

# WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

## Using *Total Worker Health*<sup>®</sup> Concepts to Reduce Fatigue among Retail Workers

### Summary

In recent years, retail workers in the United States have engaged in more shift work and longer work hours [Katz and Krueger 2016; Greenhouse 2015]. These schedules can result in fatigue and related health issues. Through its *Total Worker Health*<sup>®</sup> (TWH) Program, the National Institute for Occupational Safety and Health (NIOSH) recommends an integrated approach to addressing fatigue in retail work. An integrated approach is one that protects workers from work-related injury and illness and helps them advance their overall health and well-being, on and off the job. The approach includes addressing factors that affect both the workplace and home life, including autonomy at work, workload, and environmental factors. This document describes organizational practices related to scheduling, flexibility, and the work environment that can help address the causes and consequences of fatigue among retail workers.

### The Nature of Retail Work

The retail trade sector includes nearly 16 million workers in establishments that sell merchandise in small quantities to the public and perform services related to sales. Retail trade includes both store and non-store retailers; non-store retailers reach customers through television, websites, portable stalls, etc. According to the Bureau of Labor Statistics, the retail trade injury/illness rate was 3.3 per 100 workers in 2016; whereas across private industry, the incidence rate was 2.9 per 100 workers. The retail trade measure known as days-away-from-work (DAFW) had fewer reported cases than the Education and Health Care Sectors, but exceeded the number of DAFW that was reported for the Manufacturing Sector [BLS 2016]. The retail sub-sectors with the highest rates of injury include stores that sell building materials and gardening equipment, general merchandise (department), food and beverages, and home furnishing [BLS 2015].

Retail businesses often have non-standard and long hours of operation. Economic downturns and competition from online retailers have led to reduced staff as a cost cutting measure, and remaining staff often work longer

hours or irregular shifts, or have additional workloads [Greenhouse 2015].\* Retail work is fast-paced and can involve heavy lifting and long periods of standing, leading to overexertion and musculoskeletal injuries<sup>†</sup> [NIOSH 2018; Anderson and Chun 2014]. These factors and trends in the retail industry can lead to fatigue.

### Fatigue, Shift Work, and Health

Fatigue is the body's response to short sleep duration, sleep cycle disruption, disturbances to circadian rhythms, or lengthy physical or mental exertion, which can result from long work hours, shift work, environmental factors, or heavy workloads [ACOEM 2012; Techera et al. 2016]. People also feel fatigue when their body is fighting off

<sup>\*</sup>BLS [2005] data on the numbers of retail workers in shift work was last compiled in 2004; it shows that 16.3% of retail workers work shift work and night work, which is higher than the percentage for workers in all industries (14.8%).

<sup>†</sup>Although older workers have a lower overall injury rate, they are more affected by musculoskeletal injuries, since their recovery time is longer [NIOSH 2018]. For more information about productive aging and the workforce, visit <https://www.cdc.gov/niosh/topics/productiveaging/default.html>



Centers for Disease Control  
and Prevention  
National Institute for Occupational  
Safety and Health

infectious organisms and when they have certain chronic diseases or take certain medications.

Shift work can cause workers to sleep at irregular times or during daylight hours when their normal physiology is driving them to be awake and active. Sleep during daylight hours and after irregular shifts is generally shorter and less refreshing than sleep at night [NIOSH 1997]. Long work hours may not allow enough time between work shifts to get enough sleep [ACOEM 2012]. Most adults need 7 or more hours of sleep each day for optimal health and safety [Mukherjee et al. 2015].

Sleep cycle disruption and short sleep duration can also result from pain, certain medications, stress, insomnia, and other sleep disorders [NORA Sector Council 2016; Techera et al. 2016; ACOEM 2012; National Sleep Foundation 2015]. Sleep disorders are common but they are often not identified and treated [Colten and Altevogt 2006]. Another source of sleep disturbance is caring for infants or other family members: this can make it difficult for workers to get enough sleep and cause them to feel fatigued.

Workers with fatigue report more physical health problems, role limitations, and poorer general health and social functioning [NORA Sector Council 2016; OSHA n.d.]. Shift workers have a higher risk of digestive disorders, metabolic disorders, cardiovascular disease, psychological disorders, cancer, and type 2 diabetes. They can also experience adverse reproductive outcomes including reduced fertility, pre-term birth, and miscarriages [Caruso 2014; ANSES 2016]. Shift work and long work hours are associated with poor health behaviors such as smoking, alcohol use, and a lack of physical activity [NIOSH 2004; Caruso 2014].

## Fatigue and Work Performance

Risk factors for occupational fatigue include long work hours, heavy workload, job stress, working late evening hours, night work, and irregular shifts [NIOSH 1997, 2002; NORA Sector Council 2016; Techera et al. 2016]. Exposure to environmental factors at work such as excessive noise, extreme temperatures, poor lighting, poor air quality, and vibration may also cause fatigue [NIOSH 1997; Techera et al. 2016]. Not getting enough breaks during the work shift also increases the risk for fatigue. In addition, workers may become fatigued if they do not drink enough fluids and eat enough nutritious food at regular intervals during the work shift.

Fatigue resulting from nonstandard or extended shifts can affect cognitive ability and function; reduced functioning results in slower reaction time and more errors on the job. Errors on the job can compromise safety and cause more injuries [NIOSH 1997, 2012a,b; Caruso 2014]. Fatigue-related incidents are related to time of day, with an increased

risk in the early morning hours (about 4 to 6 A.M.) when the urge to sleep is at its peak [ACOEM 2012]. The middle of the afternoon is another time when workers are prone to feeling sleepy and may make errors.

The risk of fatigue-related injuries increases with evening and night shift work, and as more consecutive hours and consecutive nightshifts are worked [Techera et al. 2016]. Studies on the effects of extended shifts report that the 9th to 12th hours of work are associated with decreased alertness, increased fatigue, lower cognitive function, declines in vigilance, and increased injuries [NIOSH 2004]. Decreased alertness also affects productivity, because fatigue increases the time it takes to accomplish tasks [NORA Sector Council 2016].

Although specific industries have guidelines to limit shifts or to provide minimum time between shifts, no U.S. federal regulations limit shift length or specify a minimum number of hours between shifts for the majority of workers, including those in retail.\* The Department of Labor defines limits on the number of hours that **youth under 16** can work [DOL n.d.].

## Fatigue in the Retail Industry

Trends in the retail industry include irregular and extended shifts and reduced staff. Understaffing may mean that only a few core remaining employees are able to close one shift and open the next; they may also have to take on additional workloads. More overtime and heavier workloads for remaining employees can lead to overexertion, stress, fatigue, and more turnover [Anderson and Chun 2014; Greenhouse 2015; ACOEM 2012; Katz and Krueger 2016]. Overexertion (and fatigue) can also result from long periods of standing, time pressure, and lifting merchandise [Anderson and Chun 2014]. Forty-two percent of store and other retail workers noted that their job has a negative effect on their level of stress [Harvard School of Public Health 2016].

According to the National Health Interview Survey [NIOSH 2015a], more than half of retail employees work nonstandard shifts or work weeks longer than 48 hours; food and beverage workers are particularly affected. Half of retail workers know their schedules only a week or less in advance [Lambert et al. 2014]. The growing percentage of workers who are temporary, on call, or under contract shows that this trend is increasing [Katz and Krueger 2016]. Uncertain scheduling, heavy workloads, and overexertion among retail workers may be more acute during peak seasonal periods. When workers have less control over schedules and workloads, they have less **autonomy at work**.

\*The U.S. Department of Transportation regulates hours of service for all the commercial transportation modes. The U.S. Nuclear Regulatory Commission regulates work hours for nuclear power plants. Some states ban mandatory overtime in registered nurses [OSHA n.d.].

## Total Worker Health®: an Integrated Approach

Total Worker Health® approaches are defined as policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts in order to advance employee well-being [NIOSH 2015b]. According to research on TWH, comprehensive practices and policies that take into account the work environment (both physical and organizational), while also addressing personal health risks, are more effective in preventing disease and promoting safety and health than each approach taken separately [NIOSH 2015b; Sorensen et al. 2013]. Traditional workplace safety and health programs have concentrated on the safety of the work itself and on protection from exposure.

Traditional health promotion programs have promoted personal health and individual interventions separately from issues related to work. But TWH recognizes how work itself is a determinant of health and how factors such as stress, workload, autonomy, and hours of work and rest can influence health outcomes [NIOSH 2015b; Schulte et al. 2007].

## Organizational Support for Total Worker Health®

TWH prioritizes organizational-level policies, programs, and practices designed to protect workers and improve their health [NIOSH 2015b]. Organizations can lead through example and support positive influences within the work environment to help decrease fatigue among employees. This type of support may include developing and implementing a fatigue risk management system [see NIOSH 2015c and ACOEM 2012 for elements of a fatigue risk management system].

Retail employers should be aware that workers may take extra shifts or work an extra job to make ends meet, or be awake after a night shift to attend classes or take care of family [Techera et al. 2016; Greenhouse 2015]. Those who work night shifts may sleep when the surrounding environment is noisier and more disruptive. These issues need to be considered when workers' schedules are made.

Long hours and resulting fatigue may limit the opportunity to pursue other health-enhancing or health-promoting activities and may limit time spent with friends and family. As noted by Schulte et al. [2015], true well-being requires that workplaces adopt a comprehensive approach to worker health and safety.

## Benefits of Total Worker Health®

Although TWH emphasizes that the safety, health, and well-being of the worker are of primary importance, providing



opportunities for promoting worker health (such as allowing for adequate rest and time between work shifts) also has benefits to the employer. These benefits can be direct, such as the reduction of health-related expenditures and absenteeism, as well as indirect, such as improved employee morale, advantages in recruitment and retention, and even reduced injury rates [Fabius et al. 2013]. Employers, workers, their families, and communities all benefit from improved health, disease prevention, and work productivity that can result from adequate amounts of sleep and reduced fatigue [NORA Sector Council 2016].

When implementing these policies and systems in support of TWH, retail employers should consider both work-related and individual factors to reduce fatigue and improve worker safety, health, and well-being.

## Recommendations for Incorporating Total Worker Health® Concepts into Workplace Safety and Health Programs

Because of the potentially higher health and safety risks as well as risks of decrements in performance associated with night shifts, retail managers can consider whether they are able to eliminate or modify night shifts and move the work to daytime hours (for example, 7 A.M. to 11 P.M.). Employers

should also consider the following TWH concepts to reduce worker fatigue [NIOSH 1997, 2012, 2014, 2015c; CDC 2012; 2014; Schulte et al. 2015; ACOEM 2012; Goetzel and Ozminkowski 2008; Goetzel et al. 2014; AHA 2014]:

- Implement a fatigue risk management system that is supported by research, has stakeholder input, and includes incident reporting. (NIOSH has developed strategies for designing work schedules and workloads in Part 2, Module 5 of publication **2015-115**.) (The American College of Occupational and Environmental Medicine also has information about implementing a **fatigue risk management system** [ACOEM 2012].)
- Offer workers more job autonomy and control over schedules, job tasks, and other conditions of work.
- Consider shortening work shifts that involve heavy workloads, or redistributing heavy workloads to times when workers are more alert.
- Ensure that any program striving to advance worker safety, health, and well-being has the commitment of organizational leadership, support from all levels of management, and worker participation and input.
- Involve workers and labor representatives in designing and implementing procedures and practices to reduce fatigue.
- Include health education (information dissemination and awareness) about the effects of fatigue, managing sleep disorders, and coping with shift work (in combination with the policies, programs, and practices that allow workers to adjust conditions of work to minimize fatigue).
- Link existing worker safety and health programs to related programs such as counseling or **employee assistance programs** and related training efforts [OPM n.d.].
- Evaluate existing resources and current policies, programs, and practices to assess what is effective in promoting autonomy, determining work schedules and workloads that promote good health, and promoting other conditions that minimize fatigue.
- Promote the importance of sleep and let workers know what resources are available to help them.
- Design the work environment to minimize noise and vibration. Ensure adequate lighting and comfortable temperatures.
- Routinely evaluate the program and make adjustments as needed.

## Steps Retail Employers Can Take Right Away

[NIOSH 1997, 2004 2012a, 2015c, 2017; Anderson and Chun 2014; Galinsky et al. 2000; ACOEM 2012; Iridiastadi and

Nussbaum 2006; Techera et al. 2016; Rahman et al. 2014; Mayo Clinic 2018; ODPHP 2015]

When making schedules, employers should determine necessary staffing level and not depend on fewer workers to work longer hours. Rotation schedules should allow for recovery from the night shift, and tasks and the work environment should be designed to maximize alertness and protect against errors.

Employers should also consider following these specific strategies when developing schedules and assigning shifts:

- Allow for variation in work tasks, duties, and body position to avoid monotony and muscle fatigue (for more information about counteracting the effects of stationary positions, see **NIOSH 2017**).
- Allow for adequate rest breaks. Frequent brief breaks (e.g., every 1-2 hours) during demanding work are more effective against fatigue than a few long breaks. Allow longer breaks for meals. Rest breaks can be implemented without a resulting decrease in performance. (Naps during breaks could last 20-30 minutes. See NIOSH 2015c Part 2 Module 7 for information about using naps).
- Allow at least 10 hours between shifts so employees can get 7-8 hours of sleep.
- Avoid using rotating shift schedules that change every week: for example, one week of day shift, one week of night shift (work hours include midnight to 6 A.M.). Most workers bodies have difficulty adjusting to weekly rotating schedules because of the way the human body is designed (human physiology). See NIOSH (2015c) Part 2 Module 5 for information about designing appropriate work schedules.
- Limit night shifts to no longer than 8 hours whenever possible.
- Ensure that 12-hour shifts do not include excessive workloads.
- Plan one or two full days of rest to follow five consecutive 8-hour shifts or four 10-hour shifts. Consider 2 rest days after 3 consecutive 12-hour shifts.
- Avoid scheduling an employee to work an opening shift right after a closing shift.
- Schedule strenuous work when employees are most alert.
- Give as much advanced notice as possible for schedule change.
- Record injury incidents and near misses and collect information about fatigue-related factors to determine whether fatigue contributed to the incident.
- Provide anti-fatigue mats, shoe inserts, and sit stand chairs/ stools for cashiers and others who stand for long periods.



monkeybusinessimages/iStock/Getty Images Plus/Getty Images

- Design the work environment to minimize noise and vibration. Ensure adequate lighting and comfortable temperatures.
- Provide the opportunity for healthful and balanced meals to help reduce stress and improve productivity:
  - Share information with workers about **current recommendations** for healthful eating through fliers, internal websites, and posters.
  - Provide healthful snacks during meetings and in vending machines and cafeterias.
  - Provide refrigerators and microwaves at work so workers can bring healthful food from home.

## Steps Employees Can Take Right Away

Retail employees can consider the following strategies to reduce fatigue:

- Make sure to give yourself enough time to sleep after working your shift.
- Sleep some place dark, comfortable, quiet, and cool so you can fall asleep quickly and stay asleep.
- Seek assistance from an appropriate healthcare provider if you are having difficulties sleeping.
- Get the 7 or more hours of sleep that you need each day to feel refreshed and alert.

- Follow **current nutrition guidelines** on healthful meals and snacks.
- Avoid heavy foods and alcohol before sleeping since these can make it difficult to get quality sleep.
- Exercise routinely, as keeping physically fit can help you manage stress, stay healthy, and improve your sleep.
- Drink enough water to replace fluids loss from the heat and workload; do not wait until you feel thirsty.
- More strategies for employees are available in Part 2, Modules 6 to 11 of **NIOSH 2015c**.

## Acknowledgments

This document was prepared by Susan Afanuh of the National Institute for Occupational Safety and Health, with input from the following NIOSH Programs: *Total Worker Health*®, Healthy Work Design and Well-Being, and Wholesale Retail Trade. Subject matter expert review was provided by Claire Caruso and Vern Anderson.

## Suggested Citation

NIOSH [2018]. Using *Total Worker Health*® Concepts to Reduce Fatigue Among Retail Workers. By Afanuh S. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2019-102. DOI: <https://doi.org/10.26616/NIOSH PUB2019102>

## References

- ACOEM Presidential Task Force on Fatigue Risk Management [2012]. ACOEM guidance statement: fatigue risk management in the workplace. *J Occup Environ Med* 54(2):231–258. [http://www.acoem.org/uploadedFiles/Public\\_Affairs/Policies\\_And\\_Position\\_Statements/Fatigue%20Risk%20Management%20in%20the%20Workplace.pdf](http://www.acoem.org/uploadedFiles/Public_Affairs/Policies_And_Position_Statements/Fatigue%20Risk%20Management%20in%20the%20Workplace.pdf)
- AHA (American Heart Association) [2014]. Staying hydrated — staying healthy. [http://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/FitnessBasics/Staying-Hydrated---Staying-Healthy\\_UCM\\_441180\\_Article.jsp#.WxAD68JLL9](http://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/FitnessBasics/Staying-Hydrated---Staying-Healthy_UCM_441180_Article.jsp#.WxAD68JLL9)
- Anderson V, Chun H [2014]. Workplace hazards and prevention options from a nonrandom sample of retail trade businesses. *Int J Occup Safety Ergonomics* 20(1):181–195.
- ANSES [2016]. Assessment of the health risks for professionals exposed to atypical working hours, especially night work. Agence Nationale de Sécurité Sanitaire, Alimentation, Environnement, Travail. <https://www.anses.fr/en/system/files/AP2011SA0088RaEN.pdf>
- BLS [2005]. Shifts usually worked. Washington, DC: U.S. Department of Labor, Bureau of Labor Statistics. <https://www.bls.gov/news.release/flex.t05.htm>
- BLS [2015]. Table R4. Number of nonfatal occupational injuries and illnesses involving days away from work by industry and selected events or exposures leading to injury or illness, private industry, 2014. Washington, DC; U.S. Department of Labor, Bureau of Labor Statistics, <https://www.bls.gov/iif/oshwc/osh/case/ostb4370.pdf>
- BLS [2016]. Nonfatal occupational injuries and illnesses requiring days away from work, 2015. <https://www.bls.gov/news.release/osh2.nr0.htm>
- Caruso C [2014]. Negative impact of shift work and long work hours. *Rehabil Nurs* 39(1):16–25. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4629843/>
- CDC [2012]. The National Healthy Worksite Program <https://www.cdc.gov/workplacehealthpromotion/pdf/nhwp-program-overview.pdf>
- CDC [2014]. Workplace health promotion. <http://www.cdc.gov/workplacehealthpromotion/>
- Colten HR, Altevogt BM [2006]. Sleep disorders and sleep deprivation: an unmet public health problem. Washington, D.C.: National Academies. [https://www.ncbi.nlm.nih.gov/books/NBK19960/pdf/Bookshelf\\_NBK19960.pdf](https://www.ncbi.nlm.nih.gov/books/NBK19960/pdf/Bookshelf_NBK19960.pdf)
- DOL [n.d.]. YouthRules! Washington, DC: U.S. Department of Labor. <https://www.youthrules.gov/>
- Fabius R, Thayer R, Dixon BA, Konick DL, Yarborough CM, Peterson KW, Isaac F, Loeppke RR, Eisenberg BS, Dreger M [2013]. The link between workforce health and safety and the health of the bottom line: tracking market performance of companies that nurture a “culture of health.” *J Occup Environ Med* 55(9):993–1000.
- Galinsky TL, Swanson NG, Sauter SL, Hurrell JJ, Schleifer LM [2000]. A field study of supplementary rest breaks for data-entry operators. *Ergonomics* 43(5):622–638.
- Goetzel RZ, Ozminkowski RJ [2008]. The health and cost benefits of work site health-promotion programs. *Ann Rev Public Health* 29:303–323. [http://www.annualreviews.org/doi/full/10.1146/annurev.publhealth.29.020907.090930?url\\_ver=Z39.88-2003&rft\\_id=ori:rid:crossref.org&rft\\_dat=cr\\_pub%3dpubmed](http://www.annualreviews.org/doi/full/10.1146/annurev.publhealth.29.020907.090930?url_ver=Z39.88-2003&rft_id=ori:rid:crossref.org&rft_dat=cr_pub%3dpubmed)
- Goetzel RZ, Henke RM, Tabrizi M, Pelletier KR, Loeppke R, Ballard DW, Grossmeier J, Anderson DR, Yach D, Kelly RK, McCalister T, Serxner S, Selecky C, Shallenberger LG, Fries JF, Baase C, Isaac F, Crighton KA, Wald P, Exum E, Shurney D, Metz RD [2014]. Do workplace health promotion (wellness) programs work? *Am College Occup Environ Med* 56(9):927–934.
- Greenhouse S [2015]. In service sector, no rest for the working. *New York Times*, February 22, [https://www.nytimes.com/2015/02/22/business/late-to-bed-early-to-rise-and-working-tired.html?\\_r=0](https://www.nytimes.com/2015/02/22/business/late-to-bed-early-to-rise-and-working-tired.html?_r=0)
- Harvard School of Public Health [2016]. The workplace and health. NPR/Robert Wood Johnson Foundation/Harvard School of Public Health. [http://www.rwjf.org/content/dam/farm/reports/surveys\\_and\\_polls/2016/rwjf430330](http://www.rwjf.org/content/dam/farm/reports/surveys_and_polls/2016/rwjf430330)
- Iridiastadi H, Nussbaum MA [2006]. Muscle fatigue and endurance during repetitive intermittent static efforts: development of prediction models. *Ergonomics* 49(4):344–360.
- Katz LF, Krueger AB [2016]. The rise and nature of alternative work arrangements in the United States, 1995–2015. Harvard University and NBER; Princeton University and NBER. [https://krueger.princeton.edu/sites/default/files/akrueger/files/katz\\_krueger\\_cws\\_-\\_march\\_29\\_20165.pdf](https://krueger.princeton.edu/sites/default/files/akrueger/files/katz_krueger_cws_-_march_29_20165.pdf)
- Lambert SJ, Fugiel PJ, Henly HR [2014]. Schedule unpredictability among early career workers in the US labor market: a national snapshot (executive summary). University of Chicago. [https://ssascholars.uchicago.edu/sites/default/files/einet/files/lambert.fugiel.henly\\_.executive\\_summary.b\\_0.pdf](https://ssascholars.uchicago.edu/sites/default/files/einet/files/lambert.fugiel.henly_.executive_summary.b_0.pdf)
- Mukherjee S, Patel SR, Kales SN, Ayas NT, Strohl KP, Gozal D, Malhotra A [2015]. An official American Thoracic Society statement: the importance of healthy sleep. Recommendations and future priorities. *Am J Respir Crit Care Med* 191(12):1450–8.
- Mayo Clinic [2018]. Dehydration. <https://www.mayoclinic.org/diseases-conditions/dehydration/symptoms-causes/syc-20354086>
- National Sleep Foundation [2015]. 2015 Sleep in America® poll. Sleep and pain. <http://www.sleephealthjournal.org/pb/assets/raw/Health%20Advance/journals/sleh/2015SleepinAmericaPollSummaryofFindings.pdf>
- NIOSH [1997]. Plain language about shift work. By Rosa RR, Colligan MJ. DHHS (NIOSH) Publication No. 97-141. <https://www.cdc.gov/niosh/docs/97-145/pdfs/97-145.pdf>

- NIOSH [2002]. The changing organization of work and the safety and health of working people. By The NORA Organization of Work Team. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2002-116. <https://www.cdc.gov/niosh/docs/2002-116/>
- NIOSH [2004]. Overtime and extended work shifts: recent findings on illnesses, injuries, and health behaviors. By Caruso CC, Hitchcock EM, Dick RB, Russo JM, Schmit JM. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2004-143. <https://www.cdc.gov/niosh/docs/2004-143/default.html>
- NIOSH [2012a]. NIOSH Science Blog: sleep and work. By Caruso C, Rosa R. <https://blogs.cdc.gov/niosh-science-blog/2012/03/08/sleep-and-work/>
- NIOSH [2012b]. Preventing slips, trips, and falls in wholesale and retail trade establishments. By Anderson V, Afanuh S, and Bell J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2013-100. <https://www.cdc.gov/niosh/docs/2013-100/>
- NIOSH [2014] Total Worker Health Infographic: top reasons to create a new pathway for a safer and healthier workforce. <http://www.cdc.gov/niosh/twh/topreasons/infographic.html>
- NIOSH [2015a]. National health interview survey: occupational health supplement. <https://www.cdc.gov/niosh/topics/nhis/>
- NIOSH [2015b]. NIOSH Workplace Safety and Health Topic: Total Worker Health. <https://www.cdc.gov/niosh/twh/totalhealth.html>
- NIOSH [2015c]. NIOSH training for nurses on shift work and long work hours. By Caruso CC, Geiger-Brown J, Takahashi M, Trinkoff A, Nakata A. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2015-115. <https://www.cdc.gov/niosh/docs/2015-115/default.html>
- NIOSH [2017]. Using *Total Worker Health*® concepts to reduce the health risks from sedentary work. DHHS (NIOSH) Publication No. 2017-131. <https://www.cdc.gov/niosh/docs/wp-solutions/2017-131/>
- NIOSH [2018]. Wholesale and retail trade. <https://www.cdc.gov/niosh/about/strategicplan/musctrade.html>
- NORA Sector Council [2016]. Sleep deficiency, fatigue, pain, and loss of productivity in retail work. NORA Sector Council Bulletin: Wholesale and Retail Trade. Issue 7, July. <https://www.cdc.gov/niosh/programs/wrt/pdfs/wrt-sector-council-bulletinw3-2016-07-20.pdf>
- ODPHP [2015]. Dietary guidelines for Americans, 2015–2020. <https://health.gov/dietaryguidelines/2015/guidelines/>
- OHSU [2018]. Health impacts safety. Portland, OR: Oregon Institute of Occupational Health Sciences. <https://www.ohsu.edu/xd/research/centers-institutes/oregon-institute-occupational-health-sciences/outreach/impact.cfm>
- OPM [n.d.]. Work-life. Washington, DC: Office of Personnel Management. <https://www.opm.gov/policy-data-oversight/worklife/employee-assistance-programs/>
- OSHA [n.d.]. Long work hours, extended or irregular shifts, and worker fatigue. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration. <https://www.osha.gov/SLTC/workerfatigue/index.html>
- Rahman SA, Flynn-Evans EE, Aeschbach D, Brainard GC, Czeisler CA, Lockley SW [2014]. Diurnal spectral sensitivity of the acute alerting effects of light. *Sleep* 37(2):271–281.
- Schulte PA, Wagner GW, Ostry A, Blanciforti LA, Cutlip RG, Krajnak KM, Luster M, Munson AE, O’Callaghan JP, Parks CG, Simeonova PP, Miller DB [2007]. Work, obesity, and occupational safety and health. *Am J Public Health* 97(3): 428–436. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1805035/>
- Schulte PA, Pandalai S, Wulsin V, Chun H [2012]. Interaction of occupational and personal risk factors in workforce health and safety. *Am J Public Health* 102(3):434–448 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3487655/>
- Schulte PA, Schill AL, Guerin RJ, Bhattacharya A, Cunningham TR, Pandalai SP, Eggerth D, Stephenson CM [2015]. Considerations for incorporating “well-being” in public policy for workers and workplaces. *Am J Public Health* 105(8):e31–e44. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4504308/>
- Sorenson G, McLellan D, Dennerlein JT, Pronk NP, Allen JD, Boden LI, Okechukwu CA, Hashimoto D, Stoddard A, Wagner GR [2013]. Integration of health protection and health promotion: rationale, indicators, and metrics. *J Occup Med* 55(12):S12–S18. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4184212/>
- Techera U, Hallowell M, Stambaugh N, Littlejohn R [2016]. Cases and consequences of occupational fatigue: meta-analysis and systems model. *J Occup Environ Med* August. <https://www.ncbi.nlm.nih.gov/pubmed/27525527>

## For More Information

More information is available on the NIOSH website about the following programs and research:

*Total Worker Health\**

<https://www.cdc.gov/niosh/twh/letsgetstarted.html>

Work schedules: shift work and long hours

<https://www.cdc.gov/niosh/topics/workschedules/>

Wholesale and Retail Trade

<https://www.cdc.gov/niosh/programs/wrt/>

Healthy work design and well-being program

<https://www.cdc.gov/niosh/programs/hwd/default.html>

To receive documents or other information about occupational safety and health topics, contact NIOSH at

Phone: 1-800-CDC-INFO (1-800-232-4636)

TTY: 1-888-232-6348

Email: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)

or visit the NIOSH website at [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

For a monthly update on news at NIOSH, subscribe to *NIOSH eNews* by visiting [www.cdc.gov/niosh/eNews](http://www.cdc.gov/niosh/eNews)

• Mention of any company or product does not constitute  
• endorsement by the National Institute for Occupational  
• Safety and Health (NIOSH), Centers for Disease Control  
• and Prevention (CDC). In addition, citations to websites  
• external to NIOSH do not constitute NIOSH endorsement  
• of the sponsoring organizations or their programs or  
• products. Furthermore, NIOSH is not responsible for the  
• content of these websites. All web addresses referenced in  
• this document were accessible as of the publication date.

---

• **This document is in the public domain and may be freely**  
• **copied or reprinted. NIOSH encourages all readers of**  
• **the *Workplace Solutions* to make them available to all**  
• **interested employers and workers.**

---

• As part of the Centers for Disease Control and Prevention,  
• NIOSH is the Federal agency responsible for conducting  
• research and making recommendations to prevent work-  
• related illnesses and injuries. All *Workplace Solutions* are based  
• on research studies that show how worker exposures to hazard-  
• ous agents or activities can be significantly reduced.

• **DHHS (NIOSH) Publication No. 2019-102**  
• **DOI: <https://doi.org/10.26616/NIOSH PUB2019102>**

November 2018