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Workers Memorial Day — April 28, 2012

Workers Memorial Day recognizes those workers who have died or sustained work-related injuries or illnesses. In 2010, a total of 4,547 U.S. workers died from occupational injuries (*1*), and each year, approximately 49,000 deaths are attributed to work-related illnesses (*2*). For 2010, the Bureau of Labor Statistics reported that approximately 3.1 million workers in private industry and 820,000 in state and local government had a nonfatal occupational injury or illness (*3*). In 2010, an estimated 2.7 million workers were treated in emergency departments for occupational injuries and illnesses, and approximately 110,000 were hospitalized (CDC, unpublished data, 2012).

Economists are working to calculate the costs associated with occupational injuries and illnesses in the United States. Recent research estimates the cost of fatal injuries at $6 billion and the cost of fatal illnesses at $46 billion. Nonfatal injuries and illnesses are estimated to cost $186 billion and $12 billion annually (*4*). Additional information on workplace safety and health is available from CDC at http://www.cdc.gov/niosh.

References

1. Bureau of Labor Statistics, US Department of Labor. Economic news release: table 2. Fatal occupational injuries by industry and selected event or exposure, 2010 (preliminary). Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2012. Available at http://bls.gov/news.release/cfoi.t02.htm. Accessed April 19, 2012.
2. Steenland K, Burnett C, Lalich N, Ward E, Hurrell J. Dying for work: the magnitude of US mortality from selected causes of death associated with occupation. Am J Ind Med 2003;43:461–82.
3. Bureau of Labor Statistics, US Department of Labor. Economic news release: workplace injury and illness summary. Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2011. Available at http://www.bls.gov/news.release/osh.nr0.htm. Accessed April 19, 2012.
4. Leigh JP. Economic burden of occupational injury and illness in the United States. Millbank Q 2011;89:728–72.

Short Sleep Duration Among Workers — United States, 2010

Insufficient sleep can have serious and sometimes fatal consequences for fatigued workers and others around them (*1–3*). For example, an estimated 20% of vehicle crashes are linked to drowsy driving (*3*). The National Sleep Foundation recommends that healthy adults sleep 7–9 hours per day. To assess the prevalence of short sleep duration among workers, CDC analyzed data from the 2010 National Health Interview Survey (NHIS). The analysis compared sleep duration by age group, race/ethnicity, sex, marital status, education, and employment characteristics. Overall, 30.0% of civilian employed U.S. adults (approximately 40.6 million workers) reported an average sleep duration of ≤6 hours per day. The prevalence of short sleep duration (≤6 hours per day) varied by industry of employment (range: 24.1%–41.6%), with a significantly higher rate of short sleep duration among workers in manufacturing (34.1%) compared with all workers combined. Among all workers, those who usually worked the night shift had a much higher prevalence of short sleep duration (44.0%, representing approximately 2.2 million night shift workers) than those who worked the day shift (28.8%, representing approximately 28.3 million day shift workers). An especially high prevalence of short sleep duration was reported by night shift workers in the transportation and warehousing (69.7%) and health-care and social assistance (52.3%) industries.

INSIDE

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Targeted interventions, such as evidence-based shift system designs that improve sleep opportunities and evidence-based training programs on sleep and working hours tailored for managers and employees (*4*), should be implemented to protect the health and safety of workers, their coworkers, and the public.

NHIS collects information about the health and health care of the noninstitutionalized, civilian population in the United States using nationally representative samples. Interviews are conducted in respondents' homes. Questions about average sleep duration,* employment status, and industry of employment are asked of a randomly selected adult within each family in the household as part of the core sample adult questionnaire that changes little from year to year. For this study, short sleep duration was defined as ≤6 hours of sleep in a 24-hour period, on average. NHIS obtains verbatim responses from each of the employed, randomly selected, adult respondents (aged ≥18 years) in the subsample regarding his or her employer's type of business (industry). These responses are reviewed by U.S. Census Bureau coding specialists who assign 4-digit industry codes based on the 1997 North American Industrial Classification System. This analysis used the 21 simple 2-digit industry recodes provided in the NHIS public dataset. In 2010, CDC's National Institute for Occupational Safety and Health (NIOSH) sponsored supplemental questions in NHIS about occupational health, including a question about the usual shift worked.

For this analysis, the usual shift worked was categorized as regular daytime, regular night, or other (regular evening, rotating shift, or some other schedule). Weighted data were used to produce national estimates of short sleep duration by industry of employment and usual shift worked. Point estimates and estimates of corresponding variances were calculated using statistical software to account for the complex sample design. Statistical significance was defined as $p<0.05$. Results based on fewer than 10 workers are not shown because of the instability of these estimates. Estimates are based on data collected from 15,214 sample adults employed at the time of interview who reported their average sleep duration. The final sample adult response rate was 60.8%.

Short sleep duration (average ≤6 hours per 24-hour period) was reported by 30.0% of employed U.S. adults (approximately 40.6 million workers) (Table 1). The majority of workers included in the survey (72.6%), reported that they usually worked a regular daytime shift; 3.7% worked a regular night shift, and 23.5% worked some other shift.† Workers who usually worked the night shift were significantly more likely to report short sleep duration (44.0%) than those who worked the day shift (28.8%) or some other shift (31.6%). However, this translates into approximately 2.2 million night shift workers with

* NHIS asked, "On average, how many hours of sleep do you get in a 24-hour period?" Answers were recorded as whole numbers of hours.

† 5.3% of employed adults worked a regular evening shift, 9.5% worked a rotating shift, 8.7% worked some other shift, and data were missing for 0.2%.

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short sleep duration compared with approximately 28.3 million day shift workers with short sleep duration. Among workers in all shifts, workers in the middle age groups of 30–44 years (31.6%) and 45–64 years (31.8%) were significantly more likely than workers aged 18–29 years (26.5%) or ≥65 years (21.7%) to report short sleep duration (Table 1).

Non-Hispanic black workers (38.9%), non-Hispanic workers of other races (35.3%), and non-Hispanic Asian workers (33.2%) were significantly more likely to report short sleep duration than non-Hispanic white workers (28.6%) or Hispanic workers (28.8%). Workers who were widowed, divorced, or separated (36.4%) were significantly more likely than workers who were currently married (29.4%) or those who had never been married (28.2%) to report short sleep duration. Workers with educational status equivalent to a high school diploma (33.7%) or some college (33.8%) were significantly more likely than workers with less (29.1%) or more (26.7%) education to report short sleep duration.

The prevalence of short sleep duration was significantly higher among workers with more than one job (37.0%) than among those with one job (29.4%), and significantly higher among workers who worked more than 40 hours per week (36.2%) than among those who worked 40 hours or less (27.7%). When stratified by shift, similar patterns were observed among day shift workers and workers with non-day or non-night schedules (evening, rotating, or other) regarding differences in short sleep duration by demographic characteristics (Table 1).

Among workers on all shifts, workers employed in the manufacturing industry sector (34.1%) were significantly more likely, and workers employed in "other services" industries (24.1%) were significantly less likely, to report short sleep duration than workers in all industries combined (30.1%) (Table 2). Among night shift workers, workers employed in the transportation and warehousing sector (69.7%) were significantly more likely, and workers employed in arts, entertainment, and recreation industries (9.8%) were significantly less likely, to report short sleep duration than night shift workers in all industries combined (44.0%) (Table 2). The prevalence of short sleep duration among night shift workers in the health-care and social assistance sector (52.3%) also was notably high, although not significantly different from the prevalence among all night shift workers.

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What is already known on this topic?

According to National Health Interview Survey (NHIS) data from 2004–2007, the prevalence of self-reported short sleep duration (≤6 hours per day) among U.S. workers increased over the past 2 decades and varied by industry and occupation; however, 2010 was the first year that the NHIS included a question about the usual shift worked.

What is added by this report?

Data from the 2010 NHIS substantiate previous findings and indicate that, among all adult workers, 30.0% report short sleep duration. Those who usually worked the night shift had a much higher prevalence of short sleep duration (44.0%) than those who worked the day shift (28.8%). An especially high prevalence of short sleep duration among night shift workers was found in the transportation and warehousing (69.7%) industry.

What are the implications for public health practice?

Because short sleep duration is associated with various adverse health effects and with decreased workplace safety, targeted interventions are needed to increase the proportion of adults who get sufficient sleep. In-depth examination of work hours and scheduling with respect to industry can guide employers in the design of schedules that afford more opportunity for workers to sleep. Evidence-based training programs on sleep and working hours tailored for managers and employees promote better sleep habits for workers on any shift.

Editorial Note

In recognition of the importance of adequate sleep to public health, *Healthy People 2020* includes objective SH-4: "Increase the proportion of adults who get sufficient sleep."[§] A previous study using NHIS data from 2004–2007 reported that the prevalence of self-reported short sleep duration among U.S. workers had increased during the past 2 decades and varied by industry and occupation (*5*). That study found a high prevalence of short sleep among workers employed in industries likely to have nonstandard work schedules (e.g., manufacturing and transportation and warehousing), but those earlier findings were limited by a lack of data on individual workers' shifts.

In 2010, NHIS included a question about the usual shift worked. In 2010, the overall prevalence of short sleep duration remained high among workers in manufacturing. The prevalence also appeared high among workers in transportation and warehousing, mining, utilities, and public administration, but these rates were not significantly different from the prevalence among all workers, possibly because of small subsamples in these sectors. Among all workers, those who usually worked the night shift had a much higher prevalence of short sleep

[§] Defined by *HealthyPeople 2020* objective SH-4 as ≥8 hours for those aged 18–21 years and ≥7 hours for those aged ≥22 years on average during a 24-hour period. Available at http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=38.

TABLE 1. Percentage* of employed civilian workers who reported short sleep duration (average ≤6 hours per 24-hour period), by demographic and employment characteristics and usual shift worked — National Health Interview Survey (NHIS), United States, 2010

Characteristic	No.†	All shifts§		Regular daytime shift		Regular night shift		Other shift¶	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Total	**15,214**	**30.0**	**(29.2–30.9)**	**28.8**	**(27.8–29.9)**	**44.0**	**(38.8–49.4)**	**31.6**	**(29.7–33.6)**
Sex									
Male	7,435	29.8	(28.6–31.0)	28.8	(27.4–30.2)	41.7	(34.6–49.2)	31.1	(28.5–33.8)
Female	7,779	30.3	(29.2–31.5)	28.9	(27.6–30.3)	46.6	(39.7–53.5)	32.2	(29.4–35.2)
Age group (yrs)									
18–29	3,367	26.5	(24.7–28.3)	24.6	(22.4–27.0)	37.4	(28.3–47.0)	27.9	(24.8–31.3)
30–44	5,366	31.6	(30.1–33.2)	29.4	(27.7–31.1)	51.1	(42.8–59.4)	36.2	(33.0–39.7)
45–64	5,752	31.8	(30.5–33.1)	31.1	(29.6–32.7)	46.4	(39.0–53.8)	32.8	(29.8–36.1)
≥65	729	21.7	(18.4–25.4)	21.1	(17.2–25.7)	0.0	—	23.7	(17.8–30.9)
Race/Ethnicity									
White, non-Hispanic	8,706	28.6	(27.5–29.6)	27.6	(26.4–28.8)	44.8	(38.8–49.4)	29.6	(27.3–32.1)
Black, non-Hispanic	2,211	38.9	(36.1–41.8)	38.1	(34.7–41.6)	45.6	(35.6–55.9)	39.5	(34.0–45.3)
Asian, non-Hispanic	1,008	33.2	(29.7–36.9)	32.7	(29.0–36.7)	42.6	(25.8–61.4)	32.7	(24.3–42.4)
Other, non-Hispanic	294	35.3	(29.0–42.2)	37.4	(29.4–46.1)	28.1	(13.0–50.6)	31.7	(21.9–43.6)
Hispanic	2,995	28.8	(26.9–30.7)	26.4	(24.2–28.8)	42.7	(33.3–52.7)	33.8	(29.5–38.3)
Marital status									
Married/Living with partner	8,209	29.4	(28.3–30.5)	28.2	(27.8–29.9)	47.0	(40.5–53.7)	31.3	(28.8–34.0)
Widowed/Divorced/Separated	3,032	36.4	(34.3–38.5)	35.0	(32.6–37.5)	42.7	(32.3–53.7)	40.0	(35.7–44.4)
Never married	3,947	28.2	(26.4–30.0)	26.7	(24.6–29.0)	39.1	(29.7–49.5)	28.8	(14.2–82.1)
Education									
Less than high school diploma	1,532	29.1	(26.4–31.9)	27.2	(24.0–30.6)	39.9	(27.5–53.9)	33.4	(27.5–39.8)
High school or GED diploma	3,219	33.7	(31.9–35.6)	32.2	(30.0–34.5)	39.9	(30.7–49.9)	37.0	(32.9–41.4)
Some college	4,051	33.8	(32.0–35.5)	32.5	(30.5–34.4)	54.1	(44.6–63.3)	34.7	(31.0–38.6)
College degree	4,773	26.7	(25.2–28.2)	25.8	(24.1–27.4)	44.6	(32.5–57.5)	29.7	(26.1–33.5)
No. of current jobs									
1	13,879	29.4	(28.5–30.3)	28.2	(27.1–29.3)	42.2	(36.8–47.9)	31.2	(29.1–33.4)
>1	1,312	37.0	(34.0–40.0)	36.7	(32.9–40.7)	60.5	(45.6–73.7)	34.5	(29.3–40.1)
Weekly work hours									
≤40	11,203	27.7	(26.7–28.6)	27.1	(26.0–28.3)	38.8	(33.0–45.0)	27.6	(25.6–29.7)
>40	3,910	36.2	(34.3–38.1)	33.4	(31.3–35.5)	58.1	(48.7–66.9)	42.4	(38.2–46.6)

Abbreviations: CI = confidence interval; GED = General Educational Development.
* Weighted using NHIS sample adult weights.
† Unweighted sample.
§ Among workers, 72.6% reported that they usually worked a regular daytime shift, 3.7% worked a regular night shift, and 23.5% worked some other shift.
¶ Includes regular evening shift, rotating shift, and some other shift.

duration than those who worked the day shift, although a much higher number of workers with short sleep duration worked the day shift. An especially high prevalence of short sleep duration among night shift workers was found in the transportation and warehousing and health-care and social assistance industries.

Previous research has suggested many reasons for associations between short sleep duration and work factors such as usual shift worked and industry of employment. Although the effects of work might interact with lifestyle factors and stress at home, some studies have suggested that work factors remain important after adjusting for many potential confounders (*6, 7*). In addition to the quantity of hours worked affecting the opportunity for sleep, the timing of hours available for sleep can affect sleep duration through circadian disruption. Attempts to sleep during daylight hours, when melatonin levels decline and body temperature rises, usually result in shorter sleep episodes and more wakefulness (*8,9*).

Differences in the industry sectors of employment with the highest prevalence of short sleep duration after stratification by usual shift worked suggest that industry factors and shift factors both might influence workers' sleep opportunities. For example, manufacturing workers on all shifts combined have a high prevalence of short sleep duration compared with all workers in all sectors, but manufacturing employees working night shifts are not significantly different than night shift workers overall with respect to the prevalence of short sleep duration. On the other hand, the especially high prevalence of short sleep duration among transportation and warehousing workers on the night shift suggests that characteristics of night shift work specific to this sector might exist that have a particularly detrimental effect on sleep duration.

The findings in this report are subject to at least four limitations. First, average sleep duration (in whole hours) is self-reported, and no distinction is made between the amount of sleep obtained on work days compared with nonwork days. Second, differences in the prevalence of short sleep duration among workers working different shifts and employed in different industries might be confounded by other nonoccupational variables (e.g., age or

TABLE 2. Percentage* of employed civilian workers who reported short sleep duration (average ≤6 hours per 24-hour period), by industry sector and usual shift worked — National Health Interview Survey (NHIS), United States, 2010

Industry sector†	No.§	All shifts¶		Regular daytime shift		Regular night shift		Other shift**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Agriculture, forestry, fishing, and hunting (11)	184	26.2	(19.3–34.5)	26.9	(17.9–38.4)	—§§	—§§	23.2	(11.9–40.2)
Mining (21)	67	41.6	(26.1–59.0)	33.6	(15.3–58.7)	—§§	—§§	40.9	(21.9–63.0)
Utilities (22)	130	38.0	(28.4–48.6)	38.0	(28.0–49.1)	—§§	—§§	32.3	(14.7–57.0)
Construction (23)	923	29.0	(25.8–32.5)	27.9	(24.4–31.6)	—§§	—§§	38.3	(29.5–47.8)
Manufacturing (31–33)	1,402	34.1	(31.2–37.1)	33.5	(30.2–36.9)	41.4	(29.6–54.3)	34.5	(28.2–41.4)
Wholesale trade (42)	356	30.7	(25.2–36.8)	29.7	(23.8–36.5)	35.7	(12.0–69.4)	36.9	(23.5–52.6)
Retail trade (44–45)	1,532	30.3	(27.3–33.5)	28.8	(24.9–33.0)	36.4	(24.6–50.1)	31.7	(26.9–37.0)
Transportation and warehousing (48–49)	626	32.7	(28.4–37.3)	30.8	(25.4–36.8)	69.7	(50.8–83.7)	29.1	(22.1–37.2)
Information (51)	394	28.3	(23.6–33.5)	29.3	(23.9–35.5)	—††	—††	21.4	(12.9–33.3)
Finance and insurance (52)	670	27.4	(23.4–31.8)	26.5	(22.5–30.8)	—††	—††	32.4	(19.6–48.5)
Real estate, rental, and leasing (53)	298	28.1	(22.4–34.7)	26.5	(19.8–34.4)	—††	—††	29.6	(18.9–43.2)
Professional, scientific, and technical service (54)	1,007	28.2	(25.4–31.2)	27.9	(24.9–31.1)	—††	—††	30.3	(22.7–39.2)
Management of companies and enterprises (55)	9	—††	—††	—††	—††	—††	—††	—§	—††
Administrative support, waste management, and remediation services (56)	717	29.7	(25.9–33.8)	26.3	(22.0–31.1)	29.8	(15.2–50.0)	38.4	(30.9–46.5)
Education services (61)	1,500	27.3	(24.6–30.1)	26.9	(24.0–30.0)	31.7	(12.0–61.2)	30.1	(23.2–38.0)
Health care and social assistance (62)	2,196	32.0	(29.7–34.3)	28.9	(26.5–31.5)	52.3	(42.9–61.6)	36.6	(31.9–41.7)
Arts, entertainment, and recreation (71)	309	30.7	(25.2–36.9)	31.2	(23.8–39.8)	9.8	(2.2–33.8)	32.0	(23.8–41.5)
Accommodation and food service (72)	1,027	28.4	(25.0–32.0)	31.5	(26.4–37.1)	37.8	(25.9–51.4)	24.2	(20.1–28.8)
Other services, except public administration (81)	808	24.1	(20.6–28.1)	22.2	(18.4–26.5)	—††	—††	29.4	(21.7–38.5)
Public administration (92)	836	34.3	(30.1–38.8)	32.9	(28.1–38.0)	44.1	(24.4–65.9)	38.9	(29.8–48.7)

Abbreviation: CI = confidence interval.
* Weighted using NHIS sample adult weights.
† As designated in the 2007 North American Industry Classification System; available at http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007.
§ Unweighted sample.
¶ Among workers, 72.6% reported that they usually worked a regular daytime shift, 3.7% worked a regular night shift, and 23.5% worked some other shift.
** Includes regular evening shift, rotating shift, and some other shift.
†† Results based on <10 workers are not shown.

race/ethnicity). Third, broad industry categories were used for this analysis. A drawback to using broad industry categories is that they aggregate workers who likely have substantially different working conditions. On the other hand, using narrower industry categories would result in smaller subsamples, leading to wider confidence intervals and more estimates that are too unstable to report. Finally, the final sample response rate was only 60.8%.

Because short sleep duration is associated with various adverse health effects (e.g., cardiovascular disease or obesity) (*1*), decreased workplace and public safety, and impaired job performance (*2,3,10*), targeted interventions are needed to increase the proportion of adults who get sufficient sleep.¶ In-depth examination of work hours and scheduling with respect to industry can guide employers in the design of schedules that increase the probability that workers will be able to sleep during their rest times. For example, rotating workers forward from evening to night shifts rather than backwards from night to evening shifts makes it easier for circadian rhythms to adjust so that workers can sleep during their rest times (*4*). NIOSH currently is developing evidence-based training programs on sleep and working hours tailored for managers and employees in the manufacturing, mining, nursing, retail, and trucking industries. Further explorations of the relationship between work and sleep are needed.

¶ Additional information is available at http://www.cdc.gov/sleep/index.htm.

References

1. Grandner MA, Patel NP, Gehrman PR, Perlis ML, Pack AI. Problems associated with short sleep: bridging the gap between laboratory and epidemiological studies. Sleep Med Rev 2010;14:239–47.
2. Lombardi DA, Folkard S, Willetts JL, Smith GS. Daily sleep, weekly working hours, and risk of work-related injury: US National Health Interview Survey (2004–2008). Chronobiol Int 2010;27:1013–30.
3. Colten HR, Altevogt BM. Sleep disorders and sleep deprivation: an unmet public health problem. Washington, DC: National Academies Press; 2006.
4. Knauth P, Hornberger S. Preventive and compensatory measures for shift workers. Occup Med (Lond) 2003;53:109–16.
5. Luckhaupt SE, Tak SW, Calvert GM. The prevalence of short sleep duration by industry and occupation in the National Health Interview Survey. Sleep 2010;33:149–59.
6. Pilcher JJ, Lambert BJ, Huffcutt AI. Differential effects of permanent and rotating shifts on self-report sleep length: a meta-analytic review. Sleep 2000;23:155–63.
7. Burgard S, Ailshire J. Putting work to bed: stressful experiences on the job and sleep quality. Population Studies Center research report 08-652. Ann Arbor, MI: University of Michigan; 2008. Available at http://www.psc.isr.umich.edu/pubs/pdf/rr08-652.pdf.
8. Dijk DJ, Duffy JF, Riel E, Shanahan TL, Czeisler CA. Ageing and the circadian and homeostatic regulation of human sleep during forced desynchrony of rest, melatonin and temperature rhythms. J Physiol 1999; 516:611–27.
9. Czeisler CA, Weitzman ED, Moore-Ede MC, Zimmerman JC, Knauer RS. Human sleep: its duration and organization depend on its circadian phase. Science 1980;210:1264–7.
10. Lockley SW, Cronin JW, Evans EE, et al. Effect of reducing interns' weekly work hours on sleep and attentional failures. N Engl J Med 2004;351:1829–37.