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Workers' Memorial Day — April 28, 2016

Workers' Memorial Day, observed annually on April 28, recognizes workers who suffered or died because of exposures to hazards at work. In 2014, 4,679 U.S. workers died from work-related injuries (*1*). Although deaths from work-related injuries are captured by surveillance systems, most deaths from work-related illness are not. In 2007, an estimated 53,445 deaths from work-related illness occurred (*2*). In 2014, employers reported approximately 3 million nonfatal injuries and illnesses to private industry workers and 722,000 to state and local government workers (*3*); an estimated 2.7 million work-related injuries were treated in emergency departments, resulting in 113,000 hospitalizations (National Institute for Occupational Safety and Health (CDC-NIOSH), unpublished data, 2016)*

Occupational injuries and illnesses also have economic costs. The societal cost of work-related fatalities, injuries, and illnesses was estimated at $250 billion in 2007 on the basis of methods that focus on medical costs and productivity losses (*2*).

New estimates of worker hearing impairment from the CDC-NIOSH Occupational Hearing Loss Surveillance program are reported in this issue of *MMWR*. The audiometric data analyzed in this report represent one example of existing health data that CDC-NIOSH uses for occupational health surveillance.

* http://www.cdc.gov/niosh/topics/surveillance/default.html.

References

1. Bureau of Labor Statistics. National Census of Fatal Occupational Injuries in 2014 preliminary results [Table 2]. Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2015. http://www.bls.gov/news.release/pdf/cfoi.pdf
2. Leigh JP. Economic burden of occupational injury and illness in the United States. Milbank Q 2011;89:728–72. http://dx.doi.org/10.1111/j.1468-0009.2011.00648.x
3. Bureau of Labor Statistics. Employer-reported workplace injuries and illnesses in 2014 [Table 2]. Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2015. http://www.bls.gov/news.release/pdf/osh.pdf

Hearing Impairment Among Noise-Exposed Workers — United States, 2003–2012

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Hearing loss is the third most common chronic physical condition in the United States, and is more prevalent than diabetes or cancer (*1*). Occupational hearing loss, primarily caused by high noise exposure, is the most common U.S. work-related illness (*2*). Approximately 22 million U.S. workers are exposed to hazardous occupational noise (*3*). CDC compared the prevalence of hearing impairment within nine U.S. industry sectors using 1,413,789 noise-exposed worker audiograms from CDC's National Institute for Occupational Safety and Health (NIOSH) Occupational Hearing Loss Surveillance Project (*4*). CDC estimated the prevalence at six hearing impairment levels, measured in the better ear, and the impact on quality of life expressed as annual disability-adjusted life years (DALYs), as defined by the 2013 Global Burden of Disease (GBD) Study (*5*). The mining sector had the highest prevalence of workers with any hearing impairment, and with moderate or worse

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impairment, followed by the construction and manufacturing sectors. Hearing loss prevention, and early detection and intervention to avoid additional hearing loss, are critical to preserve worker quality of life.

The NIOSH Occupational Hearing Loss Surveillance Project collects de-identified audiograms* for U.S. workers (*4*) who were tested to comply with regulatory requirements because of high occupational noise exposure, defined as ≥85 decibels on the A-scale (dBA).† Audiometric service providers and others that perform worker testing agreed to share these data with NIOSH. A cross-sectional retrospective cohort analysis was conducted using the last audiogram completed for each worker during 2003–2012. Audiograms missing necessary fields or with other quality issues, having hearing threshold values that suggested testing errors, or displaying attributes unlikely to be primarily caused by occupational exposures, were excluded (*4*). Industries were classified using the 2007 North American Industry Classification System.§

The prevalences of six severity levels of hearing impairment were calculated for workers in each industry sector using the audiometric definitions from the GBD Study (Table 1) (*5*), except that workers in this sample who had hearing aids did not wear them during testing. DALYs representing the number of healthy years lost per 1,000 workers each year were calculated by industry sector using the GBD Study disability weights (Table 1).¶ Tinnitus information required to calculate the DALYs was not available in the NIOSH Occupational Hearing Loss Surveillance Project sample and was estimated using results from previous studies (*6*,*7*).**

The final sample included 1,413,789 audiograms for workers employed by 25,908 U.S. companies during 2003–2012. Among 99% of audiograms for which information on the worker's sex was available, 78% were recorded for males and 22% for females. A greater percentage of males had any hearing impairment (14%) than did females (7%), and the prevalence and severity of impairment increased with age (Table 2) for

* Audiograms are the results of hearing tests.

† Decibel is a unit of measure of the intensity (or loudness). The A-scale is used because it corresponds better to the sound intensities perceived by the human ear at low frequencies.

§ North American Industry Classification System (NAICS) codes range from two-digit to six-digit numbers and industry specificity increases with each digit (https://www.census.gov/eos/www/naics/).

¶ For morbid conditions, such as hearing impairment, the burden over a one-year period is represented by a "disability weight" between 0 and 1, representing life limitations as a lost fraction of a year of healthy life. Because the most recent audiograms for workers were used to characterize hearing impairment, the DALY results are an estimate of the annual number of DALYs per 1,000 workers in the year of the last audiogram, and a minimum estimate of DALYs in following years. Thus, the DALY results are estimates of the annual DALYs per 1,000 workers as of 2012, the last year included in the analysis.

** Tinnitus prevalences were estimated using results for U.S. noise-exposed workers with daily or more frequent tinnitus comorbid with hearing loss (http://onlinelibrary.wiley.com/doi/10.1002/ajim.22565/epdf) and proportions of the general population experiencing daily tinnitus by GBD Study level of hearing impairment (http://www.who.int/healthinfo/statistics/GlobalDALYmethods_2000_2011.pdf). Tinnitus prevalence estimates for each level of hearing impairment severity for the DALYs calculations were as follows: mild (18.40%); moderate (26.58%); moderately severe (28.61%); severe (55.79%); profound (56.42%); and complete (47.97%).

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TABLE 1. Hearing impairment audiometric definitions, and Global Burden of Disease (GBD) Study disability weights and lay descriptions

Severity of hearing impairment	Audiometric definition*	GBD Study disability weight (no tinnitus)	GBD Study disability weight (with tinnitus)	GBD Study lay description (no tinnitus)	GBD Study lay description (with tinnitus)
Mild	20–34 dB† average hearing threshold level across 500, 1,000, 2,000, and 4,000 Hz in the better ear	0.01	0.021	Has great difficulty hearing and understanding another person talking in a noisy place (for example, on an urban street)	Has great difficulty hearing and understanding another person talking in a noisy place (for example, on an urban street), and sometimes has annoying ringing in the ears
Moderate	35–49 dB average hearing threshold level across 500, 1,000, 2,000, and 4,000 Hz in the better ear	0.027	0.074	Is unable to hear and understand another person talking in a noisy place (for example, on an urban street), and has difficulty hearing another person talking even in a quiet place or on the phone	Is unable to hear and understand another person talking in a noisy place (for example, on an urban street), has difficulty hearing another person talking even in a quiet place or on the phone, and has annoying ringing in the ears for 5 minutes at a time, almost every day
Moderately severe	50–64 dB average hearing threshold level across 500, 1,000, 2,000, and 4,000 Hz in the better ear	Not calculated by GBD Study	Not calculated by GBD Study	Not generated by the GBD Study	Not generated by the GBD Study
Severe	65–79 dB average hearing threshold level across 500, 1,000, 2,000, and 4,000 Hz in the better ear	0.158	0.261	Is unable to hear and understand another person talking, even in a quiet place, and unable to take part in a phone conversation. Difficulties with communicating and relating to others cause emotional impact at times (for example, worry or depression)	Is unable to hear and understand another person talking, even in a quiet place, is unable to take part in a phone conversation, and has annoying ringing in the ears for more than 5 minutes at a time, almost every day. Difficulties with communicating and relating to others cause emotional impact at times (for example, worry or depression)
Profound	80–94 dB average hearing threshold level across 500, 1,000, 2,000, and 4,000 Hz in the better ear	0.204	0.277	Is unable to hear and understand another person talking, even in a quiet place, is unable to take part in a phone conversation, and has great difficulty hearing anything in any situation. Difficulties with communicating and relating to others often cause worry, depression or loneliness	Is unable to hear and understand another person talking, even in a quiet place, is unable to take part in a phone conversation, has great difficulty hearing anything in any situation, and has annoying ringing in the ears for more than 5 minutes at a time, several times a day. Difficulties with communicating and relating to others often cause worry, depression or loneliness
Complete	95 dB or greater average hearing threshold level across 500, 1,000, 2,000, and 4,000 Hz in the better ear	0.215	0.316	Cannot hear at all in any situation, including even the loudest sounds, and cannot communicate verbally or use a phone. Difficulties with communicating and relating to others often cause worry, depression or loneliness	Cannot hear at all in any situation, including even the loudest sounds, and cannot communicate verbally or use a phone, and has very annoying ringing in the ears for more than half of the day. Difficulties with communicating and relating to others often cause worry, depression or loneliness

Abbreviations: dB = decibel; Hz = hertz.
* These are the same as GBD Study audiometric definitions, except that the workers in this sample with hearing aids did not wear them during testing.
† dB is a unit of measure of the intensity (or loudness) of a sound.

both sexes. Among all industries, 13% of noise-exposed workers had any impairment and 2% had moderate or worse impairment (Table 3). Workers with hearing impairment were represented in all industry sectors, with sharply decreasing numbers of workers with higher levels of impairment. The mining sector had the highest prevalence of workers with any impairment (17%) and with moderate or worse impairment (3%), followed by the construction sector (any impairment = 16%, moderate or worse impairment = 3%), and the manufacturing sector (14% and 2%). The public safety sector, which includes police protection, fire protection (including wildland firefighters), corrections, and ambulance services, had the lowest prevalence of workers with any impairment (7%).

Across all industries, 2.53 healthy years were lost annually per 1,000 noise-exposed workers (Table 3). Mild impairment accounted for 52% of all healthy years lost and moderate impairment accounted for 27%. Workers

TABLE 2. Sample demographics for 1,413,789 workers in the United States,* with prevalence by hearing impairment severity,† 2003–2012

Characteristic	Total (%)	No hearing impairment	Any hearing impairment (mild–complete)	Mild	Moderate	Moderately severe	Severe	Profound	Complete
		No. (prevalence %)	No. (prevalence %)	No. (prevalence %)	No. (prevalence %)	No. (prevalence %)	No. (prevalence %)	No. (prevalence %)	No. (prevalence %)
Sex									
Male	**1,087,936 (78.11)**	929,487 (85.44)	158,449 (14.45)	132,434 (12.17)	21,385 (1.97)	3,625 (0.33)	722 (0.07)	204 (0.02)	79 (0.01)
Female	**304,830 (21.89)**	282,700 (92.74)	22,130 (7.26)	18,941 (6.21)	2,375 (0.78)	560 (0.18)	182 (0.06)	57 (0.02)	15 (<0.01)
Missing	**21,023**	NA	NA	NA	NA	NA	NA	NA	NA
Age group (yrs)									
18–25	**222,675 (15.75)**	218,724 (98.23)	3,951 (1.77)	3,299 (1.48)	378 (0.17)	166 (0.07)	66 (0.03)	27 (0.01)	15 (0.01)
26–35	**333,461 (23.59)**	322,504 (96.71)	10,957 (3.29)	9,462 (2.84)	974 (0.29)	312 (0.09)	128 (0.04)	57 (0.02)	24 (0.01)
36–45	**348,350 (24.64)**	320,260 (91.94)	28,090 (8.06)	25,020 (7.18)	2,267 (0.65)	564 (0.16)	152 (0.04)	69 (0.02)	18 (0.01)
46–55	**330,934 (23.41)**	265,640 (80.27)	65,294 (19.73)	56,837 (17.17)	6,962 (2.10)	1,137 (0.34)	275 (0.08)	58 (0.02)	25 (0.01)
56–65	**164,807 (11.66)**	98,403 (59.71)	66,404 (40.29)	52,935 (32.12)	11,427 (6.93)	1,717 (1.04)	265 (0.16)	49 (0.03)	11 (0.01)
66–75	**13,562 (0.96)**	5,280 (38.93)	8,282 (61.07)	5,777 (42.60)	2,095 (15.45)	365 (2.69)	39 (0.29)	5 (0.04§)	1 (¶)
Missing	—	—	—	—	—	—	—	—	—

Abbreviation: NA = not available.
* Worker representation in states of employment as condensed into six geographical regions based on the U.S. Embassy region groupings (http://usa.usembassy.de/travel-regions.htm) were the following: Mid-Atlantic with 244,930 workers (17.64%); Midwest with 641,487 workers (46.20%); New England with 11,255 workers (0.81%); South with 267,941 workers (19.30%); Southwest with 24,499 workers (1.76%); and West with 198,537 workers (14.30%). There were missing geographical region values for 25,140 workers.
† Hearing impairment severity audiometric definitions and lay descriptions are provided in Table 1. Hearing impairment was measured in the better ear.
§ This estimate has a relative standard error ≥30% and <50% and should be used with caution as it does not meet standards of reliability/precision.
¶ Estimate not shown as it has a relative standard error ≥50% and does not meet standards of reliability/precision.

TABLE 3. Annual number of disability-adjusted life years (DALYs) per 1,000 workers,* by industry sector, and estimated prevalence of workers with hearing impairment and percent of DALYs, by severity level† and industry sector — 1,413,789 workers in the United States, 2003–2012

Industry sector (NAICS 2007 Code)	Total (%)	DALYs/1,000 workers§	Total % DALYs per sector¶	Measure	Hearing impairment severity: No hearing impairment	Hearing impairment severity: Any hearing impairment (mild–complete)
All industries	**1,413,789 (100)**	2.53	100.00	No. (prevalence %)	1,230,811 (87.06)	182,978 (12.94)
				% DALYs within sector	—	100
Agriculture, forestry, fishing and hunting (11, except 115310)	**15,945 (1.13)**	2.17	0.97	No. (prevalence %)	14,171 (88.87)	1,774 (11.13)
				% DALYs within sector	—	100
Mining, quarrying, and oil and gas extraction (21)	**7,274 (0.51)**	3.45	0.70	No. (prevalence %)	6,058 (83.28)	1,216 (16.72)
				% DALYs within sector	—	100
Construction (23)	**35,969 (2.55)**	3.09	3.11	No. (prevalence %)	30,109 (83.71)	5,860 (16.29)
				% DALYs within sector	—	100
Manufacturing (31–33)	**932,686 (66.01)**	2.66	69.52	No. (prevalence %)	804,548 (86.26)	128,138 (13.74)
				% DALYs within sector	—	100
Wholesale and retail trade (42, 44–45)	**110,299 (7.81)**	2.57	7.95	No. (prevalence %)	95,904 (86.95)	14,395 (13.05)
				% DALYs within sector	—	100
Transportation, warehousing and utilities (48, 49, 22)	**153,272 (10.85)**	1.54	6.60	No. (prevalence %)	141,181 (92.11)	12,091 (7.89)
				% DALYs within sector	—	100
Healthcare and social assistance (62, except 62191)	**8,056 (0.57)**	2.69	0.61	No. (prevalence %)	7,020 (87.14)	1,036 (10.51)
				% DALYs within sector	—	100
Public safety (115310, 62191, 92212, 92214, 92216)	**13,974 (0.99)**	1.30	0.51	No. (prevalence %)	12,951 (92.68)	1,023 (7.32)
				% DALYs within sector	—	100
Services (51–56, 61, 71–72, 81, 92 [except 92212, 92214, 92216])	**135,524 (9.59)**	2.61	9.92	No. (prevalence %)	118,192 (87.21)	17,332 (12.79)
				% DALYs within sector	—	100

See table footnotes on next page.

in the mining and construction sectors lost 3.45 and 3.09 healthy years per 1,000 workers, respectively. Overall, 66% of the sample worked in the manufacturing sector and represented 70% of healthy years lost by all workers. Public safety workers lost 1.30 healthy years per 1,000 workers, the fewest among all workers.

Discussion

Findings of increasing prevalence with age and a higher prevalence among males were expected and consistent with other research (*2*,*4*,*8*). Industry results highlight the high prevalence of hearing loss within the noise-exposed working population

TABLE 3. (Continued) Annual number of disability-adjusted life years (DALYs) per 1,000 workers,* by industry sector, and estimated prevalence of workers with hearing impairment and percent of DALYs, by severity level† and industry sector — 1,413,789 workers in the United States, 2003–2012

		Hearing impairment severity					
Industry sector (NAICS 2007 Code)	**Measure**	**Mild**	**Moderate**	**Moderately severe**	**Severe**	**Profound**	**Complete**
All industries	No. (prevalence %)	153,330 (10.85)	24,103 (1.70)	4,261 (0.30)	925 (0.07)	265 (0.02)	94 (0.01)
	% DALYs within sector	51.64	26.66	4.83–22.38**	5.58	1.82	0.69
Agriculture, forestry, fishing and hunting (11, except 115310)	No. (prevalence %)	1,492 (9.36)	233 (1.46)	31 (0.19)	10 (0.06††)	5 (0.03††)	3 (§§)
	% DALYs within sector	51.88	26.49	3.51–16.55**	6.06	3.37	2.16
Mining, quarrying, and oil and gas extraction (21)	No. (prevalence %)	994 (13.67)	178 (2.45)	33 (0.45)	9 (0.12††)	2 (§§)	—
	% DALYs within sector	47.57	27.95	5.24–24.46**	7.72	1.92	—
Construction (23)	No. (prevalence %)	4,902 (13.63)	805 (2.24)	123 (0.34)	27 (0.08)	3 (§§)	—
	% DALYs within sector	53.01	28.56	4.47–20.72**	5.23	0.62	—
Manufacturing (31–33)	No. (prevalence %)	107,514 (11.53)	16,845 (1.81)	2,933 (0.31)	620 (0.07)	180 (0.02)	46 (<0.01)
	% DALYs within sector	52.09	26.80	4.78–22.15**	5.38	1.78	0.49
Wholesale and retail trade (42, 44–45)	No. (prevalence %)	12,099 (10.97)	1,832 (1.66)	345 (0.31)	85 (0.08)	26 (0.02)	8 (0.01††)
	% DALYs within sector	51.28	25.49	4.91–22.78**	6.44	2.23	0.71
Transportation, warehousing and utilities (48, 49, 22)	No. (prevalence %)	10,186 (6.65)	1,528 (1.00)	290 (0.19)	51 (0.03)	20 (0.01)	16 (0.01)
	% DALYs within sector	51.95	25.59	4.96–23.02**	4.64	2.07	1.76
Healthcare and social assistance (62, except 62191)	No. (prevalence %)	847 (10.51)	146 (1.81)	34 (0.42)	6 (0.07††)	2 (§§)	1 (§§)
	% DALYs within sector	46.94	26.43	6.19–29.06**	5.80	2.22	0.99
Public safety (115310, 62191, 92212, 92214, 92216)	No. (prevalence %)	885 (6.33)	111 (0.79)	26 (0.19)	—	1 (0.01)	—
	% DALYs within sector	58.66	24.05	5.69–26.64**	—	1.13	—
Services (51–56, 61, 71–72, 81, 92 [except 92212, 92214, 92216])	No. (prevalence %)	14,319 (10.57)	2,409 (1.78)	442 (0.33)	116 (0.09)	26 (0.02)	20 (0.01)
	% DALYs within sector	48.62	26.87	5.04–23.39**	7.04	1.79	1.47

Abbreviations: GBD = Global Burden of Disease; NAICS = North American Industry Classification System.

* Annual number of DALYs per 1,000 workers represent how many years of healthy life were lost by 1,000 workers each year and can be compared across different health conditions.

† Hearing impairment severity audiometric definitions and lay descriptions are provided in Table 1. Hearing impairment was measured in the better ear.

§ DALYs were calculated by 1) applying the GBD Study disability weight with tinnitus to the number of workers estimated to have tinnitus; 2) applying the GBD Study disability weight without tinnitus to the number of workers estimated not to have tinnitus; and 3) adding these two values together for each industry sector and overall.

¶ Percent of total DALYs lost by all noise-exposed workers within each industry sector.

** The GBD Study did not calculate a disability weight for moderately severe hearing impairment. DALYs are presented as a range, applying the disability weight for moderate impairment to obtain the lower limit, and applying the disability weight for severe impairment to obtain the upper limit. The average of the lower and upper limits was used to calculate the total DALYs in each industry sector and overall.

†† This estimate has a relative standard error ≥30% and <50% and should be used with caution as it does not meet standards of reliability/precision.

§§ Estimate not shown as it has a relative standard error ≥50% and does not meet standards of reliability/precision.

and the need for continued prevention efforts, especially in the mining, construction, and manufacturing sectors. The proportion of mining sector employees exposed to hazardous noise (76%) was the highest in any sector (*3*), and studies have consistently indicated elevated risks for occupational hearing loss within this sector (*2*,*4*). Occupational hearing loss risks have also been established within the construction sector (*2*,*4*); however, current noise regulations do not require audiometric testing for construction workers (*2*). Without testing to identify workers losing their hearing, intervention might be delayed or might not occur. Although a comparatively smaller percentage of manufacturing workers are noise-exposed (37%), this sector accounts for the most noise-exposed workers in the United States (*3*), and, as expected, the largest number of workers with hearing impairment. Some manufacturing sub-sectors, such as wood product, apparel, and machinery manufacturing, have been found to have occupational hearing loss risks as high as those in the mining and construction sectors (*4*). Another study using earlier GBD Study hearing impairment definitions also found the heaviest burdens of hearing impairment were in the mining, construction, and manufacturing sectors, indicating the most healthy years were lost in these sectors (*8*).

Approximately 78% of the healthy years lost were attributable to mild or moderate hearing impairment. Preventing any occupational hearing loss is the best way to reduce worker hearing impairment over a lifetime, because even mild-to-moderate impairment during working years can culminate in more healthy years lost during retirement. Prevention also has short-term benefits; persons with even mild hearing loss experience reduced audibility (loudness), reduced dynamic range of hearing (the difference between the softest and loudest perceptible sounds), and increased listening fatigue (*2*). They also often experience difficulties understanding speech, especially in the presence of background noise (*2*). Other effects include degraded communication (*2*), cognitive decline (*9*), and depression (*2*).

In the general population, the prevalence of impairment also sharply decreases at higher levels of impairment, and severe impairment is not typically caused exclusively by noise. Some workers with a substantial hearing impairment might transfer

Summary

What is already known about this topic?

Hearing loss is prevalent in the United States, especially among noise-exposed workers.

What is added by this report?

This is the first known study to quantify the disability-adjusted life years attributable to hearing impairment for noise-exposed U.S. workers, and to estimate the prevalence at each level of hearing impairment by industry sector.

What are the implications for public health practice?

Prevention, early detection, and intervention to preclude additional hearing loss are essential to reducing worker disability caused by hearing impairment.

away from noisy jobs because of difficulties communicating in noisy environments, or from jobs where hearing is critical for productivity and safety. For example, although the public safety sector had fewer older workers (lowering the prevalence), hearing impairment might have resulted in attrition because of the hearing-critical nature of many occupations in this sector (*2*).

The findings in this report are subject to at least seven limitations. First, this was a convenience sample and might not be representative of all noise-exposed workers tested in the United States. Second, not all noise-exposed workers are tested in the United States, especially in industries with high proportions of mobile or temporary workers, such as the construction and agriculture sectors. Third, in the absence of additional information, such as medical records, hearing impairment caused by occupational exposures can only be inferred. However, this inference was strengthened by studying exposed workers and excluding audiograms indicating nonoccupational exposures. Fourth, GBD Study disability weights were developed using international surveys asking respondents to compare life limitations posed by different health conditions, and to compare the value of preventing certain health conditions to the value of preventing death (*5*); respondents might not be able to appreciate the impact a disability can have on quality of life if they do not have that disability. Fifth, GBD Study audiometric definitions for impairment levels are conservative, with stringent requirements to reach even mild impairment. In addition, no impairment is identified when there is a total loss of hearing in one ear, and the impairment in the other ear can be lessened by hearing aid use. These limitations might have lowered impairment estimates, and worker impairment might be higher than reported here. Sixth, workers in the Occupational Hearing Loss Surveillance Project who wear hearing aids did not wear them during testing. However, few persons wear hearing aids during working years (*9*), so no adjustments were made for hearing aid use. Finally, no information was available on other conditions, so healthy years lost because of hearing impairment were not adjusted for comorbidities (*5*).

Occupational hearing loss is a permanent but entirely preventable condition with today's hearing loss prevention strategies and technology (*2*). Concurrent with prevention efforts, early detection of hearing loss by consistent annual audiometric testing, and intervention to preclude further loss (e.g., refitting hearing protection, training), are critical. Although lost hearing cannot be recovered, workers can benefit from clinical rehabilitation, which includes fitting hearing aids, learning lip-reading, and adopting other compensation strategies to optimize hearing. Study results support beginning rehabilitation at a mild level of hearing impairment. Prevention, and early detection, intervention, and rehabilitation, might greatly improve workers' quality of life (*2*,*9*).

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References

1. Blackwell DL, Lucas JW, Clarke TC. Summary health statistics for US adults: National Health Interview Survey, 2012. Vital health statistics, series 10, no. 260. Atlanta, GA: National Center for Health Statistics, CDC; 2014. http://www.cdc.gov/nchs/data/series/sr_10/sr10_260.pdf
2. Themann CL, Suter AH, Stephenson MR. National research agenda for the prevention of occupational hearing loss—part 1. Semin Hear 2013;34:145–207. http://dx.doi.org/10.1055/s-0033-1349351
3. Tak S, Davis RR, Calvert GM. Exposure to hazardous workplace noise and use of hearing protection devices among US workers—NHANES, 1999–2004. Am J Ind Med 2009;52:358–71. http://dx.doi.org/10.1002/ajim.20690
4. Masterson EA, Tak S, Themann CL, et al. Prevalence of hearing loss in the United States by industry. Am J Ind Med 2013;56:670–81. http://dx.doi.org/10.1002/ajim.22082
5. Global Burden of Disease Study 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2015;386:743–800. http://dx.doi.org/10.1016/S0140-6736(15)60692-4
6. Masterson EA, Themann CL, Luckhaupt SE, Li J, Calvert GM. Hearing difficulty and tinnitus among US workers and non-workers in 2007. Am J Ind Med 2016;59:290–300. http://dx.doi.org/10.1002/ajim.22565
7. World Health Organization. WHO methods and data sources for global burden of disease estimates 2000–2011. Global health estimates technical paper WHO/HIS/HSI/GHE/2013.4. Geneva, Switzerland: World Health Organization; 2013. http://www.who.int/healthinfo/statistics/GlobalDALYmethods_2000_2011.pdf
8. Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M. The global burden of occupational noise-induced hearing loss. Am J Ind Med 2005;48:446–58. http://dx.doi.org/10.1002/ajim.20223
9. Chien W, Lin FR. Prevalence of hearing aid use among older adults in the United States. Arch Intern Med 2012;172:292–3. http://dx.doi.org/10.1001/archinternmed.2011.1408

Patterns in Zika Virus Testing and Infection, by Report of Symptoms and Pregnancy Status — United States, January 3–March 5, 2016

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CDC recommends Zika virus testing for potentially exposed persons with signs or symptoms consistent with Zika virus disease, and recommends that health care providers offer testing to asymptomatic pregnant women within 12 weeks of exposure. During January 3–March 5, 2016, Zika virus testing was performed for 4,534 persons who traveled to or moved from areas with active Zika virus transmission; 3,335 (73.6%) were pregnant women. Among persons who received testing, 1,541 (34.0%) reported at least one Zika virus-associated sign or symptom (e.g., fever, rash, arthralgia, or conjunctivitis), 436 (9.6%) reported at least one other clinical sign or symptom only, and 2,557 (56.4%) reported no signs or symptoms. Among 1,541 persons with one or more Zika virus-associated symptoms who received testing, 182 (11.8%) had confirmed Zika virus infection. Among the 2,557 asymptomatic persons who received testing, 2,425 (94.8%) were pregnant women, seven (0.3%) of whom had confirmed Zika virus infection. Although risk for Zika virus infection might vary based on exposure-related factors (e.g., location and duration of travel), in the current setting in U.S. states, where there is no local transmission, most asymptomatic pregnant women who receive testing do not have Zika virus infection.

Zika virus is a flavivirus primarily transmitted by *Aedes* species mosquitoes (*1*,*2*) that has recently spread in the Region of the Americas (*2*). From January 1, 2015 to April 13, 2016, a total of 358 travel-associated cases of Zika virus disease were reported from U.S. states, 351 of which were in persons who traveled to or moved from areas with active Zika virus transmission (http://www.cdc.gov/zika/index.html). Most Zika virus infections are asymptomatic or cause mild clinical disease (*3*). Among persons with clinical illness, signs and symptoms commonly include one or more of the following: fever, rash, arthralgia, and conjunctivitis (*3*,*4*). Zika virus infection during pregnancy has been causally linked to congenital microcephaly and has been associated with other adverse pregnancy outcomes, including pregnancy loss (*5*–*8*). CDC recommends that persons with possible exposure to Zika virus receive testing if they have symptoms of Zika virus disease within 2 weeks of exposure. On February 12, 2016, CDC recommended that health care providers offer testing to asymptomatic pregnant women with possible exposure to Zika virus (*9*).

CDC calculated the number of persons in the 50 U.S. states and District of Columbia (DC) who traveled to or moved from areas of active Zika virus transmission and received testing for Zika virus infection in early 2016, and the proportion of tested persons who had evidence of confirmed Zika virus infection or recent unspecified flavivirus infection, by pregnancy status and presence of reported signs and symptoms. This analysis included specimens that were received for Zika virus testing at CDC's Arboviral Diseases Branch during January 3–March 5, 2016, corresponding to epidemiologic weeks 1–9. Confirmed Zika virus infection was defined as detection of 1) Zika virus RNA by reverse transcription-polymerase chain reaction (RT-PCR) or 2) anti-Zika immunoglobulin M (IgM) antibodies by enzyme-linked immunosorbent assay (ELISA) with neutralizing antibody titers against Zika virus, at levels ≥4-fold higher than those against dengue virus. Recent unspecified flavivirus infection was defined as detection of anti-Zika or anti-dengue virus IgM antibodies by ELISA with <4-fold difference in neutralizing antibody titers between Zika and dengue viruses. State and local health departments collected information on clinical signs and symptoms. Zika virus-associated signs and symptoms were defined as at least one of the following: fever, rash, arthralgia, or conjunctivitis (*5*). Other signs and symptoms not necessarily associated with Zika virus disease were defined as one or more of the following: headache, myalgia, vomiting, diarrhea, edema, oral ulcers, chills, influenza-like illness, or malaise. Persons who reported no symptoms were considered to be asymptomatic. All persons tested in this analysis had traveled to or moved from areas with active Zika virus transmission. Suspected cases of sexually transmitted and congenital Zika virus disease were excluded from the analysis.

During January 3–March 5, 2016, Zika virus testing was performed for 4,534 persons (Table), among whom 3,335 (73.6%) were pregnant women. Among all persons receiving testing, 197 (4.3%) had confirmed Zika virus infection, 55 (1.2%) had recent unspecified flavivirus infection, and 4,282 (94.4%) had no evidence of recent Zika virus infection. Among all persons receiving testing, 1,541 (34.0%) reported one or more Zika virus-associated symptoms, 436 (9.6%) reported at least one other symptom only, and 2,557 (56.4%) were asymptomatic. Among persons with at least one Zika virus-associated symptom, 620 (40.2%) were pregnant women; among persons with at least one other symptom only, 290 (66.5%) were pregnant women; and among persons with no symptoms, 2,425 (94.8%) were pregnant women.

During epidemiologic weeks 1–5 (weeks ending January 9–February 6, 2016), <10% of persons receiving testing were asymptomatic (Figure). After the recommendation to offer serologic testing to asymptomatic pregnant women was published on February 12, 2016 (*9*), the proportion of persons receiving testing for Zika virus infection who were asymptomatic increased, ranging from 26.1% to 75.9% during epidemiologic weeks 6–9. The proportion of persons who received testing who had confirmed Zika virus infection decreased from 33.3% (epidemiologic week 1) to 1.5% (week 9).

Among all persons with one or more Zika virus-associated symptoms, 182 (11.8%) had confirmed Zika virus infection and 41 (2.7%) had recent unspecified flavivirus infection (Table). Among persons who reported one or more other symptoms only, eight (1.8%) had confirmed Zika virus and three (0.7%) had recent unspecified flavivirus infection. Among asymptomatic persons, seven (0.3%) had confirmed Zika virus and 11 (0.4%) had recent unspecified flavivirus infection.

Among 3,335 pregnant women receiving testing, 28 (0.8%) had confirmed Zika virus infection and 19 (0.6%) had recent unspecified flavivirus infection. Among pregnant women with at least one Zika virus-associated symptom, 18 (2.9%) had confirmed Zika virus infection, and nine (1.5%) had recent unspecified flavivirus infection. Among 2,425 asymptomatic pregnant women, only seven (0.3%) had confirmed Zika virus infection, and 10 (0.4%) had recent unspecified flavivirus infection. Among pregnant women tested after guidelines were expanded to recommend testing of asymptomatic pregnant women (epidemiologic weeks 6–9), seven (35%) of 20 pregnant women with confirmed Zika virus infection were asymptomatic. Among the seven asymptomatic pregnant women with confirmed Zika virus infection, five were residing in areas with active Zika virus transmission at some time during their pregnancy and two were short-term travelers.

Discussion

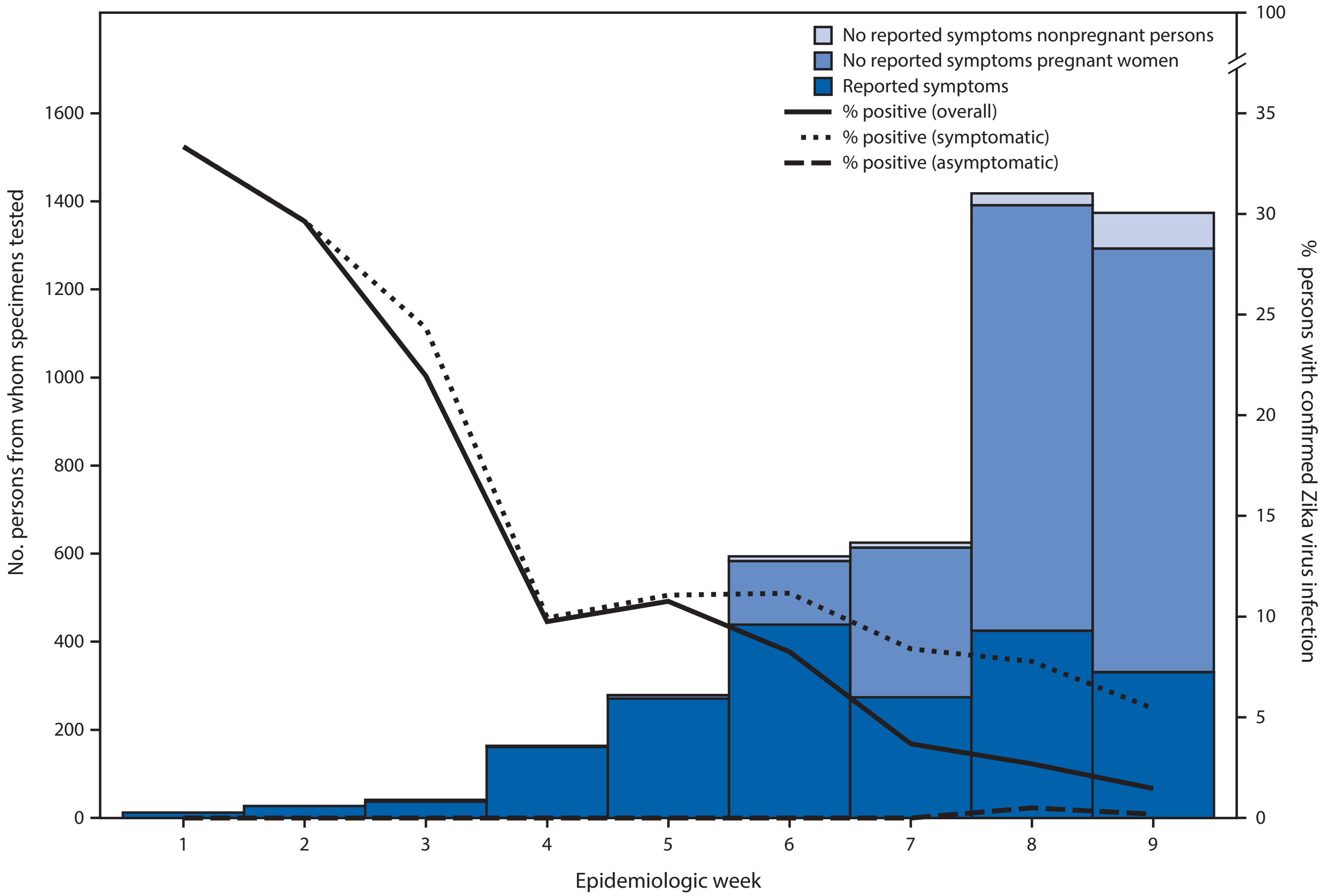
Overall, relatively few persons receiving testing for Zika virus at CDC had confirmed Zika virus infection, and the proportion with confirmed Zika virus infection was higher among persons who reported at least one Zika virus-associated symptom than among persons with other symptoms only or asymptomatic persons. These results reflect the current situation in U.S. states and DC, where there is no local mosquito-borne transmission; results of testing in areas with active Zika virus transmission might be different. Although confirmed Zika virus infection was identified in seven (0.3%) asymptomatic pregnant women who received testing, it is reassuring that the proportion of asymptomatic pregnant women with confirmed Zika virus infection in this report was low. However, because

TABLE. Zika virus testing outcomes among persons with specimens tested at CDC's Arboviral Diseases Branch, by Zika virus infection status, reported symptoms, and pregnancy status* — United States, January 3–March 5, 2016†

Testing outcome	≥1 Zika virus-associated symptom§ No. (%)	≥1 other symptom only¶ No. (%)	No symptoms No. (%)	Total No. (%)
All persons tested				
Confirmed Zika virus infection	182 (11.8)	8 (1.8)	7 (0.3)	**197 (4.3)**
Recent unspecified flavivirus infection	41 (2.7)	3 (0.7)	11 (0.4)	**55 (1.2)**
No Zika virus infection	1,318 (85.5)	425 (97.5)	2,539 (99.3)	**4,282 (94.4)**
Total	**1,541 (100)**	**436 (100)**	**2,557 (100)**	**4,534 (100)**
Pregnant women*				
Confirmed Zika virus infection	18 (2.9)	3 (1.0)	7 (0.3)	**28 (0.8)**
Recent unspecified flavivirus infection	9 (1.5)	0 (0)	10 (0.4)	**19 (0.6)**
No Zika virus infection	593 (95.7)	287 (99.0)	2,408 (99.3)	**3,288 (98.6)**
Total	**620 (100)**	**290 (100)**	**2,425 (100)**	**3,335 (100)**
Other persons (excluding pregnant women)				
Confirmed Zika virus infection	164 (17.8)	5 (3.4)	0 (0)	**169 (14.1)**
Recent unspecified flavivirus infection	32 (3.5)	3 (2.1)	1 (0.8)	**36 (3.0)**
No Zika virus infection	725 (78.7)	138 (94.5)	131 (99.2)	**994 (82.9)**
Total	**921 (100)**	**146 (100)**	**132 (100)**	**1,199 (100)**

* Determined at the time of illness onset (or date of specimen collection, among asymptomatic persons).
† As of April 11, 2016.
§ Fever, rash, arthralgia, or conjunctivitis.
¶ Headache, myalgia, vomiting, diarrhea, edema, oral ulcers, chills, influenza-like illness, or malaise.

FIGURE. Number of symptomatic and asymptomatic persons who received Zika virus testing,* by pregnancy status, and percentage of positive results among all persons tested, persons with symptoms, and asymptomatic persons, by epidemiologic week — United States, January 3–March 5, 2016†



* Testing performed at CDC's Arboviral Diseases Branch.
† As of April 11, 2016.

of the potential serious adverse pregnancy and neonatal outcomes associated with maternal Zika virus infection, health care providers should continue to offer testing to pregnant women with potential exposure to Zika virus, even if they do not have symptoms (*9*). Follow-up of women with confirmed Zika virus infection or recent unspecified flavivirus infection during pregnancy is important to identify congenital Zika virus infection and other possible adverse pregnancy outcomes.

The findings in this report are subject to at least five limitations. First, because testing might have been performed weeks after potential exposure, persons might not recall symptoms, particularly if they were mild. Second, only tests performed at CDC's Arboviral Diseases Branch were included in this analysis. Some state health departments were testing for Zika virus during this time and the total number of cases reported in this period from U.S. states (http://www.cdc.gov/zika/index.html) exceeds the number of cases described in this analysis. Third, this study did not account for heterogeneous exposure risk among persons receiving testing. Travel-associated exposure can vary by location, duration, accommodations, and activities during travel. Fourth, findings in this report are not generalizable to residents of areas with active Zika virus transmission. Finally, patients with unspecified flavivirus infection likely experienced a previous infection with or had been vaccinated against other related flaviviruses making results difficult to interpret. In the setting of the current Zika virus outbreak and because of the concern for adverse fetal effects, pregnant women with unspecified flavivirus infection should follow CDC guidance for pregnant women with possible Zika virus infection (*10*).

In the U.S. states and DC, the proportion of persons who traveled to or moved from areas with active Zika virus

Summary

What is already known about this topic?

Zika virus is an emerging mosquito-borne flavivirus. Travel-associated cases of Zika virus disease have been reported in the United States. Zika virus infection during pregnancy has been causally linked to congenital microcephaly and has been associated with other adverse pregnancy outcomes, including pregnancy loss. On February 12, 2016, CDC recommended that health care providers offer testing for Zika virus disease to asymptomatic pregnant women with possible exposure to Zika virus.

What is added by this report?

During January 3–March 5, 2016, Zika virus testing was performed for 4,534 persons from the U.S. states and District of Columbia (DC), among whom 3,335 (73.6%) were pregnant women. Among 1,541 persons with one or more Zika-virus associated symptoms who received testing and reported symptoms, 182 (11.8%) had confirmed Zika virus infection. Only seven (0.3%) of 2,425 asymptomatic pregnant women who received testing had confirmed Zika virus infection.

What are the implications for public health practice?

Among persons from U.S. states and DC receiving testing for Zika virus, few persons had confirmed Zika virus infection. Approximately 99% of asymptomatic pregnant women who received testing did not have Zika virus infection. In the current U.S. setting, where most exposure is travel-associated, the likelihood of Zika virus infection among asymptomatic persons is low. Given the potential for adverse pregnancy and infant outcomes associated with Zika virus infection, health care providers should continue to offer Zika virus testing to asymptomatic pregnant women with potential exposure.

transmission, who received testing, and who had confirmed Zika virus infection was substantially higher in symptomatic than asymptomatic persons. Furthermore, 64% of pregnant women with confirmed Zika virus infection had at least one Zika virus-associated symptom, and approximately 99% of asymptomatic pregnant women who received testing did not have Zika virus infection. Because of the potential for adverse outcomes associated with Zika virus infection during pregnancy and the lack of current understanding of the risks for infection in asymptomatic pregnant women, health care providers should continue to offer Zika virus testing to asymptomatic pregnant women with potential exposure (*9*). Although individual risk for Zika virus infection will differ on the basis of exposure, these data suggest that in the current setting in U.S. states, where most exposure is travel-associated, most asymptomatic persons do not have Zika virus infection.

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References

1. Hayes EB. Zika virus outside Africa. Emerg Infect Dis 2009;15:1347–50. http://dx.doi.org/10.3201/eid1509.090442
2. CDC. Areas with Zika. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. http://www.cdc.gov/zika/geo/
3. Duffy MR, Chen TH, Hancock WT, et al. Zika virus outbreak on Yap Island, Federated States of Micronesia. N Engl J Med 2009;360:2536–43. http://dx.doi.org/10.1056/NEJMoa0805715
4. Armstrong P, Hennessey M, Adams M, et al. Travel-associated Zika virus disease cases among US residents—United States, January 2015–February 2016. MMWR Morb Mortal Wkly Rep 2016;65:286–9. http://dx.doi.org/10.15585/mmwr.mm6511e1
5. Oliveira Melo AS, Malinger G, Ximenes R, Szejnfeld PO, Alves Sampaio S, Bispo de Filippis AM. Zika virus intrauterine infection causes fetal brain abnormality and microcephaly: tip of the iceberg? Ultrasound Obstet Gynecol 2016;47:6–7. http://dx.doi.org/10.1002/uog.15831
6. Martines RB, Bhatnagar J, Keating MK, et al. Notes from the field: evidence of Zika virus infection in brain and placental tissues from two congenitally infected newborns and two fetal losses—Brazil, 2015. MMWR Morb Mortal Wkly Rep 2016;65:159–60. http://dx.doi.org/10.15585/mmwr.mm6506e1
7. Mlakar J, Korva M, Tul N, et al. Zika virus associated with microcephaly. N Engl J Med 2016;374:951–8. http://dx.doi.org/10.1056/NEJMoa1600651

8. Rasmussen SA, Jamieson DJ, Honein MA, Petersen LR. Zika virus and birth defects—reviewing the evidence for causality. N Engl J Med 2016. E-pub April 13, 2016. http://dx.doi.org/10.1056/NEJMsr1604338
9. Oduyebo T, Petersen EE, Rasmussen SA, et al. Update: interim guidelines for health care providers caring for pregnant women and women of reproductive age with possible Zika virus exposure—United States, 2016. MMWR Morb Mortal Wkly Rep 2016;65:122–7. http://dx.doi.org/10.15585/mmwr.mm6505e2
10. Petersen EE, Polen KN, Meaney-Delman D, et al. Update: interim guidance for health care providers caring for women of reproductive age with possible Zika virus exposure—United States, 2016. MMWR Morb Mortal Wkly Rep 2016;65:315–22. http://dx.doi.org/10.15585/mmwr.mm6512e2

Notes from the Field

Respiratory Symptoms and Skin Irritation Among Hospital Workers Using a New Disinfection Product — Pennsylvania, 2015

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In March 2014, a new disinfection product, consisting of hydrogen peroxide, peroxyacetic acid, and acetic acid, was introduced at a Pennsylvania hospital to aid in the control of health care–associated infections. The product is an Environmental Protection Agency–registered non-bleach sporicide advertised as a one-step cleaner, disinfectant, and deodorizer. According to the manufacturer's safety data sheet, the product requires no personal protective equipment when it is diluted with water by an automated dispenser before use. On January 30, 2015, CDC's National Institute for Occupational Health (NIOSH) received a confidential employee request to conduct a health hazard evaluation at the hospital. The request cited concerns about exposure of hospital environmental services staff members to the product and reported symptoms among persons who had used the product that included eye and nasal problems, asthma-like symptoms, shortness of breath, skin problems, wheeze, chest tightness, and cough.

In response to the request, NIOSH gathered information by telephone and e-mail in February and March and visited the hospital on April 9 to inform the design of an air sampling evaluation and health interview questionnaire. Pilot air sampling was conducted on July 29, including the collection of full-shift, time-weighted average personal air samples from five workers for measurement of hydrogen peroxide, acetic acid, and peroxyacetic acid.

During August 31–September 3, NIOSH interviewed 79 (78%) of 101 current environmental services staff members about their health. Among the 79 interviewees, 68 (86%) reported using the product; the interview responses of these 68 staff members were analyzed. Asthma-like symptoms were defined using a set of validated questions (*1*). Work-related symptoms were defined as symptoms that improved when the worker was away from the facility on days off or on vacation. During September 8–11, NIOSH collected 45 additional full-shift personal air samples for measurement of hydrogen peroxide, acetic acid, and peroxyacetic acid. Exposure assessment results from July and September were combined for a total convenience sample of 50 workers.

The most commonly reported health outcomes were watery eyes (46%), nasal problems (41%), asthma-like symptoms (28%), use of allergy medicine (16%), and shortness of breath (16%) (Table). Thirty (44%) workers reported at least one work-related health outcome, most commonly watery eyes (29%) or nasal problems (22%). Among 10 respondents with self-reported physician-diagnosed asthma, six reported that something at work brought on or worsened their asthma, and three mentioned the disinfection product. Full-shift air sample results for hydrogen peroxide ranged from 6 parts per billion (ppb) to 511 ppb; for acetic acid, from 7 ppb to 530 ppb; and for peroxyacetic acid, from 1 ppb to 48 ppb. All measurements for hydrogen peroxide and acetic acid were below their respective occupational exposure limits of 1,000 ppb and 10,000 ppb (*2*). No full-shift exposure limit has been established for peroxyacetic acid.

Few assessments of worker exposure to hydrogen peroxide, acetic acid, and peroxyacetic acid in health care settings have been conducted, despite the use of this product in more than 500 hospitals nationally. Two previous investigations conducted by the Occupational Safety and Health Administration at hospitals in Pennsylvania (*3*) and Vermont (Karl Hayden, Safety/Health Compliance Officer, personal communication, Vermont Department of Labor, 2015), in response to employee concerns about symptoms reported while using this product, were limited to air sampling; no health assessments were performed. In the CDC evaluation, environmental services staff members reported work-related symptoms despite measured exposures that were below the established full-shift exposure limits for hydrogen peroxide and acetic acid. However, because both hydrogen peroxide and peroxyacetic acid are strong oxidants, it is possible that the mixture of hydrogen peroxide and peroxyacetic acid contributed to the symptoms reported by workers. Furthermore, existing exposure limits might not be protective against asthma-like symptoms. The Association of Occupational and Environmental Clinics recently listed this product as an asthmagen in its Exposure Database (*4*).

These results are preliminary and further investigation is needed to fully understand the relationship between exposure to disinfection products in health care settings and worker health. In the interim, consideration of the health and safety of workers is prudent when choosing disinfection products, and hospitals should be alert for respiratory, skin, and eye symptoms in environmental services staff members. Hospital management can implement a reporting system that would permit employees to report work-related symptoms, with the option for employees to remain anonymous. If environmental services staff members report respiratory, skin, and/or eye symptoms, a combination of engineering and administrative controls could be needed to reduce employee exposures. In addition, physicians should be aware of the potential adverse health effects of occupational exposure to cleaning and disinfection products when evaluating patients with respiratory and skin symptoms (*5*).

Although a one-step cleaner, disinfectant, and deodorizer might be considered for widespread use in a hospital, the decision to use particular disinfection products in specific areas of a health care facility should reflect the level of risk for a health care–associated infection. The NIOSH Health Hazard Evaluation program (http://www.cdc.gov/niosh/hhe/) can assist hospitals and public health departments in the investigation of potential health effects related to exposures in a health care setting.

TABLE. Prevalence of symptoms and work-related symptoms among hospital environmental services staff members reporting use of a new disinfection product (N = 68) — Pennsylvania, August–September 2015

Symptom	Reported symptoms No. (%)	Reported work-related symptoms* No. (%)
Watery eyes†	31 (46)	20 (29)
Nasal problems†	28 (41)	15 (22)
Asthma-like symptoms§	19 (28)	10 (15)
Shortness of breath	11 (16)	5 (7)
Skin problems†	10 (15)	7 (10)
Wheeze†	10 (15)	5 (7)
Chest tightness†	9 (13)	2 (3)
Cough	3 (4)	1 (1)
Asthma attack†	2 (3)	1 (1)

* Defined as a symptom that improved away from the facility, either on days off or on vacation.
† During the past 12 months.
§ Defined as current use of asthma medicine or one or more of the following symptoms in the last 12 months: wheezing or whistling in the chest, awakening with a feeling of chest tightness, or attack of asthma.

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References

1. Grassi M, Rezzani C, Biino G, Marinoni A. Asthma-like symptoms assessment through ECRHS screening questionnaire scoring. J Clin Epidemiol 2003;56:238–47. http://dx.doi.org/10.1016/S0895-4356(02)00613-3
2. National Institute for Occupational Safety and Health (NIOSH). Pocket guide to chemical hazards. DHHS (NIOSH) publication no. 2010–168c. Atlanta, GA: US Department of Health and Human Services, CDC, NIOSH. http://www.cdc.gov/niosh/npg/
3. Occupational Safety and Health Administration. Inspection no. 1019738. Region 3. Pittsburgh, PA: Occupational Safety and Health Administration; 2015.
4. Association of Occupational and Environmental Clinics. Comprehensive Occupational & Environmental Exposure Database; 2015. http://www.aoecdata.org/ExpCodeLookup.aspx
5. Quinn MM, Henneberger PK; National Institute for Occupational Safety and Health (NIOSH), National Occupational Research Agenda (NORA) Cleaning and Disinfecting in Healthcare Working Group. Cleaning and disinfecting environmental surfaces in health care: toward an integrated framework for infection and occupational illness prevention. Am J Infect Control 2015;43:424–34. http://dx.doi.org/10.1016/j.ajic.2015.01.029

Notes from the Field

Development of a Contact Tracing System for Ebola Virus Disease — Kambia District, Sierra Leone, January–February 2015

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Kambia District is located in northwestern Sierra Leone along the international border with Guinea. The district is dominated by forest and swamp habitat and has a population of approximately 270,000 persons (approximately 5% of the nation's population) who live in rural villages and predominantly subsist on farming and trading. During 2014–2015, the remoteness of the area, a highly porous border with Guinea, and strong traditional beliefs about health care and sickness led to unique challenges in controlling the Ebola Virus Disease (Ebola) outbreak within the district.

When the first Ebola cases in Kambia District were confirmed in September 2014, the Ministry of Health and Sanitation introduced a contact tracing system. Contact tracers were to monitor all contacts of confirmed Ebola cases daily for signs and symptoms of Ebola and report contacts' health status to contact tracing supervisors daily. However, by December 2014, the system's performance and efficacy remained unknown because reporting was irregular and status assessments lacked quality control. Therefore, the number of contacts traced daily and the number of suspected cases arising from contacts were unknown.

In January 2015, the District Ebola Response Center created two new positions to quantify contact tracing indicators and to ensure daily action related to these indicators. The first position was a database manager responsible for ensuring that each contact tracing supervisor received a current list of contacts to be monitored and a subsequent daily status report on each contact, and for recording daily status results for every contact in a centralized database. The second position was a field coordinator who provided on-site quality control of contact tracing visits, ensuring that contact tracing visits were conducted appropriately. The coordinator confirmed that each contact being followed appeared for monitoring, stood for 3–5 minutes (if physically able to do so), and received an individual status assessment.

To improve system management and accountability, new staff members as well as existing contact tracers, supervisors, and surveillance officers received training and on-site mentoring. Goals for daily monitoring of contact tracing indicators included 100% of contacts being visited by a contact tracer, receiving an appropriate status assessment, and having their status reported and recorded in the centralized database, as well as investigation by a surveillance officer within 24 hours, when indicated by signs or symptoms.

From January 8–February 18, 2015, an average of 201 contacts required daily monitoring; among these, an average of 193 (95.7%) received appropriate daily follow-up. During this interval, 47 contacts who displayed signs or symptoms of Ebola were identified and investigated; among these 47 contacts, 13 (28%) had confirmed Ebola, one (2%) had probable Ebola, and 16 (34%) had suspected Ebola, according to the national case definitions (*1*).

In Kambia, managed contact tracing through required daily visits and follow-up by contact tracers was effective in identifying 13 Ebola cases that might previously have been missed, before the introduction of clear accountability for daily follow-up and status recording. Based on the findings from this pilot contact tracing program, recommendations and training materials for improvements in data management and quality control to increase the effectiveness of Ebola contact tracing were subsequently developed for widespread use in Sierra Leone.

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Reference

1. Dietz PM, Jambai A, Paweska JT, Yoti Z, Ksaizek TG. Epidemiology and risk factors for Ebola virus disease in Sierra Leone—23 May 2014 to 31 January 2015. Clin Infect Dis 2015;61:1648–54.

Announcement

National Campaign to Prevent Falls in Construction — United States, May 2–6, 2016

The National Safety Stand-Down to Prevent Falls in Construction* will be observed May 2–6, 2016, and is hosted by the federal Occupational Safety and Health Administration and stakeholders, including CDC's National Institute for Occupational Safety and Health. During the voluntary stand-down, construction employers are asked to speak directly to their employees about fall hazards to reinforce the importance of adhering to fall prevention measures. Employers are encouraged to have a Spanish speaker deliver the stand-down message to Spanish-speaking employees (simultaneous translation is an alternative). Across the United States, state agencies, public health practitioners, and private contractors will promote participation in the event.

In 2014, a total of 845 fatal on-the-job injuries were reported among construction workers, more deaths than in any other industry, and the most for this industry sector since 2008 (*1*). Falls on construction sites are the leading cause of death in construction (39.9% of all worker deaths in 2014) (*2*). During 2008–2010 (*3*), 55% of all fatal falls in construction occurred in the smallest construction establishments (1–10 employees). Although construction is a high-risk industry for all workers, Hispanic immigrants (20% of the U.S. construction workforce) (*4*), are at increased risk because of language and cultural barriers to effective safety communication. As the construction workforce grows (up 1.2% to 9.9 million workers in 2015) (*5*), so does the need for effective safety messages that can overcome any barriers (*6*).

Falls are preventable. The National Institute for Occupational Safety and Health has worked with construction sector stakeholders through a government-labor-management partnership to develop a national falls prevention campaign aimed at construction contractors, onsite supervisors, and workers. Modeled on U.S. military programs, the annual stand-down is a component of this campaign.

* https://www.osha.gov/StopFallsStandDown/.

References

1. US Bureau of Labor Statistics. Economic news release: Census of Fatal Occupational Injuries summary, 2014. Washington, DC: US Department of Labor, US Bureau of Labor Statistics; 2015. http://www.bls.gov/news.release/cfoi.nr0.htm
2. Occupational Safety and Health Administration. Commonly used statistics. Washington, DC: US Department of Labor, Occupational Safety and Health Administration; 2016. https://www.osha.gov/oshstats/commonstats.html
3. CPWR Data Center, US Bureau of Labor Statistics. The construction chart book: fatal and nonfatal injuries from falls in construction. Silver Spring, MD: US Bureau of Labor Statistics, CPWR Data Center. http://www.cpwr.com/sites/default/files/publications/CB%20page%2044.pdf
4. CPWR Data Center, US Bureau of Labor Statistics. 2010–2014 March supplement to the current population survey. Silver Spring, MD: US Bureau of Labor Statistics, CPWR Data Center.
5. US Bureau of Labor Statistics. 2015 current population survey. Washington, DC: US Department of Labor, US Bureau of Labor Statistics; 2015.
6. Flynn MA, Cunningham TR, Guerin RJ, et al. DHHS (NIOSH) publication no. 2015–178. Overlapping vulnerabilities: the occupational safety and health of young workers in small construction firms. Cincinnati, OH: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 2015. http://www.cdc.gov/niosh/docs/2015-178/

Announcement

World Malaria Day — April 25, 2016

The World Malaria Day 2016 theme, "End Malaria for Good," reflects a renewed global effort to eliminate malaria from countries with endemic malaria by the middle of this century. More than a century of global malaria control efforts resulted in the elimination of the disease from 24 countries by 1987, and progress toward elimination has accelerated in the last decade. In 2014, 16 additional countries reported no new annual cases, and in 2015, 33 additional countries reported fewer than 1,000 cases of malaria per year (*1*).

Current malaria control initiatives, led by the World Health Organization; the Roll Back Malaria Partnership; the Global Fund to Fight AIDS, Tuberculosis, and Malaria; and the U.S. President's Malaria Initiative, have contributed to important reductions in malaria morbidity and mortality during the last 15 years. Since 2005, donors have supported the procurement and distribution of approximately 1 billion insecticide-treated bed nets and approximately 1 billion artemisinin combination antimalarial treatments globally (*1*). As a result of these and other investments since 2000, the estimated number of malaria deaths worldwide declined 48% from 839,000 to 438,000 in 2015, an accomplishment estimated to have saved the lives of approximately 6.2 million persons, mostly children aged <5 years (*1*).

Despite these improvements, 3.2 billion persons remain at risk for malaria each year. Through ongoing research to improve current interventions and develop new tools to support global malaria control, CDC and its global partners are committed to end malaria by preventing, detecting, and treating a growing portion of malaria cases.

Reference

1. World Health Organization. World malaria report 2015. Geneva, Switzerland: World Health Organization; 2015. http://www.who.int/malaria/publications/world-malaria-report-2015/report/en/

Errata

Vol. 65, No. SS-3

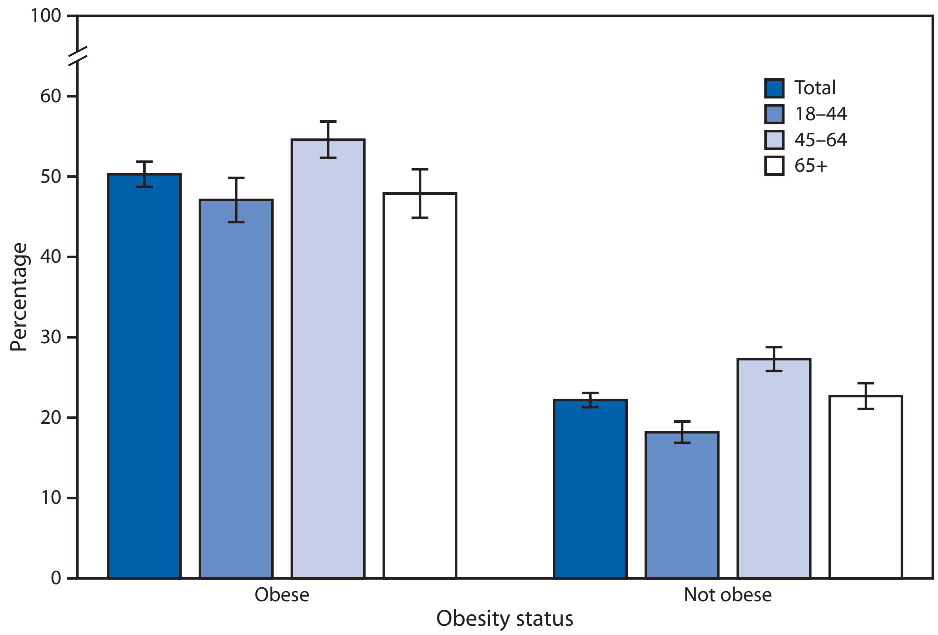
In the report "Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2012," multiple errors occurred on page 15. In "TABLE 3. Estimated prevalence* of autism spectrum disorder among 1,000 children aged 8 years, by race/ethnicity — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2012," the row for Georgia should have read as follows (corrected entries are noted by italics):

	Race/Ethnicity				Prevalence ratio		
	White, non-Hispanic	Black, non-Hispanic	Hispanic	API, non-Hispanic			
Site	Prevalence (95% CI)	Prevalence (95% CI)	Prevalence (95% CI)	Prevalence (95% CI)	White-to-black	White-to-Hispanic	Black-to-Hispanic
Georgia	*18.3 (16.3–20.5)*	*13.7 (12.2–15.4)*	*9.0 (7.2–11.2)*	*13.7 (10.3–18.1)*	1.3†	*2.0*†	*1.5*†

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults with a Visit to a Health Professional in the Past 12 Months Who Received Dietary Advice,† by Obesity Status§ and Age Group — National Health Interview Survey,¶ United States, 2014



* With 95% confidence intervals indicated with error bars.

† Based on the question, "During the last 12 months, has a doctor or other health professional talked to you about your diet?"

§ Obesity status was based on respondent-reported height and weight and calculated as body mass index (BMI) using the following formula: BMI = weight/height^2 (kg/m^2). An adult who was obese had a BMI ≥30; an adult who was not obese had a BMI <30.

¶ Estimates are based on household interviews of a sample of the noninstitutionalized U.S. civilian population and were derived from the National Health Interview Survey Sample Adult component.

In 2014, among adults with a doctor visit in the past 12 months, approximately half (49.7%) of adults with obesity had a doctor or other health professional talk to them about their diet. Middle-aged (i.e., aged 45–64 years) adults with obesity (54.6%) were more likely than younger (47.1%) or older (47.9%) adults with obesity to have received dietary advice from a health professional. This pattern by age was also found for adults who were not obese; however, adults who were not obese were approximately half as likely as adults with obesity in the same age groups to have received dietary advice from a health professional.

Source: National Health Interview Survey, 2014 data. http://www.cdc.gov/nchs/nhis.htm.

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