

Understanding Fatigue Risk: Assessment and Countermeasures



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Introduction to the Pilot Study

The Fatigue Initiative at the National Safety Council (NSC) was launched in June 2016 and is focused on educating employers and providing resources to effectively manage fatigue risk in the workplace.

Beginning with talks in the spring of 2017, the Fatigue Initiative collaborated with Campbell Institute member organizations to investigate fatigue in the workplace. The purpose of the pilot study was to help Campbell Institute participants obtain a better understanding of the causes of fatigue in the workplace, both from workplace factors and employee habits on- and off-the-job. The project includes two parts: an operational needs assessment to investigate workplace sources of fatigue (such as shift scheduling practices), and an employee survey to identify employee habits that may introduce fatigue (such as sleep schedules). This information can ideally be used to develop strategies and countermeasures, for example educational programs or scheduling policies, to better manage and reduce the risk that fatigue poses in the workplace. The goal of the project is the creation of a safer working environment, happier and healthier employees, and an overall better community.

Background on Fatigue

Annual productivity gains are part of many organizational goals. Employees may seek to increase their income by working more hours, and they have family and social obligations after work. Time for recovery rest breaks and restorative sleep seems like a luxury that fewer people and organizations provide. With all these factors, fatigue is becoming a major concern for U.S. employees and employers.

Incidents in safety-critical industries can have serious consequences for employees, the public and employers. It is essential to address factors that contribute to high injury and fatality rates. Nearly every American employee (97 percent) is at risk for fatigue, and fatigue likely affects every workforce (National Safety Council, 2018a).

Safety-critical industries have higher risks because the impact of fatigue is more than just lower productivity. Safety incidents endanger not only the employees involved but all those around them. In addition, increased health care costs, lawsuits, breach-of-contract issues, and lost business are just a few of the significant financial costs of fatigue that organizations may experience. While the cost of fatigue can be difficult to isolate from other financial hits that organizations can take, it is estimated that health and wellbeing issues in general can cost employers in the United States upwards of \$1,700 per employee per year (Campbell Institute, 2016).

The symptoms of fatigue include tiredness, sleepiness, reduced energy, and increased effort needed to perform basic tasks. Many factors cause fatigue, with the most obvious being sleep loss. However, factors in addition to sleep loss can play a role in employees' ability to get proper rest and how much fatigue they experience. Shift schedules, monotonous tasks, physically demanding work, stress, and the work environment are also factors.

Fatigue affects employees' ability to think clearly, slows reaction time, decreases attention and vigilance, and impacts short-term memory, judgment, and other functions. Tired employees are less effective (presenteeism) and more likely to miss work (absenteeism), creating a drag on productivity. Importantly for safety-critical industries, fatigued employees are also more likely to make mistakes that cause incidents and injuries. A 2014 meta-analysis of 27 observational studies estimated up to 13 percent of workplace injuries could be attributed to fatigue, and workers with sleep problems had a 1.62 times higher risk of being injured than those without (Uehli, 2014).

Nearly every respondent to the National Employee Survey (National Safety Council, 2018a) has at least one risk factor for fatigue, and nearly all safety-critical industries report a higher incidence of multiple risk factors than all industries (National Safety Council, 2018b). While a conclusion cannot be drawn in a definable fashion that two or more risk factors multiply risk, it is common sense that the more risk factors individuals have, the higher the probability that their work quality, productivity, and safety will be affected. Minimizing factors that cause fatigue and implementing appropriate countermeasures to fatigue are ways to control health and safety risks in the workplace.

While the cost of fatigue can be difficult to isolate from other financial hits that organizations can take, it is estimated that health and wellbeing issues in general can cost employers in the United States upwards of \$1,700 per employee per year.

The pilot study involving Campbell Institute member organizations and the two instruments (the operational needs assessment and employee survey) were designed to help organizations identify the major causes of fatigue in their operations and workforce. By identifying these factors and gaining a better understanding of the role that fatigue plays within the organization, employers can make more informed decisions about appropriate countermeasures to control these risks.

Methodology

National Safety Council researchers obtained Institutional Review Board (IRB) approval for the research project. In total, three Campbell Institute member organizations all in the manufacturing sector participated in the pilot study. There were eight individual sites that participated across the three member organizations, which enlisted the participation of 1158 employees in total. NSC researchers generated individual reports for each of the eight sites based upon the responses received for the operational needs assessment and the employee survey.

Operational Needs Assessment

The organizations that participated in the study are members of the Campbell Institute that have agreed to enroll specific locations or departments in the pilot study. The operational needs assessment is designed to help the selected area of the Institute organization identify hazards, calculate risk levels, and audit for fatigue risk management countermeasures. The information generated by the operational needs assessment will ideally be used to create an action plan including identification of hazards and recommendations on how to manage or reduce those hazards through policies, practices, procedures, programs, and/or training. The operational needs assessment is intended to be completed by a human resources manager and/or an operational leader at the participating Institute member location/department, and was deployed via a Word document to the appropriate individuals at the site/department of the member organization.

The operational needs assessment comprises three sections:

Section one of the operational needs assessment is designed to be a quick scan of fatigue hazards in the workplace through a series of “Yes/No” questions. This section asks questions about physical and mental work demands, general work scheduling, and environmental conditions that could affect ergonomics and fatigue. Section one will most likely be completed by a site safety leader or workplace supervisor.

Section two of the operational needs assessment gets deeper into determining the risk level of fatigue at a worksite by asking for data in two ways – scheduled work hours versus actual work hours. This section also asks for data about the time of day that the majority of near misses and incidents occurred.

Section three continues the needs assessment with a short series of “Yes/No” questions pertaining to leadership commitment and initiatives for fatigue risk management systems that may already exist at the organization/site.

Employee Survey

The individuals who took part in the employee survey are employed in the locations or departments of Campbell Institute participants. There are no formal requirements of individuals to participate in the employee survey other than working in a participating site/department. Individuals could cease their participation in the employee survey at any time.

The following procedure is applicable to those organizations that have access to third-party survey services such as QuestionPro. The questions for the employee survey along with the Informed Consent Letter were uploaded to the QuestionPro platform. Contacts at the member site/department distributed the individual organization survey links via email to the employee population. This process ensured that neither the NSC investigators nor the contacts at member sites had access to employee email addresses and had no way of tracing who had or had not completed the employee survey.

For those organizations that did not have access to third-party survey services, the questions for the employee survey were provided to the company for upload to an internal survey tool and were also distributed in paper form. The paper surveys were returned to NSC via postal service for manual data entry.

The first page of the employee survey will be the Informed Consent Form. Employees who do not agree to the conditions of informed consent as outlined in the form will not complete the survey. Those who do agree to the conditions of informed consent still have the option of terminating the survey at any point.

The employee survey required about 10-15 minutes to complete online and was designed to gather information about on- and off-the-job factors that contribute to sleep health and energy levels that can act as sources of fatigue. The employee survey includes multiple choice and fill-in-the-blank questions about sleep habits, job factors (such as shift timing and rest breaks), and the organization’s safety culture. The data collected from the employee survey is completely anonymous and will help the organization understand the sources of fatigue in the workplace and the risk that fatigue may pose in the workplace. The intent of the employee survey is that the member participant will use this information to develop a plan to manage the sources of fatigue in its workplace.

Key Findings

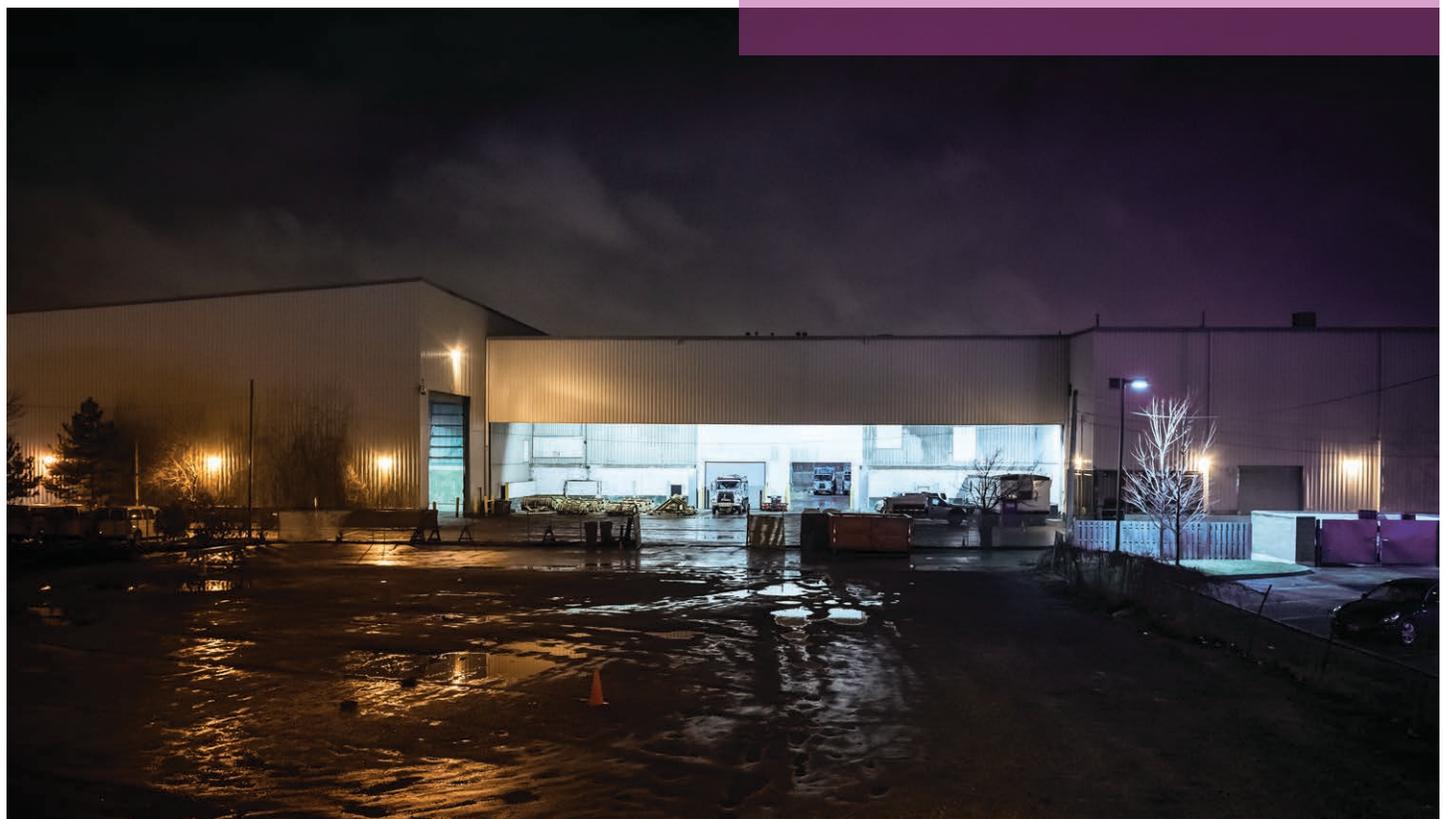
While there were small variations in the areas of fatigue risk across the eight different sites, there were four trends that stood out across all the sites in both the operational needs assessment and the employee survey: (1) the high prevalence of evening, night, and early morning shifts; (2) the variance of scheduled work hours to actual work hours; (3) the lack of fatigue risk management system (FRMS) components; and (4) the mixed opinions of employees regarding the organization's cultural approach to fatigue.

Evening, night, and early morning shifts

All of the participating sites in the pilot study noted that they utilized evening, night, and/or early morning shift scheduling in their facilities. This is not surprising, seeing as the Employer Survey on Workplace Fatigue (National Safety Council, 2018b) found that 47 percent of employers rely on night shifts. Workers on these shifts, particularly those that take place between midnight and 6:00 a.m., are operating when their body clocks are naturally at a low point, which is why night shifts carry an additional risk for fatigue and fatigue-related safety incidents.

It is also notable that many of the major safety and environmental disasters that have occurred in recent memory (e.g. Exxon Valdez, Three Mile Island, Chernobyl) occurred during hours when most people are normally asleep (Williamson et al., 2011). While there are many confounding factors, the correlation between time of day and the risk for a safety incident cannot be quickly dismissed. Other studies have shown that night shift workers are three times more likely to be injured than workers on a more traditional day shift (Swaen et al., 2003).

Night shift workers also struggle to get sufficient sleep during the day, commonly reporting a reduction in quantity and quality of sleep. This has safety implications, especially when commuting to and from work, and for those who work on safety-sensitive tasks. Changing schedules and unpredictable shifts make it especially difficult for workers on evening, night, and early morning shifts to stick with a regular sleep schedule, plan for adequate rest and recovery, prepare and eat meals – all things that affect fatigue levels, and thus raise the risk for injury on the job.



Scheduled hours versus actual hours worked

Another key finding from across all the pilot locations is the variance of scheduled work hours to the actual hours worked. The majority of workers at all sites reported that they are scheduled to work 8 hours a day and 40 hours a week, but about the same proportion of workers reported that they frequently work longer shifts and many more hours per week.

In Figure 1, we see that only about 17 percent of the 954 respondents to this question reported that they actually work 8 hours per day. The other 83 percent of respondents answered that they frequently work more than 8 hours per day, although just over half of those surveyed said that they are scheduled to work only 8 hours per day.

Overtime or shifts with extended hours put a strain on the workforce. Most employers that use overtime rely on it most of the year to cover operations (National Safety Council, 2018b). Employees who work long hours accumulate fatigue throughout the shift, increasing their risk for accident and injury. A meta-analysis conducted by Folkard and Lombardi (2006) found that longer hours on task puts workers at higher risk for injury, with the risk rising exponentially after 8 hours on task. There is a 13 percent increase on a 10-hour shift and a 30 percent increase on a 12-hour shift.

In Figure 3, we see that the modal response category for number of actual hours worked per week is 40 hours. This is only 25 percent of all respondents, however. The other 74 percent of respondents answered that they frequently work more than 40 hours per week, ranging anywhere from 41 to more than 60 hours per week.

Long shifts take away from time to recuperate with sleep, and working long shifts on a regular basis contributes to sleep deprivation, which affects health and wellbeing. The NSC National Employee Survey (National Safety Council, 2018a) found that more than half (59 percent) of employees working overtime were not getting enough sleep. While this pilot research did not focus specifically on just those employees working overtime, many reported how many hours of sleep they typically get on a weekday.

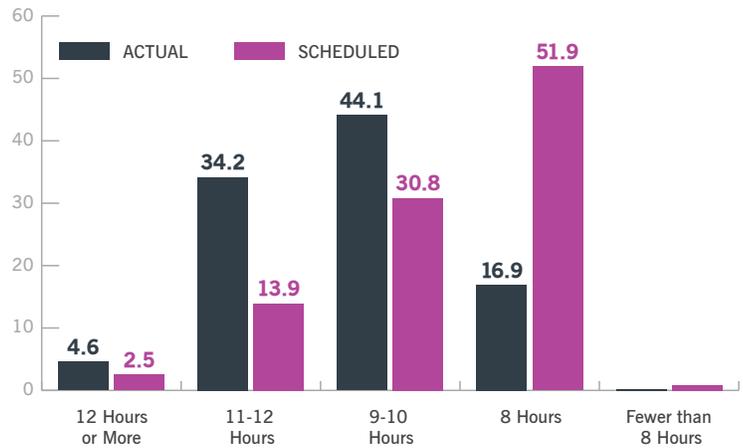


Figure 1
The actual and scheduled hours worked per day, percent by category. 954 total respondents for actual hours; 961 total respondents for scheduled hours.

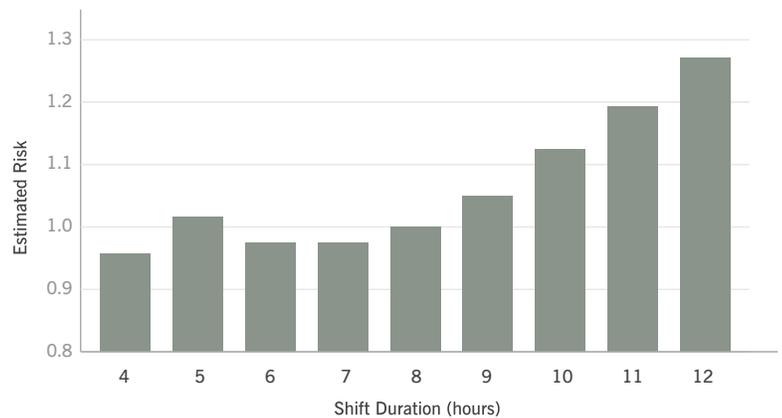


Figure 2
The estimated relative risk on different lengths of shift. Figure from Folkard and Lombardi (2006).

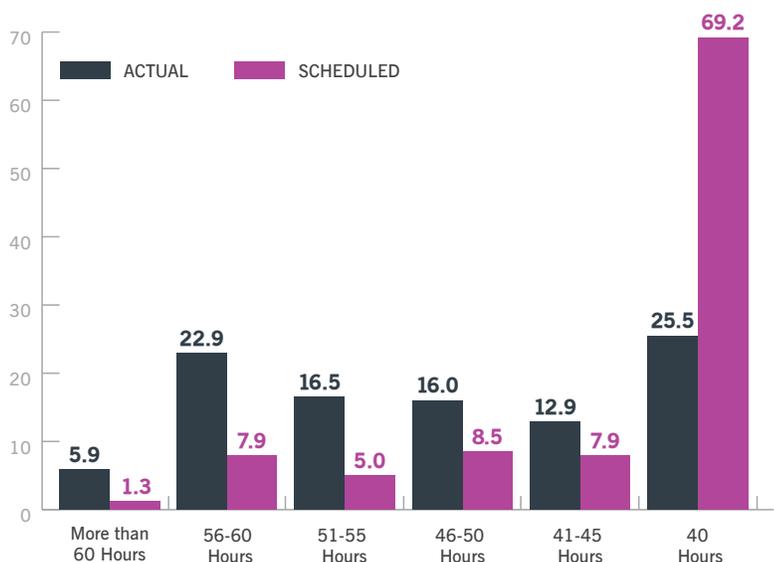


Figure 3
The actual and scheduled hours worked per week, percent by category. 1074 total respondents for actual hours; 1070 total respondents for scheduled hours.

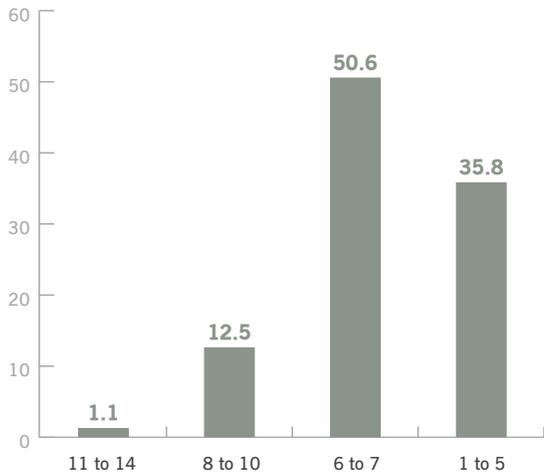


Figure 4
Number of hours of sleep on a weekday. 961 total respondents

Experts recommend sleeping 7 to 9 hours per night for optimal performance during the day, yet we can see that 35 percent of the participants in the pilot survey reported sleeping only 1 to 5 hours per weekday. This indicates that a large proportion of workers at these sites are chronically sleep deprived, which when coupled with longer work days and work weeks than scheduled means that the risk of a fatigue-related injury is significantly increased.

Fatigue Risk Management System (FRMS) components

A third finding from the pilot study is that the participating sites do not have many components (if any) of a fatigue risk management system implemented within the organization. This may not come as a surprise, seeing as awareness of fatigue as a safety issue has become known only in recent years. Examples of FRMS components that could be put in place are:

- **Fatigue management policy that includes limits on work hours and minimum requirements for off-duty and recovery rest periods**
- **Regular review of overtime schedules**
- **Shared responsibilities for managing fatigue, such as communication from the organization and the employee assuming responsibility for arriving fit for duty**
- **Fatigue reporting system for employees**
- **Procedures to determine whether fatigue played a role in an incident**
- **Fatigue management training and education for employees and management**
- **Provision of sleep disorder information and management**
- **Continuous improvement process for managing fatigue risks**

More information on these FRMS components can be found in the next section on recommendations for countermeasures to combat fatigue risk and fatigue-related injury.

Organization’s cultural approach to worker fatigue

The fourth overall finding from the pilot study is that worker opinion appears to be mixed regarding the organization’s approach to workplace fatigue. In response to the organizational culture questions in the employee survey, no site showed any clear trends regarding the encouragement of breaks, the concern for the amount of rest employees receive, etc. This is a bit surprising for Campbell Institute member organizations with excellent safety records and robust safety cultures. This suggests that fatigue is yet to be as strongly communicated as a safety issue as other more traditional health and safety topics.

To illustrate the mixed opinions of workers regarding their organization’s approach to fatigue, we present the results of one site in response to the organizational culture questions. The answers from this site’s employees are very similar to those from employees at different sites and different Institute member organizations.

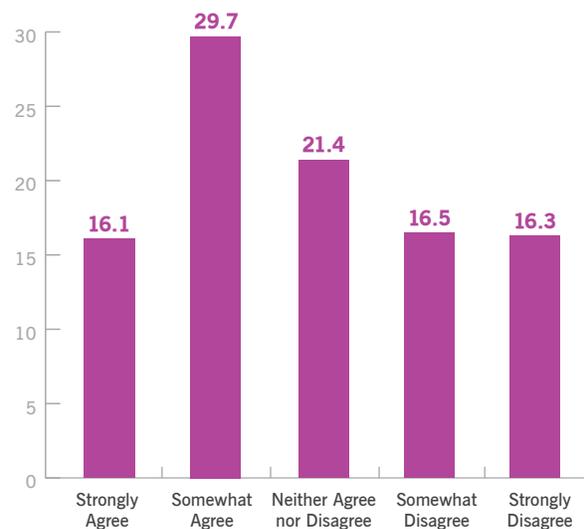


Figure 5
Levels of agreement to “My employer sees fatigue as a safety issue”; percent by category. 472 total respondents.

There appears to be fairly even responses to how much employees agree with the statement that the employer sees fatigue or being tired as a safety issue. Just under half (45 percent) agreed with the statement and 33 percent disagreed with the statement, with the rest remaining neutral.

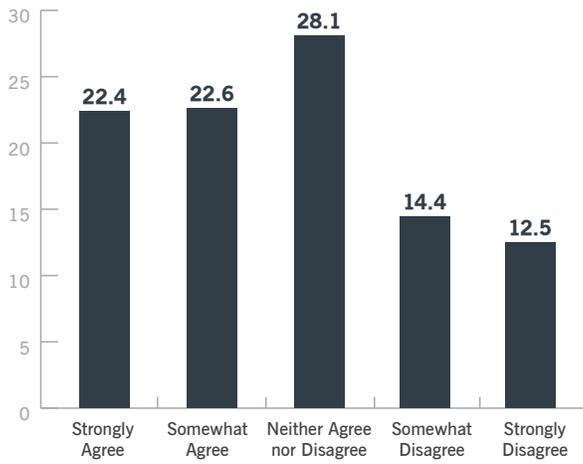


Figure 6: Levels of agreement to “My employer encourages breaks”; percent by category. 473 total respondents.

In Figure 6, the spread of responses skews very slightly to the left as to how much employees agree with the statement that their employer encourages breaks. Forty-five percent agree that the employer encourages breaks and just over a quarter (27 percent) disagree that the employer encourages breaks. The modal response, however, is neutral – neither agree nor disagree.

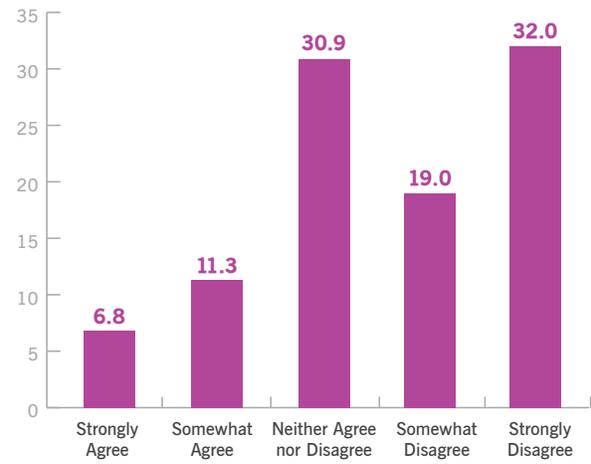


Figure 8: Levels of agreement to “My employer considers my ability to get sleep when scheduling shifts”; percent by category. 469 total respondents.

There were interesting results for the next question about the employer considering employee ability to get sleep when creating work schedules. About 50 percent disagreed with the statement and 30 percent remained neutral. Only 18 percent agreed with the statement.

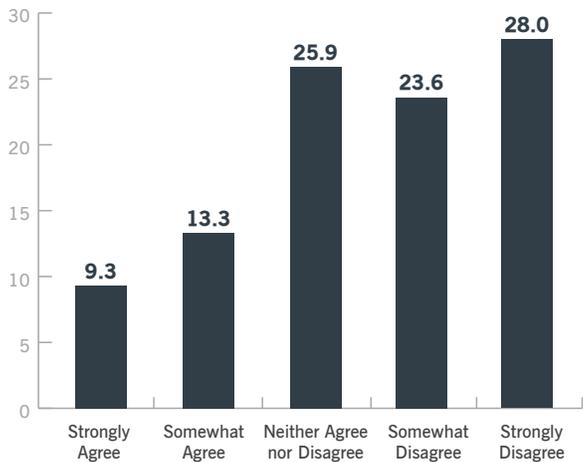


Figure 7: Levels of agreement to “My employer cares about how much rest I get outside of work”; percent by category. 475 total respondents.

The spread of responses skews slightly to the right as to how much employees agree with the statement that the employer is concerned about the amount of rest that employees get outside of work. Just over half (52 percent) disagree with the statement and 23 percent agree with the statement. One quarter of respondents remained neutral on this point.

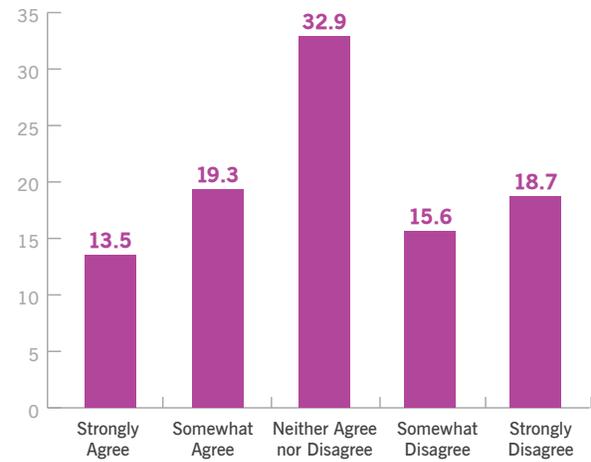


Figure 9: Levels of agreement to “I feel comfortable telling my supervisor I need a break”; percent by category. 513 total respondents.

There were mixed responses regarding employees’ comfort level with telling their supervisors if they need breaks. One-third of respondents said that they agreed that they felt comfortable telling their supervisors when they need a break. Similarly, one-third of respondents disagreed with the statement. The last third of respondents provided a neutral response to this statement.

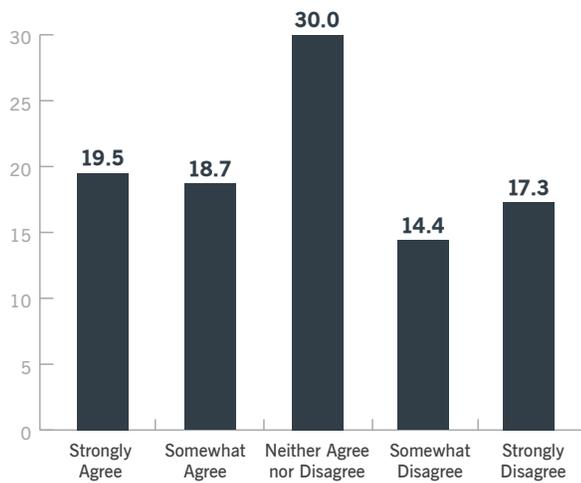


Figure 10:

Levels of agreement to “I would not feel comfortable telling my supervisor I am too tired to perform my job safely”; percent by category. 513 total respondents.

The final culture question also received some mixed responses. Almost 40 percent of respondents said that they would feel comfortable telling their supervisors that they are too tired to safely perform their jobs. The modal response was neither agree nor disagree, with 30 percent of respondents in this category. About one-third of respondents indicated that they would not feel comfortable telling their supervisors that they are too tired to perform their jobs safely.

Conclusions and Recommendations

Because the key findings across the eight pilot sites were largely the same, the conclusions and countermeasures for fatigue risk that NSC researchers offered were also similar. Below are the recommendations and countermeasures provided to the pilot sites based on the data from the assessment tools. These recommendations fell into four general areas:

1	2
Science-based scheduling practices	Education and training
<ul style="list-style-type: none"> Limit on-call periods Safety-sensitive tasks Overtime policies Rest breaks Rotating tasks Predictable schedules Safe transportation 	<ul style="list-style-type: none"> Sleep health education and screening Drowsy driving education Fatigue strategies education
3	4
Monitoring and continuous improvement	Workplace safety culture
<ul style="list-style-type: none"> Identify and mitigate employee fatigue Report and investigate incidents Reporting systems Monitor and review safety data, work schedules Fatigue committee 	<ul style="list-style-type: none"> Communicate about fatigue Rest breaks Fatigue education

Recommendation 1:

Science-based scheduling practices

Science-based policies that manage work and rest periods, both short- and long-term, are a foundational piece for managing fatigue within an organization. It is recommended to develop policies consistent with the latest known scientific information on sleep and the body clock to establish limits on daily and weekly work hours, minimum rest periods, and recovery rest periods.

Limit on-call periods: Policies should be established or supervisors should take responsibility to minimize the use of on-call work periods and provide as much advance notice as possible when used. Potential examples include only allowing individuals to work on-call for two consecutive days or four times/week. Another example is to establish a policy that provides additional compensatory rest time to workers after completion of their on-call duties.

Safety-sensitive tasks: Workers who have been on duty 13 or more hours should avoid safety-sensitive tasks if at all possible. If such tasks are necessary, extra precautions and safe guards should be taken.

Overtime policies: Extended/overtime shifts and on-call situations may lead to increased risks especially for the second shift if work is extended past midnight. Additional precautions are encouraged during such times (e.g. provide extra breaks, double check work, monitor workers for fatigue symptoms).

Rest breaks: Regular breaks during a work shift allow for both physical and mental restoration, and recovery from vibrations and harsh environments. Short, frequent breaks (for instance, 10-15 minutes) may be better for this than a single longer break mid-shift, providing employees a chance to clear their heads and feel refreshed when transitioning between tasks. Breaks during the longer third shift mitigate the fatiguing effects of extended time on task. Efforts should be made to plan safety-sensitive tasks during the first half of that shift.

Rotating tasks: Rotating tasks when possible can benefit employees dealing with mental fatigue, strain from repetitive motion, and fatigue due to environmental conditions such as vibrations. Combined with regular short breaks, this can allow employees a chance to refresh and re-energize with a new task. Efforts should be made to schedule tasks that are especially safety sensitive earlier in shifts and avoid times of day where there is an increased likelihood of sleepiness.

Predictable schedules: Policies that minimize scheduling variability should be encouraged such as providing as much advance notice as possible so workers can best plan for rest and sleep during their time off. Stability in start times is especially important, as variability in shift starts has been linked to increased human errors and accidents risks.

Safe transportation: An employee assistance program that provides fatigued workers with the option of safe transportation home, especially after extended or on-call work periods, should be considered.

Recommendation 2: Education and training

Training and education equips employees with knowledge, motivates them to prioritize sleep, and empowers them with an open dialogue on an important safety topic.

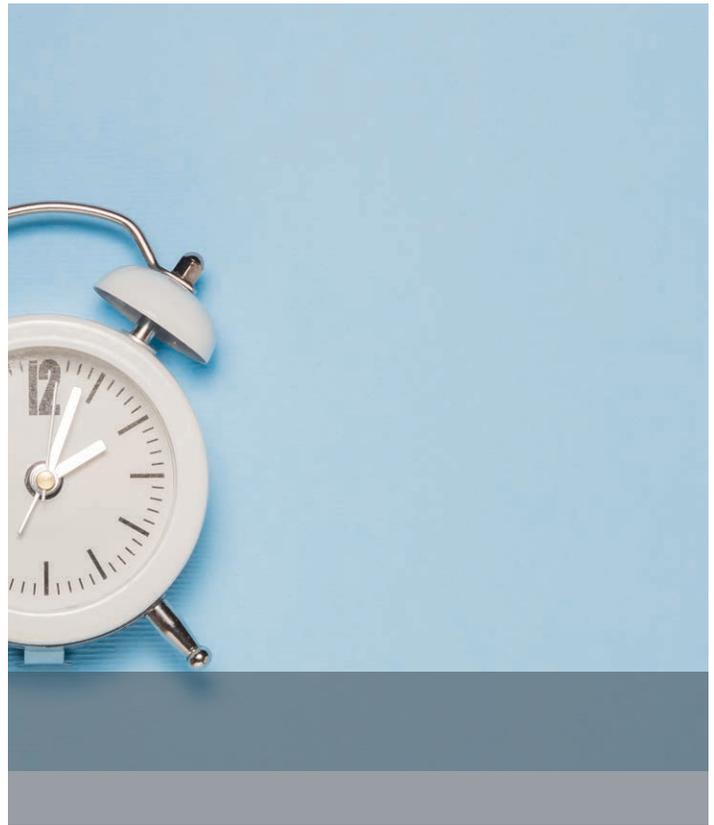
Sleep health education: Sleep health education, delivered through a corporate wellbeing program, is an easy and effective way to provide information on sleep health to employees. Education can include:

- How good healthy sleep is needed on a regular basis for both physical and mental restoration, and how adequate rest is necessary for safe, effective performance when doing demanding tasks
- How proper conditioning and nutrition can help with sleep
- Actions such as massage, stretching, and relaxation techniques that can help with sleep
- Suggested practices such as journaling sleep habits and identifying barriers to proper sleep
- Awareness that the regular use of some pain medications may impact sleep

Education should be provided that stresses healthy sleep practices especially for those workers with early starts. Morning wake times before 5:00 a.m. may not come easily for many workers and may be in conflict with their body clock programming. Practices that promote getting to sleep in a healthy way in preparation for an early wake time can benefit workers on- and off-the-job.

Anchor sleep techniques (maintaining consistent sleep times) may benefit workers whose work schedules have varying or irregular timing. Even though the timing of sleep periods may need to change due to work scheduling, getting a 4-5 hour block of sleep consistently at the same time can lead to better quality sleep and keep the body clock trained.

Sleep disorder education and screening: Sleep disorders may affect both organizational safety and individual health. Some organizations have found significant cost-savings related to programs that address these issues in their workforce. Educational efforts can include in-person classroom sessions as part of a corporate wellness program. Programs that include sleep disorder screening are effective at ensuring that employees understand their risk for a sleep disorder.



Additionally programs that include screening, treatment, and compliance monitoring have shown decreases in near miss, accident, and injury rates as well as healthcare costs.

Education on drowsy driving: Workers should be provided education about the risks associated with drowsy driving. Raised awareness on the signs and symptoms of drowsiness and effective use of mitigation strategies should be included in this effort.

Fatigue education: Fatigue education can take various forms, including in-person classroom sessions as part of a corporate wellness program, a break room poster, or safety talks that raise awareness about the risk of fatigue, drowsy driving, what contributes to fatigue, and how fatigue can effectively be managed. Awareness should be raised about increased fatigue risks during early morning hours and for the commute into work.

Recommendation 3: Monitoring and continuous improvement

An effective and comprehensive safety management system should recognize and address fatigue as a potential hazard in the workplace. The best way to identify fatigue risk is to conduct an assessment and include fatigue in incident reporting. Identifying and minimizing factors that cause fatigue allow organizations to control health and safety risks in the workplace.

Identifying and mitigating employee fatigue: A “fitness for duty” checklist could be considered in which workers rate themselves on a variety of factors (e.g. amount of sleep prior to work, total sleep in the past two days). Based on the score, workers may be encouraged to implement strategies to minimize fatigue-related risks.

Non-punitive policies should be in place for those cases when the check-in does not meet satisfactory levels. Similar checks later in the shift might be considered, especially for the longer third shift, as hours on duty and hours awake will lead to different levels of continued worker fitness.

Monitoring of on-call workers by supervisors or other members of the work group should be considered. If signs or symptoms of fatigue are observed, the worker should be provided a break or opportunity for a short rest period.

Monitoring of workers on early morning shifts by supervisors or other members of the work group should be considered. If signs or symptoms of fatigue are observed, the worker should be provided the opportunity for a break or to use other fatigue countermeasures.

Monitor and review data and schedules: Monitor incident data for fatigue and consider additional data such as shift worked and number of days into the work schedule, as these can help provide better insights into the factors that are tied to these safety issues. As fatigue management efforts are implemented, this can provide a good benchmark for assessing improvements.

Evaluate shift schedules for possible fatigue risk: Fatigue modeling programs are available to evaluate work schedules for predicted levels of fatigue. Simpler tools such as risk assessment checklists can be adapted to provide similar feedback. Either approach can be used proactively or reactively: (1) to determine whether mitigations are necessary for anticipated work; (2) to provide an evaluation of work completed, generating potential lessons learned and enable better planning for future projects.

Fatigue reporting systems: Examples of anonymous fatigue reporting systems can be found in other industries, such as transportation. There should be policies for how data is reviewed and processed in order to be actionable.

Reporting and investigating incidents for continuous improvement: Incident reporting provides another data source for those managing the fatigue risk issue to determine where and when fatigue risks exist and to formulate efforts to manage those risks.

Incidents may occur during overtime or on-call situations. Further analysis would be beneficial to understand more about such incidents (e.g. number of hours on duty, number of days of consecutive work) to fully inform fatigue management efforts.

Fatigue committee: Initiate steps to form a fatigue committee with participation from different departments. As a minimal starting point, representatives from HR, medical/occupational health and safety should be included and processes established for review of activities. The committee would be responsible for:

- Determining a process that will establish benchmarks based on initial data collected, and allow for future improvements
- Reviewing safety data and reports
- Making recommendations based on trends in review materials for process improvements
- Surveying supervisors and employees for attitudes and issues with fatigue
- Generating materials that can be included in education/training efforts that provide feedback to workforce and present potential lessons learned.

Recommendation 4: Workplace safety culture

Many employers are beginning to recognize that long days and overly tasked employees do not produce better results, but instead produce burnout and fatigue, directly affecting employees’ health and safety. NSC surveys found that while most employers recognize fatigue as a safety hazard, fewer employees agree (National Safety Council, 2018c). Understanding that limitation and recognizing fatigue as a hazard in the workplace is the first step to managing the risks.

Communicate about fatigue: Leaders within the organization are encouraged to have an open dialogue about fatigue as a workplace safety hazard, discussing the importance of sleep health, how to get better sleep, and how to get screened for a sleep disorder. A five-minute safety talk is an easy way to start talking about fatigue in the workplace.

Rest breaks: Employers can show their concern for worker fatigue by providing areas for rest breaks and encouraging employees to take breaks during their shifts. Worksites with night shifts should provide space and opportunities for short naps.

Fatigue education: Employers can also show concern for worker health and fatigue by educating themselves and employees about the risk factors for fatigue in the workplace. Organizations can provide opportunities for sleep disorder assessments and hold workshops to help employees learn how to get better sleep.

Next Steps

Now that the pilot project has been completed at these three Campbell Institute member organizations and eight locations, the next step for these sites is to implement some or all of the recommended countermeasures to better manage worker fatigue in the workplace. The National Safety Council hopes to conduct further assessments with the participating organizations and locations of the pilot study and evaluate the effectiveness of these countermeasures on lagging indicators such as incident rates (particularly fatigue-related incident rates), hours of employee sleep, feelings of restfulness/wakefulness, and measures of organizational culture.

Employers reading this report can use the operational needs assessment (included in Appendix 1) or modified questions from the assessment to gauge the level of fatigue risk within their organizations. Going through the different modules of the operational needs assessment should give an employer a comprehensive picture of the key areas where fatigue risk is present and the major structural and organizational contributors to those levels of fatigue risk. It is impossible to make meaningful and effective changes to a safety management system without first knowing the baseline level of risk.

Employers can also use the employee survey (included in Appendix 2) to reveal the on-the-job and off-the-job risk factors for fatigue that workers may be experiencing. Sections or individual questions from the employee survey can be incorporated into an existing organizational safety perception survey. Additionally, the employee survey for fatigue can be used as an educational tool for employees to start thinking about their individual risk factors.

The National Safety Council continues to lead the conversation on workplace fatigue in the U.S. and to bring awareness of fatigue as a safety issue. Learn more and get needed resources at nsc.org/fatigue.

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Appendix 1

OPERATIONAL NEEDS ASSESSMENT

Section 1: Scanning for Fatigue Hazards

Work demands

1. **Y / N** Does anyone do physically demanding tasks? Physically demanding tasks may include heavy lifting and are physically tiring, such as heavy lifting, walking for long lengths of time.
2. **Y / N** Does anyone do cognitively demanding tasks? Cognitively demanding tasks may require long durations of concentration or require high levels of attention and vigilance, such as working under pressure or tight timelines or interacting and dealing with the public.
3. **Y / N** Does anyone conduct repetitive tasks over long periods of time? Repetitive tasks often require the same movements. Examples could include typing, assembly, driving long distances, etc.

Scheduling and hours

4. **Y / N** Does anyone consistently work between the hours of midnight and 6 a.m.? Consistently means at least 30% of their working hours.
5. **Y / N** Are workers scheduled for at least one day off per week?
6. **Y / N** Does the work schedule make it difficult for workers to consistently have at least two consecutive nights sleep per week?
7. **Y / N** Do work practices include on-call work, call-backs and/or sleepovers?
Call-back = employees called in to do repair work.
8. **Y / N** Do planned work schedules vary from those actually worked?
9. **Y / N** Does the work schedule involve rotating shifts?
10. **Y / N** Does anyone travel more than one hour to their job?
11. **Y / N** Does anyone regularly work in excess of 12 hours a day including overtime?
12. **Y / N** Is the break between shifts less than 10 hours?
13. **Y / N** Is work performed at low body clock times (between 2 a.m. and 6 a.m.)?

Environmental conditions

14. **Y / N** Does anyone perform work in harsh or uncomfortable temperature conditions (e.g. hot, humid or cold)?
15. **Y / N** Does anyone work with plant or machinery that vibrates?
16. **Y / N** Is anyone consistently exposed to loud noise?

Section 2: Determining Risk Level

1. Y / N Scheduled versus actual hours

- a. What is the typical shift schedule for these departments?
- b. What is the average shift length? What is the range?
 - i. Scheduled hours: Average: Range: to
 - ii. Actual hours worked: Average: Range: to
- c. What is the average number of hours worked a week? What is the range?
 - i. Scheduled hours: Average: Range: to
 - ii. Actual hours worked: Average: Range: to
- d. What is the average number of consecutive shifts?
 - i. Scheduled: Average: Range: to
 - ii. Actual: Average: Range: to
- e. What was the longest shift worked in the past 30 days? 15 hours
 - i. Scheduled: Average: Range: to
 - ii. Actual: Average: Range: to

2. Near miss, incident reporting and investigation

- a. What percentage of near misses or incidents occurred during a night shift (a shift between the hours of midnight and 6 a.m.)?
- b. What percentage of near misses or incidents occurred during an early morning shift (a shift that starts prior to 7 a.m.)?

Section 3: Needs Assessment (FRMS Audit / Countermeasures)

Leadership commitment

1. Y / N Does your organization have a diverse committee in place to manage fatigue in the workplace, including representation from operations, HR, medical, data managers, executive team?

FRMS audit

2. Y / N Does your organization have a fatigue management policy that includes limits on work hours, and minimum requirements for off-duty and recovery rest periods?
3. Y / N Does your organization regularly monitor for fatigue risk, such as reviewing overtime schedules?
4. Y / N Does your organization's safety culture communicate shared responsibility, where the organization defines roles and responsibilities for managing fatigue and the employee assumes responsibilities for arriving fit for duty?
5. Y / N Does your organization have a fatigue reporting system for employees?
6. Y / N Does your organization have procedures to determine whether fatigue played a role in an incident?
7. Y / N Does your organization have fatigue management training and education for employees, and management?
8. Y / N Does your organization provide sleep disorder information and management?
9. Y / N Does your organization have a continuous improvement process for managing fatigue risks?

Appendix 2

EMPLOYEE SURVEY

Section 1: Sleep Health

1. How important is it for you to get good sleep?

- 1. 1 - Not at all important
- 2. 2
- 3. 3
- 4. 4
- 5. 5 - Very important

2. How concerned are you with how your sleep affects your.....?

	1 Not concerned at all	2	3	4	5 Very concerned
Physical health					
Mental health					
Job performance					
Family life					

3. How often do you...

	1 Never	2	3	4	5 Frequently
Get enough sleep to feel your best the next day					
Feel tired at work					

4. About how many hours of sleep do you typically get a day?

- 1. 1 hour
- 2. 2 hours
- 3. 3 hours
- 4. 4 hours
- 5. 5 hours
- 6. 6 hours
- 7. 7 hours
- 8. 8 hours
- 9. 9 hours
- 10. 10 hours
- 11. 11 hours
- 12. 12 hours
- 13. 13 hours
- 14. 14 hours

Section 2: Job factors

5. How do you describe your normal work hours?

1. Daytime hours/shift
2. Evening hours/shift
3. Night shift
4. Rotating shift (shifts that rotate or change according to a set schedule)
5. Irregular shift (shifts that may vary day-to-day and are unpredictable or follow no set schedule)
6. Other

6. How many hours is your scheduled work day, or shift length?

7. How long is your actual, typical work day in hours?

8. How long is your scheduled work week, or the number of hours you are scheduled in a week?

9. How long is your actual, typical work week in hours?

10. On average, how many hours do you get off from the end of your workday until you begin to work again? For example, if your work day ends at 5 p.m., and you begin work the next day at 8 a.m., your answer would be 13 hours. If your work schedule varies, please give your best estimate.

11. Roughly how many breaks, including lunch, do you take in a work day? By breaks, we mean any activity away from your work that lasts 10 minutes or longer.

12. Thinking about your regular job, about how often do you find yourself performing activities that are

	Never	Rarely	Sometimes	Often	Always
Physically demanding (such as heavy lifting, frequent movement or on my feet)					
Mentally demanding (such as monitoring, reading, scheduling, strategic development)					
Frequently repetitive tasks (such as driving long distances, assembling, or typing)					

13. On average, about how long is your drive to your job?

1. Less than 15 minutes
2. 15 minutes to less than 30 minutes
3. 30 minutes to less than 1 hour
4. 1 hour to less than 2 hours
5. More than 2 hours
6. Don't drive/carpool/use public transportation

Section 3: Workplace culture

14. How often do you feel...

	Never	Rarely	Sometimes	Often	Always
Pressured to work more hours?					
Pressured to skip or take fewer breaks during your shift?					
Your work schedule causes you to get less sleep than you need?					
Workplace safety is at risk due to your own tiredness?					
Your safety at work is at risk due to someone else's tiredness?					

15. Please rate your level of agreement with the following statements

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
My employer sees fatigue (or being tired) as a safety issue					
My employer encourages breaks					
My employer cares about how much rest I get outside of work					
My employer considers my ability to get sleep when scheduling shifts					
My work schedule allows me to get the proper rest I need to function safely on the job					

16. Please rate your level of agreement with the following statements

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
I am not able to perform my job as well when I'm tired					
I feel comfortable telling my supervisor I need a break					
I would not feel comfortable telling my supervisor I am too tired to safely perform my job					

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