Healthcare Worker Fatigue: Current Strategies for Prevention

INTRODUCTION

Fatigue can be described as an overwhelming sense of tiredness, lack of energy, and feeling of exhaustion associated with impaired physical and/or cognitive functioning. For industries that perform 24-hour operations, fatigue has been recognized as a safety issue for many years. The media has reported catastrophic accidents in the aviation, transportation, and nuclear power arenas in which fatigue has been noted as a major causative factor.

In a highly publicized healthcare case, fatigue was noted as one of the causes of a fatal medication error. In 2006, a Wisconsin registered nurse (RN) was charged with a class H felony (neglect of a patient, causing great bodily harm) after she mistakenly gave an epidural medication through the patient’s peripheral intravenous (IV) line instead of the prescribed antibiotic. Records from the Wisconsin Department of Regulation and Licensing state that this nurse had worked two consecutive eight-hour shifts ending at midnight and then planned to work the next morning at 7 a.m. for another eight-hour shift.

The primary focus for addressing fatigue in the work setting has been through the implementation of hours-of-service programs whereby employee work hours are restricted to include specific rest periods between shifts. Research has shown that restriction of work hours alone has not been successful in reducing the risk of fatigue-related mistakes. In the case noted above, the nurse’s license was suspended for nine months and she was ordered to no longer work more than 12 hours in any 24 consecutive hours and no more than 60 hours in any seven consecutive days.

An analysis of fatigue-related events that have been reported through the Pennsylvania Patient Safety Authority’s Pennsylvania Patient Safety Reporting System (PA-PSRS) provides insight into this patient safety issue. Also provided are fatigue risk mitigation practices currently in place in healthcare and other industries, including more comprehensive fatigue risk management programs.

HEALTHCARE WORKER FATIGUE AND ERRORS

Taking a page from other industries that staff around the clock, healthcare has been studying the effects of healthcare worker fatigue as it presents as both a patient safety and employee health issue. There is an increase in awareness that fatigue impairs performance, and studies have shown that 17 hours of sustained wakefulness is equivalent to a blood alcohol level of 0.05% and that after 24 hours, it is equivalent to 0.10%.

Regardless of fatigue, healthcare workers are required to maintain an astute level of alertness and vigilance to ensure that safe, quality healthcare is delivered.

Fatigue is described by Dr. A. E. Rogers as an overwhelming sense of tiredness, lack of energy, and feeling of exhaustion associated with impaired physical and/or cognitive functioning. Healthcare workers experience fatigue for a variety of reasons, but the two major causes of fatigue are disruption of circadian rhythm sleep and sleep deprivation. The nature of healthcare work is such that staff will work during the night and for extended shifts, such as 12-hour shifts and overtime. These conditions go against the body’s need for rest and may result in the worker being fatigued on the job.

The Joint Commission, through a Sentinel Event Alert, reports that fatigued workers can exhibit the following conditions:

- Lapses in attention and inability to stay focused
- Reduced motivation
— Compromised problem solving
— Confusion
— Irritability
— Memory lapses
— Impaired communication
— Slowed or faulty information processing and judgment
— Diminished reaction time
— Indifference and loss of empathy

In studies conducted with nurses, it was shown that working a 12-hour work shift or working overtime is associated with difficulties staying awake while on duty, reduced sleep times, and nearly triple the risk of making an error, with the most significant elevations in the risk of making an error occurring when nurses worked 12.5 hours or longer. In addition, fatigue-related cognitive impairment has been linked to adverse events and errors in care, as have working more than 40 hours per week or working voluntary paid overtime. Feelings of fatigue, tiredness, sleep deprivation, sickness, and general discomfort among staff were reported as contributory factors to errors. In addition to long work hours, physical exhaustion can also be caused by lack of breaks to eat and/or drink.

Data on the effects of extended work hours as a patient safety risk was not available when hospitals began using 12-hour shifts. Many hospitals have adopted 12-hour shifts as the norm, and it is a similar choice with nursing staff who choose to limit the number of days they work within a week. Although nursing executives may feel that using 12-hour shifts results in nursing satisfaction and retention, the research on risk of error and patient safety begs for further review. Research has shown the practice of self-regulation is not a reliable mitigator of fatigue and the result may be a tired nurse showing up to work. Moving away from the 12-hour shift would be a major shift in practice, and clear evidence-based data would be necessary to support such a change.

There is much discussion regarding whether fatigue contributes to the human errors associated with adverse patient events. The Joint Commission, in a Sentinel Event Alert, has stated that a fatigued worker tends to make more mistakes. Sentinel event data released in September 2013 lists “human factors,” including fatigue, as the most frequently identified root cause of a sentinel event, and the Joint Commission now recommends that fatigue be considered and evaluated as a contributing factor in the root-cause analysis process.

Pasupathy and Barker stated that current research has not clearly identified thresholds for fatigue levels that will lead to meaningful changes in objective performances in nurses. It is unknown how much fatigue is too much or at what level of fatigue a healthcare worker is safe to work. Other studies have shown that duty hour restrictions or hours-of-service regulations alone will not address the cause of fatigue, because they do not address circadian time of work (night shift), the opportunity to sleep, and the total number of hours of sustained wakefulness.

**PA-PSRS EVENT REPORTS**

PA-PSRS allows facility reporters to select fatigue as a contributing factor to an event report. In reviewing this topic, two queries of the PA-PSRS database were performed. The first query searched for events in which healthcare worker fatigue was noted as a contributing factor. This query found 1,601 events identified between June 2004 and August 2013; 1,564 events (97.7%) were reported as Incidents and did not result in any harm to the patient, and 37 events (2.3%) were reported as Serious Events (harm score E to I) that resulted in patient injury. Four of the Serious Events had a harm score of I, meaning they involved patient fatality. The top five locations in which events occurred were the medical-surgical unit, emergency department, pharmacy, general medical ward, and the laboratory. For context associated with harm scores, in 2013, acute healthcare facilities reported 246,606 events in total, of which 239,063 events (96.9%) were reported as Incidents and 7,543 (3.1%) were reported as Serious Events.

### Table 1. Medication Errors Reported to the Pennsylvania Patient Safety Authority with Fatigue as a Contributing Factor, June 2004 through August 2013

<table>
<thead>
<tr>
<th>MEDICATION ERROR</th>
<th>NO. OF REPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong dose</td>
<td>427</td>
</tr>
<tr>
<td>Dose omission</td>
<td>271</td>
</tr>
<tr>
<td>Extra dose</td>
<td>94</td>
</tr>
<tr>
<td>Medication list incorrect</td>
<td>64</td>
</tr>
<tr>
<td>Prescription refill delay</td>
<td>43</td>
</tr>
<tr>
<td>Monitoring error</td>
<td>30</td>
</tr>
<tr>
<td>Unauthorized drug</td>
<td>15</td>
</tr>
<tr>
<td>Inadequate pain control</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>47</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>995</strong></td>
</tr>
</tbody>
</table>
Medication errors (62.1%, n = 995) and errors related to a procedure, treatment, or test (26.4%, n = 422) comprised the majority (88.5%) of all events that listed healthcare worker fatigue as a contributing factor. For context associated with event types, in 2012, medication errors (18.2%, n = 42,898) and errors related to a procedure, treatment, or test (21.9%, n = 51,443) comprised the predominant event types reported by acute healthcare facilities.20

The most common medication errors made involving healthcare worker fatigue were wrong dose given, dose omission, and extra dose given (see Table 1). Medication errors occurred more frequently in the medical-surgical unit, pharmacy, general medical ward, and emergency department than in other locations.

The second query of the PA-PSRS database searched for events in which fatigue was mentioned in the recommendations field. Five additional reports were identified in which the staff described fatigue as a contributing factor to the event in a narrative comment. The following are examples from event reports to PA-PSRS in which staff reported that being fatigued or tired contributed to the event (emphasis added in bold).

**Medication Errors**

RN hung NSS [normal saline solution] bolus. Due to only having one infusion pump, the bolus was primed through new tubing, but when RN hooked up tubing to patient's central venous line, she thought she put it in the pump but didn't. Patient's main IV fluid of D51/2 NSS had been running at 30 mL/hr and [more than 80 mL] infused before the error was caught.

The NSS bolus was then correctly hooked up, and the patient received the remaining ordered volume. Two physicians from neurosurgery were notified and stated this was not a problem for the patient. The RN had gone without a meal on a very intensely busy shift. Fatigue and hunger were definitely factors. If the RN could have had a chance to eat and take a break in that time, perhaps this may not have occurred.

Patient found with 3.375 Zosyn hanging, which was not prescribed to the patient. Patient had PCN [penicillin] allergy. Zosyn was due [in the morning] for Patient A. Patient A had Zosyn hanging in room. Patient B also had Zosyn hanging in room, and this bag was labeled with Patient A's name. Patient B has a documented PCN allergy. Physician aware. Patient monitored for any adverse reaction. None noted. RN manager reviewed with staff involved. Staff member stated they made the mistake.
due to being fatigued and not double-checking prior to hanging bag. Staff had worked four 12-hour night shifts.

Laboratory Errors
Clerical error in cerebral spinal fluid gram stain result. Need to type “cyto” for cytospin slide instead of “cylo” and typed twice “enter” so it became cyclospora species. Work was very busy so I was hungry and tired.

Lab tech had difficult time with blood draw; procedure took longer than normal; tech was experiencing back pain/fatigue, which contributed to distraction from normal procedures, and inadvertently left tourniquet on patient. Lab techs encouraged to take a break if back pain or fatigue begins to cause distraction.

Radiology Errors
After finishing the lung scan, proceeding to send the images, and [quality-checking] the images, I realized that I would have to utilize remote radiology. Transport called and said they were tied up in ICU, so I decided to take the patient back to the unit by myself. When I arrived back in the department to finish up, I believe it had slipped my mind to fill out the form and send images to remote radiology. Later that morning while walking back to work, I realized that I might not have finished the paperwork. I immediately contacted the reading room to alert the radiologist reading. Tired, that would be the number one factor. Had been working for over 16 hours. I got easily sidetracked in trying to get the patient situated. Next time, finish all paperwork before moving on to the next situation.

REDUCING THE RISK OF FATIGUE-RELATED ERRORS PAST, PRESENT, AND FUTURE
In response to the current research and information on healthcare worker fatigue, healthcare organizations and professional associations have implemented programs to address the effects of fatigue in hopes of reducing the incidence of subsequent errors and patient injuries. As previously stated, the initial efforts in addressing fatigue have been through implementation of hours-of-service standards, such as those implemented for residents in training. These alone have not been successful, as they do not address the two major causes of fatigue, which are disruption of circadian rhythm sleep and sleep deprivation.1 These alone have not been successful, as they do not address the two major causes of fatigue, which are disruption of circadian rhythm sleep and sleep deprivation.1

In 2003, the Accreditation Council for Graduate Medical Education (ACGME) implemented duty hour standards for physicians in training. The standards were put forth with the intent of promoting safe patient care and increasing the quality of the educational experience for the resident physician. The standards included regulations on the maximum number of hours of work per week (80 hours averaged over a four-week period, inclusive of all in-house call), maximum duty period length (24 consecutive hours, inclusive of in-house call), and mandatory time that the resident would be free from duty (one day in seven free from clinical and educational responsibilities averaged over a four-week period and inclusive of call).22-24

The standards have been under much scrutiny and discussion since their inception, as there was concern that the limitations put forth with these standards alone did not achieve the prescribed purpose of relieving the level of fatigue or necessarily reducing medical error.22,23,26 Concern has been voiced that adherence to the standards has not resulted in a positive impact to patient care or medical education. It was cited that the standards have resulted in an increase in the number of patient handoffs and that the patient may be cared for by a resident less familiar with the patient’s case.22,27 In addition, the resident may still be required to do the same amount of work in less time, which may produce more errors.27

In a 2009 report, the Institute of Medicine (IOM) recommended that ACGME include guidelines to increase residents’ opportunities for sleep so that acute and chronic sleep deprivation could be minimized and fatigue-related errors reduced. IOM further recommended that residents be allowed 5 hours of protected sleep during any work shift that exceeded 16 hours and that this time be counted toward the weekly maximum of duty hours (80 hours averaged over four weeks). In addition, it recommended that resident supervision and handover procedures be enhanced to identify potential errors before they reach the patient.31

In 2011, the ACGME standards were revised. The maximum number of hours worked per week stayed at 80 hours averaged over a four-week period but now included a caveat that this was inclusive of all in-house call activity and all moonlighting.24 Maximum duty hours for the first-year resident were reduced from 24 hours to 16 hours. For higher-level residents scheduled to a maximum of 24 hours, the program must encourage residents to use fatigue mitigating strategies, such as napping after 16 hours of continuous duty and between the hours of 10 p.m. and 8 a.m., to maintain a safe level of alertness.22,24,25 The standards stipulate that one day free of duty must be scheduled every week (averaged over four weeks) and that at-home call cannot be assigned during the residents’ free day.24 The standards further provide a detailed approach as to program requirements for the education of faculty and staff on fatigue mitigation strategies.22,24,25

In regard to nurses, Trinkoff et al. state that there are only voluntary recommendations.
that nurses limit their work hours to no more than 60-hour weeks or 16 hours in a 24-hour period. IOM in 2004 recommended that state regulatory agencies should prohibit nurses from providing care in excess of 12 hours in any given 24 hours and over 60 hours in a seven-day period. These recommendations apply to any combination of scheduled shifts and mandatory or voluntary overtime.

Several states have prohibited the use of mandatory overtime as a means whereby hospitals can demand that nurses work extra shifts to fill known staffing needs. In Pennsylvania, Act 102 was enacted in July 2009 and prohibits healthcare facilities from using this practice for nurses and other caregivers. The American Nurses Association (ANA) has stated in its discussion of mandatory overtime that the individual RN has the ethical duty to decide if he or she is too fatigued to work additional hours or an additional shift. This may be problematic, as research has shown that the fatigued worker may not be able to make this judgment regarding his or her ability to work safely and as self-regulation is not a reliable mitigator of fatigue.

In addition, a study done by Pasupathy and Barker discussed the ranges of levels of fatigue and perceived performance. They stated that current research does not clearly identify thresholds for fatigue levels that will lead to meaningful changes in objective performances in nurses and therefore cannot predict what level of fatigue is too much to allow staff to practice safely. ANA has convened a nurse fatigue professional issues panel that is charged with revising the 2006 position paper on fatigue. The position paper is expected to be released in April 2014.

**FATIGUE RISK MANAGEMENT SYSTEMS**

The term fatigue risk management system (FRMS) has evolved from organizational risk management and is being used in healthcare and other industries. The Federal Aviation Administration has defined a fatigue risk management program as “a data driven and scientifically based process that allows for continuous monitoring and management of safety risks associated with fatigue-related error. It is part of a repeating performance improvement process. This process leads to continuous safety enhancements by identifying and addressing fatigue factors.”

Using its aviation maintenance FRMS,

<table>
<thead>
<tr>
<th>INTERVENTION</th>
<th>REDUCE FATIGUE</th>
<th>REDUCE OR CAPTURE FATIGUE-RELATED ERRORS</th>
<th>MINIMIZE THE HARM CAUSED BY FATIGUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours-of-service limits</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific scheduling</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Napping strategies</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training and education for aviation maintenance technicians and inspectors</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Training and education for supervisors and planning staff</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Excused absences</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Medical treatment for sleep disorders</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Self-assessment</td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>Fatigue detection technology</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Work breaks</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Work environment</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Careful use of caffeine</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatigue-proofing of task procedures</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task scheduling interventions</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Progressive restrictions of work responsibilities</td>
<td>X</td>
<td></td>
<td></td>
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</tbody>
</table>

levels of risk are assessed to determine what fatigue risk mitigating strategies need to be employed. Table 4 lists the fatigue interventions used to achieve the objectives of reducing fatigue, reducing or capturing fatigue-related errors, and minimizing the harm caused by fatigue-related errors. A successful program will be system-based and will limit the potential for human errors and have redundant systems that catch errors before they reach patients.

The key characteristics of an FRMS are as follows:

- Science-based
- Data-driven
- Cooperative
- Fully implemented
- Integrated
- Continuously improved
- Budgeted
- Owned

A good FRMS will provide the following:

- Education and training on the effects of fatigue
- Strategies to increase alertness and mitigate fatigue
- Opportunities to identify and treat any medical conditions that may affect alertness or fatigue, such as sleep disorders
- Scheduling policies
- Adverse event, medical error, and occupational injury investigation

The most well-documented healthcare model of a comprehensive FRMS is that of Queensland Health in Australia. Its belief that fatigue is an occupational hazard that needs to be managed just as hospitals would manage hazardous chemicals led to the implementation of the Queensland Health Medical Fatigue Risk Management Policy in 2011. This policy was developed with the intent of minimizing the risk of patient harm caused by fatigue and keeping employees and the work environment healthy and safe. At each level, the staff and leadership can gather data and determine what controls, if any, need to be implemented to alleviate fatigue (see Table 5).

Queensland Health suggests that a series of questions can be asked at each level, including the following:

- What information do we have about hours of work, actual sleep, time awake, fatigue reports, and so on?
- Do we need to collect more information or data about these factors?
- What is the information telling us?
- What do we need to do differently (e.g., work practices)?
- Can we do things differently?
- What prevents or restricts us from changing things? Are these reasonable barriers?

Developing a comprehensive FRMS may appear daunting, but careful review of current organizational leadership policies, procedures, and practices may reveal that portions of an FRMS exist. Currently, the healthcare industry has provided some programs to address fatigue through duty hour restrictions and restrictions on mandatory overtime. In addition, research has shown that other efforts are being used to mitigate fatigue within hospitals and include the following:

- Education and training on the effects of fatigue
- Alertness strategies and fatigue mitigators (e.g., snacking, exercising, eating, drinking)
- Napping
- Use of caffeine
- Use of lights, such as at nurses’ stations, in laboratories, and in other areas that would not disturb patients’ sleep

<table>
<thead>
<tr>
<th>INCIDENT TRAJECTORY</th>
<th>PROACTIVE OR REACTIVE?</th>
<th>HAZARD ASSESSMENT</th>
<th>CONTROL MECHANISM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Proactive</td>
<td>Adequate sleep opportunity?</td>
<td>Hours-of-work guidelines</td>
</tr>
<tr>
<td>Level 2</td>
<td>Proactive</td>
<td>Acceptable levels of prior sleep and wake?</td>
<td>Individual fatigue likelihood score</td>
</tr>
<tr>
<td>Level 3</td>
<td>Proactive</td>
<td>Are there fatigue-related behaviors?</td>
<td>Prior sleep/wake assessment</td>
</tr>
<tr>
<td>Level 4</td>
<td>Reactive</td>
<td>Fatigue-related errors?</td>
<td>Subjective reports</td>
</tr>
<tr>
<td>Level 5</td>
<td>Reactive</td>
<td>Fatigue-related incidents?</td>
<td>Individual/collegial symptom checklist</td>
</tr>
</tbody>
</table>

— Appropriate scheduling policies, including use of fatigue risk management software as used in other industries to develop more healthful schedules.\textsuperscript{15,32}

**HIGHLIGHT ON READING HOSPITAL**

Reading Hospital in Pennsylvania is actively addressing healthcare worker fatigue. In an interview with Gayle Walsh, patient safety coordinator, she relayed that her organization has been working on this issue with more focus since the Joint Commission published the Sentinel Event Alert titled “Health Care Worker Fatigue and Patient Safety” on December 14, 2011.

Through the sponsorship of their patient safety committee made up of representatives from selected clinical departments, Reading Hospital completed a survey in which the department representatives reviewed pertinent policies and procedures, staffing, current fatigue management strategies, and staff education related to fatigue management. One immediate outcome from this assessment was the certified registered nurse anesthetists revising their scheduling process to reduce the effects of fatigue on their staffs.

A subcommittee of the patient safety committee has since been formed with the goal of reviewing current literature and developing a toolkit that can be used by the organization to educate and inform staff on the effects of fatigue and what can be done to minimize fatigue. The subcommittee, with representation from high-reliability departments and human resources, is charged with developing policies that most likely will impact current work patterns. In addition, it will continue to evaluate how handoff processes can be enhanced to mitigate the risk of fatigue and catch potential fatigue-related errors before they result in harm to the patient. Walsh envisions that the toolkit will include a self-learning module that can be loaded onto their intranet so that the information will be available 24/7 to their staff. Reading Hospital has already incorporated the evaluation of fatigue in their discussion when performing root-cause analyses. Lastly, Reading Hospital is exploring modifying their current event reporting system to gather data regarding fatigue as a contributing factor to the event.

Walsh reports that the efforts have been positive. Walsh discussed that in addition to the hospital’s work on this issue, the organization has had to prioritize other major project work, such as implementation of a new electronic health record system.

**CONCLUSION**

Due to the nature of round-the-clock staffing, fatigue is an occupational hazard in healthcare. A fatigued healthcare worker is more likely to make an error that may result in patient injury. Initial programs to address healthcare worker fatigue have primarily been focused on reducing hours worked for resident physicians. Current research shows that work-hour restriction alone will not solve the problem, as it does not address the disruption in the circadian cycle and sleep deprivation associated working the night shift or working long, extended shifts.

Most of the events reported to PA-PSRS in which healthcare worker fatigue was cited as a contributing factor were medication errors and errors related to a procedure, treatment, or test. Reporters have indicated that working extended shifts, multiple long shifts, or without a break or meal have led to feelings of tiredness and fatigue.

FRMSs are emerging as a more scientific and comprehensive method for mitigating the causes of fatigue and reducing the impact fatigue has on patient safety. An FRMS will include education for staff and leadership on the effects of fatigue, risk mitigation strategies for monitoring and managing fatigue-related risk, and a process for monitoring and evaluating any fatigue-related events.

**NOTES**


THE PENNSYLVANIA PATIENT SAFETY AUTHORITY AND ITS CONTRACTORS

The Pennsylvania Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error (Mcare) Act. Consistent with Act 13, ECRI Institute, as contractor for the Authority, is issuing this publication to advise medical facilities of immediate changes that can be instituted to reduce Serious Events and Incidents. For more information about the Pennsylvania Patient Safety Authority, see the Authority’s website at http://www.patientsafetyauthority.org.

ECRI Institute, a nonprofit organization, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for more than 40 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research. More than 5,000 healthcare organizations worldwide rely on ECRI Institute’s expertise in patient safety improvement, risk and quality management, and healthcare processes, devices, procedures and drug technology.

The Institute for Safe Medication Practices (ISMP) is an independent, nonprofit organization dedicated solely to medication error prevention and safe medication use. ISMP provides recommendations for the safe use of medications to the healthcare community including healthcare professionals, government agencies, accrediting organizations, and consumers. ISMP’s efforts are built on a nonpunitive approach and systems-based solutions.