ORIGINAL RESEARCH

Napping on the Night Shift: A Two-Hospital Implementation Project

Findings reveal barriers to implementing this evidence-based practice.

Nurses who work the night shift often experience high levels of sleepiness as a normal biological consequence of working during a dip in the circadian rhythm (2 AM to 6 AM).[1] Other factors, such as sleep disturbances or sleep loss associated with working 12-hour shifts or frequent overtime, can also play a role.[2] And the nighttime work environment typically has periods characterized by lower stimulation (dimmer lighting, quiet, and less bustle), which can raise the propensity for sleep in nurses who are already sleep deprived. Night-shift sleepiness produces three problems: reduced alertness and possible involuntary sleep, which have been associated with increased risk of patient care errors[3, 4]; increased risk of job-related injuries and accidents, including motor vehicle accidents on the drive home[5-8]; and increased risk of long-term health impairments, which are associated with lost workdays and increased health care costs.[6, 9, 10]

It's clear that night-shift sleepiness among nurses warrants serious attention. Research indicates that scheduled naps during night shifts can be an effective countermeasure, decreasing sleepiness, increasing both alertness and total sleep time, and improving response accuracy.[11] This article describes the results of a napping implementation project that was conducted in two hospitals. Its purpose was twofold: to assess the barriers to successful implementation of night-shift naps, and to describe the nap experiences of night-shift nurses.

BACKGROUND

Researchers began studying night-shift sleepiness in the 1950s; and physiologic evidence of involuntary sleep in train engineers, truck drivers, and industrial workers, among others, has been reported in the literature since the 1980s.[12] Sleep scientists have been writing about the benefits of napping to reduce night-shift sleepiness since the 1970s.[12-15] In a recent systematic review of experimental and quasi-experimental studies of napping, Ruggiero and Redeker concluded that "planned naps hold promise as the means to improve sleepiness and sleep-related performance deficits among shift workers. . . . It may be feasible to implement nap programs in current workplace studies."[11] Indeed, in certain industries in which safety is a concern, such as the transportation industry, napping has been adopted as an effective countermeasure to sleepiness and fatigue.[16, 17]

The 2004 report *Keeping Patients Safe: Transforming the Work Environment of Nurses* from the Institute of Medicine (now the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine) discussed the benefits of providing nurses with nap opportunities in order to maintain a safer work environment.[17] Napping was promoted as a safety practice in an evidence-based

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ABSTRACT

Background: Nurses who work the night shift often experience high levels of sleepiness. Napping has been adopted as an effective countermeasure to sleepiness and fatigue in other safety-sensitive industries, but has not had widespread acceptance in nursing.

Purpose: To assess the barriers to successful implementation of night-shift naps and to describe the nap experiences of night-shift nurses who took naps.

Methods: In this two-hospital pilot implementation project, napping on the night shift was offered to six nursing units for which the executive nursing leadership had given approval. Unit nurse managers' approval was sought, and where granted, further explanation was given to the unit's staff nurses. A nap experience form, which included the Karolinska Sleepiness Scale, was used to assess pre-nap sleepiness level, nap duration and perceived sleep experience, post-nap sleep inertia, and the perceived helpfulness of the nap. Nurse managers and staff nurses were also interviewed at the end of the three-month study period.

Results: Successful implementation occurred on only one of the six units, with partial success seen on a second unit. Barriers primarily occurred at the point of seeking the unit nurse managers' approval. On the successful unit, 153 30-minutes naps were taken during the study period. A high level of sleepiness was present at the beginning of 44% of the naps. For more than half the naps, nurses reported achieving either light (43%) or deep (14%) sleep. Sleep inertia was rare. The average score of helpfulness of napping was high (7.3 on a 1-to-10 scale). Nurses who napped reported being less drowsy while driving home after their shift.

Conclusion: These data suggest that when barriers to napping are overcome, napping on the night shift is feasible and can reduce nurses' workplace sleepiness and drowsy driving on the way home. Addressing nurse managers' perceptions of and concerns about napping may be essential to successful implementation.

Keywords: adverse event, drowsy driving, fatigue, medication error, occupational health, occupational safety, patient safety, shift work, sleepiness, workplace safety, work schedule tolerance

handbook for nurses published in 2008 by the Agency for Healthcare Research and Quality, whose mission it is to produce and disseminate evidence that will make health care safer.[2] The Joint Commission, concerned about the effects of health care worker fatigue on patient safety, issued a Sentinel Event Alert in 2011 recommending that all health care organizations work "to help mitigate the risks of fatigue."[18] Noting that "the only way to counteract the severe consequences of sleepiness is to sleep," the document included napping as one component of a fatigue management plan. And the American Nurses Association (ANA) updated its position statement on nurse fatigue in September 2014, adding a recommendation that RNs "use naps (in accordance with workplace policies)" as one of several "evidence-based fatigue countermeasures."[19]

The two-process model of sleep. Conceptually, the benefits of napping can best be understood by considering the two-process model of sleep, first described by Borbély.[20] This model holds that sleep is regulated by two interactive processes: sleep–wake homeostasis and circadian rhythm. The homeostatic drive to sleep, often called sleep pressure, increases with every hour awake and reduces rapidly at next sleep onset. The circadian drive for wakefulness, often called waking pressure, follows a more nuanced pattern: it increases at daybreak, dips in early afternoon between 1 PM and 3 PM, increases to a peak level between 7 PM and 9 PM, and then decreases during the night, reaching its lowest point between 2 AM and 6 AM.[21] In night-shift workers the natural interaction of these forces is disrupted, such that, in the middle of the night, high sleep pressure exists unopposed by waking pressure, resulting in a high level of sleepiness.

'The only way to counteract the severe consequences of sleepiness is to sleep.'

Normal sleep involves two sleep states—non–rapid eye movement (NREM) and rapid eye movement (REM)—and four sleep stages, ranging from a transition stage (NREM stage 1) and light sleep (NREM stage 2) to deep sleep (NREM stage 3 and REM stage 4), with the sleeper cycling through all four stages several times a sleep period. During short naps (20 to 30 minutes), the sleeper will usually experience

stage 1 or 2 sleep only, since stage 3 sleep typically occurs after about 30 to 45 minutes of sleep time. Thus a short nap can reduce sleep pressure without inducing sleep inertia (the groggy feeling that some people feel when awakened from deep sleep[22]).

The recent literature. In one Canadian study, Edwards and colleagues used an online survey to assess experience with and attitudes toward napping in 47 critical care nurse managers, most of whom had worked the night shift themselves.[23] Although they were aware of the risks that nurses' fatigue posed to patient and nurse safety, and had evidence of both fatigue-related adverse events and injuries or near injuries resulting from nurses' drowsy driving on the way home from their units, not all were in favor of napping. Several kinds of barriers were identified. The lack of a written policy on napping was common, and a majority of respondents felt that their colleagues and administrators were either neutral toward or disapproved of napping. Some respondents pointed to a lack of suitable napping space. Many respondents expressed concerns that combining break times to create longer napping periods could cause inadequate staff coverage; that covering staff would be less proactive with patients not under their assigned care; and that families would have concerns about nurses napping. And some worried that nurses would have difficulty reawakening or that sleep inertia would cause them to function poorly if they were awakened to attend a code.

Night-shift sleepiness among nurses warrants serious attention.

The Canadian researchers also interviewed 13 critical care nurses at one hospital to assess their experience with and perceptions of napping.[24] The data suggested that these nurses were mindful of the need for staff to be fully present and alert at all times, and saw napping as one way to ensure this. Regarding breaks, they were careful to take several variables into account, "scann[ing] the environment of the unit or department to determine if it was safe to nap on break." Indeed, breaks weren't always possible, given limited night-shift staffing and the need to cover codes. The participants varied in their response to naps: many reported improved alertness, but some felt disoriented afterward. The reported consequences of not napping included "foggy thinking," concerns about making errors, and drowsy driving on the way home. Some participants also shared the critical care nurse managers' perception that "management does not support napping" and echoed their concerns about how families might view napping and the lack of suitable napping space.

There are only a few experimental studies where naps of brief duration have actually been implemented in occupational settings or under laboratory conditions using workers as participants. In three studies of industrial and transportation workers (aircraft maintenance workers,[25] oil refinery operators,[26] and air traffic controllers[27]), night shifts ranged from eight to 12 hours, and naps ranged from 20 to 50 minutes. In all three studies, workers who took naps showed increased vigilance compared to those who didn't; and in two of the three,[26, 27] there was also improved alertness after the nap.

In a small Australian study of nurses and other health workers, those who took a brief nap (average duration, 16 minutes) between 1 AM and 3 AM showed improved vigilance and reduced sleepiness afterward.[28] Similar results were found in a field study of ED nurses and physicians who took a 25-minute nap at 3 AM.[29] Both studies focused on outcomes and did not consider or discuss potential barriers to implementing a napping program. In exploring barriers to napping as well as nurses' experiences with napping, our study sought to address this gap in the literature.

METHODS

Setting. This pilot study of a napping implementation project was one component of a study of fatigue risk management implementation initiatives in two mid-Atlantic hospitals. One is a 380-bed community teaching hospital, and the other a 313-bed children's hospital. Both hospitals have received Magnet recognition from the American Nurses Credentialing Center.

Procedures. Initial study approval was obtained from the directors of nursing research, the nursing research councils, and the vice presidents for nursing at each hospital. Approval was also obtained from each hospital's institutional review board (IRB) and from the University of Maryland's IRB. Six nursing units were then selected collaboratively by the nursing research directors and executive nursing leadership. Unit selection took place between October 2011 and May 2012. The selected units included medical–surgical, critical care, and ED units.

The process of engaging the units was the same in both settings. Between January and October 2012, the principal investigator (JGB) met with each nurse manager and her designates (nurse educators, senior nurses, or a staff nurse designated as the project "point person"), and provided information about the risks of sleepiness on the night shift, the scientific evidence supporting napping, and methods to avoid

post-nap sleep inertia. Each unit was encouraged to develop its own evidence-based method of implementing napping (see Table 1[7, 22, 24, 25, 30-35]). Nurse managers often delegated implementation to their senior nursing staff. When requested, the principal investigator introduced the study to nurses verbally during change of shift meetings.

Data collection with staff nurses took place between February 2012 and May 2013. Nurse managers were interviewed at the end of the data collection period, and night-shift nurses were also interviewed as a group on the unit where napping was successful. These interviews took place during February 2014, and written notes were taken.

Measures. A single-page nap experience form was used by napping nurses to document aspects of the nap. Nurses were asked to complete the form each time they took a nap. Data gathered included the timing and duration of the nap, sleepiness level immediately before the nap, sleep ability during the nap, sleep inertia upon arising, and helpfulness of the nap. No unique identifiers were collected. The nap experience form incorporated the following tools.

Sleepiness levels immediately before napping were assessed using the Karolinska Sleepiness Scale (KSS). This scale rates sleepiness on an ordinal scale ranging from 1 to 9, with 1 representing extremely alert, 5 representing neither alert nor sleepy, and 9 representing very sleepy, great effort to keep awake, fighting sleep. Ratings of 7 to 9 indicate levels of sleepiness that can impair workplace safety. The KSS is widely used in sleep science to describe state of sleepiness,[36] and has been validated against performance and electroencephalographic variables.[37] Sleep ability during

Table 1. Guidelines for Hospital Nurses on Implementing Naps on the Night Shift

Who should nap?
Ideally, all nurses working between the hours of midnight and 6 AM. If there is insufficient staff to allow all night-shift nurses to nap, the following should be given priority: • nurses with self-perceived sleepiness[7] • nurses with driving commutes longer than 20 minutes, or that involve highways or rural roads[30, 35] • nurses who have shiftwork sleep disorder, sleep apnea, insomnia, or other sleep disorders, or a chronic medical disorder[31] • nurses who work rotating rather than fixed shifts, especially those who haven't slept before their first shift or are working three shifts in a row[32, 33]
Where should naps occur?
Ideally, the nap environment should[24] • be private and safe, preferably with a locked door. • be dark, quiet, and cool. • be near the nursing unit. • have a timer or clock, a bed or fully reclining chair, and clean linens.
How long should a nap be?
The duration of a nap matters, as naps that are too long increase the risk of sleep inertia. • A nap of 20 to 30 minutes is ideal.[22, 25] • Shorter naps may also be restorative. • If longer naps are possible, a nap of 90 minutes allows the sleeper to complete a sleep cycle. • To prevent sleep inertia, naps of more than 30 and less than 90 minutes should be avoided.[22]
What time should naps be taken?
Any sleep is preferable to no sleep; but ideally, naps should be taken after midnight to alleviate sleepiness during the night shift. • Naps taken between 3 AM and 5 AM may be harder to wake from,[34] but may still provide more alertness at the end of the shift.
What is the best way to prevent sleep inertia?
Nurses who are significantly sleep deprived before coming to work are more likely to have sleep inertia after napping, compared with those who are getting adequate sleep. Keeping naps short and allowing a little extra time for the sleeper to fully wake up and move around before resuming duties will help.

the nap was assessed using an investigator-developed four-point ordinal scale (1, awake, eyes closed; 2, eyes closed, not sure if I fell asleep; 3, slept lightly; 4, slept deeply). Sleep inertia on arising was measured using an investigator-developed four-point scale (1, very groggy or sluggish; 2, a little groggy or sluggish; 3, alert, not refreshed; 4, alert and refreshed). The perceived helpfulness of the nap was assessed using an investigator-developed visual analog scale in which participants marked a line to rate their nap somewhere between "not at all helpful" (rated 0) and "extremely helpful" (rated 10).

In order to ensure participants' anonymity, we did not collect demographic data.

Data analysis. Data were described based on the level of measurement, and graphs were produced to display the relative proportions of the variables.

RESULTS

Napping uptake. Napping was implemented on two of the six units, but in only one of these could implementation be deemed successful. Napping was not implemented on the other four units.

On the four units that did not implement napping, which included a medical–surgical unit, two ICUs, and an ED unit, several barriers were identified. On three of these units, the nurse managers declined the invitation to implement napping without presenting it to the staff or attempting implementation. One nurse manager stated that she felt it wouldn't be feasible to implement napping because her unit covered rapid response team calls, and she was afraid of short staffing during an event or a delay in responding; she also felt there was no feasible and acceptable napping space on the nursing unit or nearby. Another nurse manager stated that although nurses on her unit worked 12-hour shifts, they didn't take formal breaks; they just ate at the nursing station when they had an opportunity. She didn't think napping could be successfully implemented on her unit. The third nurse manager felt that the quality of nursing care would not be as good if nurses took naps. The layout of that unit was such that other nurses wouldn't be able to see the cardiac monitors assigned to the napping nurse without running back and forth. On the fourth unit (the medical–surgical unit), the nurse manager accepted the invitation to implement napping and presented it to staff. Implementation activities were begun, including designating a space and bedding for napping; but the implementation was not completed. A severe winter storm struck the area early in the implementation process, and the napping space was used to house staff who were staying over. After the weather cleared, the unit didn't continue with implementation because of reduced staff and high unit acuity.

On two units, napping was implemented and nurses actually did nap; but on one of these units, implementation was ultimately unsuccessful. On that unit (an ICU), the nurse manager established napping space in a conference room that wasn't used at night, appointed a staff nurse as the project's "champion," and verbally supported the project during staff meetings. Ten nurses on the unit tried napping over the three-month course of the study, but none took a second nap. An interview with the manager revealed that the nurses were frequently called in to work on their days off because, for budgetary reasons, a hospital-wide staffing change had eliminated staffing margins. She stated that although nurse-to-patient ratios had not changed, the unit climate had: it was less relaxed, with a greater sense of resource scarcity. She felt the climate was not right for implementing napping. The staff nurse champion felt that there was a stigma attached to napping, despite reassurances that naps are acceptable and can be helpful.

Future napping implementation projects will need to pay attention to the experiences and attitudes of nurse managers.

On the unit where implementation was successful (a medical–surgical unit), there was excellent uptake of napping, with 153 30-minute naps taken during the three months of the project's implementation. On this unit, the nursing director met with supervisors and charge nurses before implementation to discuss their concerns and perceived barriers to napping. The discussion focused on how to overcome barriers and create a secure environment for napping. Once the charge nurses' concerns were addressed, staff nurses were engaged in deciding how to begin the napping program. Several nurses had experienced napping in other settings and actively promoted it to peers. A napping space was chosen that would allow sleeping nurses complete privacy. At the start of the shift, nap breaks were planned along with patient care assignments, ensuring coverage for napping nurses. Nurses on this

unit already took planned breaks; and they already used a "buddy" system to cover patient care and had developed a very high level of trust with one another.

(It's worth noting that after the three-month trial period ended, the nurses on this unit continued napping but modified the protocol to be more liberal, allowing 30 minutes of sleep time plus five minutes before and after for settling into bed and transitioning back to work. In the same hospital, two other units that had not been included in the study approached the primary investigator to learn how to implement napping. The hospital's shared governance committees are currently exploring opportunities to implement napping more widely.)

Nap experience form data. A total of 153 nap experience forms were collected and analyzed. The average nap duration was 31 minutes (SD, 5.4 minutes). Most participants reported some sleepiness immediately before the nap (mean KSS score, 6.1; SD, 1.8), which is to be expected on the night shift. For 44.2% of naps, nurses reported KSS scores between 7 and 9. For more than half of naps, nurses reported actual sleep, with 43% reporting that they slept lightly and 14% reporting that they slept deeply. Sleep inertia was relatively rare, with 1.3% of naps ending in the nurse feeling "very groggy or sluggish" and 20.3% of naps ending in the nurse feeling "a little groggy or sluggish." Nurses reported feeling "alert and refreshed" at the end of 56.2% of naps. Regarding the helpfulness of napping, the average score was 7.3 out of 10 (SD, 2.2).

During the subsequent group interview, several night-shift nurses commented that napping had eliminated drowsy driving on the way home from work. Many of them also thought that having the napping implementation project on their unit made it more desirable for other night-shift nurses to "float" there so that they could take a nap.

DISCUSSION

This multiunit pilot study showed that barriers to napping implementation remain. Those seen were similar to those described by Edwards and colleagues, who found that nurse managers' experience with and attitudes toward napping were a crucial barrier.[23] In half of the units where we attempted implementation, the process was halted by the nurse manager before the staff nurses could provide input. Indeed, various barriers were identified on all of the units in our study. But on the one unit that successfully implemented napping, the nurse manager's concerns were first addressed, ensuring support for the project. Then both the nurse manager and the staff nurses engaged in open dialogue about the barriers; sought potential solutions; and, using the model of shared governance, made the decision to proceed with a trial of napping. This collaborative approach was also likely crucial to successful implementation. Future napping implementation projects will need to pay attention to the experiences and attitudes of nurse managers, and find ways to address the perceived risks of napping while promoting its benefits for both nurses and patients.

Our findings are also consistent with those of Rogers and colleagues, who found that nurses often failed to take breaks, despite shift durations of 12 or more hours.[38] The concept of a "completely relieved" break (one in which nurses are completely free of patient care responsibilities) may be more and more difficult to achieve, given that staffing margins have been reduced at many hospitals. The aforementioned ANA position statement supports nurses taking rest breaks to reduce fatigue, and makes addressing nurse fatigue a joint responsibility of the employer and the nurse.[19] We observed that the reluctance to take breaks seemed to stem as much from a unit's culture as from staffing issues. It seems likely that nurses might be more amenable to taking breaks if their nurse managers fully supported this.

Our findings further indicated that nurses found naps to be helpful, which is consistent with results from multiple experimental napping studies reviewed by Ruggiero and Redeker.[11] Although we did not directly assess drowsy driving, it was repeatedly mentioned by nurses who napped, who generally felt that napping had helped them stay awake on the drive home. This supports the idea that napping implementation could potentially reduce the risk of motor vehicle accidents occurring on the way home after a night shift. According to the National Highway Traffic Safety Administration, drowsy driving accounts for about 1.5% of all crashes and 2.6% of fatal crashes.[39] More recently, the American Automobile Association Foundation for Traffic Safety

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analyzed data from a representative sample of crashes occurring between 1999 and 2013 that were subjected to in-depth investigation. It found that an estimated 17% to 21% of fatal crashes likely involved a drowsy driver.[40] Research further indicates that the hours between midnight and 6 AM are a peak time for drowsy driving accidents[35]; and that compared with day and evening shift workers, night-shift workers are much more likely to crash their vehicles on the drive home (according to one study, up to 5.5 times more likely[41]). It stands to reason, then, that the burden of morbidity and mortality could be greatly reduced through the use of strategic napping.

Napping is an evidence-based practice that has the potential to improve workplace safety.

Limitations. We attempted to implement napping in only two hospitals, and on only six units overall. A larger sample is needed in order to identify and better understand all of the barriers to implementation, as well as the best methods for overcoming these. Because we assessed each nap as an independent event and did not collect data on the identity of the nurse, we were unable to assess the within-subject results.

PRACTICE IMPLICATIONS AND CONCLUSIONS

This study has several implications for nursing practice. First, napping is unlikely to be successful unless staff nurses are willing to take completely relieved breaks, and can be assured that when they do, coverage will be adequate and the quality of patient care won't suffer. Our impression is that many nurses don't take breaks despite long shift durations, and that this problem is often related to unit culture.

Second, napping is an evidence-based practice that has the potential to improve workplace safety. Nurses' fatigue poses clear dangers for both nurses and patients. One study found that 32% of night-shift nurses nodded off at work at least once a week, and were 1.17 times as likely to make a medication error and 2.1 times as likely to report a near-miss medication error as nurses working day or evening shifts.[42] Another study found that struggling to stay awake was a primary predictor of errors.[4] Moreover, for nurses working the night shift, postshift drowsy driving is a real concern; and studies indicate that the strongest predictor of drowsy driving is drowsiness at work.[4,7] Do we only consider implementing evidence-based practice when it's convenient for management and staff?[43]

Third, napping is but one component—if it's included at all—of hospitals' employee health and safety management programs, which usually focus mainly on safe lifting practices and the prevention of communicable diseases. The daily risks posed by nurses' drowsy driving to themselves and to others are significant, yet this problem is ignored.

Nearly 50 years have passed since researchers first found evidence of the benefits of napping. Yet although other safety-sensitive industries have adopted napping to reduce worker sleepiness and fatigue, napping still isn't standard practice for night-shift nurses in the health care industry. As did Edwards and colleagues, we found that nurse managers' attitudes toward napping often stymied implementation, even when executive nursing leadership supported it. But when napping was implemented, it was well accepted by staff nurses, who found it helpful in addressing their fatigue. Thus addressing nurse managers' perceptions of and concerns about napping will likely be an essential first step to successful implementation. Although further research on implementing napping in nursing settings is needed, there is already more than enough evidence to support the practice. We believe it's time to take napping from a fatigue risk management abstraction to a real-life method of helping nurses to improve both patient and nurse safety. ▼

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REFERENCES

1. Åkerstedt T. Sleepiness as a consequence of shift work. *Sleep* 1988;11(1):17-34.
2. Rogers AE. The effect of fatigue and sleepiness on nurse performance and patient safety. In: Hughes RG, ed. *Patient safety and quality: an evidence-based handbook for nurses*.

Rockville, MD: Agency for Healthcare Research and Quality; 2008.

3. Dorrian J, et al. A pilot study of the safety implications of Australian nurses' sleep and work hours. *Chronobiol Int* 2006;23(6):1149-63.
4. Dorrian J, et al. Sleep and errors in a group of Australian hospital nurses at work and during the commute. *Appl Ergon* 2008;39(5):605-13.
5. Folkard S, et al. Estimating the circadian rhythm in the risk of occupational injuries and accidents. *Chronobiol Int* 2006; 23(6):1181-92.
6. Horwitz IB, McCall BP. The impact of shift work on the risk and severity of injuries for hospital employees: an analysis using Oregon workers' compensation data. *Occup Med (Lond)* 2004;54(8):556-63.
7. Scott LD, et al. The relationship between nurse work schedules, sleep duration, and drowsy driving. *Sleep* 2007;30(12): 1801-7.
8. Swanson LM, et al. Employment and drowsy driving: a survey of American workers. *Behav Sleep Med* 2012;10(4):250-7.
9. Geiger-Brown J, Lipscomb J. The health care work environment and adverse health and safety consequences for nurses. *Annu Rev Nurs Res* 2010;28:191-231.
10. Geiger-Brown JM, et al. The role of work schedules in occupational health and safety. In: Gatchel RJ, Schultz IZ, eds. *Handbook of occupational health and wellness*. New York: Springer Publishing Company; 2012. p. 297-322. Handbooks in health, work, and disability.
11. Ruggiero JS, Redeker NS. Effects of napping on sleepiness and sleep-related performance deficits in night-shift workers: a systematic review. *Biol Res Nurs* 2014;16(2):134-42.
12. Åkerstedt T, Landström U. Work place countermeasures of night shift fatigue. *Int J Ind Ergon* 1998;21(3-4):167-78.
13. Åkerstedt T, Torsvall L. Napping in shift work. *Sleep* 1985; 8(2):105-9.
14. Dinges DF, et al. Temporal placement of a nap for alertness: contributions of circadian phase and prior wakefulness. *Sleep* 1987;10(4):313-29.
15. Rosa RR, et al. Intervention factors for promoting adjustment to nightwork and shiftwork. *Occup Med* 1990;5(2):391-415.
16. Ficca G, et al. Naps, cognition and performance. *Sleep Med Rev* 2010;14(4):249-58.
17. Page A, Committee on the Work Environment for Nurses and Patient Safety, Board on Health Care Services; Institute of Medicine, eds. *Keeping patients safe: transforming the work environment of nurses*. Washington, DC: National Academies Press; 2004. http://www.nap.edu/catalog/10851/keeping-patients-safe-transforming-the-work-environment-of-nurses.
18. Joint Commission. Health care worker fatigue and patient safety. *Sentinel Event Alert* 2011(48):1-4.
19. American Nurses Association. *Addressing nurse fatigue to promote safety and health: joint responsibilities of registered nurses and employers to reduce risks*. Silver Spring, MD; 2014 Sep 10. Policy and advocacy: position statements; http://www.nursingworld.org/MainMenuCategories/Policy-Advocacy/Positions-and-Resolutions/ANAPositionStatements/Position-Statements-Alphabetically/Addressing-Nurse-Fatigue-to-Promote-Safety-and-Health.html.
20. Borbély AA. A two process model of sleep regulation. *Hum Neurobiol* 1982;1(3):195-204.
21. National Sleep Foundation. *Sleep drive and your body clock*. n.d. https://sleepfoundation.org/sleep-topics/sleep-drive-and-your-body-clock.
22. Tassi P, Muzet A. Sleep inertia. *Sleep Med Rev* 2000;4(4): 341-53.
23. Edwards MP, et al. Napping during breaks on night shift: critical care nurse managers' perceptions. *Dynamics* 2013; 24(4):30-5.
24. Fallis WM, et al. Napping during night shift: practices, preferences, and perceptions of critical care and emergency department nurses. *Crit Care Nurse* 2011;31(2):e1-e11.
25. Purnell MT, et al. The impact of a nap opportunity during the night shift on the performance and alertness of 12-h shift workers. *J Sleep Res* 2002;11(3):219-27.
26. Sallinen M, et al. Promoting alertness with a short nap during a night shift. *J Sleep Res* 1998;7(4):240-7.
27. Signal TL, et al. Scheduled napping as a countermeasure to sleepiness in air traffic controllers. *J Sleep Res* 2009;18(1): 11-9.
28. Smith SS, et al. Napping and nightshift work: effects of a short nap on psychomotor vigilance and subjective sleepiness in health workers. *Sleep Biol Rhythms* 2007;5(2):117-25.
29. Smith-Coggins R, et al. Improving alertness and performance in emergency department physicians and nurses: the use of planned naps. *Ann Emerg Med* 2006;48(5):596-604, e1-e3.
30. [no author.] *Rural/urban comparison*. Washington, DC: National Center for Statistics and Analysis, National Highway Traffic Safety Administration; 2014 Jul. DOT HS 812 050. Traffic safety facts: 2012 data; http://www-nrd.nhtsa.dot.gov/Pubs/812050.pdf
31. Åkerstedt T. Sleepiness, alertness, and performance. In: Cappuccio F, et al., eds. *Sleep, health, and society: from aetiology to public health*. Oxford: Oxford University Press; 2010. p. 355-81.
32. Axellson J, et al. Sleep and shift work. In: Cappuccio F, et al., eds. *Sleep, health, and society: from aetiology to public health*. Oxford: Oxford University Press; 2010. p. 325-54.
33. Geiger-Brown J, et al. Sleep, sleepiness, fatigue, and performance of 12-hour-shift nurses. *Chronobiol Int* 2012;29(2): 211-9.
34. Kubo T, et al. How do the timing and length of a night-shift nap affect sleep inertia? *Chronobiol Int* 2010;27(5):1031-44.
35. National Highway Traffic Safety Administration. *Research on drowsy driving*. n.d. http://www.nhtsa.gov/Driving+Safety/Drowsy+Driving.
36. Gillberg M, et al. Relations between performance and subjective ratings of sleepiness during a night awake. *Sleep* 1994; 17(3):236-41.
37. Kaida K, et al. Validation of the Karolinska sleepiness scale against performance and EEG variables. *Clin Neurophysiol* 2006;117(7):1574-81.
38. Rogers AE, et al. The effects of work breaks on staff nurse performance. *J Nurs Adm* 2004;34(11):512-9.
39. [no author.] *Drowsy driving: a brief statistical summary*. Washington, DC: National Center for Statistics and Analysis, National Highway Traffic Safety Administration; 2011 Mar. DOT HS 811 449. Traffic safety facts: crash stats.
40. AAA Foundation for Traffic Safety. *Prevalence of self-reported drowsy driving, United States: 2015*. Washington, DC; 2015 Nov. https://www.aaafoundation.org/prevalence-self-reported-drowsy-driving-united-states-2015.
41. Stutts JC, et al. Driver risk factors for sleep-related crashes. *Accid Anal Prev* 2003;35(3):321-31.
42. Gold DR, et al. Rotating shift work, sleep, and accidents related to sleepiness in hospital nurses. *Am J Public Health* 1992; 82(7):1011-4.
43. Disch J. Are we evidence-based when we like the evidence? *Nurs Outlook* 2012;60(1):3-4.