Original Article

International Nursing Review

Associations between work schedule characteristics and occupational injury and illness

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DE CASTRO A.B., FUJISHIRO K., RUE T., TAGALOG E.A., SAMACO-PAQUIZ L.P.G. & GEE G.C. (2010) Associations between work schedule characteristics and occupational injury and illness. *International Nursing Review* **57**, 188–194

Background: Nurses often endure working irregular day, night and evening shifts as well as mandatory overtime (i.e. employer-imposed work time in excess of one's assigned schedule). While these work characteristics are examined as potential risks for nurses' safety and health, it is not clear whether negative health impacts occur simply because of working long hours or in combination with other mechanisms.
Aim: This study investigates how these work characteristics are associated with nurses' work-related injury and illness over and above long work hours.
Methods: In this cross-sectional study, questionnaire data were collected from a sample of 655 registered nurses in the Philippines. Multiple logistic regression was used to assess associations of shift work and mandatory overtime with four work-related health outcomes.
Results: After weekly work hours, shift length and demographic variables were accounted for, non-day shifts were associated with work-related injury [odds ratio (OR) = 1.54; 95% confidence interval (CI): 1.07, 2.24] and work-related illness (OR = 1.48; 95% CI: 1.02, 2.16). Also, frequency of working mandatory overtime was associated with work-related injury (OR = 1.22; 95% CI: 1.06, 1.41), work-related illness (OR = 1.19; 95% CI: 1.04, 1.37) and missing more than 2 days of work because of a work-related injury or illness (OR = 1.25; 95% CI: 1.08, 1.44).
Conclusions: These findings suggest that non-day shifts and mandatory overtime may negatively impact nurses' health independent of working long hours. Mechanisms through which these work characteristics affect health, such as circadian rhythm disturbance, nurse-to-patient ratios and work–family conflict, should be examined in future studies.

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Disclaimer: The findings and conclusion in this report are those of the authors and do not necessarily represent the views of the US National Institute for Occupational Safety and Health.

Keywords: Health and Safety, International Issues, Occupational Health Nursing, The Philippines, Quantitative Methods, Research, Workforce Organization

Introduction

Long work hours negatively impact workers' health by increasing exposure to occupational hazards and reducing time for recovery (Caruso et al. 2006). Previous studies show that long work hours are associated with adverse health outcomes (Brown & Thomas 2003; Costa et al. 2006; Dembe et al. 2005; Morikawa et al. 2001; Vegso et al. 2007). Long work hours are of particular concern for nurses because their jobs routinely include working long shifts, and mandatory or unplanned overtime. Trinkoff et al.'s (2006a) survey of more than 2000 nurses in the USA found that 6% worked 60 h or more per week, and 6% worked more than 12 h a day. Rogers et al. (2004) examined over 5300 shifts among a national sample of US nurses and found that among those scheduled for up to 8.5 h, only 15% actually ended within 8.5 h.

The burden of working long hours can take a toll on nurses' health and well-being. Evidence has emerged showing that increased working hours is associated with musculoskeletal injuries (Lipscomb et al. 2002; Trinkoff et al. 2006b), needlestick incidents (Ilhan et al. 2006; Trinkoff et al. 2007) and fatigue (Josten et al. 2003; Lockley et al. 2007) among nurses. Mandatory overtime is also associated with less control over one's job and lower levels of participation in workplace decision making (Golden & Wiens-Tuers 2005), which are harmful to workers' well-being (Theorell 2002). Despite this, the prevailing concern about the consequences of nurses working long hours is patient safety (Institute of Medicine 2004; Rogers et al. 2004), and relatively little research has emphasized the health and safety issues faced by nurses themselves.

Shift work (working non-daytime hours) is also thought to have adverse physiologic health effects and increased risk for occupational injury and illness (Berger & Hobbs 2006; Dembe et al. 2006; Horwitz & McCall 2005; Strong & Zimmerman 2005). Among hospital workers, Horwitz & McCall (2005) found greatest risk for occupational injury among evening and night shift workers compared with day shift workers, with night shift workers experiencing greatest severity in terms of disability. Guastello et al. (1999) also found that shift work was associated with exposure to blood-borne pathogens and occupational accidents among health-care workers. Among nurses, working other than day shift was associated with musculoskeletal disorders (Lipscomb et al. 2002; Trinkoff et al. 2006b), needlestick injuries (Trinkoff et al. 2007), coronary heart disease (Kawachi et al. 1995) and spontaneous abortion (Whelan et al. 2007). Hughes & Stone (2004) posit that shift work may increase fatigue, making nurses less alert towards the end of their shifts, which can lead to lapses in performance and errors.

Taken together, the current literature shows that long work hours and shift work are not uncommon to nursing work and negatively impact on nurses' health. However, it is not clear whether these work schedule characteristics adversely affect health simply because of working longer hours or in combination with effects of other mechanisms. Hence, this study examined associations of mandatory overtime and shift work with occupational health consequences for nurses, over and above long work hours. We explored these associations among nurses in the Philippines where, to our knowledge, these issues have not been previously researched.

Methods

Study participants and data collection

This study involved a collaborative relationship among US-based researchers, the Philippine Nurses Association (PNA) and the Occupational Health Nurses Association of the Philippines. Study participants were recruited among registered nurses attending the PNA Annual National Convention in October, 2007. The first 1000 attendees were given a hard copy anonymous, self-administered survey. Our survey was adapted from the 2001 American Nurses Association Health and Safety Survey (Houle 2001). Surveys were provided in English because it is widely used in professional, business and educational contexts, including nursing, in the Philippines. Upon returning the survey, each respondent received a raffle ticket to win a digital video-disc player. A total of 690 surveys were returned (response rate = 69%). The present analysis excludes 21 persons currently not working as a registered nurse and another 14 who did not identify being a registered nurse, leaving an analytic sample of 655 respondents. This study was reviewed and approved by the Human Subjects Division (Institutional Review Board) of the University of Washington.

Measures

We measured four occupational health outcomes: (1) *work-related injury* in past year (0 = none, 1 = one or more); (2) *work-related illness* in the past year (0 = no, 1 = yes); (3) *missed work*

for more than 2 days in the past year because of a work-related injury or illness (0 = no, 1 = yes); and (4) *back pain* (0 = no, 1 = yes).

Primary independent variables of interest included work hours, shift length, shift, frequency of mandatory or unplanned overtime, and number of overtime hours worked per month. For *work hours*, participants indicated the average number of hours worked per week (less than 20 h, 21–40 h, 41–60 h, 61–80 h or 81 h or greater). Responses were collapsed into a dichotomous categorical variable (0 = 40 h or less, 1 = more than 40 h) because of the low numbers of persons reporting on the extreme ends of the range of choices and because the standard workweek in the Philippines is 40 h. Participants also indicated typical *shift length* (0 = less than or equal to 8 h, 1 = more than 8 h). Shift was measured by *primary work shift* (1 = regular daytime, 0 = all other shifts). Mandatory overtime was measured by (1) number of *times per month worked mandatory or unplanned overtime* (0 = 'never', 1 = '1 to 2 times', 2 = '3 to 4 times', 3 = '5 to 6 times', 4 = '7 or more times'), and (2) *average number of overtime hours worked per month* (0 = none, 1 = 1–16 h, 2 = 17–24 h, 3 = 25–39 h, 4 = 40–56 h, 5 = 57–80 h, 6 = 81 h or more).

Three demographic measures were included in the analysis as control variables: (1) age in years, (2) type of work setting (1 = clinical setting, 2 = educational setting, 3 = other), and (3) whether working in another job in addition to main nursing job (0 = no, 1 = yes). We also control for two safety resource variables: (1) nurses' rating of information provided by their employers about dangerous or unhealthy working conditions (1 = not at all, 2 = poor, 3 = good, 4 = very good), and (2) the availability of safety devices, comprised of whether the following were provided: safer needle devices (0 = no, 1 = yes), patient lifting and transfer devices (0 = no, 1 = yes), and gloves (0 = no, 1 = yes), combining for a safety device score ranging from 0 to 3. Further, we control for per cent time spent in direct patient care activities (0 = none, 1 = less than 25%, 2 = 25–50%, 3 = 51–75%, 4 = more than 75%).

Analysis

We began by first providing descriptive statistics of our data to examine prevalence rates. Next, unadjusted bivariate associations were assessed by estimating the per cent of nurses reporting adverse outcomes by long hours, shift and overtime variables. Differences across factors were then assessed using chi-square.

Multivariate logistic regression was then used to assess associations of work hour and schedule variables with each of the occupational health outcomes. In addition to long hours, shift and overtime, each model was adjusted for age, work setting, having an additional job, safety resources and time spent in direct patient care. All analyses were conducted with STATA statistical software release 10.1 (College Station, TX, USA).

A small fraction (i.e. 1.1–2.4%) of participants had missing values on one or more occupational health outcome variables. Per convention, the outcome variables were not imputed (Rubin 1987), and these participants were excluded on an analysis-by-analysis basis. Missing data for independent variables were imputed with multiple imputation. Ten complete data sets with imputed values were created, and the bivariate and multivariate analyses were performed for each of the ten data sets. The results were averaged using Rubin's combining rules (Rubin 1987).

Results

Table S1 summarizes the descriptive characteristics of our sample. The mean age was 43 years. Close to half (44%) worked in clinical settings, followed by educational (38%) and other settings, including industry and government (18%). Thirty per cent of respondents spent the majority (50–75%) of their time in direct patient care, while only 12% of respondents spent no time in direct patient care. Further, nearly one-third (31%) had another job in addition to their main nursing job. Nearly two-thirds (66%) felt that the safety information provided by their employers was good or very good. Eighty percent, 45% and 85% reported the availability of safer needle devices, patient lifting and transfer devices, and gloves, respectively.

A substantial number of nurses had long work hours and worked overtime. About 65% of participants reported working over 40 h per week, and 23% had shifts lasting over 8 h. Nearly 35% reported working a shift other than a regular day shift. Additionally, 83% of nurses worked mandatory or unplanned overtime at least once per month, of which about 15% reported working overtime 7 or more times per month. In terms of monthly overtime work hours, most nurses (42%) worked 1–16 h of overtime.

In terms of occupational health outcomes, 37% experienced a work-related injury and 41% experienced a work-related illness in the past year. Nearly one-third (31%) missed at least 2 days of work because of a work-related injury or illness. Also, over three-fourths (78%) currently experience back pain.

Table S2 shows the bivariate relations for work hours, shift and overtime with the four outcomes of interest: work-related injury, work-related illness, missed 2 or more days of work because of a work-related injury or illness, and back pain. Working longer hours was significantly associated with work-related illnesses and missing work. Specifically, among those working over 40 h per week, 45% reported a work-related illness in the past year, compared with 35% of those working 40 or fewer hours. Also, 35% of those working over 40 h per week reported missing more than 2 days of work compared with 26% of those working 40 or fewer

hours. Similar trends were seen for work-related injuries (40% vs. 34% for those working over 40 h/week, and 40 or fewer hours, respectively) and back pain (81% and 78%, respectively), but these were not statistically significant. Shift length also showed similar trends, but they were statistically significant only for missed work days. Table S2 also shows that working overtime was significantly associated with work-related injury, work-related illness and missed work. For instance, 46% of participants who worked 7 or more times of mandatory or unplanned overtime in the past month reported a work-related injury within the past year compared with 24% of those who never worked overtime. A similar but attenuated and not statistically significant trend was seen for back pain. The same was also observed when overtime was examined in terms of number of hours worked.

Of course, these associations may be confounded by other factors, such as worker age, work setting and per cent time in direct patient care. Table S3 shows the associations for weekly work hours, shift length, shift type and times worked overtime per month with outcomes controlling for age, work setting, having an additional job, safety resources and time spent in direct patient care. Neither hours worked per week nor shift length was significantly associated with any of the four outcomes. For instance, in terms of experiencing a work-related injury in the past year, the odds ratio (OR) for working over 40 h/week compared with working 40 or fewer hours/week was 0.92 with a 95% confidence interval (CI) of 0.62, 1.36.

In contrast, frequency of mandatory or unplanned overtime worked per month was significantly associated with three of four health outcomes. Specifically, a one-unit increase in frequency of overtime was associated with a 1.22 (95% CI: 1.06, 1.41) greater odds of reporting a work-related injury, a 1.19 (95% CI: 1.04, 1.37) greater odds of experiencing a work-related illness and a 1.25 (95% CI: 1.08, 1.44) greater odds of missing two or more days of work because of work-related injury or illness, controlling for age, work setting and other factors. This overtime measure, however, was not associated with back pain (OR = 1.02; 95% CI: 0.86, 1.21). Similarly, working non-day shift was significantly associated with work-related injury (OR = 1.54; 95% CI: 1.07, 2.24) and illness (OR = 1.48; 95% CI: 1.02, 2.16).

We performed several additional analyses to evaluate the robustness of our findings. First, we reanalysed our data, replacing number of *times* worked overtime with average number of overtime *hours* worked per month and found similar results. Second, we created a summary score of occupational injury and illness by summing the four outcomes. Reanalysis with this score as the dependent variable also showed similar results for times per month worked mandatory or unplanned overtime (see column for occupational health outcome sum score in Table S3).

Discussion

This study examined the associations among long work hours, shift work and overtime with occupational injury and illness among a sample of 655 nurses in the Philippines. Findings indicate that nurses who work in non-day shifts are at higher risk for occupational injury and illness, and the more frequently a nurse works mandatory or unplanned overtime, the greater the odds of experiencing a work-related injury or illness, and missing work because of it. These significant associations were observed even after hours worked per week and shift length were accounted for. This suggests that non-day shifts and mandatory/unplanned overtime negatively correlate with nurses' health independent of working long hours.

One mechanism through which shift work may increase the likelihood of experiencing work-related injury and illness is disrupted circadian rhythms. The demand of shift work has been related to disruption of physiologic functioning (Fujiwara et al. 1992; Totterdell et al. 1995), sleepiness (Berger & Hobbs 2006; Gold et al. 1992) and occurrence of errors and injury and illness (Canini et al. 2008; Lipscomb et al. 2002; Trinkoff et al. 2006b, 2007). Another possible explanation is an increased workload during shift work as a function of fewer nurses staffed on non-day (evening and night) shifts. Lower nurse-to-patient ratios during non-day shifts may likely increase risk for exposure to work hazards. Not having specifically investigated these reasons, we recommend further research in the Philippine context.

Our findings are consistent with previous studies that have reported the association between overtime and occupational injury and illness. O'Brien-Pallas et al. (2004), in a sample of Canadian nurses, observed greater odds of lost time injury claim rates for workers' compensation the more nurses worked overtime. In the USA, Gershon et al. (2009) found an association between mandatory overtime and percutaneous injury (i.e. needlesticks) among home health nurses. These studies, however, did not control for work hours and, therefore, could not differentiate the impact of overtime from the impact of simply working longer hours. In our study, the effect of mandatory/unplanned overtime was significant over and above the effect of number of hours worked. This suggests that characteristics of overtime other than increased work hours negatively impact nurses' health. Future studies should examine such characteristics, such as lack of control over one's work schedule and work–family conflict.

One health outcome that was not associated with mandatory overtime in our study was back pain. This is contrary to the findings reported by Trinkoff et al. (2006b). They found that mandatory overtime was associated with musculoskeletal disorders involving the neck, shoulder and back among a sample of US nurses. The difference may reflect the demographic profile of

our sample, in which over half (56%) did not work in clinical settings and may not be subjected to the physical demand of moving and lifting patients often linked to back pain for nurses. Thus, further research among a sample of nurses working in more direct patient care jobs may reveal associations between work schedule characteristics and back pain or other musculoskeletal disorders. Given our findings, though, national or organizational-level policies restricting mandatory overtime in the Philippines may be worth considering.

Mandatory or unplanned overtime may be a consequence of inadequate staffing levels. While this study did not specifically examine staffing levels, previous studies have shown that inadequate nurse staffing increases risk for occupational injury and illness (Clarke et al. 2002a,b; Yassi et al. 1995). Yet, a recent literature review on nurse staffing found that the predominant interest in this body of literature is patient safety and quality of care, not nurses' well-being (Lang et al. 2004). Because patient safety is intertwined with nurses' health and well-being (Foley et al. 2001), we recommend a comprehensive approach to investigating nurse staffing, patient safety and nurses' health.

We did not observe any significant associations for hours worked per week (>40 h per week) or shift length (>8 h) with any of the occupational health outcomes. This is contrary to what might be expected given that nurses are likely to have increased exposure time with workplace hazards or become more fatigued with increasing number of hours worked by shift or week. It is possible that this finding reflects the profile of our sample. For example, only 22% had typical work shifts longer than 8 h. And, while 65% did report working more than 40 h per week, associations between hours worked per week and work-related injury or illness may have been captured as a function of working overtime. Despite not observing significant associations, further investigation of these work hour factors is warranted given findings from other research. Further, the US Institute of Medicine has recognized the dangers associated with long work hours for both nurses and patients, recommending that nurses work no more than 12 h within a 24-h period and no more than 60 h within a 7-day period (Institute of Medicine 2004). In the Philippines, the standard workweek is limited to 40 h.

Limitations

Our findings should be viewed with the following limitations in mind. The sample of nurses is derived from attendees of the PNA 2007 Annual National Convention, which consisted of a notable proportion of nurses working in non-clinical positions, such as in educational settings. As such, the nature of work hours, overtime and shift may be different from those nurses working in more traditional, direct patient care roles. It would be important for future studies to ask how many hours per week are spent in various nursing activities (e.g. teaching in a classroom vs. direct patient care). Also, the 31% non-response rate raises issues about sampling bias (Groves et al. 2002; Jones 1996). We do not know if non-responders systematically differed from responders, and hence, our results should be seen as preliminary. We were unable to conduct a comparative analysis because demographic data profiling the 310 non-responders were not systematically collected. Further, these findings may not be generalizable to the entire population of nurses in the Philippines. Additionally, we utilized survey items developed for American nurses. Hence, it is possible that these items did not fully capture Filipino nurses' interpretations of some concepts. However, items referring to concrete information (e.g. number of hours worked, type of shift) were less likely to be affected by cultural differences than items addressing respondents' opinions or expectations (Behling & Law 2000). One limitation of our injury and illness measures is that they were binary (yes/no) and do not provide information on severity. We could not further investigate important questions, such as whether shift work contributed to likelihood not only of injury, but also of serious vs. minor injuries. Moreover, we do not have detailed information on the types of injuries or illnesses experienced. Future research is needed to examine the types and severity of outcomes that may be associated with shift work and overtime. Also, while the self-reported availability of safety devices was measured, data do not indicate whether nurses in the sample actually used them. We note further that self-report data are subject to various biases. However, the different pattern of relationships across the various occupational health outcomes in this study suggests that common method variance was not a major issue. Lastly, the cross-sectional nature of the data makes it difficult to detect causal effects. Despite these limitations, to our knowledge, this is the first reported study of the impact of work hours, overtime and shift work on occupational injury and illness among nurses in the Philippines, an understudied nurse population.

Conclusion

This study illustrates how working conditions adversely affect the health of nurses in the Philippines. We find that shift work and overtime are associated with occupational injury and illness. In particular, associations between mandatory/unplanned overtime and adverse worker health outcomes were significant even when controlling for number of hours worked. This study also adds to the current literature on the impact of work hours on nurses' health by examining the issue among nurses in the Philippines, an understudied, though prominent, workforce in the country. Previous investigations have largely involved nurses in more developed nations and in Western contexts.

In a 2006 commentary, Judith Oulton, then Chief Executive Officer of the International Council of Nurses, recognized that work environment factors directly impact nurses' well-being and contribute to their decision to remain on the job. She further asserted that unfavourable working conditions must be addressed in order to retain nurses and prevent nursing shortages (Oulton 2006). Our findings suggest that limiting overtime and attending to safety needs during non-day shifts should be prioritized in order to protect and preserve the nursing workforce in the Philippines.

Acknowledgements

The authors wish to acknowledge Salome Dalao, Dr Teresita Barcelo, Dr Annabelle Borromeo, Allyne Delos Santos and Joyce Jumawan for their support and assistance with this study. This publication was made possible by funds from the University of Washington School of Nursing, Department of Psychosocial and Community Health, and Grant Number 1KL2RR025015-01, of which Dr de Castro and Ms Rue are a part, from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH) and NIH Roadmap for Medical Research. Its contents are solely the responsibility of the authors and do not necessarily represent the official view of NCRR or NIH. Information on NCRR is available at http://www.ncrr.nih.gov/. Information on Re-engineering the Clinical Research Enterprise can be obtained from http://nihroadmap.nih.gov/clinicalresearch/overview-translational.asp.

Author contributions

This study was conceptualized by Drs de Castro, Fujishiro and Gee; data collection was conducted by Dr de Castro, Mr Tagalog and Dr Samaco-Paquiz; data analysis was conducted by Drs de Castro, Fujishiro, Gee and Ms Rue with statistical expertise provided by Ms Rue; drafting of the manuscript was led by Drs de Castro and Fujishiro with critical revisions for important intellectual content provided by Ms Rue, Mr Tagalog, Dr Samaco-Paquiz and Dr Gee; and additional administrative, technical and material support were provided by Mr Tagalog and Dr Samaco-Paquiz.

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Table S1 Sample characteristics

Table S2 Percentages of occupational health outcomes by work characteristics

Table S3 Results of multivariate regression analysis for each occupational health outcome (odds ratios, 95% confidence intervals; estimates averaged over ten imputed data sets)

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