in workers' circadian cycles and set off a series of negative bodily and psychological alterations, affecting physiologic and neurobehavioral processes, psychomotor performance, and regular menstruation, and disrupting sleep duration and quality, raising the risk of burnout and job discontent, weariness, emotional depletion, cardiovascular disease, diminished self-esteem, and the chance of getting Type 2 Diabetes Mellitus (Di Muzio, 2019; Chang 2021). The high demand in this area can create challenges in balancing work with personal life, leading to potential fatigue, stress, and decreased job satisfaction. In healthcare settings, where nurses must be available at all hours and be adaptable to changing patient needs, a high work scheduling demand can affect both their physical and mental well-being because nurses must be available and flexible enough to adjust.

This level of scheduling demand also points to the need for more efficient and supportive scheduling practices. Strategies like better shift planning, more predictable schedules, adequate rest periods, and flexibility in work hours mitigate the negative impact of these demands, allowing nurses to perform their duties effectively while reducing burnout and improving overall job satisfaction. Out of the four items under work scheduling demand, nurses tend to start on their job as soon as they arrive, which is vital for ensuring continuity of care, reflecting the high level of responsibility nurses hold in patient care from the moment they arrive.

SOP 4: Is there a significant relationship between the level of alarm fatigue and work-role functioning among nurses?

Table 4: The Test of Relationship between the Nurses' Level of Alarm Fatigue and Work-Role Functioning.

Independent Variable	Work-Role Functioning			
	r_s	p-value	Decision	Remarks
Alarm Fatigue	.308	.010	Reject H_{01}	S

Note: $p < 0.05$ (Significant); S-Significant; $r_s = \rho$; DV-Work-Role Functioning.

Table 4 shows the relationship between alarm fatigue and work-role functioning among nurses. The results revealed a significant, positive relationship between nurses' alarm fatigue and work-role functioning ($r_s = .308$, $p = .010$). This led to the rejection of the null hypothesis (H_{01}) as its p-values are less than the 0.05 alpha level of significance. Moreover, it further suggests that an increase in nurses' alarm fatigue in general is correlated with an increase in their level of work-role functioning.

The positive correlation ($r_s = 0.308$) suggests that nurses' work-role functioning increases as they experience more alarm fatigue. In other words, higher levels of alarm fatigue may correlate with higher demands or a greater sense of responsibility in their role, leading them to work harder, be more engaged, or take on more

tasks. This may seem counterintuitive, as alarm fatigue typically leads to desensitization and reduced responsiveness.

However, the positive correlation could reflect that nurses, despite experiencing fatigue, continue to engage in their work with a sense of duty or adapt to the demands of their environment. In the study of Seok et al. (2019), participants had a high overall alarm fatigue score. Nurses may have a delayed response to the alarm, but it was reported that they attended to the alarms immediately. The findings are consistent with the current finding that alarm fatigue interferes with nurse’s functions but does not affect response time. In addition, a study by Kim (2021) on Korean Hospitals' alarm fatigue may not directly affect a nurse’s role because the nurses remained vigilant to the alarm sound through previous experiences in the unit. A study by Salameh et al. (2024) revealed that nurses working regular day shifts experienced a high stress level, which can be attributed to the heavy workload of morning shift nurses and alarms from medical devices. In addition to this study, female nurses are more susceptible to experiencing alarm fatigue, which is contradicted by the study done by Bourji et al. (2020), in which male nurses experience alarm fatigue more frequently. Constant alarms may cause nurses to pay less attention and react more slowly. Nurses who misread non-urgent alerts may react slowly or do nothing (Lu et al., 2024), leading to stress, tension, anxiety, and increased alarm fatigue, again in the study of Lewandowska (2020).

SOP 5: Does the level of alarm fatigue significantly influence the level of work-role functioning among nurses?

Table 5. The Test of Influence of Alarm Fatigue on Work-Role Functioning among Nurses.

WRF	Observed	Bootstrap	Z	P-	Decision	Remarks
	Estimate	SE		value		
Mean						
WRF	3.997	.042	95.28	0.000		
Effect						
AF	.268	.103	2.61	0.009	Reject H ₀₂	Significant

Note: Significant if p-value <.05; R²= 0.2318; IV- AF (Alarm Fatigue); DV-WRF (Work-Role Functioning)

Table 5 revealed that the level of alarm fatigue (OE=0.268, p=0.009) significantly influences the work role of nurses. This led to a rejection of the null hypothesis (H₀₃) as its p-value is less than 0.05 alpha significance level. Moreover, the findings were apparent in the results of nonparametric regression analysis, in which 23.18% of the variance of the work-role functioning of nurses can be explained by the level of alarm fatigue as indicated by an r-square of 0.2318. This would mean that 76.82% of the variation can be attributed to other factors besides alarm fatigue. The null hypothesis (Ho2) was rejected where alarm fatigue significantly influences work role functioning among nurses. These results are consistent with earlier studies showing how alarm fatigue impairs healthcare workers' capacity to do their jobs efficiently (Nyarko, 2024). In contrast with the findings by Wunderlich et al. (2023), which suggest that alarm fatigue does have an influence concerning psychophysiological aspects among nurses like reduced motivation and concentration, body malaise, and confusion. Based on a variety of measured vitals, the patient monitor sounds an alarm. The alert will frequently sound when just one of these numbers surpasses the limit, but the majority of the alarms the monitor generates are turned off since they do not need to be addressed, as discussed in the study of Sanz-Segura et al. (2019).

Medical alarms can significantly increase stress levels for nursing personnel, which makes the nurses tired and reduces the quality of sleep. With the disturbance in sleep, chronic exhaustion can affect nurses' well-being and health (Rypicz et al., 2024). Baker and Rodger (2020) have concluded that alarm fatigue has the potential to drain nursing resources while answering numerous alarms where nurses felt some fatigue due to clinical alarms. Additionally, nurses' stress levels are raised by the strain of reacting to multiple nonactionable alerts, which causes mistakes, exhaustion, burnout, and alarm indifference (Jeong & Kim, 2022). Research indicates that alarm fatigue can lead to considerable stress and emotional depletion among nursing personnel; chronic stress can result in diminished performance, intensified anxiety and sadness, and disengagement from obligations at work (Salameh et al 2024). The incessant influx of alerts might inundate nurses, leading them to prioritize specific alarms based on familiarity or perceived urgency, thus undermining their capacity to deliver effective care (Lewondaska et al 2020).

Conclusion and Recommendations

The study aimed to explore the influence of alarm fatigue and work role functioning among staff nurses in Private Hospitals in Davao City. According to the results generated from the study, the findings revealed that the respondents span a wide range of ages, with the largest group falling within the 35-40 age bracket, predominantly female, and influencing workplace dynamics as gender differences have been shown to impact communication styles and caregiving approaches. In the area of assignment, the Intensive care unit is very relevant to understanding the stressors and challenges such as alarm fatigue faced by nurses with a large number of nurses with 11-15 year of experience with considerable expertise. The level of alarm fatigue experienced by nurses is moderate, but this does not exclude the fact that it is still significant enough to influence their work. It does not indicate complete desensitization.

The data indicates that nurses face high demands, particularly in mental and social aspects. One of the indicators shows a very high score for these demands, highlighting the challenges of nursing duties. This underscores the importance of having a strong support network to help nurses manage these challenges, ultimately enhancing their well-being. There is a significant positive correlation between alarm fatigue and

work role functioning, indicating that higher levels of alarm fatigue are associated with improved role functioning. Alarm fatigue can significantly influence how nurses perform their duties in healthcare settings. The study indicates that as nurses encounter elevated levels of alert fatigue, their capacity to perform their responsibilities improves moderately. Nurses develop adaptive strategies to cope with the stress caused by frequent alarms, resulting in heightened alertness and responsiveness to various situations.

Based on these conclusions, further research could focus on developing and evaluating strategies designed to reduce alarm fatigue among staff nurses, a customized monitoring bundle can be initiated to mitigate alarm fatigue. Research is needed to explore nurses' coping mechanisms to manage alarm fatigue and their effectiveness. To understand how nurses adapt to stress induced by alarm systems, with a design of support systems and interventions that will enhance the resilience of nurses and reduce the negative influence of alarm fatigue in their work performances. Future researchers may conduct exploratory and confirmatory factor analysis since the adopted questionnaire for alarm fatigue is unidimensional.

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