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Trends in Pneumoconiosis Deaths — United States, 1999–2018

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Pneumoconioses are preventable occupational lung diseases caused by inhaling dust particles such as coal dust or different types of mineral dusts (*1*). To assess recent trends in deaths associated with pneumoconiosis, CDC analyzed multiple cause-of-death data*,† for decedents aged ≥15 years for the years 1999–2018, and industry and occupation data collected from 26 states§ for the years 1999, 2003, 2004, and 2007–2013. During 1999–2018, pneumoconiosis deaths decreased by 40.4%, with the exception of pneumoconiosis attributed to other inorganic dusts (e.g., aluminum, bauxite, beryllium, iron, and tin oxide), which increased significantly (p-value for time trend <0.05). The largest observed decreases in pneumoconiosis deaths were for those associated with coal workers' pneumoconiosis (69.6%) and silicosis (53.0%). Asbestosis was the most frequently reported pneumoconiosis and was associated with working in the construction industry. The ongoing occurrence of deaths associated with pneumoconiosis underscores the importance of occupational dust exposure reduction, early case detection, and continued surveillance to monitor trends.

The CDC National Vital Statistics System's multiple cause-of-death data for 1999–2018 were analyzed for decedents aged ≥15 years. For this analysis, decedents were identified using death certificates listing pneumoconiosis as the underlying¶ or contributing cause of death and included deaths with the following *International Classification of Diseases, Tenth Revision* (ICD-10) codes: J60 (coal workers' pneumoconiosis), J61 (pneumoconiosis due to asbestos and other mineral fibers, [asbestosis]), J62 (pneumoconiosis due to dust containing silica, [silicosis]), J63 (pneumoconiosis due to other inorganic dust [applies to berylliosis, a disease caused by exposure to beryllium; pulmonary siderosis, a disease most common in workers exposed to metal fumes during welding; and other diseases]), J64 (unspecified pneumoconiosis), J65 (pneumoconiosis associated with tuberculosis), and J66 (airway disease due to specific organic dust [applies to byssinosis, a disease caused by prolonged inhalation of textile fiber dust]). Death

* Each death record includes codes for up to 20 conditions derived from the "Cause of Death" section of the death certificate. https://www.cdc.gov/nchs/data/dvs/DEATH11-03final-acc.pdf.
† https://wonder.cdc.gov/wonder/help/mcd.html.
§ Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin. States are where the death took place, not necessarily where the decedent had resided.
¶ Underlying cause of death is defined as "the disease or injury which initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury." https://wonder.cdc.gov/wonder/help/mcd.html#Source.

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rates per 1 million population were age-adjusted by applying age-specific death rates to the 2000 U.S. Census standard population.** Industry and occupation data were available from 26 states for 1999, 2003, 2004, and 2007–2013 and coded†† in accordance with the U.S. Census 2000 Industry and Occupation Classification System.§§ Cause-of-death data from the 26 states were compiled using CDC's National Occupational Respiratory Mortality Surveillance system.¶¶ Data were processed using SAS software (version 9.4; SAS Institute), and Joinpoint regression software (version 4.8.0.1; National Cancer Institute) was used to analyze time trends in deaths and log transformed death rates.

During 1999–2018, a total of 43,366 decedents aged ≥15 years had pneumoconiosis listed on their death certificates, including 17,578 (40.5%) for whom pneumoconiosis was the underlying cause of death. Among all pneumoconiosis decedents, 17,797 (41.0%) were aged 75–84 years, and nearly all were male (41,777; 96.3%), white (41,029; 94.6%), and non-Hispanic (42,339; 97.6%). Asbestosis was associated with approximately three fifths of the deaths (26,059; 60.1%), followed by coal workers' pneumoconiosis (11,203; 25.8%), and unspecified pneumoconiosis (3,409; 7.9%) (Table 1).

During 1999–2018, the overall annual number of pneumoconiosis deaths decreased 40.4%; a significant decline began in 2002 (2,715 deaths) through 2018 (1,632) (p-value for time trend <0.05). Age-adjusted death rates (deaths per 1 million population) decreased from 12.8 in 1999 to 5.3 in 2018 (annual percent change = –0.88% during 1999–2001 and –5.22% during 2002–2018 [p-value for 2002–2018 time trend <0.05]).

Deaths decreased for all types of pneumoconiosis during the period studied, with the exception of those attributed to other inorganic dusts, which increased significantly from 12 deaths in 1999 to 25 in 2018 (108.3%; p<0.05). However, none of the distinct disease categories in this group increased significantly. The largest decreases over time were for deaths associated with coal workers' pneumoconiosis (69.6%), from 1,002 in 1999 to 305 in 2018 (p-value for time trend <0.05), and silicosis (53.0%), from 185 in 1999 to 87 in 2018 (p-value for 2018 time trend <0.05]) (Table 1).

Age-adjusted death rates varied across geographic locations for each pneumoconiosis type (Table 2). The highest age-adjusted death rates for the 20-year period were in West Virginia for coal workers' pneumoconiosis (59.8 per million population), Montana for asbestosis (20.0), Vermont for silicosis (2.3), and West Virginia for unspecified pneumoconiosis (24.1).

Industry and occupation data were available for 6,223 (96.7%) of 6,436 pneumoconiosis-associated deaths among persons aged ≥15 years from 26 states during 1999, 2003, 2004, and 2007–2013 (Table 3). Whereas the highest number

** https://wonder.cdc.gov/wonder/help/mcd.html#Age-AdjustedRates.
†† https://www.cdc.gov/niosh/topics/coding/.
§§ https://www.census.gov/topics/employment/industry-occupation/data/tables.2000.html.
¶¶ https://wonder.cdc.gov/wonder/help/mcd.html#Location.

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TABLE 1. Pneumoconiosis mortality time trends among decedents aged ≥15 years, by disease* and year — United States, 1999–2018

Year	No. of deaths (rate)†							
	Total	Coal workers' pneumoconiosis	Asbestosis	Silicosis	Pneumoconiosis attributed to other inorganic dusts	Unspecified pneumoconiosis	Pneumoconiosis associated with tuberculosis	Airway disease attributed to specific organic dust
1999	**2,738 (12.8)**	1,002 (4.7)	1,258 (5.8)	185 (0.9)	12 (—)§	284 (1.3)	5 (—)	7 (—)
2000	**2,859 (13.2)**	949 (4.4)	1,486 (6.8)	151 (0.7)	10 (—)	263 (1.2)	7 (—)	10 (—)
2001	**2,743 (12.4)**	886 (4.0)	1,449 (6.6)	163 (0.7)	10 (—)	233 (1.1)	7 (—)	10 (—)
2002	**2,715 (12.2)**	858 (3.8)	1,467 (6.6)	146 (0.6)	22 (0.1)	226 (1.0)	6 (—)	9 (—)
2003	**2,635 (11.6)**	772 (3.4)	1,464 (6.5)	177 (0.8)	12 (—)	210 (0.9)	6 (—)	8 (—)
2004	**2,524 (11.0)**	703 (3.1)	1,460 (6.4)	165 (0.7)	16 (—)	185 (0.8)	5 (—)	8 (—)
2005	**2,425¶ (10.4)**	652 (2.8)	1,416 (6.1)	160 (0.7)	19 (—)	189 (0.8)	7 (—)	7 (—)
2006	**2,308 (9.7)**	654 (2.8)	1,340 (5.7)	126 (0.5)	23 (0.1)	176 (0.7)	0 (—)	7 (—)
2007	**2,189 (9.1)**	524 (2.2)	1,393 (5.8)	122 (0.5)	9 (—)	144 (0.6)	5 (—)	5 (—)
2008	**2,155 (8.8)**	470 (1.9)	1,341 (5.5)	146 (0.6)	18 (—)	191 (0.8)	4 (—)	2 (—)
2009	**1,993 (8.0)**	480 (1.9)	1,255 (5.1)	121 (0.5)	15 (—)	140 (0.5)	2 (—)	1 (—)
2010	**2,028 (8.0)**	486 (1.9)	1,308 (5.2)	101 (0.4)	12 (—)	131 (0.5)	2 (—)	1 (—)
2011	**1,890 (7.2)**	409 (1.6)	1,243 (4.8)	88 (0.3)	17 (—)	140 (0.5)	4 (—)	5 (—)
2012	**1,850 (6.8)**	399 (1.4)	1,208 (4.5)	103 (0.4)	14 (—)	136 (0.5)	1 (—)	2 (—)
2013	**1,859 (6.8)**	361 (1.3)	1,229 (4.5)	111 (0.4)	22 (0.1)	145 (0.5)	2 (—)	1 (—)
2014	**1,790 (6.4)**	363 (1.3)	1,218 (4.4)	84 (0.3)	17 (—)	115 (0.4)	0 (—)	2 (—)
2015	**1,735 (6.0)**	323 (1.1)	1,188 (4.1)	105 (0.4)	25 (0.1)	107 (0.4)	2 (—)	2 (—)
2016	**1,662 (5.6)**	300 (1.0)	1,142 (3.9)	73 (0.2)	16 (—)	140 (0.4)	2 (—)	3 (—)
2017	**1,636 (5.4)**	307 (1.0)	1,102 (3.7)	98 (0.3)	17 (—)	118 (0.4)	1 (—)	5 (—)
2018	**1,632 (5.3)**	305 (1.0)	1,092 (3.5)	87 (0.3)	25 (0.1)	136 (0.4)	2 (—)	2 (—)
Total	**43,366** (8.6)**	**11,203 (2.2)**	**26,059 (5.2)**	**2,512 (0.5)**	**331 (0.1)**	**3,409 (0.7)**	**70 (0.0)**	**95 (0.0)**
Time trends								
Slope††	1999–2002 = −19.96 2002–2009 = −102.51§§ 2009–2018 = −45.83§§	1999–2008 = −58.29§§ 2008–2018 = −20.63§§	1999–2001 = 102.49§§ 2001–2018 = −23.90§§	1999–2018 = −5.04§§	1999–2018 = 0.43§§	1999–2007 = −15.13§§ 2007–2018 = −3.09§§	1999–2018 = −0.18§§	1999–2009 = −0.96§§ 2009–2018 = 0.13
APC¶¶	1999–2001 = −0.88 2002–2018 = −5.22§§	1999–2018 = −8.56§§	1999–2002 = 4.02 2001–2018 = −3.94§§	N/A***	N/A***	N/A***	N/A***	N/A***

Source: CDC WONDER multiple cause-of-death data. https://wonder.cdc.gov/mcd.html.
Abbreviations: APC = annual percent change; N/A = not available.
* *International Classification of Diseases, Tenth Revision* codes: J60 (coal workers' pneumoconiosis), J61 (pneumoconiosis due to asbestos and other mineral fibers, [asbestosis]), J62 (pneumoconiosis due to dust containing silica, [silicosis]), J63 (pneumoconiosis due to other inorganic dusts]), J64 (unspecified pneumoconiosis), J65 (pneumoconiosis associated with tuberculosis), and J66 (airway diseases due to specific organic dust).
† Death rates per 1 million population were age-adjusted by applying age-specific death rates to the 2000 U.S. Census standard population.
§ Dashes indicate unreliable death rates because there were fewer than 20 deaths per year.
¶ Data were compiled using CDC WONDER's record axis methodology, which differs from Healthy People 2020's entity axis methodology. Healthy People 2020's baseline total is 2,430. https://www.healthypeople.gov/node/5046/data_details.
** The sum of decedents is less than sum of disease-associated deaths because some decedents have more than one type of pneumoconiosis listed on their death certificate.
†† Calculated using death counts; the slope characterizes the direction of the disease trend (negative slope indicates decrease in deaths over time).
§§ p<0.05.
¶¶ Calculated using age-adjusted death rates.
*** APCs could not be calculated because of unreliable death rates or insufficient data to determine standard error.

of coal workers' pneumoconiosis–associated deaths occurred among workers in the coal mining industry (1,331; 74.2%), and among mining machine operators (1,203; 65.0%), the highest number of asbestosis-associated deaths occurred among workers in the construction industry (820; 25.0%) and among pipe layers, plumbers, pipefitters, and steamfitters (264; 8.0%). The highest number of silicosis-associated deaths occurred among workers in the construction industry (63; 18.9%) and among mining machine operators (41; 12.3%).

Discussion

CDC previously examined pneumoconiosis mortality for 1968–2000 and reported decreases in death trends in all pneumoconioses with the exception of asbestosis, for which an increase was observed (*2*). In this report, the annual number of deaths associated with pneumoconiosis have continued to decline during 1999–2018 for all pneumoconioses with the exception of pneumoconiosis attributed to other inorganic

TABLE 2. Number of coal workers' pneumoconiosis, asbestosis, silicosis, and unspecified pneumoconiosis-associated deaths* and age-adjusted death rates† among persons aged ≥15 years, by state — United States, 1999–2018

State	No. of deaths (rate)†			
	Coal workers' pneumoconiosis	Asbestosis	Silicosis	Unspecified
Alabama	120 (1.5)	818 (10.2)	41 (0.5)	51 (0.7)
Alaska	—§	39 (7.2)	—§	—§
Arizona	43 (0.4)	337 (3.2)	68 (0.6)	30 (0.3)
Arkansas	37 (0.7)	249 (4.8)	20 (0.4)	—§
California	155 (0.3)	1,844 (3.4)	105 (0.2)	48 (0.1)
Colorado	111 (1.6)	270 (4.1)	119 (1.8)	115 (1.7)
Connecticut	—§	327 (4.9)	13 (—)¶	—§
Delaware	—§	218 (14.2)	—§	—§
District of Columbia	—§	—§	—§	—§
Florida	184 (0.5)	1,667 (4.0)	68 (0.2)	49 (0.1)
Georgia	31 (0.3)	308 (2.5)	39 (0.3)	22 (0.2)
Hawaii	—§	56 (2.2)	—§	—§
Idaho	—§	177 (7.6)	27 (1.1)	11 (—)¶
Illinois	234 (1.1)	435 (2.1)	65 (0.3)	59 (0.3)
Indiana	133 (1.3)	216 (2.1)	53 (0.5)	35 (0.3)
Iowa	31 (0.5)	153 (2.6)	16 (—)¶	10 (—)¶
Kansas	12 (—)¶	134 (2.7)	11 (—)¶	—§
Kentucky	1,596 (22.1)	246 (3.5)	57 (0.8)	350 (4.9)
Louisiana	47 (0.7)	515 (7.4)	39 (0.5)	—§
Maine	—§	287 (10.8)	—§	—§
Maryland	34 (0.4)	728 (8.2)	26 (0.3)	23 (0.3)
Massachusetts	—§	641 (5.3)	19 (—)¶	—§
Michigan	79 (0.5)	687 (4.0)	80 (0.5)	35 (0.2)
Minnesota	13 (—)¶	502 (5.6)	59 (0.7)	—§
Mississippi	245 (5.3)	666 (14.0)	30 (0.6)	—§
Missouri	25 (0.2)	258 (2.5)	41 (0.4)	10 (—)¶
Montana	—§	363 (20.0)	19 (—)¶	—§
Nebraska	—§	102 (3.2)	—§	—§
Nevada	16 (—)¶	132 (3.7)	27 (0.7)	15 (—)¶
New Hampshire	—§	125 (5.6)	10 (—)¶	—§
New Jersey	34 (0.2)	1,318 (8.6)	40 (0.3)	30 (0.2)
New Mexico	75 (2.4)	96 (3.0)	51 (1.6)	113 (3.5)
New York	52 (0.2)	1,178 (3.5)	119 (0.4)	56 (0.2)
North Carolina	112 (0.7)	862 (5.8)	76 (0.5)	35 (0.2)
North Dakota	—§	56 (4.3)	—§	—§
Ohio	366 (1.8)	1045 (5.1)	204 (1.0)	139 (0.7)
Oklahoma	40 (0.7)	206 (3.3)	28 (0.4)	13 (—)¶
Oregon	—§	597 (8.8)	36 (0.5)	—§
Pennsylvania	3,258 (12.3)	1,553 (6.0)	268 (1.1)	636 (2.4)
Rhode Island	—§	122 (5.9)	14 (—)¶	—§
South Carolina	41 (0.5)	536 (7.2)	39 (0.5)	—§
South Dakota	—§	29 (1.8)	15 (—)¶	—§
Tennessee	273 (2.7)	515 (5.1)	52 (0.5)	59 (0.6)
Texas	107 (0.3)	2,106 (6.7)	157 (0.4)	52 (0.1)
Utah	89 (2.9)	112 (3.8)	45 (1.5)	63 (2.1)
Vermont	—§	61 (5.5)	27 (2.3)	—§
Virginia	1,300 (10.8)	894 (7.5)	44 (0.4)	326 (2.7)
Washington	19 (—)¶	1,322 (12.8)	36 (0.3)	12 (—)¶
West Virginia	2,191 (59.8)	516 (14.1)	58 (1.5)	887 (24.1)
Wisconsin	22 (0.2)	382 (3.8)	116 (1.2)	14 (—)¶
Wyoming	28 (3.3)	45 (5.3)	—§	35 (4.2)

Source: CDC WONDER multiple cause-of-death data. https://wonder.cdc.gov/mcd.html.
* Pneumoconiosis deaths attributed to other organic dusts or specific organic dust or associated with tuberculosis are not displayed because the numbers of cases were fewer than10 for each state.
† Death rates per 1 million population were age-adjusted by applying age-specific death rates to the 2000 U.S. Census standard population.
§ Suppressed because there were fewer than 10 decedents.
¶ Unreliable death rates because there were fewer than 20 deaths per state.

TABLE 3. Top three industries and occupations associated with pneumoconiosis* deaths among persons aged ≥15 years, by disease† — 26 states,§ 1999, 2003, 2004, and 2007–2013

Disease	Characteristic	No. (%)¶ of deaths
Coal workers' pneumoconiosis (n = 1,838)		
Industry	Coal mining	1,331 (74.2)
	Construction	75 (4.1)
	Nonpaid worker	52 (2.8)
Occupation	Mining machine operators	1,203 (65.0)
	Laborers and freight, stock, and material movers	43 (2.3)
	Homemakers	41 (2.2)
Asbestosis (n = 3,284)		
Industry	Construction	820 (25.0)
	Industrial/Miscellaneous chemicals	162 (5.0)
	Not specified manufacturing industries	148 (4.5)
Occupation	Pipe layers, plumbers, pipefitters, and steamfitters	264 (8.0)
	Electricians	145 (4.4)
	Carpenters	110 (3.4)
Silicosis (n = 333)		
Industry	Construction	63 (18.9)
	Coal mining	25 (7.5)
	Foundries	19 (5.7)
Occupation	Mining machine operators	41 (12.3)
	Laborers and freight, stock, and material movers	21 (6.3)
	Construction laborers	14 (4.2)
Unspecified pneumoconiosis (n = 792)		
Industry	Coal mining	508 (64.1)
	Metal ore mining	34 (4.3)
	Construction	32 (4.0)
Occupation	Mining machine operators	485 (61.2)
	Laborers and freight, stock, and material movers	17 (2.1)
	Electricians	15 (1.9)

Source: National Institute for Occupational Safety and Health, CDC. https://webappa.cdc.gov/ords/norms-io2000.html.
* Excludes the following *International Classification of Diseases, Tenth Revision* codes because five or fewer deaths occurred in available industries or occupations: J63 (pneumoconiosis due to other inorganic dusts), J65 (pneumoconiosis associated with tuberculosis), and J66 (airway diseases due to specific organic dust).
† *International Classification of Diseases, Tenth Revision* codes: J60 (coal workers' pneumoconiosis), J61 (pneumoconiosis due to asbestos and other mineral fibers, [asbestosis]), J62 (pneumoconiosis due to dust containing silica, [silicosis]), J64 (unspecified pneumoconiosis), J65 (pneumoconiosis associated with tuberculosis), and J66 (airway diseases due to specific organic dust [including byssinosis]).
§ Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin. States are where the death took place, not necessarily where the decedent had resided. Data were compiled using CDC's National Occupational Respiratory Mortality Surveillance (NORMS) system. https://wonder.cdc.gov/wonder/help/mcd.html#Location.
¶ Percentage of total deaths associated with specific disease.

dusts, which increased. In this category, berylliosis and siderosis were the most frequently reported diseases; however, there was no evidence of a change in death rates attributed to these conditions.

Each decade, the Healthy People Initiative develops new goals and objectives to improve the health of all Americans.

Summary

What is already known about this topic?

Pneumoconioses are a group of occupational lung diseases caused by inhaling organic dust and inorganic mineral dust particles. From 1968 to 2000, death rates for all pneumoconioses decreased with the exception of those for asbestosis. Although preventable, deaths continue to occur.

What is added by this report?

Pneumoconiosis deaths decreased from 2,738 deaths in 1999 to 1,632 in 2018, and age-adjusted death rates decreased from 12.8 to 5.3 per million population. All pneumoconioses decreased with the exception of pneumoconiosis attributed to other inorganic dusts.

What are the implications for public health practice?

Pneumoconiosis-associated deaths continue to occur, underscoring the importance of occupational dust exposure reduction, early case detection, and continued surveillance to monitor trends, with an increased focus on pneumoconiosis attributable to other inorganic dusts.

The Healthy People 2020 Occupational Safety and Health Objective 4 set the goal of reducing pneumoconiosis deaths by 10% from the baseline of 2,430 deaths in 2005 to 2,187 deaths in 2020 (*3*). Results of this study indicate that the total number of pneumoconiosis deaths in 2018 was 1,632, a 32.8% decline from the baseline. If this trend continues, the goal will likely be surpassed in 2020.

The decline in overall pneumoconiosis mortality primarily reflects the decrease in coal workers' pneumoconiosis and silicosis deaths, which together accounted for nearly one third (31.6%) of all pneumoconiosis-associated deaths reported during 1999–2018. The decline in coal workers' pneumoconiosis–associated deaths likely reflects the reduction in the coal mining industry workforce (from 108,224 in 1999 to 98,505 in 2015)*** and legislative actions. For example, the 1969 Federal Coal Mine Health and Safety Act††† required federal inspections of all coal mines, created enforceable safety measures, and added health protections and federal benefits for coal workers' pneumoconiosis. Several other historical statutes§§§ have been enacted to improve miner safety and decrease disease mortality. Most recently, the 2014 final rule¶¶¶ of the Mine Safety and Health Administration (MSHA) standard on respirable coal mine dust lowered existing exposure limits from 2.0 mg of dust per cubic meter of air (mg/m^3) to 1.5 mg/m^3 at underground and surface coal mines, expanded medical monitoring for coal mine dust lung diseases, and made changes in dust monitoring systems to include the use of continuous personal dust monitors. Because of the long latency of coal workers' pneumoconiosis, this new rule likely did not contribute to any decreases in mortality; however, adherence to this rule is expected to foster continued disease mortality reduction.

The decline in silicosis-associated deaths likely reflects the enactment of national compliance standards for silica dust exposure in 1971, implementation of disease prevention initiatives, and changes in industrial activity (*4*). The early standards, however, did not include measures such as medical surveillance requirements or employer and employee training about silica hazards. In 2016, the Occupational Safety and Health Administration (OSHA) published a final rule,**** for crystalline silica, lowering the permissible exposure limit to 50 $\mu g/m^3$ of air in all industries covered by the rule and included requirements to further protect employees (e.g., including exposure control, respiratory protection, hazard communication, medical surveillance, and recordkeeping). The rule also issued two separate standards, one for general industry and maritime and the other for construction, to tailor requirements to the respective industries' hazards.

Asbestosis continues to be the most frequently reported cause of pneumoconiosis mortality, accounting for 60.1% of all pneumoconiosis deaths during 1999–2018. The number of annual asbestosis-associated deaths began to decline in 2001. This ongoing decrease likely reflects the cessation of asbestos mining, discontinued manufacturing of asbestos-containing products in the United States,†††† adoption of standards intended to control emissions of asbestos into the environment (*5*), and adoption of lower permissible exposure limits (*6*). In 1971, OSHA established a permissible exposure limit for asbestos at 12.0 fibers per cubic centimeter (f/cc) of air as an 8-hour time-weighted average. This initial permissible exposure limit was subsequently reduced to 5.0 f/cc in 1972, to 2.0 f/cc in 1976, to 0.2 f/cc in 1986, and to 0.1 f/cc in 1994.

Despite the decline in mortality and updated regulatory actions addressing occupational exposures to hazardous dusts, pneumoconiosis-associated deaths continue to occur, underscoring the need for maintaining exposure prevention measures and continued surveillance. Recent reports indicate the re-emergence of progressive massive fibrosis (the most severe form of coal workers' pneumoconiosis) (*7*), new tasks and occupations (e.g., quartz countertop installation and hydraulic fracturing) that put workers at an increased risk for silicosis (*8*), continued importation of asbestos-containing materials for domestic consumption, and an increase in prevalence of other asbestos-associated diseases (e.g., malignant mesothelioma) (*9*).

*** https://www.msha.gov/sites/default/files/Data_Reports/DEC_15_2016_Historical_MIWQ_Employment_and_Production.pdf.
††† https://www.msha.gov/45-years-federal-coal-mine-health-and-safety-act.
§§§ https://www.msha.gov/regulations/laws.
¶¶¶ https://www.govinfo.gov/content/pkg/FR-2014-05-01/pdf/2014-09084.pdf.
**** https://www.federalregister.gov/documents/2016/03/25/2016-04800/occupational-exposure-to-respirable-crystalline-silica.
†††† https://www.usgs.gov/centers/nmic/mineral-commodity-summaries.

In addition, a 2019 significant new use rule[§§§§] for asbestos, promulgated to ensure that any discontinued uses of asbestos cannot re-enter the marketplace without Environmental Protection Agency review, still permits importation of asbestos into the United States; use of asbestos in gaskets, brakes, and chemical manufacturing; and asbestos mining.

The findings in this report are subject to at least five limitations. First, death records were not validated by medical records; therefore, results might be subject to misclassification. Second, some silicosis-associated deaths might not be work-related. For example, pneumoconiosis attributable to talc dust (ICD-10 code J62.0) in some decedents has been associated with use of illicit drugs (*10*); however, these pneumoconiosis-associated deaths were considered in this study to maintain comparability with previous studies and the Healthy People 2020 methods. Third, the industries and occupations represent the usual[¶¶¶¶] industries and occupations entered on each death certificate, which might not be the industry and occupation in which the decedent's exposure occurred. Fourth, the age-adjusted mortality rates might not correctly project disease frequency. The rates were calculated using data on the general population that might include those who are not at an occupational risk for developing the disease. Finally, because of small death counts, trends in pneumoconiosis attributable to other inorganic dusts could not be evaluated by distinct disease categories.

The decrease in pneumoconiosis-associated deaths during 1999–2018 indicates that prevention strategies are effective. The findings underscore the importance of maintaining primary prevention strategies to reduce exposures to respirable dusts, secondary prevention through early disease detection, and surveillance to monitor trends over time, in particular focusing on pneumoconiosis attributable to other inorganic dusts. Prevention strategies are available at the websites of OSHA (https://www.osha.gov/), MSHA (https://www.msha.gov/), and CDC's National Institute for Occupational Safety and Health (https://www.cdc.gov/niosh/index.htm).

[§§§§] https://www.federalregister.gov/documents/2019/04/25/2019-08154/restrictions-on-discontinued-uses-of-asbestos-significant-new-use-rule.

[¶¶¶¶] https://www.cdc.gov/nchs/data/misc/hb_occup.pdf.

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Impact of the COVID-19 Pandemic on Emergency Department Visits — United States, January 1, 2019–May 30, 2020

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On March 13, 2020, the United States declared a national emergency to combat coronavirus disease 2019 (COVID-19). As the number of persons hospitalized with COVID-19 increased, early reports from Austria (*1*), Hong Kong (*2*), Italy (*3*), and California (*4*) suggested sharp drops in the numbers of persons seeking emergency medical care for other reasons. To quantify the effect of COVID-19 on U.S. emergency department (ED) visits, CDC compared the volume of ED visits during four weeks early in the pandemic March 29–April 25, 2020 (weeks 14 to 17; the early pandemic period) to that during March 31–April 27, 2019 (the comparison period). During the early pandemic period, the total number of U.S. ED visits was 42% lower than during the same period a year earlier, with the largest declines in visits in persons aged ≤14 years, females, and the Northeast region. Health messages that reinforce the importance of immediately seeking care for symptoms of serious conditions, such as myocardial infarction, are needed. To minimize SARS-CoV-2, the virus that causes COVID-19, transmission risk and address public concerns about visiting the ED during the pandemic, CDC recommends continued use of virtual visits and triage help lines and adherence to CDC infection control guidance.

To assess trends in ED visits during the pandemic, CDC analyzed data from the National Syndromic Surveillance Program (NSSP), a collaborative network developed and maintained by CDC, state and local health departments, and academic and private sector health partners to collect electronic health data in real time. The national data in NSSP includes ED visits from a subset of hospitals in 47 states (all but Hawaii, South Dakota, and Wyoming), capturing approximately 73% of ED visits in the United States able to be analyzed at the national level. During the most recent week, 3,552 EDs reported data. Total ED visit volume, as well as patient age, sex, region, and reason for visit were analyzed.

Weekly number of ED visits were examined during January 1, 2019–May 30, 2020. In addition, ED visits during two 4-week periods were compared using mean differences and ratios. The change in mean visits per week during the early pandemic period and the comparison period was calculated as the mean difference in total visits in a diagnostic category between the two periods, divided by 4 weeks ([visits in diagnostic category {early pandemic period} – visits in diagnostic category {comparison period}]/4). The visit prevalence ratio (PR) was calculated for each diagnostic category as the proportion of ED visits during the early pandemic period divided by the proportion of visits during the comparison period ([visits in category {early pandemic period}/all visits {early pandemic period}]/[visits in category {comparison period}/all visits {comparison period}]). All analyses were conducted using R software (version 3.6.0; R Foundation).

Reason for visit was analyzed using a subset of records that had at least one specific, billable *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) code. In addition to Hawaii, South Dakota, and Wyoming, four states (Florida, Louisiana, New York outside New York City, and Oklahoma), two California counties reporting to the NSSP (Santa Cruz and Solano), and the District of Columbia were also excluded from the diagnostic code analysis because they did not report diagnostic codes during both periods or had differences in completeness of codes between 2019 and 2020. Among eligible visits for the diagnostic code analysis, 20.3% without a valid ICD-10-CM code were excluded. ED visits were categorized using the Clinical Classifications Software Refined tool (version 2020.2; Healthcare Cost and Utilization Project), which combines ICD-10-CM codes into clinically meaningful groups (*5*). A visit with multiple ICD-10-CM codes could be included in multiple categories; for example, a visit by a patient with diabetes and hypertension would be included in the category for diabetes and the category for hypertension. Because COVID-19 is not yet classified in this tool, a custom category, defined as any visit with the ICD-10-CM code for confirmed COVID-19 diagnosis (U07.1), was created (*6*). The analysis was limited to the top 200 diagnostic categories during each period.

The lowest number of visits reported to NSSP occurred during April 12–18, 2020 (week 16). Although visits have increased since the nadir, the most recent complete week (May 24–30, week 22) remained 26% below the corresponding week in 2019 (Figure 1). The number of ED visits decreased 42%, from a mean of 2,099,734 per week during March 31–April 27, 2019, to a mean of 1,220,211 per week during the early pandemic period of March 29–April 25, 2020. Visits declined for every age group (Figure 2), with the largest proportional declines in visits by children aged ≤10 years (72%) and 11–14 years (71%).

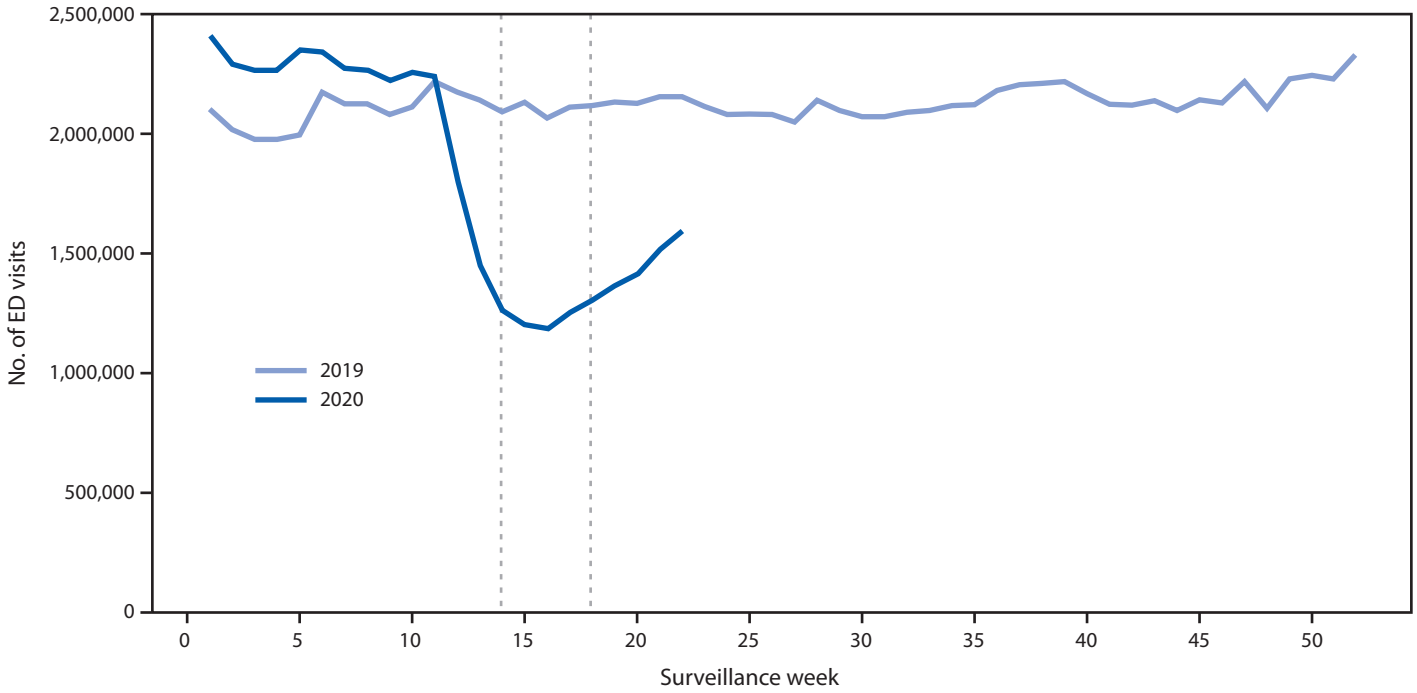
Declines in ED visits varied by U.S. Department of Health and Human Services region,* with the largest declines in the Northeast (Region 1, 49%) and in the region that includes New Jersey and New York (Region 2, 48%) (Figure 2). Visits declined 37% among males and 45% among females across all NSSP EDs between the comparison and early pandemic periods.

Among all ages, an increase of >100 mean visits per week from the comparison period to the early pandemic period occurred in eight of the top 200 diagnostic categories (Table). These included 1) exposure, encounters, screening, or contact with infectious disease (mean increase 18,834 visits per week); 2) COVID-19 (17,774); 3) other general signs and symptoms (4,532); 4) pneumonia not caused by tuberculosis (3,911); 5) other specified and unspecified lower respiratory disease (1,506); 6) respiratory failure, insufficiency, or arrest (776); 7) cardiac arrest and ventricular fibrillation (472); and 8) socioeconomic or psychosocial factors (354). The largest declines were in visits for abdominal pain and other digestive or abdomen signs and symptoms (–66,456), musculoskeletal pain excluding low back pain (–52,150), essential hypertension (–45,184), nausea and vomiting (–38,536), other specified upper respiratory infections (–36,189), sprains and strains (–33,709), and superficial injuries (–30,918). Visits for nonspecific chest pain were also among the top 20 diagnostic categories for which visits decreased (–24,258). Although not in the top 20 declining diagnoses, visits for acute myocardial infarction also declined (–1,156).

During the early pandemic period, the proportion of ED visits for exposure, encounters, screening, or contact with infectious disease compared with total visits was nearly four times as large as during the comparison period (Table) (prevalence ratio [PR] = 3.79, 95% confidence interval [CI] = 3.76–3.83). The other diagnostic categories with the highest proportions of visits during the early pandemic compared with the comparison period were other specified and unspecified lower respiratory disease, which did not include influenza, pneumonia, asthma, or bronchitis (PR = 1.99; 95% CI = 1.96–2.02), cardiac arrest and ventricular fibrillation (PR = 1.98; 95% CI = 1.93–2.03), and pneumonia not caused by tuberculosis (PR = 1.91; 95% CI = 1.90–1.93). Diagnostic categories that were recorded less commonly during the early pandemic period included influenza (PR = 0.16; 95% CI = 0.15–0.16), no immunization or underimmunization (PR = 0.28; 95% CI = 0.27–0.30), otitis media (PR = 0.35; 95% CI = 0.34–0.36), and neoplasm-related encounters (PR = 0.40; 95% CI = 0.39–0.42).

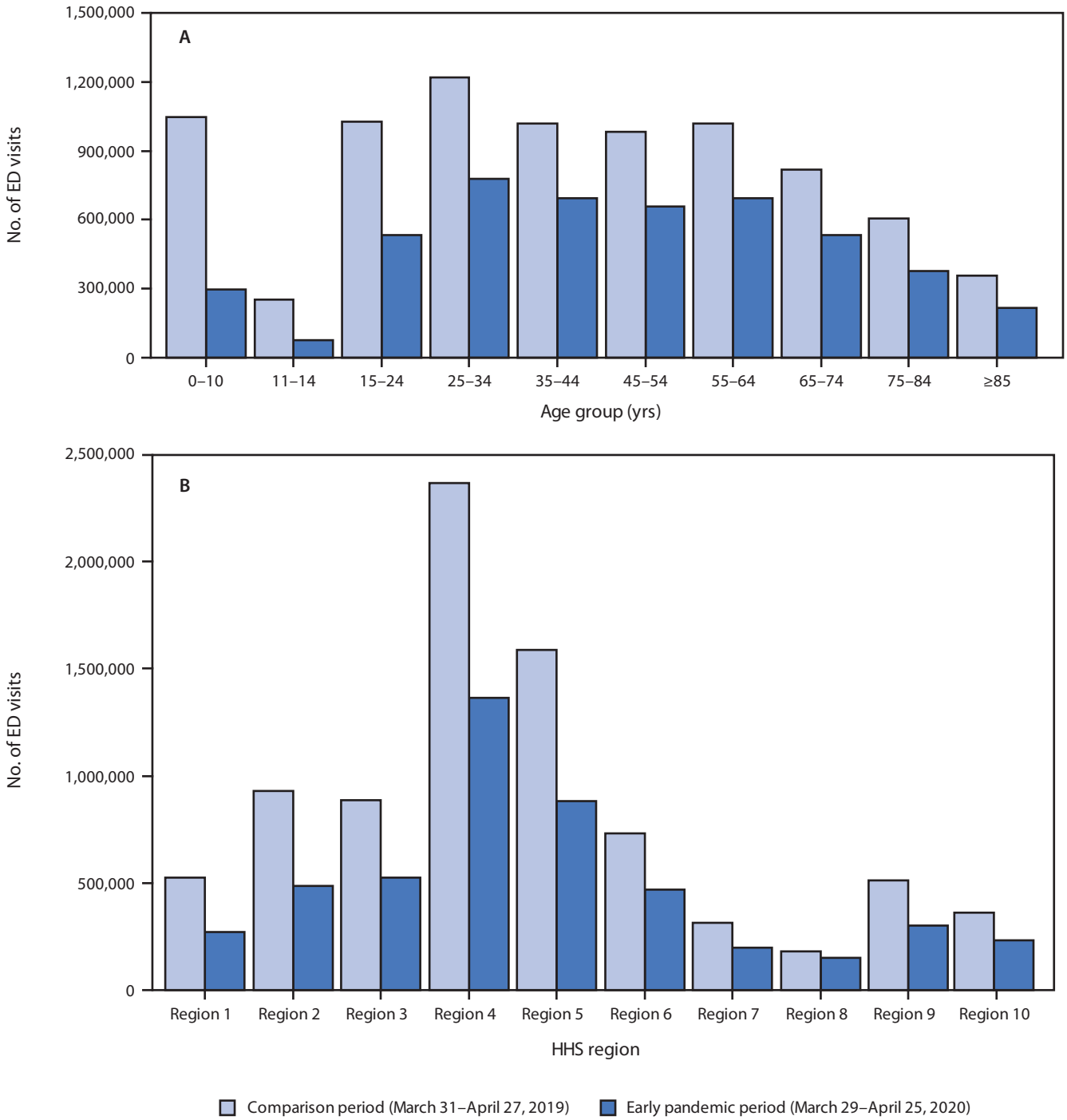
* https://www.hhs.gov/about/agencies/iea/regional-offices/index.html.

FIGURE 1. Weekly number of emergency department (ED) visits — National Syndromic Surveillance Program, United States,* January 1, 2019–May 30, 2020†



* Hawaii, South Dakota, and Wyoming are not included.
† Vertical lines indicate the beginning and end of the 4-week coronavirus disease 2019 (COVID-19) early pandemic period (March 29–April 25, 2020) and the comparison period (March 31–April 27, 2019).

FIGURE 2. Emergency department (ED) visits, by age group (A) and U.S. Department of Health and Human Services (HHS) region* (B) — National Syndromic Surveillance Program, United States,† March 31–April 27, 2019 (comparison period) and March 29–April 25, 2020 (early pandemic period)



* *Region 1*: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2*: New Jersey and New York; *Region 3*: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4*: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5*: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6*: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7*: Iowa, Kansas, Missouri, and Nebraska; *Region 8*: Colorado, Montana, North Dakota, and Utah; *Region 9*: Arizona, California, and Nevada; *Region 10*: Alaska, Idaho, Oregon, and Washington.
† Hawaii, South Dakota, and Wyoming are not included.

In the 2019 comparison period, 12% of all ED visits were in children aged ≤10 years old, compared with 6% during the early pandemic period. Among children aged ≤10 years, the largest declines were in visits for influenza (97% decrease), otitis media (85%), other specified upper respiratory conditions (84%), nausea and vomiting (84%), asthma (84%), viral infection (79%), respiratory signs and symptoms (78%), abdominal pain and other digestive or abdomen symptoms (78%), and fever (72%). Mean weekly visits with confirmed COVID-19 diagnoses and screening for infectious disease during the early pandemic period were lower among children than among adults. Among all ages, the diagnostic categories with the largest changes (abdominal pain and other digestive or abdomen signs and symptoms, musculoskeletal pain, and essential hypertension), were the same in males and females, but declines in those categories were larger in females than males. Females also had large declines in visits for urinary tract infections (–19,833 mean weekly visits).

Discussion

During an early 4-week interval in the COVID-19 pandemic, ED visits were substantially lower than during the same 4-week period during the previous year; these decreases were especially pronounced for children and females and in the Northeast. In addition to diagnoses associated with lower respiratory disease, pneumonia, and difficulty breathing, the number and ratio of visits (early pandemic period versus comparison period) for cardiac arrest and ventricular fibrillation increased. The number of visits for conditions including nonspecific chest pain and acute myocardial infarction decreased, suggesting that some persons could be delaying care for conditions that might result in additional mortality if left untreated. Some declines were in categories including otitis media, superficial injuries, and sprains and strains that can often be managed through primary or urgent care. Future analyses will help clarify the proportion of the decline in ED visits that were not preventable or avoidable such as those for life-threatening conditions, those that were manageable through primary care, and those that represented actual reductions in injuries or illness attributable to changing activity patterns during the pandemic (such as lower risks for occupational and motor vehicle injuries or other infectious diseases).

The striking decline in ED visits nationwide, with the highest declines in regions where the pandemic was most severe in April 2020, suggests that the pandemic has altered the use of the ED by the public. Persons who use the ED as a safety net because they lack access to primary care and telemedicine might be disproportionately affected if they avoid seeking care because of concerns about the infection risk in the ED.

Summary

What is already known about this topic?

The National Syndromic Surveillance Program (NSSP) collects electronic health data in real time.

What is added by this report?

NSSP found that emergency department (ED) visits declined 42% during the early COVID-19 pandemic, from a mean of 2.1 million per week (March 31–April 27, 2019) to 1.2 million (March 29–April 25, 2020), with the steepest decreases in persons aged ≤14 years, females, and the Northeast. The proportion of infectious disease–related visits was four times higher during the early pandemic period.

What are the implications for public health practice?

To minimize SARS-CoV-2 transmission risk and address public concerns about visiting the ED during the pandemic, CDC recommends continued use of virtual visits and triage help lines and adherence to CDC infection control guidance.

Syndromic surveillance has important strengths, including automated electronic reporting and the ability to track outbreaks in real time (*7*). Among all visits, 74% are reported within 24 hours, with 75% of discharge diagnoses typically added to the record within 1 week.

The findings in this report are subject to at least four limitations. First, hospitals reporting to NSSP change over time as facilities are added, and more rarely, as they close (*8*). An average of 3,173 hospitals reported to NSSP nationally in April 2019, representing an estimated 66% of U.S. ED visits, and an average of 3,467 reported in April 2020, representing 73% of ED visits. Second, diagnostic categories rely on the use of specific codes, which were missing in 20% of visits and might be used inconsistently across hospitals and providers, which could result in misclassification. The COVID-19 diagnosis code was introduced recently (April 1, 2020) and timing of uptake might have differed across hospitals (*6*). Third, NSSP coverage is not uniform across or within all states; in some states nearly all hospitals report, whereas in others, a lower proportion statewide or only those in certain counties report. Finally, because this analysis is limited to ED visit data, the proportion of persons who did not visit EDs but received treatment elsewhere is not captured.

Health care systems should continue to address public concern about exposure to SARS-CoV-2 in the ED through adherence to CDC infection control recommendations, such as immediately screening every person for fever and symptoms of COVID-19, and maintaining separate, well-ventilated triage areas for patients with and without signs and symptoms of COVID-19 (*9*). Wider access is needed to health messages that reinforce the importance of immediately seeking care for

TABLE. Differences in mean weekly numbers of emergency department (ED) visits* for diagnostic categories with the largest increases or decreases† and prevalence ratios§ comparing the proportion of ED visits in each diagnostic category, for categories with the highest and lowest ratios — National Syndromic Surveillance Program, United States,¶ March 31–April 27, 2019 (comparison period) and March 29–April 25, 2020 (early pandemic period)

Diagnostic category	Change in mean no. of weekly ED visits*	Prevalence ratio (95% CI)§
All categories with higher visit counts during the early pandemic period		
Exposure, encounters, screening, or contact with infectious disease**	18,834	3.79 (3.76–3.83)
COVID-19	17,774	—
Other general signs and symptoms**	4,532	1.87 (1.86–1.89)
Pneumonia (except that caused by tuberculosis)**	3,911	1.91 (1.90–1.93)
Other specified and unspecified lower respiratory disease**	1,506	1.99 (1.96–2.02)
Respiratory failure, insufficiency, arrest**	776	1.76 (1.74–1.78)
Cardiac arrest and ventricular fibrillation**	472	1.98 (1.93–2.03)
Socioeconomic or psychosocial factors**	354	1.78 (1.75–1.81)
Other top 10 highest prevalence ratios		
Mental and substance use disorders, in remission**	6	1.69 (1.64–1.75)
Other specified encounters and counseling**	22	1.69 (1.67–1.72)
Stimulant-related disorders**	−189	1.65 (1.62–1.67)
Top 20 categories with lower visit counts during the early pandemic period		
Abdominal pain and other digestive or abdomen signs and symptoms	−66,456	0.93 (0.93–0.93)
Musculoskeletal pain, not low back pain	−52,150	0.81 (0.81–0.82)
Essential hypertension	−45,184	1.11 (1.10–1.11)
Nausea and vomiting	−38,536	0.85 (0.84–0.85)
Other specified upper respiratory infections	−36,189	0.82 (0.81–0.82)
Sprains and strains, initial encounter††	−33,709	0.61 (0.61–0.62)
Superficial injury; contusion, initial encounter	−30,918	0.85 (0.84–0.85)
Personal or family history of disease	−28,734	1.21 (1.20–1.22)
Headache, including migraine	−27,458	0.85 (0.84–0.85)
Other unspecified injury	−25,974	0.84 (0.83–0.84)
Nonspecific chest pain	−24,258	1.20 (1.20–1.21)
Tobacco-related disorders	−23,657	1.19 (1.18–1.19)
Urinary tract infections	−23,346	1.02 (1.02–1.03)
Asthma	−20,660	0.91 (0.90–0.91)
Disorders of lipid metabolism	−20,145	1.12 (1.11–1.13)
Spondylopathies/Spondyloarthropathy (including infective)	−19,441	0.78 (0.77–0.79)
Otitis media††	−17,852	0.35 (0.34–0.36)
Diabetes mellitus without complication	−15,893	1.10 (1.10–1.11)
Skin and subcutaneous tissue infections	−15,598	1.01 (1.00–1.02)
Chronic obstructive pulmonary disease and bronchiectasis	−15,520	1.05 (1.04–1.06)
Other top 10 lowest prevalence ratios		
Influenza††	−12,094	0.16 (0.15–0.16)
No immunization or underimmunization††	−1,895	0.28 (0.27–0.30)
Neoplasm-related encounters††	−1,926	0.40 (0.39–0.42)
Intestinal infection††	−5,310	0.52 (0.51–0.54)
Cornea and external disease††	−9,096	0.54 (0.53–0.55)
Sinusitis††	−7,283	0.55 (0.54–0.56)
Acute bronchitis††	−15,470	0.59 (0.58–0.60)
Noninfectious gastroenteritis††	−11,572	0.63 (0.62–0.64)

Abbreviations: CI = confidence interval; COVID-19 = coronavirus disease 2019.

* The change in visits per week during the early pandemic and comparison periods was calculated as the difference in total visits between the two periods, divided by 4 weeks ([visits in diagnostic category, {early pandemic period} – visits in diagnostic category, {comparison period}] / 4).

† Analysis is limited to the 200 most common diagnostic categories. All eight diagnostic categories with an increase of >100 in the mean number of visits nationwide in the early pandemic period are shown. The top 20 categories with decreasing visit counts are shown.

§ Ratio calculated as the proportion of all ED visits in each diagnostic category during the early pandemic period, divided by the proportion of all ED visits in that category during the comparison period ([visits in category {early pandemic period}/all visits {early pandemic period})/(visits in category {comparison period}/all visits {comparison period}]). Ratios >1 indicate a higher proportion of visits in that category during the early pandemic period than the comparison period; ratios <1 indicate a lower proportion during the early pandemic than during the comparison period. Analysis is limited to the 200 most common diagnostic categories. The 10 categories with the highest and lowest ratios are shown.

¶ Florida, Hawaii, Louisiana, New York outside of New York City, Oklahoma, South Dakota, Wyoming, Santa Cruz and Solano counties in California, and the District of Columbia are not included.

** Top 10 highest prevalence ratios; higher proportion of visits in the early pandemic period than the comparison period.

†† Top 10 lowest prevalence ratios; lower proportion of visits in the early pandemic period than the comparison period.

serious conditions for which ED visits cannot be avoided, such as symptoms of myocardial infarction. Expanded access to triage telephone lines that help persons rapidly decide whether they need to go to an ED for symptoms of possible COVID-19 infection and other urgent conditions is also needed. For conditions that do not require immediate care or in-person treatment, health care systems should continue to expand the use of virtual visits during the pandemic (*10*).

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Knowledge and Practices Regarding Safe Household Cleaning and Disinfection for COVID-19 Prevention — United States, May 2020

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On June 5, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

A recent report described a sharp increase in calls to poison centers related to exposures to cleaners and disinfectants since the onset of the coronavirus disease 2019 (COVID-19) pandemic (*1*). However, data describing cleaning and disinfection practices within household settings in the United States are limited, particularly concerning those practices intended to prevent transmission of SARS-CoV-2, the virus that causes COVID-19. To provide contextual and behavioral insight into the reported increase in poison center calls and to inform timely and relevant prevention strategies, an opt-in Internet panel survey of 502 U.S. adults was conducted in May 2020 to characterize knowledge and practices regarding household cleaning and disinfection during the COVID-19 pandemic. Knowledge gaps were identified in several areas, including safe preparation of cleaning and disinfectant solutions, use of recommended personal protective equipment when using cleaners and disinfectants, and safe storage of hand sanitizers, cleaners, and disinfectants. Thirty-nine percent of respondents reported engaging in nonrecommended high-risk practices with the intent of preventing SARS-CoV-2 transmission, such as washing food products with bleach, applying household cleaning or disinfectant products to bare skin, and intentionally inhaling or ingesting these products. Respondents who engaged in high-risk practices more frequently reported an adverse health effect that they believed was a result of using cleaners or disinfectants than did those who did not report engaging in these practices. Public messaging should continue to emphasize evidence-based, safe practices such as hand hygiene and recommended cleaning and disinfection of high-touch surfaces to prevent transmission of SARS-CoV-2 in household settings (*2*). Messaging should also emphasize avoidance of high-risk practices such as unsafe preparation of cleaning and disinfectant solutions, use of bleach on food products, application of household cleaning and disinfectant products to skin, and inhalation or ingestion of cleaners and disinfectants.

Survey questions were administered by Porter Novelli Public Services and ENGINE Insights on May 4, 2020, through PN View: 360,* a rapid turnaround survey that can be used to provide insights into knowledge and practices of targeted audiences. This opt-in Internet panel survey was administered to 502 U.S. adults aged ≥18 years using the Lucid platform (*3*); panel members who had not taken a survey in the previous 20 waves of survey administration were eligible to participate. Quota sampling and statistical weighting were employed to make the panel representative of the U.S. population by gender, age, region, race/ethnicity, and education.Respondents were informed that their answers were being used for market research and could refuse to answer any question at any time. No personally identifying information was included in the data file provided to CDC.†

Survey questions asked about general knowledge, attitudes, and practices related to use of household cleaners and disinfectants§ and about specific information regarding cleaning and disinfection strategies for prevention of SARS-CoV-2 transmission. Weighted response frequencies were calculated using SAS statistical software (version 9.4; SAS Institute). Because respondents were recruited from an opt-in panel rather than by probability sampling, no inferential statistical tests were performed.¶ Differences were noted when a difference of ≥5 percentage points was found between any estimates being compared.

The median age of respondents was 46 years (range = 18–86 years), and 52% of respondents were female. Overall, 63% of respondents were non-Hispanic white, 16% were Hispanic (any race), 12% were non-Hispanic black, and 8% were multiracial or of other race/ethnicity. Respondents represented all U.S. Census regions,** with 38% from the South, 24% from the West, 21% from the Midwest, and 18% from the Northeast.

Participants had limited knowledge of safe preparation of cleaning and disinfectant solutions (Figure 1). Overall, 23% responded that only room temperature water should be used for preparation of dilute bleach solutions, 35% that bleach should not be mixed with vinegar, and 58% that bleach should not be mixed with ammonia. In comparison, a higher percentage of respondents had knowledge about use of recommended personal protective equipment: 64% responded that

* http://styles.porternovelli.com/pn-view-panels/.

† CDC obtained the survey data from Porter Novelli Public Services through a subscription license. Porter Novelli Public Services and its vendors are not subject to review by CDC's Institutional Review Board; they adhere to professional standards and codes of conduct set forth by the Insights Association (https://www.insightsassociation.org/issues-policies/insights-association-code-standards-and-ethics-market-research-and-data-analytics-0).

§ Questions regarding storage of hand sanitizers were included with questions regarding storage of cleaners and disinfectants.

¶ https://www.aapor.org/AAPOR_Main/media/MainSiteFiles/NPS_TF_Report_Final_7_revised_FNL_6_22_13.pdf.

** https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf.

Summary

What is already known about this topic?

Calls to poison centers regarding exposures to cleaners and disinfectants have increased since the onset of the COVID-19 pandemic.

What is added by this report?

An Internet panel survey identified gaps in knowledge about safe preparation, use, and storage of cleaners and disinfectants. Approximately one third of survey respondents engaged in nonrecommended high-risk practices with the intent of preventing SARS-CoV-2 transmission, including using bleach on food products, applying household cleaning and disinfectant products to skin, and inhaling or ingesting cleaners and disinfectants.

What are the implications for public health practice?

Public messaging should continue to emphasize evidence-based, safe cleaning and disinfection practices to prevent SARS-CoV-2 transmission in households, including hand hygiene and cleaning and disinfection of high-touch surfaces.

eye protection was recommended for use of some cleaners and disinfectants, and 71% responded that gloves were recommended for use. Similarly, 68% responded that handwashing was recommended after using cleaners and disinfectants and 73% that adequate ventilation was recommended when using these products. Regarding safe storage of cleaners, disinfectants, and hand sanitizers, 79% of respondents said that cleaners and disinfectants should be kept out of the reach of children, and 54% that hand sanitizers should be kept out of the reach of children.

Respondents reported engaging in a range of practices during the previous month with the intent of preventing SARS-CoV-2 transmission (Figure 2). Sixty percent of respondents reported more frequent home cleaning or disinfection compared with that in preceding months. Thirty-nine percent reported intentionally engaging in at least one high-risk practice not recommended by CDC for prevention of SARS-CoV-2 transmission (*2*), including application of bleach to food items (e.g., fruits and vegetables) (19%); use of household cleaning and disinfectant products on hands or skin (18%); misting the body with a cleaning or disinfectant spray (10%); inhalation of vapors from household cleaners or disinfectants (6%); and drinking or gargling diluted bleach solutions, soapy water, and other cleaning and disinfectant solutions (4% each).

One quarter (25%) of respondents reported at least one adverse health effect during the previous month that they believed had resulted from using cleaners or disinfectants, including nose or sinus irritation (11%); skin irritation (8%); eye irritation (8%); dizziness, lightheadedness, or headache (8%); upset stomach or nausea (6%); or breathing problems (6%). Respondents who reported engaging in at least one high-risk practice more frequently reported an adverse health effect than did those who did not report engaging in such practices (39% versus 16%).

Approximately half (51%) of respondents strongly agreed and 31% somewhat agreed that they knew how to clean and disinfect their home safely. Similarly, 42% strongly agreed and 35% somewhat agreed that they knew how to clean and disinfect their home to prevent SARS-CoV-2 transmission. When asked who their most trusted sources of SARS-CoV-2-related cleaning and disinfection information were, the top three responses were CDC (65%), state or local health departments (49%), and doctors, nurses, or medical providers (48%).

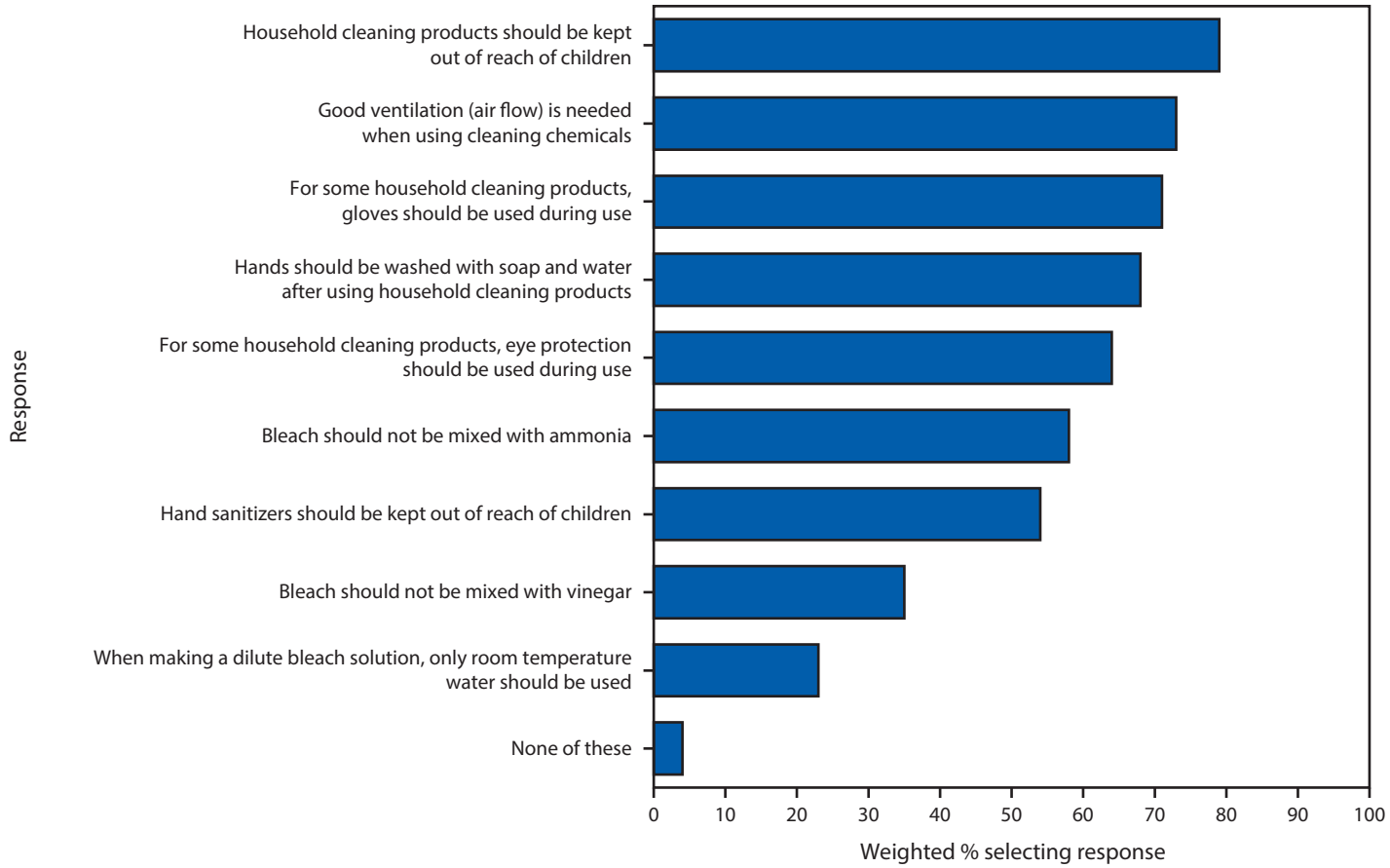
Discussion

This survey identified important knowledge gaps in the safe use of cleaners and disinfectants among U.S. adults; the largest gaps were found in knowledge about safe preparation of cleaning and disinfectant solutions and about storage of hand sanitizers out of the reach of children. Mixing of bleach solutions with vinegar or ammonia, as well as application of heat, can generate chlorine and chloramine gases that might result in severe lung tissue damage when inhaled (*4*,*5*). Furthermore, exposures of children to hand sanitizers, particularly via ingestion, can be associated with irritation of mucous membranes, gastrointestinal effects, and in severe cases, alcohol toxicity (*6*). The risk of ingestion and consequent toxicity from improperly stored hand sanitizers, cleaners, and disinfectants can also extend to pets (*7*).

Consistent with current guidance for daily cleaning and disinfection of frequently touched surfaces (*2*), a majority of respondents reported increased frequency of cleaning in the home. However, approximately one third reported engaging in high-risk practices such as washing food products with bleach, applying household cleaning and disinfectant products to bare skin, and intentionally inhaling or ingesting cleaners or disinfectants. These practices pose a risk of severe tissue damage and corrosive injury (*8*,*9*) and should be strictly avoided. Although adverse health effects reported by respondents could not be attributed to their engaging in high-risk practices, the association between these high-risk practices and reported adverse health effects indicates a need for public messaging regarding safe and effective cleaning and disinfection practices aimed at preventing SARS-CoV-2 transmission in households.

COVID-19 prevention messages should continue to emphasize evidence-based, safe practices such as frequent hand hygiene and frequent cleaning and disinfection of high-touch surfaces (*2*). These messages should include specific recommendations for the safe use of cleaners and disinfectants, including the importance of reading and following label instructions, using water at room

FIGURE 1. Knowledge about safe use of cleaners and disinfectants*,† based on responses to an opt-in Internet panel survey§ (N = 502 respondents) — United States, May 2020

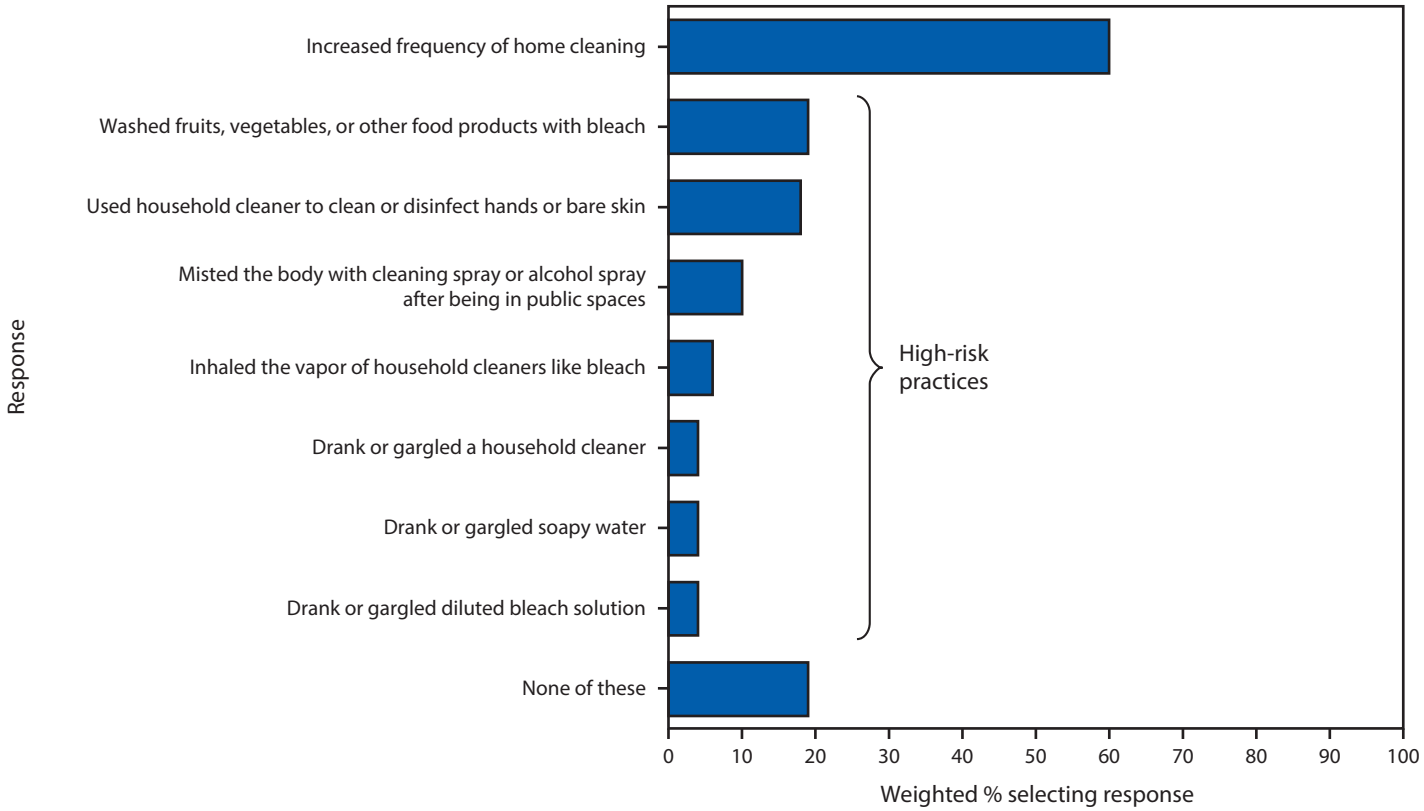


* In response to the question "Which of the following have you heard is true about using household cleaning products (such as bleach or Lysol)?"; response options reflected CDC recommendations for safe cleaning and disinfection. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/disinfecting-your-home.html.
† In survey questions, the term "cleaning" referred to using a cleaner or disinfectant on surfaces or objects. Questions regarding storage of hand sanitizers were included with questions regarding storage of cleaners and disinfectants.
§ Survey administered by Porter Novelli Public Services through PN View: 360; respondents could select multiple responses to the question (all response options shown). Selection of the response "none of these" was exclusive (i.e., respondents could not select this response option in addition to other responses).

temperature for dilution (unless otherwise stated on the label), avoiding mixing of chemical products, wearing skin protection and considering eye protection for potential splash hazards, ensuring adequate ventilation, and storing and using chemicals and hand sanitizers out of the reach of children and pets (*10*). Despite the knowledge gaps and high-risk practices identified in this survey, most respondents believed that they knew how to clean and disinfect their homes safely; thus, prevention messages should highlight identified gaps in knowledge about safe and effective practices and provide targeted information using innovative communication strategies (e.g., digital, social media) regarding safe cleaning and disinfection. These messages about cleaning and disinfection practices for COVID-19 prevention can be coordinated and disseminated through trusted sources of information such as national, state, and local public health agencies and medical providers.

The findings in this report are subject to at least four limitations. First, although survey responses were weighted to be nationally representative of U.S. demographics, whether responses among this opt-in panel sample are truly representative of knowledge, attitudes, and practices shared by the broader U.S. population is difficult to determine. Second, social desirability bias might have affected responses, with some respondents potentially overstating their perceived knowledge or underreporting engagement in high-risk practices; thus, these findings might underestimate the risk for exposures. Third, cross-sectional data captured in survey responses do not allow for direct attribution of specific outcomes, such as adverse health effects, to specific knowledge gaps or practices. Finally, responses were recorded at a single point in time and might not reflect ongoing shifts in public opinion or cleaning and

FIGURE 2. Cleaning and disinfection practices in the previous month with the intent of preventing SARS-CoV-2 infection,*,† based on responses to an opt-in Internet panel survey§ (N = 502 respondents) — United States, May 2020



* In response to the question "In the past month, which of the following cleaning behaviors have you or a household member engaged in to prevent coronavirus?"
† In survey questions, the term "cleaning" referred to using a cleaner or disinfectant on surfaces or objects.
§ Survey administered by Porter Novelli Public Services through PN View: 360; respondents could select multiple responses to the question (nine of 11 possible response options shown). Selection of the response "none of these" was exclusive (i.e., respondents could not select this response option in addition to other responses).

disinfection practices by the public throughout the national COVID-19 response.

Efforts are ongoing to collect these data over time and to characterize knowledge gaps and practices among specific demographic and geographic groups. These data will allow for development and evaluation of further targeted messaging to ensure safe cleaning and disinfection practices in U.S. households during and after the COVID-19 pandemic.

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First Reported Cases of SARS-CoV-2 Infection in Companion Animals — New York, March–April 2020

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On April 22, CDC and the U.S. Department of Agriculture (USDA) reported cases of two domestic cats with confirmed infection with SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). These are the first reported companion animals (including pets and service animals) with SARS-CoV-2 infection in the United States, and among the first findings of SARS-CoV-2 symptomatic companion animals reported worldwide. These feline cases originated from separate households and were epidemiologically linked to suspected or confirmed human COVID-19 cases in their respective households. Notification of presumptive positive animal test results triggered a One Health* investigation by state and federal partners, who determined that no further transmission events to other animals or persons had occurred. Both cats fully recovered. Although there is currently no evidence that animals play a substantial role in spreading COVID-19, CDC advises persons with suspected or confirmed COVID-19 to restrict contact with animals during their illness and to monitor any animals with confirmed SARS-CoV-2 infection and separate them from other persons and animals at home (*1*).

SARS-CoV-2 is a zoonotic coronavirus that likely originated in bats (*2*). A small number of animals worldwide, including dogs, cats, zoo tigers and lions, and farmed mink, have been infected naturally with SARS-CoV-2, mostly through suspected human-to-animal transmission† (*3*). In addition, experimental studies in ferrets, golden Syrian hamsters, Egyptian fruit bats, and cats show that these species can transmit infection to cohoused animals of the same species (*4–7*).

SARS-CoV-2 Clinical Presentation in Domestic Cats

On March 24, in Nassau County, New York, a 4-year-old male domestic shorthair (cat A), developed respiratory illness characterized by sneezing, clear ocular discharge, and mild lethargy (Figure). On April 1, the cat was taken to a veterinary clinic; on physical examination the cat was found to be overweight, with a normal body temperature (101.4°F [38.6°C]). Nasal, oropharyngeal, and ocular swabs were collected by veterinary staff members and submitted to a private diagnostic laboratory (laboratory A) for a routine feline respiratory polymerase chain reaction (PCR) panel designed to detect *Mycoplasma felis, Bordetella bronchiseptica,* feline calicivirus, *Chlamydophila felis,* feline herpesvirus, and influenza A H1N1pdm. A broad-spectrum cephalosporin class antibiotic (cefovecin; 52 mg) was administered subcutaneously, and the cat was returned home, where it fully recovered by April 3. Results of the routine feline respiratory panel were negative for all pathogens and the specimen was tested using a SARS-CoV-2 reverse transcription PCR (RT-PCR) diagnostic assay as part of laboratory A's passive COVID-19 pet surveillance program.

On April 1, in Orange County, New York, a 5-year-old female Devon Rex (cat B), developed respiratory illness including sneezing, coughing, watery nasal and ocular discharge, loss of appetite, and lethargy. On April 6, the owner, an employee at a Connecticut veterinary clinic, collected conjunctival, nasal, deep oral, and fecal specimens from cat B in the home using sterile culturettes. These specimens also were sent to laboratory A and tested using the feline respiratory PCR panel. Cat B fully recovered by April 8 without treatment. At laboratory A, the feline respiratory PCR panel had a positive result for *Mycoplasma felis* and negative results for other common feline respiratory pathogens. The specimens from cat B also were tested by laboratory A for SARS-CoV-2.

On April 14, laboratory A reported a positive SARS-CoV-2 RT-PCR result for cat A to the USDA National Veterinary Services Laboratories (NVSL), veterinary clinic, and New York state veterinarian, who immediately notified the New York State Department of Health (NYSDH). The same day, laboratory A notified NVSL and Connecticut state animal health officials of the positive SARS-CoV-2 RT-PCR result for cat B. After determining that cat B resided in New York, the New York state veterinarian was informed, and the NYSDH was immediately notified. RNA from the positive respiratory specimens from both cat A and cat B were forwarded from laboratory A to NVSL for confirmatory testing.

Public Health Response

On April 14, following notification of presumptive positive SARS-CoV-2 test results for cats A and B, state and

* One Health is a collaborative, multisectoral, and transdisciplinary approach, working at the local, regional, national, and global levels, with the goal of achieving optimal health outcomes recognizing the interconnection between humans, animals, plants, and their shared environment.

† https://www.oie.int/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019novel-coronavirus/.

federal partners conducted a joint epidemiologic investigation. Household members and veterinarians who had treated the infected cats were questioned regarding the cats' living arrangements, health condition, potential sources of infection, and risks posed by these animals to other animals inside and outside the home, and to humans.

Cat A lived in an apartment with five persons, including three who had shown signs of mild respiratory illness including fever, cough, and sweating; none of the five were tested for SARS-CoV-2 infection. The first person's illness began around March 15, 9 days before cat A became ill, and lasted <48 hours. Residents of the household's apartment complex also experienced multiple cases of human COVID-19 around the same time. A second cat in the household, a 3-year-old female domestic shorthair, remained healthy and was not tested for SARS-CoV-2. Both cats were typically kept indoors but did occasionally venture outside.

Cat B lived in a single-family home with one person, who developed fever, productive cough, chills, muscle aches, abdominal pain, headache, diarrhea, sore throat, and fatigue on March 24, 8 days before cat B became ill. Specimens collected from this person on March 26 for viral testing were positive for SARS-CoV-2. By March 27, the illness had resolved. A second cat in the household, a 7-year-old Devon Rex, remained healthy and was not tested for SARS-CoV-2. Both cats were kept exclusively indoors.

On April 17, state and local One Health partners collected additional specimens from cats A and B for confirmatory diagnosis of SARS-CoV-2 at NVSL (Table). Real-time RT-PCR, using a modified CDC N-target assay and sequencing (*8*), determined that results for both cat A and B were positive at the first specimen collections (April 1 and 6, respectively), and the nasal swab from cat A was weakly positive from the subsequent collection (April 17). Both cats had SARS-CoV-2–specific virus neutralizing antibodies, but virus isolation in cell culture from subsequent specimen collection was unsuccessful for both cats, likely due to virus clearance. Cat A and B recovered from illness 11 days and 6 days before initiation of the epidemiologic investigation; therefore, no additional monitoring or infection prevention measures were recommended.

Discussion

An estimated 76 million pet cats live in the United States, and approximately 70% of U.S. households own at least one pet (*9*). Close interactions between humans and pets create opportunities for zoonotic disease transmission. In both cases presented in this report, the cats with positive test results for SARS-CoV-2 had close epidemiologic links to owners with suspected or confirmed COVID-19. In addition, human symptom onset preceded that in cat A by 9 days and in cat B by 8 days. No identified onward human or animal infections were attributed to these animals. This evidence supports findings to date that animals do not play a substantial role in spreading SARS-CoV-2, although human-to-animal transmission can occur in some situations. Companion animals that test positive for SARS-CoV-2 should be monitored and separated from persons and other animals until they recover.

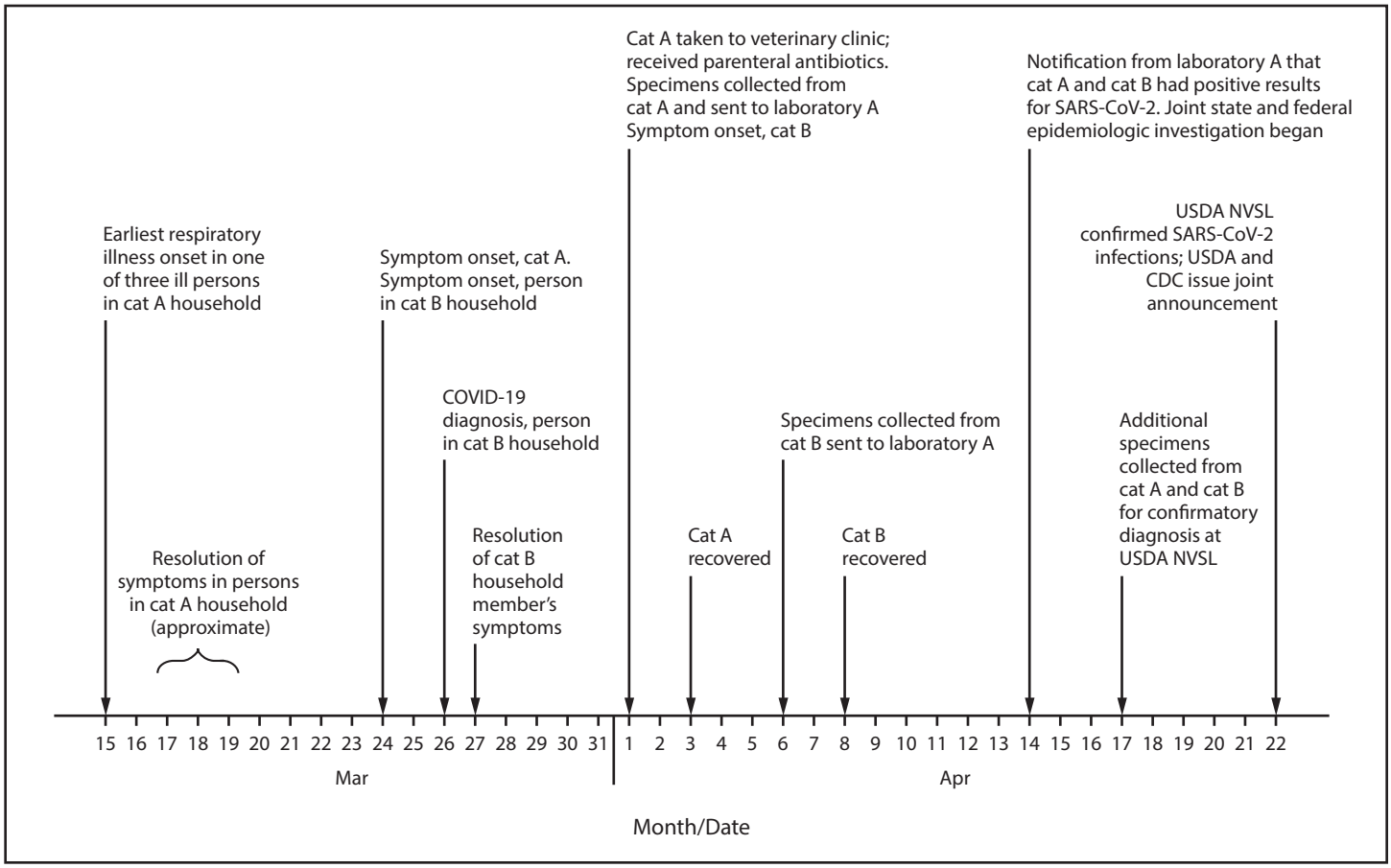
Both animals in this report were initially tested by laboratory A as part of a passive COVID-19 pet surveillance program that operated independently from state and federal health agencies. This method of surveillance was unable to routinely obtain epidemiologic information regarding SARS-CoV-2 exposures before testing. CDC and USDA have identified four situational testing categories[§] (*10*); one of the four categories recommends testing symptomatic animals with close contact to a person with suspected or confirmed COVID-19. Epidemiologic investigation conducted after positive SARS-CoV-2 test results were reported found that both cat A and cat B fit this situational category.

Currently, CDC and USDA recommend that epidemiologic information be collected before companion animal SARS-CoV-2 testing, and that the decision to test animals be coordinated with state public health veterinarians and state animal health officials using a One Health approach, to ensure that animal and public health responses occur in a timely and effective manner. Laboratory A's passive surveillance program operated for a limited period to better understand the impact of SARS-CoV-2 on animals at risk for infection and did not divert resources necessary to conduct human SARS-CoV-2 testing, consistent with CDC and USDA guidance.

Establishment of the U.S. One Health Federal Interagency COVID-19 Coordination Group (OHFICCG) in February 2020, and routine communication between state and federal One Health partners have been instrumental in ensuring a coordinated government response to the One Health aspects of COVID-19. This One Health coordination platform allows for collaboration and rapid information-sharing across sectors while also facilitating alignment of research, priorities, and messaging regarding the human, animal, and environmental aspects of COVID-19. Laboratory A, state partners, and members of OHFICCG coordinated information sharing during this investigation. Information from this investigation

[§] Testing is indicated for four situational categories: 1) Animals with clinical signs of illness consistent with SARS-CoV-2 infection and an epidemiologic link to a person with suspected or confirmed COVID-19; 2) Animals with clinical signs of illness consistent with SARS-CoV-2 infection and an epidemiologic link to an environment that is at high risk for SARS-CoV-2 contamination; 3) Threatened, endangered, or otherwise imperiled or rare animals in a rehabilitation or zoologic facility with possible exposure to SARS-CoV-2 through an infected person or animal; 4) Animals in a mass care or group setting where a cluster of animals shows clinical signs of illness consistent with SARS-CoV-2.

FIGURE. Timeline of events related to SARS-CoV-2 infections in two domestic cats (cats A and B) kept as pets in two different households — New York, March 15–April 22, 2020



Abbreviations: COVID-19 = coronavirus disease 2019; USDA NVSL = United States Department of Agriculture National Veterinary Services Laboratories.

TABLE. Results of SARS-CoV-2 real-time RT-PCR, partial next-generation sequencing, SARS-CoV-2 virus neutralization, and virus isolation in two domestic cats kept as pets (cat A and cat B) by specimen type and date collected — U.S. Department of Agriculture National Veterinary Services Laboratories, United States, April 2020

Case	Date collected	Specimen type	N1* target result (Average Ct)†	N2* target result (Average Ct)†	Spike gene sequencing	Virus neutralization	Virus isolation
Cat A	April 1	Laboratory A-extracted RNA	Positive (22.3)	Positive (24.4)	Positive	N/A	N/A
	April 17	Nasal swab	Positive (35.9)	Positive (37.3)	Positive	N/A	Negative
	April 17	Rectal swab	Negative	Negative	N/A	N/A	Negative
	April 17	Serum	N/A	N/A	N/A	Positive	N/A
Cat B	April 6	Laboratory A-extracted RNA	Positive (27.1)	Positive (26.2)	Positive	N/A	N/A
	April 17	Nasal swab	Negative	Negative	N/A	N/A	Negative
	April 17	Rectal swab	Negative	Negative	N/A	N/A	Negative
	April 17	Serum	N/A	N/A	N/A	Positive	N/A

Abbreviations: Ct = cycle threshold; N1 = virus nucleocapsid gene 1; N2 = virus nucleocapsid gene 2; N/A = not applicable; RT-PCR = reverse transcription–polymerase chain reaction.
* N1 and N2 targets = primer-probes for CDC's real-time RT-PCR assay that targets virus nucleocapsid (N) gene for specific detection of SARS-CoV-2.
† Ct = the number of cycles required for the fluorescent signal to cross the threshold, where lower values indicate more starting nucleic acid.

informed OHFICCG guidance development for managing SARS-CoV-2–infected animals, including guidance for when animals with positive test results should resume normal activities. This investigation provides further support for the utility of a One Health approach to addressing zoonotic diseases such as COVID-19 to safeguard the health, welfare, and safety of humans, animals, and their shared environment.

Summary

What is already known about this topic?

A small number of companion animals worldwide have been naturally infected with SARS-CoV-2, the virus that causes COVID-19.

What is added by this report?

Two domestic cats with respiratory illnesses lasting 8 and 10 days are the first reported companion animals with SARS-CoV-2 infection in the United States. Both cats were owned by persons with suspected or confirmed COVID-19, and both cats fully recovered.

What are the implications for public health practice?

Human-to-animal transmission of SARS-CoV-2 can occasionally occur. Animals are not known to play a substantial role in spreading COVID-19, but persons with COVID-19 should avoid contact with animals. Companion animals that test positive for SARS-CoV-2 should be monitored and separated from persons and other animals until they recover.

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Members of cat A and cat B households; veterinary clinics in New York state and Connecticut; laboratory A; officials from the New York State Department of Health, New York State Department of Agriculture and Markets, and Connecticut Department of Agriculture; U.S. Department of Agriculture One Health Coordination and National Veterinary Services Laboratories staff members; staff members from CDC's COVID-19 One Health Working Group.

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SARS-CoV-2 Infections and Serologic Responses from a Sample of U.S. Navy Service Members — USS Theodore Roosevelt, April 2020

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Compared with the volume of data on coronavirus disease 2019 (COVID-19) outbreaks among older adults, relatively few data are available concerning COVID-19 in younger, healthy persons in the United States (*1*,*2*). In late March 2020, the aircraft carrier USS Theodore Roosevelt arrived at port in Guam after numerous U.S. service members onboard developed COVID-19. In April, the U.S. Navy and CDC investigated this outbreak, and the demographic, epidemiologic, and laboratory findings among a convenience sample of 382 service members serving aboard the aircraft carrier are reported in this study. The outbreak was characterized by widespread transmission with relatively mild symptoms and asymptomatic infection among this sample of mostly young, healthy adults with close, congregate exposures. Service members who reported taking preventive measures had a lower infection rate than did those who did not report taking these measures (e.g., wearing a face covering, 55.8% versus 80.8%; avoiding common areas, 53.8% versus 67.5%; and observing social distancing, 54.7% versus 70.0%, respectively). The presence of neutralizing antibodies, which represent antibodies that inhibit SARS-CoV-2, among the majority (59.2%) of those with antibody responses is a promising indicator of at least short-term immunity. This report improves the understanding of COVID-19 in the U.S. military and among young adults in congregate settings and reinforces the importance of preventive measures to lower risk for infection in similar environments.

In mid-January, the USS Theodore Roosevelt was deployed to the western Pacific. An outbreak of COVID-19 occurred during deployment, which resulted in the aircraft carrier stopping in Guam at the end of March. During this time, approximately 1,000 service members were determined to be infected with SARS-CoV-2, the virus that causes COVID-19. The United States Navy and CDC investigated this ongoing outbreak during April 20–24; 382 service members voluntarily completed questionnaires and provided serum specimens (a convenience sample comprising 27% of 1,417 service members staying at the base on Guam or on the ship). The 1,417 included persons who were previously infected, currently infected, or never infected. Among these 382 service members, 267 (70%) also provided a nasopharyngeal (NP) swab specimen. Serum specimens were tested for antibody reactivity using a CDC-developed, SARS-CoV-2 spike protein enzyme-linked immunosorbent assay (ELISA) (a pan-immunoglobulin assay) as an indicator of previous SARS-CoV-2 exposure and infection; signal threshold ratio ≥1 was defined as a positive ELISA result (*3*). ELISA-positive specimens were further tested for neutralizing antibodies using a microneutralization assay to detect presence of SARS-CoV-2 inhibiting antibodies (antibody titers >40 defined as positive). Real-time reverse transcription–polymerase chain reaction (RT-PCR) testing of NP swab specimens was used to detect SARS-CoV-2 RNA (*4*). Previous or current SARS-CoV-2 infection was defined as a positive real-time RT-PCR result or positive ELISA result.

At the time of specimen collection, participants completed a questionnaire eliciting information on demographic characteristics, exposure, COVID-19 protective behaviors, health history, and symptoms; participants also reported whether they had had a previous positive COVID-19 test since deployment but before this investigation. Protective behaviors listed on the questionnaire were not mutually exclusive, so participants could select all that applied. Reported symptoms were categorized using the Council of State and Territorial Epidemiologists (CSTE) case definition for COVID-19 (*5*), including category A (at least cough or shortness of breath/difficulty breathing) and category B (no cough or shortness of breath, but two or more other symptoms*) or neither. Demographic, exposure, and symptom characteristics and engagement in protective behaviors were compared among participants infected with SARS-CoV-2 and those having no evidence of previous or current infection, and unadjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Analyses were performed using SAS statistical software (version 9.4; SAS Institute).

Among the 382 survey participants (Figure 1), 289 (75.7%) were male; their median age was 30 years (interquartile range [IQR] = 24–35 years), 223 (58.4%) were non-Hispanic white, and 28 (7.3%) reported a history of asthma, hypertension, diabetes, or immunosuppression (Table). Among 238 (62.0%) participants with previous or current SARS-CoV-2 infection, 194 (81.5%) reported one or more symptoms, 44 (18.5%)

* Fever, chills, muscle pain, headache, sore throat, new taste or smell disorder.

Summary

What is already known about this topic?

Information about COVID-19 among young adults is limited.

What is added by this report?

Among a convenience sample of 382 young adult U.S. service members aboard an aircraft carrier experiencing a COVID-19 outbreak, 60% had reactive antibodies, and 59% of those also had neutralizing antibodies at the time of specimen collection. One fifth of infected participants reported no symptoms. Preventive measures, such as using face coverings and observing social distancing, reduced risk for infection.

What are the implications for public health practice?

Young, healthy adults with COVID-19 might have mild or no symptoms; therefore, symptom-based surveillance might not detect all infections. Use of face coverings and other preventive measures could mitigate transmission. The presence of neutralizing antibodies among the majority is a promising indicator of at least short-term immunity.

were asymptomatic, and two (0.8%) were hospitalized for COVID-19. Among all participants, the prevalence of previous or current infection among males was higher than that among females (OR = 1.8) but did not differ significantly by age, race, ethnicity, or history of a preexisting medical condition.

Among 284 symptomatic participants (194 [68.3%] with previous or current SARS-CoV-2 infections and 90 [31.7%] without), loss of taste (ageusia) or smell (anosmia) were the symptoms most strongly associated with previous or current infection (OR = 10.3), followed by fever (OR = 2.8), chills (OR = 2.7), and myalgia (OR = 2.6) (Figure 2). CSTE-defined category B symptoms were more strongly associated with infection (OR = 5.8) than were category A symptoms (OR = 3.5). Reporting four or more symptoms and seeking medical care for symptoms (OR = 2.3) were significantly associated with infection.

Overall, 228 (59.7%) participants had a positive ELISA result, and among those, 135 (59.2%) also had a positive microneutralization test result. Among those with positive ELISA results, Hispanic/Latino participants were more likely to have positive microneutralization test results (33 of 44; 75.0%) than were participants of non-Hispanic/Latino or unspecified ethnicity (102 of 184; 55.4%) (OR = 2.4; 95% CI = 1.1–5.1). Among the 267 participants who provided an NP swab, 98 (36.7%) had a positive real-time RT-PCR result; 171 (64.0%) persons who provided an NP swab had a positive ELISA result. Among 235 participants who reported a positive SARS-CoV-2 test result before this investigation (defined as during this deployment, mid-January to April 20–24, 2020), 212 (90.2%) had positive ELISA results compared with 16 (10.9%) among 147 not reporting previous positive test results for SARS-CoV-2 (OR = 75.5; 95% CI = 38.5–148.1).

Among 191 symptomatic participants who reported a symptom onset date and had positive real-time RT-PCR results, positive ELISA results, or both, eight had positive real-time RT-PCR and negative ELISA results; for these participants, ≤15 days had elapsed since symptom onset at the time of specimen collection (Figure 3). Among symptomatic participants with positive ELISA results and positive microneutralization test results (n = 107), a median of 22 days (IQR = 15–26) had elapsed since symptom onset at the time of specimen collection (Figure 3). Among 12 participants with positive ELISA results >40 days after symptom onset, eight maintained positive microneutralization test results, including two participants who were tested >3 months after symptom onset.

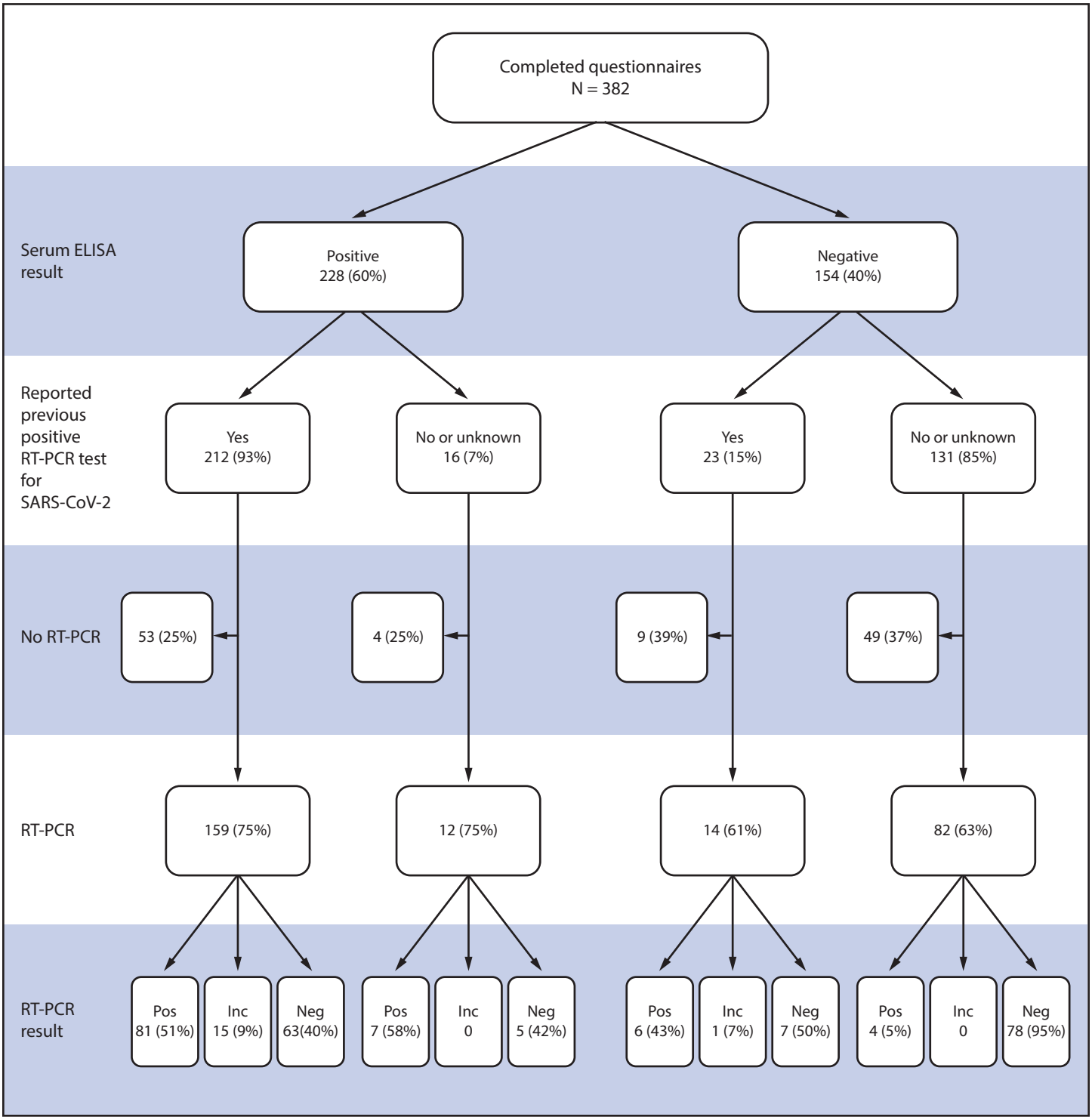
Prevalence of previous or current infection was higher among participants who reported contact with someone known to have COVID-19 (64.2%), compared with those who did not (41.7%) (OR = 2.5; 95% CI = 1.1–5.8); prevalence was also higher among persons who reported sharing the same sleeping berth with a crewmember who had positive test results (65.6%), compared with those who did not (36.4%) (OR = 3.3; 95% CI = 1.8–6.1). Lower odds of infection were independently associated with self-report of wearing a face covering (55.8% versus 80.8%; OR = 0.3; 95% CI = 0.2–0.5), avoiding common areas (53.8% versus 67.5%; OR = 0.6; 95% CI = 0.4–0.9), and observing social distancing (54.7% versus 70.0%; OR = 0.5; 95% CI = 0.3–0.8), compared with service members who did not report these behaviors.

Discussion

In this convenience sample of young, healthy U.S. service members experiencing close contact aboard an aircraft carrier, those with previous or current SARS-CoV-2 infection experienced mild illness overall, and nearly 20% were asymptomatic. Approximately one third of participants reported fever, myalgia, and chills and had higher odds of SARS-CoV-2 infection than did persons who reported cough and shortness of breath. Participants reporting anosmia (loss of sense of smell) or ageusia (loss of sense of taste) had 10 times the odds of having infection, compared with those who did not.

A study of adolescents and young adults with mild COVID-19 illness in China found rapid propagation of chains of transmission by asymptomatic persons (*6*). Reporting symptoms of anosmia and ageusia was common, and these symptoms are recognized in other respiratory viral infections as well. Acute anosmia was reported among one in seven COVID-19 patients in a South Korean study and was perceived to be an important sign of the disease (*7*). Others concluded that new onset anosmia should be considered SARS-CoV-2 infection until proven otherwise and recommended immediate isolation and confirmatory testing in persons with this symptom (*8*). Whereas

FIGURE 1. Laboratory results among a convenience sample of U.S. service members who provided serum specimens* (N = 382) and nasopharyngeal swabs (N = 267) for SARS-CoV-2 testing — USS Theodore Roosevelt, April 2020



Abbreviations: Ab = antibody; ELISA = enzyme-linked immunosorbent assay; Inc = inconclusive; Neg = negative; Pos = positive; RT-PCR = real-time reverse transcription–polymerase chain reaction.
* Of those with positive serum ELISA tests, 59% demonstrated positive microneutralization tests.

TABLE. Comparison of U.S. Navy service members with and without previous or current SARS-CoV-2 infection (N = 382) — USS Theodore Roosevelt, April 2020

Characteristic	No. (%)		
	Current or previous SARS-CoV-2 infection* (N = 238)	No evidence of SARS-CoV-2 infection (N = 144)	Infection versus no infection OR (95% CI)†
RT-PCR and antibody results			
RT-PCR positive and ELISA positive	88 (37.0)	0	**N/A**
RT-PCR negative and ELISA positive	83 (34.9)	0	N/A
RT-PCR positive and ELISA negative	10 (4.2)	0	N/A
RT-PCR not done and ELISA positive	57 (23.9)	0	N/A
RT-PCR negative or not done and ELISA negative	0	144 (100)	N/A
Sex			
Male	190 (65.7)	99 (34.3)	1.80 (1.12–2.89)§
Female	48 (51.6)	45 (48.4)	Referent
Age group (yrs)			
18–24	77 (68.1)	36 (31.9)	Referent
25–29	50 (64.1)	28 (35.9)	0.84 (0.45–1.54)
30–39	87 (58.8)	61 (41.2)	0.67 (0.40–1.11)
40–59	24 (55.8)	19 (44.2)	0.59 (0.29–1.21)
Race/Ethnicity¶			
AI/AN or NH/PI	9 (60.0)	6 (40.0)	0.86 (0.29–2.49)
Asian	13 (61.9)	8 (38.1)	0.93 (0.37–2.33)
Black	25 (61.0)	16 (39.0)	0.89 (0.45–1.77)
Hispanic/Latino	47 (61.8)	29 (38.2)	0.92 (0.54–1.58)
Other/Unknown	2 (33.3)	4 (66.7)	0.29 (0.05–1.59)
White	142 (63.7)	81 (36.3)	Referent
History of asthma, hypertension, diabetes, or immunosuppression	15 (53.6)	13 (46.4)	0.68 (0.31, 1.47)
Reported ≥1 symptom			
Yes	194 (81.5)	90 (62.5)	2.65 (1.65–4.23)§
No	44 (18.5)	54 (37.5)	Referent
Symptoms (among those reporting ≥1 symptom)			
Symptoms (CSTE criteria)**			
Category A	97 (50.0)	36 (40.0)	3.50 (1.90–6.45)§
Category B	67 (34.5)	15 (16.7)	5.81 (2.78–12.11)§
Other symptom(s)	30 (15.5)	39 (43.3)	Referent
Individual symptoms			
Loss of taste, smell, or both	119 (61.3)	12 (13.3)	10.31 (5.26–20.21)§
Palpitations	19 (9.8)	3 (3.3)	3.15 (0.91–10.93)
Fever (documented or subjective)	89 (45.9)	21 (23.3)	2.79 (1.58–4.90)§
Chills	85 (43.8)	20 (22.2)	2.73 (1.54–4.84)§
Myalgia	109 (56.2)	30 (33.3)	2.56 (1.52–4.32)§
Cough	86 (44.3)	29 (32.2)	1.68 (0.99–2.83)
Nausea	40 (20.6)	13 (14.4)	1.54 (0.78–3.05)
Fatigue	107 (55.2)	41 (45.6)	1.47 (0.89–2.43)
Shortness of breath/difficulty breathing	46 (23.7)	17 (18.9)	1.33 (0.72–2.49)
Chest pain	40 (20.6)	15 (16.7)	1.30 (0.68–2.50)
Abdominal pain	39 (20.1)	15 (16.7)	1.26 (0.65–2.42)
Runny nose	108 (55.7)	46 (51.1)	1.20 (0.73–1.98)
Diarrhea	47 (24.2)	20 (22.2)	1.12 (0.62–2.03)
Headache	129 (66.5)	59 (65.6)	1.04 (0.62–1.77)
Vomiting	11 (5.7)	5 (5.6)	1.02 (0.34–3.03)
Sore throat	81 (41.8)	44 (48.9)	0.75 (0.45–1.24)
Sought medical care for symptoms	115 (59.3)	35 (38.9)	2.29 (1.37–3.82)§
Hospitalized	2 (1.0)	0	N/A

See table footnotes on next page.

anosmia or ageusia alone was predictive of COVID-19, absence of either of these symptoms should not be used to rule out SARS-CoV-2 infection.

Nearly two thirds of persons in this sample had positive ELISA test results, which indicate previous exposure to SARS-CoV-2. Among those who provided NP swab samples, approximately one third had positive real-time RT-PCR test results, some having recent symptom onset without evidence of having yet developed an antibody response. In another study, seroconversion among laboratory-confirmed COVID-19

TABLE. (*Continued*) Comparison of U.S. Navy service members with and without previous or current SARS-CoV-2 infection (N = 382) — USS Theodore Roosevelt, April 2020

Characteristic	No. (%)		
	Current or previous SARS-CoV-2 infection* (N = 238)	No evidence of SARS-CoV-2 infection (N = 144)	Infection versus no infection OR (95% CI)†
Number of symptoms			
1–3	51 (26.3)	49 (54.4)	Referent
4–5	37 (19.1)	13 (14.4)	2.74 (1.30–5.75)§
6–8	50 (25.8)	16 (17.8)	3.00 (1.51–5.96)§
>8	56 (28.9)	12 (13.3)	4.48 (2.15–9.37)§
Still symptomatic at time of survey (n = 275)			
Yes	65 (34.0)	24 (28.6)	1.29 (0.74–2.26)
No	126 (66.0)	60 (71.4)	Referent
Duration >1 week (n = 186)	70 (55.6)	29 (48.3)	1.34 (0.72–2.47)
Reported prevention behaviors			
Increased hand washing	218 (62.1)	133 (37.9)	0.90 (0.42–1.94)
Hand sanitizer use	219 (61.5)	137 (38.5)	0.59 (0.24–1.44)
Avoiding common areas	78 (53.8)	67 (46.2)	0.56 (0.37–0.86)§
Face covering use	158 (55.8)	125 (44.2)	0.30 (0.17–0.52)§
Increased workspace cleaning	195 (63.5)	112 (36.5)	1.30 (0.78–2.16)
Increased berthing cleaning	156 (61.9)	96 (38.1)	0.95 (0.61–1.47)
Increased distance from others	105 (54.7)	87 (45.3)	0.52 (0.34–0.79)§

Abbreviations: AI/AN = American Indian or Alaska Native; CI = confidence interval; CSTE = Council of State and Territorial Epidemiologists; ELISA = enzyme-linked immunosorbent assay; N/A = not applicable; NH/PI = Native Hawaiian or other Pacific Islander; OR = odds ratio; RT-PCR = real-time reverse transcription–polymerase chain reaction.

* Current or previous SARS-CoV-2 infection is defined as a positive RT-PCR test result or a reactive antibody result determined by testing performed at CDC laboratories on specimens collected during April 20–24, 2020.

† Odds ratios are unadjusted.

§ P-values <0.05 were considered statistically significant.

¶ White, black, Asian, AIAN/NHPI, and Other persons were non-Hispanic/Latino. Hispanic/Latino persons might be of any race.

** Category A = ≥1 of cough or shortness of breath/difficulty breathing. Category B = no cough or shortness of breath, but ≥2 of fever, chills, muscle pain, headache, sore throat, no taste or smell disorder.

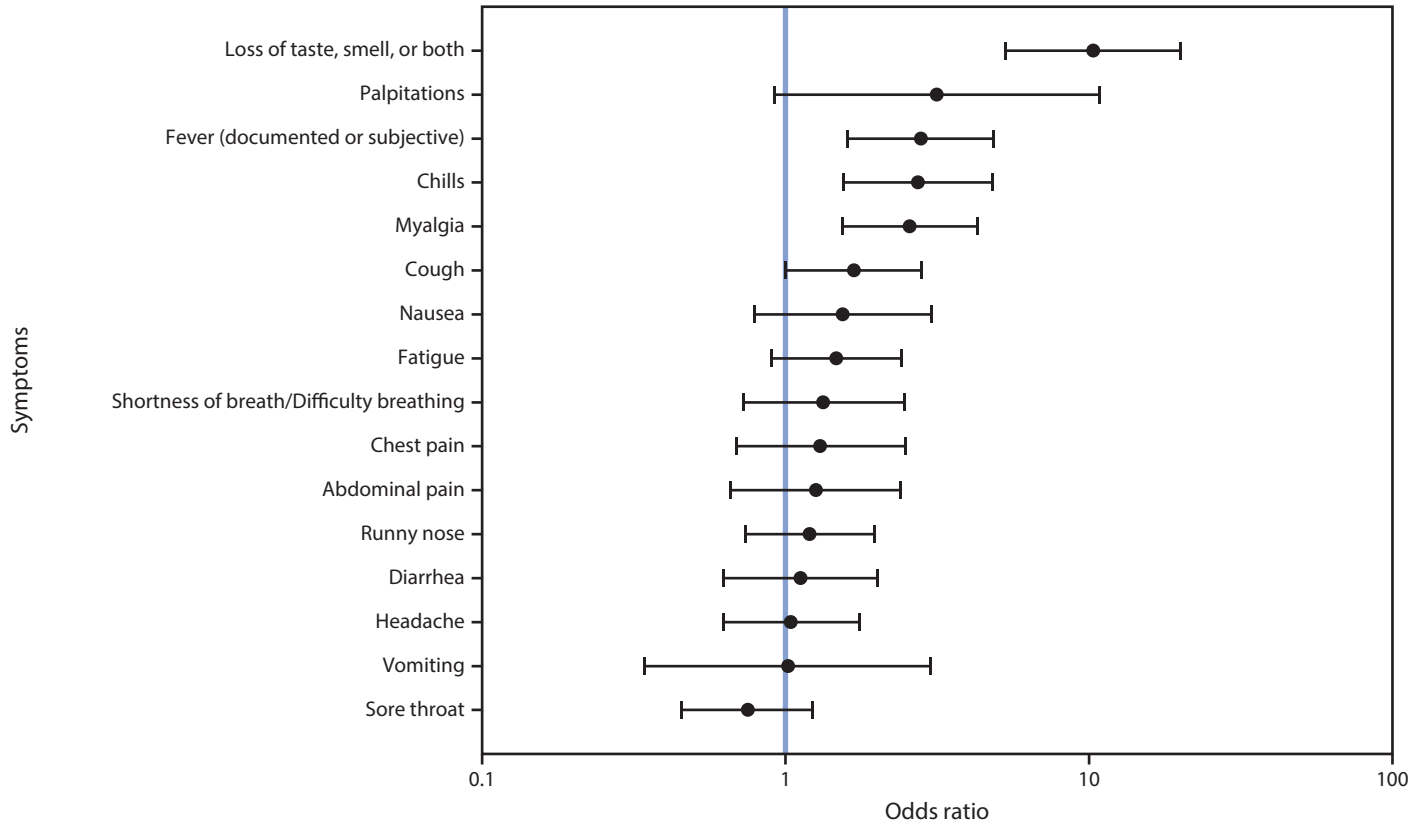
patients was observed a median of 11 days after symptom onset for total antibodies and longer for more virus-specific antibodies, including neutralizing antibodies (*9*). The results from the current study reflect the intensity of exposure experienced by these participants and the recency of the outbreak at the time of specimen collection.

The shipboard environment presents substantial challenges for reducing viral transmission because of congregate living quarters and close working environments. The significant association of infection and male sex could reflect an association with berthing, which is separated by sex aboard the ship. Protective behaviors included wearing a face covering and maintaining physical distance. Multiple cruise ship outbreaks have documented undetected transmission of SARS-CoV-2 because of mild and asymptomatic infection (*10*). In outbreak investigations of younger crew members aboard cruise vessels, transmission was associated with working on the same deck and being within the same occupational group as persons with confirmed cases (*1*).

In this sample of intensely exposed subjects, assessed at a single point in time, results demonstrated that antibodies developed and that, at the time of specimen collection, many of these were neutralizing antibodies. Affinity maturation of antibodies is an important determinant for the outcome of viral infection. High-affinity antibodies can elicit neutralization by recognizing specific proteins on the surface of the virus, and these might be produced early or late in the course of viral infection. Approximately one half of the participants with positive ELISA results also had neutralizing antibodies, which indicate functional antibodies that would be expected to inhibit SARS-CoV-2 infection. This is a promising indicator of immunity, and in several participants, neutralizing antibodies were still detectable >40 days after symptom onset. Ongoing studies assessing the humoral antibody response over time will aid the interpretation of serologic results in an outbreak investigation such as this.

The findings in this report are subject to at least four limitations. First, the analysis was conducted on a convenience sample of persons who might have had a higher likelihood of exposure, and all information was based on self-report, raising the possibility of selection and recall biases. The sex and ethnic distribution of the participants was similar to that of all service members aboard the aircraft carrier, although survey participants were slightly older and of a slightly different racial distribution; therefore, they might not be a representative sample. Second, this analysis was limited by the lack of temporal data on previous positive test results for SARS-CoV-2, which

FIGURE 2. Odds ratios and 95% confidence intervals of previous or current SARS-CoV-2 infection, by individual symptoms among service members reporting at least one symptom (n = 284) — USS Theodore Roosevelt, April 2020



complicates interpretation of the ELISA and microneutralization assays. Third, although the date of any symptom onset was collected, information on timing, duration, and severity of individual symptoms was not collected. Finally, the cross-sectional nature of these data might underestimate the eventual antibody response and neutralizing antibody activity among persons tested early in the course of their infections.

These results provide new indications of symptomatology of SARS-CoV-2 infections and serologic responses among a cohort of young U.S. adults living in a congregate environment and contribute to a better understanding of COVID-19 epidemiology in the U.S. military. The findings reinforce the importance of nonpharmaceutical interventions such as wearing a face covering, avoiding common areas, and observing social distancing to lower risk for infection in similar congregate living settings.

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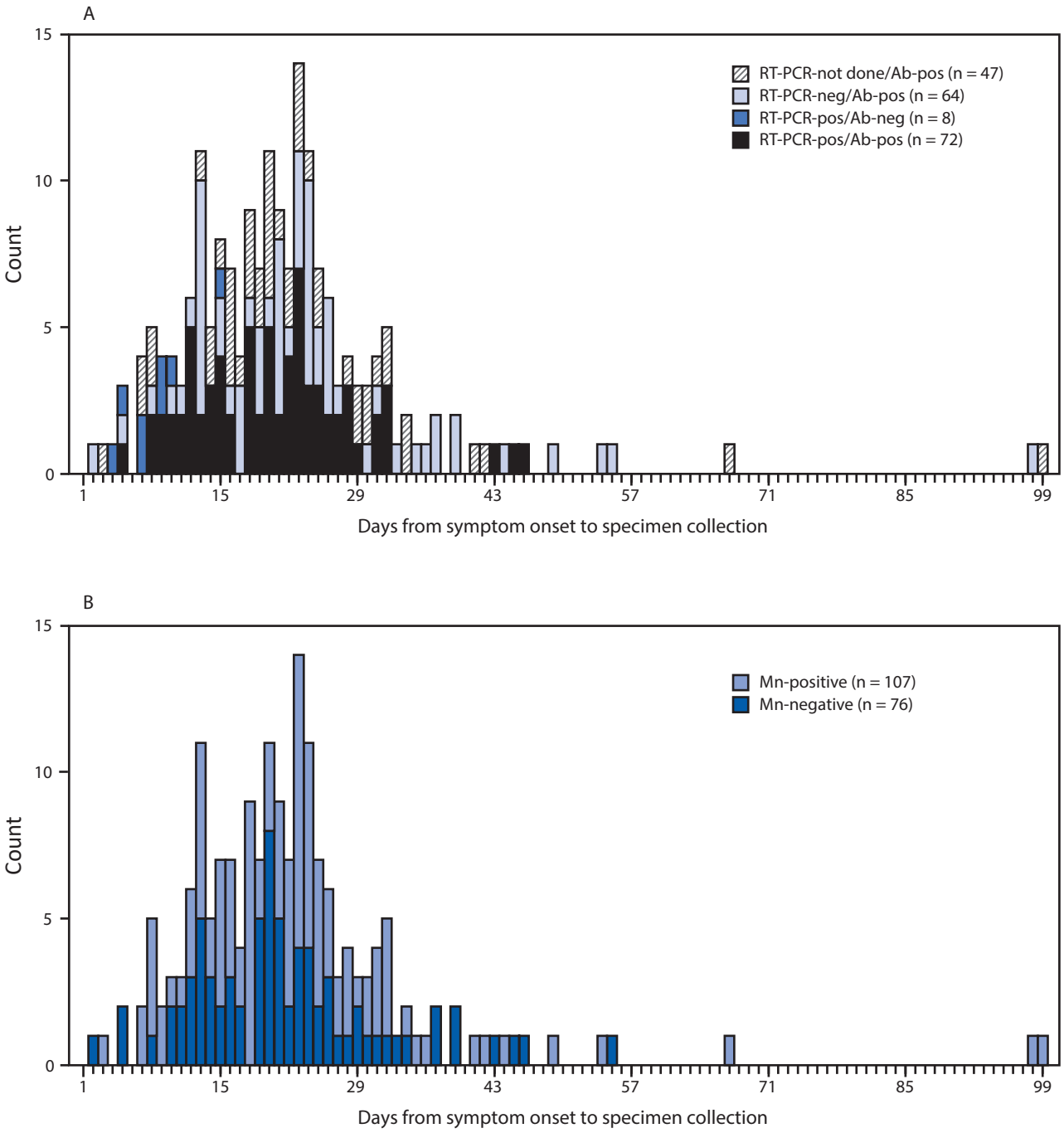
FIGURE 3. Days from symptom onset* to specimen collection (A) among a convenience sample of participants who had positive real-time reverse transcription–polymerase chain reaction (RT-PCR) or positive enzyme-linked immunosorbent assay (ELISA) test results for SARS-CoV-2 (n = 191) and (B) microneutralization results among those with positive ELISA test results (n = 183) — USS Theodore Roosevelt, April 2020



Abbreviations: Ab = pan-immunoglobulin antibody response; Mn = microneutralization test.
* Three persons who reported symptoms and had previous or current infection did not report a date of symptom onset and were not included in this figure.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Notes from the Field

Measles Outbreak on an Army Post and a Neighboring Community — El Paso, Texas, July–September 2019

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On July 3, 2019, Army Public Health (APH), located at Fort Bliss, Texas, received a report of a suspected case of measles in a woman who worked at Fort Bliss. The woman did not live on the post and had no recent reported travel. Fort Bliss, one of the largest U.S. Army posts, is located in El Paso County, Texas, which has >800,000 residents* and shares a border with Mexico and the city of Juarez, with a population of 1.4 million.† The last confirmed measles case reported in El Paso County, Texas, was in 1993, and the last outbreak occurred in 1990 (*1*). The same day, the City of El Paso Department of Public Health (CEPDPH) alerted the Texas Department of State Health Services (TDSHS) of another suspected measles case in an unvaccinated El Paso County resident, aged 3 years, who lived on Fort Bliss, also had no recent travel, and whose father was an active-duty soldier. On July 9, both cases were confirmed by reverse transcription–polymerase chain reaction testing at the TDSHS laboratory in Austin.

CEPDPH immediately issued advisories to local medical providers and began contact tracing of confirmed cases. Preexisting immunization clinics extended their hours to provide measles, mumps, and rubella (MMR) vaccine, and immune globulin was requested from TDSHS for postexposure prophylaxis for infants, pregnant women, and immunocompromised persons. TDSHS initiated daily telephone calls with CEPDPH and APH to coordinate prevention and control efforts. CEPDPH established a telephone help line to field concerns among community members, deployed an education task force throughout the county, sent letters to all local school district superintendents, and actively communicated with Mexican health officials located directly across the U.S. border. At Fort Bliss, use of military child care facilities and youth service programs were restricted to children who were up to date with MMR vaccinations§ (*2*). APH actively monitored all Fort Bliss medical facilities for new cases and held daily meetings with Fort Bliss senior leaders. TDSHS monitored a statewide syndromic surveillance system to identify persons with measles-like symptoms. At the end of July, a CDC team was invited to El Paso to provide epidemiologic support.

Four additional cases were confirmed at the TDSHS laboratory in Austin, bringing the total number of cases to six; all rash onset dates occurred during June 30–July 19. Fort Bliss–associated cases included one in a child and two in adults, neither of whom were active duty personnel. Among the six cases, three cases occurred in children aged 1–4 years, all of whom were completely unvaccinated (i.e., had not received MMR or any other vaccines); the other three were in adults. One adult patient had laboratory evidence of immunity suggesting previous vaccination; vaccination status of the other two adult patients was unknown. Genotyping by CDC and the Minnesota Vaccine Preventable Disease Reference Center revealed an identical measles strain (D8) in all six patients. A total of 91 specimens from patients with measles-compatible symptoms were tested at the TDSHS laboratory during July 3–September 3; several specimens were also tested for rubella, but no cases of rubella were diagnosed.

Interviews with all six patients or their proxies found that, approximately 2 weeks before their rash onsets, the first two patients visited the same large shopping center where it is possible that exposure to a person with undiagnosed measles could have occurred. Despite investigation into how the first two patients were infected, the primary case for this outbreak remains unidentified. Similarly, interviews with the four other patients or their proxies failed to identify any epidemiologic links. On September 3, 2019, the outbreak was declared over, after two incubation periods (total of 42 days) without occurrence of a new case.

Measles remains a risk to unvaccinated persons in the United States. Thus, although the coordinated prevention and control measures implemented by CEPDPH, APH, TDSHS, and CDC likely prevented a larger outbreak, this event served as an important reminder that persons without presumptive evidence of immunity to measles, mumps, and rubella¶ should receive MMR vaccine according to published recommendations by the Advisory Committee on Immunization Practices (*2*).

* Includes service members stationed at Fort Bliss and their families. http://www.census.gov/quickfacts/fact/table/elpasocountytexas#.

† http://data.un.org/Data.aspx?q=mexico+city&d=POP&f=tableCode%3A240%3BcountryCode%3A484.

§ Children who had received all MMR vaccine doses recommended by the Advisory Committee on Immunization Practices appropriate for their current age.

¶ Documentation of receipt of ≥1 dose of measles-containing vaccine on or after the first birthday for preschool-aged children and adults not at high risk for exposure or 2 doses for school-aged children and adults at high risk; or laboratory evidence of immunity; or laboratory confirmation of disease; or birth before 1957.

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Notes from the Field

High Prevalence of Fentanyl Detected by the Maryland Emergency Department Drug Surveillance System — Baltimore, Maryland, 2019

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The toxicology screens of many hospitals include tests for common substances of abuse, including amphetamines, barbiturates, benzodiazepines, cocaine, cannabis, phencyclidine, and opiates. These tests, often enzyme-linked immunosorbent assays (ELISAs), might be limited by cross-reactivity and false-positives and false-negatives, and might only detect a specific set of substances. In 2018, a multicenter study of Baltimore-area emergency departments (EDs) showed a decline in the percentage of intoxicated patients with positive test results for opiates. At the same time, opioid-involved overdose deaths were increasing in Baltimore (*1*), suggesting that another opioid, not heroin, was the cause (*2*). Liquid chromatography-tandem mass spectrometry (LC-MS/MS) can be used to analyze urine specimens and identify a much wider variety of substances to which a person might be exposed (*3*). Unfortunately, LC-MS/MS is difficult to implement for point-of-care testing, and it would be cost-prohibitive to test every patient. The Maryland Emergency Department Drug Surveillance (EDDS) system institutes limited LC-MS/MS testing when there are changes in patient signs and symptoms that are not explained by routine testing, suggesting that a new substance is being used. This report documents the frequent identification of fentanyl among ED patients suffering from overdoses in Baltimore, which would not have been possible without the assistance of EDDS.

Since 2016, EDDS has obtained quarterly exports of deidentified encounter data and routine urine drug screen results for patients with an *International Classification of Diseases, Tenth Revision* (ICD-10) encounter code of T40 (poisoning by, adverse effect of and underdosing of narcotics and psychodysleptics [hallucinogens]), or if one or more of the following main complaint reason codes are included: drug overdose (378), overdose, accidental (807), overdose intentional (808), HPI-toxidrome, or overdose, ingestion (301056). The EDDS sites include seven academic and community EDs located in Baltimore City and Prince George's County, Maryland.*

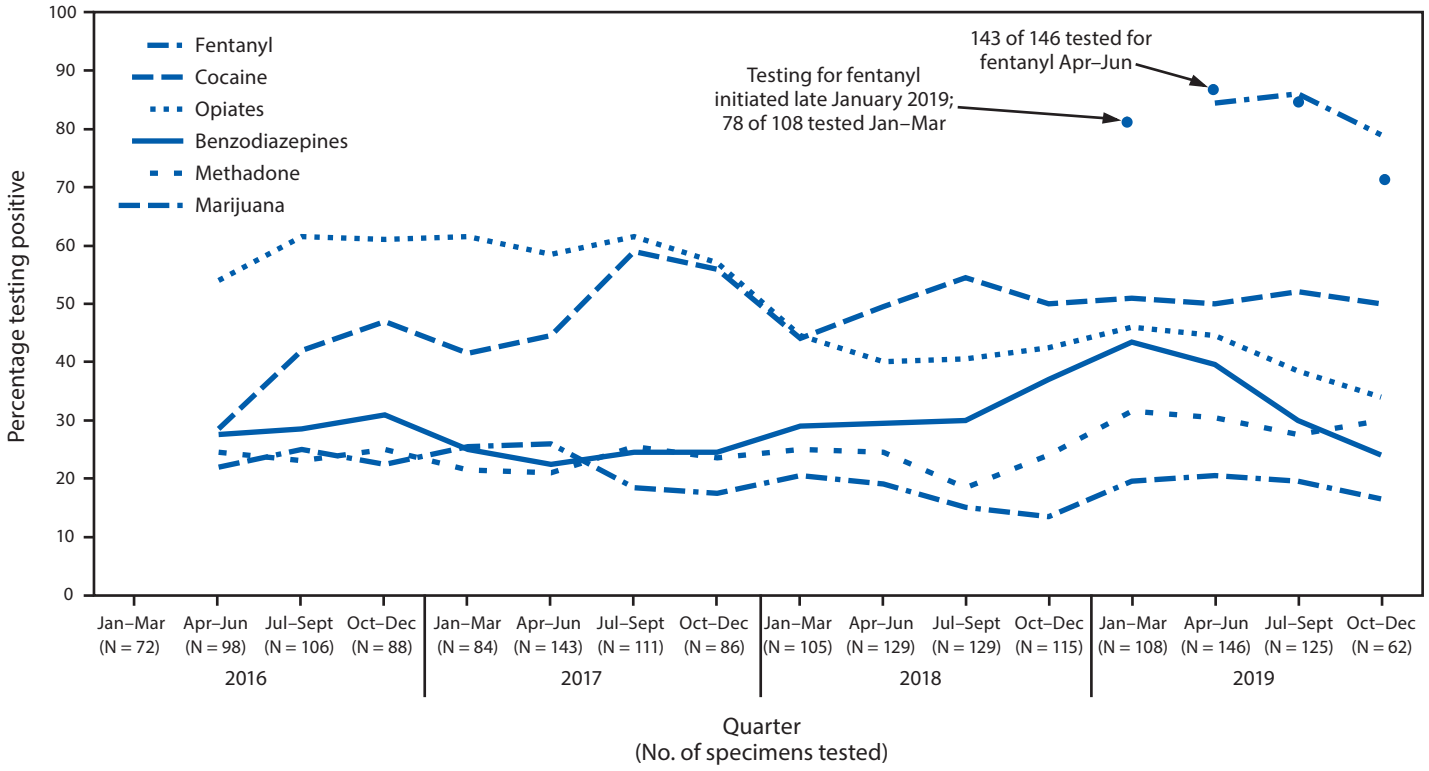
Previous pilot studies using LC-MS/MS conducted at University of Maryland, Midtown Campus (MTC), one of the EDDS hospitals, suggested an increasing prevalence of fentanyl among patients evaluated for drug overdoses. In 2016, 28% (19 of 69) of patients evaluated at the MTC ED with complaints of overdose and synthetic cannabinoid use had positive test results for fentanyl and fentanyl metabolites (*3*). During the 2017 Memorial Day weekend (May 27–29), four of eight patients treated in the MTC ED with complaints of overdose or intoxication had positive test results for fentanyl and related metabolites (*4*). A subsequent study of patients evaluated in the MTC ED with complaints of overdose or withdrawal or seeking substance use disorder treatment was conducted during February–April 2018. On-site fentanyl testing by urine rapid chromatographic immunoassay (Rapid Response, BTNX, Inc.) found that 83% of 76 patients had used fentanyl, whereas only 25% of these patients had positive test results for opiates using the hospital's opiate screen (*5*). These findings suggested that fentanyl alone, not in combination with heroin, was being used more frequently and would otherwise be undetected among patients. In late January 2019, MTC and the University of Maryland Medical Center (UMMC) initiated routine fentanyl testing for all patients who undergo urine drug testing using the Vitros 5600 Immunoanalyzer with fentanyl immunoassay reagents (ARK Diagnostics†).

Fentanyl test results were available for 408 of 441 patients with specimens submitted to EDDS by UMMC and MTC for January–December 2019. Seventy-two (18%) of the 408 patients had only an ICD-10 T40 encounter code, 236 (58%) had one or more of the listed complaint codes, and 100 (24%) had both. The MTC and UMMC results were combined because there were no substantial differences between sites in patient mean age (47.6 years versus 47.7 years), proportion male (66.9% versus 68.3%), or proportion who reported nonwhite race (78.1% versus 74.1%), respectively. During January–December 2019, 83% (340 of 408) of patients had positive test results for fentanyl, making fentanyl the most commonly detected drug during 2019. Among the 340 patients with positive test results for fentanyl, 70% were male, 81% reported nonwhite race, and the median patient age was 50 years. Consistent with previous UMCC findings, fentanyl was the most prevalent drug, detected in 73% (45 of 62) to 87% (125 of 143) of patients tested in each of the four calendar

* University of Maryland: Midtown Campus; University of Maryland Medical Center; Baltimore-Washington Medical Center; University of Maryland: Saint Joseph's Medical Center; Prince George's County Medical Center; University of Maryland Laurel Medical Center; and University of Maryland Bowie Health Center.

† https://www.ark-tdm.com/products/urine-drug-tests/fentanyl/pdfs/ARK_Fentanyl_Assay_Rev04_June_2018.pdf.

FIGURE. Percentage of substances detected in emergency department (ED) patients evaluated for drug overdoses*,† (N = 1,707) — University of Maryland Medical Centers,§ January 2016–December 2019



* Lines indicate 2-quarter moving average. Amphetamines, barbiturates, and phenylcyclohexyl piperidine (PCP) results not shown because of low occurrence.
† Numbers for benzodiazepines and methadone vary slightly because not all specimens were tested for all drugs each period.
§ University of Maryland Medical Center and Midtown Campus combined.

quarters in 2019 (Figure). The opiate screen was negative for 55% (186 of 340) of the fentanyl-positive specimens. Among all fentanyl-positive specimens, 44 (13%) were positive for fentanyl alone. Most patients with positive test results for fentanyl were exposed to multiple substances: 61% (208 of 340) of specimens contained two or more drugs or drug classes in addition to fentanyl.

The high frequency of fentanyl use found in the population, especially in those patients who tested negative for opiates, demonstrates that regular fentanyl testing addressed a gap in patient care. A hybrid approach of rapid testing for the most common substances combined with limited LC-MS/MS testing to detect emerging substances enabled researchers and hospital systems to respond to the latest trends in substance use affecting patients. Programs like EDDS, which rely on robust institutional partnerships, are a model for other areas of the country seeking to address their own changing patterns of substances use in their community. The high prevalence of fentanyl detected in this study only applies to patients in Baltimore, and the findings might not be generalized to other cities or hospitals. Immunoassays validated for fentanyl might not detect all of the clinically relevant fentanyl analogs. Hospitals should consider conducting validation studies with analytical methods such as LC-MS/MS to determine what substances are being used in their communities.

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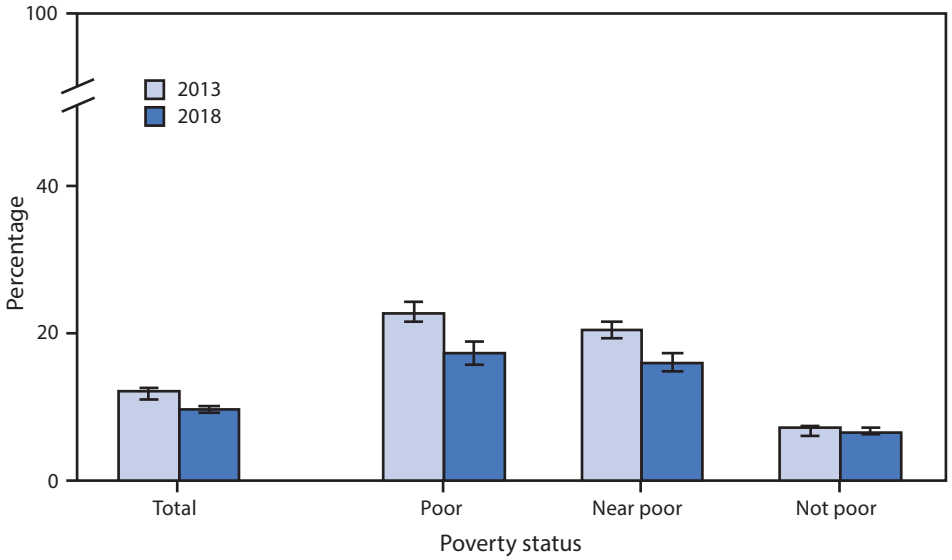
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Families That Did Not Get Needed Medical Care Because of Cost,† by Poverty Status§ — National Health Interview Survey, United States, 2013 and 2018



* With 95% confidence intervals shown by error bars.
† Household interviews of a sample of the civilian, noninstitutionalized U.S. population were conducted using the National Health Interview Survey Family component. Estimates were derived from answers to the question "During the past 12 months, was there any time when (you/someone in the family) needed medical care, but did not get it because (you/the family) couldn't afford it?"
§ Poverty status, based on family income and family size, using the U.S. Census Bureau's poverty thresholds. "Poor" families are defined as those with incomes below the poverty threshold; "near poor" families have incomes of 100% to <200% of the poverty threshold; and "not poor" families have incomes of ≥200% of the poverty threshold.

The percentage of all families that did not get needed medical care because of cost in the past 12 months decreased from 12.1% in 2013 to 9.7% 2018. From 2013 to 2018, the percentage of poor families that did not get medical care decreased (22.7% to 17.3%) as did the percentage of near-poor families (20.4% to 16.0%); no significant change occurred for not-poor families (7.1% and 6.6%). In 2013 and 2018, the percentage of families that did not get needed medical care because of cost was lowest among the not poor.

Source: National Health Interview Survey, 2013 and 2018 data. https://www.cdc.gov/nchs/nhis.htm.

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