FATIGUED NURSES

Assessing the Risk, Implementing the Defenses

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Sleep deprivation and fatigue are an ever-present challenge for health care workers. Thus far, most of the attention has been paid to sleep-deprived resident physicians and their increased risks of diagnostic errors,[1] needlestick injuries[2] and complications in post-surgical patients,[3] which culminated in the 2011 decision by the Accreditation Council for Graduate Medical Education to limit resident duty hours.[4] However, fatigue represents a similar high-risk occupational health and safety exposure for nurses.

Many factors are converging today to increase fatigue risks and costs in the nursing profession, and the need to address nurse fatigue has never been more urgent. The increasing cognitive skill demands of medical technology, the rapidly expanding patient loads resulting from the enactment of national health care, and the need to retain experienced nurses in the workforce make addressing fatigue, and sustaining nurse alertness and job performance around-the–clock, a vitally important issue.

Recognizing the dangers of nurse fatigue, an increasing number of US states have introduced legislation to control mandatory overtime for nurses. But these laws alone do not solve the problem of fatigue. Fatigue needs to be managed both at the organizational and at the individual level. Recently, a number of nursing policy papers and position statements have urged nurse employers to adopt sound comprehensive fatigue risk management practices.[5,6,7,8] And while many nurse managers and hospital administrators recognize the inherent value of implementing such policies and practices, they are faced with the practical questions of what to do and where to begin.

This white paper will provide nursing directors and nurse managers with a practical road map on how to address fatigue risks in their nurses and other employees. We will outline how to conduct a fatigue risk assessment, so managers can better understand how fatigue impacts their nursing staff and identify the fatigue risks that need to be addressed.

And we will share well-established and scientifically-validated fatigue management practices that are increasingly used across other shiftwork occupations in 24/7 industries.

The Evidence for Nurse Fatigue

There is now an abundance of research data on nurse fatigue to support the conclusion that too many nurses are sleep-deprived. Compared to the 7-8 hours of sleep required for optimal alertness and performance[9] it is sobering that 80% of nurses get less than 6 hours sleep prior to work shifts[10,11] and 55% of nurses say that they felt fatigued *during* work almost always, or all of the time, while 80% of nurses feel fatigued *after* work almost always, or all the time.[12]

However, nurse fatigue is more than feeling sleepy; it also includes a wide range of psychological, social and cognitive impairments (Table 1) all of which lead to a reduced ability to work safely and productively.

TABLE 1:
Fatigue Impairments In Nurses[13,14,15]

Physical	• Reduced motor coordination • Slower reaction times. • Decreased energy
Psychological/ Social:	• Less connected with the environment around you • Less motivated • More apathetic towards the people around you. • More easily frustrated
Cognitive	• Cannot think as clearly or as quickly. • Reduced problem solving ability • Memory lapses • More difficult to communicate and/or process communications and information. • Reduced judgment/more risk taking

The consequences of these fatigue impairments include:

Fatigue-Induced Errors: There is plenty of evidence that nurses working rotating and/or long shifts have an increased risk of making fatigue-induced errors. Nurses who work rotating shifts are nearly twice as likely to make a medication error when compared with nurses who predominantly worked the day shifts.[16] Nurses who work shifts longer than 12.5 hour are three times more likely to make an error in patient care.[17] A survey of 686 nurses conducted by the Association of Perioperative Registered Nurses, found that 58% of nurses who were fatigued felt unsafe while caring for patients, 13% reported making mistakes, and 38% reported almost making mistakes.[18]

Occupational Injuries and Illnesses: Registered nurses are one of the ten occupations with the highest levels of occupational injury or illness requiring days away from work, with 27,950 cases reported in 2011 (nursing aides are also in the top ten).[19] Studies have shown that nurses who work long hours and get less sleep have an increased rate of musculoskeletal injuries, needlestick incidents and other occupational injuries.[20,21,22,23] Night shiftwork in nurses has also been associated with an increased risk of medical conditions (such as breast cancer[24] and colorectal cancers[25]).

Absenteeism: In addition to missing work because of injury and illness, nurses commonly cite missing work due to fatigue. A 2010 survey of 6,312 registered nurses in Canada reported that 50% of nurses reported missing 1-10 shifts within the last year due to fatigue, and 7% missing 6-10 shifts.[26]

Where to Begin … Fatigue Risk Assessment

The nursing profession is becoming increasingly focused on mitigating nurse fatigue. The Joint Commission, which accredits more than 20,000 U.S. health care organizations, recommended in December 2011 that health care organizations "create and implement a fatigue management plan."[27]

> ***There are now some evidence-based actions that healthcare organizations can take to help mitigate the risk of fatigue that results from the extended work hours—and, therefore, protect patients from preventable adverse outcomes.***
>
> —Joint Commission Sentinel Event Alert: Health Care Worker Fatigue and Patient Safety (December 2011)

Taking a cue from The Joint Commission's Sentinel Event Alert "Health Care Worker Fatigue and Patient Safety," the first suggested action is to conduct a Fatigue Risk Assessment (FRA) to create an evidenced-based approach to fatigue.[27]

What is a Fatigue Risk Assessment? It is a data collection process and policy review used to identify the fatigue risks for your nursing staff. Essentially a FRA will clarify the current state of fatigue management in your organization, allow you to better understand how fatigue is impacting your nursing staff, and identify fatigue risks that need to be addressed.

A FRA is also the first step in developing a feedback loop for evaluation, modification and continuous improvement of your fatigue management plan. By collecting key performance indicators (such as overtime levels, medication errors, needlestick injuries, etc.) during your FRA, you can use that data as a benchmark to compare and evaluate the effectiveness of your fatigue management plan going forward.

Key Components of a Fatigue Risk Assessment (FRA)

1. Survey Nursing Staff about Fatigue: Creating and administering a confidential survey on sleep and fatigue to nursing staff and supervisors is critical to the FRA process. The goal of the survey is to collect data that will clarify not only the frequency and impact of fatigue on your various units, but also identify potential causal factors. The questions on the survey should extract information on unit demographics (e.g. age, gender, years on job, commute, off-the-job demands), and explore how the shift schedule, overtime policies, workload, sleep habits, work environment, etc. affect fatigue levels.

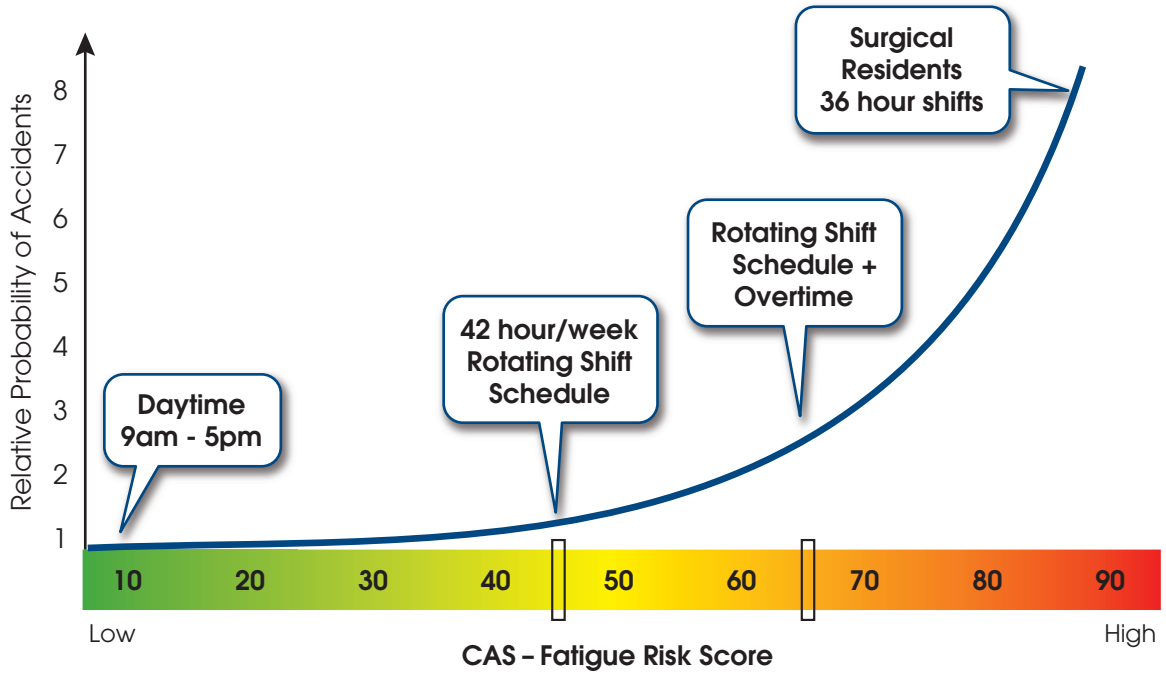
2. Review Work Schedules: Shift patterns that do not adequately balance human physiology, workload, employee demographics and employee preferences may lead to excessive employee

fatigue. To account for the impact shift schedules have on fatigue in the FRA, nurse managers should evaluate the design of their shift schedule, determine how the schedule was selected and see how frequently the published schedule is altered (due to absences, overtime, shift swaps, etc.).

The risks of schedule-related fatigue can be best assessed by using a **fatigue risk model**. By downloading data from the time-and-attendance and/or nurse scheduling systems, you can assess the fatigue associated with planned and actual work-rest patterns (after shift swaps and additional overtime assignments) and establish a baseline against which future improvements can be measured.

Fatigue risk models, such as the scientifically-validated Circadian Alertness Simulator (CAS),[28] can also provide a "fatigue risk score" for each work schedule that gives the relative probability of having an accident/incident (Figure 1).

FIGURE 1
The Circadian Alertness Simulator (CAS)



The Circadian Alertness Simulator (CAS) provides a "fatigue risk score" for work schedules. As the fatigue risk score increases, so does the relative probability of having an incident, error or accident. CAS can be used in a FRA to benchmark the fatigue levels of your nurses and identify high-risk staff. As part of a feedback loop, CAS can be used evaluate future schedules and drive down fatigue risk. © 2013 Circadian International, Inc.

3. Review Current Fatigue and Shiftwork Management Practices: During a FRA managers should review the policies currently in place that relate to shiftwork and fatigue management. For example, what are your duty/rest policies? Do you limit the number of hours a nurse can work in a day or week? What are your overtime policies? Do you mandate overtime? Do you have napping policies?

It's also a useful exercise to think about how you would handle a fatigued employee with your current policy. Are there policies and procedures in place to handle cases of nurse fatigue (e.g. recommended fatigue countermeasures, reporting tools, etc.)? Have fatigue policies been communicated to nurse managers and staff?

Another key issue is to evaluate your hand-off process and procedures. For example, what must be completed during shift hand-offs? How long does the hand-off take? Does one shift come in early or stay late to complete hand-off?

4. Education on Shiftwork and Fatigue Management: A critical component to managing fatigue, particularly for nurses working rotating and/or night shifts, is to provide education and training on managing a shiftwork lifestyle. A FRA should assess current fatigue management/shiftwork educational materials and training policies/programs for new hires, existing workforce, and supervisors and managers. The training can be classroom or online, and should include an evaluation and certification process.

5. Key Performance Indicators (KPI): An eye-opening task during a FRA is to collect and evaluate operating, HR/payroll, safety, and other KPI data for the previous 2-3 year period. The type of KPI data you want to analyze includes turnover and absenteeism rates, overtime averages (both by unit and staff member), safety data (medication errors, needlesticks, etc,), and worker compensation costs.

By cross-comparing the KPI data to known contributors of fatigue - such as time of day, type of shift (day vs. evening) and hours on duty - you can begin to better understand and document the impact fatigue is having on your operations and make a business case for implementing defenses. Once fatigue countermeasures have been implemented, future KPI exercises can reveal the impact they are having on your operation and provide a feedback loop.

6. Accident/Incident/Near-Miss Investigation: A FRA should analyze the process by which accidents/incidents are investigated to determine if (and how) fatigue is considered as a causal factor. By creating an objective standard for investigating the role of fatigue in all incidents, your operation will be better able to assess, benchmark and measure the risks and impact fatigue is having on your operation. One convenient tool for analyzing the contribution of fatigue to incidents, errors and accidents is the Fatigue Accident/Incident Causation Testing System (FACTS), which can be found at facts.circadian.com.

Emergence of Fatigue Risk Management Systems (FRMS)

The purpose of an FRA is to enable you to design a fatigue management plan which reduces the risks and costs of fatigue. Addressing these issues requires more than just a training program that urges nurses to get more sleep. While there are some factors influencing fatigue that relate to a nurse's lifestyle and personal choices, many drivers of nurse fatigue are under the control of nursing management.

Over the past five years, a broad international consensus has emerged across many 24/7 industries that the optimal way to manage and reduce employee fatigue risk is through a systematic process called a Fatigue Risk Management System (FRMS). The pace of adoption of FRMS has accelerated so fast that it has taken some by surprise. Government regulatory agencies, industry associations, and many corporations with 24/7 operations have recently incorporated a FRMS into their regulations, industry standards, and corporate policies (Table 2).

For example, all the major companies in the petrochemical industry have recently adopted the API/ANSI RP-755 Fatigue Risk Management standard which requires staffing level analysis and overtime control, limits the length of shifts and the number of consecutive shifts, and requires training on fatigue and the investigation of fatigue related accidents.[29]

TABLE 2:
FRMS Laws, Regulations and Standards Across 24/7 Industries

24/7 INDUSTRY	DATE ADOPTED	TYPE OF FRMS
Airlines	2010	H.R. 5900 Act SEC. 212. Pilot fatigue
Mining	2010-2013	Widespread industry practice
Nuclear Power	2009	NRC Regulation 10 CFR Part 26 Sub Part I Managing Fatigue
Oil/Petrochemical	2010	API-ANSI RP-755 Standard
Pipelines	2010	PHMSA Regulation 49 CFR Part 195.446 Control room management. Subpart (e) Fatigue Mitigation
Railroads	2008	Rail Safety Improvement Act of 2008

The American College of Occupational and Environmental Medicine has recently issued a guidance document for FRMS implementation across all 24/7 industries which covers staffing levels, scheduling, overtime, education and training and incident investigation.[30] Should we do any less to protect the safety of nurses and their patients?

The nursing profession is on the brink of large-scale adoption of the FRMS model. The Joint Commission has recommended nine evidence-based actions for health care organizations to take, in order to "create and implement a fatigue management plan."[31]

Given the benefits the FRMS model offers in improving patient care and nurse well-being, nursing organizations should give priority to the design and implementation of fatigue risk management systems.

What is a Fatigue Risk Management System?

In its guidance document titled Fatigue Risk Management in the Workplace, the American College of Occupational and Environmental Medicine (ACOEM) defines FRMS as:

> *"A scientifically based, data-driven addition or alternative to prescriptive hours of work limitations which manages employee fatigue in a flexible manner appropriate to the level of risk exposure and the nature of the operation."*[30]

The key characteristics of an FRMS are:

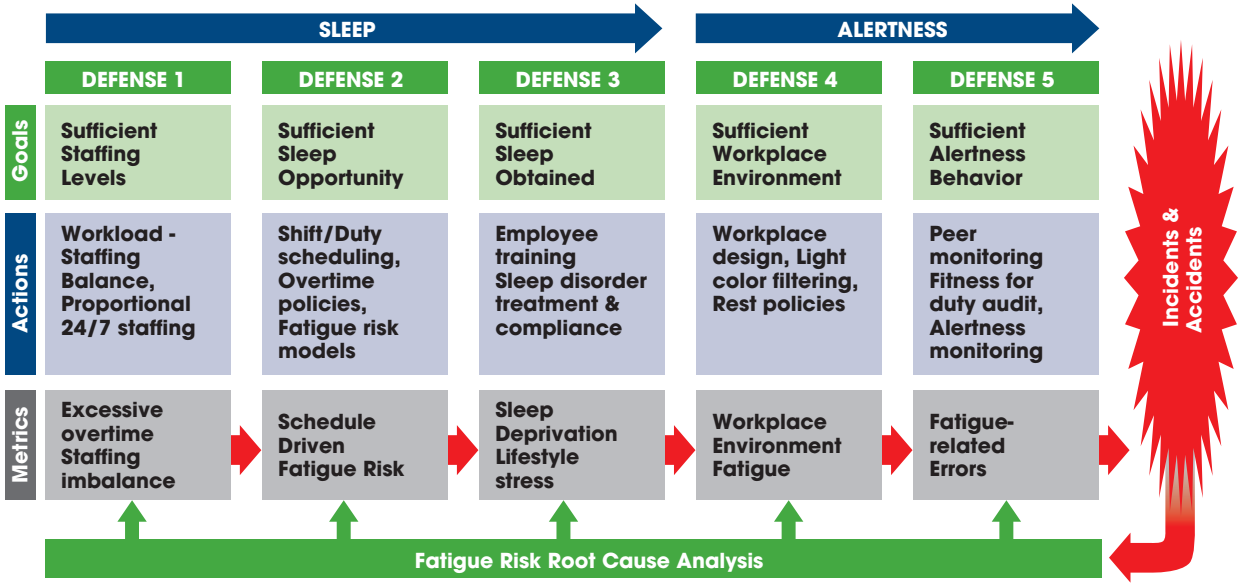
- Science Based – Supported by established peer-reviewed science
- Data Driven – Decisions based on collection and objective analysis of data
- Cooperative – Designed together by all stakeholders
- Fully Implemented – System-wide use of tools, systems, policies, procedures
- Integrated – Built into the corporate safety & health management systems
- Continuously Improved – Progressively reduces risk using feedback, evaluation & modification
- Budgeted – Justified by an accurate ROI business case
- Owned – Responsibility accepted by senior management[32]

Five Defenses of FRMS

A Fatigue Risk Management System consists of a series of five defenses (Figure 2). Each defense has a goal, specific tools to mitigate fatigue, and metrics to evaluate the defense. The first three defenses (i.e. workload-staffing, scheduling, training) impact sleep opportunity and management,

while the last two (work environment, fatigue monitoring) provide alertness management. Lastly, the FRMS has a feedback loop which analyses fatigue-related errors & incidents and strengthens defenses to ensure the FRMS is risk-informed, performance-based, and continuously improved.

FIGURE 2
The Five Defenses of FRMS



The five major lines of defense used in designing and implementing a Fatigue Risk Management System and the feedback loop which analyses fatigue-related errors & incidents and strengthens defenses to ensure the FRMS is risk-informed, performance-based, and continuously improved. © 2013 Circadian International, Inc.

Each of the five defenses needs to be addressed in order to build an effective FRMS:[33]

Defense 1 - Workload-Staffing Balance: The staffing level, and not the shift schedule, is the primary determinant of overtime levels, average time off-duty, and other key factors related to nurse fatigue. Therefore, it is vital to first address taskload/workflow issues, ensure adequate staffing levels, and to proportionally balance them to workload across the 24/7 schedule. Workload/staffing balancing strategies are discussed in more detail in the CIRCADIAN® white paper *Staffing Levels: A Key to Managing Risk in 24/7 Operations.*[34]

Defense 2 - Shift or Duty-Rest Scheduling: Even in appropriately staffed operations, poorly designed shift schedules, duty-rest schedules that do not account for a nurse's commuting time to and from work or nurses swapping shifts or overtime assignments may lead to excessive employee fatigue. Hospitals should address this issue by using fatigue risk models (Figure 2) to assess actual (rather than just planned) work-rest patterns in order to measure and intervene to minimize the

risk, as well as to provide a set of outer-boundary limits (e.g., limits on working beyond a certain number of consecutive hours or working more than a certain number of days in a row).

The goal of schedulers should be to utilize the fatigue risk model to evaluate potential schedules and try to drive down the baseline fatigue score of the nurse staff. Furthermore, fatigue risk models can also be used to address daily scheduling issues that occur on the nursing unit (e.g. overtime, extra shifts, shift swapping, etc.) to make informed decisions on who is at least risk to work extra shifts. Readers can access a web-based version of CAS at scheduleanalyzer.circadian.com/Login.php, Using such technology can be a highly effective Fatigue Risk Management tool by allowing schedulers and managers to progressively drive down the rate of errors, incidents and injuries caused by fatigue.

The key factors in developing an optimal shift schedule are discussed further in the CIRCADIAN® white papers: *Shift Scheduling & Employee Involvement: The Key to Successful Schedules*[35] and *Biocompatible Shift Scheduling: The critical factors that influence the overall mental and physical fatigue risks of a core shift schedule*.[36]

Defense 3 - Employee Fatigue Training & Sleep Disorder Management: Educating employees to better understand and manage their personal sleep and fatigue risk is a critical component of an FRMS. A recent study of nurses at Vanderbilt University Medical Center examined the preparation and sleeping habits of nurses before their first 12-hour night shift. They found that as many as 25% of the nurses in the study took no steps to prepare for their night shift (e.g., wake up later in the morning, take a nap before work, etc) and ended up staying awake for at least 24 consecutive hours by the end of their shift.[37] Factors such as inadequate shiftwork lifestyle coping skills, personal crises (such as a sick child at home), and undiagnosed and treated sleep disorders may prevent employees from obtaining adequate sleep even when they have work-rest schedules designed to provide adequate sleep opportunity. How to optimize the benefits of employee shiftwork lifestyle training is discussed in the CIRCADIAN® white paper, *Shiftworker Lifestyle Training: Employee and Employer Benefits*,[38] and the screening and management of sleep disorders in the white paper, *Reducing the Costs, Risks, and Liabilities of Obstructive Sleep Apnea*.[39]

Defense 4 - Workplace Environment Design: However diligently they manage their sleep, nurses still will be required to work in the early morning hours at the lowpoint in the circadian cycle or will report on occasion to the workplace in a sleep-deprived state. The next critical line of defense is the design of the workplace environment. Key factors such as the intensity and wavelength of lighting, sound levels, temperature and humidity should be designed to protect employees' levels of alertness and prevent employee impairment. A CIRCADIAN® management report, *The Practical Guide to Managing 24-Hour Operations*,[40] discusses these and other environmental factors.

Defense 5 - Alertness Monitoring & Fitness for Duty: Holes in the above four defenses may still exist. Therefore, a fifth line of defense is critical. Reducing fatigue-related risk in the workplace requires that both the employees themselves and their supervisors and peers learn to recognize the

signs and symptoms of fatigue through workplace training programs that have fatigue as their focal points. In addition, technologies such as alertness monitors and fitness for duty tests are becoming increasingly reliable and available to the shiftwork population and its managers.

Once these five defenses have been implemented, it is important to establish methods to continuously monitor the effectiveness of the FRMS. For example, all errors, incidents and accidents should be assessed for the contribution of nurse fatigue. When fatigue is identified as a causal factor, you should evaluate the root causes, which will indicate gaps in the FRMS to address.

Conclusion

There is now an extensive body of scientific evidence and operational experience confirming that shiftwork and fatigue in the nursing profession represents a high risk for nurses and their patients. Fatigue Risk Management Systems (FRMS) are now widely recognized as the optimal way to manage and mitigate fatigue risk across many 24/7 occupations, and they are now being introduced and adopted by the nursing profession.

The best place to begin is to conduct a Fatigue Risk Assessment, which will provide key data you need to develop your fatigue management plan and implement your FRMS defenses.

If you have questions about conducting a Fatigue Risk Assessment, or are looking for resources, support or fatigue risk tools during the development of your Fatigue Risk Management System, our experienced team at CIRCADIAN would be delighted to help. You can learn more at www.circadian.com or by emailing us at info@circadian.com.

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Anneke has conducted multiple large workplace studies as well as numerous controlled laboratory studies on the effects of work hours and sleep deprivation on human alertness and performance, the validation of fatigue countermeasures and the evaluation of technologies for alertness monitoring (microsleep detection) and impairment detection (fitness-for-duty testing). Anneke has extensive experience with computerized alertness simulations of work schedules. She has also been involved with the development of shiftworker education tools. She was selected to serve as a member of the NORA (National Occupational Research Agenda) group for long work hours and served on scientific advisory panels related to human fatigue in the workplace.

For ten years, she was the research director of Circadian Technologies and subsequently founded Awake Institute in 2006. Her current work at Circadian focuses on research on the effects on lighting in night workers and on fatigue management initiatives in the healthcare sector. Her work in the healthcare sector includes projects with emergency doctors and nurses.

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Editors: Martin Moore-Ede, M.D., Ph.D, Becca Chacko
Publisher: Circadian Information LP

FIRST EDITION

Circadian Information provides information and publications on scheduling, training, and other services for 24-hour operations.

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