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Prevalence of Electronic Cigarette Use Among Adult Workers — United States, 2017–2018

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Electronic cigarettes (e-cigarettes) heat a liquid to produce an aerosol that usually contains nicotine, flavors, and other chemicals and that is inhaled by the user (*1*). E-cigarette aerosols generally have a lower number and level of harmful toxicants than conventional cigarettes; however, e-cigarette aerosols can contain harmful ingredients, including ultrafine particles, volatile organic compounds, and heavy metals (*1*,*2*). The U.S. Surgeon General has determined that evidence is inadequate to conclude that use of e-cigarettes, in general, increases smoking cessation (*3*). During 2014–2016, an estimated 5.2 million U.S. workers were current e-cigarette users, and prevalence of e-cigarette use was higher among workers in certain industries and occupations (*4*). To estimate recent national prevalence of e-cigarette use among U.S. workers, CDC analyzed 2017–2018 National Health Interview Survey (NHIS) data for adults aged ≥18 years who were employed during the week before the interview. Among an estimated 156 million U.S. workers, 5.3 million (3.4%) were current e-cigarette users (i.e., "every day" or "some days" use), approximately one half of whom also currently used combustible tobacco products. Current e-cigarette use was highest among males, non-Hispanic Whites, those aged 18–24 years, those with no health insurance, those reporting poor or fair physical health, and those who currently used other tobacco products. Prevalence of e-cigarette use was highest among workers in the accommodation and food services industry and in food preparation and serving-related occupations. Continued surveillance of e-cigarette use in the United States, including among workers, is important to inform the development and implementation of evidence-based strategies to minimize population risks of use of e-cigarettes while continuing to explore their potential usefulness for cessation among adult cigarette smokers (*2*,*3*). To maximize the health of workers, employers can integrate comprehensive and effective tobacco cessation programs into workplace health promotion programs (*4*,*5*).

NHIS is an annual, nationally representative, in-person survey of the noninstitutionalized U.S. civilian population.* The NHIS adult questionnaire is administered to one adult aged ≥18 years randomly selected from each family within the sampled household.† Sample sizes (response rates) for NHIS were 26,742 (53.0%) in 2017 and 25,417 (53.1%) in 2018.§

* https://www.cdc.gov/nchs/nhis/nhis_2018_data_release.htm
† https://www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm
§ ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2018/srvydesc.pdf

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Data analysis included responses from 30,447 adults aged ≥18 years who were "working at a job or business," "with a job or business but not at work," or "working, but not for pay, at a family-owned job or business" during the week before the interview. A standardized coding system was used to classify industry of employment and occupation information.† Current e-cigarette users were defined as adults who reported ever using an e-cigarette, even one time, and who reported using e-cigarettes "every day" (daily) or "some days" at the time of the survey. Current e-cigarette use was also assessed by cigarette smoking status (current, former, or never),¶ current use of other noncigarette combustible tobacco products (yes or no),** current use of any combustible tobacco products (yes or no),†† and current use of any smokeless tobacco products (yes or no).§§

Sample weights were adjusted for pooled data to provide nationally representative estimates. Prevalence estimates and 95% confidence intervals were calculated. E-cigarette use was assessed overall for working adults and by sociodemographic characteristics, industry, and occupation. Estimates with a relative standard error ≥30% are not reported. Two-sided t-tests were used to determine statistically significant ($p<0.05$) differences between point estimates.

During 2017–2018, the prevalence of current e-cigarette use among U.S. workers (3.4%) was significantly higher than that among nonworkers (2.3%). Prevalence was highest among workers who were male (4.1%), non-Hispanic White (4.0%), and aged 18–24 years (7.3%) and among those with a high school education or less (4.7%), with family income <$35,000 (4.9%), with no health insurance (5.0%), and with self-reported poor or fair physical health (5.0%) (Table 1). The prevalence of e-cigarette

¶ Current cigarette smokers were adults who reported smoking ≥100 cigarettes during their lifetime and who reported smoking "every day" or "some days" at the time of the survey. Former smokers were adults who reported smoking ≥100 cigarettes during their lifetime and reported smoking "not at all" at the time of the survey. Never smokers were adults who reported not having smoked 100 cigarettes during their lifetime.

** Current other combustible tobacco smokers (i.e. no-cigarette combustible tobacco products) were adults who reported ever smoking cigars, little cigars, cigarillos, pipes, water pipes, or hookahs even one time, and currently reported smoking these products "every day" or "some days," at the time of the survey. Nonsmokers were those who reported never using, or who ever used and reported smoking "not at all" at the time of the survey.

†† Any combustible tobacco users were defined as those who reported current ("everyday" or "some days") use of cigarettes and/or other combustible tobacco products.

§§ Current smokeless tobacco users were adults who reported ever using smokeless tobacco products that are placed in the mouth or nose (including chewing tobacco, snuff, dip, snus, or dissolvable tobacco) even one time, and reported currently using these products "every day" or "some days" at the time of the survey. Nonusers were those who reported never using, or who ever used and reported using "not at all" at the time of the survey.

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TABLE 1. Estimated annual average current e-cigarette use among U.S. workers,* by selected characteristics — National Health Interview Survey, United States, 2017–2018

Characteristic	Estimated no. of workers† (x1,000)	Current e-cigarette users§			
		Estimated no. (x1,000)	Prevalence (95% CI)	Daily users, % (95% CI)	Using combustible tobacco,¶ % (95% CI)
Total	**156,306**	**5,312**	**3.4 (3.1–3.7)**	**43.1 (39.3–46.9)**	**49.5 (45.5–53.4)**
Age group, yrs					
18–24	18,781	1,364	7.3 (6.0–8.6)	35.1 (26.5–43.6)	35.8 (27.5–44.1)
25–44	69,089	2,675	3.9 (3.5–4.3)	45.4 (40.4–50.4)	54.0 (48.9–59.0)
45–64	59,267	1,174	2.0 (1.7–2.3)	45.1 (37.9–52.3)	55.6 (48.2–62.9)
≥65	9,169	100	1.1 (0.7–1.5)	67.8 (50.9–84.7)	43.6 (25.3–61.9)
Sex					
Male	82,404	3,352	4.1 (3.7–4.5)	46.2 (41.3–51.0)	50.1 (45.1–55.2)
Female	73,902	1,961	2.7 (2.3–3.0)	37.9 (31.8–44.0)	48.3 (41.9–54.7)
Race/Ethnicity					
Hispanic	26,629	615	2.3 (1.7–2.9)	28.3 (16.7–39.9)	46.5 (32.9–60.1)
White, non-Hispanic	99,006	3,990	4.0 (3.7–4.4)	45.1 (40.9–49.4)	49.6 (45.4–53.8)
Black, non-Hispanic	18,628	425	2.3 (1.7–2.9)	45.0 (31.0–59.1)	53.5 (37.5–67.8)
Other	12,043	282	2.3 (1.6–3.1)	44.0 (27.1–60.9)	47.9 (30.4–65.3)
Education					
≤High school/GED	46,215	2,185	4.7 (4.2–5.3)	45.7 (39.2–52.3)	52.5 (45.8–59.3)
>High school	109,517	3,127	2.9 (2.6–3.1)	41.3 (36.8–45.8)	47.3 (42.6–52.1)
Unknown	574	—**	—	—	—
Family income					
<$35,000	26,002	1,267	4.9 (4.2–5.6)	41.2 (34.5–48.0)	54.6 (47.8–61.3)
$35,000–$74,999	41,606	1,602	3.9 (3.3–4.4)	47.5 (41.0–54.1)	54.3 (47.9–60.8)
≥$75,000	76,734	2,089	2.7 (2.4–3.1)	44.0 (37.4–50.7)	45.2 (38.6–51.7)
Unknown	11,964	355	3.0 (1.7–4.2)	24.4 (9.2–39.6)	34.8 (16.1–53.5)
Health insurance status					
Not insured	17,206	859	5.0 (4.1–6.0)	42.2 (33.5–50.9)	55.3 (45.7–64.9)
Insured	138,201	4,379	3.2 (2.9–3.4)	43.7 (39.6–47.9)	48.2 (43.8–52.6)
Unknown	899	—	—	—	—
U.S. Census region††					
Northeast	28,150	658	2.3 (1.8–2.8)	48.4 (38.0–58.7)	50.8 (41.2–60.4)
Midwest	35,277	1,344	3.8 (3.3–4.4)	43.7 (36.0–51.4)	53.0 (46.3–59.7)
South	55,574	2,084	3.8 (3.3–4.2)	42.4 (36.8–47.9)	51.0 (44.5–57.5)
West	37,306	1,227	3.3 (2.7–3.9)	40.9 (31.9–49.9)	42.2 (33.3–51.2)
Cigarette smoking status§§					
Current	21,040	2,286	10.9 (9.8–12.0)	26.6 (19.6–33.6)	—
Former	29,951	2,045	6.8 (6.0–7.7)	65.8 (59.9–71.7)	—
Never	104,866	981	0.9 (0.7–1.1)	12.5 (4.0–21.1)	—
Unknown	449	—	—	—	—

See table footnotes on the next page.

use was 10.9% among current cigarette smokers, 6.8% among former smokers, 10.4% among users of other combustible tobacco, and 7.3% among smokeless tobacco users. Among the estimated 5.3 million workers who were current e-cigarettes users, 2.3 million (43.1%) were daily e-cigarette users, and 2.6 million (49.5%) also currently smoked combustible tobacco products. Among the estimated 2 million former cigarette smokers, 1.3 million (65.8%) were daily e-cigarette users.

Among the industries assessed, the prevalence of current e-cigarette use ranged from 6.9% among accommodation and food services workers (36.9% were daily users; 49.0% were current combustible tobacco product users) to 1.4% among education services workers (40.0% were daily users; 38.8% were current combustible tobacco product users). Among the occupations assessed, current e-cigarette use prevalence ranged from 7.3% among food preparation and serving-related workers (31.0% were daily users; 47.5% were current combustible tobacco product users) to 1.4% among education, training, and library workers (44.2% were daily users; 29.1% were current combustible tobacco product users). Daily e-cigarette use was highest among workers in the wholesale trade industry and production occupations. Among e-cigarette users, the prevalence of current combustible tobacco product use was highest among workers in the other services industry (including repair and maintenance, private household, and laundry services¶¶) and transportation and material moving occupations (Table 2).

¶¶ https://www.bls.gov/iag/tgs/iag81.htm

TABLE 1. (*Continued*) Estimated annual average current e-cigarette use among U.S. workers,* by selected characteristics — National Health Interview Survey, United States, 2017–2018

Characteristic	Estimated no. of workers† (x1,000)	Current e-cigarette users§			
		Estimated no. (x1,000)	Prevalence (95% CI)	Daily users, % (95% CI)	Using combustible tobacco,¶ % (95% CI)
Other combustible tobacco use¶¶					
Yes	7,784	813	10.4 (8.7–12.2)	30.2 (21.9–38.4)	—
No	148,097	4,492	3.0 (2.8–3.3)	45.5 (41.4–49.6)	—
Unknown	427	—	—	—	—
Smokeless tobacco use* **					
Yes	4,102	299	7.3 (5.2–9.3)	44.3 (30.3–58.4)	5.6 (4.0–7.2)
No	151,784	5,013	3.3 (3.0–3.6)	43.0 (39.1–47.0)	2.5 (2.3–2.8)
Unknown	420	—	—	—	—
Self-rated health†††					
Excellent/Very good/Good	147,048	4,850	3.3 (3.0–3.6)	43.2 (39.2–47.2)	48.7 (44.6–52.7)
Poor/Fair	9,223	458	5.0 3(.7–6.2)	42.0 (28.8–55.1)	58.2 (45.8–70.7)
Unknown	35	—	—	—	—

Abbreviations: CI = confidence interval; e-cigarettes = electronic cigarettes; GED = General Education Development certificate.

* Adults who were "working at a job or business," "with a job or business but not at work," or "working, but not for pay, at a family-owned job or business" during the week before the interview.

† Weighted to provide national annual average population estimates for current employment.

§ Used e-cigarettes at least once during their lifetime and used e-cigarettes "every day" or "some days" at the time of the survey.

¶ Combustible tobacco users were defined as persons who used either "every day" or "some days" at least one combustible tobacco product: cigarettes, cigars, cigarillos, filtered little cigars, pipes, water pipes, or hookahs (for cigarettes, users were defined as persons who had smoked ≥100 cigarettes during their lifetime and smoked "every day" or "some days" at the time of the survey).

** Small sample sizes or prevalence estimates with a relative standard error ≥30% are not presented.

†† *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

§§ Cigarette smokers were defined as persons who reported smoking ≥100 cigarettes during their lifetime and who currently smoke every day or some days.

¶¶ Cigars, cigarillos, or little filtered cigars, or smoked tobacco in a regular pipe, water pipe, or hookah at least once during their lifetime and now smoked at least one of these products "every day" or "some days."

*** Using chewing tobacco, snuff, dip, snus, or dissolvable tobacco at least once during their lifetime and now used at least one of these products "every day" or "some days."

††† Perceived self-reported health categorized on the basis of the response to the question "Would you say your health in general is excellent, good, fair, or poor?"

Discussion

The prevalence of current e-cigarette use among U.S. workers during 2017–2018 (3.4%) was similar to that during 2014–2016 (3.6%) (*6*). E-cigarette use varied by sociodemographic characteristics, industry, and occupation. Compared with 2014–2016, e-cigarette use prevalence increased among certain subpopulations of workers, especially among young adults. Similar to previous findings, a majority of current adult e-cigarette users reported nondaily use of the products (*7*), and e-cigarette use was associated with use of other tobacco products, mostly notable combustible products (*6*). These findings underscore the importance of continued surveillance of all forms of tobacco products use and the implementation of proven strategies to prevent and reduce tobacco product use among working adults.

Approximately one half of workers who currently use e-cigarettes also smoke combustible tobacco products, with the percentage varying by sociodemographic characteristics, industry, and occupation. Previous findings indicate that many adults reported using e-cigarettes in an attempt to quit smoking (*8*). E-cigarettes have the potential to benefit adult smokers if used as a complete substitute for conventional cigarettes and other combustible tobacco products (*3*). However, e-cigarettes are not approved by the Food and Drug Administration as a smoking cessation aid, and evidence is inadequate to conclude that e-cigarettes, in general, increase smoking cessation (*3*). Moreover, many adult e-cigarette users do not stop smoking cigarettes and instead continue to use both products; in this study, one half of current e-cigarette users also currently smoked combustible tobacco products. Smoking even a few cigarettes per day has health risks (*3*), and the use of cigarettes in combination with e-cigarettes is associated with the same, or in some cases higher, exposure to known tobacco-related toxicants*** compared with using cigarettes alone (*9*). Therefore, adults who use e-cigarettes as an alternative to cigarettes should quit smoking completely rather than use both for an extended period (*3*).

Prevalence of e-cigarette use varied by industry and occupation; prevalence was highest among workers in the accommodation and food services industry and in food preparation and

*** https://www.cdc.gov/workplacehealthpromotion/tools-resources/workplace-health/tobacco-use-cessation.html

TABLE 2. Estimated annual average current e-cigarette use among workers,* by industry and occupation — National Health Interview Survey, United States, 2017–2018

Industry/Occupation	Estimated no. of workers (x1,000)	Current e-cigarette users†			
		Estimated no. (x1,000)	Prevalence, % (95% CI)	Daily users, % (95% CI)	Using combustible tobacco,§ % (95% CI)
Industry group					
Accommodation and food services	9,737	669	6.9 (5.0–8.7)	36.9 (24.8–49.0)	49.0 (35.2–62.9)
Transportation and warehousing	6,950	367	5.3 (3.7–6.9)	47.8 (34.6–61.0)	52.1 (37.0–67.3)
Retail trade	15,161	749	5.0 (4.0–5.9)	35.5 (25.8–45.2)	55.0 (45.9–64.2)
Administrative and support, waste management, and remediation services	6,499	297	4.6 (3.3–5.9)	34.9 (20.7–49.0)	52.2 (37.4–66.9)
Information	2,774	124	4.5 (2.0–6.9)	—¶	53.5 (25.4–81.5)
Construction	10,996	455	4.1 (3.1–5.2)	48.9 (35.3–62.4)	54.6 (40.5–68.6)
Manufacturing	14,871	510	3.4 (2.6–4.2)	55.9 (44.2–67.6)	48.3 (37.2–59.5)
Real estate and rental and leasing	3,394	113	3.3 (1.8–4.9)	—	38.6 (16.6–60.7)
Public administration	7,807	254	3.3 (2.2–4.3)	50.1 (32.3–67.8)	29.3 (15.4–43.3)
Other services (except public administration)	7,466	243	3.3 (2.0–4.5)	42.8 (24.3–61.2)	62.8 (45.0–80.6)
Wholesale trade	3,574	115	3.2 (1.5–4.9)	79.2 (61.0–97.4)	62.5 (37.2–87.7)
Arts, entertainment, and recreation	3,139	97	3.1 (1.4–4.8)	—	47.6 (18.8–76.4)
Finance and insurance	7,205	215	3.0 (1.6–4.4)	49.1 (30.4–67.7)	—
Health care and social assistance	22,567	478	2.1 (1.6–2.6)	42.5 (31.2–53.8)	51.8 (40.5–63.1)
Professional, scientific, and technical services	13,105	266	2.0 (1.4–2.6)	45.3 (30.6–60.0)	50.0 (34.9–65.0)
Education services	14,612	204	1.4 (0.9–1.9)	39.8 (22.7–56.8)	38.8 (22.0–55.6)
All others**	4,365	131	3.0 (1.6–4.4)	—	—
Refused, not ascertained, don't know	2,084	—	—	—	—
Occupation group					
Food preparation and serving related	7,689	556	7.3 (5.1–9.5)	31.0 (18.2–43.8)	47.5 (31.8–63.1)
Transportation and material moving	9,134	517	5.7 (4.2–7.2)	47.4 (35.2–59.6)	66.1 (54.4–77.8)
Protective service	3,287	169	5.1 (2.8–7.5)	53.3 (29.2–77.4)	50.2 (26.1–74.3)
Sales and related	13,975	667	4.8 (3.8–5.8)	36.9 (26.7–47.2)	50.8 (40.0–61.7)
Installation, maintenance, and repair	4,606	215	4.7 (3.0–6.3)	43.0 (26.2–59.9)	56.6 (39.5–73.7)
Construction and extraction	8,241	353	4.3 (3.0–5.6)	52.2 (36.1–68.3)	49.3 (33.3–65.3)
Production	8,112	341	4.2 (3.0–5.4)	57.4 (44.7–70.2)	39.8 (27.1–52.5)
Arts, design, entertainment, sports, and media	3,709	139	3.8 (2.1–5.4)	45.0 (23.8–66.2)	40.8 (19.7–61.8)
Personal care and service	5,734	184	3.2 (1.8–4.7)	22.7 (3.2–42.3)	56.0 (33.2–78.9)
Business and financial operations	8,959	278	3.1 (1.9–4.3)	48.2 (31.9–64.4)	40.7 (22.4–59.0)
Building and grounds cleaning and maintenance	5,392	161	3.0 (2.0–4.0)	42.6 (25.4–59.8)	48.8 (31.4–66.1)
Office and administrative support	18,875	538	2.9 (2.2–3.5)	46.5 (35.2–57.9)	42.3 (30.6–54.0)
Health care support	3,908	108	2.8 (1.5–4.0)	—	57.1 (33.2–81.0)
Computer and mathematical	5,993	138	2.3 (1.4–3.2)	52.6 (33.1–72.1)	39.1 (20.9–57.4)
Management	15,797	364	2.3 (1.7–2.9)	48.8 (35.9–61.7)	55.4 (42.9–67.8)
Health care practitioners and technical	9,850	160	1.6 (1.1–2.2)	36.4 (19.7–53.0)	45.9 (28.2–63.6)
Education, training, and library	9,614	132	1.4 (0.8–2.0)	44.2 (22.5–65.9)	29.1 (10.7–47.8)
All others††	11,540	275	2.4 (1.6–3.2)	—	54.1 (38.2–70.1)
Refused, not ascertained, don't know	1,890	—	—	—	—

Abbreviation: CI = confidence interval.

* Adults who were "working at a job or business"; "with a job or business but not at work"; or "working, but not for pay, at a family-owned job or business" during the week before the interview. Data are weighted to provide national estimates using the survey sample weights for each participant.

† Current users are adults who used e-cigarettes at least once in their lifetime and currently use every day or some days.

§ Combustible tobacco use was defined as use either "every day" or "some days" of at least one combustible tobacco product: cigarettes, cigars, cigarillos, filtered little cigars, pipes, water pipes, or hookahs (for cigarettes, users were defined as persons who had smoked ≥100 cigarette during their lifetime and reported currently smoking "every day" or "some days").

¶ Small sample size or prevalence estimates with a relative standard error ≥30% are not presented.

** Includes workers in the agriculture, forestry, fishing, and hunting industry, mining industry, utilities industry, Management of companies and enterprises industry and armed forces industry. Industries with small sample size or ≥30% relative standard error, were combined to improve reliability.

†† Includes workers in the architecture and engineering occupation, life, physical, and social science occupation, community and social services occupation, legal occupation, farming, fishing, and forestry occupation, and military occupation. Occupations with small sample size or ≥30% relative standard error were combined to improve reliability.

serving-related occupations. Workers in the accommodation and food services industry were generally younger; among those using e-cigarettes, one third used e-cigarettes daily, and approximately one half reported concurrent combustible tobacco product use. Since 2014–2016, e-cigarette use has increased among workers in certain industries, including public administration and in food preparation and serving related, protective services, transportation and material moving, and sales and related occupations (*6*). This increase in e-cigarette use might be attributable, in part, to these industries and occupations having younger workers, less stringent tobacco-free policies, fewer cessation programs, or varying workplace cultures related to tobacco product use (*10*). Implementing targeted workplace interventions that help prevent initiation of tobacco product use and that encourage cessation of all tobacco products among current users can help improve overall worker health.

The findings in this report are subject to at least three limitations. First, only workers employed the week before the interview were included in this study. Some workers might have changed jobs and thus might have been in a different occupation or industry at the time of the survey interview. However, supplementary analyses examining the longest held job yielded similar results. Second, e-cigarette use was self-reported, which could introduce recall bias. Finally, despite data for multiple years being combined, e-cigarette use estimates for some industry and occupation groups were suppressed because of small sample sizes.

Workplace tobacco-control interventions have been effective in reducing cigarette smoking prevalence (*4*). Full implementation of targeted, evidence-based tobacco-control interventions that address the diversity of tobacco products used among U.S. adults, in coordination with regulation of tobacco product manufacturing, marketing, and sales, can reduce tobacco-related disease and death in the United States. To maximize the health of workers, employers can integrate comprehensive and effective tobacco cessation programs (*4*,*5*) into workplace health promotion programs.[†††]

[†††] https://www.cancer.org/cancer/cancer-causes/tobacco-and-cancer/carcinogens-found-in-tobacco-products.html

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Summary

What is already known about this topic?

During 2014–2016, an estimated 5.2 million U.S. workers used e-cigarettes, and prevalence was high among certain industries and occupations.

What is added by this report?

During 2017–2018, an estimated 5.3 million (3.4%) U.S. workers used e-cigarettes, one half of whom also smoked combustible tobacco products. E-cigarette use was highest among males, non-Hispanic Whites, persons aged 18–24 years, combustible tobacco product users, and workers in the accommodation and food services industry and in food preparation and serving-related occupations.

What are the implications for public health practice?

Full implementation of targeted, evidence-based tobacco-control interventions that address the diversity of tobacco products used by U.S. adults, in coordination with regulation of tobacco product manufacturing, marketing, and sales, can reduce tobacco-related disease and death.

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References

1. US Department of Health and Human Services. E-cigarette use among youth and young adults: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Exec_Summ_508.pdf
2. National Academies of Sciences, Engineering, and Medicine. Public health consequences of e-cigarettes. Washington, DC: The National Academies Press; 2018.
3. US Department of Health and Human Services. Smoking cessation: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC; 2020. https://www.hhs.gov/sites/default/files/2020-cessation-sgr-full-report.pdf
4. Castellan RM, Chosewood LC, Trout D, et al. Current intelligence bulletin 67: promoting health and preventing disease and injury through workplace tobacco policies. Morgantown, WV: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 2015. https://www.cdc.gov/niosh/docs/2015-113/pdfs/fy15_cib-67_2015-113_v3.pdf
5. Bauer JE, Hyland A, Li Q, Steger C, Cummings KM. A longitudinal assessment of the impact of smoke-free worksite policies on tobacco use. Am J Public Health 2005;95:1024–9. PMID:15914828 https://doi.org/10.2105/AJPH.2004.048678
6. Syamlal G, King BA, Mazurek JM. Tobacco use among working adults—United States, 2014–2016. MMWR Morb Mortal Wkly Rep 2017;66:1130–5. PMID:29072865 https://doi.org/10.15585/mmwr.mm6642a2

7. Creamer MR, Wang TW, Babb S, et al. Tobacco product use and cessation indicators among adults—United States, 2018. MMWR Morb Mortal Wkly Rep 2019;68:1013–9. PMID:31725711 https://doi.org/10.15585/mmwr.mm6845a2
8. Caraballo RS, Shafer PR, Patel D, Davis KC, McAfee TA. Quit methods used by US adult cigarette smokers, 2014–2016. Prev Chronic Dis 2017;14:E32. PMID:28409740 https://doi.org/10.5888/pcd14.160600
9. Goniewicz ML, Smith DM, Edwards KC, et al. Comparison of nicotine and toxicant exposure in users of electronic cigarettes and combustible cigarettes. JAMA Netw Open 2018;1:e185937. PMID:30646298 https://doi.org/10.1001/jamanetworkopen.2018.5937
10. Syamlal G, King BA, Mazurek JM. Workplace smoke-free policies and cessation programs among U.S. working adults. Am J Prev Med 2019;56:548–62. PMID:30772152 https://doi.org/10.1016/j.amepre.2018.10.030

Giardiasis Outbreaks — United States, 2012–2017

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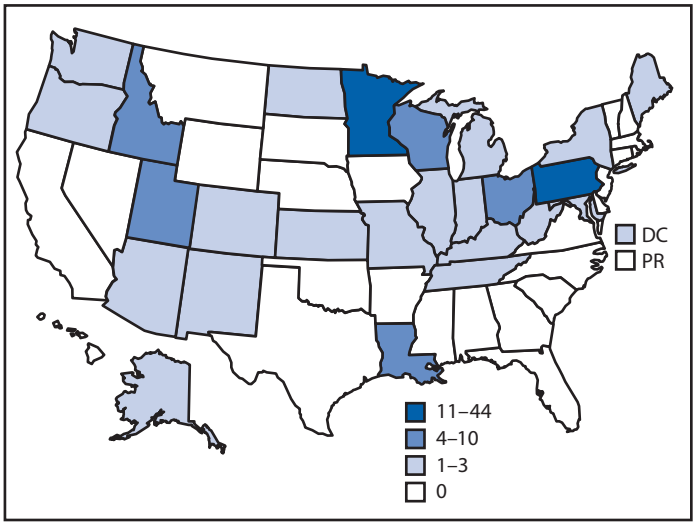
Giardiasis is a diarrheal disease caused by the parasite *Giardia duodenalis*, the most common cause of intestinal parasite infections in the United States. Transmission occurs when *Giardia* cysts spread from feces to water, food, surfaces, or skin and are then ingested. Illness is characterized by gastrointestinal symptoms, including diarrhea, abdominal cramps, greasy stools, bloating or gas, nausea, vomiting, weight loss, and dehydration. Approximately 50% of infections are asymptomatic (*1*,*2*). Most symptomatic *Giardia* infections are self-limited in duration; however, some persons might experience a reoccurrence of symptoms or develop long-term complications (*3*). During 2012–2017, public health officials from 26 states reported 111 giardiasis outbreaks (760 cases) to the National Outbreak Reporting System (NORS). Three main modes of transmission for these outbreaks were identified: water exposure in 29 (26%) outbreaks, person-to-person contact in 28 (25%) outbreaks, and contaminated food in six (5%) outbreaks. A single transmission mode could not be determined in 48 (43%) of the outbreaks. Private residences and child care facilities were the most common settings of outbreaks for all the transmission modes combined. To prevent and control giardiasis outbreaks, CDC recommends prompt diagnosis, maintaining good hand hygiene, cleaning and disinfecting home environments and child care facilities, and monitoring water quality in private wells.

A giardiasis outbreak is defined as the occurrence of two or more cases of illness epidemiologically linked to a common exposure (*1*). Health department officials from across the United States (state, local, and District of Columbia), U.S. territories,* and freely associated states† voluntarily report outbreaks to NORS. This study included giardiasis outbreak reports submitted to NORS by December 30, 2019 and data reported during 2012–2017 (the year of the earliest case illness onset date through the most recent year for which data were available). NORS data summarized in this study include primary case counts, hospitalizations, and deaths; transmission mode; exposures and settings; and earliest onset date. Negative binomial regression analysis was conducted to assess for annual trends in outbreak counts using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.§

During 2012–2017, public health officials from 26 states reported 111 giardiasis outbreaks with 760 primary cases, 28 hospitalizations, 48 emergency department visits, and no deaths. Among the 703 cases with available data, 370 (53%) persons were male and 333 (47%) persons were female. Pennsylvania reported the largest number of outbreaks with 44 (40%), followed by Minnesota with 11 (10%); no other state reported >10 outbreaks (Figure 1). There was no significant trend in giardiasis outbreaks by year (χ^2 = 0.67, p = 0.98) (Figure 2).

Among 29 (26%) waterborne outbreaks (370 cases), exposure sources included tap water systems (e.g., municipal systems or private wells) in nine outbreaks, outdoor freshwater consumption in seven outbreaks, treated recreational water in five outbreaks, untreated recreational water in four outbreaks, and "other" in four outbreaks (Table). Reported settings for waterborne outbreaks included 12 (41%) outdoor areas (e.g., parks and forests) five (17%) private residences, four (14%) camps or cabins, three (10%) community/municipality settings, three (10%) unknown, and two (7%) other settings. Person-to-person transmission was the primary mode identified in 28 (25%) outbreaks, resulting in 129 cases. The primary exposure settings for these outbreaks were 14 (50%) private residences and 12 (43%) child care facilities (Table). Among

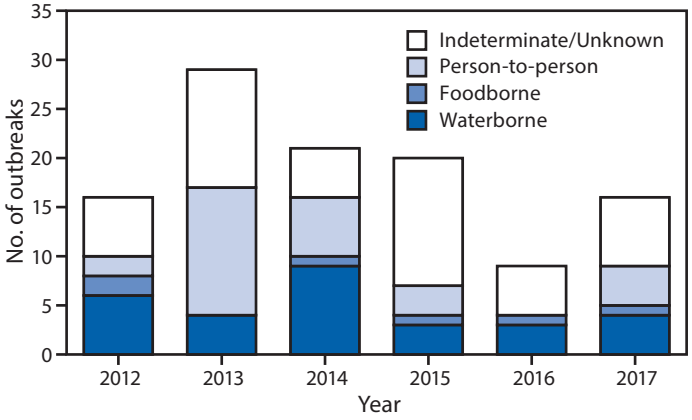
FIGURE 1. Reported giardiasis outbreaks (N = 111), by jurisdiction — National Outbreak Reporting System, United States, 2012–2017*



Abbreviations: DC = District of Columbia; PR = Puerto Rico.
* These numbers are dependent on reporting requirements and public health capacity, which vary across jurisdictions and do not necessarily indicate the actual occurrence of giardiasis outbreaks in a given jurisdiction.

* American Samoa, Northern Mariana Islands, Guam, Puerto Rico, and U.S. Virgin Islands.
† Federated States of Micronesia, Marshall Islands, and Palau.
§ 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE 2. Reported giardiasis outbreaks (N = 111), by mode of transmission* and year of earliest illness onset date — United States, 2012–2017



* Transmission modes were categorized as follows: indeterminate/unknown if evidence to implicate one specific primary mode of transmission was insufficient; person-to-person if transmission occurred from direct contact with an infected person, their body fluids, or by contact with the local environment where the exposed person was present; foodborne if transmitted through consumption of contaminated food or non-water beverages; waterborne if transmission occurred via ingestion, inhalation, contact, or another exposure to water (e.g., treated or untreated recreational water, drinking water [including bottled water], or an environmental or indeterminate water source). There were no outbreaks attributed to animal contact or environmental contamination other than food and water (https://www.cdc.gov/nors/forms.html).

the 14 settings in private homes, nine (64%) were in households with children aged ≤5 years; two (14%) were in homes with only adults. Among the six (5%) foodborne outbreaks, all foods associated with the five known food exposures were eaten raw or with minimal or no processing. No outbreaks were attributed to animal contact or environmental contamination other than food and water (i.e., contact with objects or surfaces with *Giardia*). Among all 111 outbreaks, 48 (43%) had an indeterminate or unknown transmission mode, meaning that there was insufficient evidence to implicate one specific primary mode of transmission; 33 (69%) of these outbreaks occurred in private residences (Table).

TABLE. Reported giardiasis outbreaks (N = 111), by mode of transmission and exposure — United States, 2012–2017

Transmission mode	No. (%) Outbreaks	No. (%) Cases
All modes	**111 (100)**	**760 (100)**
Waterborne (exposure source)	**29 (26)**	**370 (49)**
Tap water systems*	9	94
Recreational water		
Treated (e.g., pool)	5	19
Untreated (e.g., lake)	4	135
Outdoor freshwater (drinking source)	7	103
Other†	4	19
Person-to-person (exposure setting)	**28 (25)**	**129 (17)**
Private home/residence	14	47
Child care facilities	12	49
School/College/University	2	33
Foodborne (food vehicle)§	**6 (5)**	**97 (13)**
Oysters, raw	3	14
Whole milk, unpasteurized	1	38
Mixed green salad	1	25
Undetermined¶	1	20
Indeterminate/Unknown (exposure setting)**	**48 (43)**	**164 (22)**
Private home/residence	33	93
Child care facilities	2	25
Other††	5	17
Undetermined§§	8	29

* Includes municipal systems and private wells.
† Other waterborne outbreaks involved the following exposures: undetermined exposure to outdoor freshwater (two), sewage effluent (one), and undetermined exposure to water (one).
§ Includes confirmed and suspected food vehicles.
¶ Foodborne outbreaks were categorized as undetermined if specific food vehicle was not identified or reported.
** Outbreaks were categorized as having an indeterminate/unknown transmission mode if there was insufficient evidence to implicate one specific primary mode of transmission.
†† Indeterminate/unknown outbreaks categorized as "other" involved the following settings: communitywide (one), fair/festival (one), prison/detention center (one), resort (one), workplace (one).
§§ Indeterminate/unknown outbreaks were categorized as undetermined if specific setting was not identified or reported.

Discussion

Among giardiasis outbreaks transmitted person-to-person, and by waterborne and indeterminate transmission modes, 50% (52 of 105) occurred in private residences. Patients with giardiasis might be infectious for several weeks, and ingestion of as few as 10 cysts can cause disease, making good hygiene a critical component of preventing further disease spread (*4*). After a giardiasis diagnosis, prevention messaging to patients and their household members should include the importance of good hand hygiene practices, especially before preparing food or eating and after using the bathroom or changing diapers, as well as cleaning and disinfecting the home environment. Beyond the home, these hygiene recommendations also apply to child care facilities, another frequently reported setting for giardiasis outbreaks. CDC also recommends that persons with *Giardia* infection abstain from sexual activity for at least 2 weeks after diarrhea has resolved, because *Giardia* organisms can be transmitted through sexual contact (*5*).

Households that use tap water from a private well should be advised to have their water tested at least once a year to monitor water quality and for any contaminant of concern based on local conditions (e.g., septic system overuse, nearby wastewater discharges, agricultural or industrial runoff, or contaminants detected in neighbors' wells).

Reported waterborne outbreaks of giardiasis were associated primarily with exposures to outdoor freshwater sources, either through drinking or recreational water use. Because drinking

water directly from these sources is not regulated, health promotional materials should include information on the health risks of consuming water from outdoor freshwater sources and guidance on how to adequately treat water before consumption. Untreated water or ice from lakes, rivers, streams, ponds, or shallow wells should not be consumed. Because the infectious dose of *Giardia* is small and *Giardia* cysts are immediately infectious and moderately resistant to chlorine disinfection, CDC recommends that persons should not swim if sick with diarrhea and for at least 2 weeks after diarrhea has resolved.[¶]

Prompt diagnosis and treatment of giardiasis can also prevent further spread. Many patients endure symptoms long before they receive a diagnosis. For example, in a U.S. study of insurance claims data, one half of giardiasis patients required three or more office visits before the diagnosis was made; in >20% of patients, a giardiasis diagnostic code was not recorded until >30 days after the initial visit for gastrointestinal symptoms (*6*). Because *Giardia* organisms are excreted intermittently in feces, sensitivity of microscopy with the direct fluorescent antibody test (the standard for diagnosis) can be increased by collecting and testing three stool specimens from patients on separate days (*7*,*8*). If available, molecular-based gastrointestinal panel assays that include *Giardia* as a target pathogen might also be used for diagnosis (*9*). Nitroimidazoles, including metronidazole and tinidazole, are efficacious first-line drugs available in the United States (*10*).

The Council for State and Territorial Epidemiologists changed the confirmed case definition for giardiasis in 2011 from requiring only laboratory confirmation to requiring laboratory confirmation and meeting the clinical description for illness (*1*). Despite this stricter definition, there was no statistically significant decline in the number of reported outbreaks during 2012–2017.

The findings in this report are subject to at least two limitations. First, the number of outbreaks and their associated cases reported to NORS are likely underestimates, as resources for investigating and reporting outbreaks vary among states. Less than one half of states reported any giardiasis outbreak. It is unclear whether the geographic spread of outbreaks represents the actual underlying distribution, or whether it is a surveillance artifact. Second, attribution to a single transmission mode was not always possible. Identifying a single transmission mode might be particularly challenging among close household contacts who have overlapping exposures.

Results from this study suggest a need to focus prevention messages on the settings of giardiasis outbreaks, rather than on a single transmission mode, as nearly one half of reported outbreaks had an unknown mode of transmission. In view of these results, giardiasis prevention and control initiatives and health materials should promote prompt diagnosis, maintaining good hand hygiene, cleaning and disinfecting home environments and child care facilities, and monitoring water quality in private wells.

[¶] https://www.cdc.gov/healthywater/swimming/swimmers/rwi/diarrheal-illness.html

Summary

What is already known about this topic?

Giardiasis is a diarrheal disease caused by the parasite *Giardia duodenalis*, the most common cause of intestinal parasite infections in the United States.

What is added by this report?

During 2012–2017, public health officials from 26 states reported 111 giardiasis outbreaks involving 760 cases. Leading causes of outbreaks were waterborne and person-to-person exposures. Private residences and child care facilities were the most common settings of giardiasis outbreaks across all transmission modes.

What are the implications for public health practice?

To prevent and control giardiasis outbreaks, CDC recommends prompt diagnosis, maintaining good hand hygiene, cleaning and disinfecting home environments and child care facilities, and monitoring water quality in private wells.

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References

1. Council of State and Territorial Epidemiologists. 10-ID-17: Update to giardiasis case definition. Atlanta, GA: Council of State and Territorial Epidemiologists; 2011. https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/10-id-17.pdf
2. Farthing MJ. Giardiasis. Gastroenterol Clin North Am 1996;25:493–515. PMID:8863037 https://doi.org/10.1016/S0889-8553(05)70260-0
3. Robertson LJ, Hanevik K, Escobedo AA, et al. Giardiasis—why do the symptoms sometimes never stop? Trends Parasitol 2010;26:75–82. PMID:20056486 https://doi.org/10.1016/j.pt.2009.11.010
4. Rendtorff RC. The experimental transmission of human intestinal protozoan parasites. II. Giardia lamblia cysts given in capsules. Am J Hyg 1954;59:209–20. PMID:13138586
5. Escobedo AA, Almirall P, Alfonso M, et al. Sexual transmission of giardiasis: a neglected route of spread? Acta Trop 2014;132:106–11. PMID:24434784 https://doi.org/10.1016/j.actatropica.2013.12.025

6. Beer KD, Collier SA, Du F, Gargano JW. Giardiasis diagnosis and treatment practices among commercially insured persons in the United States. Clin Infect Dis 2017;64:1244–50. PMID:28207070 https://doi.org/10.1093/cid/cix138
7. Garcia LS, Arrowood M, Kokoskin E, et al. Practical guidance for clinical microbiology laboratories: laboratory diagnosis of parasites from the gastrointestinal tract. Clin Microbiol Rev 2018;31:e00025-17. PMID:29142079 https://doi.org/10.1128/CMR.00025-17
8. Soares R, Tasca T. Giardiasis: an update review on sensitivity and specificity of methods for laboratorial diagnosis. J Microbiol Methods 2016;129:98–102. PMID:27546714 https://doi.org/10.1016/j.mimet.2016.08.017
9. Llewellyn S, Inpankaew T, Nery SV, et al. Application of a multiplex quantitative PCR to assess prevalence and intensity of intestinal parasite infections in a controlled clinical trial. PLoS Negl Trop Dis 2016;10:e0004380. PMID:26820626 https://doi.org/10.1371/journal.pntd.0004380
10. Escobedo AA, Cimerman S. Giardiasis: a pharmacotherapy review. Expert Opin Pharmacother 2007;8:1885–902. PMID:17696791 https://doi.org/10.1517/14656566.8.12.1885

SARS-CoV-2 Infection Risk Among Active Duty Military Members Deployed to a Field Hospital — New York City, April 2020

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Protecting health care workers from COVID-19 remains a priority during the ongoing pandemic. Accurate assessment of the risk for infection among health care workers is important in determining the effectiveness of infection control plans. In late March 2020, a total of 591 U.S. Army personnel from three units were deployed from areas in which COVID-19 incidence was low to the Javits New York Medical Station (JMS), a 452-bed Federal Emergency Management Agency Federal Medical Station in New York City (NYC), to provide care to COVID-19 patients. Army personnel followed a rigorous infection control plan and remained largely isolated from the surrounding community while in NYC. During April 3–25, a total of 1,095 COVID-19 patients were admitted from NYC area hospitals to the JMS ward or intensive care unit (ICU). A cross-sectional study of the prevalence of SARS-CoV-2 infection among 336 active duty soldiers enrolled in a prevalence study identified an infection rate of 1.7% overall and 0.9% in the 223 (66.4%) enrolled soldiers who provided direct care to COVID-19 patients. A well-designed and well-implemented infection control plan can mitigate the risk for SARS-CoV-2, the virus that causes COVID-19, infection in health care settings, including nontraditional settings.

All patients transferred to JMS had received a positive SARS-CoV-2 polymerase chain reaction (PCR) test result or a clinical diagnosis of COVID-19 when evaluated at the transferring hospital, were clinically stable or improving, and did not have other complex medical conditions. Upon arrival, patients were admitted to a 452-bed patient care area converted from an exhibition space. The ventilation in the JMS patient care area was adjusted to create a negative pressure differential related to all other JMS spaces. Beds were contained within 8-foot square pods separated by temporary dividers with open ceilings and cloth doorways, and pods were supplied with oxygen by concentrators or portable tanks. Patients whose clinical condition deteriorated after admission were transferred to the ICU within JMS or to a local hospital.

Active duty soldiers from three army units, the 9th Hospital Center (Fort Hood, Texas), 531st Hospital Center (Fort Campbell, Kentucky), and the 44th Medical Brigade (Fort Bragg, North Carolina), were deployed to JMS to care for COVID-19 patients. These soldiers were not routinely tested for SARS-CoV-2 before deployment to NYC, and none had previously received a positive SARS-CoV-2 test result.

A multidisciplinary team of infection control specialists proactively designed and implemented infection control procedures to protect health care personnel. All personnel were screened for COVID-19–associated symptoms and fever upon each entry to JMS. The patient care area had one entry point for health care personnel where personal protective equipment (PPE) donning was continually observed, with assistance provided. All personnel working within 6 ft of COVID-19 patients were fit-tested and wore N95 respirators, eye protection, gloves, disposable gowns, and single-use scrubs. All personnel were required to completely doff PPE, with assistance, at the doffing station before exiting the patient care area for breaks and were required to repeat the observed donning process to reenter.

Military personnel were the sole occupants of local hotels and were housed in single-occupancy rooms. The military chain of command encouraged deployed personnel to stay in their hotel rooms as much as possible when off duty; meals were available at JMS, through food delivery services, or by take-out from restaurants within short walking distances of the hotels. The chain of command enforced mask wearing and physical distancing at all times. Personnel were placed in command-directed isolation if they reported experiencing any COVID-19–associated symptoms.

To assess the prevalence of SARS-CoV-2 infection among active duty soldiers deployed to JMS, researchers recruited soldiers for the study in late April. Among 591 eligible soldiers who deployed to NYC beginning on March 24, a total of 336 (56.8%) consented to participate in the prevalence study during April 28–30. Among the enrolled soldiers, 298 (88.7%) originated from an area where the 3-day average COVID-19 incidence was <10 cases per 100,000 persons; in contrast, the 3-day average incidence in NYC during March 30–April 1, 2020, was 519 per 100,000.* All enrolled soldiers completed an anonymous study questionnaire that asked about demographic characteristics, duties at JMS, and history of COVID-19 symptoms, isolation, and testing. During April 28–30, 2020, nasopharyngeal swabs were collected from all enrolled

* https://github.com/nytimes/covid-19-data

participants and were tested using the TaqPathTM COVID-19 Combo Kit (Thermo Fisher Scientific).[†] All participants also received enzyme-linked immunosorbent assay (ELISA) immunoglobulin G (IgG) and multiplex microsphere-based immunoassay (MMIA) IgG and immunoglobulin M (IgM) testing. Although not authorized for clinical diagnostic purposes at the time, MMIA can test simultaneously for antibodies to multiple antigens using an extremely small sample volume, in this case, <2 μL. SARS-CoV-2 antibody presence and titer were ascertained by using ELISA and MMIA (*1*).[§]

Enrolled soldiers were considered to have been infected if SARS-CoV-2 viral RNA was detected on nasopharyngeal PCR tests or if SARS-CoV-2 IgG antibodies were detected by ELISA. MMIA serologic testing was used to improve the sensitivity of antibody detection. Medians were compared by Wilcoxon-rank sum test using SPSS Statistics (version 22.0; IBM).

This study was approved by the Uniformed Services University Institutional Review Board. The activities were reviewed by CDC and were conducted consistent with applicable federal law and CDC policy.[¶]

Among the 336 soldiers who participated in the study, 304 (90.5%) had arrived in NYC before the first COVID-19 patient was admitted to JMS (Figure). During April 3–25, a total of 1,095 COVID-19 patients were admitted to JMS. Throughout that time, 77 (13.0%) of 591 soldiers were tested for SARS-CoV-2 by PCR because of reported COVID-19–compatible symptoms, including four who received positive SARS-CoV-2 PCR test results. Among the 336 soldiers enrolled in the study, 45 (13.3%) were tested because of symptoms; two had a positive SARS-CoV-2 PCR result.

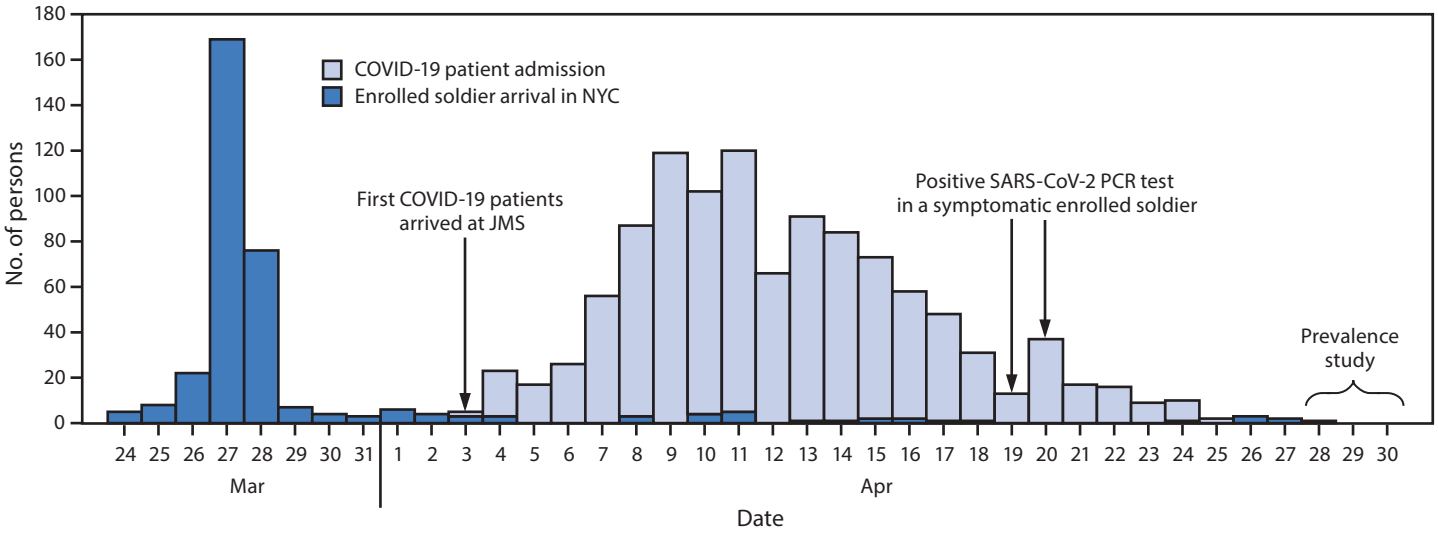
The 336 solders enrolled in the SARS-CoV-2 prevalence study included 100 registered nurses (29.7%), 99 medical support staff members (27.9%), 25 physicians and physician assistants (7.4%), and 117 other staff members (34.7%) (Table 1). Direct contact with COVID-19 patients was reported by 223 (66.4%) enrolled soldiers, for a self-estimated median of 240 hours at the time of enrollment and testing.

During the SARS-CoV-2 prevalence study, six of 336 (1.7%) soldiers received a positive SARS-CoV-2 test result, either by nasopharyngeal swab PCR (two), ELISA (five), or both (one) (Table 2). The five soldiers with positive IgG test results had titers of 1:80 (three), 1:160 (one), and 1:2,880 (one). Two (0.6%) soldiers had detectable IgG antibodies to the spike protein and receptor binding domain by MMIA testing; both soldiers also had positive ELISA test results (titers = 1:160 and 1:2880). The three soldiers with ELISA titers of 1:80 had negative MMIA results. Both soldiers with positive MMIA IgG results also had detectable IgM to SARS-CoV-2 spike protein; all other IgM results were negative.

The median age of the soldiers with positive SARS-CoV-2 test results (22 years) was significantly younger than that of all enrolled soldiers (32 years) (p = 0.02). Among the six soldiers with positive PCR or ELISA test results, two reported directly caring for COVID-19 patients, four reported having

[†] https://www.thermofisher.com/us/en/home/clinical/clinical-genomics/pathogen-detection-solutions/covid-19-sars-cov-2/interpretive-software.html
[§] https://pubmed.ncbi.nlm.nih.gov/33083807/
[¶] 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 501 et seq.

FIGURE. Admission of COVID-19 patients, arrival of deployed U.S. Army personnel enrolled in prevalence study, and dates of positive SARS-CoV-2 test results — Javits New York Medical Station (JMS), New York City (NYC), March 24–April 30, 2020



Abbreviation: PCR = polymerase chain reaction.

TABLE 1. Characteristics of active duty military members enrolled in a cross-sectional prevalence study of SARS-CoV-2 infection — Javits New York Medical Station (JMS), New York City (NYC), April 2020

Characteristic	No. (column %) of participants	
	All (N = 336)	SARS-CoV-2–positive (n = 6)
Median age, yrs (IQR)	**32 (25.3–40.0)**	22 (20.3–23.0)
Sex		
Female	**135 (40.2)**	2 (33.3)
Male	**201 (59.8)**	4 (66.7)
Professional role		
Registered nurse	**100 (29.7)**	1 (16.7)
Medical support*	**94 (27.9)**	1 (16.7)
Physician/Physician assistant	**25 (7.4)**	0 (—)
Other	**117 (34.7)**	4 (66.7)
Median no. of days in NYC (IQR)	**31 (30.0–32.0)**	**31 (31.0–31.8)**
Travel within 2 wks before arrival	**27 (8.0)**	**0 (—)**
Potential exposure risks		
Directly cared for COVID-19 patients	**223 (66.4)**	2 (33.3)
Median number of patient-care hours (IQR)†	**240 (176.0–288.0)**	264 (228.0–300.0)
Performed aerosol-generating procedures	**26 (7.7)**	0 (—)
Reported break in PPE	**36 (10.7)**	1 (16.7)
Symptoms and isolation		
Reported potential symptoms	**133 (39.6)**	4 (66.7)
Isolated for COVID-19–associated symptoms	**52 (15.5)**	2 (33.3)
Median days isolated (IQR)	**7 (7.0–7.0)§**	10.5 (10.3–11.0)
Symptoms while in NYC, reported at enrollment, no. (%)		
Fever	**16 (4.8)**	2 (33.3)
Cough	**32 (9.5)**	2 (33.3)
Shortness of breath	**14 (4.2)**	1 (16.7)
Diarrhea	**55 (16.4)**	1 (16.7)
Anosmia	**7 (2.1)**	2 (33.3)
Sore throat	**52 (15.5)**	3 (50.0)
Rhinorrhea	**81 (24.1)**	3 (50.0)
Median duration of symptoms, when present, days (IQR)		
Fever	**2 (2.0–3.3)**	3.5 (3.3–3.8)
Cough	**4 (2.0–7.0)**	8 (7.5–8.5)
Shortness of breath	**5 (2.0–6.0)**	8 (—)
Diarrhea	**2 (1.0–4.0)**	1 (—)
Anosmia	**2 (2.0–3.0)**	4 (4.0–4.0)
Sore throat	**3 (2.0–4.0)**	3 (3.0–6.0)
Rhinorrhea	**4.5 (2.0–7.0)**	3 (3.0–5.0)

Abbreviations: IQR = interquartile range; PPE = personal protective equipment.
* Medical support includes licensed practical nurses, medics, therapists, and other specialists who typically interact with patients.
† Patient-care hours for those who directly cared for COVID-19 patients, determined by self-reported hours/week caring for patients and the time from arrival to NYC or the first admission of COVID-19 patients to JMS, whichever was later.
§ Because the majority of persons were isolated for 7 days, the 25th and 75th percentiles are both 7 days, as is the median.

COVID-19 symptoms, and two were isolated for symptomatic SARS-CoV-2 infection that was previously detected by PCR while the soldiers were at JMS. The SARS-CoV-2 infection rate among those who provided direct care to COVID-19 patients was 0.9% (two of 223).

TABLE 2. Molecular test and serologic assay results among soldiers with positive SARS-CoV-2 test results (N = 6) — Javits New York Medical Station, New York City, April 2020

Soldier	SARS-CoV-2 test results				
	PCR	ELISA IgG	Titer	MMIA IgG	MMIA IgM
A	Pos	Pos	1:160	Pos	Pos
B	Neg	Pos	1:2,880	Pos	Pos
C	Neg	Pos	1:80	Neg	Neg
D	Neg	Pos	1:80	Neg	Neg
E	Neg	Pos	1:80	Neg	Neg
F	Pos	Neg	N/A	Neg	Neg

Abbreviations: ELISA = enzyme-linked immunosorbent assay; IgG = immunoglobulin G; IgM = immunoglobulin M; MMIA = multiplex microsphere-based immunoassay; N/A = not available; Neg = negative; PCR = polymerase chain reaction; Pos = positive.

Discussion

This study of active duty military personnel deployed to care for COVID-19 patients demonstrates that a low rate of SARS-CoV-2 infection among health care personnel in a field hospital is achievable when appropriate resources are coupled with robust infection control measures. Deployed military personnel were from geographic regions with low COVID-19 incidence and were relatively isolated from the community after arriving in NYC. The overall SARS-CoV-2 infection rate among soldiers was <2%, and among those involved in direct patient care, the rate was <1%, which is lower than rates in health care personnel reported in previous studies (*2*–*5*). These findings underscore the importance of use of adequate PPE and rigorous infection control plans for the protection of health care personnel, especially in a field hospital that lacks the standard physical barriers and infrastructure of a traditional health care setting.

JMS protocols and practices highlight the need to ensure compliance with infection control best practices such as assisted donning and doffing of PPE (*6*). Cohorting all COVID-19 patients helped to conserve PPE and reduced the frequency of doffing, thereby limiting risk to medical staff members for exposure to contaminated PPE surfaces during doffing. However, wearing PPE during long shifts can be uncomfortable for staff members. Appropriate monitoring and enforcement can be implemented in any health care setting, but the military command structure is especially well suited for this purpose.

The findings in this report are subject to at least three limitations. First, the patients admitted to JMS were transferred from a hospital in the NYC area with known COVID-19 and were stable or improving before transfer. This resulted in a lower likelihood of these patients being infectious than the typical COVID-19 patient evaluated in a hospital emergency department. Second, the interval between exposure of health care personnel to COVID-19 patients at JMS and serologic

Summary

What is already known about this topic?

Health care workers caring for patients with COVID-19 are at risk for infection.

What is added by this report?

In April 2020, U.S. military personnel were deployed to a New York City field hospital to care for COVID-19 patients. A robust infection control plan was implemented and enforced. Among 336 soldiers participating in an infection risk study, the overall infection rate was 1.7%; the rate among those involved in direct patient care was 0.9%.

What are the implications for public health practice?

A well-designed and well-implemented infection control plan and use of adequate personal protective equipment can mitigate the risk for SARS-CoV-2 transmission in health care settings, including nontraditional settings.

testing was relatively short. Because SARS-CoV-2 IgG increases during the first 4 weeks after infection, this short interval reduced the sensitivity of SARS-CoV-2 serologic testing (*7*). Finally, soldiers volunteered to participate and might have had different risk factors and infection rates than did those who did not participate.

The SARS-CoV-2 infection rate among soldiers deployed to NYC was low compared with the rate for other health care personnel cohorts, for both those who cared directly for patients and those who did not. This experience demonstrates that a well-designed, well-resourced infection control plan implemented with fidelity to best practices as well as adequate PPE and isolation of health care personnel from community-based exposures can mitigate the risk for SARS-CoV-2 infection in health care settings, including nontraditional health care settings.

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References

1. Amanat F, Stadlbauer D, Strohmeier S, et al. A serological assay to detect SARS-CoV-2 seroconversion in humans. Nat Med 2020;26:1033–6. PMID:32398876 https://doi.org/10.1038/s41591-020-0913-5
2. Moscola J, Sembajwe G, Jarrett M, et al.; Northwell Health COVID-19 Research Consortium. Prevalence of SARS-CoV-2 antibodies in health care personnel in the New York City area. JAMA 2020;324:893–5. PMID:32780804 https://doi.org/10.1001/jama.2020.14765
3. Steensels D, Oris E, Coninx L, et al. Hospital-wide SARS-CoV-2 antibody screening in 3056 staff in a tertiary center in Belgium. JAMA 2020;324:195–7. PMID:32539107 https://doi.org/10.1001/jama.2020.11160
4. Hunter E, Price DA, Murphy E, et al. First experience of COVID-19 screening of health-care workers in England. Lancet 2020;395:e77–8. PMID:32333843 https://doi.org/10.1016/S0140-6736(20)30970-3
5. Sikkema RS, Pas SD, Nieuwenhuijse DF, et al. COVID-19 in health-care workers in three hospitals in the south of the Netherlands: a cross-sectional study. Lancet Infect Dis 2020;20:1273–80. PMID:32622380 https://doi.org/10.1016/S1473-3099(20)30527-2
6. Okamoto K, Rhee Y, Schoeny M, et al.; CDC Epicenters Program. Impact of doffing errors on healthcare worker self-contamination when caring for patients on contact precautions. Infect Control Hosp Epidemiol 2019;40:559–65. PMID:30890193 https://doi.org/10.1017/ice.2019.33
7. Guo L, Ren L, Yang S, et al. Profiling early humoral response to diagnose novel coronavirus disease (COVID-19). Clin Infect Dis 2020;71:778–85. PMID:32198501 https://doi.org/10.1093/cid/ciaa310

Estimated SARS-CoV-2 Seroprevalence Among Persons Aged <18 Years — Mississippi, May–September 2020

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As of March 1, 2021, persons aged <18 years accounted for approximately 11% of 28.4 million reported COVID-19 cases in the United States*; however, data on pediatric infections with SARS-CoV-2, the virus that causes COVID-19, are limited (*1*). Surveys of SARS-CoV-2 antibody seroprevalence suggest that cumulative incidence of infection is much higher than that ascertained by reported COVID-19 cases (*2*,*3*). Evidence of previous SARS-CoV-2 infections among young persons in Mississippi was assessed by testing for antibodies to SARS-CoV-2 on a convenience sample of residual serum specimens collected for routine testing by an academic medical center laboratory during May 17–September 19, 2020. Seroprevalence by calendar month was standardized to the state population by race/ethnicity; cumulative numbers of infections were estimated by extrapolating seroprevalence to all persons aged <18 years in Mississippi. Serum specimens from 1,603 persons were tested; 175 (10.9%) were positive for SARS-CoV-2 antibodies. Among 1,579 (98.5%) specimens for which the race/ethnicity of the person tested was known, specimens from 16 (23.2%) of 69 Hispanic persons, 117 (13.0%) of 901 non-Hispanic Black persons, and 30 (5.3%) of 565 non-Hispanic White persons tested positive. Population-weighted seroprevalence estimates among persons aged <18 years increased from 2.5% in May to 16.3% in September 2020. Based on these estimates, 113,842 (95% confidence interval [CI] = 90,096–153,652) persons aged <18 years in Mississippi might have been infected with SARS-CoV-2 by mid-September 2020. The number of COVID-19 cases reported in this age group through August 31, 2020 was 8,993. Serosurveys that include pediatric age groups can help provide evidence of cumulative disease incidence, estimate frequency of undiagnosed cases of SARS-CoV-2 among young persons, and guide prevention efforts.

Most persons who are infected with SARS-CoV-2 develop antibodies to SARS-CoV-2 proteins within 1–2 weeks of disease onset (*4*). Serologic testing for SARS-CoV-2 antibodies, albeit having imperfect sensitivity and specificity,† is useful to identify past SARS-CoV-2 infections. Serology tests are used widely in seroprevalence studies to understand patterns of virus spread and cumulative incidence of SARS-CoV-2 infection§ (*2*,*3*).

This retrospective seroprevalence study was conducted by the University of Mississippi Medical Center in collaboration with the Mississippi State Department of Health (MSDH) and CDC to describe trends in SARS-CoV-2 antibody seroprevalence among young persons in Mississippi during the COVID-19 pandemic. The University of Mississippi Medical Center provides clinical laboratory services for university hospitals in central Mississippi and 12 hospitals outside the university network statewide (*5*). Demographic data including age, sex, race/ethnicity, and date of collection were obtained for deidentified residual serum specimens collected for routine clinical testing during May 17–September 19, 2020, from persons aged <18 years. One specimen per person was included in the analysis, either the first seropositive specimen or the earliest specimen from persons with all seronegative specimens, to avoid potential bias in underestimating infections from decline in antibodies below the limit of detection for seropositivity. Sera were stored at −20°C (−4°F) before testing at CDC.

Seropositivity was determined for serum specimens using one of two assays, based on specimen volume. Specimens with adequate volume (≥0.3 mL) were tested with a qualitative VITROS anti–SARS-CoV-2 total antibody in vitro diagnostic test using the automated VITROS 3600 Immunodiagnostic System (Ortho Clinical Diagnostics) (*6*). One aliquot was heat-treated at 56°C (132.8°F) for 10 minutes and tested on the VITROS Immunodiagnostic System. An automatically calculated ratio of test sample signal to cutoff value (S/C) <1.0 was interpreted as nonreactive, and S/C ≥1.0 was interpreted as reactive for anti–SARS-CoV-2 total antibody (*6*). Samples with volumes <0.3 mL were tested to determine seropositivity using an enzyme linked immunosorbent assay (ELISA) developed by CDC to measure total SARS-CoV-2 antibodies against the extracellular domain of the SARS-CoV-2 spike protein (*2*).¶

* https://covid.cdc.gov/covid-data-tracker/#demographics
† https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antibody-tests-guidelines.html
§ https://covid.cdc.gov/covid-data-tracker/#national-lab
¶ https://www.biorxiv.org/content/10.1101/2020.04.24.057323v2

Seroprevalence by calendar month was standardized to the Mississippi population aged <18 years by race/ethnicity**; 95% CIs accounting for assay test performance were estimated by using published methods (*2*). Cumulative numbers of SARS-CoV-2 infections were estimated by extrapolating seroprevalence and 95% CIs to the Mississippi population aged <18 years and were compared with cumulative numbers of confirmed and probable COVID-19 cases (as defined by the Council of State and Territorial Epidemiologists)†† in persons aged <18 years reported to MSDH.§§ Ratios of estimated SARS-CoV-2 infections to reported COVID-19 cases were calculated by dividing estimated numbers of SARS-CoV-2 infections by the reported cumulative number of COVID-19 cases as of the last day of the preceding month. Statistical analyses were conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.¶¶ The project was also reviewed and approved by the University of Mississippi Medical Center Institutional Review Board through its expedited review procedure.

Among 1,603 serum specimens from persons aged <18 years included in analyses, 175 (10.9%) tested positive for SARS-CoV-2 antibodies, including 152 of 1,469 (10.4%) by VITROS assay and 23 of 134 (17.2%) by ELISA (Table 1). Among 1,579 (98.5%) specimens for which the race/ethnicity of the person receiving testing was known, specimens from 16 (23.2%) of 69 Hispanic persons, 117 (13.0%) of 901 non-Hispanic Black persons, and 30 (5.3%) of 565 non-Hispanic White persons tested seropositive. After adjusting by race/ethnicity to the Mississippi population aged <18 years, estimated seroprevalence increased from 2.5% in May to 16.3% in September (Figure). Extrapolating to the state population, an estimated 113,842 (95% CI = 90,096–153,652) Mississippi residents aged <18 years might have been infected with SARS-CoV-2 by mid-September 2020; through August 31, a total of 8,993 COVID-19 cases among persons aged <18 years had been reported to MSDH (Table 2). Ratios of estimated numbers of SARS-CoV-2 cases based on seropositivity to COVID-19 cases reported at the end of the preceding month decreased from 68.2 in May to 12.7 in September. This finding suggests an improvement in case detection over time, even though the number of SARS-CoV-2 cases estimated from seroprevalence was consistently higher than the number of SARS-CoV-2 cases reported during each month.

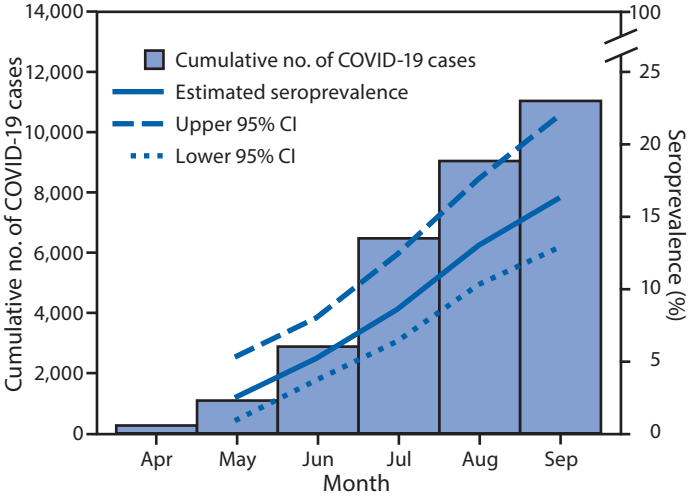
** 2019 U.S. Census data for Mississippi. https://wonder.cdc.gov
†† https://wwwn.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/
§§ https://msdh.ms.gov/msdhsite/_static/14,0,420.html
¶¶ Activity was determined to meet the requirements of public health surveillance as defined in 45 CFR 46.102(l)(2).

TABLE 1. Characteristics and SARS-CoV-2 serology results of persons aged <18 years whose residual serum specimens* were tested for presence of SARS-CoV-2 antibodies — Mississippi, May 17–September 19, 2020

Characteristic	Total	SARS-CoV-2 serology result		P-value§
		No. positive	% (95% CI)†	
Overall	**1,603**	**175**	**10.9 (9.4–12.4)**	—
Age group				0.03
<6 mos	**420**	61	14.5 (11.2–17.9)	
6–11 mos	**63**	9	14.3 (5.6–22.9)	
1–8 yrs	**423**	42	9.9 (7.1–12.8)	
9–17 yrs	**697**	63	9.0 (6.9–11.2)	
Sex (missing = 2)				0.28
Female	**771**	91	11.8 (9.6–14.1)	
Male	**830**	84	10.1 (8.1–12.2)	
Race/Ethnicity (missing = 24)				<0.01
Black, non-Hispanic	**901**	117	13.0 (10.8–15.2)	
Hispanic	**69**	16	23.2 (13.2–33.2)	
Other, non-Hispanic	**44**	7	15.9 (5.1–26.7)	
White, non-Hispanic	**565**	30	5.3 (3.5–7.2)	
Assay				0.02¶
Ortho VITROS	**1,469**	152	10.4 (8.8–11.9)	
CDC ELISA	**134**	23	17.2 (10.8–23.6)	
Dates of specimen collection				<0.01
May 17–May 31	**174**	6	3.5 (0.7–6.2)	
Jun 1–30	**447**	28	6.3 (4.0–8.5)	
Jul 1–31	**339**	35	10.3 (7.1–13.6)	
Aug 1–31	**368**	56	15.2 (11.6–18.9)	
Sep 1–19	**275**	50	18.2 (13.6–22.7)	

Abbreviations: CI = confidence interval; ELISA = enzyme-linked immunosorbent assay.
* Includes residual serum specimens from 1,603 persons aged <18 years.
† 95% CIs for seroprevalence by month were calculated assuming a binomial distribution for SARS-CoV-2 seropositivity in the sample.
§ P-value for difference in proportion seropositive by individual characteristic, serologic assay, or dates of specimen collection using chi-squared test.
¶ P-value for difference in proportion seropositive in specimens tested by each assay; individual specimens were tested with Ortho VITROS if specimen volume was ≥0.3 mL or CDC ELISA if specimen volume was <0.3 mL.

FIGURE. Cumulative number of reported COVID-19 cases and estimated race/ethnicity–standardized SARS-CoV-2 antibody seroprevalence* among persons aged <18 years — Mississippi, April–September 2020



Abbreviation: CI = confidence interval.
* From residual serum specimens collected during May 17–September 19, 2020, from persons aged <18 years.

TABLE 2. Estimated number of SARS-CoV-2 infections based on seroprevalence estimates and the number of reported COVID-19 cases at of the end of the preceding month among persons aged <18 years — Mississippi, May 17–September 19, 2020

Specimen collection date	Estimated seroprevalence* % (95% CI)	Estimated cumulative infections,† no. (95% CI)	Cumulative reported cases§ (report date)	Estimated infection/reported case ratio (95% CI)
May 17–31	2.5 (0.9–5.3)	17,461 (6,286–37,016)	256 (Apr 30)	68.2 (24.6–144.6)
Jun 1–30	5.2 (3.7–8.0)	36,318 (25,842–55,874)	1,083 (May 31)	33.5 (23.9–51.6)
Jul 1–31	8.6 (6.4–12.4)	60,064 (44,699–86,604)	2,869 (Jun 30)	20.9 (15.6–30.2)
Aug 1–31	13.0 (10.3–17.6)	90,795 (71,937–122,922)	6,439 (Jul 31)	14.1 (11.2–19.1)
Sep 1–19	16.3 (12.9–22.0)	113,842 (90,096–153,652)	8,993 (Aug 31)	12.7 (10.0–17.1)

Abbreviation: CI = confidence interval.

* Standardized to the race/ethnicity distribution of the Mississippi population aged <18 years using weights derived from the 2019 U.S. Census; 95% CIs were calculated for race/ethnicity–weighted SARS-CoV-2 seropositivity in the sample accounting for assay test performance.

† Race/ethnicity–standardized seroprevalence estimates for each period applied to the 2019 Mississippi population aged <18 years = 698,420 (https://www.census.gov).

§ Cumulative number of confirmed and probable COVID-19 cases in persons aged <18 years reported to Mississippi State Department of Health as of the end of the preceding month.

Discussion

During July–August 2020, Mississippi experienced a rapid rise in COVID-19 cases, which preceded a second peak in incidence in December 2020. Analyses of a convenience sample of residual sera collected during May–September 2020, indicated that 16.3% of children and adolescents in Mississippi might have been infected with SARS-CoV-2 by mid-September 2020. Seropositivity rates among non-Hispanic Black and Hispanic young persons were 2.4 and 4.3 times, respectively, the rate among non-Hispanic White persons. Monthly increases in population-weighted seroprevalence among persons aged <18 years paralleled increases in the cumulative number of reported COVID-19 cases among young persons in Mississippi. Projected cumulative infections based on seroprevalence suggests that case-based surveillance underestimated SARS-CoV-2 infections among children and adolescents, consistent with national data suggesting underascertainment of COVID-19 disease incidence in all age groups[***,†††] (*7*). Compared with seroprevalence data from older age groups in Mississippi, data from this study sample suggests that cumulative infection rates by mid-September among persons aged <18 years were similar to those among persons aged 18–49 years, the age group with the highest seroprevalence during the period (*3*).

Nationwide serosurveys have identified varying seroprevalences by sex, age group, and urban/rural status. In four cross-sectional serosurveys conducted in Mississippi during July–October 2020, female sex, age 18–49 years, and living in nonmetropolitan jurisdictions were associated with higher SARS-CoV-2 seroprevalence (*3*). However, numbers of specimens from persons aged <18 years were insufficient to provide seroprevalence estimates for this age group. In contrast, the current investigation of percentage of serum specimens with positive SARS-CoV-2 antibody test results benefited from large numbers of pediatric specimens collected during a 4-month period when incidence of reported COVID-19 cases increased rapidly.

The findings in this report are subject to at least four limitations. First, seroprevalence among a convenience sample of sera from one laboratory might not be representative of seroprevalence among all persons aged <18 years in Mississippi; therefore, actual numbers of SARS-CoV-2 infections in this age group might have been higher or lower than projected. Second, young persons who have blood collected for routine laboratory testing might differ from the general pediatric population with respect to underlying health conditions, access to care, or adherence to prevention measures including use of masks and physical distancing. However, compared with more representative serosurveys, residual sera from commercial laboratories have previously been shown to provide an approximate measure of community SARS-CoV-2 seroprevalence (*3*). Third, misclassification of antibody status was possible because of imperfect sensitivity and specificity of the assays used in the report. Finally, selecting the first seropositive specimen from persons receiving positive test results at any time point rather than randomly selected specimens might have overestimated population seroprevalence. Alternatively, seroprevalence could be underestimated if participants who were infected had not yet mounted an antibody response or if antibody titers had declined since infection (*8*,*9*).

These estimates of SARS-CoV-2 infections among children and adolescents in Mississippi add to those from other studies of the general population from nationwide cross-sectional serosurveys. Including pediatric age groups in serosurveys can help track the spread of SARS-CoV-2 among young persons in the United States.

*** https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/burden.html

††† https://www.medrxiv.org/content/10.1101/2021.01.27.21250570v1.full

Summary

What is already known about the topic?

Serosurveys estimating prior SARS-CoV-2 infections in the United States have focused on adults; little is known about seroprevalence among young persons.

What is added by this report?

Serologic testing of residual blood specimens collected during May–September 2020, from 1,603 persons aged <18 years suggested that approximately 113,842 (16.3%) of 698,420 young persons in Mississippi might have been infected with SARS-CoV-2 by mid-September 2020, and only 8,993 confirmed and probable COVID-19 cases among young persons had been reported to the Mississippi State Department of Health by August 31.

What are the implications for public health practice?

Serosurveys including pediatric age groups help estimate cumulative disease incidence and frequency of undiagnosed cases of COVID-19 among young persons to guide prevention efforts.

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References

1. Dingens AS, Crawford KHD, Adler A, et al. Serological identification of SARS-CoV-2 infections among children visiting a hospital during the initial Seattle outbreak. Nat Commun 2020;11:4378. PMID:32873791 https://doi.org/10.1038/s41467-020-18178-1
2. Havers FP, Reed C, Lim T, et al. Seroprevalence of antibodies to SARS-CoV-2 in 10 sites in the United States, March 23–May 12, 2020. JAMA Intern Med 2020;180:1576–86. PMID:32692365 https://doi.org/10.1001/jamainternmed.2020.4130
3. Bajema KL, Wiegand RE, Cuffe K, et al. Estimated SARS-CoV-2 seroprevalence in the US as of September 2020. JAMA Intern Med 2020. Epub November 24, 2020. https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2773576
4. Sethuraman N, Jeremiah SS, Ryo A. Interpreting diagnostic tests for SARS-CoV-2. JAMA 2020;323:2249–51. PMID:32374370 https://doi.org/10.1001/jama.2020.8259
5. Inagaki K, Garg P, Hobbs CV. SARS-CoV-2 positivity rates among children of racial and ethnic minority groups in Mississippi. Pediatrics 2021;147:e2020024349. PMID:33115793 https://doi.org/10.1542/peds.2020-024349
6. Biggs HM, Harris JB, Breakwell L, et al.; CDC Field Surveyor Team. Estimated community seroprevalence of SARS-CoV-2 antibodies—two Georgia counties, April 28–May 3, 2020. MMWR Morb Mortal Wkly Rep 2020;69:965–70. PMID:32701941 https://doi.org/10.15585/mmwr.mm6929e2
7. Reese H, Iuliano AD, Patel NN, et al. Estimated incidence of COVID-19 illness and hospitalization—United States, February–September, 2020. Clin Infect Dis 2020. Epub November 25, 2020.
8. Patel MM, Thornburg NJ, Stubblefield WB, et al. Change in antibodies to SARS-CoV-2 over 60 days among health care personnel in Nashville, Tennessee. JAMA 2020;324:1781–2. PMID:32940635 https://doi.org/10.1001/jama.2020.18796
9. Self WH, Tenforde MW, Stubblefield WB, et al.; CDC COVID-19 Response Team; IVY Network. Decline in SARS-CoV-2 antibodies after mild infection among frontline health care personnel in a multistate hospital network—12 states, April–August 2020. MMWR Morb Mortal Wkly Rep 2020;69:1762–6. PMID:33237893 https://doi.org/10.15585/mmwr.mm6947a2

Community Transmission of SARS-CoV-2 at Three Fitness Facilities — Hawaii, June–July 2020

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On July 2, 2020, the Hawaii Department of Health was notified that a fitness instructor (instructor A) had experienced signs and symptoms compatible with coronavirus disease 2019 (COVID-19)* and received a positive reverse transcription–polymerase chain reaction (RT-PCR) test result for SARS-CoV-2, the virus that causes COVID-19. At the time, Honolulu County reported community transmission of a 7-day average of 2–3 cases per 100,000 persons per day (*1*). Before the onset of symptoms, instructor A taught classes at two fitness facilities in Honolulu, facilities X and Y. Twenty-one COVID-19 cases were linked to instructor A, including a case in another fitness instructor (instructor B). The aggregate attack rates in classes taught by both instructors <1 day, 1 to <2 days, and ≥2 days before symptom onset were 95% (20 of 21), 13% (one of eight), and 0% (zero of 33), respectively. Among the 21 secondary cases, 20 (95%) persons had symptomatic illness, two (10%) of whom were hospitalized. At the time of this outbreak, use of masks was not required in fitness facilities. To reduce SARS-CoV-2 transmission in fitness facilities, staff members and patrons should wear a mask (including during high-intensity exercise), and facilities should implement engineering and administrative controls including 1) improving ventilation; 2) enforcing consistent and correct mask use and physical distancing (maintaining ≥6 ft of distance between all persons, limiting physical contact and class size, and preventing crowded spaces); 3) reminding all patrons and staff members to stay home when ill; and 4) increasing opportunities for hand hygiene. Conducting exercise activities entirely outdoors or virtually could further reduce SARS-CoV-2 transmission risk.

Investigation and Results

The Hawaii Department of Health conducted a cluster investigation across three fitness facilities. The index patient, fitness class participants, and facility staff members were interviewed using a standardized questionnaire; clinical and SARS-CoV-2 molecular test records were reviewed; and on-site facility assessments were conducted. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.†

The index case occurred in a male fitness instructor (instructor A) aged 37 years. Instructor A reported onset of fatigue on the evening of June 29 (Figure). The next day, he reported chills, body aches, cough, congestion, sore throat, and headache. On July 1, he received a positive SARS-CoV-2 RT-PCR test result.

Before his symptoms began, instructor A taught classes at two fitness facilities (facilities X and Y) on June 27, 28, and 29 (Table 1). On the morning of June 27, >2 days (60 hours) before symptom onset, instructor A taught a 1-hour yoga class for 27 participants at facility X. Instructor A wore a mask, but no participants wore masks. No participants reported symptoms during the next 14 days.§ Only one (4%) participant received SARS-CoV-2 RT-PCR testing, with a negative result, on July 3. Thus, the attack rate for facility X on June 27 was 0% (zero of 27) (Table 2).

On June 28, less than 2 but more than 1 day (38 hours) before symptom onset, instructor A taught a 1-hour high-intensity stationary cycling class for 10 participants at a second facility, facility Y. Instructor A and participants followed facility Y's protocol and did not wear masks during exercise (*2*). The stationary cycling room measured 24 ft by 17 ft (408 sq ft). Doors and windows were closed, and three large floor fans were directed toward the participants for cooling. Instructor A was on a pedestal facing participants, shouting instructions and encouragement. Instructor A was >6 ft away from participants, and cycling stations were ≥6 ft apart. Among 10 participants, four had exposure to instructor A only during this class; all four received negative SARS-CoV-2 RT-PCR test results during July 3–4 (attack rate = 0% [zero of four]). Six participants had additional exposure to instructor A the next day.

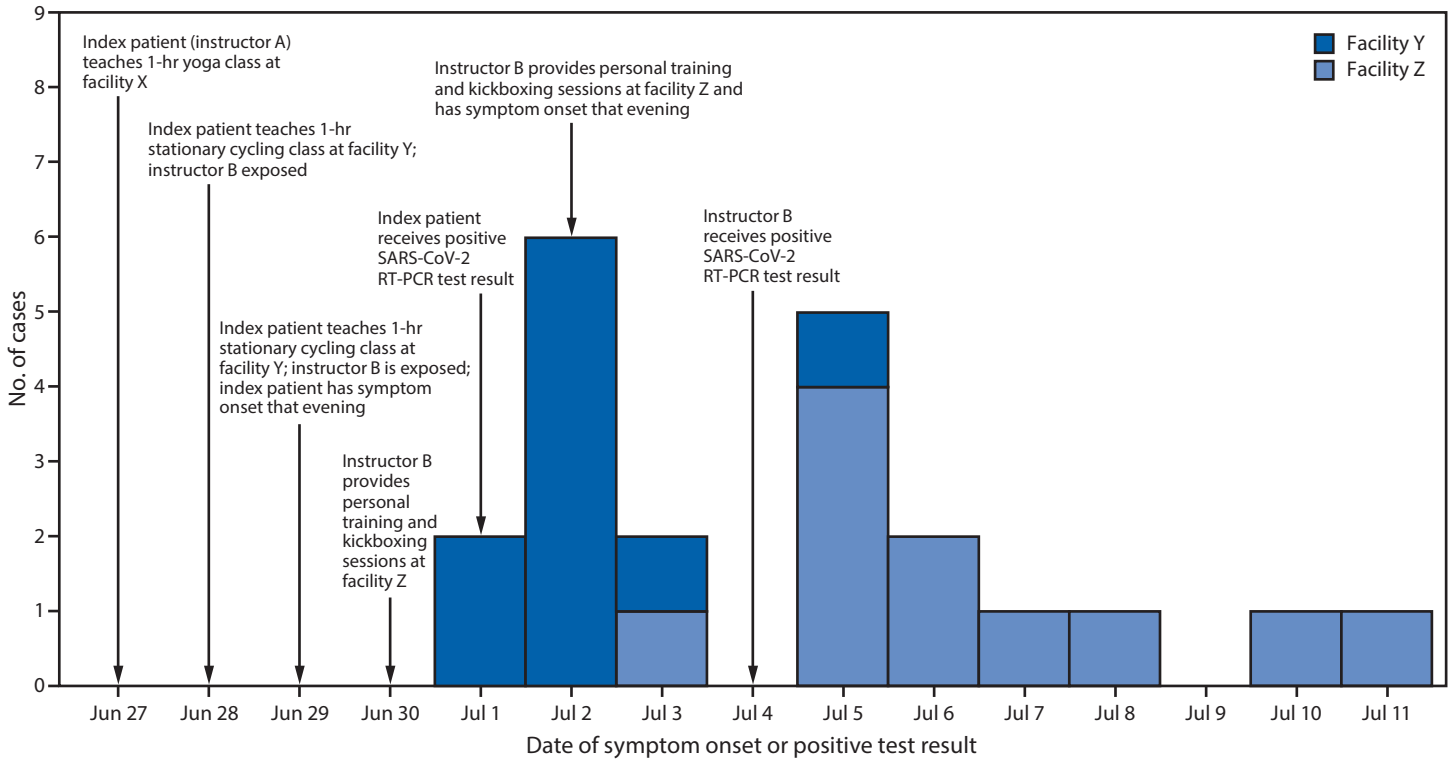
On June 29, 4 hours before symptom onset, instructor A taught a 1-hour stationary cycling class with 10 participants at facility Y in the same format and room as that on June 28 (Table 1). No one wore masks while exercising. Six of the

* Signs and symptoms included fever, cough, shortness of breath, muscle or body aches, fatigue, headache, congestion or runny nose, sore throat, and new loss of sense of taste or smell.

† 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq. Participants provided oral consent for interviews and clinical record reviews.

§ Participants who were not tested and reported no symptoms for 14 days after exposure were considered not infected and categorized as negative for attack rate calculations.

FIGURE. Date of symptom onset or positive test result* among 21 COVID-19 cases epidemiologically linked to a fitness center instructor — Hawaii, June 29–July 11, 2020



Abbreviations: COVID-19 = coronavirus disease 2019; RT-PCR = reverse transcription–polymerase chain reaction.
* Date of positive SARS-CoV-2 test result was used for one asymptomatic patient from facility Z.

TABLE 1. Timeline of classes and characteristics of instructors and participants at three fitness facilities — Hawaii, June 27–July 11, 2020

Fitness facility	Date	Class time	Exercise	Instructor	Instructor masked	No. of participants (no. masked)	No. of participants with SARS-CoV-2 test and outcome*			Attack rate, %[§]
							RT-PCR positive	RT-PCR negative	Asymptomatic, not tested[†]	
X	Jun 27	AM	Yoga	A	Yes	27 (0)	0	1	26	0
Y	Jun 28	PM	Stationary cycling	A	No	4 (0)[¶,**]	0	4	0	0
Y	Jun 29	PM	Stationary cycling	A	No	10 (0)**	10	0	0	100
Z	Jun 30	AM	PT	B	Yes	3 (3)[¶]	0	1	2	0
Z	Jun 30	PM	Kickbox	B	No	3 (0)[¶]	0	0	3	0
Z	Jul 1	AM	PT	B	No	4 (0)	1	2	1	25
Z	Jul 2	AM	PT	B	No	2 (0)[††]	1	1	0	50
Z	Jul 2	PM	Kickbox	B	No	9 (2)	9	0	0	100

Abbreviations: PT = personal training; RT-PCR = reverse transcription–polymerase chain reaction.
* SARS-CoV-2 RT-PCR test result conducted within 2 weeks of last exposure.
† Participant was not tested for SARS-CoV-2 and reported no fever, cough, shortness of breath, muscle or body aches, fatigue, headache, congestion, runny nose, sore throat, or new loss of sense of taste or smell for 14 days after last exposure.
§ Participants who were not tested and reported no symptoms for 14 days after exposure were considered not infected and categorized as negative for attack rate calculations.
¶ Participants who had more than one exposure date to the instructor were only included in the class counts and attack rate for the last exposure date.
** Instructor B was a class participant.
†† Included a caregiver of a participant.

TABLE 2. COVID-19 attack rates* among participants in classes conducted by instructors A and B who taught at three fitness facilities while infected with SARS-CoV-2, by number of days before instructor symptom onset — Hawaii, June 29–July 11, 2020

	Instructor A†			Instructor B†			Instructors A and B§	
Days before symptom onset	Instructor masked	No. of class participants exposed (no. masked)	No. of cases (attack rate)	Instructor masked	No. of class participants exposed (no. masked)	No. of cases (attack rate)	No. of class participants	No. of cases (attack rate, %)
≥2	Yes	27 (0)	0 (—)	AM: Yes PM: No	6 (3)	0 (—)	33	0 (—)
<2 to 1	No	4 (0)	0 (—)	No	4 (0)	1 (25)	8	1 (13)
<1	No	10 (0)	10 (100)	No	11 (2)	10 (91)	21	20 (95)

Abbreviation: COVID-19 = coronavirus disease 2019.
* Percentage of cases among all participants.
† Instructor B is included among instructor A's class participants.
§ No participants were exposed to both instructors.

participants were those who had exposure to instructor A the previous day, and four participants had no exposure the day before. All 10 participants received positive SARS-CoV-2 RT-PCR test results during July 2–6 (attack rate = 100% [10 of 10]) (Table 2). Among these 10 cases at facility Y, seven occurred in women, seven patients identified as Asian and three as Native Hawaiian or Pacific Islander, and their median age was 37 years (range = 31–50 years). All patients were symptomatic, one of whom was another fitness instructor, instructor B.

Instructor B, a man aged 46 years, worked as a personal trainer at a third facility, facility Z. On the evening of July 2, 4 days after his first exposure to instructor A, instructor B reported body aches and sore throat with progression of symptoms, including fever, chills, cough, shortness of breath, and fatigue. On July 4, instructor B received a positive RT-PCR test result for SARS-CoV-2; he was later hospitalized and required admission to an intensive care unit.

On June 30, 2 days after first exposure at facility Y and ≥2 days before his symptom onset, instructor B taught five personal training and small-group kickboxing sessions with 10 participants and a participant caregiver at facility Z. For six participants (three in the morning and three in the afternoon), June 30 was their only exposure to instructor B. Sessions were 1 hour in duration, and physical distancing was not maintained except by the caregiver. Everyone in morning personal training sessions, including instructor B, wore a mask. No one in the afternoon kickboxing sessions, including instructor B, wore a mask. One of these participants received a negative SARS-CoV-2 molecular test result on July 6; five reported no symptoms during the next 14 days (attack rate = 0% [zero of six]) (Table 2). Four participants and the caregiver had additional exposure to instructor B on July 2.

On July 1, less than 2 but more than 1 day (36 hours) before symptom onset, instructor B provided personal training to four different participants at facility Z. No one wore masks. Among these four participants, one reported no symptoms in the next 14 days, and two received negative test results (one on July 6; one on both July 8 and July 16), and one received a positive SARS-CoV-2 RT-PCR test result on July 6 (attack rate = 25% [one of four]).

On July 2, 12 hours before symptom onset, instructor B taught 10 participants (one personal training and three kickboxing sessions with nine participants) with the caregiver present (11 exposed persons); four participants and the caregiver also participated in sessions on June 30. This was the only exposure to instructor B for the other six persons. Instructor B did not wear a mask. Two participants wore masks; both were infected. One had exposure on both June 30 and July 2, and one had exposure only on July 2. All received SARS-CoV-2 RT-PCR testing, and nine participants and the caregiver received positive results during July 6–8. The attack rate was 91% (10 of 11).

Among 11 cases from facility Z, seven were in women, seven patients identified as Asian, three as White, and one as Native Hawaiian or Pacific Islander, and their median age was 61 years (range = 53–81 years). Two (18%) participants had Parkinson disease. Ten patients were symptomatic, and one was hospitalized and required admission to an intensive care unit. The aggregate attack rates for both instructors by timing of exposure relative to their symptom onset dates were 0% (zero of 33), 13% (one of eight), and 95% (20 of 21), for exposure ≥2 days, <2 days to 1 day, and <1 day before symptom onset respectively (Table 2).

Public Health Response

The Hawaii Department of Health provided isolation and quarantine instructions to all participants with exposure to instructors A and B in facilities Y and Z. Facility X participants were not quarantined because their exposure was >48 hours before instructor A's symptom onset. In response to increasing COVID-19 case rates and fitness facility clusters, Honolulu City and County amended emergency orders on July 22, 2020, to require that all persons wear face coverings (i.e., nonmedical masks) in fitness facilities, including during exercise (*3*).

Summary

What is already known about this topic?

COVID-19 outbreaks have been reported from fitness and sports facilities.

What is added by this report?

Twenty-one COVID-19 cases were linked to an index case in a fitness instructor, who, along with a patient who was also an instructor, taught classes <1 day, 1 to <2 days, and ≥2 days before symptom onset; aggregate attack rates were 95%, 13%, and 0%, respectively.

What are the implications for public health practice?

To reduce SARS-CoV-2 transmission in fitness facilities, staff members and patrons should wear a mask, and facilities should enforce consistent and correct mask use (including during high-intensity activities) and physical distancing, improve ventilation, and remind patrons and staff members to stay home when ill. Exercising outdoors or virtually could further reduce SARS-CoV-2 transmission risk.

Facility Y installed plexiglass barriers between stationary cycling cycles, removed four cycles from the stationary cycling room, limited classes to six participants, and instituted facility-wide single-direction foot traffic flow. All three facilities began checking patrons' temperatures upon entry; facility Y also required signed affirmations that patrons did not have COVID-19–compatible symptoms.

Discussion

In this SARS-CoV-2 cluster investigation among fitness class participants exposed to fitness instructors who taught before their symptom onset, but while potentially infectious, the rate of transmission was highest on the day of symptom onset for both instructors, which is consistent with findings from a previous study; persons infected with SARS-CoV-2 are most infectious from 2 days before to 7 days after symptom onset (*4*). Transmission was likely facilitated by not wearing face masks, extended close contact, and poor room ventilation. SARS-CoV-2 transmission occurred despite stationary cycles being spaced ≥6 ft apart. Instructor A's shouting throughout the 1-hour stationary cycling class might have contributed to transmission; aerosol emission during speech has been correlated with loudness (*5*), and COVID-19 outbreaks related to intense physical activity and singing have been previously reported (*6*–*8*).

This COVID-19 cluster occurred when SARS-CoV-2 community transmission was low (daily average of 2–3 cases per 100,000) (*1*). To reduce SARS-CoV-2 transmission in fitness facilities, staff members and patrons should wear a mask, and facilities should combine engineering and administrative controls including improving ventilation; enforcing consistent and correct mask use and physical distancing (maintaining ≥6 ft of distance between all persons, limiting physical contact and class size, and preventing crowded spaces); increasing opportunities for hand hygiene; and reminding patrons and staff members to stay home when ill. Conducting exercise activities entirely outdoors or virtually could further reduce SARS-CoV-2 transmission risk. As of February 2021, CDC guidance for fitness facilities recommends using the occupational hazard hierarchy of controls and combining controls to prevent SARS-CoV-2 transmission (*9*). Facilities should increase or improve ventilation by maximizing fresh air delivered to occupied spaces; increasing filter efficiency of heating, ventilation, and air conditioning units; using portable high-efficiency particulate air filtration units where indicated; and ensuring that fans do not direct air from one patron to another (*9*). Additional engineering and administrative controls include modifying fitness areas to provide ≥6 ft of physical distance between patrons, installing physical barriers, making foot traffic flow in a single direction, using visual cues for physical distancing, and adding hand sanitizer stations (*9*). Adding multiple engineering and administrative controls, including enforcing consistent and correct mask use for staff members and patrons, cleaning with Environmental Protection Agency–registered products for surface disinfection, and reducing facility occupancy and class sizes, are recommended to further reduce transmission risk (*9*).

The findings in this report are subject to at least three limitations. First, many participants had multiple dates of exposure; attack rate was calculated based on participants' most recent exposure day, although exposure effects might have been cumulative. Second, the true number of participants infected with SARS-CoV-2 might have been underestimated. Many asymptomatic participants did not receive SARS-CoV-2 tests because of personal reluctance or lack of available testing. Finally, participants might have underreported symptoms or refused testing because of recall bias or social desirability bias or to avoid isolation.

This cluster investigation highlights the high transmissibility of SARS-CoV-2 in certain settings, including indoor fitness facilities. To reduce SARS-CoV-2 transmission in fitness facilities, staff members and patrons should wear a mask, and facilities should implement engineering and administrative controls including improving ventilation, enforcing physical distancing and consistent and correct mask use (even during high-intensity activities)[¶] (*10*), increasing opportunities for hand hygiene, and reminding all patrons and staff members to stay home when ill. Conducting exercise activities entirely outdoors or virtually could further reduce SARS-CoV-2 transmission risk.

[¶] Per CDC guidance, persons who are unable to wear a mask because of difficulty breathing during high-intensity activities must choose a location with greater ventilation and air exchange (e.g., outdoors versus indoors) where it is possible to keep ≥6 ft from others during activity. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

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References

1. Hawaii Department of Health. Hawaii COVID-19 data. Accessed November 14, 2020. Honolulu, HI: Hawaii Department of Health; 2020. https://health.hawaii.gov/coronavirusdisease2019/what-you-should-know/current-situation-in-hawaii/
2. Caldwell KW, Amemiya RK. Amendment to Ho'oulu i Honolulu 3.0 emergency order 2020–15 (COVID-19 [novel coronavirus]). Honolulu, HI: Office of the Mayor, City and County of Honolulu; 2020. https://www.honolulu.gov/rep/site/may/may_docs/Amendment_to_Hooulu_i_Honolulu_3.0.pdf
3. Caldwell KW, Amemiya RK. Third amendment to Ho'oulu i Honolulu 4.0 emergency order 2020–20 (COVID-19 [novel coronavirus]). Honolulu, HI: Office of the Mayor, City and County of Honolulu; 2020. https://www.honolulu.gov/rep/site/may/may_docs/Emergency_Order_No._2020-20_-_2.pdf
4. He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. Nat Med 2020;26:672–5. PMID:32296168 https://doi.org/10.1038/s41591-020-0869-5
5. Asadi S, Wexler AS, Cappa CD, Barreda S, Bouvier NM, Ristenpart WD. Aerosol emission and superemission during human speech increase with voice loudness. Sci Rep 2019;9:2348. PMID:30787335 https://doi.org/10.1038/s41598-019-38808-z
6. Jang S, Han SH, Rhee JY. Cluster of coronavirus disease associated with fitness dance classes, South Korea. Emerg Infect Dis 2020;26:1917–20. PMID:32412896 https://doi.org/10.3201/eid2608.200633
7. Atrubin D, Wiese M, Bohinc B. An outbreak of COVID-19 associated with a recreational hockey game—Florida, June 2020. MMWR Morb Mortal Wkly Rep 2020;69:1492–3. PMID:33056952 https://doi.org/10.15585/mmwr.mm6941a4
8. Hamner L, Dubbel P, Capron I, et al. High SARS-CoV-2 attack rate following exposure at a choir practice—Skagit County, Washington, March 2020. MMWR Morb Mortal Wkly Rep 2020;69:606–10. PMID:32407303 https://doi.org/10.15585/mmwr.mm6919e6
9. CDC. COVID-19 employer information for gyms and fitness centers. Accessed February 5, 2021. Atlanta, GA: US Department of Health and Human Services, CDC; 2020. https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/gym-employers.html
10. Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nat Med 2020;26:676–80. PMID:32371934 https://doi.org/10.1038/s41591-020-0843-2

COVID-19 Outbreak Among Attendees of an Exercise Facility — Chicago, Illinois, August–September 2020

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On September 8, 2020, the Chicago Department of Public Health (CDPH) was notified of a potential outbreak of coronavirus disease 2019 (COVID-19) at an exercise facility. COVID-19 cases were identified among 55 (68%) of 81 attendees of in-person classes held during August 24–September 1, 2020, including 49 (60%) cases confirmed by real-time reverse transcription–polymerase chain reaction (RT-PCR) testing and six (7%) probable cases among attendees who had compatible symptoms but negative or no RT-PCR test results. Overall, 43 (78%) attendees with COVID-19 participated in multiple classes while potentially infectious.* Twenty-two (40%) attendees with COVID-19 attended on or after the day of symptom onset. Among 58 exercise class attendees who provided information on in-class behaviors, 44 (76%) reported infrequent mask use, including 32 of 38 (84%) attendees with COVID-19 and 12 of 20 (60%) without COVID-19. The increased respiratory exertion that occurs in the enclosed spaces of indoor exercise facilities facilitates transmission of SARS-CoV-2, the virus that causes COVID-19, in these settings (*1*,*2*). To reduce SARS-CoV-2 transmission in exercise facilities, employees and patrons should wear a mask, even during high-intensity activities when ≥6 ft apart. In addition, facilities should provide engineering and administrative controls including 1) improving ventilation; 2) enforcing consistent and correct mask use and physical distancing (maintaining ≥6 ft of distance between all persons and limiting physical contact, class size, and crowded spaces); 3) reminding infected employees and patrons to stay home and away from others for ≥10 days after symptom onset or, if asymptomatic, after a positive test result, as well as to observe quarantine guidance after close contact with a person with COVID-19 and while awaiting test results; and 4) increasing opportunities for hand hygiene. Conducting exercise activities entirely outdoors or virtually could further reduce SARS-CoV-2 transmission risk.

Investigation and Results

During August 24–September 1, 2020, an exercise facility offered four to eight high-intensity indoor classes daily. All classes were held at ≤25% capacity (i.e., 10–15 persons). Mask use, temperature checks, and symptom screenings were required on entry; however, patrons were allowed to remove masks during exercise. Patrons brought their own mats and weights and were stationed ≥6 ft apart. On September 1, a patron notified the facility of receipt of a positive test result. The dates of symptom onset and last exercise class attendance were both August 28. The facility closed for 13 days and informed all attendees of their possible COVID-19 exposure. On September 8, during routine case investigation, CDPH identified a cluster of cases linked to the facility. When CDPH first contacted the facility on September 10, the facility had already notified all attendees (employees and patrons) of potential COVID-19 exposure and learned of 41 patrons with COVID-19–compatible symptoms or positive test results. The facility provided contact information and last attendance date for all persons who had attended classes during August 24–September 1.

Case investigations were conducted using standardized REDCap data collection tools (version 10.3.3; Vanderbilt University). All August 24–September 1 class attendees were contacted for interview during September 14–22. Testing and outcomes data,† social activities,§ and in-class behaviors (i.e., mask use and physical distancing) were assessed.

A laboratory-confirmed case was defined as a positive SARS-CoV-2 RT-PCR test result for any facility attendee during August 24–September 15. Attendees with symptoms clinically compatible with COVID-19¶ who did not have a positive

* The infectious period was presumed to begin 2 days before symptom onset or positive SARS-CoV-2 test result, whichever was known to be first, and presumed to end ≥10 days after symptom onset or positive test result as long as other symptoms (except loss of taste or smell) were improving and the patient had been fever-free for 24 hours without fever-reducing medication. https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/end-home-isolation.html

† COVID-19 testing and outcomes data included date, result, and location of any SARS-CoV-2 test conducted; date of symptom onset; and recovery. Information on emergency department, intensive care, or other hospital admission was collected, including oxygen administration, ventilation or intubation, and location and length of stay.

§ Social exposures assessed included working outside the home, attending church, visiting someone's home, attending a party, dining at restaurants, going to bars or music venues, going to gyms other than the exercise facility, gathering with others outdoors, going to a salon, and attending other indoor or outdoor activities.

¶ COVID-19–compatible symptoms assessed included measured fever (≥100.4°F [38°C]), subjective fever, chills, myalgia, rhinorrhea, sore throat, new onset or worsening cough, dyspnea, nausea or vomiting, headache, abdominal pain, diarrhea (three or more loose, or looser than normal, stools in a 24-hour period), and loss of taste or smell. https://wwwn.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/

test result were considered to have probable COVID-19. Self-reported positive test results were confirmed through Illinois' National Electronic Disease Surveillance System (I-NEDSS). Characteristics of attendees with and without COVID-19 were compared using Fisher's exact test. Associations between in-class behaviors and COVID-19 case status were estimated using logistic regression.** The primary analyses included probable and confirmed cases. A complete-case sensitivity analysis included only attendees with laboratory-confirmed positive or negative COVID-19 status (i.e., a positive or negative SARS-CoV-2 test result) who also provided information on frequency of in-class mask use and distancing. Analyses were completed using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.††

Among 91 facility attendees (88 patrons and three employees), 10 had neither testing nor interview data available and were excluded. Among the remaining 81 attendees, 55 (68%) COVID-19 cases were identified, including 49 (60%) laboratory-confirmed cases and six (7%) probable cases; all identified cases were among patrons. Seventy-three (90%) attendees were interviewed, including 47 (85%) of 55 with COVID-19. Eight attendees with laboratory-confirmed COVID-19 (16%) were not interviewed.

Sixty-eight (84%) attendees were Chicago residents, 71 (88%) were women, and 72 (97%) were non-Hispanic Black; the median age was 42 years (interquartile range [IQR] = 29–55 years) (Table 1). Among 73 interviewees, 24 (33%) reported medical conditions associated with severe COVID-19 illness§§; asthma was the most frequently reported underlying condition, reported by 11 (15%) attendees.

Twenty-two (40%) attendees with COVID-19 reported measured or subjective fever (Table 2). Two (4%) visited an emergency department; one (2%) patient was hospitalized for 8 days. No deaths were reported. Symptom onset dates ranged from August 19 to September 11. Twenty-two (40%) attendees with COVID-19 attended an exercise class on or after the date of symptom onset, including three (5%) who attended on the same day or after they received the positive test result. Overall, 43 (78%) attendees with COVID-19 attended an exercise class during their estimated infectious periods. Attendees with COVID-19 reported participating in a median of five exercise classes (IQR = 3–7); attendees without COVID-19 reported attending a median of three exercise classes (IQR = 1–6).

Two attendees with COVID-19 (attendees A and B) reported symptom onset during August 19–20; each attended five classes during August 24–September 1 while symptomatic (Figure). Attendees A and B both received positive SARS-CoV-2 RT-PCR results after the facility closed; both reported mask use ≤60% of the time in class (infrequent mask use).

Among 58 (72%) interviewees who provided information on in-class behaviors, including 38 (69%) attendees with and 20 (77%) without COVID-19, infrequent mask use during class was reported more commonly among attendees with COVID-19 (32; 84%) than among those who did not have COVID-19 (12; 60%) (odds ratio [OR] = 3.5; 95% confidence interval [CI] = 0.9–15.1). Twelve attendees with COVID-19 and eight who did not have COVID-19 reported social exposures outside the exercise facility during August 19–September 2 (Table 1). Sensitivity analyses included 32 attendees with positive SARS-CoV-2 RT-PCR test results and 10 with negative results (Supplementary Table; https://stacks.cdc.gov/view/cdc/103076). Findings were similar to those of the primary analysis: 28 (88%) attendees with COVID-19 and six (60%) without COVID-19 reported infrequent mask use during an exercise class; the odds of infrequent mask use were greater (OR = 4.5; 95% CI = 0.6–32.2) among attendees with COVID-19 than among those without COVID-19.

Public Health Response

After receiving notification of a COVID-19 case in one of its patrons, the exercise facility closed and informed all attendees of possible COVID-19 exposure. CDPH reviewed infection control guidance with the facility, emphasizing the importance of mask use, a 14-day quarantine, isolation, and testing. In addition to following this public health guidance, the facility also asked attendees to provide proof of a negative COVID-19 test result to return to class. At the time of this outbreak, businesses in Chicago were encouraged but not required to report COVID-19 cases. Under CDPH's revised public health order, city-licensed businesses are now required to report any COVID-19–related suspension of operations and awareness of five or more confirmed COVID-19 cases among employees or patrons.¶¶

** Crude odds ratios (ORs) with 95% confidence intervals (CIs) were estimated using logistic regression. Odds of wearing masks, observing others wearing masks, and practicing physical distancing in class were compared for 0%–60% of class time versus 61%–100% of class time. Five-point frequency scales used during interviews were dichotomized during analyses because of small cell sizes, which allowed comparison of "most of the time" with "not most of the time."

†† 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect.552a; 44 U.S.C. Sect.3501 et seq.

§§ Underlying medical conditions assessed were asthma, chronic heart, kidney, liver or pulmonary disease, diabetes, hypertension, obesity, seizures, sickle cell disease, and any immunocompromising conditions.

¶¶ Since October 1, 2020, Public Health Order 2020–2 has mandated that city-licensed businesses report to CDPH 1) any suspension in operations because of COVID-19 cases among employees or patrons and 2) awareness of five or more employees or patrons with positive COVID-19 test results within a 14-day period. https://www.chicago.gov/content/dam/city/sites/covid/health-orders/CDPH%20Order%202020-2%203rd%20Amended%20FINAL%209.30.20_AAsigned.pdf

TABLE 1. Demographic characteristics, in-class behaviors, and other social exposures among attendees (N = 81) of an exercise facility, by COVID-19 status — Chicago, Illinois, August 24–September 1, 2020

Characteristic	No. (%) of attendees			p-value[†]	OR (95% CI)[§]
	Total (N = 81)	With COVID-19 (n = 55)*	Without COVID-19 (n = 26)		
Female	**71 (87.7)**	**48 (87.3)**	**23 (88.5)**	**1.00**	—
Age, yrs, median (IQR)	**42 (29–55)**	**42 (27–57)**	**41 (29–53)**	**1.00**	—
Age group, yrs (n = 78)[¶]					
<18	**1 (1.3)**	1 (1.8)	0 (—)	0.80	—
18–44	**44 (56.4)**	32 (58.2)	12 (52.2)		—
45–54	**21 (26.9)**	13 (23.6)	8 (34.8)		—
55–64	**10 (12.8)**	7 (12.7)	3 (13.0)		—
≥65	**2 (2.6)**	2 (3.6)	0 (—)		—
Other characteristics					
Black, non-Hispanic** (n = 74)	**72 (97.3)**	49 (98.0)	23 (95.8)	1.00	—
Underlying medical conditions[††] (n = 73)	**24 (32.9)**	16 (34.0)	8 (30.8)	1.00	—
No history of smoking[§§] (n = 68)	**64 (94.1)**	41 (93.2)	23 (95.8)	1.00	—
Pregnant or could be pregnant	**1 (1.4)**	0 (—)	1 (3.8)	1.00	—
Attendee type					
Facility patron	**78 (96.3)**	55 (100.0)	23 (88.5)	—	—
Facility employee	**3 (3.7)**	0 (—)	3 (11.5)	—	—
In-class behaviors					
Self-reported days of attendance, median (IQR) (n = 53)	**5 (2–8)**	5 (3–7)	3 (1–6)	—	—
Wore a mask during ≤60% of class time[¶¶] (n = 58)	**44 (75.9)**	32 (84.2)	12 (60.0)	0.06	3.5 (0.9–15.1)
Observed others wearing masks ≤60% of class time (n = 58)	**46 (79.3)**	33 (86.8)	13 (65.0)	0.11	3.5 (0.8–16.6)
Practiced physical distancing ≤60% of class time*** (n = 56)	**4 (7.1)**	3 (8.3)	1 (5.0)	1.00	1.7 (0.1–95.4)
Other social exposures[†††]	**20 (27.4)**	12 (25.5)	8 (30.8)	0.42	—

Abbreviations: CI = confidence interval; COVID-19 = coronavirus disease 2019; IQR = interquartile range; OR = odds ratio.

* Attendees with laboratory-confirmed COVID-19 who were not reached for interview (n = 8) were included in analyses of attendance while infectious; dates of positive test result and facility-confirmed last attendance were used.

† p-values from Fisher's exact test were used to compare differences in demographic distributions and in-class behaviors among attendees with COVID-19 versus without COVID-19.

§ ORs among attendees with COVID-19 versus without COVID-19 were calculated for mask use, observing others' mask use, and physical distancing during ≤60% versus ≥61% of exercise class time. Data on frequency of wearing or observing others wearing masks were missing for 17 (30.9%) attendees with COVID-19 and six (23.1%) without COVID-19; physical distancing data were missing for 19 (34.5%) attendees with COVID-19 and six (23.1%) without COVID-19; and data on self-reported classes attended were missing for 19 attendees with COVID-19 (34.5%) and nine without COVID-19 (34.6%).

¶ Age was unknown for three (11.5%) attendees without COVID-19.

** Race/ethnicity data were missing for five (9.1%) attendees with COVID-19 and two (7.7%) without COVID-19.

†† Reported underlying medical conditions among 73 respondents were as follows (with missing data for eight of 55 attendees with COVID-19): asthma, 11 (15%); hypertension, 10 (13.7%); and diabetes, chronic kidney disease, or prediabetic neuropathy, one (1.4%) each. None of the other underlying medical conditions asked about by interviewers were reported (i.e., chronic heart, liver, or pulmonary disease; seizures; sickle cell disease; or any immunocompromising conditions).

§§ Data on smoking status were missing for 11 (20%) attendees with COVID-19 and for two (7.7%) without COVID-19.

¶¶ Data on in-class mask use were missing for 17 (30.9%) attendees with COVID-19 and six (23.1%) without COVID-19; data on physical distancing were missing for 19 (34.5%) attendees with COVID-19 and for six (23.1%) without COVID-19.

*** Data on in-class physical distancing were missing for 19 (34.5%) attendees with COVID-19 and for six (23.1%) without COVID-19.

††† Other social exposures reported in the 2 weeks before symptom onset or a positive test result included working outside the home: six (10.9%) attendees with COVID-19, six (23.1%) without COVID-19; dining at restaurants: three (5.4%) attendees with COVID-19, none without COVID-19; attending church: one (1.8%) attendee with COVID-19, none without COVID-19; and other indoor or outdoor activities: nine (16.3%) attendees with COVID-19, three (11.5%) without COVID-19. One (1.8%) attendee with COVID-19 worked in a correctional facility with an ongoing COVID-19 outbreak; one attendee with COVID-19 hosted an indoor gathering with no mask use; one attendee with COVID-19 participated in a group bike ride with no mask use; and one attendee with COVID-19 participated in an indoor party with mask use.

Discussion

This outbreak reinforces the need for combined COVID-19 prevention strategies, including universal mask use in public settings when persons are with others who do not live in the same household, especially indoors***; testing of symptomatic persons and those who have been exposed to SARS-CoV-2; self-isolation after symptom onset or a positive COVID-19 test result; and quarantining of persons who have been exposed to SARS-CoV-2 (*3*). Cases were identified among 68% of facility attendees, and CDPH attributed this outbreak to the high proportion of attendees with COVID-19 who participated in class while symptomatic, or asymptomatic and infectious. Most attendees did not wear a mask during exercise class; infrequent mask use when participating in indoor exercise classes likely contributed to transmission. In addition, the potential for infected persons to infect others between their testing date and receipt of test result reinforces the need to quarantine while waiting for a COVID-19 test result and avoid gatherings while unknowingly infectious.

Data on transmission of SARS-CoV-2 in exercise facilities are limited; outbreak reports indicate that increased respiratory

*** https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-to-wear-cloth-face-coverings.html

TABLE 2. COVID-19 signs, symptoms, and outcomes among attendees (N = 55) of an exercise facility — Chicago, Illinois, August 24–September 1, 2020

Signs, symptoms, and outcomes	No. (%)*
Signs and symptoms	
Headache	38 (69.1)
Loss of taste or smell	33 (60.0)
Myalgia	33 (60.0)
Chills	31 (56.4)
Cough	28 (50.9)
Fever (measured or subjective)	22 (40.0)
Shortness of breath	22 (40.0)
Fatigue	22 (40.0)
Sore throat	13 (23.6)
Diarrhea†	12 (21.8)
Rhinorrhea	11 (20.0)
Nausea or vomiting	10 (18.2)
Congestion	8 (14.5)
Loss of appetite	5 (9.1)
Abdominal pain	5 (9.1)
Confusion	2 (3.6)
Outcomes	
Emergency department visit	2 (3.6)
Hospital admission§	1 (1.8)
Death	0 (—)

Abbreviation: COVID-19 = coronavirus disease 2019.
* Signs, symptoms, and outcome data were unavailable for eight (14.5%) attendees with COVID-19 who were not interviewed.
† Three or more loose, or looser than normal, stools in 24 hours.
§ One attendee with COVID-19 was hospitalized for 8 days, without use of oxygen, intubation, or ventilation.

exertion might facilitate transmission (*4*–*7*). Clusters of SARS-CoV-2 transmission associated with exercise groups were reported before COVID-19 was declared a pandemic and before mask use was broadly recommended (*5*,*6*). In a more recent outbreak related to an indoor hockey game, only athletic face shields partially covering the nose and mouth were used (*7*).

Although the timing of cases suggests a point-source exposure, none was identified. Most interviewees attended several exercise classes. Some published evidence supports aerosolized transmission of SARS-CoV-2 (*8*), which could have been a contributing factor in this outbreak. Although the facility's ventilation system was not assessed, inadequate air circulation might have exacerbated transmission in the building, which was not originally designed for exercise classes (*9*).

The findings in this report are subject to at least five limitations. First, because of incomplete interview and testing data, the cases might have been undercounted. Second, not all interviewees reported their class attendance or in-class behaviors, which limited the ability to link cases to particular classes and assess differences between attendees who did and did not have COVID-19. Third, reliance on self-reported behaviors and COVID-19 case status might have introduced recall and social desirability biases. Fourth, nonresponse and the small cohort size limited the precision of effect estimates. Finally, whole-genome sequencing was not performed to assess the phylogenetic relationships among cases linked to the exercise facility, and some attendees with COVID-19 might have acquired different strains of SARS-CoV-2 elsewhere in the community.

Summary

What is already known about this topic?

Increased respiratory exertion facilitates SARS-CoV-2 transmission; outbreaks linked to indoor activities have been reported.

What is added by this report?

In August 2020, 55 COVID-19 cases were identified among 81 attendees of indoor high-intensity classes at a Chicago exercise facility. Twenty-two (40%) persons with COVID-19 attended on or after the day symptoms began. Most attendees (76%) wore masks infrequently, including persons with (84%) and without COVID-19 (60%).

What are the implications for public health practice?

To reduce SARS-CoV-2 transmission in fitness facilities, attendees should wear a mask, including during high-intensity activities when ≥6 ft apart. In addition, facilities should enforce physical distancing, improve ventilation, and encourage attendees to isolate after symptom onset or receiving a positive SARS-CoV-2 test result and to quarantine after a potential exposure to SARS-CoV-2 and while awaiting test results. Exercising outdoors or virtually could further reduce SARS-CoV-2 transmission risk.

The outbreak described in this report occurred despite use of certain COVID-19 mitigation measures. To reduce SARS-CoV-2 transmission in exercise facilities, employees and patrons should wear a mask, even during high-intensity activities (*10*) while ≥6 ft apart.††† In addition, facilities should provide engineering and administrative controls including improving ventilation, enforcing physical distancing, increasing opportunities for hand hygiene, and reminding all employees and patrons to 1) isolate when experiencing COVID-19–like symptoms or after receiving a positive SARS-CoV-2 test result and 2) quarantine after a potential exposure to SARS-CoV-2 and while awaiting test results. Conducting exercise activities entirely outdoors or virtually could further reduce SARS-CoV-2 transmission risk.

††† Per CDC guidance, persons who are unable to wear a mask because of difficulty breathing during high-intensity activities must choose a location with greater ventilation and air exchange (e.g., outdoors versus indoors) where it is possible to keep ≥6 ft from others during activity. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

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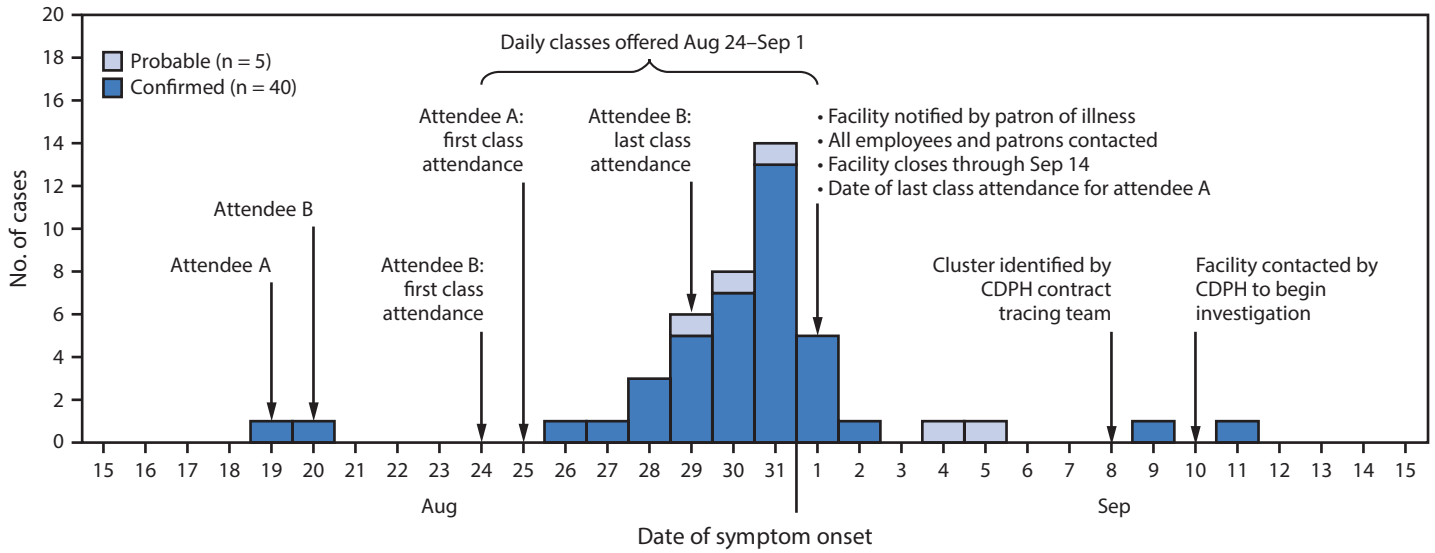
FIGURE. Confirmed and probable COVID-19 cases (n = 45) among attendees of an exercise facility,* by date of reported symptom onset† — Chicago, Illinois, August 19–September 11, 2020



Abbreviations: CDPH = Chicago Department of Public Health; COVID-19 = coronavirus disease 2019.
* Attendees A and B with COVID-19 each reported attending five classes after symptom onset.
† Onset dates were unavailable for 10 (18.2%) of the 55 total cases.

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References

1. Bourouiba L. Turbulent gas clouds and respiratory pathogen emissions: potential implications for reducing transmission of COVID-19. JAMA 2020;323:1837–8. PMID:32215590 https://doi.org/10.1001/jama.2020.4756
2. CDC. COVID-19: public health guidance for community-related exposure. Atlanta, GA: US Department of Health and Human Services, CDC. https://www.cdc.gov/coronavirus/2019-ncov/php/public-health-recommendations.html
3. Leung CC, Lam TH, Cheng KK. Mass masking in the COVID-19 epidemic: people need guidance. Lancet 2020;395:945. PMID:32142626 https://doi.org/10.1016/S0140-6736(20)30520-1
4. Hamner L, Dubbel P, Capron I, et al. High SARS-CoV-2 attack rate following exposure at a choir practice—Skagit County, Washington, March 2020. MMWR Morb Mortal Wkly Rep 2020;69:606–10. PMID:32407303 https://doi.org/10.15585/mmwr.mm6919e6
5. Jang S, Han SH, Rhee JY. Cluster of coronavirus disease associated with fitness dance classes, South Korea. Emerg Infect Dis 2020;26:1917–20. PMID:32412896 https://doi.org/10.3201/eid2608.200633
6. Brlek A, Vidovič Š, Vuzem S, Turk K, Simonović Z. Possible indirect transmission of COVID-19 at a squash court, Slovenia, March 2020: case report. Epidemiol Infect 2020;148:e120. PMID:32600479 https://doi.org/10.1017/S0950268820001326
7. Atrubin D, Wiese M, Bohinc B. An outbreak of COVID-19 associated with a recreational hockey game—Florida. MMWR Morb Mortal Wkly Rep 2020;69:1492–3. PMID:33056952
8. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med 2020;382:1564–7. PMID:32182409 https://doi.org/10.1056/NEJMc2004973
9. CDC. COVID-19: COVID-19 employer information for gyms and fitness centers. Atlanta, GA: US Department of Health and Human Services, CDC. https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/gym-employers.html
10. Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nat Med 2020;26:676–80. PMID:32371934 https://doi.org/10.1038/s41591-020-0843-2

Reduction in COVID-19 Patients Requiring Mechanical Ventilation Following Implementation of a National COVID-19 Vaccination Program — Israel, December 2020–February 2021

Ehud Rinott[1,*]; Ilan Youngster, MD[2,*]; Yair E. Lewis, MD, PhD[3]

On February 26, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The availability of COVID-19 vaccines represents an opportunity to mitigate the effects of the global pandemic. Achieving high vaccination coverage through intensive vaccination campaigns has the potential to substantially reduce COVID-19–associated morbidity and mortality. Clinical trials have demonstrated the efficacy of COVID-19 vaccines in preventing mild and severe COVID-19 in a controlled setting. However, clinical trials are not designed to assess the population impact of vaccination in a real-world setting (*1*,*2*). Israel initiated a national vaccination campaign using the Pfizer-BioNTech BNT162b2 (Pfizer-BioNTech) vaccine in December 2020, prioritizing persons aged >60 years, health care workers, and persons with underlying medical conditions. By February 2021, 2-dose vaccination coverage among persons aged ≥70 years was 84%. To assess the effect of COVID-19 vaccination on the occurrence of severe disease, an ecological study was conducted. Requiring mechanical ventilation was used as a proxy for severe COVID-19. The number of COVID-19 patients aged ≥70 years (who had the highest 2-dose vaccination coverage, 84.3%) requiring mechanical ventilation was compared with that of patients aged <50 years, who had the lowest 2-dose vaccination coverage (9.9%). Since implementation of the second dose of the vaccination campaign, the ratio of COVID-19 patients requiring mechanical ventilation aged ≥70 years to those aged <50 years has declined 67%, from 5.8:1 during October–December 2020 to 1.9:1 in February 2021. These findings provide preliminary evidence of the effectiveness of vaccines in preventing severe cases of COVID-19 at the national level in Israel. Receipt of COVID-19 vaccines by eligible persons can help limit spread of disease and potentially reduce the occurrence of severe disease.

The first case of COVID-19 in Israel, a country with a population of approximately 9 million, was reported in February 2020. As of February 9, 2021, approximately 700,000 cases and 5,200 deaths had been reported (*3*). Nonpharmaceutical interventions have included three national stay-at-home orders,[†] multiple rounds of school closures, restrictions on commercial activity and travel, and a mask mandate, among others. The most recent stay-at-home order was implemented on January 8, 2021, amid a nationwide surge in cases (*4*). On December 20, 2020, Israel initiated a national vaccination program against COVID-19, using the Pfizer-BioNTech vaccine and prioritizing persons aged ≥60 years, health care workers, and persons with chronic conditions that increase risk for infection or severe disease (*5*).

To assess the impact of COVID-19 vaccination on the occurrence of severe COVID-19 at the population level an ecological study was conducted using the number of COVID-19 patients requiring mechanical ventilation as a proxy for severe disease. The number of COVID-19 patients requiring mechanical ventilation aged ≥70 years, who had the highest 2-dose COVID-19 vaccination coverage, was compared with the number of those aged <50 years, who had the lowest 2-dose coverage. COVID-19 vaccine administration data during December 20, 2020–February 9, 2021, were obtained from publicly available Israel Ministry of Health data (*6*). Vaccinated persons with missing age data were excluded from the analysis. Daily numbers of COVID-19 patients receiving mechanical ventilation between October 2, 2020, and February 9, 2021, (including during the second and third stay-at-home orders) were obtained from the Israel Ministry of Health COVID-19 dashboard using a publicly available repository.[§] Vaccination status is not available for individual patients in this repository. Population data were drawn from the Israel Central Bureau of Statistics as of the end of 2019.

By February 9, 2021, a total of 3,606,858 persons had received the first vaccine dose, and among those, 2,223,176 (62%) had received the second dose. Two-dose COVID-19 vaccination coverage among persons aged ≥70 years, 60–69 years, 50–59 years, and <50 years was 84.3%, 69.0%, 50.2%, and 9.9%, respectively (Figure 1).

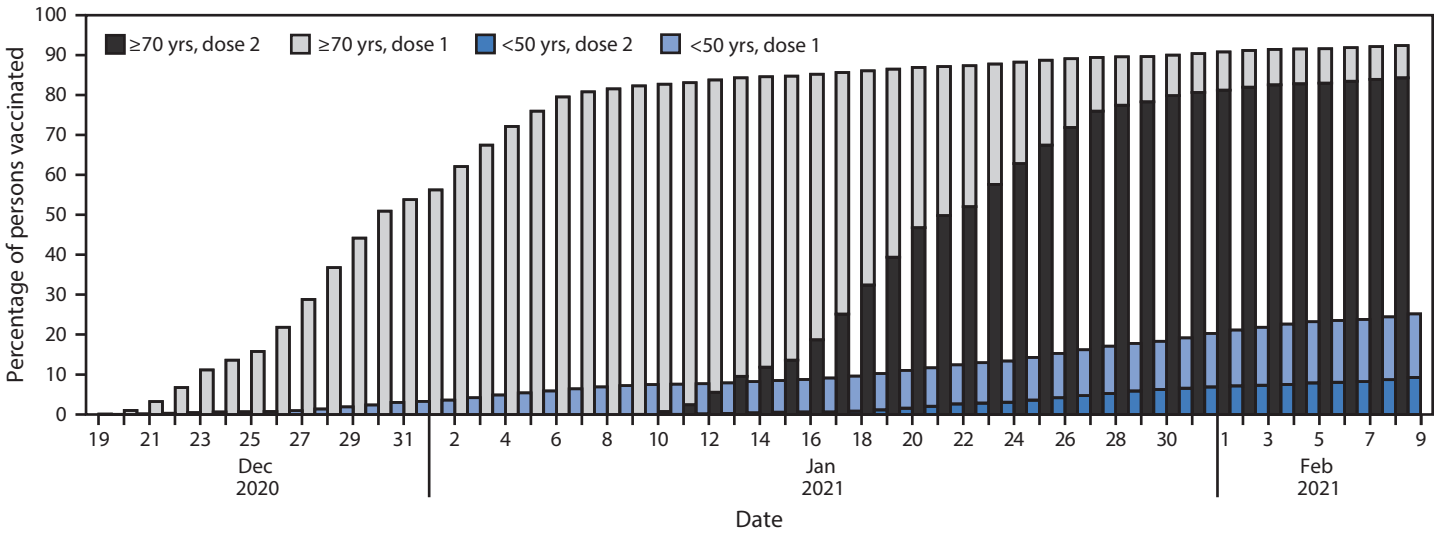
During October 2, 2020–February 9, 2021, the median daily numbers of COVID-19 patients aged <50 years and ≥70 years who required mechanical ventilation were 15 (range = 6–63) and 84 (range = 45–127), respectively. During October 8–December 30, 2020, the mean ratio of ventilated patients aged ≥70 years to those aged <50 years was 5.8:1 (99% confidence interval = 5.5–6.1; range = 4.2–8.5). During the last week of January 2021, although the average daily number of ventilated patients aged ≥70 years had begun

[*] These authors contributed equally to this report.

[†] The dates of the three stay-at-home orders were March 12–April 19, 2020; September 18–October 18, 2020; and January 8–February 7, 2021.

[§] https://github.com/dancarmoz/israel_moh_covid_dashboard_data

FIGURE 1. First- and second-dose COVID-19 vaccination coverage* among persons aged <50 and ≥70 years† — Israel, December 20, 2020–February 9, 2021



* Dose 2 shaded areas include those who received dose 1.
† Total population: 6.4 million (aged <50 years); 0.735 million (aged ≥70 years).

Summary

What is already known about this topic?

Clinical trials have demonstrated the efficacy of COVID-19 vaccines in a controlled setting. Israel initiated a national vaccination campaign in December 2020, prioritizing persons aged >60 years and other high-risk populations.

What is added by this report?

By February 2021, 2-dose vaccination coverage was 84% among persons aged ≥70 years and 10% among those aged <50 years. The ratio of COVID-19 patients aged ≥70 years requiring mechanical ventilation to those aged <50 years declined 67% from October–December 2020 to February 2021.

What are the implications for public health practice?

These findings provide preliminary evidence of the effectiveness of vaccines in preventing severe cases of COVID-19 at the national level in Israel.

to decline, the average daily number of ventilated patients aged <50 years was still increasing (Figure 2). By February 9, 2021, the 7-day rolling average number of ventilated patients aged ≥70 years was 109, and among those aged <50 years was 57.7 (ratio = 1.9:1), representing a 67% decrease in the ratio compared with that during October 8–December 30, 2020.

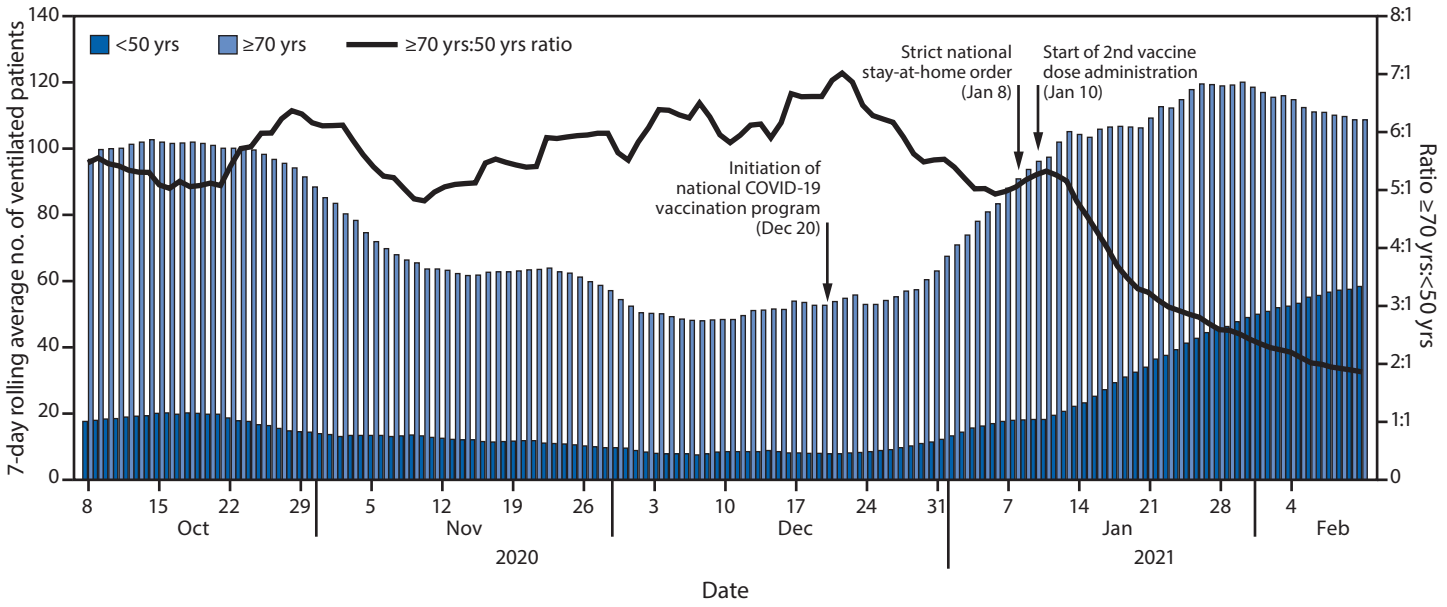
Discussion

These findings suggest a possible impact of the nationwide COVID-19 vaccination campaign in Israel on reducing severe COVID-19 requiring mechanical ventilation. The Israeli national vaccination campaign (*5*), which was initiated on December 20, 2020, in the midst of a nationwide surge of COVID-19 cases, was followed by a strict national stay-at-home order starting on January 8, 2021 (*4*). Vaccine rollout was rapid, and because older age groups were prioritized for vaccination (*5*), it was feasible to compare the number of patients requiring mechanical ventilation between the oldest and youngest age groups, whose COVID-19 vaccination coverage rates differed the most. The percentage of COVID-19 patients aged ≥70 years requiring mechanical ventilation in Israel fluctuated during October–December 2020 but has considerably and consistently decreased after implementation of the vaccination campaign prioritizing older adults. The decline in the ratio of persons aged ≥70 years to those aged <50 years requiring mechanical ventilation began around the time of commencement of administration of the second vaccine dose (January 10, 2021). This might reflect the effects of the first dose, an observation that is consistent with the Pfizer-BioNTech vaccine phase 3 results, which demonstrated partial efficacy after the first dose (*1*).

Considering the vaccination rate and the expected vaccine efficacy, this study provides preliminary evidence at the population level for the reduction in risk for severe COVID-19, as manifested by need for mechanical ventilation, after vaccination with the Pfizer-BioNTech COVID-19 vaccine. These data are consistent with preliminary reports showing a reduction in COVID-19 cases and severe cases in the vaccinated population and a reduction in viral load in vaccinated persons compared with that in unvaccinated persons.[¶,**,††] Taken

¶ https://www.medrxiv.org/content/10.1101/2021.02.06.21251283v1
** https://www.medrxiv.org/content/10.1101/2021.02.08.21251325v1
†† https://www.medrxiv.org/content/10.1101/2021.02.02.21250630v1

FIGURE 2. Number and ratio of COVID-19 patients aged <50 and ≥70 years requiring mechanical ventilation — Israel, October 8, 2020–February 9, 2021



together, these results suggest reduced rates of severe COVID-19 following vaccination.

The findings in this report are subject to at least three limitations. First, this was an ecological analysis that relied on preliminary and aggregated data and might be subject to delays in reporting of COVID-19 cases. Second, the longitudinal and observational nature of this study limited the ability to account for different concomitant effects, including development and spread of novel variants, the general increase in COVID-19 cases and national stay-at-home orders. However, by analyzing the percentage of cases by age group (accounting for vaccination rates), these results are unlikely to be influenced by the overall incidence in the population. Finally, there were possible differences in adherence to mitigation measures between the age groups. To address this limitation, the analysis period was extended to include an earlier period with a stay-at-home order (September–October 2020).

Many countries are currently conducting national COVID-19 vaccine campaigns. The findings from this study provide preliminary but important evidence of the effectiveness of vaccines in preventing severe cases of COVID-19 at the national level in Israel. Receipt of COVID-19 vaccines by eligible persons can help limit spread of disease and potentially reduce the occurrence of severe disease.

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References

1. Polack FP, Thomas SJ, Kitchin N, et al.; C4591001 Clinical Trial Group. Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. N Engl J Med 2020;383:2603–15. PMID:33301246 https://doi.org/10.1056/NEJMoa2034577
2. Baden LR, El Sahly HM, Essink B, et al.; COVE Study Group. Efficacy and safety of the mRNA-1273 SARS-CoV-2 Vaccine. N Engl J Med 2021;384:403–16. PMID:33378609 https://doi.org/10.1056/NEJMoa2035389
3. State of Israel Ministry of Health. COVID-19 dashboard. Jerusalem, Israel: State of Israel Ministry of Health; 2021. https://datadashboard.health.gov.il/COVID-19/general
4. State of Israel Ministry of Health. The government approved the Ministry of Health new restrictions in addition to the ones in force. Jerusalem, Israel: State of Israel Ministry of Health; 2021. https://www.gov.il/en/departments/news/07012021-01
5. State of Israel Ministry of Health. The COVID-19 vaccine operation launched today. Jerusalem, Israel: State of Israel Ministry of Health; 2021. https://www.gov.il/en/Departments/news/19122020-02
6. State of Israel Ministry of Health. COVID-19 databases. Jerusalem, Israel: State of Israel Ministry of Health; 2021. https://data.gov.il/dataset/covid-19

The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Janssen COVID-19 Vaccine — United States, February 2021

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On March 2, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On February 27, 2021, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for the Janssen COVID-19 (Ad.26.COV2.S) vaccine (Janssen Biotech, Inc, a Janssen Pharmaceutical company, Johnson & Johnson; New Brunswick, New Jersey). The Janssen COVID-19 vaccine is a recombinant, replication-incompetent adenovirus serotype 26 (Ad26) vector vaccine, encoding the stabilized prefusion spike glycoprotein of SARS-CoV-2, the virus that causes COVID-19 (*1*). Vaccination with the Janssen COVID-19 vaccine consists of a single dose (5×10^{10} virus particles per 0.5-mL dose) administered intramuscularly. On February 28, 2021, the Advisory Committee on Immunization Practices (ACIP) issued an interim recommendation* for use of the Janssen COVID-19 vaccine in persons aged ≥18 years for the prevention of COVID-19. This vaccine is the third COVID-19 vaccine authorized under an EUA for the prevention of COVID-19 in the United States (*2*). To guide its deliberations regarding the vaccine, ACIP used the Evidence to Recommendations (EtR) framework,† following the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.§ The ACIP recommendation for the use of the Janssen COVID-19 vaccine under an EUA is interim and will be updated as additional information becomes available.

Since June 2020, ACIP has convened 11 public meetings to review data on the epidemiology of COVID-19 and the potential use of COVID-19 vaccines, including the Janssen COVID-19 vaccine (*3*). The COVID-19 Vaccines Work Group, comprising experts in infectious diseases, vaccinology, vaccine safety, public health, and ethics, has held weekly meetings to review COVID-19 surveillance data, evidence for vaccine efficacy and safety, and implementation considerations for COVID-19 vaccines. Within the EtR framework for the Janssen COVID-19 vaccine, ACIP considered the importance of COVID-19 as a public health problem, as well as resource use, benefits and harms, patients' values and preferences, acceptability, feasibility, and equity. After a systematic review of available data, the work group used the GRADE approach to assess the certainty of evidence for outcomes related to the vaccine, rated on a scale of 1 (high certainty) to 4 (very low certainty) (*4*). Work group conclusions regarding certainty of evidence for the Janssen COVID-19 vaccine were discussed at public ACIP meetings (*3*).

The body of evidence for the Janssen COVID-19 vaccine was primarily informed by one international Phase III clinical trial initiated in September 2020 that enrolled approximately 40,000 participants aged 18–100 years (median age = 52 years), using two coprimary endpoints: prevention of symptomatic, laboratory-confirmed¶ COVID-19 among persons without evidence of previous SARS-CoV-2 infection** occurring 1) ≥14 days and 2) ≥28 days after vaccination (*5*). Interim findings from this clinical trial indicate that the Janssen COVID-19 vaccine efficacy against symptomatic, laboratory-confirmed COVID-19 was 66.3% (95% confidence interval [CI] = 59.9%–71.8%) ≥14 days after vaccination and 65.5% (95% CI = 57.2%–72.4%) ≥28 days after vaccination. At ≥14 days after vaccination, efficacy of ≥63.0% was observed across age, sex, race,†† and ethnicity categories and among

* On February 28, 2021, ACIP voted 12–0 in favor of the interim recommendation for use of the Janssen COVID-19 vaccine. One ACIP member recused himself from voting because of recent (<6 months) participation in clinical trials or other studies involving companies producing COVID-19 vaccines.

† https://www.cdc.gov/vaccines/acip/recs/grade/downloads/ACIP-evidence-rec-frame-508.pdf

§ https://www.cdc.gov/vaccines/acip/recs/grade/about-grade.html

¶ Symptomatic, laboratory-confirmed moderate to severe/critical COVID-19, defined as 1) a positive polymerase chain reaction (PCR) test result and 2) one or more of the following: respiratory rate ≥20 breaths/min, abnormal oxygen saturation, pneumonia, deep vein thrombosis, and shortness of breath or difficulty breathing or two or more of the following: fever (≥100.4°F [38°C]), heart rate ≥90 beats/min, shaking chills, sore throat, cough, malaise, headache, myalgia, gastrointestinal symptoms (e.g., nausea, vomiting, diarrhea, or abdominal pain), olfactory or taste disorder, or red or bruised toes. This definition captured almost all cases of symptomatic COVID-19 given the very limited number of mild COVID-19 cases. Laboratory confirmation of COVID-19 cases with PCR testing could have been performed at local laboratories, the central laboratory at University of Washington, Covance, or laboratories external to the study. All PCR assays were authorized by FDA. The sponsor's two coprimary endpoints were vaccine efficacy of moderate to severe/critical COVID-19 only confirmed by the central laboratory 1) ≥14 days and 2) ≥28 days after vaccination. This GRADE review conducted by CDC was based on vaccine efficacy of any PCR-confirmed moderate to severe/critical COVID-19 case ≥14 days after vaccination. The vaccine efficacy estimated using all PCR-positive cases was not meaningfully different from the efficacy using protocol-specified PCR confirmation by a central laboratory, which was not yet available for all cases at the time of analysis.

** Persons with positive serology test results at baseline were excluded from the primary efficacy analyses but were included in all safety analyses. Efficacy was similar in a secondary analysis that included participants both with and without evidence of previous SARS-CoV-2 infection.

†† Defined as White or Black race; numbers for other race groups were too small to produce reliable estimates.

persons with underlying medical conditions. Efficacy varied geographically and was highest in the United States (74.4%; 95% CI = 65.0%–81.6%), followed by Latin America (64.7%; 95% CI = 54.1%–73.0%) and South Africa (52.0%; 95% CI = 30.3%–67.4%). Regional differences in SARS-CoV-2 variants were noted; in South Africa, 94.5% of virus sequences from trial participants were from the B.1.351 lineage, whereas in Brazil, the P.2 lineage accounted for 69.4% of virus sequences. Vaccine efficacy for the prevention of COVID-19–associated hospitalization was high: overall, 31 COVID-19–associated hospitalizations were documented ≥14 days after vaccination, including 29 in the placebo group and two in the vaccine group (estimated efficacy = 93.1%; 95% CI = 71.1%–98.4%). No COVID-19–associated hospitalizations occurred ≥28 days after vaccination in the vaccine group, and 16 occurred in the placebo group (vaccine efficacy = 100%; 95% CI = 74.3%–100.0%). Vaccine efficacy against all-cause death was 75.0% (95% CI = 33.4%–90.6%). Seven COVID-19–associated deaths occurred, all in placebo recipients. Preliminary data suggest that the Janssen COVID-19 vaccine might also provide protection against asymptomatic SARS-CoV-2 infection,[§§] as measured by seroconversion to a non–spike protein. Among a subset of participants with SARS-CoV-2 serology results 71 days after vaccination, 0.7% of vaccine recipients had no symptoms of COVID-19 but had documented seroconversion to a non–spike protein, compared with 2.8% of placebo recipients (estimated efficacy = 74.2%; 95% CI = 47.1%–88.6%).

Vaccine recipients frequently experienced reactogenicity symptoms, defined as solicited local injection site or systemic adverse reactions during the 7 days after vaccination; however, the symptoms were mostly mild to moderate and resolved 1–2 days after vaccination. Symptoms were more frequent among persons aged 18–59 years than among those aged ≥60 years. Severe local or systemic reactogenicity symptoms (grade ≥3)[¶¶] were more common in vaccine recipients than in placebo recipients (2.2% versus 0.7%). The frequency of reported serious adverse events[***] was low (0.4%) both in vaccine and placebo recipients. Three serious adverse events were determined by FDA to be related to vaccination (injection site pain, hypersensitivity, and systemic reactogenicity). No specific safety concerns were identified in subgroup analyses by age, race, ethnicity, underlying medical conditions, or previous SARS-CoV-2 infection. A detailed summary of safety data, including information on reactogenicity, is available at https://www.cdc.gov/vaccines/covid-19/info-by-product/janssen/reactogenicity.html.

From the GRADE evidence assessment, the level of certainty for the benefits of the Janssen COVID-19 vaccine was type 2 (moderate certainty) for the prevention of symptomatic COVID-19. Evidence was also type 2 (moderate certainty) for the estimate of prevention of COVID-19–associated hospitalization and death. Evidence was type 3 (low certainty) for the estimates of prevention of SARS-CoV-2 seroconversion. Regarding certainty of evidence for possible harms after vaccination, evidence was type 1 (high certainty) for reactogenicity and type 2 (moderate certainty) for serious adverse events. Data reviewed within the EtR framework supported the use of the Janssen COVID-19 vaccine. ACIP determined that COVID-19 is a major public health problem and that use of the Janssen COVID-19 vaccine is a reasonable and efficient allocation of resources. Although there was variability in how populations value receipt of a COVID-19 vaccine, it was determined that for most populations, the desirable effects outweigh the undesirable effects, making the Janssen COVID-19 vaccine acceptable to implementation stakeholders. The Janssen COVID-19 vaccine is feasible to implement, requiring only a single dose and refrigerator temperatures (36°F–46°F [2°C–8°C]) for transportation and storage. These characteristics will allow for expanded availability of the Janssen COVID-19 vaccine in most community settings and mobile sites when this vaccine becomes more widely available. In addition, persons who want to complete their vaccination schedule quickly or who might have difficulty returning for a second dose might prefer a single-dose vaccine. The feasibility of administering the Janssen COVID-19 vaccine in a wider variety of settings provides an opportunity to improve equitable access to an effective COVID-19 vaccine. However, advancing health equity, particularly in populations who experience disproportionate COVID-19 morbidity and mortality, requires engagement with community leaders to identify and remove barriers to COVID-19 vaccination, including those related to vaccine access and vaccine confidence. Community engagement and education will be important as new COVID-19 vaccines are authorized for use. The GRADE evidence profile and supporting evidence for the EtR framework are available at https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-janssen-vaccine.html and https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-janssen-etr.html.

[§§] Asymptomatic SARS-CoV-2 infection is defined as 1) a positive antibody test (to a non–spike protein), and 2) no previous positive SARS-CoV-2 PCR test result or COVID-19 symptoms during the study. Seroconversion to a non–spike protein can be used to distinguish between natural infection and vaccine-induced immunity.

[¶¶] Grade 3 reactions are defined as those requiring use of a prescription pain reliever or preventing daily activity or a fever of 102.1°F–104.0°F (39°C–40°C); grade 4 reactions are defined as those requiring hospitalization or preventing basic self-care or fever >104.0°F (40°C). No grade 4 reactions were reported.

[***] Serious adverse events are defined as any untoward medical occurrence that results in death, is life-threatening, requires inpatient hospitalization or prolongation of existing hospitalization, or results in persistent disability or incapacity; suspected transmission of any infectious agent via a medicinal product; and a medically important event.

Summary

What is already known about this topic?

On February 27, 2021, the Food and Drug Administration issued an Emergency Use Authorization (EUA) for the Janssen COVID-19 vaccine.

What is added by this report?

On February 28, 2021, after a transparent evidence-based review of all available data, the Advisory Committee on Immunization Practices (ACIP) issued an interim recommendation for use of the Janssen COVID-19 vaccine in persons aged ≥18 years for the prevention of COVID-19.

What are the implications for public health practice?

The Janssen COVID-19 vaccine has high efficacy against COVID-19–associated hospitalization and death. Persons may receive any ACIP-recommended COVID-19 vaccine and are encouraged to receive the earliest vaccine available to them. Use of all EUA-authorized COVID-19 vaccines is critical in controlling the pandemic.

The Janssen COVID-19 vaccine is not interchangeable with other COVID-19 vaccine products. ACIP does not state a product preference; persons may receive any ACIP-recommended COVID-19 vaccine and are encouraged to receive the earliest vaccine available to them. Before vaccination, the EUA Fact Sheet should be provided to recipients and caregivers. Providers should counsel Janssen COVID-19 vaccine recipients about expected systemic and local reactogenicity. Additional clinical considerations are available at https://www.cdc.gov/vaccines/covid-19/info-by-product/clinical-considerations.html. Considerations for implementation are available at https://www.cdc.gov/vaccines/covid-19/phased-implementation.html. The interim recommendation and clinical considerations are based on use of the Janssen COVID-19 vaccine under an EUA and might change as more evidence becomes available. ACIP will continue to review additional data as they become available; updates to recommendations or clinical considerations will be posted on the ACIP website (https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/covid-19.html).

Reporting of Vaccine Adverse Events

FDA requires that vaccination providers report vaccination administration errors, serious adverse events, cases of multisystem inflammatory syndrome, and cases of COVID-19 that result in hospitalization or death after administration of COVID-19 vaccine under an EUA (*6*). Adverse events that occur after receipt of any COVID-19 vaccine should be reported to the Vaccine Adverse Events Reporting System (VAERS). Information on how to submit a report to VAERS is available at https://vaers.hhs.gov/index.html or 1-800-822-7967. Any person who administers or receives a COVID-19 vaccine is encouraged to report any clinically significant adverse event, whether or not it is clear that a vaccine caused the adverse event. In addition, CDC has developed a new, voluntary smartphone-based online tool (v-safe) that uses text messaging and online surveys to provide near real-time health check-ins after receipt of a COVID-19 vaccine. CDC's v-safe call center follows up on reports to v-safe that include possible medically significant health events to collect additional information for completion of a VAERS report. Information on v-safe is available at https://www.cdc.gov/vsafe.

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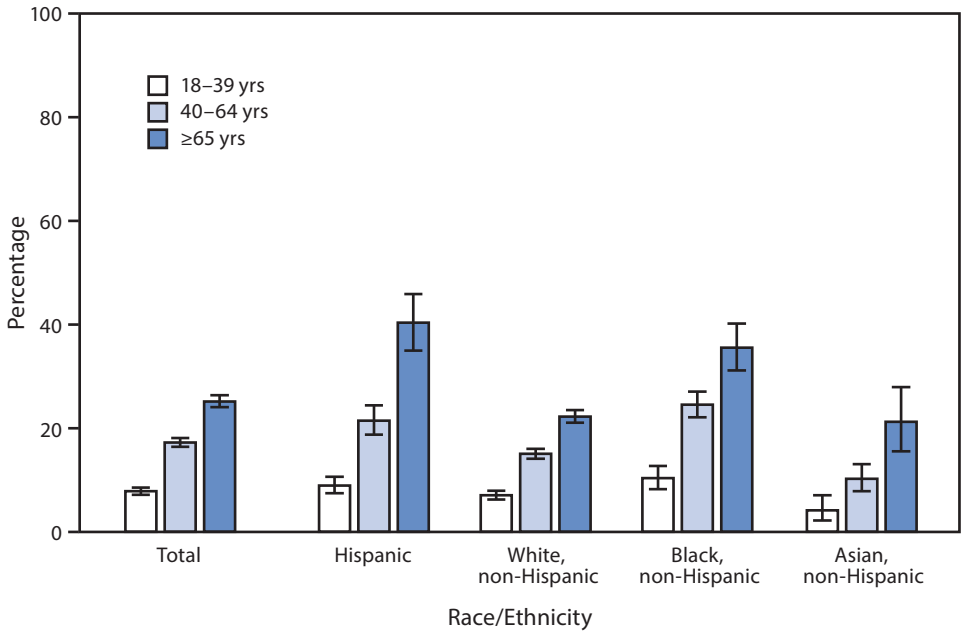
References

1. Food and Drug Administration. Janssen COVID-19 vaccine emergency use authorization. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2021. https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/Janssen-covid-19-vaccine
2. Food and Drug Administration. COVID-19 vaccines. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2021. https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines
3. Advisory Committee on Immunization Practices. ACIP meeting information. Atlanta, GA: US Department of Health and Human Services, CDC; 2021. https://www.cdc.gov/vaccines/acip/meetings/index.html
4. Advisory Committee on Immunization Practices. Advisory Committee on Immunization Practices (ACIP): GRADE (grading of recommendations, assessment, development and evaluation). Atlanta, GA: US Department of Health and Human Services, CDC; 2020. https://www.cdc.gov/vaccines/acip/recs/grade
5. Vaccines and Related Biological Products Advisory Committee. Vaccines and Related Biological Products Advisory Committee February 26, 2021, meeting: FDA briefing document. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2021. https://www.fda.gov/media/146217/download
6. Food and Drug Administration. Fact sheet for healthcare providers administering vaccine (vaccination providers). Emergency use authorization (EUA) of the Janssen COVID-19 vaccine to prevent coronavirus disease 2019 (COVID-19). Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2021. https://www.fda.gov/media/146304/download

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults in Fair or Poor Health,† by Age Group and Race and Ethnicity§ — National Health Interview Survey, United States, 2019



* With 95% confidence intervals shown by error bars.
† Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population. Based on a response of fair or poor to the question "Would you say your health in general is excellent, very good, good, fair or poor?"
§ Adults categorized as non-Hispanic White, non-Hispanic Black, and non-Hispanic Asian indicated one race only; respondents had the option to select more than one racial group. Hispanic respondents might be of any race or combination of races. Non-Hispanic adults of multiple or other races are not shown separately but are included in the total groups.

In 2019, the percentage of adults in fair or poor health increased by age (7.8% for those aged 18–39 years, 17.2% for those 40–64 years, and 25.1% for those ≥65 years) and for each racial/ethnic group shown. Hispanic and non-Hispanic Black adults were most likely to be in fair or poor health in each age group. Among persons aged 18–39 and 40–64 years, non-Hispanic Asian adults were least likely to be in fair or poor health. Among persons aged ≥65 years, non-Hispanic Asian and non-Hispanic White adults were least likely to be in fair or poor health. Hispanic and non-Hispanic Black adults aged ≥65 years had the highest percentages of fair or poor health (40.3% and 35.5%, respectively), and non-Hispanic Asian adults aged 18–39 years had the lowest percentage of fair or poor health (4.1%).

Source: National Center for Health Statistics, National Health Interview Survey, 2019 data. https://www.cdc.gov/nchs/nhis.htm

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