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Do staffing levels predict missed nursing care?

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Abstract

Objective. To examine whether actual nurse staffing predicts missed nursing care, controlling for other unit characteristics.

Design. This study utilized a cross-sectional, descriptive design.

Setting. Ten hospitals in the Midwestern region of the USA.

Participants. Nursing staff members with direct care responsibilities ($n = 4288$) on 110 care units.

Main Outcome Measures. The MISSCARE Survey was utilized to capture respondents' perceptions of missed nursing care as well as other unit characteristics (i.e. demographics, work schedules and absenteeism). Actual staffing data (hours per patient day [HPPD], registered nurse hours per patient day [RN HPPD], skill mix) and unit level case mix index were collected from the participating hospitals for the mean scores of 2 months during survey distribution.

Results. HPPD was a significant predictor of missed nursing care ($\beta = -0.45$, $P = 0.002$).

Conclusions. Findings from this study suggest that missed nursing care may explain, at least in part, the relationship between staffing levels and patient outcomes.

Keywords: missed care, staffing, nurse, absenteeism, hours per patient day

Introduction

Numerous studies have demonstrated the impact of nurse staffing on patient outcomes. Increased nurse staffing levels have been linked to a reduction in several patient outcomes, including mortality rates [1, 2], infection rates [3–5], pressure ulcers [6] and falls [7]. These complications, in many instances, lead to longer hospital stays and increased costs [8, 9].

Although the link between staffing levels and patient outcomes has been well established, few studies have focused on the process of nursing care that results in better outcomes when nurse staffing is richer. The nursing process variable utilized in this study is 'missed nursing care', which is defined as any aspect of required patient care that is omitted (either in part or whole) or significantly delayed [10]. These are defined as errors of omission. The primary focus of the patient safety movement has been on avoiding errors of commission (e.g. hanging the wrong blood). However, it is believed that errors of omission are much more prevalent and detrimental than errors of commission [11]. In previous studies, the most prevalent reason for missing care (i.e. errors of omission) was related to inadequate staffing [12, 13]. To gain a deeper understanding of this relationship, the current study examines whether actual staffing levels predict missed nursing care.

Previous studies

There have been a few studies which have investigated the extent to which specific aspects of nursing care (namely, ambulation, turning, maintaining nutrition, missed medications, hand washing and intravenous site care) are completed. One research team studied the frequency of hallway walking by adults hospitalized on a medical unit and found that 73% of patients did not walk at all [14]. Although an accepted standard of care is turning immobilized patients every 2 h, Krishnagopalan *et al.* [15] found in an observational study of 74 intensive care patients for 566 h of patient care (7.7 h per patient) that 97% of patients did not receive the minimum standard of body repositioning every 2 h. Rasmussen *et al.* [16] discovered nearly 40% of hospitalized patients were malnourished, and only a small proportion had a nutrition plan. There have also been studies which point to

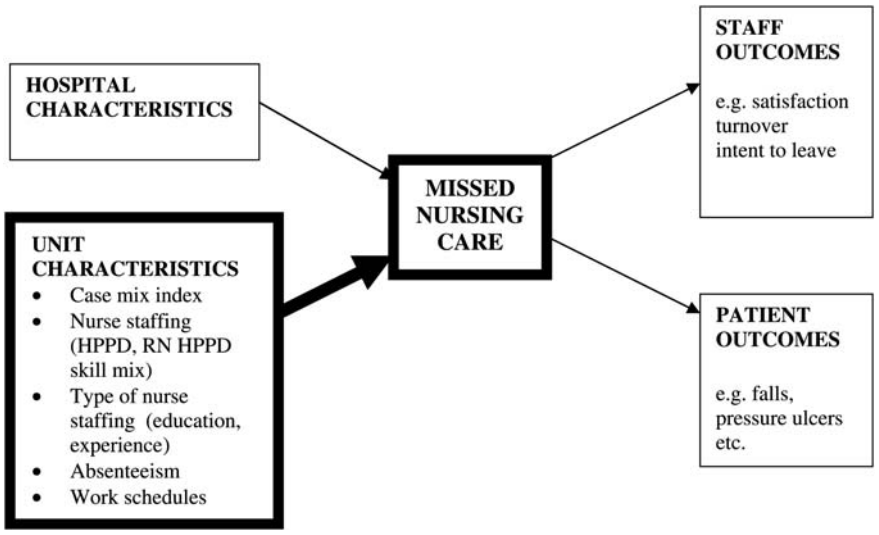

Figure 1 The missed nursing care model (Heavy lines refer to current study).

missed medications [17, 18]. Omission of ordered medications has been found to be the most common medication error [17, 18]. One investigator discovered that 6% of all medication doses were omitted [19]. Other studies revealed 14–69% of all medication errors were errors of omission [17, 18, 20].

In examining the amount and type of missed nursing care occurring in acute care hospital patient units, two studies have been conducted which show a significant amount of missed nursing care [12, 13]. Nurses in three hospitals on medical–surgical, rehabilitation and intensive care units ($n = 459$) reported a substantial amount of care being missed (62%) with similar trends across the three hospitals. The six most frequently missed care activities were ambulation (84%), assessing of the effectiveness of medications (83%), turning (82%), mouth care (82%), patient teaching (80%) and the timeliness of PRN medication administration (80%). The four least frequently missed care activities included patient assessment each shift (17%), glucose monitoring (26%), hand washing (30%) and focused reassessment (36%). Reasons for missed care identified by the study participants included labor resources (85%), material resources (56%) and communication (38%) [12]. In a subsequent study of 10 hospitals with 4086 nursing staff participants, the amount and type of missed care were found to be similar [13]. The most missed elements of nursing care in this study were ambulation (76%), attendance at care conferences (66%) and mouth care (65%) and the reasons for missed care were the same as the previous study.

The conceptual framework for this study was the Missed Nursing Care Model (Fig. 1), which posits the structure variables of hospital characteristics and unit characteristics, missed nursing care and the outcome variables related to staff and patient outcomes. The study reported here focuses on the relationships between unit characteristics and missed nursing care. The units characteristics included in this study were nurse staffing levels (Hours per Patient Day [HPPD], Registered Nurse Hours per Patient Day [RN HPPD], skill mix), staffing type (education, experience), demographic characteristics (age, gender), absenteeism, unit case mix index and work schedules.

The overall aim of this study was to examine the relationship between the levels and type of nurse staffing and missed nursing care in acute care hospitals and to answer the research question.

Does the level and type of nurse staffing and other unit characteristics predict missed nursing care?

Methods

Setting and sample

This study utilized a cross-sectional, descriptive design. A purposive sample of hospitals was used to ensure variation in hospital size and type. A total of 110 medical–surgical, rehabilitation, intermediate and intensive care units in 10 acute care hospitals in one Midwestern state were included in the study. Hospital bed sizes ranged from 60 to 913 beds.

Characteristics of staff and unit are contained in Table 1. Unit participation within the hospitals ranged from 2 to 22 units. All units within the hospitals eligible for inclusion (i.e. adult in-patient units) participated. The inclusion criteria for the patient units within each hospital included an average patient length of stay ≥ 2 days and a patient population >18 years of age. Exclusion criteria were: (i) short stay units (≤ 23 h) and (ii) pediatric, women's health, perioperative and psychiatric units. Registered nurses (RNs), licensed practical nurse (LPNs) and nursing assistants (NAs) were invited to participate in the study.

All of the surveys were collected within a 4 week timeframe for each hospital. The return rate in this study was 60% overall, with a unit response rate varying from 44 to 99%. The

Table I Staff characteristics and unit characteristics

Characteristics	Mean Percentage
Age	
Under 25 years (<25)	15.4
25–34 years old	31.3
35–44 years old	24.5
Over 45 years old (45+)	28.7
Gender	
Female	90.0
Male	10.0
Education	
Grade school	0.4
High school or GED	15.5
Associate degree	37.3
Bachelor's degree	43.1
Graduate	3.6
Experience in the profession/occupation	
Up to 6 months	5.1
Greater than 6 months to 2 years	23.5
Greater than 2 years to 5 years	20.4
Greater than 5 years to 10 years	18.3
Greater than 10 years	32.7
Occupation	
RN	73.5
LPN	1.9
NA	22.0
Nurse manger	2.5
Employment status	
Less than 30 h/week	18.3
More than 30 h/week	81.7
Shift worked	
Day	49.5
Evening	8.2
Night	34.5
Rotating	7.8
Unit type	
ICU	24.0
Intermediate/Stepdown	19.0
Medical–surgical	52.1
Rehabilitation	4.9

return rate for this study was in alignment with other return rates of surveys published in medical journals (60%) [21].

Study variables

Missed nursing care. Missed nursing care was measured by The MISSCARE Survey, which is made up of two parts—Part A (elements of nursing care) and Part B (reasons for missed nursing care). In this study, only data from Part A was utilized. Part A (24 questions) asks nurses to identify how frequently specific elements of nursing care (such as ambulation, turning, patient assessment, teaching, etc.) are missed. In this instrument, respondents are asked to identify the frequency of care being missed using a four-point Likert scale, with anchors 'rarely missed' (1) to 'always missed' (4). Specifics regarding the development and psychometric testing of the MISSCARE Survey have been published elsewhere [22]. The content validity index 0.89 and test–retest reliability was 0.88 ($P < 0.001$).

Unit characteristics

Unit characteristics collected for this study included five nurse staffing indicators (HPPD, RN HPPD, skill mix, education and experience), demographic characteristics (age, gender), absenteeism, work schedules and unit-level case mix index. Operational definitions for the unit characteristics are as follows.

HPPD and RN HPPD. HPPD refers to the overall time expended by the RNs, LPNs and NAs working on the unit per patient day. HPPD values were calculated as the number of productive hours worked by all nursing staff (RN, LPN and NA) with direct patient care responsibilities divided by in-patient days. RN HPPD parcels out only time spent by the RN in relation to patient days. RN HPPD was computed as the number of productive hours worked by RN nursing staff with direct patient care responsibilities divided by inpatient days. The computations for HPPD and RN HPPD were in alignment with the National Database of Nursing Quality Indicators [23] and endorsed by the U.S. National Quality Forum [24].

Skill mix. Skill mix is defined as the proportion of RNs, LPNs and NAs working on the unit. The skill mix value was calculated as the number of productive hours worked by the RNs divided by the total number of productive hours worked by nursing staff (RN, LPN and NA). This computation of skill mix has also been endorsed by the U.S. National Quality Forum [24].

Education and experience. Education (last completed degree) and experience (number of years working in the profession/occupation) were collected to determine the type of staffing. Nursing staff were asked to identify their highest degree earned (i.e. high school diploma, associate degree, baccalaureate degree, masters or higher). Experience levels referred to the number of years the respondent had been working in the profession/occupation (i.e. RN, LPN and NA). Individual responses were aggregated to the unit level in order to compute a unit-level education and experience variable. From the individual level descriptive analysis, a cut-off point (i.e. median split) was decided (i.e. associate degree and lower vs. bachelor's degree and higher). For each unit, an education and experience variable were calculated using the proportion of respondents above the cut-off value at the unit.

Absenteeism. Absenteeism refers to the perceived number of days or shifts in the past 3 months the respondent missed work due to illness, injury or extra rest (exclusive of approved days off). Test–retest reliability for this variables was 0.73 ($n = 29$). Respondents were asked to choose either: none, 2–3 days, 4–6 days or over 6 days or shifts. The individual level responses were subsequently aggregated to the unit level in a similar fashion as the education and experience variables. The absenteeism value for each unit represented

the proportion of nursing staff above the cut-off point (i.e. no absent days).

Case mix index. Case mix index is the average diagnosis-related group weight for all of Medicare patients on a given patient care unit. Although case mix index does not measure differences in severity of illness or acuity, it may represent the relative differences in resources expended for patient care. Case mix index data were obtained through the administrative repository at the study hospitals. This variable was collected to control for variations in perceptions of missed nursing care that were related to differences in patient demands.

Other variables. Respondents were also asked to identify the shift they worked (day or other), the length of the shift (12 or other), their role (RN, LPN/NA), age and gender. The variables for the shift they worked and the length of the shift were dichotomized for the purpose of analysis. The other values for each unit represented the proportion of nursing staff above the cut-off point using a median split.

Procedure

Institutional Review Board approval from each of the 10 participating hospitals was obtained prior to study initiation. Data for the study were collected over a period of 5 months in late 2008 and early 2009 and included the following: (i) surveying the staff on medical, surgical, rehabilitation and intensive care units with the MISSCARE Survey and (ii) the collection of administrative staffing data (i.e. HPPD, RN HPPD, case mix index and skill mix) by patient care unit for the 2 months prior to the administration of the MISSCARE Survey to account for any temporal or unusual variation in staffing. Hospitals were asked to provide the data in raw form (i.e. numerator and denominator) in order to ensure consistency in computation. Administrative staff of each hospital were given an excel file with specific definitions and data requirements. Staffs were asked to input data into a template designed by the research team. Subsequently, the research team computed all variables of interest.

Data analysis

Analyses were completed using SPSS, Version 16.0. After data cleaning, preliminary analyses of the data were completed using descriptive and bivariate analysis techniques according to the research questions. Data structure in this study is hierarchical. Characteristics of the sample, although collected at the individual level ($n = 4288$), were aggregated to the unit level in order to test the relationship between unit characteristics (i.e. actual staffing levels and type, etc.) and missed care. For missed care, a unit-level missed care score was used which was calculated as the average amount of missed care identified for each of the elements of nursing care by nursing staff on each unit.

For aggregation to be statistically appropriate, it is necessary to demonstrate that the members of each unit reported similar scores for the unit on a given measure, and the units have significant between unit variance for a given measure [25]. In order to determine the degree of congruence between individual staff' survey responses and the appropriateness of aggregating theses measure to the unit level, one-way analysis of variance (ANOVA) and intraclass correlation coefficients (ICC1 and ICC2) were used. ICC1 provides an estimate of correlation among staff responses within units; ICC2 provides an overall estimate of the reliability of unit means [26]. Whereas the values of ICC1 tend to range between 0.05 and 0.30, ICC2 values equal to or above 0.70 are considered acceptable. In this study, the ICC1 for the missed care is 0.13 and the ICC2 for the missed care is 0.90. The one-way ANOVA with type of unit as the independent variable and the missed care mean scores as the dependent variable was highly significant ($P < 0.001$). Findings from these techniques supported the creation of a unit-level missed care score.

One-way ANOVA was used to test missed nursing care difference by type of units. Correlation analysis was used to address the relationship between unit characteristics and missed nursing care. A multiple regression analysis was performed to determine the predictive ability of the variables on the dependent variable, missed nursing care. In addition, accounting for hospital effect (i.e. nesting of data), nine hospital dummy variables were included in the multivariate analysis.

Results

As noted in Table 1, the majority of the patient care units in this study employed a large number of staff members over the age of 35 years (53.2%). A majority of staff (within each hospital) were female (90%), RNs (73.5%) and worked full time (81.7%). On average, 49.5% of the respondents within the hospitals worked day shift. In terms of education, the average percentage of staff on the unit holding a BSN degree or higher was 46.7%. The majority of units sampled employed staff with >5 years experience in the profession/occupation (51.0%).

The mean missed nursing care score for the participating units was 1.55 (SD $\pm$ 0.19), with a range of 1.09–2.67 (1.55 is midway between 'rarely missed' (1) and 'occasionally missed' (2)). HPPD values for participating units ranged from a low of 6.5 to a high of 32.0 with the mean of 11.16 (SD $\pm$ 4.55). The average RN HPPD value was 8.55 (SD $\pm$ 4.28), with a range of 3.5–20.9. The mean skill mix of staff on the units was 0.75 (SD $\pm$ .15), with a range of 0.39–1.00 (1.00 being an all RN staff). Missed nursing care was tested for difference by type of units. No differences were found (F [3, 106] = 2.219, $P < 0.101$).

Unit characteristics associated with missed care

Pearson correlations were performed (Table 2) to determine unit characteristics significantly related to missed nursing care. A negative correlation was found between missed care and two of the staffing variables: HPPD and RN HPPD. The higher the HPPD ($r = -0.32$, $P < 0.01$) and RN

Table 2 Missed care and unit characteristics: correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Missed care	—											
2. HPPD	−0.32†	—										
3. RN HPPD	−0.27†	0.91†	—									
4. Case mix index	−0.20*	0.64†	0.70†	—								
5. Skill mix	−0.06	0.19*	0.55†	0.35†	—							
6. Age (>35 years)	−0.01	0.05	−0.01	−0.16	−0.07	—						
7. Gender (Female)	0.08	−0.21*	−0.30†	−0.37†	−0.29†	0.04	—					
8. Education (BSN or higher)	−0.07	0.48†	0.59†	0.52†	0.45†	0.36†	−0.10	—				
9. Experience (Greater than 5 years)	−0.17	0.25†	0.22*	0.04	.00	−0.76†	−0.02	−0.11	—			
10. Work hours (Day)	−0.00	−0.13	−0.30†	−0.24*	−0.49†	−0.02	0.01	0.09	0.04	—		
11. Shift (12 h)	−0.05	0.31†	0.17	0.26†	−0.26†	0.10	−0.01	0.09	0.04	0.15	—	
12. Occupation (RN)	−0.04	0.45†	0.61†	0.36†	0.63†	0.03	−0.11	0.55†	0.10	0.02	0.17	—
13. Absenteeism	0.26†	−0.16	0.05	−0.02	0.51†	0.08	−0.14	0.06	−0.17	0.21*	−0.14	0.26†

$^{*}P < 0.05$. $^{\dagger}P < 0.01$.

Table 3 Predictors of missed nursing care

Variable	*B*	SE	t	*P*
HPPD	−0.02	0.01	−0.45	0.002
Case mix index	0.01	0.02	0.04	0.75
Experience (>5 years)	0.06	0.11	0.06	0.58
Absenteeism	0.16	0.17	0.15	0.34
R^2		0.294		
F (*P*)		3.03 (0.001)		

Note. Analysis included nine dummy variables for study hospitals to control for their effects (output suppressed).

HPPD ($r = -0.27$, $P < 0.01$), the lower the levels of missed care. Absenteeism was also significantly related to missed care. Specifically, greater absenteeism was associated with higher missed care ($r = 0.26$, $P < 0.01$). In contrast, case mix index was negatively associated with missed care, such that higher case mix index values were linked to lower missed care ($r = -0.20$, $P < 0.05$).

Predicting missed care

Multiple regression analysis was computed to determine whether unit characteristics predict missed nursing care. RN HPPD was dropped from the model due to a strong correlation between HPPD and RN HPPD ($r = 0.91$, $P < 0.01$). Also, this decision was based on the fact that the study sample included all levels of nurse staffing (RNs, LPNs and NAs). The model (Table 3) considered the following indicators: HPPD, experience (>5 years), absenteeism and case mix index, which had significant correlations with missed nursing care.

Nine hospital dummy variables were also included accounting for the nested data structure. The overall model accounted for 29.4% of the variation in missed nursing care ($P < 0.001$). HPPD was significantly associated with missed nursing care. Specifically, the greater the HPPD, the lower the level of missed nursing care ($\beta = -0.45$, $P = 0.002$). Other variables in the model were not significant predictors of the dependent variable, missed nursing care.

Discussion

Although there have been numerous studies which link staffing levels with patient outcomes, there has been less research which explains why these linkages exist. Findings of this study explain, at least in part, what is occurring within the process of providing nursing care. It reveals the fact that aspects of nursing care are not being completed. The findings of this study substantiated other investigations which have shown that specific aspects of care are being missed (e.g. ambulation [14], turning [15] maintaining nutrition [16] and administering medications [17, 18, 20]).

These findings also validate previous research by two teams who have investigated similar concepts to missed nursing care, namely unfinished care and rationed care [25, 27]. Sochalski [25] looked at the relationship between nurse staffing and the quality of nursing care. The result showed that quality of nursing care was significantly related to rates of unfinished care (number of nursing tasks left undone) for those patients. In addition, a team in Switzerland investigated 'rationed nursing care', which occurs when nurses lack sufficient time to provide all the care they perceive is needed by their patients. Although the nurses reported little care not completed, there was a significant impact on selected patient outcomes such as medication administration errors, patient falls, nosocomial infections, critical incidents and pressure ulcers [27].

Other studies besides Schubert *et al.* [27] investigation have shown that missing specific elements of nursing care result in adverse patient outcomes. For example, failure to ambulate patients has been linked to new onset delirium [28], pneumonia [16], delayed wound healing [29], pressure ulcers [30], increased length of stay and delayed discharge [29, 31–33], increased pain and discomfort [34], muscle wasting and fatigue [35] and physical disability [36]. Any patient with impaired mobility can be at risk of pressure ulcers, which are typically caused by 'periods of uninterrupted pressure on the skin, soft tissue, muscle and bone' [37]. A new report issued by the AHRQ reports that pressure ulcers among hospitalized patients have become significantly more prevalent over the last 15 years. On the basis of data from the Healthcare Cost and Utilization Project (HCUP), the analysis found that in 2006, there were more than 500 000 hospital stays with pressure ulcers noted as a diagnosis when compared with 280 000 in 1993—an increase of almost 80% [38]. Perhaps missed care accounts for some or all of this increase. Mouth care is another example of missed care which leads to a reluctance to eat that in turn impacts risk of pressure ulcer development and/or pneumonia, particularly in ventilated patients.

HPPD, in this study, was the strongest predictor of missed nursing care. It is possible that when staffing is less, a staff member may not be able to complete all care required. Having less staff also leads to less care because of unavailability of the staff members to help when care is required. For example, when a nurse is unable to ambulate a patient (due to other patient priorities), he/she may be more likely to find other staff members who would have time to ambulate the patient. These potential factors for missed care may warrant further investigation. Other variables included in the multivariate model, including absenteeism, shift worked, experience, unit case mix index and hospital were not found to be significant predictors of missed care, despite the fact that bivariate analysis revealed significant associations.

In addition, unit type was not included in the final regression model since unit type was not correlated with missed care (F [3, 106] = 2.219, $P = 0.10$). However, we ran the multiple regressions after including a unit type variable (i.e. ICU [reference] vs. non-ICU unit) to explore relationship of case mix index and unit type on missed nursing care. HPPD was a significant predictor ($\beta = 3.71$, $P < 0.001$). Case mix index was still negatively associated with missed care, but it was not statistically significant ($\beta = -0.03$, $P = 0.84$). It is possible that patients, who are more acutely ill, get more overall attention than those who are less acute.

There are three limitations of this study. Generalizeability is limited to hospitals of similar size (60–913 beds) and location (one Midwestern state in the USA). Second, the MISSCARE Survey captures perceptions of missed care as opposed to observing care processes. However, the fact that minimal variation in the types and reasons of missed care were found across hospitals suggests that the findings may be widely applicable. The third limitation is that absenteeism was measured by self-report of the participants instead of obtaining data from actual attendance records.

Conclusions

This study highlights the importance of adequate nurse staffing levels to ensure that required nursing care is provided to patients on a consistent basis. As concerns for cost reduction continue, it is imperative to consider the impact of reducing staffing levels in nursing. Finding from this study also reveals insight into how we can specifically improve nursing care. Understanding what care is being provided (or not) will assist in the development of focused interventions. Unless we understand what is actually occurring at the point of nursing care delivery, we will not be able to develop interventions to improve processes which lead to a higher quality of nursing care and in turn, better patient outcomes.

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