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Research Article

A Comparison of Nursing Activity Score Means for Missed Care Dimensions in Intensive Care Unit Patients

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Background. The workload of nurses in the intensive care unit (ICU) can affect the quality of nursing services. *Aim*. This study aimed to determine the relationship between the nursing activity score and missed care in patients hospitalized in the ICU in Zanjan, Iran. *Methods*. This observational and prospective study was conducted from April 3 to September 18 in 2021. The study utilized a patient and nurse profile questionnaire, the Nursing Activity Score (NAS), and a checklist for missed care as research tools. Missed care was observed in the 301 patients for whom the NAS was calculated. Analysis of variance (ANOVA) was used to investigate the differences in mean levels of missed care. Logistic regression models were used to assess the association between factors and missed nursing care. *Results*. Results show that the medical ICU's mean NAS was 76.31 (95% CI: −13.06–14.89). In 9 dimensions of care, the extent of missed care was 40.7%. In the care dimensions of assessment, hand hygiene, and infection control, the mean NAS had a statistically significant increase at higher levels of missed care ($P < 0.5$). Furthermore, work experience was identified as a protective factor for missed care (OR = 0.59, 95% CI: 0.37–0.94, $\chi 2 = = 4.97$, $p = 0.026$). *Conclusion*. The study revealed a high incidence of missed care. The study revealed that the mean workload was high in certain dimensions of care such as assessment, hand hygiene, and infection control. The increase in workload for nurses results in lost care. Nonetheless, the utilization of experienced nurses can help mitigate this problem. However, utilizing experienced nurses can help reduce this problem.

1. Introduction

The nursing workload is one factor that can affect patient safety and nursing care in the intensive care unit (ICU) [1]. Because of the conditions of the patients in ICU, nurses working in the ICU spend more time directly caring for the patients and have various responsibilities [2, 3]. Nurse workloads are defined as the amount of performance required to carry out nursing activities. The amount of nursing time; level of nursing qualification; direct patient care weight; the amount of physical activity; and the complexity of care are the attributes of nurses' workload [4].

Undesirable consequences, such as physical and emotional fatigue, nurse burnout, omission of nursing care, and reduction in quality, have been linked to workload in some studies [5–8]. Missed care refers to the delay or omission of any aspect of patient care [9]. The review study revealed that a majority of nurses (55–98%) reported leaving at least one task incomplete [10]. The most important reported injuries related to missed care include phlebitis, pressure ulcers, skin ulcers, infection, bed falls, delirium, uncontrolled pain, and death [11, 12]. Patients can experience short-term and long-term effects when nursing care is intentionally or unintentionally omitted [13].

Thoroughly examining all aspects of missed care during healthcare studies is challenging. In case of incorrect treatment, such as nonstandard bandaging, it can be detected and evaluated, but in the absence of treatment, detection is difficult without special tools like video recording or direct observation [14]. Identifying factors related to missed care in the ICU and the effects of nurses' physical workload on the quality of care are important in any culture. Previous studies relied on nurses' self-reporting to investigate missed care. The current research employed the observation method to evaluate the missed care for enriched data. This study aimed to determine the relationship between the nursing activity score and missed care in patients hospitalized in the ICU in Zanjan, Iran.

2. Methods

2.1. Study Design and Setting. This observational and prospective study was carried out in Zanjan City, Iran, between April 3 and September 18, 2021. This study was conducted in a medical ICU of one of the training hospitals in Zanjan (Figure 1).

2.2. Sampling. All patients who were admitted to the medical ICU during the study were included in the research. The patient's legal guardian's consent was a necessary inclusion criterion for the study. To identify missed care, the nurses' performance was observed. The study observed the performance of full-time nurses who will participate. The sample size was estimated using the following formula according to Alizadeh et al., and the sample size needed to be 298 patients with $\alpha = 0.05$, $\delta = 0.88$, and $d = 0.1$ [15].

$$n = \left(\frac{Z.\delta}{d}\right)^2. \quad (1)$$

2.3. Measures. This study employed three instruments: a questionnaire for patient and nurse profiling, the Nursing Activity Score (NAS), and a missed care checklist.

2.4. Patient and Nurses' Profile Questionnaire. The patient profile included age, gender, diagnosis, GCS, and ICU length of stay. The personal and professional profiles of nurses were constructed based on gender, age, marital status, educational level, and nurse-to-patient ratio.

2.5. Nursing Activity Score (NAS). This instrument, comprising 23 items, was developed by Miranda et al. [16]. This scale measures the percentage of a nurse's time spent directly caring for a critically ill patient during 24 hours in the ICU. The scoring range for the 23 items is from zero to 177 percent. The items comprise titration and monitoring, medication, laboratory, hygiene procedures, support and care of relatives and patients, administrative and managerial tasks, care of drains, ventilatory support, renal support, neurological support, metabolic support, and specific interventions. The inter-rater reliability of the questionnaire was evaluated in this study using Cohen's kappa coefficient. This tool has been confirmed as valid in various countries [15–18]. Regarding the validity of the translation process, the NAS was translated based on the standards recommended in the guidelines [19]. The NAS was translated into Persian by two English-Persian translators using the forward-backward translation technique. The NAS was independently translated into Persian by two translators. A group of experts, including some of the authors of this article and two other professional translators, reviewed and commented on these two Persian versions of NAS. After being translated back into English by a Persian-English translator, a group of experts confirmed the accuracy of the Persian NAS. Content validity was assessed by 10 experts (6 faculty members from the Department of Intensive Care Nursing and Emergency Nursing and 4 nursing managers). These experts evaluated the content of the Persian NAS. Afterward, the item and scale level content validity indexes were calculated for the Persian NAS tool. The 10 experts rated the relevancy of items using a 4-point Likert scale. The range of acceptable CVI values is greater than 0.80. Furthermore, two researchers simultaneously evaluated the NAS for 30 patients. The score agreement between the two researchers was 93%.

2.6. Missed Care Checklist. Previous studies were used as a basis for providing missed care in the ICU [20–25]. A checklist for missed care was reviewed by a panel of experts. This panel consisted of 6 critical care nursing faculty, 2 intensive care specialists, and 2 ICU head nurses. These experts identified 9 dimensions of missing care. The 9 dimensions of care comprise (1) assessment, (2) mobility and motion, (3) response to patient's needs and call alarm within 5 min, (4) patient education, (5) hand hygiene, (6) infection control (eye, skin, mouth, perineum, and wound or sore care, IV/central line site care, and change of disposable devices according to hospital policy), (7) oxygen therapy, (8) implementation of urgency order, and (9) nutritional care. In each of these nine dimensions, there are four items. This checklist employs a rating scale of 0 (not applicable), 1 (not done), 2 (done incompletely), and 3 (done completely), with 3 being the highest score. The mean ratio was used to compute the score of each of the 9 dimensions of missed care, following this formula

$$\text{Score} = \frac{\text{Total scores of care items}}{(\text{The number of items care} - \text{Not aplicable}) * 3} * 100. \quad (2)$$

The missed care assessment had 4 levels. A scoring range of 1–25 indicates a very high level of missed care, while 26–50 indicates a high level, 51–75 indicates a moderate level, and 76–100 indicates a low level. The missed care checklist for 30 patients was scored by two researchers simultaneously to calculate inter-observer reliability. These two researchers achieved an 89% agreement in their scores.

2.7. Procedures. The NAS was compiled for each patient according to the reporting of the previous 24 hours by first author. Missed care in patients was evaluated through direct

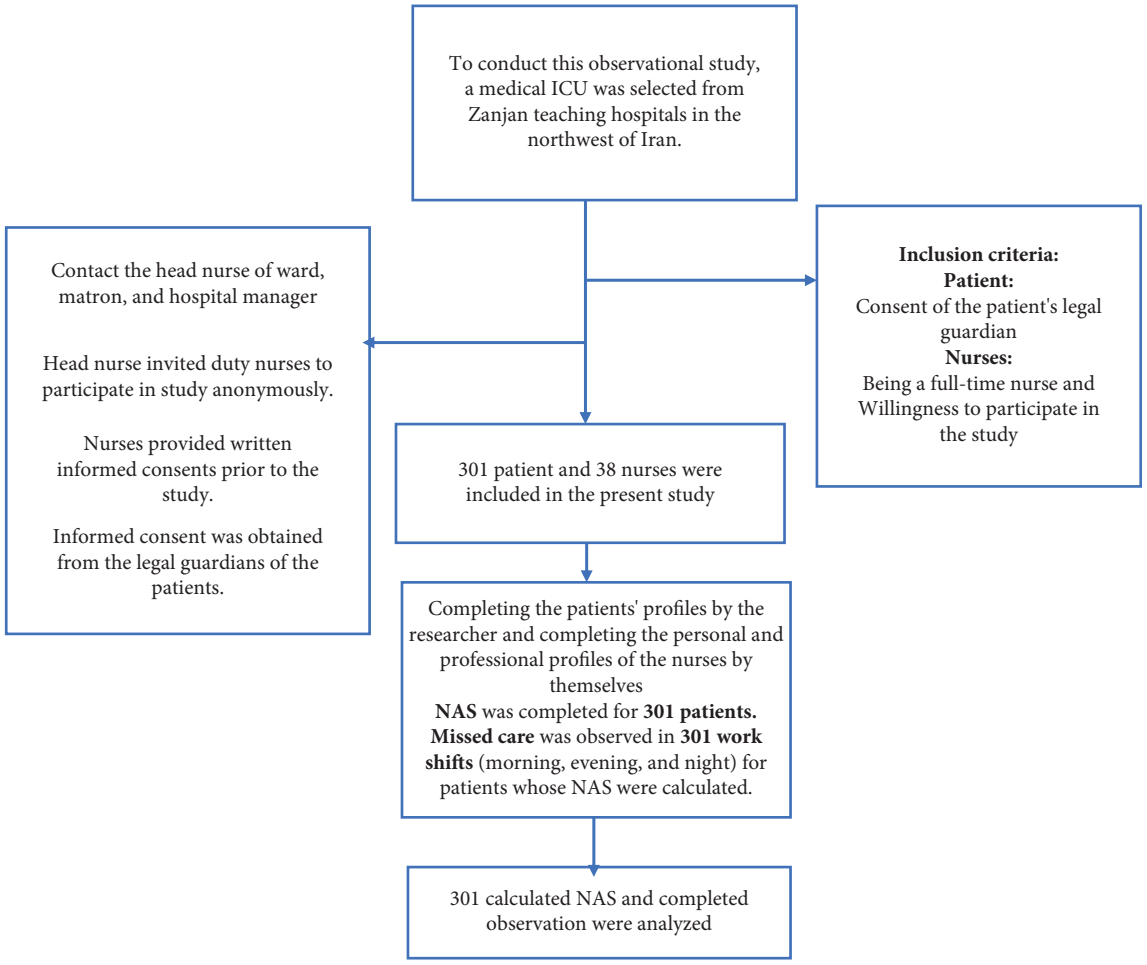

Figure 1: Flow diagram showing the study design and sampling.

observation using the missed care checklist. Missed care was observed in the patients whose NAS was calculated. The nurse's care performance was observed on the patient to calculate their NAS. On average, each nurse participating in the study had their care performance observed eight times. Missed care in patients was observed by a nursing master's intern researcher in the same medical ICU. Nurses were aware of the aim of the study. They were aware their performance would be observed, but the exact timing and details were unknown. The researcher's own presence in the ward allowed for natural observations of nurse behavior and performance.

2.8. Ethical Considerations. This study was conducted after obtaining approval from Iran's National Committee for Ethics in Biomedical Research (IR. ZUMS.1397.324). Written consent was obtained from the legal guardian of the patient and nurses participating in the study. The purpose of the research was explained to the legal guardian of the patient and the nurses.

2.9. Statistical Analysis. Data were analyzed using IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA). In this study, the kurtosis and skewness of the data were in the range (2, −2), so the data had a normal distribution. Descriptive statistics were reported as N (%) for categorical variables and the mean and confidence interval (CI) for continuous variables. Analysis of variance (ANOVA) was used to evaluate the mean difference based on the levels of missed care.

Logistic regression was used to assess the association of variables with the level of missed care. The regression analysis used the backward variable selection method because of the high number of variables included in the analysis. The following variables were included in the regression analysis: NAS, patient-related variables (gender, age, patient diagnosis, level of consciousness based on GCS, and type of oxygen therapy), nurse-related variables (gender, age, marriage status, employment status, education level, work experience, working hours/months, and nurse-patient ratio).

To conduct a logistic regression, the high/low of missed care was summarized for each individual as follows. The high-missed care group was defined as "very high missed care" or "high missed care," and the low-missed care group was defined as "moderate missed care" and "low missed care." Therefore, for each dimension, missed care was defined as "high missed" if the option was 0-1 and as "moderate missed" if the response was 2-3.

3. Results

3.1. Participants

3.1.1. Patients. Most of the patients hospitalized in this ward were men, with a mean age of 60.02 ± 21.17 (95% CI: −19.98–22.20). This study revealed that metabolic disorders were the prevailing reason for hospitalizing patients in the ICU, and the patients were often intubated (endotracheal) and under ventilation (Table 1).

3.1.2. Nurses. The study involved 38 of 45 nurses. Table 2 shows that most nurses were female and married, with a bachelor's degree and 3–5 years of experience.

3.2. NAS. The mean NAS in this medical ICU was 76.31 ± 14.01 (95% CI: −13.06–14.89).

3.3. Frequency and Percentage of Missed Care in Each Care. The results of Table 3 showed that the most frequently missed care includes applying deep vein thrombosis (DVT) prevention (53.8%), skin and vascular assessment of the upper and lower limbs at the place of restriction (49.5%), attention to ventilator settings at the beginning of the shift (46.5%), changing the direction of the endotracheal tube to prevent ischemia at least once per shift (34.6%), assessment and recording of the patient's mental state (35.5%), hand hygiene before touching a patient (33.2%), assessment and recording of SPO2 of the patient (34.6), hand hygiene before performing care procedures (34.2%), checking the correct location of the endotracheal tube and measuring endotracheal tube intracuff pressure at least once per shift (25.9), and measuring gastric residual volume (28.2%).

3.4. Frequency and Percentage of Missed Care Dimensions. Motion and mobility had high missed care at 1.7%, while oxygen therapy, patient education, and urgency order implementation had low missed care. Missed care was moderate for responding to patient needs and alarms within 5 minutes, hand hygiene, infection control, and nutritional care. The score for missed care was moderate. Table 3 shows that missed care did not happen in 59.3% of cases.

3.5. The Comparison of Means of NAS Based on Levels of Missed Care Dimensions. The results of evaluating the mean NAS based on the levels of missed care showed that, except for the evaluation dimensions, hand hygiene, and infection control ($p < 0.05$), there was no mean difference in NAS in other dimensions and the total score of missed care (Table 4). Also, the results of the LSD post hoc test showed that, in the dimension of assessment ($p = 0.018$), hand hygiene ($p = 0.013$), and infection control ($p = 0.016$), the workload based on NAS at the medium level was significantly higher than the low level.

Table 1: Personal and professional profile of the nurses participating in the study ($N = 38$).

Variable	N (%)
Gender	
Female	31 (81.58)
Male	7 (18.42)
Age (years)	
22–30	25 (65.78)
31–40	13 (34.21)
Marital status	
Single	8 (21.05)
Married	30 (78.95)
Educational level	
Bachelor's degree	35 (92.11)
Master's degree	3 (7.89)
Nurse-to-patient ratio	
1 : 1	4 (10.5)
1 : 2	27 (71.1)
1 : 3	7 (18.4)
Employment status	
Casual employees	24 (68.16)
Fixed employment contracts	5 (13.16)
Permanent full-time employment	9 (23.98)
Work experiences (years)	
6 month–2 years	10 (26.32)
3 years–5 years	19 (50)
6 years–10 years	7 (18.42)
11 years–15 years	2 (5.26)
Number of working hours/month	
>200 hours	2 (5.3)
208–240 hours	20 (52.6)
<240 hours	16 (42.1)

3.6. Factors Related to the Occurrence of Missed Nursing Care. Work experience was the only remaining variable with $R2 = 0.02$ in the backward method of logistic regression. The prevalence of missed care was significantly lower in participants with higher work experience (OR = 0.59, 95% CI: 0.37–0.94, $\chi 2 = = 4.97$, $p = 0.026$). Therefore, work experience is a protective factor for missing care.

4. Discussion

Results show that the mean NAS in medical ICU was 76.31 of 177% (95% CI: −13.06–14.89). In the study by Momennasab et al. in Shiraz (Iran), the mean NAS in the trauma ICUs was 65.3% ± 23.19% [26]. The mean NAS in 16 hospitals in Belgium was 68.6% [27]. In the study by Camuci et al., the highest mean NAS was reported in the burn ICU at 70.4% [28]. In 19 ICUs across seven countries, Padilha et al. observed a mean NAS of 72.8%, ranging from 44.5% in Spain to 101.8% in Norway [29]. The disparity in workload among studies may be because of distinctions in ICU typology. The workload of nurses in the burn, trauma, cardiac, and medical ICUs differs,

Table 2: Frequency and percentage of missed care in each care ($N = 301$).

Missed care	Not applicable, N (%)	Not done, N (%)	Done incompletely, N (%)	Don completely, N (%)
Assessment				
Patient identification with patient bracelet during shift delivery		13 (4.3)		288 (95.7)
Attention to ventilator settings at the beginning of the shift	140 (46.5)	149 (49.5)		12 (4.0)
Assessment and recording the patient's mental state (delirium, depression, and anxiety)	120 (39.9)	107 (35.5)	64 (21.3)	10 (3.3)
Control vital signs and record them in time according to the order	25 (8.3)	8 (2.7)	167 (55.5)	101 (33.6)
Report abnormal vital signs immediately after being notified	282 (93.7)	9 (3.0)	6 (2.0)	4 (1.3)
Assessment and evaluation and re-recording if the patient's condition changes	292 (97.0)	7 (2.3)	1 (0.3)	1 (0.3)
Control and record blood sugar according to the order	159 (52.8)	92 (30.6)	12 (4.0)	38 (12.6)
Taking appropriate treatment in case of abnormal blood sugar within 15 minutes	300 (99.7)			1 (0.3)
Checking the correct location of the endotracheal tube and measuring endotracheal tube cuff pressure at least once per shift	208 (69.1)	78 (25.9)	4 (1.3)	11 (3.7)
Skin and vascular assessment of the upper and lower limbs at the place of restriction	142 (47.2)	149 (49.5)	3 (1.0)	7 (2.3)
Assessment and recording of SPO2 of the patient	67 (22.3)	104 (34.6)	21 (7.0)	109 (36.2)
Treatment for abnormal SPO2 within 5 minutes	236 (78.4)	7 (2.3)	56 (18.6)	2 (0.7)
Assessing the need for suction and performing it on time	108 (35.9)	123 (40.9)	59 (19.6)	11 (3.7)
Recording of endotracheal tube secretion volume and its characteristics	217 (72.1)	1 (0.3)	1 (0.3)	82 (27.2)
Checking and recording the content characteristics of the bag connected to the nasogastric tube	291 (96.7)	5 (1.7)		5 (1.7)
Reporting the abnormal content of nasogastric tube secretions	293 (97.3)	6 (2.0)		2 (0.7)
Measuring the volume and color of urine and recording it	1 (0.3)	1 (0.3)	2 (19)	280 (93)
Reporting the abnormal volume and color of urine	281 (93.4)	16 (5.3)	1 (0.3)	3 (1.0)
Assessing and recording the volume and color of chest tube discharges	292 (97.0)	3 (1.0)		6 (2.0)
Reporting abnormal volume and color of chest tube discharges	296 (98.3)		1 (0.3)	4 (1.3)
Assessing and recording the status of any kind of drain or wound	290 (96.3)		1 (0.3)	4 (1.3)
Reporting the abnormal discharge of any type of drain or wound	294 (97.7)	5 (1.7)	1 (0.3)	1 (0.3)
Mobility and motion				
Change position every 2 hours	300 (99.7)	1 (0.3)		
Moving and walking the patient according to the order	296 (98.3)	5 (1.7)		
Applying deep vein thrombosis (DVT) prevention: intermittent bandaging or intermittent pneumatic compression (IPC)	137 (45.5)	162 (53.8)	2 (0.7)	
Using proper protection and restraint (bed side rail and bed harness)	31 (10.3)	21 (7.0)	140 (46.5)	109 (36.2)
Response to patient's needs and device alarm within 5 min				
Response to the rational request of the patient (defecation, thirst, hunger, movement, etc.) within 5 minutes of the request	266 (88.4)	1 (0.3)	29 (9.6)	5 (1.7)
Responding to device alarms within 1 to 5 minutes of its start	23 (7.6)	43 (14.3)	144 (47.8)	91 (30.2)
Patient education				
Explaining and educating the conscious patient before performing the procedures	237 (78.7)	7 (2.3)	7 (2.3)	50 (16.6)
Explaining and educating the conscious patient after the procedures	244 (81.1)	7 (2.3)	5 (1.7)	45 (15.0)
Hand hygiene				
Hand hygiene before touching a patient		100 (33.2)	201 (66.8)	

Table 2: Continued.

Missed care	Not applicable, *N* (%)	Not done, *N* (%)	Done incompletely, *N* (%)	Don completely, *N* (%)
Hand hygiene before performing care procedures		103 (34.2)	198 (65.8)	
Hand hygiene after performing care procedures		6 (2.0)	291 (96.7)	4 (1.3)
Hand hygiene after body fluid exposures risk		2 (0.7)	5 (1.7)	294 (97.7)
Hand hygiene after touching a patient	1 (0.3)	12 (4.0)	288 (95.7)	
Infection control				
Eye care according to hospital policy	253 (84.1)	35 (11.6)	11 (3.7)	2 (0.7)
Skin care on ward according to hospital policy	228 (75.7)	42 (14.0)	14 (4.7)	17 (5.6)
Mouthwash based on the needs of the patient in each shift	241 (80.1)	34 (11.3)	13 (4.3)	13 (4.3)
Perineal care: washing the perineum based on the ward's routine	253 (84.1)	18 (6.0)	13 (4.3)	17 (5.6)
Caring for any type of wound on the body (rinsing the wound if necessary and dressing)	277 (92.0)	8 (2.7)	9 (3.0)	7 (2.3)
Central venous catheter dressing	281 (93.4)	5 (1.7)		15 (5.0)
Replacement of venous line within half an hour of phlebitis	294 (97.7)	1 (0.3)	2 (0.7)	4 (1.3)
Prevention of contact of drains, bags, and connections of the patient with the ground	22 (7.3)	1 (0.3)	1 (0.3)	277 (92.0)
Change the direction of the endotracheal tube to prevent ischemia at least once per shift	196 (65.1)	104 (34.6)		1 (0.3)
Change of disposable devices according to hospital policy (microset, serum, serum set, central venous pressure monitor equipment, infusion syringe, extension tube, Foley catheter, nasogastric tube, feeding set, gavage syringe, closed suction, etc.)	200 (66.4)	6 (2.0)		95 (31.6)
Oxygen therapy				
Resetting the new ventilator items according to the order within 10 minutes	301 (100)			
Appropriately providing oxygenation according to the order	48 (15.6)	10 (3.3)	10 (3.3)	233 (77.4)
Implementation of urgency order				
Execution of STAT medication orders within 15 minutes after the order	170 (56.5)		5 (1.7)	126 (41.9)
Sending emergency samples within 15 minutes after the order	170 (56.5)		5 (1.7)	126 (41.9)
Nutritional care				
Feeding the patient within 15 minutes after food distribution	137 (45.5)	3 (1.0)	68 (22.6)	93 (30.9)
Measuring gastric residual volume	193 (64.1)	85 (28.2)	6 (2.0)	17 (5.6)
Adjusting the feed pump				
Filling the bag connected to the feeding pump within 15 minutes after its completion	It was not evaluated due to the absence of nutritional bag in the ward during the study			
Observing the semisitting position during feeding	134 (44.5)	2 (0.7)	33 (11.0)	132 (43.9)

Table 3: The comparison of NAS means based on levels of missed care dimensions (*N*: 301).

	Not applicable, *N* (%)	Very high, *N* (%)	High, *N* (%)	Moderate, *N* (%)	Low, *N* (%)	Mean (95% CI) (1–10 score)
Assessment	—	—	5 (1.7)	209 (69.4)	87 (28.9)	70.32 (69.05, 71.54)
Mobility and motion	14 (4.7)	5 (1.7)	91 (30.2)	163 (54.2)	28 (9.3)	58.88 (56.44, 61.26)
Response to patient's needs and call light within 5 min	1 (0.3)	—	45 (15)	159 (52.8)	96 (31.9)	71.93 (69.43, 74.47)
Patient education	234 (77.7)	—	8 (2.7)	9 (3.0)	50 (16.6)	19.49 (34.46, 41.27)
Hand hygiene	—	—	6 (2.0)	293 (97.3)	2 (0.7)	68.37 (67.55, 69.15)
Infection control	—	—	20 (6.6)	105 (34.9)	176 (58.5)	80.90 (78.75, 82.92)
Oxygen therapy	48 (15.9)	—	10 (3.3)	10 (3.3)	233 (77.4)	80.73 (76.52, 84.93)
Implementation of urgency order	178 (59.1)	—	—	5 (1.7)	118 (39.2)	40.31 (34.77, 45.95)
Nutritional care	139 (46.2)	—	1 (0.3)	64 (21.3)	97 (32.2)	42.84 (38.13, 47.80)
Total of missed care score	—	—	114 (37.9)	184 (61.1)	3 (1)	59.31 (58.32, 60.43)

SD = standard deviation.

Table 4: The means and standard deviation of nursing activity score according to levels of missed care dimensions.

Variable	Mean (95% CI) Very high	Mean (95% CI) High	Mean (95% CI) Moderate	Mean (95% CI) Low	Mean (95% CI) Not applicable	ANOVA df	ANOVA F	ANOVA p
Assessment		67.26 (61.26, 74.37)	77.70 (75.80, 79.42)	73.49 (70.99, 76.63)		2	3.90	0.021
Mobility and motion	75.64 (70.44, 80.71)	73.56 (69.16, 77.96)	74.46 (71.62, 77.55)	77.47 (75.23, 79.48)	76.43 (71.77, 80.98)	4	0.73	0.573
Response to patient's needs and call light within 5 min		78.05 (74.34, 82.13)	74.61 (72.49, 76.86)	78.31 (75.55, 81.03)	75.40 (75.4, 75.4)	3	1.67	0.174
Patient education		82.66 (73.25, 92.73)	78.33 (65.21, 90.23)	73.62 (70.06, 76.96)	76.59 (74.77, 78.37)	3	1.26	0.289
Hand hygiene		82.40 (69.32, 95.73)	76.02 (74.44, 77.48)	100 (100, 100)		2	3.70	0.026
Infection control		78.55 (71.18, 86.82)	78.74 (75.98, 81.48)	74.60 (72.80, 76.41)		2	3.19	0.043
Oxygen therapy		74.07 (64.02, 83.54)	80.24 (70.98, 90.80)	76.31 (74.66, 78.14)	75.96 (72.15, 79.67)	3	0.36	0.79
Implementation of urgency order			83.10 (73.46, 91.68)	77.46 (74.72, 80.00)	75.36 (73.34, 77.23)	2	1.40	0.249
Nutritional care		106.70 (106.70, 106.70)	75.11 (71.59, 78.39)	75.45 (72.40, 78.40)	77.25 (75.10, 79.43)	3	2.08	0.104
Total of missed care score		76.24 (73.04, 79.49)	76.31 (74.52, 78.25)	76.52 (69.05, 83.61)		2	0.002	0.998

as expected. In certain hospitals, ICUs are specialized for particular diseases, while in others, medical, trauma, and burn patients are admitted in one ICU. The mix of patients with various illnesses affects the nurses' workload.

This study showed that 40.7% of care was missed in 9 dimensions. Chegini et al.'s research discovered that 72.1% of nurses usually miss at least one nursing care during their last shift [30]. Results of Haftu et al. showed that 299 (74.6%) nurses and midwives commonly missed at least one nursing care in the perinatal setting [31]. The study conducted by Ball et al. revealed that 86% of nurses could not complete one or more care activities because of insufficient time during their last shift [22]. Ball et al. found that 74% of nursing care omissions occurred in general medical and surgical wards [32]. Various settings have been used to conduct these studies. Most studies report a higher percentile of missed care than the present study. These studies have been conducted in different environments (wards and ICUs). The results in all these studies were based on self-reporting [22, 30–32], which can lead to either overestimation or underestimation by participants. Although this study was conducted observationally, it made the data more objective than previous studies.

The most missed care was mobility, motion, and hand hygiene dimensions, and the least missed care was the patient education dimension. A study showed that nurses had better hand hygiene practices with fewer instances of missed care, in contrast to our findings [33]. On the other hand, patient mobility is a crucial aspect of ICU recovery, and neglecting it may lead to complications and slow down the healing process [34]. It is important for head nurses to supervise the careful administration of this care. Also, our result differs from the results of Chegini et al., who reported a high percentage of missed care in the dimension of patient education [30]. Discrepancy in the results is attributed to the difference in the study setting. Due to low levels of consciousness, this dimension was inapplicable for most ICU patients in the present study.

The results of evaluating the mean difference of NAS based on the levels of missed care showed that, except for the dimensions of assessment, hand hygiene, and infection control, there was no significant mean difference in NAS in other dimensions and the total score of missed care.

In the present study, infection control and hand hygiene were significantly related to NAS. The increase in workload led to a loss of care. In a study, hand hygiene was associated with workload [35]. Hand hygiene and infection control can shorten ICU patients' hospital stays, so it is necessary to teach ICU nurses about the importance of hand hygiene.

Unlike previous research [36–38], the current study found no association between missed care and the personal or professional characteristics of nurses or patient characteristics. The present study has different results as Ball et al. observed a significant relationship between nurse-patient ratio and missed care [22]. A review study found that missed nursing care reports were linked to low registered nursing staff [37]. Tubbs-Cooley et al. found that missed care was associated with nurses' workload [36]. In a review study, it was found that missed nursing care correlated with patient acuity, workload, work environment, and nurse characteristics, resulting in patients staying in the hospital for a longer period [38]. The findings of previous studies varied because of differences in nurse-to-patient ratios between general wards and the ICU.

The study discovered that nurses' workload had little effect on the frequency and completeness of some routine care behaviors. Care that was not provided was sometimes documented in the nursing record, as noted in another study [39]. De Marinis et al. found nursing records unsuitable for quality care evaluation [40].

In Iran, nurses have faced a high volume of documentation work [41]. Although documenting care is vital, it may override patient care, causing nurses to unintentionally or intentionally exclude specific care. Complications from not providing adequate patient care often develop slowly. All healthcare providers, not only the nurses, are responsible for these patient complications. Studies in most countries have reported missed care, indicating a lack of patient safety culture [22, 30–32]. Missed care can be prevented by enhancing nurses' knowledge and changing the culture of patient safety, particularly among nursing managers [23, 42, 43]. According to Tubbs-Cooley et al., system factors may be a contributing factor to missed care in this setting [33].

In line with Plein's research, our study found that work experience helps prevent missed care [44]. Novice nurses, who had less work experience, were responsible for more patients. They also took care of patients who were far from the nursing station and the treatment room, requiring them to travel a long distance during their shift. These cases increased the workload of nurses. Appropriate staffing and fair work distribution prevent missed care. Missed care was found to be related to the work environment in prior studies [45–47].

5. Conclusion

The study revealed a high incidence of missed care. The study revealed that the mean workload was high in certain dimensions of care such as assessment, hand hygiene, and infection control. The increase in workload for nurses results in lost care. Nonetheless, the utilization of experienced nurses can help mitigate this problem. To assess the factors related to ICU nurses' workload and patient care quality, additional studies are recommended.

6. Strength and Limitation

The study's strength was in using the observation method to measure missed care. Compared to previous studies, the data in this study are richer. Altering participant behavior and invading personal privacy are factors that limit observations. The

participating nurses were informed of the study's objectives but were not informed of case details to reduce behavior change. By trying to keep the anonymity of the hospital and nurses, the rights of the participants were respected.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Nasrin Hanifi and Fatemeh Mohammadi were responsible for study design. Fatemeh Mohammadi gathered the data. All authors were responsible for statistical analysis and interpretation of the data, drafting of the manuscript, and critical revision of the manuscript.

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