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How Differing Shift Lengths Relate to Quality Outcomes in Pediatrics

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Abstract

Objective—To describe the shift lengths of pediatric nurses and to measure the association of shift length with nurse job outcomes, nurse-reported patient outcomes, and nurse-assessed safety and quality of care in hospitals.

Background—Long work hours have been linked with poor patient outcomes in adult patient populations but little is known about the relationship in pediatric settings.

Methods—A secondary analysis of cross-sectional nurse survey data was conducted. Our analysis focused on 3,710 registered nurses who worked in 342 acute care hospitals that treated children.

Results—The majority of pediatric nurses worked 12 hour shifts especially in intensive care settings. Nurses who worked extended shifts of >13 hours reported worse job outcomes and lower quality and safety for patients compared to nurses who worked 8 hour shifts.

Conclusions—Allocating resources to nursing to improve working hours may be a productive strategy for administrators to improve the health and well-being of pediatric patients and nurses

Josie King entered a hospital for care following burns suffered during an accident at home. Healing well and days from discharge, her mother noticed that Josie was unusually thirsty and was reassured by staff that everything was ok. Repeatedly her mom raised concerns. Josie died of severe dehydration and an overdose of narcotics days later at 18 months old (1). Pediatric patients from the tiniest babies in neonatal intensive care to adolescents with chronic diseases are vulnerable to safety lapses due to complex therapies, medication dosing, and physiological development.

Serious gaps in care provided in American hospitals have been documented for over a decade in publications including *To Err is Human* (2), *Crossing the Quality Chasm* (3) and

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Keeping patients Safe (4). Often more focused on the adult population, the Josie King story reminds us of the tremendous safety vulnerabilities when delivering care to pediatric patients and prompts the question, “What elements contribute to lapses in the care of children?” This paper is one of few examining how differing shift lengths for nurses relate to safety, quality, and nurse and patient outcomes in pediatric care settings.

Nurses work 24/7 in shift patterns, rotating shifts, and through weekends and holidays. To provide the safest and highest quality of care, nurses need to be alert to changes in patient status, process information quickly, and intervene in a timely fashion. Shift work, overtime and associated stress can lead to sleep deprivation or poor sleep quality (5). Sleep loss causes not only cognitive and behavioral impairments but physiological and emotional difficulties as well (6). Overtime and extended shifts among nursing staff have been associated with poor patient outcomes and errors in adult populations (5, 7–9). In a recent alert, The Joint Commission brought the issue of fatigue and patient safety to light, calling for organizations to take action to mitigate the risk for fatigue resulting from extended shifts for all healthcare workers (10).

Very little research has examined the relationship between the work hours of pediatric nurses and patient outcomes. A qualitative study describing errors made by neonatal intensive care unit (NICU) nurses implicated long shifts as a contributing factor to the errors (11) as did a study of pediatric nurses reporting medication errors (12). A study of 34 units in 7 hospitals looked at the proportion of hours per patient day that were overtime hours and the incidence of patient adverse events but found no clear relationship (13). The paucity of studies on this topic suggest that additional research will add to the understanding of the potential consequences of pediatric nurses’ work hours on the quality and safety of care of infants and children.

The combination of stress and fatigue, leading to burnout in NICU nurses has been raised as a concern by the National Association of Neonatal Nurses (14). However, the impact of long work hours on pediatric nurse outcomes such as burnout or job dissatisfaction has not been evaluated. These 2 job-related outcomes are important management concerns because they have been linked to intent to leave, turnover, and infection (15–17).

This study describes the shift lengths of pediatric nurses in ICU and non-ICU settings and measures the association of shift length with nurse job outcomes, nurse-reported patient outcomes, and nurse-assessed safety and quality of care in hospitals. This study is the 1st to link pediatric nurses’ shift length to a comprehensive set of measures reflecting nurse and patient well-being.

Methods

Design and data

We conducted a secondary analysis of cross-sectional nurse survey data, including questions on staff nurses’ shift length, burnout, job dissatisfaction, intent to leave, frequency of adverse events and assessments of quality and safety. A description of the parent study, The Multi-State Nursing Care and Patient Safety Study, is available elsewhere (18). Data from the American Hospital Association (AHA) annual survey was used to obtain characteristics of the study hospitals. IRB approval was granted from the University of Pennsylvania.

Sample

The subset of pediatric nurse respondents from the parent nurse survey data set comprised the analytic sample of 3,710 registered nurses (RNs) in 342 hospitals from 4 states (California, New Jersey, Pennsylvania and Florida). The hospitals were among the 3 types

of acute care settings that treat children: a general hospital, a free standing children's hospital, or a children's hospital in a general hospital/health system. Nurses who were included in this study provided direct patient care in 1 of 4 types of pediatric units: NICU, pediatric intensive care unit (PICU), newborn nursery and general pediatrics.

Measurement and Instruments

Nurses' shift length was computed as the difference between the start time and end time of the last shift. We grouped nurses into 3 shift categories: 8 hours, 12 hours, and > 13 hours. We considered an 8 hour shift to include nurses who worked 8–9 hours and a 12 hour shift to include nurses who worked 12–13 hours to account for end of shift activities. Less than 2% of nurses worked 10–11 hours and they were grouped in the 8 hour category.

Nurses' job satisfaction was assessed using a 4-point Likert question, "How satisfied are you with your job?" (very satisfied to very dissatisfied). Responses were dichotomized into satisfied versus dissatisfied. Use of a single question of job satisfaction has been correlated highly with multiple question scales (19). For analysis purposes we used the negative form of the question, job dissatisfaction as the variable of interest.

Burnout was measured using the emotional exhaustion subscale of the Maslach Burnout Inventory (MBI), a reliable and valid instrument (20–22). This subscale is composed of 9 items, such as "I feel used up at the end of the workday". The frequency of each item is measured on a 7-point Likert scale ranging from 0 (never) to 6 (every day) (20) Scores totaling 27 or > are considered high emotional exhaustion (23). Using high emotional exhaustion as an indicator of burnout follows previous research (24, 25) Nurses' intent to leave their employer in the next year was assessed using a single item question (yes/no).

Nurses reported the frequency of central line associated bloodstream infections (CLABSI), urinary tract infections (UTIs) and complaints from patients/family on a 7-point Likert question ranging from never to everyday. Infections were classified as frequent if the nurse reported they occurred more often than a few times per year while complaints were classified as frequent if the nurse reported they occurred more than a few times per month. Previous research has shown that nurses reliably recall adverse patient events (26) and that nurse reports are consistent with documented adverse events (27).

Items related to patient safety and quality were modeled after the Agency for Healthcare Research and Quality's hospital survey on patient safety culture (28). Nurses reported on overall quality of nursing care on a 4 point scale, ranging from poor to excellent. Responses were dichotomized into poor and fair versus good and excellent. Nurses were asked to give their unit/practice area a safety grade from A (excellent) to F (failing). A poor safety grade included responses of C, D, and F. Lastly, nurses were asked whether "important patient care information is lost during shift changes" on a 5-point Likert scale. Responses strongly agree and agree were collapsed into agree and neither, disagree and strongly disagree were collapsed into disagree.

Control variables—We used controls in our models to adjust for individual nurse characteristics, nursing organizational factors and hospital structural characteristics that may influence our outcomes based on research in other populations (24). For individual nurse characteristics, we included age and gender, which may affect intentions to leave. We controlled for ICUs due to the demands of this setting (29). We controlled for nurse staffing and the professional practice environment as nursing organizational features because they have been associated with burnout, job dissatisfaction, and patient outcomes (30). Nurse staffing was reported as the number of nurses and patients on the unit on the last shift. The patient to nurse ratio was then averaged at the hospital level. The professional practice

environment (PPE) was measured using the practice environment scale of the nursing work index (PESNWI), a nationally endorsed nursing performance standard (31, 32). Finally, we controlled for hospital structural characteristics such as bed size to account for differences in hospital case mix and complexity. The AHA survey was used to characterize teaching status, technology availability and bed size. Hospitals were considered high technology if they performed major organ transplant and/or open heart surgery. Teaching status was determined by the ratio of post graduate medical residents to beds and bed size was the total number of licensed hospital beds.

Analysis

Frequencies and percents were used to examine the categorical variables (e.g. burnout) and means and standard deviations were used to examine continuous variables (e.g. age). Bivariate relationships were assessed between the independent variable, shift length, and each of the nurse outcomes and nurse-reported patient outcomes. Generalized estimating equation models were used to estimate the association of shift length and outcomes, accounting for the clustering of nurses in hospitals. Models controlled for individual nurse characteristics, nursing organizational characteristics and hospital characteristics. All comparisons were made using the 8 hour category as the reference group. All analyses were completed in SAS version 9.3 (SAS Institute, Cary, North Carolina). The statistical significance level was $p < .05$ for a two-tailed test.

Results

The characteristics of the nurses and types of hospitals where they worked are displayed in Table, Supplemental Digital Content 1, <http://links.lww.com/JONA/A174>. The majority of hospitals were over 250 beds, teaching hospitals with high technology available. The average nurse was 44 years old. Nearly all nurse respondents were female and about half had a bachelor's degree or higher education. Three quarters of the nurse respondents were white. Over two-thirds of pediatric nurses worked 12 hours on their last shift, while 26% worked 8 hours. Very few worked > 13 hours (3%). Table 1 displays the nurses' pediatric settings and shift lengths. More ICU nurses than acute care nurses worked 12 hour shifts; 81% of PICU nurses and 77% of NICU nurses worked 12 hours compared to 64% and 66% of acute care pediatric and newborn nursery nurses.

Nurse reported poor nurse outcomes were fairly common (Table 2). One in 4 pediatric nurses had high burnout; one in 5 was dissatisfied, and 1 in 10 intended to leave their employer. These poor outcomes were nearly 2X as common among nurses who worked > 13 hours. The number of nurses reporting intent to leave increased incrementally from 8 hours to 12 hours to > 13 hours. Frequent adverse events were less common, reported by 4–10% of nurses overall. Significantly higher percentages of nurses who worked longer shift lengths of 12 or >13 hours reported frequent central line infections and frequent urinary tract infections. Finally, from 8–30% of nurses reported poor quality and safety outcomes, but this percentage increased dramatically for nurses working > 13 hours. Half of the nurses who worked > 13 hours agreed that important patient information was lost during shift changes.

The results of multivariate regression models in Table, Supplemental Digital Content 2, show that nurses who worked > 13 hours were at least 2 X more likely to be burned out, dissatisfied, and to intend to leave than nurses who worked 8 hour shifts, <http://links.lww.com/JONA/A175>. These results were nearly equivalent in unadjusted and adjusted models, indicating that differences in nurse, nursing unit, and hospital factors did not influence the relationship between shift length and nurse outcomes. In addition, nurses

who worked 12 hour shifts were more likely to intend to leave (OR = 1.36) than nurses who worked 8 hours.

Nurses' shift length was also significantly associated with nurse-reported patient adverse events in multivariate models. In adjusted models, nurses who worked > 13 hours were significantly more likely than 8 hour shift nurses to report frequent CLABSI and complaints but not UTIs. The likelihood that nurses who worked > 13 hours reported frequent CLABSI were 2.5 X higher than nurses who worked 8 hours. Likewise, the odds of frequent complaints were 1.8 X higher.

Finally, nurses' shift length was significantly associated with their reports of quality and safety. The likelihood of a nurse reporting poor quality or a poor safety grade on their unit was over 2 and 1/2 fold greater for nurses working > 13 hours compared to nurses working 8 hours (adjusted ORs 2.76 and 3.14, respectively). In fully adjusted models, nurses who worked > 13 hours had double the likelihood of reporting information was lost during shift change.

Discussion

Three-quarters of all pediatric nurses worked 12 or > hours in our study. More nurses in intensive care settings worked 12 hour shifts than nurses in general acute care pediatrics or newborn nursery units. This finding is consistent with evidence showing that adult ICU nurses work longer shifts than adult acute care nurses (7).

Overall, we found significant differences between 8 hour and > 13 hour shifts in nurse, patient, and quality outcomes. Working > 13 hours was clearly associated with poorer self-reported nurse and patient outcomes. Nurses working extended shifts were over 2X as likely to report frequent CLABSIs. To our knowledge, this is the 1st study in pediatrics to associate shift length with a common (33) and costly (34) infection. In addition, intent to leave was higher in nurses who worked 12 hour or > than 13 hour shifts compared to nurses who worked 8 hour shifts.

Explanations for the associations we found between longer shift length and poor outcomes are found in the related research literature on rest and sleep. Nurses who work shorter shift lengths have a greater opportunity to rest and recover between shifts (35). Rest is crucial for nurses not only to sleep but to disengage from emotional stress of work and be more prepared to return for the next shift. The relationship between sleep and overall well-being suggests that adequate sleep quantity and quality result in increased ability to cope with difficult or stressful events. Conversely, sleep deprivation, which may occur when nurses work long shifts may make us more vulnerable to stressful events and impact mood (36). Our results that show nurses who worked extended shifts reported a nearly 2X increased likelihood of frequent complaints from family. These nurses may have been tired, irritable and less able to respond to the needs of patients and engage with their families, resulting in more complaints. Alternatively, settings where extended shifts are required for nurses may have limited resources or adaptability to shifting patient volume and complaints may reflect these circumstances.

Our results indicate that nurses who worked the longest shifts had increased likelihood of burnout, job dissatisfaction and intent to leave their jobs compared with nurses who worked 8 hour shifts. Although 12 hour shifts are considered desirable by many staff nurses, less is known about how these types of shifts impact nurses. We found that nurses from the most popular shift length 12 hours were associated with a 36% increased in the odds of intent to leave compared to 8 hour shift nurses. These results should give nurse managers pause

because of the high costs associated with turnover, approximately \$82,000 – \$88,000 per nurse (37) and the limited supply of experienced pediatric nurses (38).

Lastly, we note that few outcomes were significantly different for the 8 hour and 12 hour nurses. Rather, we observed the most deleterious effects associated with the small number of nurses who worked the longest shifts of >13 hours. Given these findings, which are contrary to evidence from adult populations showing deleterious effects of 12 hour shifts, it is nevertheless important to note that shift overruns are common (5). This may result in a shift scheduled for 12 hours to actually be much longer, which is potentially problematic for patients and nurses. As Geiger-Brown and Trinkoff (2011) pointed out, if 12 hour shifts are being used, every effort should be made to guarantee shifts end at the scheduled time, overtime shifts should be limited and consecutive shifts should be minimized.

Limitations

This study is observational and cross-sectional, limiting our ability to draw causal conclusions about the effect of nurses' shift length on pediatric nurse or patient outcomes. Although our sample is not national, the 4 states in this study represent nearly a quarter of the US population (39). Our sample has similar characteristics to pediatric nurses from the 2008 national sample survey of RNs, except our sample has slightly more racial and ethnic diversity (40). The nurse-reported patient outcomes were subject to inaccurate recall as well as bias, although participants were assured that their responses would be anonymous. Moreover, nurses are in the best position to know when adverse events happen (41, 42) and are a valid alternative when patient data are not available (43). Administrative patient data may provide an opportunity to validate our nurse-reported patient outcome findings in the future. Finally, the majority of sample nurses (70%) were caring for infants thus the outcomes may not be applicable to all pediatric populations.

Conclusion

This study is one of the 1st to elucidate the relationships between pediatric nurses' shift length and nurse and patient outcomes. Twelve hour shifts are common in pediatrics. Extended shifts (> 13 hours) are associated with quality of care concerns. While longer shift lengths seem to be preferred by nurses, they may be deleterious for nurses' and patients' health. Our results should motivate managers to consider how to prevent shifts of excessive length. Allocating resources to nursing to improve working conditions including achieving safer work hours may be a productive strategy to improve the health and well-being of both pediatric patients and nurses.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Distribution of Nurses by Pediatric Care Setting and Shift Length

	Shift Length Categories			Total
	8 hours	12 hours	>13 hours	
Pediatric Care Setting				
Pediatric	31%	64%	6%	747
Pediatric Intensive Care	14%	81%	5%	376
Neonatal Intensive Care	21%	77%	2%	1,396
Nursery	32%	66%	2%	1,191

Source. Nursing characteristics are from Multi-State Nursing Care and Patient Safety Study.

Note. Percentages may not add to 100 due to rounding.

Table 2

Distribution of Outcomes Combined and by Shift Length

<i>Outcomes</i>	<i>Shift Length Categories</i>			
	Total n=3,710	8 hours n=946	12 hours n=2,643	>13 hours n=121
Nurse outcomes				
Burnout	25%	24%	24%	46% [*]
Job dissatisfaction	20%	19%	19%	32% [*]
Intent to leave	11%	8%	11%	21% ^{*#}
Nurse reported patient outcomes				
Frequent central line infection	9%	5%	10%	16% ^{*#}
Frequent urinary tract infection	4%	3%	5%	6% ^{*#}
Frequent complaints	10%	10%	10%	17% [*]
Quality and Safety Outcomes				
Poor or fair quality of nursing care on unit	8%	8%	8%	19% [*]
Safety grade "C, D or F"	22%	21%	21%	46% [*]
Important patient information is lost during shift changes	30%	32%	28%	50% [*]

Note.

^{*} Denotes significant difference among the three shift length groups in chi square test $p < .05$

[#] Denotes difference between 8 hour shift category and 12 hour shift category in chi square test $p < .05$