Introduction
Fatigue among health care workers has long been documented as a contributing factor to medical errors in the healthcare setting. Although the issue is often associated with fatigue experienced by medical residents as a result of extended duty schedules, evidence supports the fact that fatigue can impact all care providers and can result from multiple factors - each with devastating consequences.

The issue of fatigue has equally been associated with safety in other industries. The Exxon Valdez incident, disasters at Three Mile Island, Bhopal and Chernobyl each list fatigue as a root cause. Questions surrounding lack of sleep among medical residents were actually first raised by Friedman et al. in 1971 when they reported that residents after a night of call made more errors when reading electrocardiograms than rested residents. Numerous studies followed pointed to potential impairment of sleep deprivation resulting in risk to both patient and house staff safety.

In 1984, the impact of fatigue was noted in the now frequently cited case of Libby Zion in which an 18 year old was admitted to an Emergency Department in a teaching hospital in New York City with flu like symptoms and subsequently died. The series of investigations following Ms. Zion’s death revealed that the two residents caring for her suffered from lack of sleep due to an extremely rigorous call schedule. On the evening in question, they were working in a very busy emergency department where there was no ability to rest or nap during any part of the extended shift. These factors, along with evidence of inadequate supervision, were identified as factors leading to Ms. Zion’s death. The New York State Department of Health launched an investigation that led the state to be the first in the nation to limit the duty hours of residents. Now more than 25 years later the American College of Graduate Medical Education (ACGME) has enacted new duty hour’s limits. These are part of a more inclusive document detailing the program requirements for any hospital serving as a teaching site for residents that became effective on July 1st.

Fatigue in High Hazard Organizations
Prior to the Zion case, many other industries had reacted to instances they were witnessing when their employees worked extended shifts or returned to work without appropriate rest. The aviation, mining, nuclear power, transport and military industries have invested heavily in research studying fatigue and its effects on workers to devise solutions to remediate fatigue related errors. So, there is much we can already learn from other industries. Perhaps after performing our own root-cause analyses, there are additional strategies which we might employ to manage some of the unique challenges inherent in today’s healthcare environment. It should be noted that as interest in curtailing work hours of health care providers has been offered as a solution, many cite a belief that reduced work hours might have the unintended consequence of creating additional errors caused by increase in hand-offs that might be required with these shortened shifts. Thus, hospitals may wish to proactively develop a two prong strategy:
1. Understand and mitigate the adverse effects of fatigue related errors, and

2. Develop standardized hand-off protocols to assure that all information necessary to assure continuity and safety of patient care is communicated effectively.

Begin with Education: What is the Impact of Fatigue on Performance and Safety?

As healthcare organizations seek to remediate errors associated with fatigue, they should begin by educating all staff about the science of sleep and the specific types of errors most commonly associated with lack of sleep. The effect of sleep deprivation and fatigue on humans is well documented and its contribution to error is clear. Sleep deprivation leads to increased periods of poor, inefficient and variable performance. As cognitive and neurobehavioral functioning decline, response times are delayed and it takes longer to process information. Short term memory is affected and it takes more time to perform tasks. The ability to maintain vigilance decreases.v,vi For example, according to the National Highway Traffic Safety Administration, driving a motor vehicle after going a day without sleep has virtually the same effect as driving with a blood alcohol content level of 0.1% - well above the legal limit. Sleep deprivation and fatigue also exact an emotional toll on individuals. Cavollo studied residents on night float rotations and reported a significant correlation between fatigue and mood measures such as tension, anxiety, anger, hostility and depression.vi Restoring psychological equilibrium can require as much as 48 hours of normal sleep patterns. Chronic sleep deprivation can result in a lack of vigilance, attention and short-term memory lapses, cognitive slowing and frontal lobe function deficits as well as rapid and involuntary sleep onsets during waking hours.vii Moodiness, emotional instability, clumsiness, lack of motivation and even loss of appetite and digestive problems can also result when a person is chronically fatigued.ix It becomes apparent that these effects can present a multitude of problems for the individual suffering them; however, when that individual is a health care provider the risk for potential adverse outcomes that harm the patient increases dramatically. Fatigue can impact any health care provider and can be caused by circumstances under the hospital’s control (generally schedule management) but also by circumstances outside the control of the hospital (staff working second jobs to support family, staff caring for children or elderly parents that may severely limit their own sleep and sleep disorders associated with stress or other medical conditions). Though the hospital can certainly help to limit fatigue associated with poor scheduling, the best they can do for the employee who is fatigued due to personal issues to make certain they are aware of the impact of stress on performance and practice strategies that reduce the potential for fatigue induced errors.

Managing Residency Related Fatigue

Fatigue among medical residents is associated with the exhausting schedule that has long been part of graduate medical education. While many still consider these grueling schedules an essential “rite of passage” and a necessary component of training, ACGME has attempted to reach consensus among educators as to how to assure physicians-in-training receive the necessary experience while not exposing their patients to undue risk. Their new residency program requirements, which were based, in part, on the recommendations of the 2009 IOM report titled Resident Duty Hours: Enhancing Sleep, Supervision and Safety, are part of a larger document detailing the requirements of hospitals offering residency training that became effective on July 1st.xi. Beginning with section six, these program requirements specifically address “resident duty hours in the learning and working environment.” These new residency program requirements call for the curtailment of duty hours for first year residents to no more than 16 hours without sleep. Many believe that these rules do not go far enough since they allow for PG -2 residents and above to be scheduled for a maximum of 24 hours of continuous duty in the hospital. The rules add the caveat that “Programs must encourage residents to use alertness management strategies in the context of patient care responsibilities. Strategic napping, especially after 16 hours of continuous duty and between the hours of 10:00 p.m. and 6:00 a.m., is strongly suggested.”xii Also, the report addresses minimum time off between scheduled duty periods, float hours, frequency of in-house night float, alertness management and fatigue mitigation and other factors that impact the quality and quantity of sleep and its relationship to safety.

As one critic of the new rules stated, “Extensive research has shown that experience does not overcome the need for sleep” and “There is no justification for maintaining unsafe work hours,
(for residents beyond the first year) other than that they're a good deal for hospitals. But they endanger patients and they even endanger residents.\textsuperscript{xxii}

In addition to strategies for managing fatigue, the report addresses the importance of maintaining safe hand-offs which become more frequent as the limitations of duty hours are imposed. These recommendations, which begin at V1.B, should be reviewed by all healthcare organizations as they develop standards to formalize the hand-off process.

\textbf{Alternative Recommendations and Solutions for Managing Fatigue For All Health Care Workers}

Much has been learned about fatigue from the research conducted across different industries that can be used to develop solutions in healthcare for combating it and its effects. Traditionally, working more and sleeping less was considered by some to be an indication of a person's motivation, training or professionalism.\textsuperscript{xiv} Nurses often worked double shifts for the extra money, but more often felt that if they failed to stay overtime when asked by a supervisor they would be accused of abandoning their patient. Chronic overtime became the norm for many organizations who choose to close budget deficits by eliminating nursing (or other patient care) positions. The impact of fatigue was poorly understood and, even when understood, often ignored. However, research has demonstrated that it is impossible for a person to adapt to inadequate sleep.\textsuperscript{xv} Joint Commission Resources published Strategies for Addressing Health Care Worker Fatigue and identifies education as the foundation of raising awareness and thereby reducing fatigue in the workplace.\textsuperscript{xvi}

This publication states that education should include basic information about how sleep works, the impact of sleep deprivation on performance and the importance of identifying symptoms of fatigue. The report also speaks to the need for healthcare workers to maintain good sleep hygiene, identify sleep disorders, understand the effects of caffeine, exercise and prescription drugs on sleep as well as be aware of and advocate for environmental conditions that improve alertness including lighting, ventilation and taking short breaks from tasks. In addition, healthcare workers must be made aware of their need to be personally accountable for placing themselves in situations which cause them to come to work fatigued and at the very least to make managers aware when situations beyond their control may require some adaptations to their schedule, workload or need to back-up.

\textbf{Conclusions}

Fatigue is often the root cause of many errors in healthcare. It seems fairly clear that medical residents training with long hours and resulting sleep loss and fatigue are hazardous to both patients and resident trainees. Currently, steps have been taken to begin to address the issue. Although debate remains as to whether the new residency program requirement released on July 1st go far enough to remediate fatigue related error, at least the impact is acknowledged and some curtailment of duty hours is now mandated. There is literature available which strongly supports that fatigue is still present despite the change in shift and total on duty duration and is a problem which extends beyond the issue of residents. However, many organizations have done little to increase staff awareness or to modify scheduling practices. Whether that will translate into an increasing number of medical errors is uncertain at this time. Given the financial pressures faced by many healthcare organizations and the strategies often employed to reduce overhead by reducing staff, it is clear that creative solutions will be necessary to maximize the ultimate goal of safe patient care.

\textbf{Contact us for a list of strategies for managing fatigue in the workplace.}


\textsuperscript{ii} Friedman RC et al. The intern and sleep loss. NEJM 1971; 285:201-3.

\textsuperscript{iii} Asch D, Parke R. The Libby Zion case: one step forward or two steps backward. NEJM 1988; 318:771-775.


vii Cavallo A. The night float paradigm to decrease sleep deprivation: good solution or new problem? Ergonomics, 2003;46:653-663.


ix Joint Commission Resources. Strategies for Addressing Health Care Worker Fatigue, Oakbrook Terrace, IL: Joint Commission on Accreditation of Health Care Organizations, 2008.


xiii https://mail.google.com/mail/?shva=1#search/Fierce+Healthcare/130c2b8c88ae3e79, (accessed August 4, 2011)


xv Ibid

xvi Joint Commission Resources. Strategies for Addressing Health Care Worker Fatigue., Oakbrook Terrace, IL: Joint Commission on Accreditation of Health Care Organizations, 2008.

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