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Hospital unit understaffing and missed treatments: The moderating effect of teamwork

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ABSTRACT

Hospitals throughout the U.S. are facing increasing demand and employee shortages. This capacity issue has led to understaffing in some hospital areas. The current study examines the impact of understaffing in hospital-unit respiratory care and the impact to missed treatment rates. The moderating effect of teamwork is also considered.

KEYWORDS: Healthcare, Staffing, Teamwork, Medical errors, Empirical

INTRODUCTION

Demand for many healthcare frontline workers is expected to increase at above-average rates between the years 2014 – 2024. Demand for registered nurses is expected to increase 16%. Demand for respiratory therapists is expected to increase 12%. Demand for nursing assistants is expected to increase 17% (BLS, 2016). In addition to increasing demand, existing staffing shortages and employee turnover in hospitals has become an increasingly important area of healthcare administration (Aiken, 2011; Jacobson, 2015). Managers within U.S. hospitals are having to deal with chronic understaffing and subsequent impacts to patient care (Jacobson, 2015).

Understaffing of nurses has been associated with higher error rates and poorer quality of care (Lang et al., 2004; Twigg et al., 2015). High demands on frontline employees and lack of staffing to meet those demands can lead to increased error rates (Jacobson, 2015; Twigg et al., 2015) and higher rates of missed treatments. *Missed treatments* are treatments that have been scheduled as part of a patient's care plan but are missed by the frontline employee. In this study, missed treatments are considered a type of medical error.

In addition to staffing concerns, teamwork among frontline employees is particularly important in a hospital environment. Hospitals are very labor-intensive service environments that have to meet the demands of diverse patient needs. Teamwork among hospital caregivers has been shown to increase communication and coordination as well as increase the quality of care to patients. Furthermore, higher levels of teamwork has been shown to decrease medical errors (IOM, 2000; IOM, 2001; Pronovost & Vohr, 2010).

The current study seeks to examine the relationship between teamwork and missed treatments as well as understaffing and missed treatments. In addition, this study investigates if teamwork among frontline employees can be effective at weakening the effects of understaffing on missed treatment rates. So, *does caregiver teamwork moderate the understaffing-missed treatments relationship?*

LITERATURE REVIEW

Literature on Hospital Understaffing

Hospital staffing (and subsequent understaffing) has been of increasing interest, particularly in the nursing literature. Understaffing of nurses has been argued to be a major impediment to providing high-quality care (Aiken et al, 2001; Aiken et al, 2002, Needleman et al., 2002). In fact, Twigg et al. (2015) found that even after controlling for patient characteristics, understaffing in nurses was associated with higher odds of: infection, pressure injury, pneumonia, deep vein thrombosis, sepsis and gastrointestinal bleed. In addition, the reader should refer to two literature reviews, Lang et al, 2004 and Kane et al, 2007, regarding the impact of nurse staffing on patient outcomes.

Furthermore, hospital understaffing is associated with lower levels of job satisfaction and higher levels of staff burnout (Aiken et al., 2002). This burnout and lack of job satisfactions will only make a staffing situation worse. Understaffing should be actively managed in order to maintain or improve hospital quality of care (Needleman et al., 2002, Twigg et al., 2015). The current study examines hospital understaffing and the association with missed treatment rates.

Literature on Hospital Teamwork

Teamwork in a healthcare environment is particularly important due to the high labor intensity required for patient care. The lack of teamwork and communication has been shown to increase error rates in hospitals (IOM, 2000; IOM, 2001; Pronovost & Vohr, 2010). The Institute of Medicine (IOM, 2001, 2002) indicated that teamwork can be a valuable mechanism to combat medical errors. Furthermore, recent work in rapid-response teams has indicated these teams have resulted in lower levels of cardiac arrests and lower mortality rates (Berwick et al, 2006; Buist et al, 2002; Chan et al, 2010; DeVita et al, 2004). The current study builds on the idea of staffing teamwork reducing errors and improving quality of care by considering the impact of teamwork on missed treatments. Furthermore, we extend current research to consider if teamwork can dampen the effect of understaffing on missed treatment rates.

HYPOTHESIS DEVELOPMENT AND MODEL

Understaffing is a problem in a labor intensive environments, like health care, where demand for services is increasing. Chronic understaffing of nurses has been shown to be associated with higher hospital-acquired infection rates, higher rates of pneumonia and higher rates of sepsis (Needleman et al., 2002; Twigg et al., 2015). Rogowski et al. (2013) confirmed this trend with NICU nurses, where higher rates of understaffing significantly raised the infection rate for critical infants. In this study, missed treatments are considered a type of medical error. Missed treatments are treatments that are scheduled per the patient's care plan but they are missed by the frontline employee. Therefore, it is expected that higher levels of understaffing will be associated with higher rates of missed treatments.

H1: Higher levels of understaffing are associated with higher missed treatment rates

Training hospital employees for better teamwork skills has been associated with better patient-safety culture, better communications about errors, and staff working together across hospital units (Jones et al., 2013). In addition, nurses with greater teamwork have been shown

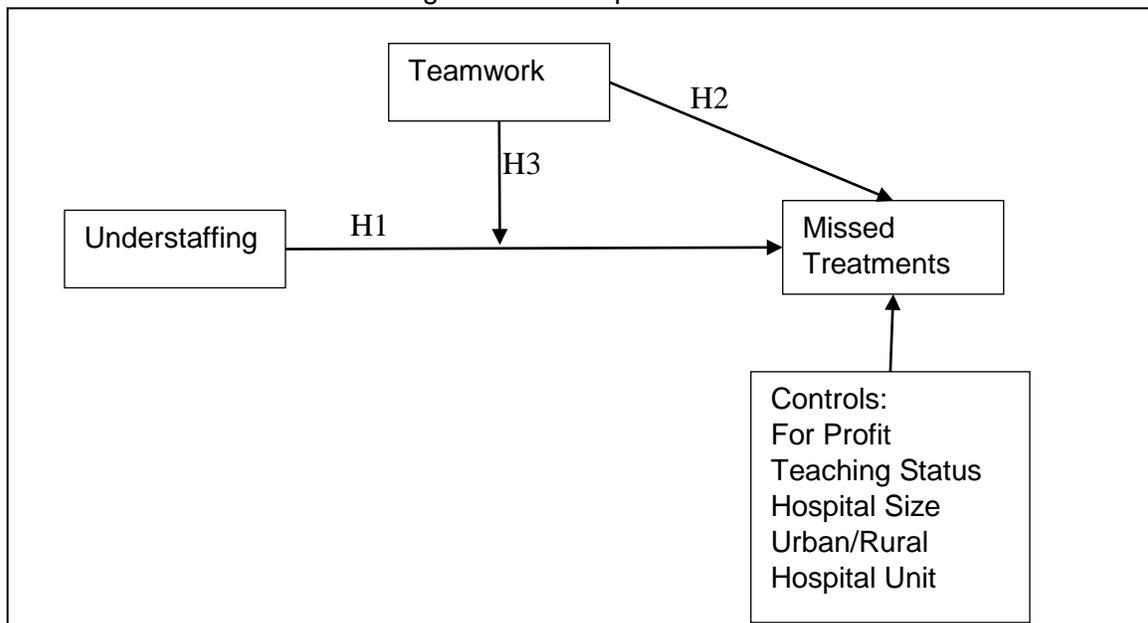
to have higher levels of job satisfaction, lower burnout, and higher perceived quality of care for their patients (Rafferty et al., 2001). In a recent statement by the American Heart Association, many preventable hospital errors are due to breakdowns in communication, collaboration and teamwork (Wahr et al., 2013). Therefore, in this study, greater levels of teamwork (and its associated communication/collaboration efforts) are expected to lower missed treatment rates for patients.

H2: Higher levels of teamwork within a hospital unit are associated with lower missed treatment rates.

Coordination and information exchange are critical to achieving better patient outcomes (Boyer and Pronovost, 2010; Gittel et al., 2000; Pronovost & Vohr, 2010). Better information exchange is expected to enhance healthcare delivery and reduce medical errors (White et al., 2004). With this in mind, it is expected that coordination and collaboration among frontline employees will create a working environment that will lessen the effects of understaffing on medical errors. In hospital units with high levels of understaffing, the existence of teamwork can help to lessen the impact of the staffing problems on missed treatment rates. Therefore, this study predicts negative moderating (i.e., dampening) effect by teamwork. Figure 1 provides a conceptual model for this study.

H3: *Higher levels of teamwork negatively moderate the relationship between understaffing the missed treatments.*

Figure 1: Conceptual Model



METHODS

Instrument Development

This study was carried out using the field of respiratory care within a set of U.S. non-governmental hospitals. Specifically, we consider four different units within a hospital: Emergency Department (ED), Intensive Care Unit (ICU), Neonatal Intensive Care Unit (NICU) and Adult Inpatient Floors (AI). In each of these units, respiratory therapists are required to provide a variety of care regarding respiratory services. Furthermore, the use of teamwork and the level of staffing (of respiratory therapists) can vary across units in the same hospital. A survey was designed to be completed by the respiratory care manager/supervisor for that particular hospital unit.

Survey questions for *Understaffing* and *Teamwork* were developed by working closely with our industry managers. Both understaffing and teamwork are well understood variables that respiratory care managers are consistently aware. *Understaffing* is the degree to which a hospital unit is under-staffed in respiratory therapists. *Teamwork* is the degree to which the frontline employees (nurses, therapists, etc.) work together to solve problems for patient care.

In order to measure error rates as an outcome measure, a variable was needed that was consistently monitored at the unit-level between hospitals settings. Most variables are aggregated to the hospital-level for government reporting. Other objective data is available at the patient-level (but not necessarily defined by hospital unit). In addition, patient-level data requires significant IRB approvals from each participating hospital because of privacy rights. So, our industry partners and the American Association for Respiratory Care (AARC) were contacted to determine if there were any measures consistently tracked by respiratory care managers at the unit-level within a hospital.

One variable emerged that is known by respiratory care managers across the country (and measured in a consistent way): *missed treatments*. In fact, the AARC maintains a proprietary benchmarking database that tracks missed treatments rates for its participating hospitals. The AARC variable for missed treatments is defined as the percentage of "treatments ordered but not delivered within a given time period" (AARC, 2016). While the full missed treatment database was not available from the AARC, the association provided us with blind (no hospital identifiers) annual numbers for missed treatments. Quartile calculations from the AARC database for missed treatments were used to develop the scale cutoffs which were then used as the survey response options for the missed treatments variable in this study. Details of all survey items are presented in the Appendix.

Hospital control variables such as hospital size (measured as number of beds), profit vs. non-profit, teaching vs. non-teaching, and urban vs. rural were obtained from the American Hospital Association database for our participating hospitals.

Data Collection

The data collection for this study involved several stages, a pre-test, revision, and the main data collection. The proposed research questions in this study are dependent on the practical relevance of the survey questions and the full understanding of the survey items by responding practitioners. Several rounds of instrument pre-testing with industry partners (respiratory care managers/therapists/pulmonologists) were used to ensure the content validity of the survey constructs and question wording. Content validity, defined as the 'adequacy' in which the content in question has been sampled (Nunnally, 1978), is commonly assessed through the evaluation of the survey items by content experts. As such, four academics (professors in operations management) and six practitioners (two respiratory care managers,

two pulmonology physicians, and four respiratory therapists) reviewed each of the items included in the survey. If survey items were confusing or unclear, the item was revised and then reviewed again by these experts.

For our main data collection, the survey was distributed online using the Qualtrics software. Respiratory care managers/supervisors were asked to respond to the survey for the specific unit in the hospital (ED, ICU, NICU, or AI) that they managed. In total, usable responses were received from 105 managers/supervisors from 45 different hospitals.

Data Analysis

Multiple regression was used in the STATA 13 software to test the hypotheses. Model 1 tests only the direct effects. Model 2 adds the moderating effect to the model. In addition to the main variables, each model also contains control variables for profit-status (For Profit), teaching status (Teaching), Size, Urban vs. Rural, and hospital unit (ICU, NICU, ED). The dummy variables for hospital unit (ICU, NICU, ED) are interpreted relative to the 'general adult inpatient' units.

RESULTS

Table 1 describes the regression results. Model 1 examines only the direct effects. Hypotheses 1 and 2 are both supported ($p < 0.01$). Higher levels of understaffing are associated with significantly higher levels of missed treatments. Greater levels of teamwork within the hospital unit are associated with lower levels of missed treatments.

Model 2 examines the moderating effect of teamwork. Hypothesis 3 is also supported ($p < 0.05$). Greater levels of teamwork within a hospital unit dampens the relationship between understaffing and missed treatments.

Control variables for "For Profit", "NICU", and "ED" are significant in both models. So, for-profit hospitals have lower levels of missed treatments. Furthermore, neonatal intensive care units and emergency departments have lower missed treatment rates relative to general adult inpatient units. Finally, teaching status, size of hospital, urban environments, and intensive care units were not significant predictors of missed treatment rates.

Table 1: Regression Results

DV: Missed Treatments	Model 1	Model 2
Understaffing	0.239** (0.095)	0.207* (0.094)
Teamwork (TW)	-0.494** (0.161)	-0.541** (0.159)
UnderstaffingxTW	-	-0.257* (0.118)
For Profit	-0.856* (0.527)	-1.077* (0.527)
Teaching	-0.278 (0.258)	-0.198 (0.256)
Size	0.001 (0.000)	0.000 (0.001)
Urban	-0.712 (0.331)	-0.105 (0.326)
ICU	-0.149 (0.260)	-0.142 (0.255)
NICU	-0.815* (0.397)	-0.966* (0.395)
ED	-0.600* (0.294)	-0.565* (0.289)
*p<0.05, **p<0.01, (standard error)		
N	105	105
R ²	0.27	0.31

DISCUSSION AND CONCLUSIONS

The results show that higher levels of understaffing is associated with higher missed treatment rates. This is consistent with prior literature stating the lack of adequate staffing increases error rates in hospitals (Aiken et al, 2001; Aiken et al, 2002; Jacobson et al., 2015; Lang et al., 2004; Twigg et al., 2015). The results also show that higher levels of teamwork decrease the missed treatment rates. This can be due to the increased levels of communication and collaboration for patient care in a high-teamwork environment.

Furthermore, an interesting finding in this study is the significant moderating effect of teamwork. High levels of teamwork can be used to weaken the effect of understaffing on missed treatments. So, not only does teamwork decrease missed treatments directly, but it also weakens the understaffing effect. This is an interesting effect for managers trying to maintain quality of care. To be clear, this finding is not intended to promote deliberate understaffing of hospital units. However, if a manager is stuck with an understaffed environment, efforts for teamwork and collaboration can help reduce errors and potentially maintain quality of patient care. Managers should consider efforts to increase the level of teamwork which could include

initiatives such as teamwork training or work-design to facilitate teamwork and collaboration among frontline caregivers.

Control variables for 'profit status', ED, and NICU were significant in both models. For-profit hospitals have lower missed treatment rates. One explanation of this finding could be due to the focus on profits. Medical errors can be expensive, therefore, for-profit institutions may be more actively managing the prevention of those errors. Furthermore, emergency departments and neonatal intensive care units have lower missed treatment rates compared to the 'general adult inpatient' areas. This can be explained by critical nature of care in these departments and the more active management of fulfilling treatment plans among critical patients.

While this study provides interesting implications for teamwork in an understaffed environment, it is not without limitations. This study asks managers about understaffing but does not use actual staffing ratios. Future studies can use objective data on staffing numbers across hospitals/hospital units and error rates to confirm the findings in this paper. In addition, future work should consider individual factors (i.e., personality traits, burnout, etc.) that can lead to missed treatments. Future work can also consider organizational-level initiatives and cultures that drive missed treatments and other medical errors.

APPENDIX: Survey Items

Hospital Unit

Responses: [1-ICU, 2- NICU, 3-ED, 4-General Adult Inpatient]

1. Which best describes your hospital unit?

Understaffing

Responses: [1-Strongly Disagree, 5-Strongly Agree]

1. This unit is often understaffed in respiratory therapists.

Teamwork

Responses: [1-Strongly Disagree, 5-Strongly Agree]

1. The members of this unit work together as a team for patient care.

Missed Treatments

Responses: [0-0.23%; 0.24%-0.65%; 0.66% - 1.85%; 1.86% - 5%; above 5%]

1. What is your average missed treatments (in this unit)?

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