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Deaths and Years of Potential Life Lost From Excessive Alcohol Use — United States, 2011–2015

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Excessive alcohol use is a leading cause of preventable death in the United States (*1*) and costs associated with it, such as those from losses in workplace productivity, health care expenditures, and criminal justice, were $249 billion in 2010 (*2*). CDC used the Alcohol-Related Disease Impact (ARDI) application* to estimate national and state average annual alcohol-attributable deaths and years of potential life lost (YPLL) during 2011–2015, including deaths from one's own excessive drinking (e.g., liver disease) and from others' drinking (e.g., passengers killed in alcohol-related motor vehicle crashes). This study found an average of 93,296 alcohol-attributable deaths (255 deaths per day) and 2.7 million YPLL (29 years of life lost per death, on average) in the United States each year. Of all alcohol-attributable deaths, 51,078 (54.7%) were caused by chronic conditions, and 52,361 (56.0%) involved adults aged 35–64 years. Age-adjusted alcohol-attributable deaths per 100,000 population ranged from 20.3 in New Jersey and New York to 52.3 in New Mexico. YPLL per 100,000 population ranged from 613.8 in New York to 1,651.7 in New Mexico. Implementation of effective strategies for preventing excessive drinking, including those recommended by the Community Preventive Services Task Force (e.g., increasing alcohol taxes and regulating the number and concentration of alcohol outlets), could reduce alcohol-attributable deaths and YPLL.†

CDC has updated the ARDI application, including the causes of alcohol-attributable death, *International Classification of Diseases, Tenth Revision* codes,§ and alcohol-attributable fractions.¶ CDC used ARDI to estimate the average number of annual national and state alcohol-attributable deaths and YPLL caused by excessive drinking (i.e., deaths from conditions that are 100% alcohol-attributable, acute conditions that involved binge drinking, and chronic conditions that involved medium or high average daily alcohol consumption). ARDI estimates alcohol-attributable deaths by multiplying the total number of deaths (based on vital statistics) with an underlying cause corresponding to any of the 58 alcohol-related conditions in the ARDI application by its alcohol-attributable fraction. Some conditions (e.g., alcoholic liver cirrhosis) are wholly (100%) attributable to alcohol (alcohol-attributable fraction = 1.0),

* https://www.cdc.gov/ARDI.
† https://www.thecommunityguide.org/topic/excessive-alcohol-consumption.
§ https://www.cdc.gov/alcohol/ardi/alcohol-related-icd-codes.html.
¶ https://www.cdc.gov/alcohol/ardi/methods.html.

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whereas others are partially attributable (alcohol-attributable fraction <1.0) to alcohol (e.g., breast cancer and hypertension). Deaths are assessed by age group and sex and averaged over a 5-year period. The alcohol-attributable fractions for chronic conditions are generally calculated using relative risks from published meta-analyses and the prevalence of low, medium, and high average daily alcohol consumption among U.S. adults, based on data from the Behavioral Risk Factor Surveillance System.** The prevalence estimates are adjusted to account for underreporting of alcohol use during binge drinking episodes (*3*). Alcohol-attributable fractions for acute causes (e.g., injuries) are generally based on studies that measured the proportion of decedents who had a blood alcohol concentration ≥0.10 g/dL (*4*). Alcohol-attributable fractions for motor vehicle crash deaths are based on the proportion of crash deaths that involved a blood alcohol concentration ≥0.08 g/dL.†† For 100% alcohol-attributable conditions, deaths are summed without adjustment.§§ YPLL, a commonly used measure of premature death, are calculated by multiplying the age-specific and sex-specific alcohol-attributable deaths by the corresponding reduction in years of life potentially remaining for decedents relative to average life expectancies.¶¶ Chronic causes of death are calculated for decedents aged ≥20 years, and acute causes are generally calculated for decedents aged ≥15 years. Deaths involving children that were caused by someone else's drinking (e.g., deaths caused by a pregnant mother's drinking and passengers killed in alcohol-related motor vehicle crashes) are also included.

CDC used the data available in ARDI to estimate the average annual national and state alcohol-attributable deaths and YPLL associated with excessive drinking and national estimates of alcohol-attributable deaths and YPLL by cause of death, sex, and age group. National and state alcohol-attributable deaths and YPLL per 100,000 population were calculated by dividing the average annual alcohol-attributable death and YPLL estimates, respectively, by average annual population estimates from the U.S. Census for 2011–2015, and then multiplying by 100,000. The alcohol-attributable death rates were then age-adjusted to the 2000 U.S. population.*** The number of YPLL per alcohol-attributable death was calculated by dividing total YPLL by total alcohol-attributable deaths in the United States and in states.

** https://www.cdc.gov/brfss/.
†† https://www-fars.nhtsa.dot.gov/Crashes/CrashesAlcohol.aspx.
§§ Conditions that that are 100% alcohol-attributable include 13 chronic conditions (alcoholic psychosis, alcohol abuse, alcohol dependence syndrome, alcohol polyneuropathy, degeneration of the nervous system caused by alcohol use, alcoholic myopathy, alcohol cardiomyopathy, alcoholic gastritis, alcoholic liver disease, alcohol-induced acute pancreatitis, alcohol-induced chronic pancreatitis, fetal alcohol syndrome, and fetus and newborn affected by maternal use of alcohol) and two acute conditions (suicide by and exposure to alcohol and alcohol poisoning).

¶¶ https://www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm.
*** https://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

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During 2011–2015 in the United States, an average of 93,296 alcohol-attributable deaths occurred, and 2.7 million years of potential life were lost annually (28.8 YPLL per alcohol-attributable death) (Table 1) (Table 2). Among the 93,296 deaths, 51,078 (54.7%) were caused by chronic conditions and 42,218 (45.2%) by acute conditions. Of the 2.7 million YPLL, 1.1 million (41.1%) were because of chronic conditions, and 1.6 million (58.8%) were because of acute conditions. Overall, 66,519 (71.3%) alcohol-attributable deaths and 1.9 million (70.8%) YPLL involved males. Among all alcohol-attributable deaths, 52,361 (56.1%) involved adults aged 35–64 years, 24,766 (26.5%) involved adults aged ≥65, and 13,910 (14.9%) involved young adults aged 20–34 years (Figure).

Alcoholic liver disease was the leading chronic cause of alcohol-attributable deaths overall (18,164) and among males (12,887) and females (5,277) (Table 1). Poisonings that involved another substance in addition to alcohol (e.g., drug overdoses) were the leading acute cause of alcohol-attributable deaths overall (11,839) and among females (4,315); suicide associated with excessive alcohol use was the leading acute cause of alcohol-attributable deaths among males (7,711). Conditions wholly attributable to alcohol accounted for 29,068 (31.2%) of all alcohol-attributable deaths and 762,241 (28.4%) of all YPLL.

The national average annual age-adjusted alcohol-attributable death rate was 27.4 per 100,000, and the YPLL per 100,000 was 847.7 (Table 2). The average annual number

TABLE 1. Average annual number of deaths and years of potential life lost attributable to excessive alcohol use,* by condition and sex — United States, 2011–2015

Cause	Alcohol-attributable deaths			Years of potential life lost		
	Total†	Males no. (%)	Females no. (%)	Total†	Males no. (%)	Females no. (%)
Total†	**93,296**	**66,519 (71.3)**	**26,778 (28.7)**	**2,683,211**	**1,899,089 (70.8)**	**784,121 (29.2)**
Chronic causes	**51,078**	35,583 (69.7)	15,495 (30.3)	**1,105,190**	752,936 (68.1)	352,253 (31.9)
Alcohol abuse	**2,591**	1,986 (76.6)	605 (23.4)	**66,839**	49,129 (73.5)	17,710 (26.5)
Alcohol cardiomyopathy	**510**	432 (84.7)	78 (15.3)	**12,235**	10,136 (82.8)	2,099 (17.2)
Alcohol dependence syndrome	**4,258**	3,269 (76.8)	989 (23.2)	**109,911**	81,192 (73.9)	28,719 (26.1)
Alcohol polyneuropathy	**3**	3 (100.0)	0 (—)	**54**	54 (100.0)	0 (—)
Alcoholic gastritis	**33**	26 (78.8)	7 (21.2)	**890**	696 (78.2)	194 (21.8)
Alcoholic liver disease	**18,164**	12,887 (70.9)	5,277 (29.1)	**467,996**	313,897 (67.1)	154,099 (32.9)
Alcoholic myopathy	**0**	0 (—)	0 (—)	**0**	0 (—)	0 (—)
Alcoholic psychosis	**703**	549 (78.1)	154 (21.9)	**14,129**	10,799 (76.4)	3,330 (23.6)
Alcohol-induced acute pancreatitis	**278**	214 (77.0)	64 (23.0)	**8,284**	6,247 (75.4)	2,037 (24.6)
Alcohol-induced chronic pancreatitis	**52**	38 (73.1)	14 (26.9)	**1,507**	1,046 (69.4)	461 (30.6)
Atrial fibrillation	**329**	228 (69.3)	100 (30.4)	**2,943**	2,084 (70.8)	860 (29.2)
Cancer, breast (females only)	**584**	NA	584 (NA)	**11,203**	NA	11,203 (NA)
Cancer, colorectal	**996**	898 (90.2)	98 (9.8)	**15,540**	14,016 (90.2)	1,524 (9.8)
Cancer, esophageal§	**494**	430 (87.0)	64 (13.0)	**8,038**	7,007 (87.2)	1,031 (12.8)
Cancer, laryngeal	**248**	233 (94.0)	15 (6.0)	**4,002**	3,737 (93.4)	265 (6.6)
Cancer, liver	**1,609**	1,545 (96.0)	64 (4.0)	**28,191**	27,129 (96.2)	1,061 (3.8)
Cancer, oral cavity and pharyngeal	**909**	830 (91.3)	79 (8.7)	**16,034**	14,715 (91.8)	1,319 (8.2)
Cancer, pancreatic¶	**186**	151 (81.2)	35 (18.8)	**2,827**	2,301 (81.4)	526 (18.6)
Cancer, prostate (males only)	**188**	188 (NA)	NA	**1,952**	1,952 (NA)	NA
Cancer, stomach¶	**58**	56 (96.6)	3 (5.2)	**943**	897 (95.1)	46 (4.9)
Chronic hepatitis	**2**	2 (100.0)	0 (0.0)	**42**	36 (85.7)	6 (14.3)
Coronary heart disease	**3,537**	2,971 (84.0)	567 (16.0)	**46,698**	40,183 (86.0)	6,515 (14.0)
Degeneration of nervous system attributable to alcohol	**145**	118 (81.4)	27 (18.6)	**2,617**	2,030 (77.6)	587 (22.4)
Esophageal varices	**112**	77 (68.8)	34 (30.4)	**2,414**	1,711 (70.9)	703 (29.1)
Fetal alcohol syndrome	**4**	2 (50.0)	2 (50.0)	**212**	122 (57.5)	90 (42.5)
Fetus and newborn affected by maternal use of alcohol	**1**	1 (100.0)	0 (0.0)	**76**	76 (100.0)	0 (—)
Gallbladder disease	**0**	0 (—)	0 (—)	**0**	0 (—)	0 (—)
Gastroesophageal hemorrhage	**31**	20 (64.5)	10 (32.3)	**517**	359 (69.4)	157 (30.4)
Hypertension	**3,584**	1,638 (45.7)	1,946 (54.3)	**50,016**	26,021 (52.0)	23,994 (48.0)
Infant death, low birthweight**	**2**	1 (50.0)	1 (50.0)	**133**	69 (51.9)	65 (48.9)
Infant death, preterm birth**	**44**	24 (54.5)	19 (43.2)	**3,410**	1,845 (54.1)	1,565 (45.9)
Infant death, small for gestational age**	**0**	0 (—)	0 (—)	**13**	5 (38.5)	7 (53.8)
Liver cirrhosis, unspecified	**9,801**	5,696 (58.1)	4,105 (41.9)	**197,875**	114,580 (57.9)	83,295 (42.1)
Pancreatitis, acute	**0**	0 (—)	0 (—)	**0**	0 (—)	0 (—)
Pancreatitis, chronic	**15**	12 (80.0)	3 (20.0)	**317**	252 (79.5)	65 (20.5)

See table footnotes the next page.

TABLE 1. (*Continued*) Average annual number of deaths and years of potential life lost attributable to excessive alcohol use,* by condition and sex — United States, 2011–2015

Cause	Alcohol-attributable deaths			Years of potential life lost		
	Total†	Males no. (%)	Females no. (%)	Total†	Males no. (%)	Females no. (%)
Pneumonia††	**133**	105 (78.9)	29 (21.8)	**3,714**	2,839 (76.4)	875 (23.6)
Portal hypertension	**61**	34 (55.7)	26 (42.6)	**1,267**	729 (57.5)	538 (42.5)
Stroke, hemorrhagic	**938**	565 (60.2)	374 (39.9)	**14,497**	8,856 (61.1)	5,641 (38.9)
Stroke, ischemic	**342**	243 (71.1)	100 (29.2)	**3,867**	2,837 (73.4)	1,030 (26.6)
Unprovoked seizures, epilepsy, or seizure disorder	**134**	112 (83.6)	22 (16.4)	**3,987**	3,352 (84.1	635 (15.9)
Acute causes	**42,218**	30,935 (73.3)	11,283 (26.7)	**1,578,021**	1,146,153 (72.6)	431,868 (27.4)
Air-space transport	**75**	64 (85.3)	11 (14.7)	**2,268**	1,867 (82.3)	401 (17.7)
Alcohol poisoning	**2,288**	1,735 (75.8)	553 (24.2)	**76,224**	56,511 (74.1)	19,713 (25.9)
Aspiration	**255**	141 (55.3)	114 (44.7)	**4,765**	2,695 (56.6)	2,070 (43.4)
Child maltreatment§§	**148**	87 (58.8)	61 (41.2)	**11,000**	6,294 (57.2)	4,706 (42.8)
Drowning	**981**	772 (78.7)	210 (21.4)	**33,853**	27,108 (80.1)	6,745 (19.9)
Fall injuries¶¶	**2,645**	1,873 (70.8)	772 (29.2)	**70,815**	49,887 (70.4)	20,927 (29.6)
Fire injuries	**457**	274 (60.0)	183 (40.0)	**10,950**	6,491 (59.3)	4,459 (40.7)
Firearm injuries	**337**	284 (84.3)	53 (15.7)	**12,917**	10,768 (83.4)	2,149 (16.6)
Homicide	**5,306**	4,267 (80.4)	1,039 (19.6)	**230,047**	187,052 (81.3)	42,995 (18.7)
Hypothermia	**296**	194 (65.5)	102 (34.5)	**6,199**	4,354 (70.2)	1,845 (29.8)
Motor-vehicle nontraffic crashes	**190**	144 (75.8)	47 (24.7)	**5,588**	4,249 (76.0)	1,339 (24.0)
Motor-vehicle traffic crashes***	**7,092**	5,522 (77.9)	1,570 (22.1)	**323,610**	245,447 (75.8)	78,163 (24.2)
Occupational and machine injuries	**126**	117 (92.9)	9 (7.1)	**3,294**	3,060 (92.9)	234 (7.1)
Other road vehicle crashes	**170**	137 (80.6)	33 (19.4)	**5,632**	4,473 (79.4)	1,159 (20.6)
Poisoning (not alcohol)	**11,839**	7,524 (63.6)	4,315 (36.4)	**444,235**	280,270 (63.1)	163,965 (36.9)
Suicide	**9,899**	7,711 (77.9)	2,189 (22.1)	**332,791**	252,674 (75.9)	80,117 (24.1)
Suicide by and exposure to alcohol	**38**	24 (63.2)	14 (36.8)	**1,267**	764 (60.3)	503 (39.7)
Water transport	**75**	65 (86.7)	9 (12.0)	**2,566**	2,189 (85.3)	377 (14.7)

Abbreviation: NA = not applicable.

* In the Alcohol-Related Disease Impact application (https://www.cdc.gov/ARDI), deaths attributable to excessive alcohol use include deaths from 1) conditions that are 100% alcohol-attributable, 2) deaths caused by acute conditions that involved binge drinking, and 3) deaths caused by chronic conditions that involved medium (>1 to ≤2 drinks of alcohol [women] or >2 to ≤4 drinks [men]) or high (>2 drinks of alcohol [women] or >4 drinks [men]) levels of average daily alcohol consumption.

† Numbers might not sum to totals, and row percentages might not sum to 100% because of rounding.

§ Deaths calculated for the proportion of esophageal cancer deaths caused by squamous cell carcinoma only, based on the Surveillance, Epidemiology, and End Results data in 18 states (SEER18). https://seer.cancer.gov/.

¶ Deaths among those consuming high average daily levels of alcohol only.

** Alcohol consumption prevalence estimates calculated among women aged 18–44 years only.

†† Deaths among persons aged 20–64 years only because of the high number of deaths from pneumonia among persons aged ≥65 years that are not alcohol-related and the lack of relative risks that differ by age.

§§ Deaths among persons aged 0–14 years.

¶¶ Deaths among persons aged 15–69 years only because of the high number of deaths from falls among persons aged ≥70 years that are not alcohol-attributable and the lack of alcohol-attributable fractions that differ by age.

*** Deaths among persons of all ages. A blood alcohol concentration level of ≥0.08 g/dL is used for defining alcohol attribution for this condition.

of alcohol-attributable deaths and YPLL varied across states, ranging from 203 alcohol-attributable deaths in Vermont to 10,811 in California, and from 5,074 YPLL in Vermont to 299,336 in California. Age-adjusted alcohol-attributable death rates among the 40 states with reliable estimates (excluding those with suppressed data where estimates might not account for all the alcohol-attributable deaths in the state) ranged from 20.3 per 100,000 in New Jersey and New York to 52.3 in New Mexico. YPLL per 100,000 ranged from 613.8 in New York to 1,651.7 in New Mexico.

Discussion

Excessive alcohol use was responsible for approximately 93,000 deaths and 2.7 million YPLL annually in the United States during 2011–2015. This means that an average of 255 Americans die from excessive drinking every day, shortening their lives by an average of 29 years. The majority of these alcohol-attributable deaths involved males, and approximately four in five deaths involved adults aged ≥35 years. The number of alcohol-attributable deaths among adults aged ≥65 years was nearly double that among adults aged 20–34 years. Approximately one half of alcohol-attributable deaths were caused by chronic conditions, but acute alcohol-attributable deaths, all of which were caused by binge drinking, accounted for the majority of the YPLL from excessive drinking.

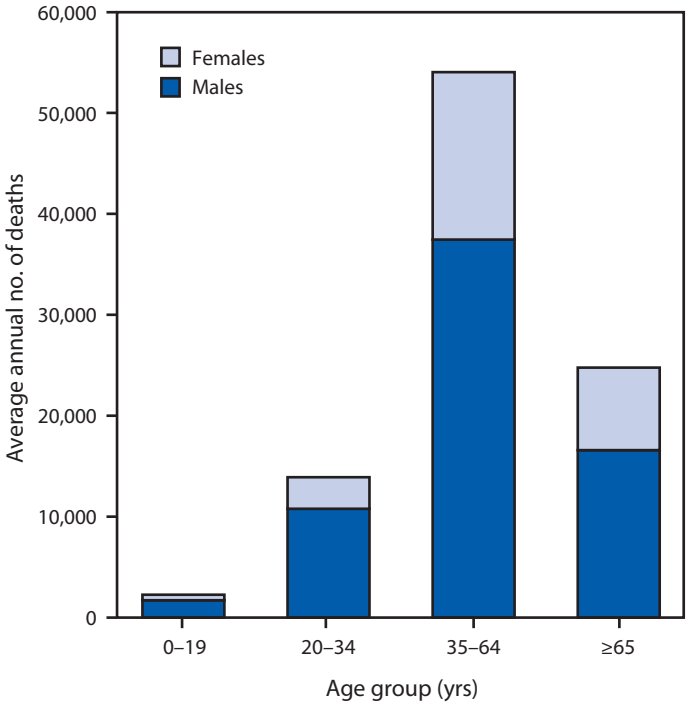
Little progress has been made in preventing deaths caused by excessive drinking; the average annual estimates of alcohol-attributable deaths and YPLL in this report are slightly higher

TABLE 2. Annual average number of deaths and years of potential life lost from excessive alcohol use,* by state — United States, 2011–2015

Location	Alcohol-attributable deaths	Age-adjusted alcohol-attributable deaths per 100,000-population	Years of potential life lost	Years of potential life lost per 100,000-population	Years of potential life lost per alcohol-attributable death
U.S. total	**93,296**	**27.4**	**2,683,211**	**847.7**	**28.8**
Alabama	1,446	28.0	44,074	912.4	30.5
Alaska	292	29.4†	9,631	1,313.2	33.0
Arizona	2,594	37.0	74,450	1,120.9	28.7
Arkansas	892	28.3	26,512	896.2	29.7
California	10,811	26.9	299,336	779.1	27.7
Colorado	1,810	32.5	54,054	1,024.0	29.9
Connecticut	900	22.8	25,738	716.3	28.6
Delaware	271	19.3†	8,136	878.2	30.0
District of Columbia	207	26.4†	5,861	905.2	28.3
Florida	6,778	29.8	183,199	932.5	27.0
Georgia	2,556	24.7	75,681	756.3	29.6
Hawaii	348	17.1†	9,470	673.4	27.2
Idaho	491	29.5	14,037	868.3	28.6
Illinois	3,295	24.0	95,560	742.3	29.0
Indiana	1,900	27.4	56,502	860.2	29.7
Iowa	834	24.5	22,014	711.6	26.4
Kansas	750	24.7	22,152	765.7	29.5
Kentucky	1,524	32.3	45,422	1,032.9	29.8
Louisiana	1,523	31.5	47,217	1,020.9	31.0
Maine	424	18.8†	11,261	847.3	26.6
Maryland	1,453	22.9	43,804	738.6	30.1
Massachusetts	1,729	23.3	48,305	720.4	27.9
Michigan	3,123	28.9	89,332	902.3	28.6
Minnesota	1,333	22.7	36,537	674.2	27.4
Mississippi	913	29.3	27,950	935.4	30.6
Missouri	1,860	28.8	55,813	923.2	30.0
Montana	414	37.4	12,232	1,205.5	29.5
Nebraska	453	23.0	12,610	674.6	27.8
Nevada	1,037	34.6	29,604	1,057.8	28.5
New Hampshire	420	20.1†	11,364	858.2	27.1
New Jersey	1,967	20.3	57,455	645.2	29.2
New Mexico	1,129	52.3	34,424	1,651.7	30.5
New York	4,390	20.3	120,761	613.8	27.5
North Carolina	2,811	26.5	82,568	838.7	29.4
North Dakota	215	21.2†	6,352	880.2	29.5
Ohio	3,608	28.6	103,809	896.8	28.8
Oklahoma	1,465	36.4	43,597	1,132.5	29.8
Oregon	1,498	33.5	39,310	997.9	26.2
Pennsylvania	3,768	26.5	108,168	846.4	28.7
Rhode Island	337	20.5†	9,240	876.9	27.4
South Carolina	1,629	31.4	48,121	1,007.2	29.5
South Dakota	282	22.0†	8,608	1,020.9	30.5
Tennessee	2,102	30.0	62,325	958.9	29.7
Texas	7,097	26.9	213,553	804.7	30.1
Utah	68	26.1	21,803	751.0	31.9
Vermont	203	21.0†	5,074	809.8	25.0
Virginia	1,972	22.2	56,965	689.9	28.9
Washington	2,195	28.8	59,665	854.1	27.2
West Virginia	725	35.3	21,621	1,167.8	29.8
Wisconsin	1,722	27.2	47,374	825.0	27.5
Wyoming	236	27.1†	7,317	1,262.3	31.0

* In the Alcohol-Related Disease Impact application (https://www.cdc.gov/ARDI), deaths attributable to excessive alcohol use include deaths from 1) conditions that are 100% alcohol-attributable, 2) deaths caused by acute conditions that involved binge drinking, and 3) deaths caused by chronic conditions that involved medium (>1 to ≤2 drinks of alcohol [women] or >2 to ≤4 drinks [men]) or high (>2 drinks of alcohol [women] or >4 drinks [men]) levels of average daily alcohol consumption.
† The estimate might be unreliable because of suppressed estimates of the number of alcohol-attributable deaths in two or more age groups, and estimates might not account for the total number of alcohol-attributable deaths in the state.

FIGURE. Average annual number of deaths attributable to excessive alcohol use,* by sex and age group — United States, 2011–2015



* In the Alcohol-Related Disease Impact application (https://www.cdc.gov/ARDI), deaths attributable to excessive alcohol use include deaths from 1) conditions that are 100% alcohol-attributable, 2) deaths caused by acute conditions that involved binge drinking, and 3) deaths caused by chronic conditions that involved medium (>1 to ≤2 drinks of alcohol [women] or >2 to ≤4 drinks [men]) or high (>2 drinks of alcohol [women] or >4 drinks [men]) levels of average daily alcohol consumption.

Summary

What is already known about this topic?

Excessive drinking is a leading cause of preventable death in the United States and is associated with numerous health and social problems.

What is added by this report?

During 2011–2015, excessive drinking was responsible for an average of 93,296 deaths (255 per day) and 2.7 million years of potential life lost (29 years lost per death, on average) in the United States each year.

What are the implications for public health practice?

Widespread implementation of prevention strategies, including those recommended by the Community Preventive Services Task Force (e.g., increasing alcohol taxes and regulating the number and concentration of places that sell alcohol) could help reduce deaths and years of potential life lost from excessive drinking.

than estimates for 2006–2010, and the age-adjusted alcohol-attributable death rates are similar (*5*), suggesting that excessive drinking remains a leading preventable cause of death and disability (*1*). From 2006–2010 (*5*) to 2011–2015, average annual deaths caused by alcohol dependence increased 14.2%, from 3,728 to 4,258, and deaths caused by alcoholic liver disease increased 23.6%, from 14,695 to 18,164. These findings are consistent with reported increasing trends in alcohol-induced deaths (e.g., deaths from conditions wholly attributable to alcohol) among adults aged ≥25 years,[†††] including alcoholic liver disease,[§§§] as well as with increases in per capita alcohol consumption during the past 2 decades.[¶¶¶]

Age-adjusted alcohol-attributable death rates varied approximately twofold across states, but deaths caused by excessive drinking were common across the country. The differences in alcohol-attributable death and YPLL rates in states might be partially explained by varying patterns of excessive alcohol use, particularly binge drinking, which is affected by state-level alcohol pricing and availability strategies (*6*) and differential access to medical care.

The findings in this report are subject to at least five limitations. First, the prevalence of alcohol consumption ascertained through the Behavioral Risk Factor Surveillance System is based on self-reported data, which substantially underestimates alcohol consumption (*7*). Second, these estimates are conservative, because former drinkers, some of whom might have died from alcohol-related conditions, are not included in the estimates of alcohol-attributable deaths and YPLL for partially alcohol-attributable causes of death. Third, direct alcohol-attributable fraction estimates for some chronic and acute conditions rely on data older than that of 2011–2015 (*4*) and might not accurately represent the proportion of excessive drinkers among persons who died of some conditions (e.g., drug overdoses) during that period. This emphasizes the importance of more timely information on alcohol involvement and various health conditions. Fourth, several conditions partially related to alcohol (e.g., tuberculosis, human immunodeficiency virus, and acquired immunodeficiency syndrome)[****] are not included because published risk estimates were not available. Finally, the alcohol-attributable deaths and YPLL are based on alcohol-related conditions that were listed as the underlying (i.e., primary) cause of death, and not as a multiple cause of death, yielding conservative estimates.

The implementation of effective population-based strategies for preventing excessive drinking, such as those recommended by the Community Preventive Services Task Force (e.g., increasing alcohol taxes and regulating the number and concentration

[†††] https://www.cdc.gov/mmwr/volumes/68/wr/mm6833a5.htm.
[§§§] https://pubs.niaaa.nih.gov/publications/surveillance111/Cirr15.htm.
[¶¶¶] https://pubs.niaaa.nih.gov/publications/surveillance110/CONS16.htm.

[****] https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua.

of alcohol outlets), could reduce alcohol-attributable deaths and YPLL. These strategies can complement other population-based prevention strategies that focus on health risk behaviors associated with excessive alcohol use, such as safer prescribing practices to reduce opioid misuse and overdoses (*8*,*9*) and alcohol-impaired driving interventions (*10*).

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Progress Toward Hepatitis B Control — South-East Asia Region, 2016–2019

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In 2015, the World Health Organization (WHO) South-East Asia Region (SEAR)* reported an estimated 40 million persons living with chronic hepatitis B virus (HBV) infection and 285,000 deaths from complications of chronic infection, cirrhosis, and hepatocellular carcinoma (*1*). Most chronic HBV infections, indicated by the presence of hepatitis B surface antigen (HBsAg) on serologic testing, are acquired in infancy through perinatal or early childhood transmission (*2*). To prevent perinatal and childhood infections, WHO recommends that all infants receive at least 3 doses of hepatitis B vaccine (HepB), including a timely birth dose (HepB-BD)† (*1*). In 2016, the SEAR Immunization Technical Advisory Group endorsed a regional hepatitis B control goal with a target of achieving hepatitis B surface antigen (HBsAg) seroprevalence of ≤1% among children aged ≥5 years by 2020, which is in line with the WHO Global Health Sector Strategy on Viral Hepatitis 2016–2021 (*2*,*3*). The South-East Asia Regional Vaccine Action Plan 2016–2020 (SEARVAP) (*4*) identified the acceleration of hepatitis B control as one of the eight regional goals for immunization. The plan outlined four main strategies for achieving hepatitis B control: 1) achieving ≥90% coverage with 3 doses of HepB (HepB3), 2) providing timely vaccination with a HepB birth dose (HepB-BD), 3) providing catch-up vaccination of older children, and 4) vaccinating adult populations at high risk and health care workers (*1*,*4*). In 2019, SEAR established a regional expert panel on hepatitis B to assess countries' HBV control status. This report describes the progress made toward hepatitis B control in SEAR during 2016–2019. By 2016, all 11 countries in the region had introduced HepB in their national immunization programs, and eight countries had introduced HepB-BD. During 2016–2019, regional HepB3 coverage increased from 89% to 91%, and HepB-BD coverage increased from 34% to 54%. In 2019, nine countries in the region achieved ≥90% HepB3 coverage, and three of the eight countries that provide HepB-BD achieved ≥90% HepB-BD coverage. By December 2019, four countries had been verified to have achieved the hepatitis B control goal. Countries in the region can make further progress toward hepatitis B control by using proven strategies to improve HepB-BD and HepB3 coverage rates. Conducting nationally representative hepatitis B serosurveys among children will be key to tracking and verifying the regional control targets.

Immunization Activities

HepB-BD and HepB3 coverage data are reported annually to WHO and the United Nations Children's Fund (UNICEF) from all 11 SEAR countries. WHO and UNICEF use country-reported survey and administrative coverage data (number of vaccine doses administered divided by the estimated target population) to estimate vaccination coverage. By 2016, all countries in the region had introduced at least 3 HepB doses into national immunization schedules, and eight countries had introduced universal HepB-BD vaccination in addition to HepB3 (Table 1) (*5*). Since 1992, Thailand has provided 4 doses of HepB (at ages 0, 2, 4, and 6 months) for all infants and administers an extra dose at age 1 month for infants born to mothers with positive test results for HBsAg (*6*). During 2016–2019, regional HepB3 coverage increased from 89% to 91%. By 2019, nine countries had reached the regional target of ≥90% HepB3 coverage, six had reached ≥95% HepB3 coverage, and four countries reported HepB3 coverage of ≥80% in all districts§ (Table 1). Regional HepB-BD coverage increased from 34% in 2016 to 54% in 2019. Three of the eight countries that had introduced HepB-BD achieved HepB-BD coverage of ≥90% in 2019. HepB-BD coverage in India, the country with the largest birth cohort in the region, was <60% during 2016–2019 (*5*).

HBsAg Seroprevalence Surveys

HBV infections in children are typically asymptomatic, but can lead to liver cirrhosis and cancer in adulthood. Therefore, to assess the effectiveness of the hepatitis B immunization program in preventing HBV infections, nationally representative surveys are conducted to determine HBsAg seroprevalence among children aged ≥5 years. Measuring HBsAg prevalence among children aged ≥5 years accounts for the period of highest risk for perinatal or horizontal transmission of HBV and of becoming chronically infected with HBV (*2*). During 2011–2017, seroprevalence studies were conducted in six countries: Bangladesh, Bhutan, Burma, Indonesia, Nepal, and Thailand.

*The South-East Asia Region, one of the six regions of World Health Organization, consists of 11 countries with a total population of approximately 2 billion, including Bangladesh, Bhutan, Burma, India, Indonesia, Maldives, Nepal, North Korea, Sri Lanka, Thailand, and Timor-Leste.

†Timely hepatitis B birth-dose is defined as administration of a dose of hepatitis B vaccine within 24 hours of birth.

§Data for Maldives and Thailand for percent district ≥80% HepB3 coverage only for provinces and atolls, respectively.

TABLE 1. Hepatitis B vaccine (HepB) schedule and estimated coverage* with a birth dose and third dose of HepB, by country — World Health Organization (WHO) South-East Asia Region, 2016–2019

Country/Area	No. of live births, 2019	HepB schedule	Year HepB introduced	Year birth dose introduced	% Coverage					
					2016			2019		
					HepB-BD	HepB3	Districts† with ≥80% HepB3 coverage (%)	Timely HepB-BD§	HepB3	Districts† with ≥80% HepB3 coverage (%)
Bangladesh	3,408,614	6, 10, 14 wks	2003	ND	NA	98	100	NA	98	98
Bhutan	11,496	0, 6, 10, 14 wks	1997	2012	82	98	100	86	97	100
Burma	981,223	0, 2, 4, 6 mos	2003	2016	NA	90	88	17	90	84
India	27,192,790	0, 6, 10, 14 wks	2002¶	2011	47	88	69	56	91	77
Indonesia	4,766,582	0, 2, 3, 4, 18 mos	1997	2002	NA	84	74	84	85	77
Maldives	5,964	0, 2, 4, 6 mos	1993	2000	NA	99	100	99	99	100
Nepal	640,789	6, 10, 14 wks	2002	ND	NA	87	68	NA	93	69
North Korea	325,605	0, 6, 10, 14 wks	2003	2004	98	96	100	98	97	100
Sri Lanka	329,754	2, 4, 6 mos	2003	ND	NA	99	100	NA	99	100
Thailand	600,267	0, 2, 4, 6 mos**	1992	1992	NA	99	NR	99	97	95
Timor-Leste	47,269	0, 6, 10, 14 wks	2007	2016	42	79	100	70	83	54
South-East Asia Region	**38,314,010**	—	—	—	**34**	**89**	—	**54**	**91**	—
Global	**139,677,000**	—	—	—	**35**	**84**	—	**43**	**85**	—

Abbreviations: HepB-BD = birth dose of monovalent hepatitis B vaccine; HepB3 = third dose of hepatitis B containing vaccine; mos = months; NA = not applicable; ND = not done; NR = not reported; UNICEF = United Nations Children's Fund; wks = weeks.

* WHO-UNICEF estimates. https://www.who.int/immunization/monitoring_surveillance/data/en.

† For Maldives and Thailand, district-level HepB3 coverage data are provided for province and atolls only, respectively.

§ Timely hepatitis B birth-dose is defined as administration of a dose of hepatitis B vaccine within 24 hours of birth.

¶ HepB introduction was piloted in 2002 and made universal in 2011. https://extranet.who.int/iris/restricted/bitstream/handle/10665/329981/India2019_epi-eng.pdf?sequence=1&isAllowed=y.

** An additional HepB dose given at 1 month for infants born to a mother chronically infected with hepatitis B virus, in addition to birth dose and routine infant doses.

HBsAg seroprevalence before vaccine introduction ranged from 0.3% to 7% (Table 2). In four (Bangladesh, Bhutan, Nepal, and Thailand) of five countries where seroprevalence data were collected after vaccine introduction, HBsAg prevalence declined to <1%.

Regional Verification of Hepatitis B Control Goal

In 2019, the WHO SEAR Office established the South-East Asia Regional Expert Panel (SEA REP), consisting of eight regional and international independent experts in hepatitis B, immunization, hepatology, and epidemiology, to verify each country's status in achieving the regional hepatitis B control goal through immunization.¶ SEA REP established two essential criteria for verifying hepatitis B control achievement: 1) a nationally representative seroprevalence survey that documents HBsAg seroprevalence ≤1% among children aged ≥5 years who were born after implementation of nationwide universal hepatitis B infant immunization and 2) coverage with HepB-BD (in countries where HepB-BD is in the national immunization schedule) and HepB3 of ≥90% at national and ≥80% at subnational levels for the previous 5 years, to follow the SEARVAP targets (*1*,*4*). Additional supplementary information may be submitted if available, such as screening of pregnant women for HBsAg during antenatal care, prophylaxis for infants born to mothers with positive test results for HBsAg,** and surveillance for acute hepatitis to guide vaccination strategies among adult populations at high risk. In 2019, SEA REP verified that Bangladesh, Bhutan, Nepal, and Thailand had achieved the regional hepatitis B control target (Table 2) (Figure).

Discussion

During 2016–2019, SEAR made significant progress toward hepatitis B control. HepB has been introduced in all 11 countries in the region and HepB-BD in eight of those countries. By 2019, HepB3 coverage exceeded 90% in all countries except Indonesia and Timor-Leste, and HepB-BD coverage had increased by 59%. By 2019, four countries in the region were verified to have achieved the 2020 regional control target. This progress was substantiated by a hepatitis B modeling study, which estimated that hepatitis B immunization prevented approximately 16 million chronic HBV infections and averted 2.5 million deaths that would have occurred during the lifetime of children born during 1992–2015 (*7*).

¶ https://www.who.int/docs/default-source/searo/ivd/guidelines-for-verification-of-achievement-of-hepatitis-b-control-target-through-immunization-in-the-who-sear.pdf.

** Countries that have not introduced HepB-BD recommended to provide evidence of high coverage for antenatal screening for HBV and HepB-BD among infants born to mothers with positive test results for HBsAg.

TABLE 2. HBsAg seropositivity, by country — World Health Organization South-East Asia Region, 2011–2017

Country	Year of most recent representative HBsAg seroprevalence survey	No. of persons tested	HBsAg seroprevalence, before vaccine introduction % (95% CI)	HBsAg seroprevalence in children aged ≥5 years,* after vaccine introduction % (95% CI)	Year of verification of ≤1% HBsAg seroprevalence†
Bangladesh§	2011–2012	2,100 prevaccine; 2,100 postvaccine	1.2 (0.7–1.6)	0.05 (0.0–0.1)	2019
Bhutan¶	2017	775 prevaccine; 546 postvaccine	2 (1.0–4.0)	0.5 (0.1–1.8)	2019
Burma**	2015	5,547 prevaccine only††	6.5 (5.9–7.2)	ND	NS
India	ND	—	—	—	NS
Indonesia§§	2013	Total sample of >15,000§§	7 (NR)	4.20 (NR)	NS
Maldives	ND	—	—	—	NS
Nepal¶¶	2012	1,200 prevaccine; 2,186 postvaccine	0.3 (0.1–0.9)	0.1 (0.04–0.4)	2019
North Korea	ND	—	—	—	NS
Sri Lanka	ND	—	—	—	NS
Thailand***	2014	2,805 prevaccine; 3,159 postvaccine§§	4.5 (NR)	0.3 (NR)	2019
Timor-Leste	ND	—	—	—	NS

Abbreviations: CI = confidence interval; HBsAg = hepatitis B surface antigen; ND = not done; NR = not reported; NS = not submitted to the regional verification commission.

* Born after the nationwide implementation of universal hepatitis B infant immunization.

† Verification is done by a regional commission of experts from the Hepatitis B immunization Expert Resource Panel that determines if the country has reached the target of ≤1% HBsAg seroprevalence among children aged 5 years.

§ http://www.ajtmh.org/content/journals/10.4269/ajtmh.17-0721.

¶ World Health Organization. Serosurvey to estimate the prevalence of biomarkers of infections with hepatitis B and C viruses, and antibodies to measles and rubella Bhutan, March–April 2017. New Delhi, India: World Health Organization, Regional Office for South-East Asia Office; 2017.

** Lwin AA, Aye KS, Htun MM, et al. Seroprevalence of hepatitis B and C viral infections in Myanmar: national and regional survey in 2015. Myanmar Health Sci Res J 2017;29(3).

†† Pre-vaccine sample included adults.

§§ Muljono DH. Epidemiology of hepatitis B and C in Republic of Indonesia. Euroasian J Hepato-Gastroenterol 2017;7:55–9.

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Achieving HepB3 coverage of ≥90% nationally and ≥80% in all districts will be essential to achieving hepatitis B control by 2020. However, in India and Indonesia, whose combined birth cohorts account for 83% of SEAR births, <80% of the districts achieved HepB3 coverage of ≥80%, despite intensified vaccination activities targeted at districts with low coverage (*8*). In Nepal, national coverage was ≥90%; however, only 69% of the districts achieved ≥80% HepB3 coverage. Additional strategies that have been successful at improving HepB3 coverage in other countries include 1) implementing online vaccination registration, 2) mapping high-risk areas to identify children who missed doses, 3) verifying complete vaccination on school entry, 4) involving the private sector by providing free vaccines to providers, and 5) addressing vaccine hesitancy through enhanced communication and social mobilization. Including such strategies could help the region accelerate progress toward hepatitis B control (*8*). National coverage inequities could be reduced by conducting catch-up vaccination activities to reach the unvaccinated and increase HepB3 coverage in all districts to ≥80%.

Improving timely HepB-BD coverage is also essential for preventing perinatal transmission of HBV from mother to child and horizontal transmission during early childhood from household members and close contacts. Promoting newborn delivery in health facilities has been shown to increase timely HepB-BD coverage when accompanied by health care worker training, availability of HepB-BD in delivery wards, standing orders for HepB-BD administration, and the presence of skilled birth attendants (*9*). Almost 80% of births in India occur in health facilities, but many births are not assisted by skilled birth attendants (*9*), and timely HepB-BD coverage in 2019 was only 56%. To reach infants born outside health facilities, Indonesia and Timor-Leste instituted national policies allowing use of a compact, prefilled, auto-disable injection device

Summary

What is already known about this topic?

In 2015, an estimated 40 million persons in the World Health Organization South-East Asia Region had chronic hepatitis B virus infection.

What is added by this report?

During 2016–2019, regional hepatitis B vaccine (HepB) birth dose (HepB BD) and third dose (HepB3) coverage increased from 34% to 54% and from 89% to 91%, respectively. In 2019, nine of 11 countries in the region achieved ≥90% HepB3 coverage nationally, and three of eight countries that provide HepB-BD achieved ≥90% HepB-BD coverage. By 2019, four countries achieved hepatitis B control.

What are the implications for public health practice?

Enhanced coordination among maternal, newborn, and child health services and immunization services could improve coverage and support achievement of hepatitis B control.

(CPAD) that makes it easier for midwives and traditional birth attendants to administer HepB-BD (*7*,*10*). Indonesia also uses CPAD outside the cold chain for HepB-BD delivery in hard to reach areas, enabling vaccinations for home births in areas lacking cold chain for vaccine storage (*7*).†† In India, use of an open vial policy§§ to reduce wastage of monovalent HepB vaccine contributed to improvement in HepB-BD coverage.¶¶ Educating mothers during prenatal care visits about the importance of a timely HepB-BD and integrating HepB-BD vaccination with essential maternal and newborn care have been shown to increase timely HepB-BD administration, especially in home births in remote, hard-to-reach areas (*9*). Reports from community health workers to health facility personnel about recent births can also help increase timely HepB-BD administration (*9*).

Nationally representative HBsAg serosurveys among children are required to verify achievement of the regional hepatitis B control goal. With sustained national HepB3 coverage of ≥90% and all districts achieving HepB3 ≥80%, Maldives, North Korea, and Sri Lanka only need to conduct serosurveys to determine whether they have reached the control target. Assessing current HBsAg prevalence in India and Indonesia would guide interventions to improve HepB vaccination in specific areas to achieve hepatitis B control.

For some countries that do not provide routine HepB-BD, national serosurvey data might show low seroprevalence. In such countries, screening pregnant women for HBsAg and providing HepB-BD and hepatitis B immunoglobulin to exposed infants would prevent perinatal infections, a key recommendation in the SEARVAP. Establishing perinatal hepatitis B databases to track screening, timely HepB-BD administration, completion of vaccination among exposed newborns, and provision of antiviral treatment to eligible pregnant women would further help prevent mother-to-child transmission of HBV. Close collaboration between the immunization, maternal, neonatal, and child health and viral hepatitis programs are needed to achieve hepatitis B control and elimination.

The findings in this report are subject to at least two limitations. First, estimates of the target population might be inaccurate, resulting in inaccurate vaccination coverage estimates and inaccurate assessments of achievement of the vaccination coverage target. Second, lack of representativeness of some serosurveys and lower sensitivity of the rapid HBsAg test in the field could bias the findings used to determine achievement and validation of hepatitis B control in some countries.

Despite progress in hepatitis B vaccination and verification that four countries have achieved the 2020 control goal, Burma, India, Indonesia, and Timor-Leste are unlikely to achieve hepatitis B control by the end of 2020. Because of the coronavirus disease 2019 pandemic, childhood vaccination coverage rates are declining globally. Interventions to maintain or improve HepB vaccination coverage, particularly HepB-BD, along with other childhood vaccines, will reduce missed opportunities for vaccination and speed progress toward the regional goal.

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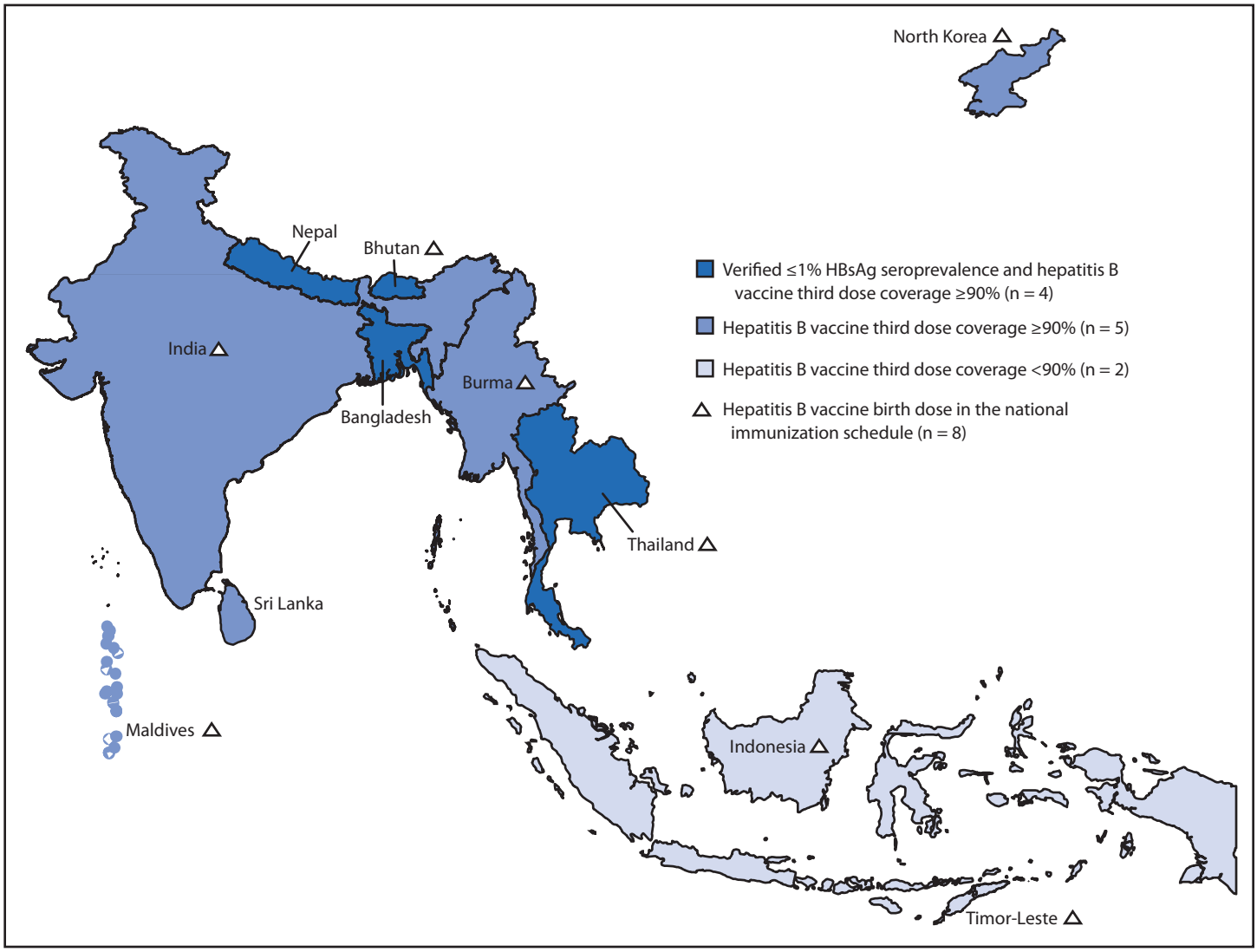
†† https://www.sciencedirect.com/science/article/pii/S0264410X9900242X?via%3Dihub.

§§ All opened WHO-prequalified multidose vials of vaccines should be discarded at the end of the immunization session, or within 6 hours of opening, whichever comes first, unless the vaccine meets all four of the following criteria, in which case, the opened vial can be kept and used for up to 28 days after opening: 1) the vaccine is currently prequalified by WHO; 2) the vaccine is approved for use for up to 28 days after opening the vial, as determined by WHO; 3) the expiry date of the vaccine has not passed; and 4) the vaccine vial has been, and will continue to be, stored at WHO- or manufacturer-recommended temperatures; furthermore, the vaccine vial monitor, if one is attached, is visible on the vaccine label and is not past its discard point, and the vaccine has not been damaged by freezing. https://apps.who.int/iris/bitstream/handle/10665/135972/WHO_IVB_14.07_eng.pdf;sequence=1.

¶¶ https://www.ijhpm.com/article_3137_629.html?_action=articleInfo&article=3137&vol=629.

FIGURE. Estimated coverage* with third dose of hepatitis B vaccine and verification of hepatitis B control,† by country — World Health Organization (WHO) South-East Asia Region, 2019



Abbreviation: HBsAg = hepatitis B surface antigen.
* WHO-United Nations Children's Fund estimates (https://www.who.int/southeastasia/health-topics/immunization).
† Verification done by South-East Asia Regional Expert Panel that determines whether the country has reached the target of ≤1% HBsAg seroprevalence among children aged ≥5 years and coverage of third dose of hepatitis B vaccine to be ≥90% at national and ≥80% at subnational levels for the previous 5 years.

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Symptom Duration and Risk Factors for Delayed Return to Usual Health Among Outpatients with COVID-19 in a Multistate Health Care Systems Network — United States, March–June 2020

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Prolonged symptom duration and disability are common in adults hospitalized with severe coronavirus disease 2019 (COVID-19). Characterizing return to baseline health among outpatients with milder COVID-19 illness is important for understanding the full spectrum of COVID-19–associated illness and tailoring public health messaging, interventions, and policy. During April 15–June 25, 2020, telephone interviews were conducted with a random sample of adults aged ≥18 years who had a first positive reverse transcription–polymerase chain reaction (RT-PCR) test for SARS-CoV-2, the virus that causes COVID-19, at an outpatient visit at one of 14 U.S. academic health care systems in 13 states. Interviews were conducted 14–21 days after the test date. Respondents were asked about demographic characteristics, baseline chronic medical conditions, symptoms present at the time of testing, whether those symptoms had resolved by the interview date, and whether they had returned to their usual state of health at the time of interview. Among 292 respondents, 94% (274) reported experiencing one or more symptoms at the time of testing; 35% of these symptomatic respondents reported not having returned to their usual state of health by the date of the interview (median = 16 days from testing date), including 26% among those aged 18–34 years, 32% among those aged 35–49 years, and 47% among those aged ≥50 years. Among respondents reporting cough, fatigue, or shortness of breath at the time of testing, 43%, 35%, and 29%, respectively, continued to experience these symptoms at the time of the interview. These findings indicate that COVID-19 can result in prolonged illness even among persons with milder outpatient illness, including young adults. Effective public health messaging targeting these groups is warranted. Preventative measures, including social distancing, frequent handwashing, and the consistent and correct use of face coverings in public, should be strongly encouraged to slow the spread of SARS-CoV-2.

Prolonged illness is well described in adults with severe COVID-19 requiring hospitalization, especially among older adults (*1*,*2*). Recently, the number of SARS-CoV-2 infections in persons first evaluated as outpatients have increased, including cases among younger adults (*3*). A better understanding of convalescence and symptom duration among outpatients with COVID-19 can help direct care, inform interventions to reduce transmission, and tailor public health messaging.

The Influenza Vaccine Effectiveness in the Critically Ill (IVY) Network, a collaboration of U.S. health care systems, is conducting epidemiologic studies on COVID-19 in both inpatient and outpatient settings (*4*,*5*). Fourteen predominantly urban academic health systems in 13 states each submitted a list of adults with positive SARS-CoV-2 RT-PCR test results obtained during March 31–June 4, 2020, to Vanderbilt University Medical Center. Site-specific random sampling was then performed on a subset of these patients who were tested as outpatients and included patients tested in the emergency department (ED) who were not admitted to the hospital at the testing encounter and those tested in other outpatient clinics. At 14–21 days from the test date, CDC personnel interviewed the randomly sampled patients or their proxies by telephone to obtain self-reported baseline demographic, socioeconomic, and underlying health information, including the presence of chronic medical conditions. Call attempts were made for up to seven consecutive days, and interviews were conducted in several languages (*4*). Respondents were asked to report the number of days they felt unwell before the test date, COVID-19–related symptoms experienced at the time of testing (*6*), whether symptoms had resolved by the date of the interview, and whether the patient had returned to their usual state of health. For this data analysis, respondents were excluded if they did not complete the interview, if a proxy (e.g., family member) completed the interview (because of their incomplete knowledge of symptoms), if they reported a previous positive SARS-CoV-2 test (because the reference date for symptoms questions was unclear), or (because this analysis focused on symptomatic persons) if they did not answer symptoms questions or denied all symptoms at testing.

Descriptive statistics were used to compare characteristics among respondents who reported returning and not returning to their usual state of health by the date of the interview.

Summary

What is already known about this topic?

Relatively little is known about the clinical course of COVID-19 and return to baseline health for persons with milder, outpatient illness.

What is added by this report?

In a multistate telephone survey of symptomatic adults who had a positive outpatient test result for SARS-CoV-2 infection, 35% had not returned to their usual state of health when interviewed 2–3 weeks after testing. Among persons aged 18–34 years with no chronic medical conditions, one in five had not returned to their usual state of health.

What are the implications for public health practice?

COVID-19 can result in prolonged illness, even among young adults without underlying chronic medical conditions. Effective public health messaging targeting these groups is warranted.

Generalized estimating equation regression models with exchangeable correlation structure accounting for clustering by site were fitted to evaluate the association between baseline characteristics and return to usual health, adjusting for potential a priori-selected confounders. Resolution and duration of individual symptoms were also assessed. Statistical analyses were conducted using Stata software (version 16; StataCorp).

At least one telephone call was attempted for 582 patients (including 175 [30%] who were tested in an ED and 407 [70%] in non-ED settings), with 325 (56%) interviews completed (89 [27%] ED and 236 [73%] non-ED). Among 257 nonrespondents, 178 could not be reached, 37 requested a callback but could not be reached on further call attempts, 28 refused the interview, and 14 had a language barrier. Among the 325 completed interviews, 31 were excluded: nine (3%) because a proxy was interviewed, 17 (5%) because a previous positive SARS-CoV-2 test was reported, and five (2%) who did not answer the symptoms questions. Two additional respondents were called prematurely at 7 days and were also excluded.* Among the 292 remaining patient respondents, 274 (94%) reported one or more symptoms at testing and were included in this data analysis. Following outpatient testing, 7% (19 of 262 with available data) reported later being hospitalized, a median of 3.5 days after the test date. The median age of symptomatic respondents was 42.5 years (interquartile range [IQR] = 31–54 years), 142 (52%) were female, 98 (36%) were Hispanic, 96 (35%) were non-Hispanic white, 48 (18%) were non-Hispanic black, and 32 (12%) were other non-Hispanic race. Overall, 141 of 264 (53%) with available data reported one or more chronic medical conditions. The median interval from test to interview date was 16 days (IQR = 14–19 days); the median number of days respondents reported feeling unwell before being tested for SARS-CoV-2 was 3 (IQR = 2–7 days).

Return to Usual State of Health

Among the 270 of 274 interviewees with available data on return to usual health,† 175 (65%) reported that they had returned to their usual state of health a median of 7 days (IQR = 5–12 days) from the date of testing (Table 1). Ninety-five (35%) reported that they had not returned to their usual state of health at the time of interview. The proportion who had not returned to their usual state of health differed across age groups: 26% of interviewees aged 18–34 years, 32% aged 35–49 years, and 47% aged ≥50 years reported not having returned to their usual state of health (p = 0.010) within 14–21 days after receiving a positive test result. Presence of chronic conditions also affected return to health rates; among 180 persons with no or one chronic medical condition, 39 with two chronic medical conditions, and 44 with three or more chronic medical conditions, 28%, 46%, and 57%, respectively, reported not having returned to their usual state of health (p = 0.003) within 14–21 days after having a positive test result. Among respondents aged 18–34 years with no chronic medical condition, 19% (nine of 48) reported not having returned to their usual state of health. Adjusting for other factors, age ≥50 versus 18–34 years (adjusted odds ratio [aOR] = 2.29; 95% confidence interval [CI] = 1.14–4.58) and reporting three or more versus no chronic medical conditions (aOR = 2.29; 95% CI = 1.07–4.90) were associated with not having returned to usual health (Table 2). Obesity (body mass index ≥30 kg per m^2) (aOR 2.31; 95% CI = 1.21–4.42) and reporting a psychiatric condition§ (aOR 2.32; 95% CI = 1.17–4.58) also were associated with more than twofold odds of not returning to the patient's usual health after adjusting for age, sex, and race/ethnicity.

Resolution of Symptoms and Duration

Among the 274 symptomatic outpatients, the median number of symptoms was seven of 17 listed in the interview tool (IQR = 5–10), with fatigue (71%), cough (61%), and headache (61%) those most commonly reported (Figure). Among respondents who reported fever and chills on the day of testing, these resolved in 97% and 96% of respondents, respectively.

* Two patients interviewed early at 12 days and three interviewed at 13 days after testing were included. Two patients who requested interview after 21 days because they were unavailable at 14–21 days were included (interviews were conducted at 25 and 26 days). All other included respondents were interviewed 14–21 days after testing.

† Patients were asked the question "Would you say that you are feeling back to your usual health?"

§ Psychiatric conditions included anxiety disorder (38), depression (21), posttraumatic stress disorder (two), paranoia (two), obsessive-compulsive disorder (one), schizophrenia (one); some patients reported more than one condition.

TABLE 1. Characteristics of symptomatic outpatients with SARS-CoV-2 real-time reverse transcription–polymerase chain reaction (RT-PCR)—positive test results (N = 270)* who reported returning to usual state of health or not returning to usual state of health at an interview conducted 14–21 days after testing — 14 academic health care systems,† United States, March–June 2020

Characteristic	Total	Returned to usual health, no. (row %)		P-value§
		Yes (n = 175)	No (n = 95)	
Sex				0.14
Women	**140**	85 (61)	55 (39)	
Men	**130**	90 (69)	40 (31)	
Age group (yrs)				0.010
18–34	**85**	63 (74)	22 (26)	
35–49	**96**	65 (68)	31 (32)	
≥50	**89**	47 (53)	42 (47)	
Race/Ethnicity				0.29
White, non-Hispanic	**94**	58 (62)	36 (38)	
Black, non-Hispanic	**46**	26 (57)	20 (43)	
Other race, non-Hispanic	**32**	24 (75)	8 (25)	
Hispanic	**98**	67 (68)	31 (32)	
Insurance (14 missing)				0.69
No	**46**	31 (67)	15 (33)	
Yes	**210**	135 (64)	75 (36)	
No. of medical conditions (7 missing)				0.003
0	**123**	87 (71)	36 (29)	
1	**57**	41 (72)	16 (28)	
2	**39**	21 (54)	18 (46)	
≥3	**44**	19 (43)	25 (57)	
Individual medical conditions (7 missing all)¶				
Hypertension	**64**	33 (52)	31 (48)	0.018
Obesity (body mass index >30 kg/m^2)	**51**	23 (45)	28 (55)	0.002
Psychiatric condition	**49**	23 (47)	26 (53)	0.007
Asthma	**36**	23 (64)	13 (36)	0.99
Diabetes	**28**	16 (57)	12 (43)	0.43
Immunosuppressive condition	**15**	6 (40)	9 (60)	0.047
Autoimmune condition	**13**	7 (54)	6 (46)	0.44
Blood disorder	**8**	4 (50)	4 (50)	0.47
Chronic kidney disease	**7**	3 (43)	4 (57)	0.26
Chronic obstructive pulmonary disease	**7**	4 (57)	3 (43)	0.71
Liver disease	**6**	4 (67)	2 (33)	1.00
Neurologic condition	**6**	3 (50)	3 (50)	0.48
Coronary artery disease	**4**	3 (75)	1 (25)	1.00
Congestive heart failure	**2**	2 (100)	0 (0)	0.54

* 294 patients responded to an interview 2–3 weeks after testing, did not report a previous positive SARS-CoV-2 test before the reference test, and answered questions about symptoms. Of these, 276 (94%) reported one or more symptoms at the time of SARS-CoV-2 RT-PCR testing, with 272 (99%) reporting whether they had returned to their usual state of health by the time of the interview. Two additional patients excluded who were called at 7 days, with 270 included here.

† Patients were randomly sampled from fourteen academic healthcare systems in 13 states (University of Washington [Washington], Oregon Health and Sciences University [Oregon], University of California Los Angeles and Stanford University [California], Hennepin County Medical Center [Minnesota], Vanderbilt University [Tennessee], Ohio State University [Ohio], Wake Forest University [North Carolina], Montefiore Medical Center [New York], Beth Israel Deaconess Medical Center and Baystate Medical Center [Massachusetts], Intermountain Healthcare [Utah/Idaho], University of Colorado Hospital [Colorado], and Johns Hopkins University [Maryland]).

§ Respondents who reported returning to usual health and respondents who reported not returning to usual health were compared using the chi-square test or Fisher's exact test.

¶ Excluding seven (3%) patients who did not answer questions about chronic underlying medical conditions; for those who answered questions about underlying conditions, some respondents were missing data on obesity (two), neurologic conditions (one), and psychiatric conditions (one).

Symptoms least likely to have resolved included cough (not resolved in 43% [71 of 166]) and fatigue (not resolved in 35% [68 of 192]); among 90 who reported shortness of breath at the time of testing, this symptom had not resolved in 26 (29%). The median interval to symptom resolution among those who reported individual symptoms at the time of testing but not at the time of the interview ranged from 4 to 8 days from the test date, with the longest intervals reported for loss of smell (median = 8 days; IQR = 5–10.5 days) and loss of taste (median = 8 days; IQR = 4–10 days). Among respondents who reported returning to their usual state of health, 34% (59 of 175) still reported one or more of the 17 queried COVID-related symptoms at the time of the interview.

Discussion

Most studies to date have focused on symptoms duration and clinical outcomes in adults hospitalized with severe COVID-19 (*1*,*2*). This report indicates that even among symptomatic adults tested in outpatient settings, it might take weeks for resolution of symptoms and return to usual health.

TABLE 2. Characteristics associated with not returning to usual health among symptomatic outpatients with SARS-CoV-2 real-time reverse transcription–polymerase chain reaction (RT-PCR)–positive test results (N = 270)* reported at an interview conducted 14–21 days after testing — 14 academic health care systems,† United States, March–June 2020

Characteristic	Odds of not returning to "usual health" at 14–21 days after testing	
	Unadjusted odds ratio (95% CI)§	Adjusted odds ratio (95% CI)§,¶
Age group (yrs)		
18–34	Referent	Referent
35–49	1.40 (0.73–2.67)	1.38 (0.71–2.69)
≥50	2.64 (1.39–5.00)	2.29 (1.14–4.58)
Sex		
Women	Referent	Referent
Men	0.68 (0.41–1.13)	0.80 (0.46–1.38)
Race/Ethnicity		
White, non-Hispanic	Referent	Referent
Black, non-Hispanic	1.23 (0.60–2.53)	1.13 (0.53–2.45)
Other, non-Hispanic	0.53 (0.21–1.31)	0.63 (0.24–1.61)
Hispanic	0.74 (0.40–1.34)	0.83 (0.44–1.58)
No. of medical conditions		
0	Referent	Referent
1	0.94 (0.47–1.89)	0.74 (0.35–1.55)
2	2.09 (1.00–4.38)	1.50 (0.68–3.33)
≥3	3.19 (1.56–6.50)	2.29 (1.07–4.90)
Individual medical conditions**		
Hypertension	1.98 (1.12–3.52)	1.30 (0.67–2.51)
Obesity (BMI >30 kg/m^2)	2.65 (1.42–4.95)	2.31 (1.21–4.42)
Psychiatric condition	2.42 (1.29–4.56)	2.32 (1.17–4.58)
Asthma	1.00 (0.48–2.08)	1.02 (0.47–2.20)
Diabetes	1.38 (0.62–3.05)	1.06 (0.46–2.44)
Immunosuppressive condition	2.84 (0.98–8.26)	2.33 (0.77–7.04)
Autoimmune condition	1.55 (0.51–4.76)	1.05 (0.32–3.46)
Blood disorder	1.82 (0.45–7.45)	1.43 (0.33–6.24)
Chronic kidney disease	2.42 (0.53–11.05)	2.36 (0.48–11.51)
Chronic obstructive pulmonary disease	1.34 (0.29–6.12)	0.70 (0.14–3.48)
Liver disease	0.88 (0.16–4.90)	0.72 (0.12–4.25)
Neurologic condition	1.78 (0.35–9.01)	1.23 (0.23–6.62)
Coronary artery disease	0.58 (0.06–5.70)	0.48 (0.05–4.92)
Congestive heart failure	—	—

Abbreviations: BMI = body mass index; CI = confidence interval.

* 294 patients responded to 14–21-day interview, did not report a previous positive SARS-CoV-2 test before the reference test, and answered questions about symptoms; 276 (94%) of these reported one or more symptoms at the time of SARS-CoV-2 RT-PCR testing, with 272 (99%) reporting whether they had returned to their usual state of health by the time of the interview. Two additional patients who were called at 7 days were excluded, with 270 included here.

† Patients were randomly sampled from academic healthcare systems in 13 states (University of Washington [Washington], Oregon Health and Sciences University [Oregon], University of California Los Angeles and Stanford University [California], Hennepin County Medical Center [Minnesota], Vanderbilt University [Tennessee], Ohio State University [Ohio], Wake Forest University [North Carolina], Montefiore Medical Center [New York], Beth Israel Deaconess Medical Center and Baystate Medical Center [Massachusetts], Intermountain Healthcare [Utah/Idaho], University of Colorado Hospital [Colorado], and Johns Hopkins University [Maryland]).

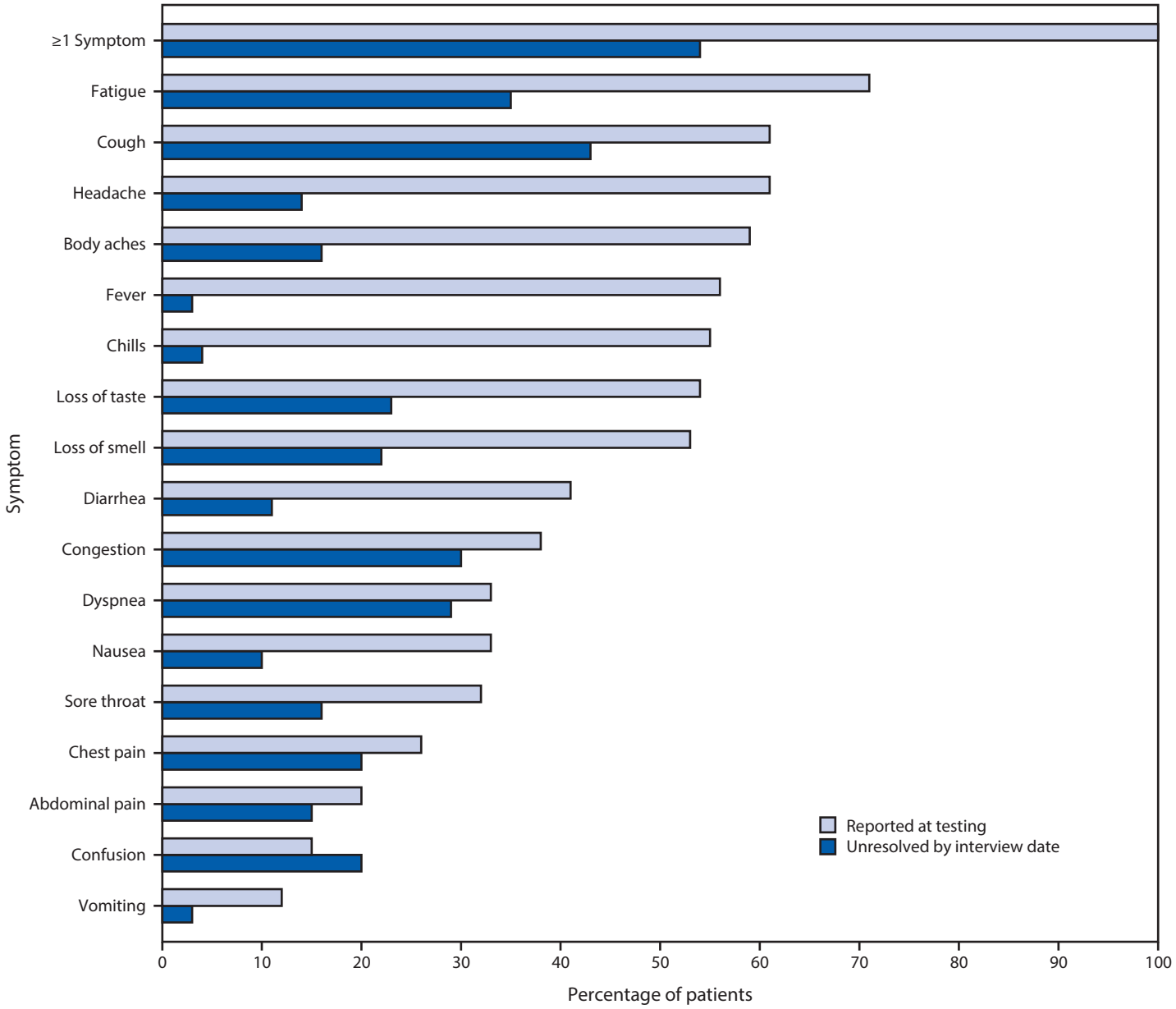
§ For this analysis, generalized estimation equation (GEE) models with exchangeable correlation structure were used to estimate the association between characteristics and the odds of not returning to usual health by the date of the 14–21-day interview. GEE models were used to account for clustering of cases by site. 95% CIs including 1.00 are not considered statistically significant.

¶ In adjusted GEE models for age, sex, race/ethnicity, and number of chronic medical conditions, the other variables were used to adjust for potential confounders. Models for individual conditions (e.g., hypertension) were adjusted for age, sex, and race/ethnicity.

** Medical conditions are not exclusive and individual patients could have more than one chronic medical condition.

Not returning to usual health within 2–3 weeks of testing was reported by approximately one third of respondents. Even among young adults aged 18–34 years with no chronic medical conditions, nearly one in five reported that they had not returned to their usual state of health 14–21 days after testing. In contrast, over 90% of outpatients with influenza recover within approximately 2 weeks of having a positive test result (*7*). Older age and presence of multiple chronic medical conditions have previously been associated with illness severity among adults hospitalized with COVID-19 (*8*,*9*); in this study, both were also associated with prolonged illness in an outpatient population. Whereas previous studies have found race/ethnicity to be a risk factor for severe COVID-19 illness (*10*), this study of patients whose illness was diagnosed in an outpatient setting did not find an association between race/ethnicity and return to usual health although the modest number of respondents might have limited our ability to detect associations. The finding of an association between chronic psychiatric conditions and delayed return to usual health requires further evaluation. These findings have important implications for understanding the full effects of COVID-19, even in persons with milder outpatient illness. Notably, convalescence can be

FIGURE. Self-reported symptoms at the time of positive SARS-CoV-2 reverse transcription–polymerase chain reaction (RT-PCR) testing results and unresolved symptoms 14–21 days later among outpatients (N = 274)* — 14 academic health care systems,† United States, March–June 2020



* 294 patients responded to 14–21-day interview, did not report a previous positive SARS-CoV-2 test before the reference test, and answered questions about symptoms; 276 (94%) of these reported one or more symptoms at the time of SARS-CoV-2 RT-PCR testing; those who were interviewed at 7 days were excluded, with 274 included here.

† Patients were randomly sampled from 14 academic health care systems in 13 states (University of Washington [Washington], Oregon Health and Sciences University [Oregon], University of California Los Angeles and Stanford University [California], Hennepin County Medical Center [Minnesota], Vanderbilt University [Tennessee], Ohio State University [Ohio], Wake Forest University [North Carolina], Montefiore Medical Center [New York], Beth Israel Deaconess Medical Center and Baystate Medical Center [Massachusetts], Intermountain Healthcare [Utah/Idaho], University of Colorado Hospital [Colorado], and Johns Hopkins University [Maryland]).

prolonged even in young adults without chronic medical conditions, potentially leading to prolonged absence from work, studies, or other activities.

The findings in this report are subject to at least three limitations. First, nonrespondents might have differed from survey respondents; for example, those with more severe illness might have been less likely to respond to telephone calls if they were subsequently hospitalized and unable to answer the telephone. Second, symptoms that resolved before the test date or that commenced after the date of testing were not recorded in this survey. Finally, as a telephone survey, this study relied on patient self-report and might have been subject to incomplete recall or recall bias.

Nonhospitalized COVID-19 illness can result in prolonged illness and persistent symptoms, even in young adults and

persons with no or few chronic underlying medical conditions. Public health messaging should target populations that might not perceive COVID-19 illness as being severe or prolonged, including young adults and those without chronic underlying medical conditions. Preventative measures, including social distancing, frequent handwashing, and the consistent and correct use of face coverings in public, should be strongly encouraged to slow the spread of SARS-CoV-2.

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Notes from the Field

Rebound in Routine Childhood Vaccine Administration Following Decline During the COVID-19 Pandemic — New York City, March 1–June 27, 2020

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Concerns have been raised about falling childhood vaccine administration and vaccination coverage rates (*1*,*2*) during the coronavirus disease 2019 (COVID-19) pandemic. In New York City (NYC), decreasing vaccination coverage has been of particular concern in light of recent outbreaks of vaccine-preventable diseases, including a large measles outbreak during 2018–2019 (*3*). The effect of the COVID-19 pandemic on routine childhood vaccination was monitored by the NYC Department of Health and Mental Hygiene (DOHMH) using the Citywide Immunization Registry (CIR),* a population-based immunization information system with high data quality and provider participation (*4*,*5*). CIR includes 2.7 million patient records for NYC persons aged 0–18 years and receives reports from approximately 1,600 immunization facilities. The weekly number of routine childhood vaccine doses administered to persons aged <24 months and 2–18 years in 2020 was compared with the number administered during the same period in 2019; influenza vaccine and vaccines administered in pharmacies and hospital nurseries were excluded from this report.† Likewise, the weekly number of unique facilities that reported administering at least one childhood vaccine in 2020 to 2019 was also compared.

A decrease in the number of vaccine doses administered in NYC was detected beginning the week of March 8, 2020, 1 week after the first COVID-19 case was confirmed in NYC. Those numbers declined further after the New York State on PAUSE Executive Order§ went into effect on March 22, which required New Yorkers to stay at home to reduce the spread of SARS-CoV-2, the virus that causes COVID-19. The largest relative decrease was observed during the week of April 5–11 and was less pronounced in persons aged <24 months (62% decrease, from 33,261 doses in 2019 to 12,746 doses in 2020) than in those aged 2–18 years (96% decrease, from 23,631 doses in 2019 to 1,054 doses in 2020) (Figure). During that same week, 488 facilities reported administering at least one vaccine to a person aged <24 months, representing a 46% decrease from the 900 reporting immunization data during the same period in 2019; the number of facilities that reported administering at least one vaccine to a person aged 2–18 years decreased 78%, from 1,238 in 2019 to 275 in 2020.

In response to the decline in vaccine administration documented during the COVID-19 pandemic, the NYC DOHMH sent three letters and one Health Alert Network notification to health care providers during March–June highlighting the importance of continuing routine immunization. In May, messages were placed on the CIR's vaccine ordering module to encourage providers to order sufficient vaccine to catch up their unvaccinated patients. Reminder and recall tools available in the CIR's provider portal were promoted to identify and recall children who were overdue for vaccination. The importance of childhood vaccination was the subject of a mayoral press conference on May 20 that was widely covered by local media.¶ A webinar targeting NYC pediatric health care providers was held on June 17 to promote strategies to increase vaccination.

Vaccine administration increased among persons aged <24 months starting the week of April 19–25, as the number of new COVID-19 cases declined,** and returned to levels comparable with those during 2019 beginning the week of May 17 (Figure). During the most recent week for which data were available (June 21–27), the number of facilities that reported administering at least one vaccine to a person aged <24 months increased 69% from the lowest point to 825. Vaccine administration among persons aged 2–18 years increased starting the week of April 26–May 2 and has continued to rise, but as of June 27 still had not reached levels comparable with 2019 (Figure). During the week of June 21–27, 35% fewer vaccines were administered to persons aged 2–18 years than were administered during the same week in 2019 (17,947 doses versus 27,405). The number of facilities that reported administering at least one vaccine to a person aged 2–18 years increased to 950, approximately three times as many as at the lowest point during 2020 (275 facilities).

* CIR is a database of immunization records and birth records. All vaccine doses administered to persons aged ≤18 years in NYC are required to be reported to CIR within 14 days of administration according to the NYC Health Code and New York State Public Health Law. Birth certificates are uploaded to CIR twice per week.

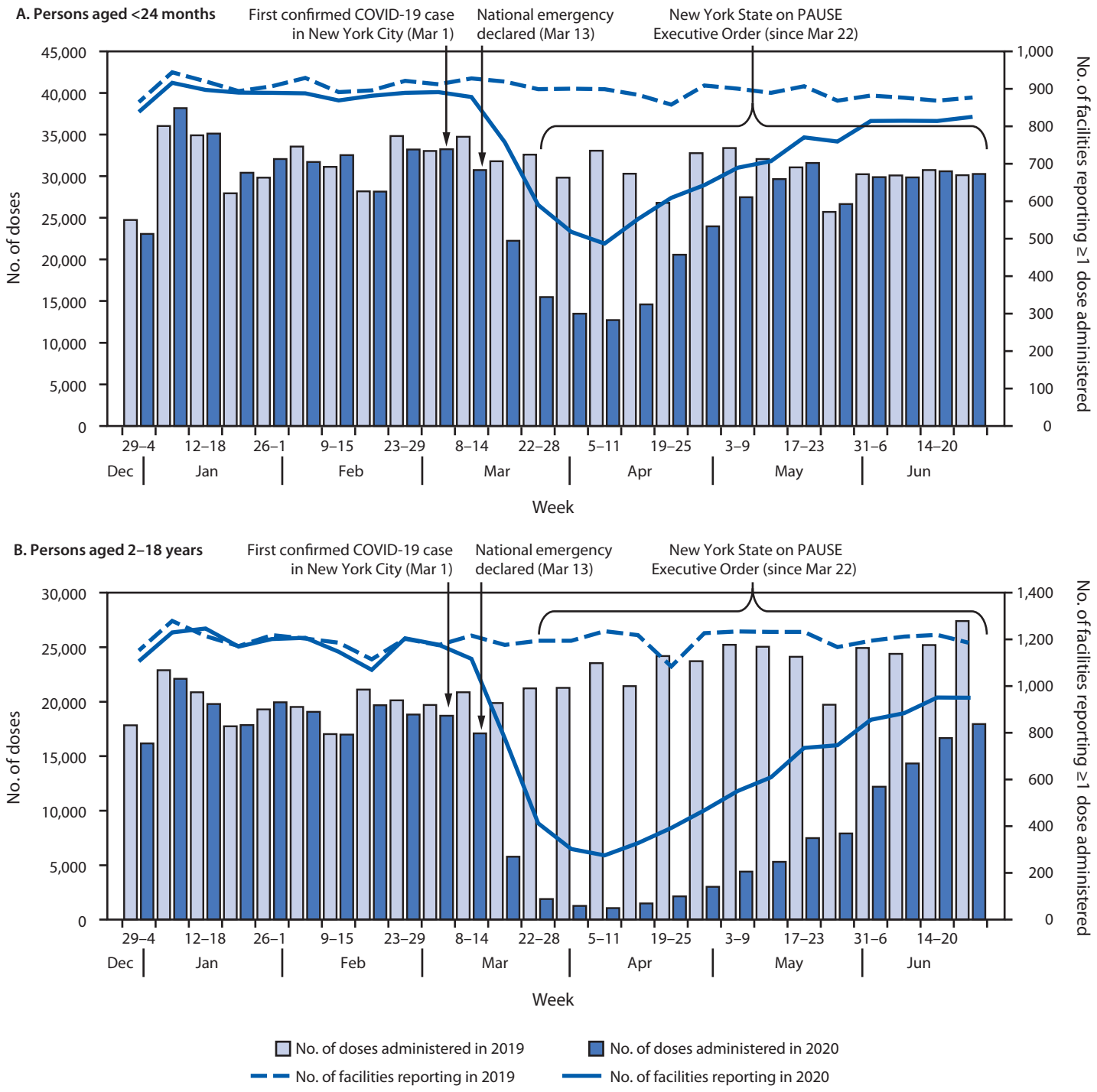
† Pharmacies and hospital nurseries were excluded because they do not administer routine childhood immunizations in NYC. In New York State, pharmacies are only authorized to administer influenza vaccine to persons aged 2–18 years. Hospital nurseries only administer the hepatitis B birth dose to infants.

§ https://www.governor.ny.gov/news/governor-cuomo-issues-guidance-essential-services-under-new-york-state-pause-executive-order.

¶ https://www.ny1.com/nyc/all-boroughs/news/2020/05/20/mayor-urges-parents-to-vaccinate-kids-during-pandemic-.

** https://www1.nyc.gov/site/doh/covid/covid-19-data.page.

FIGURE. Routine childhood vaccine doses administered, by week*,† — New York City, December 2019–June 2020§



Source: New York City Department of Health and Mental Hygiene Citywide Immunization Registry (CIR); data are as of July 14, 2020.
Abbreviation: COVID-19 = coronavirus disease 2019.
* Vaccine doses administered during December 29, 2019–June 27, 2020, and entered into CIR by July 12, 2020, compared with vaccine doses administered during December 30, 2018–June 29, 2019, and entered by July 14, 2019. Week format (Sunday–Saturday) is based on dates in 2020.
† Excludes influenza vaccine and immunizations administered in pharmacies and hospital nurseries.
§ The New York State on PAUSE Executive Order went into effect at 8:00 p.m. on Sunday, March 22, 2020, and required New Yorkers to stay at home to reduce the spread of SARS-CoV-2. https://www.state.gov/wp-content/uploads/2020/03/2020-03-20-Notice-New-York-on-Pause-Order.pdf.

The increase in vaccine administration seen in May and June is encouraging, and DOHMH continues to promote routine childhood vaccination using methods including public service announcements and letters, guidance, and webinars for health care providers on strategies to encourage parents to catch up their children's vaccinations. The rebound of administration of routine early childhood vaccines in NYC demonstrates the critical role of public health departments and partnerships with numerous stakeholders, specifically the provider community, in childhood vaccination. The availability of an immunization infrastructure to rapidly communicate with providers, an effective immunization information system to identify unvaccinated children, and the Vaccines for Children Program†† provider and vaccine distribution network have all been important to NYC's response and will be critical to distribution and administration of COVID-19 vaccines when they become available.

†† https://www.cdc.gov/vaccines/programs/vfc/index.html.

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Notes from the Field

Public Health Efforts to Mitigate COVID-19 Transmission During the April 7, 2020, Election — City of Milwaukee, Wisconsin, March 13–May 5, 2020

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Wisconsin was the first state to hold an election with in-person voting after stay-at-home orders were issued to limit transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). The statewide primary election, held on April 7, 2020, occurred fewer than 2 weeks after the statewide "Safer at Home" order* became effective on March 25.

On March 3, 2020, CDC published interim guidance to prevent spread of SARS-CoV-2 at polling locations (*1*). Mitigation measures in line with the CDC guidance and additional measures were implemented in the city of Milwaukee (in Milwaukee County) to prevent the transmission of SARS-CoV-2 at in-person polling venues (Supplementary Table, https://stacks.cdc.gov/view/cdc/90768). In addition to the nearly 500 poll workers, election inspectors, and chief inspectors, Milwaukee city health department personnel and the Wisconsin National Guard were assigned to support mitigation efforts at each of five Milwaukee polling sites and the central count location. Mitigation measures implemented at the direction of the city health department complemented public messaging campaigns to encourage absentee voting. According to the Milwaukee Election Commission, comparing the number of persons voting in the spring of 2016 with those voting in the spring of 2020, the percentage of persons who voted by absentee mail-in ballots increased approximately fifteenfold, from 4.1% (6,874) to 68.0% (64,750) of voters; those who voted early (either in person or curbside [i.e., voting while remaining in their vehicle or at the voting place entrance]) increased by 160%, from 4.7% (7,949) to 12.2% (11,612). Although the proportion of those who voted in person on election day decreased 78%, from 91.2% (153,458) to 19.8% (18,806),† ocal news media reported long waiting times at Milwaukee voting locations on election day.§ Overall, the number of persons who voted decreased 43%, from 168,281 to 95,168, and the number of polling sites decreased from 181 to five.

Laboratory-confirmed COVID-19 cases and epidemiologic data were used to characterize SARS-CoV-2 transmission from March 13, when the first case was confirmed in Milwaukee, through May 5, or 4 weeks following the election. Case counts, hospitalizations, and exposure data (including voting method ascertained using a standardized voting module) were obtained from the Wisconsin Electronic Disease Surveillance System (WEDSS).¶ Cases were reported by date of specimen collection or report if unavailable. Fatality data were obtained from the Milwaukee County Medical Examiner.

An estimated 95% of persons with COVID-19 develop symptoms within 2–14 days after exposure (*2–4*); therefore, persons infected at polls would be expected to develop symptoms during April 9–21. Among 2,789 COVID-19 cases, 642 related hospitalizations, and 137 COVID-19–associated deaths reported during March 13–May 5, 572 (21%) cases were reported during this expected incubation period (i.e., April 9–21) (Figure), compared with 693 (28%) cases reported during the 13 days preceding this incubation period (i.e., March 27–April 8). Among the 572 cases reported during April 9–21, 316 (55.2%) patients did not report their voting status, and 219 (38.3%) did not vote; 37 (6.5%) reported voting. Among these 37 COVID-19 patients who voted, 17 (45.9%) reported voting using an absentee mail-in ballot, 14 (37.8%) voted in person, and six (16.2%) voted curbside. During April 17–26 (the estimated interquartile range of the interval from illness onset to death for a person infected on election day), 24 deaths were reported, 33% fewer than the 36 deaths reported during the preceding 10 days (April 7–16) (Figure) (*5*). After a peak in hospitalizations during the last week in March, hospitalizations gradually declined.

These data provide an initial assessment of potential impacts of public health efforts to mitigate COVID-19 transmission during an election. No clear increase in cases, hospitalizations, or deaths was observed after the election, suggesting possible benefit of the mitigation strategies, which limited in-person voting and aimed to ensure safety of the polling sites open on election day. Epidemiologic trends were likely also influenced by a relatively lower turnout of voters overall compared to spring 2016.

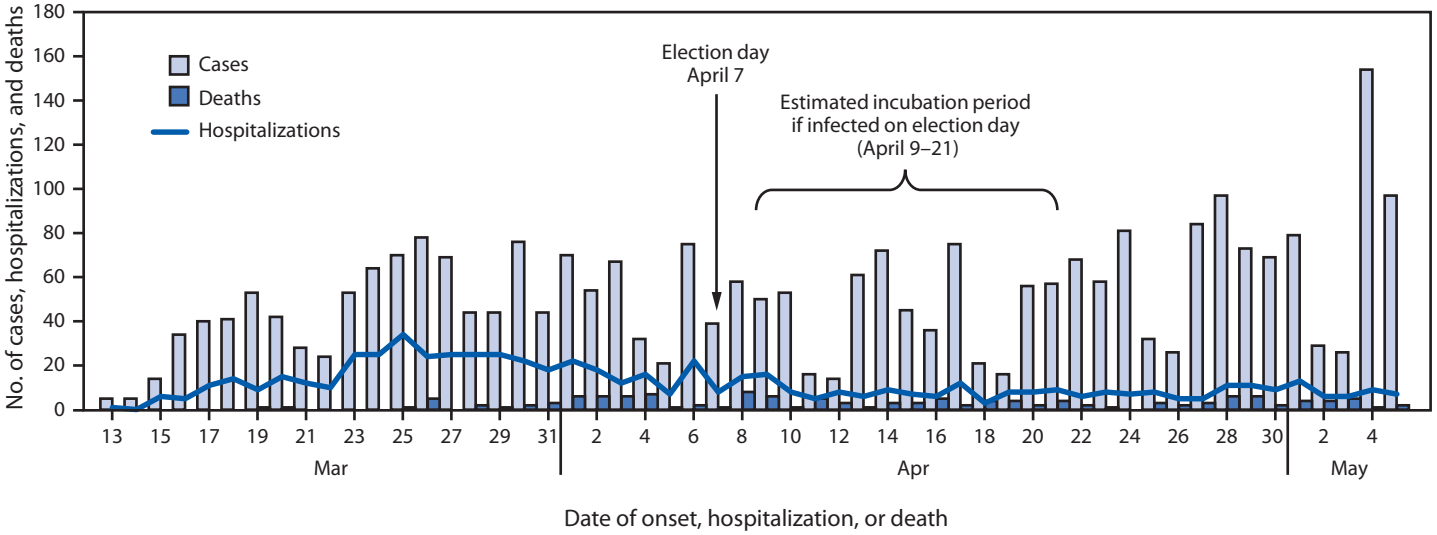
* https://content.govdelivery.com/attachments/WIGOV/2020/03/24/file_attachments/1409408/Health%20Order%20%2312%20Safer%20At%20Home.pdf.

† https://elections.wi.gov/clerks/svrs.

§ https://www.jsonline.com/story/news/politics/elections/2020/04/07/wisconsin-election-milwaukee-voters-brave-long-wait-lines-polls/2962228001/.

¶ https://www.dhs.wisconsin.gov/wiphin/wedss.htm.

FIGURE. Number of reported COVID-19 cases, hospitalizations, and associated deaths — Milwaukee, Wisconsin, March 13–May 5, 2020*



Abbreviation: COVID-19 = coronavirus disease 2019.

* Based on available evidence, for a person exposed to SARS-CoV-2 on election day, the estimated incubation period (2–14 days) was April 9–21; the estimated median interval from illness onset to death was estimated to be 10 days (corresponding with April 21).

These data provide preliminary evidence that CDC's interim guidance for ensuring various voting options, encouraging physical distancing, personal prevention practices, and employing environmental cleaning and disinfection lower COVID-19 transmission risk during elections (*1*). Further risk reduction can be achieved by fully implementing CDC interim guidance, which recommends longer voting periods, and other options such as increasing the number of polling locations to reduce the number of voters who congregate indoors in polling locations.

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Notes from the Field

Amphetamine Use Among Workers with Severe Hyperthermia — Eight States, 2010–2019

Andrew S. Karasick, MD[1,2]; Richard J. Thomas, MD[1]; Dawn L. Cannon, MD[1]; Kathleen M. Fagan, MD[1]; Patricia A. Bray, MD[1]; Michael J. Hodgson, MD[1]; Aaron W. Tustin, MD[1]

Workers can develop hyperthermia when core body temperature rises because of heat stress (environmental heat plus metabolic heat from physical activity) (*1*). Amphetamines are central nervous system stimulants that can induce hyperthermia independently or in combination with other risk factors (*2*). During 2010–2016, the Directorate of Technical Support and Emergency Management's Office of Occupational Medicine and Nursing (OOMN), at the Occupational Safety and Health Administration (OSHA), identified three workers with fatal hyperthermia who tested positive for methamphetamine (*3*). To identify additional cases of severe hyperthermia in which workers tested positive for amphetamines, and to support OSHA's enforcement activities, OOMN reviewed all medical records and investigation materials submitted by other OSHA offices to OOMN during January 1, 2010–August 31, 2019. OSHA field offices obtained the records from employers and health care facilities as part of OSHA's inspections to enforce occupational safety and health regulations. Confirmed severe hyperthermia was defined as highly elevated body temperature (e.g., core temperature ≥104°F [40°C] or peripheral temperature ≥102°F [38.9°C]) associated with death or serious central nervous system dysfunction (e.g., coma or seizure). For out-of-hospital deaths with no body temperature measurement, suspected severe hyperthermia was defined as a determination by a medical examiner or other responsible postmortem investigator that hyperthermia caused or contributed to the death. The record review identified 111 heat-related illnesses, 46 of which involved severe hyperthermia (38 fatal and eight nonfatal illnesses).

Toxicology results (e.g., urine drug screens or postmortem blood tests) were available in 34 (73.9%) of the 46 cases of severe hyperthermia (including the three previously mentioned methamphetamine cases). Nine (26.5%) of these 34 workers tested positive for an amphetamine-class substance.* All nine were adult males aged 18–47 years (median = 30 years) working in various industrial settings in eight U.S. states† on warm days in summer or late spring (Table). Based on data from the nearest National Weather Service observation stations, the maximum outdoor heat index (a metric that combines temperature and relative humidity into a single number that represents how hot the conditions feel to humans) ranged from 86°F to 107°F (median = 97°F) on the days of the nine incidents.

Seven of the nine workers died, and two survived life-threatening illnesses. Peak body temperature ranged from 103°F to 110.6°F (39.4°C to 43.7°C) in eight workers with confirmed severe hyperthermia. In one fatality with no premortem body temperature measurement, the medical examiner suspected that hyperthermia was a significant contributing condition, based upon the circumstances (i.e., death occurred in a hot environment after strenuous activity on a hot day) and lack of anatomic evidence of an alternative cause of death (e.g., myocardial infarction).

According to medical records and medical examiner reports obtained by OSHA, illicit amphetamine use appeared to be present in seven cases; three postmortem blood assays detected methamphetamine, and four qualitative screening tests detected amphetamine or amphetamine analogs in workers without amphetamine prescriptions. One of the latter four workers died of hyperthermia on his first day at a new job, after reportedly receiving a drug from his supervisor. In that case, a coworker later alleged to OSHA that before the shift started, the supervisor had provided pills whose appearance was consistent with those of a prescription amphetamine. Two cases involved legal use of prescription amphetamines to treat attention deficit hyperactivity disorder, and both persons who used legal prescription amphetamines died. Co-occurring substances detected by blood or urine toxicology testing included tetrahydrocannabinol (four patients), benzodiazepines (two), opioids (one), tricyclic antidepressants (one), antihistamines (one), and caffeine (one). Clinicians and investigators determined that these co-occurring substances were not causally related to the hyperthermia outcomes.

This investigation revealed a high prevalence (>25%) of amphetamine use among 34 workers with severe hyperthermia. CDC's National Institute for Occupational Safety and Health (NIOSH) has found that amphetamines are associated with heat intolerance (*1*), but reports of workplace hyperthermia where amphetamines were detected are limited (*4*). Workers and supervisors should be aware of potential hyperthermia-inducing synergy between amphetamines, physical activity, and environmental heat. Workers should not use illicit amphetamines to maintain alertness or enhance performance, especially when heat stress is present. Prevention of illicit amphetamine use is important, not only to avert hyperthermia

* The most common medically important amphetamine-class substances are amphetamine and its two enantiomers (levoamphetamine and dextroamphetamine), lisdexamfetamine, and methamphetamine.
† Florida, Kansas, Missouri, Nebraska, Ohio, Oklahoma, Rhode Island, and Texas.

TABLE. Characteristics of nine male workers with severe hyperthermia who tested positive for amphetamines — eight states, 2010–2019

Worker	Age (yrs)	Industry category	Month of event	Maximum outdoor heat index* (°F)	State	Highest measured body temperature (°F)	Legal amphetamine prescription	Outcome	Co-occurring substances†
A	47	Construction	August	101	Texas	108.2	No	Survived	Tetrahydrocannabinol
B	18	Landscaping	June	86	Ohio	106.6	Yes	Died	Tetrahydrocannabinol
C	25	Manufacturing	July	105	Texas	109.7	No	Survived	Benzodiazepine, opioid
D	30	Construction	August	97	Rhode Island	110.6	Yes	Died	Tricyclic antidepressant, benzodiazepine, antihistamine
E	32	Waste collection	June	95	Florida	103.0	No	Died	Tetrahydrocannabinol
F	36	Oil and gas extraction	June	97	Oklahoma	109.9	No	Died	None
G	30	Oil and gas extraction	July	95	Kansas	110.0	No	Died	Tetrahydrocannabinol
H	47	Landscaping	August	107	Missouri	Not measured§	No	Died	Caffeine
I	26	Construction	July	88	Nebraska	106.3	No	Died	None

* Heat index combines ambient temperature and relative humidity into a single metric that quantifies how hot the conditions feel to humans (https://www.weather.gov/safety/heat-index).
† Excludes medications administered during post-incident resuscitation and treatment efforts.
§ This worker died unattended and had rigor mortis when he was found. No vital signs were recorded.

but also to prevent other adverse effects. Workers should receive support for overcoming stimulant use disorders.§ Clinicians who prescribe amphetamines should consider obtaining an occupational history to facilitate discussions with patients about heat stress safety. Stakeholders should implement comprehensive occupational heat stress controls, such as those recommended by NIOSH (*1*) and OSHA (*5*), to prevent illnesses.

§ https://store.samhsa.gov/sites/default/files/SAMHSA_Digital_Download/PEP20-06-01-001_508.pdf.

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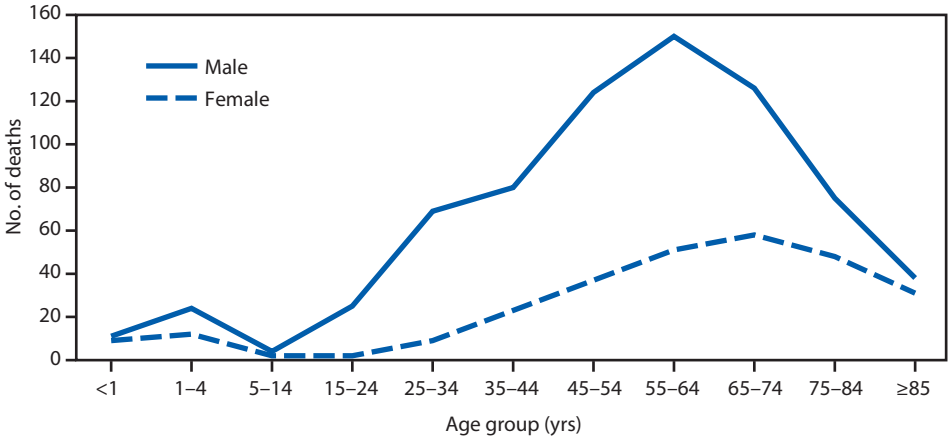
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Number of Natural Heat-Related Deaths,* by Sex and Age Group — National Vital Statistics System, United States, 2018



* Deaths associated with exposure to natural heat, as the underlying and contributing causes of death, are coded as X30 and T67, excluding code W92 (exposure to excessive heat of manmade origin) according to the *International Classification of Diseases, Tenth Revision*, for a total of 726 deaths among males and 282 among females.

In 2018, natural heat exposure was associated with 726 deaths among males and 282 deaths among females. Among males, the highest number of heat-related deaths was for those aged 55–64 years (150) and among females for those aged 65–74 years (58). The lowest numbers were for males (four) and females (two) aged 5–14 years. Approximately 72% of heat-related deaths were among males.

Source: National Vital Statistics System. Multiple cause of death data, 1999–2018. https://wonder.cdc.gov/mcd.html.

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