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Determining Nurse-Patient Ratio by Shift among Emergency Care Nurses in Brunei

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Abstract

Introduction: Increase in nurse staffing shortened patient's length of stay in hospital and lowers adverse patients' events. Only few studies have examined staffing in emergency and none of those studies were in Brunei.

Aim: To determine nurse to patient ratio by shift and improve efficiency of nurse staffing allocation using administrative data in the previous year (2015).

Methods: A retrospective observational study of unit-level administrative data from January 1 to December 31, 2015. Data included total number of nurses per shift, total number of patients, and total number of patients per shift by triage acuity.

Results: In 2015, there were more than 94,000 patients registered to emergency department where more than 2,500 were urgent cases, more than 18,000 semi-urgent cases, and more than 73,000 non-urgent cases. The nurse-patient ratio was on average 1:7 in the morning, 1:9 in the afternoon, and 1:5 at night.

Conclusions: The study revealed that the nurse to patient ratio in the emergency department were still considerably high. By determining shift demands, staffing could be allocated more effectively. Patient influx was highest in the afternoon shift however highest staffing was allocated to the morning shift. This imbalance could reduce afternoon shift nurses' ability to handle task-laden cases particularly for urgent and semi-urgent cases, efficiently. Therefore, other than increasing staffing numbers, effective allocation of existing staff may lead to betterprovision of nursing care and patient outcomes.

Keywords: Staffing and scheduling; nurse-patient ratios; Emergency nursing

INTRODUCTION

Many existing studies have reported that an increase in nurse staffing were associated with positive outcomes [1]. Increase in nurse staffing shortened patient's length of stay in hospital and lowers adverse patients' events such as pneumonia, respiratory failure, and heart attack [2]. Reduction innumber of patients per nurse were also associated with improvement in infants oxygen saturation rate [3]. Most importantly, there are strong evidence highlighting association between increase in number of staffing and decrease of hospital-related mortality [4-6].In contrast, in the acute care settings including emergency department, out-of-ratio nurse staffing had led to increase in patient waiting time [7], increase in nurses' workplace injuries and absences[8]. Furthermore, reduction of nurse staffing reduces quality of nursing care [6], increased risk of hospital-acquired (nosocomial) infection[9], and could adversely affect patient outcomes by increasing odds of patient death (inpatient mortality) [5, 10].

Nurse staffing here refers to appropriate number of nurses with a suitable mix of skills are allocated at all times to ensure patient needs are met in the context of the practice setting and situation[11]. Despite a plethora of studies on nurse staffing, there are still gaps in the existing evidences. Measurement of staffing still varied widely across studies. Some of these measures include prevalence of staffing, nurse-patient ratio over average daily census, 24-hour nurse-patient ratio, weekly nurse workload, ratio of full-time equivalent nurse per patient day, hours per patient day, and productive hours per year. Each measurement has their limitations. For instance, measuring nurse staffing by workload was the most desired method amongst many researchers however a consensus on 'workload' definition is still absent. In addition, hospital or units may not keep track of the amount of care since such measurement was not used to calculate hospital costs. Furthermore, previous studies were mostly cross-sectional and were mostly in critical care or postsurgical settings. Only few studies have examined staffing in emergency and none of those studies were in Brunei. Most staffing calculations were based on daily or 24-hour census and fewer have reported staffing based on shift pattern[1, 12]. Logically, staffing according to respective shift demands benefit scheduling and allocating of staff since nurses' work schedules are mostly shift-based. More importantly, disaggregating data by time period could further refine results on patient mortality [13]and patient survival rates [14].Therefore, the aim of this study isto determine nurse to patient ratio by shift and improve efficiency of nurse staffing allocation using administrative data in the previous year (2015).

METHODS

Design

A retrospective observational study of administrative data from January 1 to December 31, 2015. The study was conducted at the emergency department of the largest referral hospital in Brunei Darussalam. Emergency nurses here worked a three-shift pattern: morning, afternoon, and night. Morning duty starts from 7am to 2pm, afternoon duty was from 2pm to 10pm, and night duty from 10pm to 7am. This project was approved by the institutional and the Ministry of Health ethics review committee.

Data collection

Data was obtained from the unit-level as they might provide more precise data compared to hospital-level aggregated data [15]. However, the limited availability of data for a comprehensive assessment of staffing was not possible because only certain information was tracked or recorded in the department. Due to this, abstraction of relevant data only included, i.e., total number of nurses per shift, total number of absences per shift, and total number of patients per shift, and total number of patients by triage acuity per shift. To ensure confidentiality and protection of this sensitive administrative data, they werecollected by the nurse manager and administrative staff of the emergency department. No personal identifiers were included in the data.

Data analysis

Raw data received was re-arranged and categorized into respective shift. All statistical analyses were performed using SPSS, version 21. Although there are several ways to calculate staffing, nurse-patient ratio by shift was used due to availability of data. It was measured by obtaining the ratio between mean total number of staff and mean total number of patients according to shift. One-way ANOVA test was used to compare means between the three shifts. Bonferroni post-hoc test were used when significance between shifts were detected. All statistical tests were two-sided and P-value less than 0.05 were considered statistically significant.

RESULTS

Figure 1 illustrates the number of patients' attendance in the emergency department from 2007 to 2015 [16-23]. The highest total number of patients attending emergency care was in 2010 with more than 129,000 cases recorded. In 2015, there were more than 94,000 patients registered to emergency where more than 2,500 were urgent cases (P1), more than 18,000 were semi-urgent cases (P2), and more than 73,000 were non-urgent cases (P3). Amongst the recorded cases includes 813 road traffic accidents, 7655 domestic violence or assault cases, 1047 cases requiring police intervention, and 243 narcotic cases. More than 82,000 were discharged directly from emergency while more than 11,000 were transferred out for ward admissions, intensive care units or referred to clinics and specialists. A total of 44 nurse absences were recorded last year.

Table 1 presents the mean and standard deviation for number of staff, absences, and patients per shift. The nurse-patient ratio was on average 1:7 in the morning, 1:9 in the afternoon, and 1:5 at night.

Figure 1: Total number of patient attendance in the Emergency department from 2007 to 2015

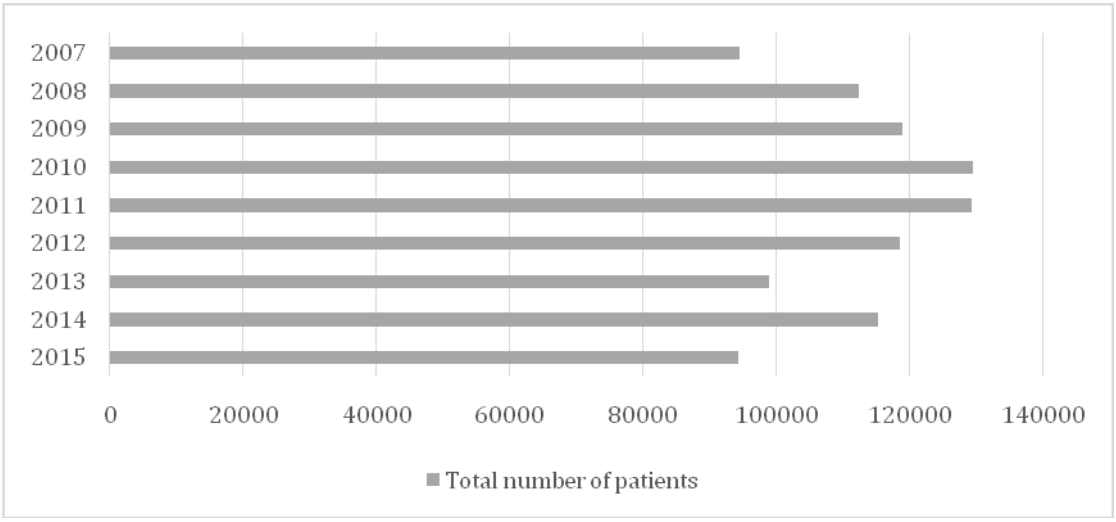

Table 1: Mean and standard deviation for number of staff, absences, and patients by shift throughout 2015

	No. of staff		**No. of absence**		**No. of patients**		**P1**		**P2**		**P3**	
Shift	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
AM	14.4	1.79)	06	0.33)	95.94	16.54)	2.53	1.72)	38.44	7.12)	4.83	15.71)
PM	14.3	1.78)	04	0.21)	121.4	19.05)	3.05	1.92)	93.14	8.09)	5.12	17.27)
ND	12.1	0.86)	04	0.21)	60.38	13.80)	2.08	1.58)	52.72	4.74)	5.37	12.15)

M=Mean, AM=Morning duty, PM=Afternoon duty, ND=Night duty; P1=Urgent cases, 2=Semi-urgent cases,P3=Non-urgent cases; Missing data: March 3-10, May 29-June 6, August 15-22

The result for One-way ANOVA also revealed that there was significant difference in number of nurses working by shift (F statistics=240.32, df=2, $P<0.001$). Post-hoc test revealed significantly higher staffing in the morning compared to night duty ($P<0.001$), significantly higher staffing in the afternoon compared to night ($P<0.001$), but no significant difference between morning and afternoon ($P=0.398$).Also, there was no significant difference in number of absences by shift ($P=0.513$).

There was significant difference in total number of patients received by shift (F statistics=1153.40, df=2, $P<0.001$). Post-hoc test revealed significantly higher patients received in the morning compared to night duty ($P<0.001$), significantly higher patients received in the afternoon compared to night ($P<0.001$), and also significantly higher patients received in the afternoon compared to morning ($P<0.001$).

There was significant difference in total number of P1 cases received by shift (F statistics=26.01, df=2, $P<0.001$). Post-hoc test revealed significantly higher number of urgent cases received in the morning compared to night duty ($P=0.003$), significantly higher urgent cases received in the afternoon compared to night ($P<0.001$), and also significantly higher urgent cases received in the afternoon compared to morning ($P<0.001$).

There was significant difference in total number of P2 cases received by shift (F statistics=199.69, df=2, $P<0.001$). Post-hoc test revealed significantly higher number of semi-urgent cases received in the morning compared to night duty ($P<0.001$), significantly higher semi-urgent cases received in the afternoon compared to night ($P<0.001$), and also significantly higher semi-urgent cases received in the afternoon compared to morning ($P<0.001$).

There was significant difference in total number of P3 cases received by shift (F statistics=918.20, df=2, $P<0.001$). Post-hoc test revealed significantly higher number of semi-urgent cases received in the morning compared to night duty ($P<0.001$), significantly higher semi-urgent cases received in the afternoon compared to night ($P<0.001$), and also significantly higher semi-urgent cases received in the afternoon compared to morning ($P<0.001$).

DISCUSSION

Due to extensive efforts by the local government to promote primary health care through setting up health centres and clinics throughout the country, there appeared to be reduction in number of patients attending emergency care from 2010 onwards. However, the nurse to patient ratio in the emergency department were still considerably high. The nurse-patient ratio was on average 1:7 in the morning, 1:9 in the afternoon, and 1:5 at night. In the United States, specifically in California, the state

mandated a maximum ratios based on number and acuity, i.e., 1:1 for trauma resuscitation, 1:2 for critical patients, and 1:4 for all other emergency patients at any point in time during the shift. Nurses working out of this mandated ratio showed increased in patient wait time [7]. Also, maintaining staffing within the ratio of 1:4 have a crucial difference to ratio of 1:8where it was reported to have reduced more than a quarterof hospital deaths within 30 days of hospitalisation [24]. In addition to staffing, the proportion of nurses with higher education was also important where it was demonstrated that 10% increase in number of nurses holding bachelor's degree or higher would decrease odds of patient dying within 30 days of admission by 5% [24].

The results have clearly showed that P1, P2, P3, and total number of patients were significantly higher in the afternoon compared to morning and lowest during night duty. However, staff allocation was not significantly different between afternoon and morning. In fact, staff allocation was, on average, slightly higher for morning shifts. This imbalance resulted in highest nurse-patient ratio in the afternoon shift, followed by morning and night. This could reduce afternoon nurses' ability to handle these task-laden cases (especially P1 and P2 cases), efficiently.

However, the results of this study should be considered with its limitations. Firstly, three weeks of data from March 3-10, May 29-June 6, and August 15-22 were missing and could contribute to random errors however averaging the measurements have enhanced the precision of the results. Secondly, the study used nurse-patient ratio by shift as measurement of staffing due to data availability whereby nurse staffing according to workload is arguably more preferable [15]. Even so, data on triage acuity per shift particularly the number of urgent and semi-urgent cases provided important information on the nature of workload the nurses experienced per shift. Finally, the source of data was obtained from the unit-level and may differ compared to data sourced from hospital-level databases[15].

Overall, in this study population, staffing could be allocated more effectively by determining shift demands. The rostering system developed by Maenhout and Vanhoucke (25)could help to achieve this. Further research is needed to determine issues in current staff allocation such as nurse absenteeism [26] and thus tailored solutions could be formulated. Nurse-patient assignments and outcomes such as hospital mortality, nosocomial infection, and other related patient outcomes should be tracked in the electronic medical record database and therefore readily available for the hospital and future researchers to examine the relationship of staffing and patient outcomes more accurately.

To move the research forward, there should be an agreed-upon definition of nurse staffing, and standardised measures of staffing according to nursing specialty since minimum staffing in highly studied critical care settings may not be adequate in emergency nursing [27]. Although strong evidences have showed that increasing number of nurse staffing could immensely increase quality of care, this is easier said than done due to the relentless global issue of nurse shortages [28]. The causal pathways and impacts of intention to leave and retention of nurses are complex and not yet fully understood [29]. Hence, collaboration amongst nursing researchers globally is needed to tackle the immense scale of the issue of nurse staffing.

CONCLUSIONS

The study revealed that the nurse to patient ratio in the emergency department were still considerably high. By determining shift demands, staffing could be allocated more effectively. Patient influx was highest in the afternoon shift however highest staffing was allocated to the morning shift. This imbalance could reduce afternoon shift nurses' ability to handle task-laden cases particularly for urgent and semi-urgent cases, efficiently. Therefore, other than increasing staffing numbers, effective allocation of existing staff may lead to better provision of nursing care and patient outcomes.

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Conflict of interest

None declared.

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