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IMPACT OF NURSE-TO-PATIENT RATIOS ON PATIENT SAFETY OUTCOMES AND HEALTHCARE QUALITY INDICATORS

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Abstract

Background: Nurse-to-patient ratio is an important indicator of healthcare quality and patient safety.
Objective: This study aimed to assess the impact of nurse-to-patient ratios on patient safety outcomes and healthcare quality indicators among registered nurses.
Methods: This cross-sectional analytical study included 155 registered nurses working in hospital inpatient units. Participants were recruited using non-probability consecutive sampling. Data were collected using a structured questionnaire and available unit records. Nurse-to-patient ratios were categorized as ≤5, 6–8, and >8 patients per nurse.
Results: The mean age of nurses was 30.84 ± 6.21 years, and the mean clinical experience was 6.72 ± 4.18 years. Medication errors increased from 10.9% in the ≤5 patients group to 45.2% in the >8 patients group ($p<0.001$). Patient falls increased from 8.7% to 38.1% ($p=0.002$), pressure ulcers from 6.5% to 33.3% ($p=0.004$), hospital-acquired infections from 13.0% to 42.9% ($p=0.003$), and delayed responses from 17.4% to 64.3% ($p<0.001$). Quality indicators also declined with increasing patient load, including patient satisfaction from 84.8% to 45.2% and timely care delivery from 87.0% to 47.6% (both $p<0.001$).
Conclusion: Higher nurse-to-patient ratios were significantly associated with poorer patient safety outcomes and reduced healthcare quality.

Introduction

Nursing is seen as the cornerstone of healthcare systems, and nurses are at the very heart of the safe, effective, and caring aspects of healthcare. One of the most significant factors for the quality of care and patient safety in hospital settings is the ratio of nurses to patients, also known as the nurse-patient ratio [1]. In the recent twenty years, numerous studies and research projects have highlighted the negative consequences associated with understaffing – such as higher patient mortality rates, longer hospital stays, decreased patient satisfaction, medication errors, and increased morbidity and demonstrated that these issues are strongly related [2]. Although these outcomes have been quantified, there is growing awareness that the lived experiences of nurses under different staffing levels also need to be explored to understand how staffing levels relate to patient safety and the mechanisms through which this occurs. Worldwide, healthcare systems are under increasing pressure because of the increasing number of patients, ageing, the increasing disease burden, and shortage of staff [3]. Nurse-to-patient ratios are one of numerous factors that impact healthcare delivery and have become a key indicator of patient safety and healthcare quality. Nurses make up the largest part of the healthcare workforce and are a key part of ensuring continuity of care, preventing complications, coordinating care, and monitoring patients while administering medication. Therefore, nurse staffing is crucial to safe and effective patient care environments [4]. Preventing adverse events in a safe environment is a

significant concern of patient safety and is recognized to be a major contributor to morbidity and mortality, hospital stays, and healthcare costs. Studies have shown that inadequate nurses' staffing can result in delayed patient evaluation, errors in medications, healthcare-associated infections, pressure injuries, patient falls, and inability to detect patient deterioration in a timely fashion [5]. Higher nurse-to-patient ratios will lead to higher workloads which will create a significant burden on the nurse and ultimately impact the quality of clinical decision making [6].

There has been extensive research into the link between nurse staffing levels and patient outcomes in a variety of healthcare environments. Research has repeatedly demonstrated that improved nurse staffing ratios are associated with reduced adverse events, enhanced patient satisfaction, improved quality of care, and lower mortality rates in hospitals [7]. On the other hand, understaffing is a risk factor for nurses to experience burnout, job dissatisfaction, emotional exhaustion and turnover, thus potentially compounding the nursing shortage and harming patient outcomes [7,8]. Healthcare quality indicators serve as measurable benchmarks for evaluating the effectiveness, safety, and efficiency of healthcare services [9]. Hospital-acquired infections, medication errors, pressure ulcers, patient falls, length of hospital stay, readmission rates and patient satisfaction scores are among the more commonly assessed indicators [10]. These indicators offer important information about the quality of health care, and can help pinpoint opportunities for improvement. There are indications that nurse staffing levels can play a large role in meeting many of these quality measures, through allowing for prompt intervention, increased surveillance, and coordination of care [11]. Recognizing the nursing workforce issues has led to a search for ways to set safe staffing levels by policies and practices. To improve outcomes for patients and ensure quality of healthcare, several countries have adopted nurse staffing guidelines and/or minimum nurse-to-patient ratios [12]. Staffing practices remain variable, though, depending on the characteristics of the institution, patient acuity, resources and policies vary across institutions and regions [13].

Objective

This study aimed to assess the impact of nurse-to-patient ratios on patient safety outcomes and healthcare quality indicators among registered nurses.

METHODOLOGY

It was a cross sectional, analytical study to examine the effect of nurse-patient ratio on patient safety results and quality indicators among registered nurses. There were a total of 155 registered nurses (RNs) participating in the study. Nurses were recruited using non-probability consecutive sampling during the study period, who met the eligibility criteria. Registered nurses with at least 6 months clinical experience and interested in participating in the study were included. Nurses who work solely in administrative staff positions, nursing interns, trainee nurses, those on prolonged leave, and those with an incomplete response were excluded.

Data Collection

Structured pre-tested questionnaire was used to collect the data. The questionnaire comprised the following items: demographic data, professional experience, clinical area of work, average number of patients assigned per shift, workload pattern and perceived patient safety outcomes. Medication errors, patient falls, pressure ulcers, hospital-acquired infections, adverse events, patient satisfaction, timely care delivery and adherence to clinical protocols were collected data via nurse responses and unit records (as available). Nurse-to-patient ratio was the independent variable and it was defined as the average number of patients assigned to one nurse for a normal shift. Patient safety outcomes and quality of healthcare measures such as medication error, falls, infection, pressure ulcer, adverse event, patient satisfaction, timely care and protocol compliance were the dependent variables.

Data Analysis

The data were entered and analysed in SPSS-29.0. Data on quantitative variables were presented as mean ± SD and qualitative as frequency and percentage. Association between nurse to patient ratio categories and patient safety outcomes was explored using Chisquare test. For comparisons of continuous variables between groups, one-way ANOVA was used. A p value of < 0.05 was deemed significant.

RESULTS

Data were collected from 155 participants, with a mean age of 30.84 ± 6.21 years and mean professional experience of 6.72 ± 4.18 years. Most participants were female, 117 (75.5%), while 38 (24.5%) were male. Regarding qualification, the majority had BSN/Post-RN BSN, 91 (58.7%), followed by Diploma Nursing, 49 (31.6%), and MSN or above, 15 (9.7%). Department-wise, nurses were fairly distributed across medical ward 42 (27.1%), ICU/HDU 40 (25.8%), surgical ward 39 (25.2%), and emergency 34 (21.9%).

Table 1. Demographic and Professional Characteristics of Nurses (n = 155)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	30.84 ± 6.21
Years of experience	Mean ± SD	6.72 ± 4.18
Gender	Male	38 (24.5%)
	Female	117 (75.5%)
Qualification	Diploma Nursing	49 (31.6%)
	BSN/Post-RN BSN	91 (58.7%)
	MSN or above	15 (9.7%)
Department	Medical ward	42 (27.1%)
	Surgical ward	39 (25.2%)
	Emergency	34 (21.9%)
	ICU/HDU	40 (25.8%)

Among 155 nurses, the most common nurse-to-patient ratio was 6–8 patients per nurse, reported by 67 (43.2%) nurses. A lower ratio of ≤5 patients per nurse was reported by 46 (29.7%) nurses, while 42 (27.1%) nurses were caring for more than 8 patients per nurse.

Table 2. Distribution of Nurse-to-Patient Ratio Among Nurses (n = 155)

Nurse-to-Patient Ratio	Frequency	Percentage
≤5 patients per nurse	46	29.7%
6–8 patients per nurse	67	43.2%
>8 patients per nurse	42	27.1%
Total	155	100.0%

Medication errors increased from 5 (10.9%) in the ≤5 patients group to 19 (45.2%) in the >8 patients group (p<0.001). Patient falls rose from 4 (8.7%) to 16 (38.1%) (p=0.002), pressure ulcers from 3 (6.5%) to 14 (33.3%) (p=0.004), and hospital-acquired infections from 6

(13.0%) to 18 (42.9%) (p=0.003). Delayed response to patient needs also increased markedly from 8 (17.4%) to 27 (64.3%) (p<0.001), showing a significant association between higher nurse workload and poorer patient safety.

Table 3. Association Between Nurse-to-Patient Ratio and Patient Safety Outcomes

Patient Safety Outcome	≤5 Patients per Nurse n=46	6–8 Patients per Nurse n=67	>8 Patients per Nurse n=42	p-value
Medication errors reported	5 (10.9%)	16 (23.9%)	19 (45.2%)	<0.001
Patient falls	4 (8.7%)	13 (19.4%)	16 (38.1%)	0.002
Pressure ulcers	3 (6.5%)	11 (16.4%)	14 (33.3%)	0.004
Hospital-acquired infections	6 (13.0%)	15 (22.4%)	18 (42.9%)	0.003
Delayed response to patient needs	8 (17.4%)	24 (35.8%)	27 (64.3%)	<0.001

Good patient satisfaction decreased from 39 (84.8%) in the ≤5 patients group to 19 (45.2%) in the >8 patients group (p<0.001), while timely care delivery declined from 40 (87.0%) to 20 (47.6%) (p<0.001). Proper documentation decreased from 41 (89.1%) to 23 (54.8%) (p=0.001), protocol compliance from 38 (82.6%) to 21 (50.0%) (p=0.003), and overall good quality of care from 40 (87.0%) to 22 (52.4%) (p=0.001).

Table 4. Association Between Nurse-to-Patient Ratio and Healthcare Quality Indicators

Healthcare Quality Indicator	≤5 Patients per Nurse n=46	6–8 Patients per Nurse n=67	>8 Patients per Nurse n=42	p-value
Good patient satisfaction	39 (84.8%)	45 (67.2%)	19 (45.2%)	<0.001
Timely care delivery	40 (87.0%)	47 (70.1%)	20 (47.6%)	<0.001
Proper documentation	41 (89.1%)	50 (74.6%)	23 (54.8%)	0.001
Protocol compliance	38 (82.6%)	46 (68.7%)	21 (50.0%)	0.003
Overall good quality of care	40 (87.0%)	48 (71.6%)	22 (52.4%)	0.001

DISCUSSION

The current study examined how nurse staffing levels relate to patient safety measures and health care quality measures for 155 registered nurses. The results showed that increased nurse workload was significantly related to adverse outcomes for patients. The proportion of nurses reporting medication error, delayed response to patients' needs, hospital-acquired infection, patient fall and pressure ulcer was significantly higher among those caring for more than 8 patients per shift than among those caring for 5 or fewer patients. The results indicate that heavy workloads can have an impact on nurses' ability to provide timely, effective care, and therefore patient safety. Demographic data of the study population showed that there was a relatively young group of nurses with a mean age of 30.84 ± 6.21 years and an average of 6.72 ± 4.18 years of clinical experience. The nursing profession had the majority of females

(75.5%) as most participants. The wide range of medical, surgical, emergency, and intensive care unit nurses increased the generalizability of the results to different hospital settings [14].

One of the major findings from this study was that the higher the workload of the nurse, the greater the medication errors. The rate of medication errors increased with the number of patients cared for, from 10.9% for nurses in five or fewer patients to 45.2% for those who cared for more than eight patients. This finding is consistent with earlier studies, which have shown an increase in medication errors among those nurses working in understaffed hospital units that have high workloads, fatigue and interruptions to medication administration [15]. With more patients comes less time for medication verification and monitoring, hence a higher risk of medication errors. Likewise, patient falls were significantly higher with higher nurse staffing levels. There is a significant increase in the percentage of falls from 8.7% in the lowest workload group to 38.1% in the highest workload group. Previous studies have shown that the staffing of nurses appropriately can enhance the care of patient surveillance and enable more frequent evaluation of patients at risk for falls, which leads to a decrease in the risk of fall and associated injuries. The present results corroborate the value of adequate staffing for better patient monitoring and reduction of preventable adverse events [16].

Other significant associations with nurse-to-patient ratios were seen for pressure ulcers and hospital-acquired infections. Pressure ulcers were observed at a rate of 33.3 per nurse for those with more than 8 patients compared with 6.5 per nurse for those with five or fewer patients; and infection rates were 42.9 per nurse for those caring for more than 8 patients and 13.0 per nurse for those who cared for five or fewer patients [17]. Previous studies have also indicated that proper nurse staffing leads to better infection control practices, timely repositioning of patients, and better compliance with preventive care measures. The interventions are frequently not carried out properly when the workload of nurses is too high. The study also showed a strong correlation between the number of nurses and indicators of quality in health care. 84.8% of nurses reported a good level of patient satisfaction when providing care to five or fewer patients, whereas 45.2% reported a good level of patient satisfaction when providing care to more than eight patients [18]. Similarly, an increased workload was associated with reduced timeliness of care delivery, documentation, adherence to protocol, and overall quality of care. Inconsistent staffing has been associated with poorer communication and care coordination, less patient education, and less compliance with clinical guidelines, and thus lower quality of care. Past studies have shown that improved staffing is linked to better communication, better care coordination, better patient education, and better adherence to clinical guidelines, which leads to better overall quality of care. These results can have significant implications for healthcare administrators and policymakers [19]. Proper nurse-to-patient ratios can not only lead to better patient safety results, but it can also increase organizational efficiency by minimizing complications, decreasing hospital stays, increasing patient satisfaction, and lowering healthcare costs. Therefore, investments in expanding and retaining the nursing workforce could have significant payoff for both patients and health care institutions [20].

LIMITATIONS

The interpretations of the findings in this study should be made under a few limitations. First, the cross-sectional design does not allow a causal relationship to be attributed to the nurse-to-patient ratio and the patient safety outcomes due to the fact that data was gathered at a single time point. Second, the data on patient safety events and healthcare quality indicators was self-reported by the nurses, which may be affected by recall bias and reporting bias. Third, this study took place in a small number of healthcare facilities, which may limit the extent to which the results can be generalized to the broader hospital and healthcare system. Multicentre, long-term studies are recommended to gain a better understanding of long term impacts of nurse staffing on patient outcomes and healthcare performance.

CONCLUSION

The results of this research support that the nurse-patient ratio is very influential in patient safety and measures of healthcare quality. More patients per nurse were correlated with an increase in medication error, fall, pressure ulcer, hospital acquired infection and delayed action on the patient's needs. By contrast, higher nurse-to-patient ratios were linked to better patient satisfaction, timely provision of care, compliance with protocols, documentation accuracy and overall improved quality of care. The findings underscore the importance of proper nurse staffing for the provision of safe and effective health care services.

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