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Hurricane Evacuation Laws in Eight Southern U.S. Coastal States — December 2018

Judy Kruger, PhD[1]; Michael J. Smith, MS[2]; Brenda Chen, MS[1]; Brandon Paetznick[1]; Belen Moran Bradley[3]; Rosa Abraha, MPH[2]; Marinda Logan, MPH[4]; Erich R. Chang, JD[5]; Gregory Sunshine, JD[5]; Sandra Romero-Steiner, PhD[6]

National Preparedness month is observed every September as a public service reminder of the importance of personal and community preparedness for all events; it coincides with the peak of the hurricane season in the United States. Severe storms and hurricanes can have long-lasting effects at all community levels. Persons who are prepared and well-informed are often better able to protect themselves and others (*1*). Major hurricanes can devastate low-lying coastal areas and cause injury and loss of life from storm surge, flooding, and high winds (*2*). State and local government entities play a significant role in preparing communities for hurricanes and by evacuating coastal communities before landfall to reduce loss of life from flooding, wind, and power outages (*3*). Laws can further improve planning and outreach for catastrophic events by ensuring explicit statutory authority over evacuations of communities at risk (*4*). State evacuation laws vary widely and might not adequately address information and communication flows to reach populations living in disaster-prone areas who are at risk. To understand the range of evacuation laws in coastal communities that historically have been affected by hurricanes, a systematic policy scan of the existing laws supporting hurricane evacuation in eight southern coastal states (Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas) was conducted. After conducting a thematic analysis, this report found that all eight states have laws to execute evacuation orders, traffic control (egress/ingress), and evacuation to shelters. However, only four of the states have laws related to community outreach, delivery of public education programs, and public notice requirements. The findings in this report suggest a need for authorities in hurricane-prone states to review how to execute evacuation policies, particularly with respect to community outreach and communication to populations at risk. Implementation of state evacuation laws and policies that support hurricane evacuation management can help affected persons avoid harm and enhance community resiliency (*5*). Newly emerging and re-emerging infectious diseases, such as SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), have and will continue to additionally challenge hurricane evacuations.

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Consistent with the principles of legal epidemiology,* evacuation laws enacted as of December 31, 2018, in southern coastal states were collected and systematically examined. State laws related to large-scale evacuation were identified using the search string SD((evacuat! Egress ((leave vacat!) /s area))) in Thomson Reuters Westlaw (Eagan, Minnesota), a subscription-based legal research service. Statutes and regulations were analyzed using an abstraction instrument with guidance from legal professionals. Each law was reviewed by two independent reviewers. Discrepancies were resolved in consultation with CDC's Public Health Law Program.

The search identified 2,150 laws; 91 of those laws (including 72 statutes and 19 regulations) specifically addressed evacuation procedures. Domain and thematic analyses of existing laws were conducted. Seven relevant domains were identified (evacuation decision-making, communications, populations at risk, responder protection, plan agreements, transportation, and shelter) that encompassed 24 related themes informed by a literature review. Abstracted laws were collapsed into 17 relevant themes for analysis and comparison between states (Table).

All eight states have laws in place regarding evacuation decision-making, responder protection, and agreements that include memoranda of understanding and plans for transportation and evacuation to shelters. Gaps were identified in three domains: 1) communications to alert the public and public outreach, 2) populations at risk (e.g., inform limited-English language or diverse populations), and 3) evacuation to shelters. Under the populations at risk domain, none of the states required alternative language use to inform those with limited English proficiency during hurricane evacuation orders. Only one state (Florida) authorized creation of a registry for persons with access and functional needs for the purposes of evacuation and sheltering. Laws in only three of the examined states (Florida, Louisiana, and Texas) included requirements to inform persons with disabilities or access and functional needs in general emergency evacuation plans.

Laws in all eight southern coastal states granted government officials authority to order large-scale evacuation in the event of a natural disaster (Figure). States differ on who has the authority to issue the evacuations orders. In Texas, for example, local jurisdictions are responsible for issuing evacuation orders, but only the governor has this authority in Florida, Georgia, and South Carolina.

Discussion

Hurricane evacuations in coastal areas can prevent illness, injury, disability, and premature death by directing the movement of persons at risk out of harm's way. Evacuation decision-making has evolved in the United States to address changing political and social environments to protect communities from anticipated hazards (*3*). Laws can further enable governments to improve planning for outreach and response to catastrophic

* https://www.cdc.gov/phlp/publications/topic/resources/legalepimodel/index.html.

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TABLE. Coverage of state evacuation laws or policies — eight southern U.S. coastal states, December 31, 2018

Domain	Themes*	Alabama	Florida	Georgia	Louisiana	Mississippi	North Carolina	South Carolina	Texas
Evacuation decision-making	Law requires an emergency operation and evacuation plan	Y	Y	Y	Y	Y	Y	Y	Y
	Law specifies who may order an evacuation	Y	Y	Y	Y	Y	Y	Y	Y
	Law specifies a trigger for ordering an evacuation	Y	Y	Y	Y	Y	Y	Y	Y
	Law requires or recommends a plan to have provisions for mandatory or voluntary evacuation	Y	Y	Y	Y	Y	Y	Y	N
Communications to alert the public and outreach education	Law requires or recommends jurisdiction to provide notice to the public	N	Y	Y	Y	Y	N	Y	N
	Law requires or recommends jurisdiction to provide educational programs related to compliance with evacuation	Y	Y	Y	N	Y	N	N	Y
Populations at risk (e.g., inform limited English or diverse populations)	Law requires or recommends informing diverse racial/ethnic and limited English-speaking populations of evacuation plans	N	Y	N	N	N	N	N	Y
	Law requires or recommends informing diverse racial/ethnic and limited English-speaking populations of an order to evacuate	N	N	N	N	N	N	N	N
	Law requires or recommends informing persons with access and functional needs of evacuation plans	N	Y	N	Y	N	N	N	Y
	Law requires or recommends informing persons with disability or access and functional needs of an order to evacuate	N	Y	N	Y	N	N	N	N
	Law requires or recommends creation of a persons with disability or access and functional needs registry for evacuation and sheltering	N	Y	N	N	N	N	N	N
Responder protection	Law includes language related to the protection of first responders who carry out evacuation orders	Y	Y	Y	Y	Y	Y	Y	Y
Plan agreements	Law requires or recommends use of memoranda of understanding or supplemental agreements for evacuation planning	Y	Y	Y	Y	Y	Y	Y	Y
	Law requires or recommends use of memoranda of understanding or supplemental agreements for carrying out evacuation	Y	Y	Y	Y	Y	Y	Y	Y
Transportation	Law requires or recommends traffic control or egress/ingress to support civil evacuation movement as a public safety measure on highways or streets	Y	Y	Y	Y	Y	Y	Y	Y
Evacuation to shelters	Law requires or recommends jurisdictional support for evacuation shelter efforts	Y	Y	Y	Y	Y	Y	Y	Y
	Law requires or recommends jurisdictional support for shelter-in-place	N	Y	N	Y	N	N	N	N

Abbreviations: N = no; Y = yes.

* As reflected in established laws or policies. Additional themes not shown in the table include laws that specify details of who may order an evacuation; the response trigger; whether the evacuation was mandatory, voluntary, or partial; delivery types of public notice warnings and alerts; delivery of information to inform disproportionately affected populations; the disproportionately affected populations to inform; and evacuation and protection of first responders.

events by specifying when and where to call for evacuations, and how to execute evacuations. Planning for hurricanes can be enhanced by providing statutory citations to communities likely to be disproportionately affected by the event when issuing evacuation orders (*4*). State officials receive hurricane awareness notifications approximately 120 hours before onset of a potential disaster event. Large-scale evacuations for natural disasters usually involve modification of major transportation routes (e.g., roadways and highways to allow rapid and orderly egress) (*6*). Evacuation plans typically commence within 72 hours before landfall; it is crucial that persons are alerted so they can safely evacuate (*6*).

Hurricane Katrina, a large Category 5 hurricane in August 2005, was one of the costliest disasters affecting the Gulf Coast, resulting in 986 deaths from drowning, injury, and trauma, and deaths among persons with chronic health conditions (*7*). Hurricane Harvey, a 2017 Category 4 hurricane, resulted in 171 deaths, including some from electrocution, car accidents, and lack of medical services (*7*). Protective actions, such as evacuation, can help keep persons alive, safe, and healthy. Lessons learned from evacuation events with poor outcomes can be used to amend and improve evacuation plans and implement relevant laws (*5*).

State laws are established to minimize the number of persons harmed during disasters and to protect those at high risk for injury and death (*8*). State governments can enact evacuation laws to protect their citizens, but successful implementation of these policies requires that state leadership effectively communicate evacuation orders and procedures to all persons in an affected area so that those persons can take action.[†] The Association of State and Territorial Health Officials urges state government agencies to analyze their preparedness strategies on an ongoing basis (*8*). Risk perceptions, community resources, and physical ability all influence evacuation decision-making; and persons most at risk might be reluctant to evacuate (*9*).

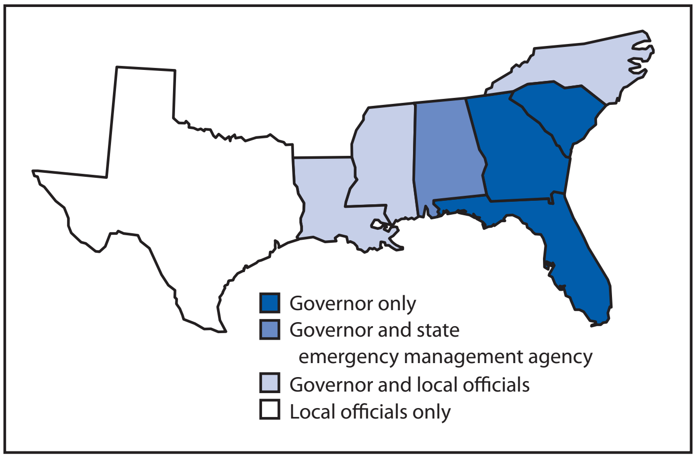
This report identified policy gaps, specifically in communications to alert the public and outreach education, outreach to those populations at risk because of limited English proficiency or functional and access needs, and evacuation to shelters and shelter-in-place policies. Implementation of strategies to mitigate the effect of hurricanes in coastal states through appropriate protective actions that include addressing informational needs of the whole community can minimize harm (*1*). Policies that include guidance on communication strategies for providing information to the whole community could address the identified gaps.[§]

The findings in this report are subject to at least three limitations. First, the findings do not include local ordinances or facility-specific evacuation laws, which might provide additional insight into particular evacuation powers. Second, federal mandates, which might affect legal requirements applicable to state evacuation planning, were not considered. Finally, laws by themselves are not sufficient to achieve community preparedness. Additional research is needed to understand the impact of evacuations in response to natural disasters.

[†] Additional information on personal preparedness is available at https://www.cdc.gov/prepyourhealth, https://www.cdc.gov/cpr/readiness/hurricane_messages.htm and #PrepYourHealth on Twitter.

[§] Guidance and resources for dealing with natural disasters and severe weather is available from CDC, in multiple languages and for specific groups, at https://www.cdc.gov/disasters/index.html.

FIGURE. Government agencies granted legal authority to order large-scale evacuation during natural disasters — eight southern U.S. coastal states, December 31, 2018



States can be better prepared by providing more information about transportation routes, shelter locations, and planning for shelter supplies (e.g., adequate medications and food for persons with special needs, durable medical equipment, and generators) to address unexpected situations such as power outages lasting longer than 2 weeks (*9*). Policymakers preparing for hurricane season might develop stay-at-home policies as well as evacuation orders (*8*). Delays in recovery efforts can occur if coastal communities do not alert all persons (e.g., those aged ≥65 years, those with access and functional needs or other disabilities, and tourists). State officials should consider providing consistent messages for all media (print, radio, social media, and television) and transmitting public health messages about impending hurricanes in multiple languages and through multiple communication channels (*9*).

State officials need to analyze their strategies for evacuation policies so that they address the safety and well-being of the whole community. The most difficult part of response and recovery planning is to consider the ever-changing events that might occur during hurricane season and envision scenarios to keep the population safe. In 2020, for example, hurricane season is occurring during the COVID-19 pandemic, which might complicate evacuations and recovery. Expanded communication efforts are needed for outreach to populations at risk, residents of senior centers, and persons with disabilities (*10*). Communication plans need to support evacuation orders to address the spread of COVID-19 in shelters. Governments have issued many types of declarations for hurricane evacuations and are adapting evacuation policies to address the needs of populations at risk, who are disproportionally affected by hurricanes and infectious diseases. Clear and consistent messaging on who should evacuate and how to practice social

Summary

What is already known about this topic?

Hurricane evacuations can prevent illness, injury, disability, and death. Policies are established to minimize the number of persons harmed and to protect those at high risk.

What is added by this report?

Analysis of evacuation policies in eight southern U.S. coastal states found that all have laws to execute evacuation orders. However, only four have laws that require informing racially and ethnically diverse populations and persons with disabilities and functional needs of emergency evacuation plans.

What are the implications for public health practice?

Evacuation laws that include communicating evacuation procedure policies for the whole community, including populations with limited English language proficiency, might help protect communities from unnecessary hurricane-related morbidity and mortality.

distancing at shelters while under evacuation orders might prevent potential confusion and conflict with COVID-related stay-at-home orders (*10*). In an era of frequent major storms and emerging threats, laws providing the necessary authority to order an evacuation in coastal states can also serve to promote equitable planning, outreach, education, and dissemination of evacuation orders.

Corresponding author: Judy Kruger, JKruger@cdc.gov.

[1]Division of State and Local Readiness, Center for Preparedness and Response, CDC; [2]Office of the Director, Center for Preparedness and Response, CDC; [3]Office of the Associate Director for Communication, Center for Global Health, CDC; [4]Office of Science, CDC; [5]Public Health Law Program, Center for State, Tribal, Local and Territorial Support, CDC; [6]Office of Science and Public Health Practice, Center for Preparedness and Response, CDC.

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Frequent Mental Distress Among Adults, by Disability Status, Disability Type, and Selected Characteristics — United States, 2018

Robyn A. Cree, PhD[1]; Catherine A. Okoro, PhD[1]; Matthew M. Zack, MD[2]; Eric Carbone, PhD[1]

Frequent mental distress, defined as 14 or more self-reported mentally unhealthy days in the past 30 days,* is associated with adverse health behaviors, increased use of health services, mental disorders (e.g., diagnosis of major depressive disorder), chronic diseases, and functional limitations (*1*). Adults with disabilities more often report depression and anxiety (*2*), reduced health care access (*3*), and health-related risk behaviors (*4*) than do adults without disabilities. CDC analyzed 2018 Behavioral Risk Factor Surveillance System (BRFSS) data to compare the prevalence of frequent mental distress among adults with disabilities with that among adults without disabilities and to identify factors associated with mental distress among those with disabilities. Nationwide, an estimated 17.4 million adults with disabilities reported frequent mental distress; the prevalence of reported mental distress among those with disabilities (32.9%) was 4.6 times that of those without disabilities (7.2%). Among adults with disabilities, those with both cognitive and mobility disabilities most frequently reported mental distress (55.6%). Adults with disabilities who reported adverse health-related characteristics (e.g., cigarette smoking, physical inactivity, insufficient sleep, obesity, or depressive disorders) or an unmet health care need because of cost also reported experiencing more mental distress than did those with disabilities who did not have these characteristics. Adults living below the federal poverty level reported mental distress 70% more often than did adults in higher income households. Among states, age-adjusted prevalence of mental distress among adults with disabilities ranged from 25.2% (Alaska) to 42.9% (New Hampshire). Understanding the prevalence of mental distress among adults with disabilities could help health care providers, public health professionals, and policy makers target interventions and inform programs and policies to ensure receipt of mental health screening, care, and support services to reduce mental distress among adults with disabilities.

BRFSS is an annual, landline and cellular telephone–based self-reported survey of noninstitutionalized U.S. adults aged ≥18 years.† In 2018, the BRFSS unweighted sample size was 430,949. The combined (landline and cellular telephone) median response rate among the 50 states and the District of Columbia in 2018 was 49.9% (range = 38.8%–67.2%).§ Adults were considered to have a disability if they reported having one or more of six disability types: hearing, vision, cognition, mobility, self-care, or independent living.¶,** Mutually exclusive disability categories were created for each disability type and for adults reporting more than one disability. The latter were further categorized into four groups, based on cognition or mobility, two of the most prevalent disability types: cognition-only, mobility-only, both, or neither. Adults were considered to have frequent mental distress if they reported 14 or more days in response to the question "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?"

CDC compared the prevalence of mental distress among adults with and without disabilities by disability type and selected demographic characteristics that included sex, age, race/ethnicity, veteran status, marital status, employment status, sexual identity,†† federal poverty level, and urban/rural designation.§§ CDC calculated age-standardized¶¶ prevalences, 95% confidence intervals, and age-adjusted*** prevalence ratios (PRs) to compare mental distress among adults with disabilities with that among those without disabilities. Among adults with disabilities, CDC compared age-standardized

* https://www.cdc.gov/hrqol/pdfs/mhd.pdf.

† https://www.cdc.gov/brfss/.

§ https://www.cdc.gov/brfss/annual_data/2018/pdf/2018-sdqr-508.pdf.

¶ Based on Section 4302 of the Affordable Care Act, the U.S. Department of Health and Human Services issued data collection standard guidance to include a standard set of disability identifiers in all national population health surveys. https://aspe.hhs.gov/datacncl/standards/aca/4302/index.pdf.

** The interviewer first reads a preamble to the telephone survey respondent ("The following questions are about health problems or impairments you may have. Some adults who are deaf or have serious difficulty hearing may or may not use equipment to communicate by phone."), followed by the six specific disability type questions. The six questions are "Are you deaf or do you have serious difficulty hearing?" (hearing); "Are you blind or do you have serious difficulty seeing, even when wearing glasses?" (vision); "Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?" (cognition); "Do you have serious difficulty walking or climbing stairs?" (mobility); "Do you have difficulty dressing or bathing?" (self-care); and "Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?" (independent living).

†† Optional module asked in 29 states: Arizona, Connecticut, Delaware, Florida, Hawaii, Idaho, Illinois, Kansas, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Montana, Nevada, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

§§ Urban/rural designation based on 2013 Urban-Rural Classification Scheme for Counties. https://www.cdc.gov/nchs/data_access/urban_rural.htm.

¶¶ Based on the population breakdown for the following age groups according to the 2000 U.S. Census: 18–44, 45–64, and ≥65 years. https://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

*** Models estimating PRs are adjusted for age (18–44, 45–64, and ≥65 years).

prevalences of mental distress by disability type and health-related characteristics, including health care access,[†††] health-related behaviors,[§§§] obesity,[¶¶¶] and a diagnosed depressive disorder.[****] Age-standardized prevalence estimates and age-adjusted PRs of mental distress were calculated among adults with disabilities by state of residence. Missing responses to questions about disability and mental distress were excluded from analyses, resulting in a total unweighted analytic sample size of 404,973. For all comparisons, statistical significance at a level of $\alpha = 0.05$ was determined using a two-sided t-test in SAS-callable SUDAAN (version 11.0.1; RTI International).

Overall, 26.2% of U.S. adults who responded to questions about disability and mental distress reported having a disability. Nearly one third of adults with disabilities (32.9%) reported experiencing frequent mental distress, compared with 7.2% of adults without disabilities (PR = 4.6) (Table 1). Frequent mental distress was reported by 55.6% of those with disability in both mobility and cognition, 8.8 times that reported among those without disabilities. Demographic differences in PRs of mental distress were generally similar among adults with and without disabilities, except for veteran and employment status. Mental distress was more commonly reported among females and persons who were unmarried; unemployed; identified as lesbian or gay, bisexual, or something else; and lived in lower-income households compared with males and those who were married, employed, identified as straight or not gay, and lived in higher-income households. Persons identifying as non-Hispanic Asian, Hispanic, and middle-aged or older reported mental distress less often than did those who identified as non-Hispanic white, and who were younger. Among adults without disabilities, both veterans and retirees were 20% less likely to report mental distress than were nonveterans and adults who were employed; no differences were found by veteran and employment status for adults with disabilities.

Among adults with disabilities, those who reported adverse health-related behaviors or conditions (i.e., cigarette smoking, insufficient sleep, physical inactivity, obesity, and diagnosed depressive disorder) or an unmet health care need because of cost more often had frequent mental distress than did those without these characteristics (Table 2). In general, patterns were similar across disability types. All health-related factors were associated with mental distress for adults without disabilities (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/92748). Among adults with disabilities, the highest prevalences of frequent mental distress were in New Hampshire (42.9%), South Carolina (39.2%), and Maine (38.7%); the median prevalence (32.5%) was in Louisiana; and the lowest prevalences were in Alaska (25.2%), Hawaii (26.7%), and Illinois (26.9%) (Figure) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/92748). Adults with disabilities in Minnesota, Kansas, Georgia, Iowa, and Delaware were 5.4–5.7 times more likely to report frequent mental distress than were adults without disabilities, whereas in Illinois and West Virginia, the PRs were 3.5 and 3.6, respectively (Figure) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/92748).

Discussion

In 2018, an estimated 17.4 million U.S. adults with disabilities reported frequent mental distress across a range of demographic characteristics (including poverty and marital status), 4.6 times as often than did adults without disabilities. Having a diagnosed depressive disorder was associated with experiencing frequent mental distress, with approximately one half of adults with disabilities and a diagnosed depressive disorder reporting distress. One in six adults with disabilities who did not have a diagnosed depressive disorder reported frequent mental distress, possibly representing adults with undiagnosed mental disorders. Health care providers caring for adults with disabilities might focus on the primary disability but miss opportunities to identify and treat co-occurring mental health conditions (*5*). Furthermore, symptoms associated with some physical disabilities and chronic conditions, as well as overall level of functional impairment, might be exacerbated

[†††] Health insurance coverage was ascertained by a "yes" response to the question "Do you have any kind of health care coverage, including health insurance, prepaid plans such as health maintenance organizations, government plans such as Medicare, or Indian Health Service?" Having a usual health care provider was assessed first with the question "Do you have one person you think of as your personal doctor or health care provider?" Adults who responded "no" were asked the question "Is there more than one, or is there no person who you think of as your personal doctor or health care provider?" Responses for having a usual health care provider were dichotomized into one or more and none. Unmet health care need because of cost was ascertained by a "yes" response to the question "Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?" Receipt of a routine check-up was assessed with the question "About how long has it been since you last visited a doctor for a routine checkup? A routine checkup is a general physical exam, not an exam for a specific injury, illness, or condition." Responses for having had a routine checkup within the preceding 12 months were dichotomized into within the past year or not within the past year.

[§§§] Binge drinking was based on a response of one or more to the question "Considering all types of alcoholic beverages, how many times during the past 30 days did you have 5 or more drinks for men or 4 or more drinks for women on an occasion?" Cigarette smoking status was determined by a response of "Every day" or "Some days" to the question "Do you now smoke cigarettes every day, some days, or not at all?" Physical inactivity was ascertained by a response of "no" to the question "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" Insufficient sleep was defined as getting less than 7 hours of sleep in response to the question "On average, how many hours of sleep do you get in a 24-hour period?"

[¶¶¶] Obesity was defined as body mass index ≥ 30.0 kg/m^2.

[****] Diagnosed depressive disorder was ascertained by a "yes" to having a depressive disorder (including depression, major depression, dysthymia, and minor depression) in response the question "Has a doctor, nurse, or other health professional ever told you that you have any of the following?"

TABLE 1. Age-adjusted prevalence of frequent mental distress, by disability status and types,* and prevalence ratios, by selected demographic characteristics — Behavioral Risk Factor Surveillance System, United States, 2018

Characteristic	Adults with a disability (n = 119,196) % (95% CI)†	PR (95% CI)§	Adults without a disability (n = 285,777) % (95% CI)†	PR (95% CI)§
Overall¶	**32.9 (32.2–33.6)**	**4.6 (4.5–4.8)**	**7.2 (7.0–7.4)**	**—**
Disability type and number of disabilities (1 versus >1)¶				
1 disability type (no.)**				
Total (n = 67,116)	23.9 (23.1–24.8)	3.2 (3.0–3.3)	—	—
Cognition only (14,776)	35.7 (34.2–37.1)	4.8 (4.6–5.1)	—	—
Independent living only (2,739)	31.6 (28.2–35.1)	4.5 (4.0–5.0)	—	—
Mobility only (25,612)	17.3 (15.5–19.3)	2.4 (2.2–2.7)	—	—
Self-care only (652)	12.6 (7.9–19.4)	1.9 (1.2–2.9)	—	—
Vision only (5,994)	11.6 (10.0–13.4)	1.6 (1.4–1.9)	—	—
Hearing only (17,343)	11.4 (9.1–14.1)	1.4 (1.2–1,6)	—	—
>1 disability type (no.)**				
Total (n = 52,080)	45.6 (44.4–46.7)	6.5 (6.3–6.8)	—	—
Mobility and cognition (18,563)	55.6 (53.8–57.5)	8.8 (8.4–9.1)	—	—
Cognition without mobility (8,389)	51.6 (49.6–53.7)	7.1 (6.8–7.5)	—	—
Mobility without cognition (21,999)	26.0 (23.6–28.5)	4.1 (3.8–4.4)	—	—
Neither cognition nor mobility (3,129)	22.5 (18.5–27.1)	3.0 (2.5–3.5)	—	—
Demographic characteristic				
Sex				
Male	28.0 (27.0–29.0)	Reference	6.0 (5.7–6.3)	Reference
Female	37.0 (36.1–38.0)	1.3 (1.2–1.3)	8.4 (8.1–8.7)	1.4 (1.3–1.5)
Age group, yrs††				
18–44	40.4 (39.2–41.6)	Reference	9.4 (9.0–9.7)	Reference
45–64	30.6 (29.8–31.5)	0.8 (0.7–0.8)	5.5 (5.2–5.8)	0.6 (0.6–0.6)
≥65	13.5 (12.8–14.1)	0.3 (0.3–0.4)	3.5 (3.2–3.8)	0.4 (0.3–0.4)
Race/Ethnicity				
White, non-Hispanic	36.5 (35.6–37.3)	Reference	7.7 (7.5–7.9)	Reference
Black, non-Hispanic	30.8 (28.8–32.8)	0.9 (0.8–1.0)	7.3 (6.8–8.0)	1.0 (0.9–1.0)
Asian, non-Hispanic	23.4 (19.0–28.4)	0.6 (0.5–0.8)	4.8 (3.9–6.0)	0.6 (0.5–0.7)
AI/AN, non-Hispanic	34.1 (29.8–38.6)	1.0 (0.9–1.2)	8.4 (6.6–10.7)	1.1 (0.8–1.4)
Hispanic	25.7 (23.9–27.5)	0.7 (0.7–0.8)	6.5 (5.9–7.2)	0.8 (0.7–0.9)
Other race/Multiracial	40.5 (37.5–43.6)	1.1 (1.1–1.2)	8.6 (7.6–9.6)	1.1 (1.0–1.2)
Veteran status				
Yes	34.8 (32.3–37.4)	1.0 (0.9–1.0)	6.1 (5.4–6.8)	0.8 (0.7–0.9)
No	32.8 (32.1–33.5)	Reference	7.3 (7.1–7.5)	Reference
Marital status				
Married/Unmarried couple	28.5 (27.4–29.5)	Reference	5.8 (5.5–6.0)	Reference
Divorced/Separated	39.0 (37.1–41.0)	1.5 (1.4–1.5)	9.0 (8.3–9.7)	1.6 (1.4–1.7)
Widowed	39.2 (33.8–44.9)	1.3 (1.2–1.4)	12.2 (8.8–16.6)	1.9 (1.6–2.1)
Never married	34.9 (33.6–36.2)	1.2 (1.2–1.3)	9.2 (8.6–9.7)	1.6 (1.5–1.7)

See table footnotes on the next page.

by mental distress and might improve with mental health treatment (*6*). To ensure recommended clinical management and referral, providers could consider screening their clients for mental health symptoms, even if mental health concerns are unrelated to the primary condition for which adults are being seen. To promote overall well-being, health care providers and public health professionals can also focus on promoting healthy lifestyles, such as maintaining a healthy weight, meeting physical activity recommendations, quitting smoking, and getting sufficient sleep,[††††] given that these findings indicate unhealthy lifestyles are associated with mental distress.

In one 6-year longitudinal study, increases in social support were associated with decreases in depressive symptoms among adults with physical disabilities (*7*). Adults with disabilities might have fewer opportunities for high-quality social engagement because of physical limitations (*8*) or reduced ability to communicate (*9*), placing them at increased risk for experiencing mental distress. The findings of reduced mental distress among adults with disabilities who are married and employed, two factors known to correlate with social ties and support (*10*), suggest that programs aimed at increasing social connectedness might help reduce the large disparity in mental distress between adults with and without disabilities.

†††† Defined as ≥7 hours in a 24-hour period. https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html.

TABLE 1. (*Continued*) Age-adjusted prevalence of frequent mental distress, by disability status and types,* and prevalence ratios, by selected demographic characteristics — Behavioral Risk Factor Surveillance System, United States, 2018

Characteristic	Adults with a disability (n = 119,196) % (95% CI)†	PR (95% CI)§	Adults without a disability (n = 285,777) % (95% CI)†	PR (95% CI)§
Employment status				
Employed	26.6 (25.7–27.6)	Reference	6.7 (6.5–7.0)	Reference
Unemployed	40.8 (38.1–43.6)	1.5 (1.4–1.6)	10.8 (9.7–12.1)	1.5 (1.4–1.7)
Homemaker or student	30.3 (28.2–32.5)	1.2 (1.1–1.2)	8.3 (7.7–9.0)	1.2 (1.1–1.3)
Retired	31.2 (24.8–38.4)	1.0 (0.9–1.1)	3.4 (2.3–5.1)	0.8 (0.7–0.9)
Unable to work	45.0 (43.3–46.6)	1.8 (1.7–1.9)	16.9 (13.7–20.5)	2.6 (2.2–3.0)
Sexual identity§§				
Straight (not gay)	31.0 (30.0–32.1)	Reference	6.9 (6.6–7.2)	Reference
Lesbian or gay	41.6 (36.3–47.2)	1.3 (1.2–1.5)	10.9 (8.5–13.9)	1.6 (1.2–2.1)
Bisexual	48.2 (43.8–52.6)	1.6 (1.5–1.8)	13.9 (12.1–15.8)	2.2 (1.9–2.5)
Something else	43.1 (37.0–49.4)	1.4 (1.2–1.6)	13.7 (10.4–17.9)	2.0 (1.5–2.6)
Federal poverty level, % above or below				
≥400% (higher income)	25.6 (23.8–27.4)	Reference	5.6 (5.3–5.9)	Reference
200% to <400%	28.9 (27.2–30.6)	1.2 (1.1–1.3)	7.9 (7.4–8.4)	1.4 (1.3–1.5)
100% to <200%	36.3 (34.9–37.8)	1.6 (1.5–1.7)	9.0 (8.5–9.6)	1.6 (1.5–1.8)
<100% (lower income)	38.6 (37.1–40.1)	1.7 (1.5–1.8)	10.2 (9.3–11.1)	1.7 (1.6–1.9)
Unknown	31.5 (29.9–33.2)	1.3 (1.2–1.4)	6.7 (6.2–7.2)	1.2 (1.1–1.3)
Urban/Rural designation¶¶				
Large central metro	30.0 (28.5–31.6)	Reference	7.1 (6.6–7.5)	Reference
Large fringe metro	33.5 (31.9–35.1)	1.1 (1.0–1.2)	6.8 (6.4–7.2)	1.0 (0.9–1.1)
Small/Medium metro	34.4 (33.3–35.6)	1.1 (1.1–1.2)	7.6 (7.3–7.9)	1.1 (1.0–1.2)
Nonmetropolitan	34.0 (32.7–35.3)	1.1 (1.1–1.2)	7.5 (7.0–8.0)	1.1 (1.0–1.2)

Abbreviations: AI/AN = American Indian/Alaska Native; CI = confidence interval; PR = prevalence ratio.
* Adults were considered to have a disability if they reported having one or more of the following six disability types: hearing, vision, cognition, mobility, self-care, or independent living. Mutually exclusive disability categories were created for each of the six disability types and for persons reporting >1 disability. Respondents reporting >1 disability were further categorized into four groups, based on whether they reported the most commonly reported disability types, cognition or mobility (cognition-only, mobility-only, both, or neither).
† Percentages are weighted and standardized based on the population breakdown for the following age groups according to the 2000 U.S. Census: 18–44, 45–64, and ≥65 years. https://www.cdc.gov/nchs/data/statnt/statnt20.pdf.
§ Models estimating PRs are adjusted for age group (18–44, 45–64, and ≥65 years).
¶ No disability is the reference category for overall and PRs for disability types. PRs for the overall and disability type categories were generated from three models using three categorizations of disability: two-level categorization (any disability, no disability); 8-level categorization (cognition only, independent living only, mobility only, self-care only, vision only, and hearing only, >1 disability, no disability); and 6-level categorization (mobility + cognition, cognition no mobility, mobility no cognition, neither cognition or mobility, 1 disability, no disability).
** Unweighted sample size.
†† Percentages and PRs are not standardized or adjusted.
§§ Optional module asked in 29 states: Arizona, Connecticut, Delaware, Florida, Hawaii, Idaho, Illinois, Kansas, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Montana, Nevada, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin.
¶¶ Urban/rural designations based on 2013 Urban-Rural Classification Scheme for Counties. https://www.cdc.gov/nchs/data_access/urban_rural.htm.

Because health care access concerns are prevalent among adults with disabilities (*3*), the finding that adults with a cost-related unmet health care need during the past 12 months more often reported mental distress is particularly concerning. Policies, such as the Affordable Care Act, put into place to improve health care access among adults with disabilities (particularly those living in lower-income households) might help address disparities in mental distress.

The findings in this report are subject to at least four limitations. First, causality cannot be inferred from data in this cross-sectional survey; disability or adverse health-related behaviors might cause mental distress, and such distress might worsen disability or increase risk. Second, social desirability bias can result in underreporting of mental health symptoms in survey data. Third, prevalence of mental distress might be underestimated if adults with severe functional and cognitive disabilities (with potentially higher distress) are underrepresented in BRFSS data. Finally, disability categories captured in BRFSS are broad, and the primary disabling condition was unknown. Considering that 4.6% of the noninstitutionalized U.S. population had a serious mental illness in 2018,§§§§ diagnosed mental disorders not assessed in BRFSS might explain in part the high prevalence of frequent mental distress among adults reporting cognitive disabilities.

This report highlights disparities in prevalence of frequent mental distress by disability status, disability type, and several

§§§§ https://www.samhsa.gov/data/report/2018-nsduh-detailed-tables.

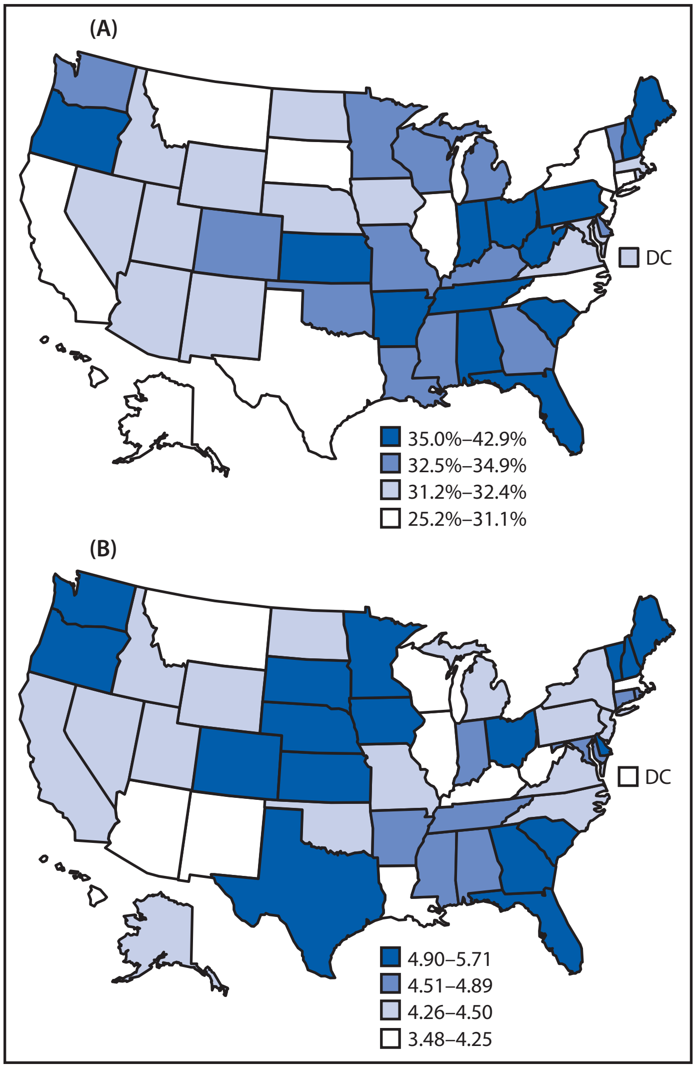
TABLE 2. Age-adjusted prevalence of frequent mental distress, by disability type,* and selected health-related characteristics among adults with disabilities — Behavioral Risk Factor Surveillance System, United States, 2018

Characteristic	Disability % (95% CI)†								
	Cognition only (n = 14,776)	Independent living only (n = 2,739)	Mobility only (n = 25,612)	Self-care only (n = 652)	Vision only (n = 5,994)	Hearing only (n = 17,343)	>1 disability type (n = 52,080)	All (n = 119,196)	P-value§
Health care factor									
Health insurance coverage									
Yes	36.4 (34.8–38.0)	31.6 (28.0–35.4)	17.1 (15.1–19.3)	13.8 (9.1–20.4)	11.7 (9.8–13.9)	10.6 (8.2–13.8)	45.6 (44.3–46.9)	33.1 (32.3–33.8)	0.9
No	31.0 (27.8–34.4)	28.4 (21.4–36.7)	18.1 (14.0–23.1)	12.1 (5.1–25.9)¶	11.5 (8.4–15.5)	12.6 (8.7–17.8)	48.1 (45.1–51.2)	33.2 (31.3–35.1)	
Usual health care provider									
Yes	35.8 (34.1–37.6)	29.6 (25.8–33.6)	17.3 (15.2–19.7)	10.4 (5.8–18.1)	12.6 (10.2–15.5)	12.2 (8.9–16.5)	45.2 (43.8–46.6)	33.2 (32.3–34.1)	0.8
No	35.9 (32.8–39.1)	35.4 (28.3–43.1)	17.9 (14.0–22.7)	19.8 (10.7–33.6)	10.8 (8.1–14.3)	10.6 (7.8–14.2)	47.9 (45.4–50.4)	33.0 (31.5–34.5)	
Unmet health care need because of cost during past 12 mos									
Yes	43.1 (39.4–46.8)	39.6 (32.7–46.8)	24.9 (21.0–29.4)	22.7 (12.3–38.1)	17.9 (13.7–23.1)	15.4 (11.9–19.7)	53.2 (51.2–55.2)	43.0 (41.6–44.5)	<0.001
No	33.3 (31.7–35.0)	28.6 (24.8–32.7)	15.0 (13.0–17.2)	10.3 (6.4–16.2)	9.6 (7.9–11.7)	11.0 (8.3–14.4)	42.1 (40.7–43.6)	29.4 (28.5–30.2)	
Routine check-up within past 12 mos									
Yes	35.9 (34.2–37.7)	30.7 (26.9–34.8)	17.2 (15.2–19.5)	12.1 (7.0–19.9)	12.0 (9.9–14.5)	11.5 (8.4–15.4)	44.9 (43.5–46.3)	32.9 (32.0–33.8)	0.6
No	33.5 (30.9–36.2)	30.7 (26.9–34.8)	17.1 (13.6–21.4)	13.1 (5.8–26.2)¶	10.4 (8.1–13.3)	11.6 (8.5–15.7)	44.9 (43.5–46.3)	32.5 (31.2–33.8)	
Health-related behaviors and obesity									
Binge drinking									
Yes	35.4 (32.1–38.9)	31.3 (25.1–38.2)	18.5 (14.3–23.5)	18.8 (9.4–34.2)¶	10.4 (7.4–14.6)	13.0 (9.3–17.8)	49.7 (46.8–52.6)	34.4 (32.7–36.2)	0.06
No	35.4 (33.8–37.1)	31.8 (28.0–35.9)	17.3 (15.3–19.6)	11.6 (7.0–18.8)	12.0 (10.0–14.4)	10.8 (8.1–14.2)	44.9 (43.6–46.2)	32.6 (31.8–33.4)	
Cigarette smoking status									
Current smoker	42.6 (39.7–45.6)	41.3 (34.8–48.2)	25.9 (22.0–30.2)	25.3 (14.0–41.2)	15.0 (11.9–18.7)	14.6 (11.0–19.1)	54.6 (52.7–56.5)	43.4 (42.1–44.7)	<0.001
Nonsmoker (former/never)	33.4 (31.7–35.1)	27.4 (23.7–31.5)	14.5 (12.5–16.7)	10.0 (5.7–16.8)	10.8 (8.9–13.0)	10.8 (8.1–14.2)	41.3 (39.8–42.8)	29.0 (28.1–29.8)	
Physical inactivity									
Yes	39.3 (36.4–42.3)	29.1 (23.0–36.0)	19.6 (16.6–23.1)	10.5 (6.5–16.5)	12.8 (9.7–16.7)	10.9 (7.6–15.3)	49.8 (48.0–51.6)	37.8 (36.5–39.2)	<0.001
No	34.4 (32.7–36.1)	31.8 (28.0–35.8)	15.9 (13.8–18.3)	17.0 (10.8–25.9)	11.2 (9.3–13.3)	11.5 (8.9–14.8)	42.0 (40.5–43.5)	29.9 (29.0–30.7)	
Obesity**									
Yes	38.0 (35.3–40.7)	32.8 (26.4–39.9)	18.7 (15.8–22.0)	12.0 (6.0–22.5)¶	13.1 (10.4–16.4)	12.3 (7.7–19.1)	47.9 (46.2–49.6)	35.0 (33.9–36.2)	<0.001††
No	35.1 (33.3–37.0)	33.3 (29.2–37.6)	16.2 (13.8–18.8)	11.8 (6.3–21.1)¶	11.4 (9.5–13.6)	10.6 (8.5–13.0)	44.8 (43.1–46.4)	32.3 (31.4–33.3)	
Unknown (n = 25,048)	32.3 (26.2–39.0)	12.8 (8.1–19.5)	16.6 (11.8–22.9)	30.0 (15.0–51.0)¶	9.5 (4.0–20.9)§	13.2 (6.3–25.7)§	39.9 (35.4–44.5)	27.4 (24.8–30.1)	
Insufficient sleep§§									
Yes	41.7 (39.4–44.0)	36.6 (31.2–42.3)	22.0 (19.1–25.2)	24.7 (15.6–36.6)	14.7 (11.9–18.1)	15.6 (11.9–20.2)	51.2 (49.7–52.7)	39.4 (38.4–40.4)	<0.001
No	30.3 (28.4–32.2)	27.7 (23.5–32.4)	13.4 (11.3–15.8)	7.2 (4.2–12.0)	9.1 (7.4–11.2)	7.6 (5.3–10.6)	38.6 (36.8–40.5)	26.3 (25.3–27.3)	
Mental health									
Diagnosed depressive disorder¶¶									
Yes	50.0 (47.8–52.1)	49.1 (43.5–54.8)	38.4 (34.5–42.5)	27.8 (17.0–41.9)	29.1 (22.6–36.7)	21.7 (16.2–28.5)	62.8 (61.5–64.2)	54.3 (53.3–55.4)	<0.001
No	21.9 (20.1–23.9)	16.1 (12.8–20.0)	10.1 (8.4–12.2)	9.7 (5.2–17.2)¶	7.9 (6.6–9.4)	9.5 (7.1–12.6)	23.7 (21.9–25.6)	16.7 (15.9–17.6)	

Abbreviation: CI = confidence interval.
* Mutually exclusive disability categories were created for each of the six disability types and for adults reporting two or more disabilities.
† Percentages are weighted.
§ Two-sided p-value from the t-distribution comparing prevalence of frequent mental distress by whether or not the person had the health-related characteristic.
¶ Estimate is unstable (relative standard error = 30%–41%).
** Obesity was defined as body mass index ≥30.0 kg/m^2.
†† Comparing yes versus no.
§§ Insufficient sleep is defined as getting <7 hours of sleep per 24-hour period on average per night.
¶¶ Includes depression, major depression, dysthymia, and minor depression.

demographic and health-related risk factors associated with mental and physical health. Public health professionals, policy makers, and health care providers can consider recommending strategies that increase social cohesion, encourage community participation, and improve access to quality mental health screening and care, as well as promoting healthy lifestyle recommendations and inclusion in evidence-based programs to address disparities in mental distress. Increasing provider awareness of the importance of mental health screening could help improve identification and treatment of co-occurring mental health conditions, especially among adults with cognitive and mobility disabilities who are approximately nine times as likely to have frequent mental distress as are adults without disabilities. Future work to better understand mental distress among adults with disabilities could help target interventions, whether as stand-alone approaches or components of existing disease prevention and health promotion strategies.

FIGURE. Age-adjusted prevalence* of frequent mental distress among adults with disabilities (A) and prevalence ratios of frequent mental distress between adults with and without disabilities (B), by geographic area — Behavioral Risk Factor Surveillance System, United States, 2018



Abbreviation: DC = District of Columbia.
* Standardized to the 2000 U.S. projected population.

Summary

What is already known about this topic?

Adults with disabilities, compared with those without disabilities, experience more mental distress and are more likely to experience factors associated with a higher occurrence of mental disorders, including poverty and limited heath care access.

What is added by this report?

Nationwide, an estimated 17.4 million adults with disabilities experience frequent mental distress 4.6 times as often than do adults without disabilities. Adults living below the federal poverty level report mental distress 70% more often than do adults in higher income households.

What are the implications for public health practice?

Targeted interventions and programs and policies that ensure receipt of mental health screening, care, and support services could help reduce mental distress among adults with disabilities.

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Corresponding author: Robyn A. Cree, rcree@cdc.gov, 404-498-5300.

[1]Division of Human Development and Disability, National Center on Birth Defects and Developmental Disabilities, CDC; [2]Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC.

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Prevalence of Underlying Medical Conditions Among Selected Essential Critical Infrastructure Workers — Behavioral Risk Factor Surveillance System, 31 States, 2017–2018

Sharon R. Silver, MA, MS[1]; Jia Li, MS[1]; Winifred L. Boal, MPH[1]; Taylor L. Shockey, PhD[1]; Matthew R. Groenewold, PhD[1]

Certain underlying medical conditions are associated with higher risks for severe morbidity and mortality from coronavirus disease 2019 (COVID-19) (*1*). Prevalence of these underlying conditions among workers differs by industry and occupation. Many essential workers, who hold jobs critical to the continued function of infrastructure operations (*2*), have high potential for exposure to SARS-CoV-2, the virus that causes COVID-19, because their jobs require close contact with patients, the general public, or coworkers. To assess the baseline prevalence of underlying conditions among workers in six essential occupations and seven essential industries, CDC analyzed data from the 2017 and 2018 Behavioral Risk Factor Surveillance System (BRFSS) surveys, the most recent data available.* This report presents unadjusted prevalences and adjusted prevalence ratios (aPRs) for selected underlying conditions. Among workers in the home health aide occupation and the nursing home/rehabilitation industry, aPRs were significantly elevated for the largest number of conditions. Extra efforts to minimize exposure risk and prevent and treat underlying conditions are warranted to protect workers whose jobs increase their risk for exposure to SARS-CoV-2.

BRFSS is an annual, state-based, random-digit–dialed landline and cellular telephone survey collecting demographic and health-related information among noninstitutionalized U.S residents aged ≥18 years. BRFSS includes standard core questions and optional modules, including an industry and occupation module. All participants are asked to report their height and weight and also asked "Has a doctor, nurse, or other health practitioner ever told you that you have…" followed by a list of underlying conditions.† In 2017 and 2018, 31 states§ administered the industry and occupation module for at least 1 year to currently or recently employed participants; the study sample comprised currently employed module respondents.¶ Open-ended responses to questions eliciting respondent industry and occupation** were coded to the U.S. Census Bureau's 2010 industry and occupation codes.†† Among states using the industry and occupation questions, the median overall survey response rate was 42.5% in 2017 §§ and 49.1% in 2018. ¶¶

Respondent demographic characteristics, as well as weighted, unadjusted prevalences and aPRs for selected underlying conditions, were obtained for a subset of critical infrastructure worker groups selected because of their inability to work from home or physically distance from others at work, and their potential exposure to infectious disease (*3*,*4*), as well as adequate sample size in the data set.*** Six occupation groups were selected: 1) health practitioners (licensed health care professionals except technicians/technologists), 2) health technicians and technologists, 3) other health care support (except home health), 4) patient and personal care aides in the home health industry (home health aides), 5) protective services (correctional officers, police, sheriffs, patrol officers, firefighters, and their supervisors), and 6) teachers (preschool

* BRFSS collects information on demographics and health, including underlying conditions, use of preventive services, health care access, and health-related behavioral risk factors. https://www.cdc.gov/brfss/index.html.

† Health conditions were elicited by the question "Has a doctor, nurse, or other health practitioner ever told you that you have…" followed by a set of conditions, including those used in this analysis: a heart attack, also called a myocardial infarction; angina or coronary heart disease; stroke; asthma (with positive responses followed by "Do you still have asthma?"); any other type of cancer (other than skin cancer); chronic obstructive pulmonary disease, emphysema, or chronic bronchitis; kidney disease (not including kidney stones, bladder infection, or incontinence); diabetes (followed by questions allowing separation of gestational diabetes, prediabetes, and borderline diabetes). Hypertension was assessed separately, but with the same question format. Possible responses to these questions were yes, no, don't know/not sure, or refused. Responses to questions in the BRFSS core for the two additional underlying conditions, arthritis and high cholesterol, were not analyzed because they have not been associated with increased risk for severe COVID-19 illness. Respondents giving positive answers to 1) a heart attack/myocardial infarction or 2) angina or coronary heart disease were counted as having coronary heart disease.

§ California, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Washington, and Wisconsin.

¶ Active duty military respondents were not included in the analyses.

** Industry was elicited by the question "What kind of business or industry do you work in? For example, hospital, elementary school, clothing manufacturing, restaurant." Occupation was elicited by the question "What kind of work do you do? For example, registered nurse, janitor, cashier, auto mechanic."

†† https://www.census.gov/programs-surveys/cps/technical-documentation/methodology/industry-and-occupation-classification.html.

§§ https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-response-rates-table-508.pdf.

¶¶ https://www.cdc.gov/brfss/annual_data/2018/pdf/2018-response-rates-table-508.pdf.

*** Minimum sample size for each occupation or industry was 1,000 in the analytic data set, selected to ensure reasonably narrow confidence limits for prevalence estimates and to meet reportability criteria for uncommon outcomes.

through grade 12). Seven industry groups were selected: 1) ambulatory health care, 2) hospitals, 3) nursing homes (nursing and residential care facilities), 4) essential retail (grocery/other food stores, alcohol stores, pharmacies, and gas stations), 5) food manufacturing, 6) transit (bus service/urban transit, taxi/limousine, postal services, and couriers/messengers), and 7) trucking. Health conditions from the BRFSS core module with strong or mixed evidence of associations with severe outcomes from COVID-19 that were evaluated included asthma (current, ever diagnosed), cancer (except nonmelanoma skin cancer), coronary heart disease (CHD; myocardial infarction, angina, or coronary heart disease), chronic kidney disease, chronic obstructive pulmonary disease (COPD), diabetes, hypertension, obesity (body mass index [BMI] ≥30 kg/m^2, calculated from respondent's self-reported height and weight), severe obesity (BMI ≥40 kg/m^2), and stroke. Hypertension questions were asked only in 2017.

For each occupation or industry, demographic distributions and unadjusted prevalences for each chronic condition were calculated using the SURVEYFREQ procedure in SAS (version 9.4; SAS Institute). Logistic regression in SUDAAN (version 11.0.1; RTI International) was used to calculate aPRs to compare the prevalence of each condition in the occupation (or industry) of interest to its prevalence among workers from all other U.S. Census-coded occupations (or industries), essential and nonessential combined, except the group of interest. Adjustments were made for age group (18–29, 30–39, 40–49, 50–59, 60–69, ≥70 years), sex (male, female), and race/ethnicity (non-Hispanic White, Black, Asian, or other race, and Hispanic). aPRs with confidence intervals not spanning the null value were considered statistically significant. Data were weighted and analyzed in accordance with the survey's complex sampling design.

The study population comprised 213,518 respondents meeting the analytic criteria (Table 1). At least 15% (weighted percentage) of workers in the health practitioner and home health aide occupations and the ambulatory health care, transit, and trucking industries were aged ≥60 years. Males comprised 85.2% of protective service workers and 89.2% of trucking industry workers. At least 25% of home health aide occupation, nursing home industry, and transit industry workers were non-Hispanic Black. The percentages of Hispanic workers were highest in the home health aide occupation (20%) and the food manufacturing industry (36%).

Prevalences of preexisting underlying conditions varied by occupation (Table 2) and industry (Table 3). Obesity and hypertension were the most common conditions in every essential worker group. Among occupations, home health aides had the highest unadjusted prevalence estimate for every chronic condition except severe obesity and had significantly elevated aPRs for five conditions (chronic kidney disease, COPD, diabetes, obesity, and severe obesity,). For health care support workers (other than home health), aPRs were significantly elevated for diabetes, obesity, and severe obesity. In contrast, among health practitioners, aPRs for many conditions were significantly below 1.0. Among workers in the nursing home industry, aPRs for CHD, COPD, diabetes, hypertension, obesity, and severe obesity were significantly elevated. Nonhealth care industries with statistically significant elevations in aPRs for more than one underlying condition included transit (current asthma and diabetes) and trucking (COPD, obesity, and severe obesity).

Summary

What is already known about this topic?

Underlying medical conditions increase risk for severe COVID-19. Many essential workers have high potential for exposure to SARS-CoV-2, the virus that causes COVID-19, because their jobs require close contact with patients, the public, or coworkers.

What is added by this report?

High prevalences of underlying medical conditions increase risks for severe COVID-19 illness among home health aides, other health care support workers, and nursing home, trucking, and transit industry workers.

What are the implications for public health practice?

For all essential workers, and particularly those at high risk because of underlying medical conditions, prioritization of exposure controls and health care access is needed to reduce the potential for SARS-CoV-2 exposure and prevent and treat underlying conditions.

Discussion

In this analysis, aPRs for underlying medical conditions were significantly elevated in several groups of essential workers at risk for exposure to SARS-CoV-2. Workers in the home health aide occupations and the nursing home industry are of particular concern because those groups had high prevalences of and significantly elevated aPRs for a number of underlying conditions. In addition to increased occupational exposure risks, some industry and occupation groups had high percentages of demographic groups that have been identified as being at higher risk for severe COVID-19–associated illness (*2*–*4*). For example, the home health aide occupation and the nursing home industry had high concentrations of workers from demographic groups at elevated risk for severe COVID-19 outcomes, such as non-Hispanic Blacks, Hispanics, and older workers. Racial and ethnic minority

TABLE 1. Demographic characteristics of selected essential workers, by industries (I) and occupations (O) — Behavioral Risk Factor Surveillance System, 31 U.S. states,* 2017–2018

		No. (%)§										
		Age group (yrs)				Sex		Race/Ethnicity¶				
Worker grouping†	Total respondents	18–49	50–59	60–69	≥70	Male	Female	White	Black	Asian	Other	Hispanic
All workers**	**213,518**	110,540 (66.0)	54,423 (20.8)	37,596 (10.6)	10,959 (2.7)	109,590 (54.9)	103,654 (45.1)	157,236 (59.4)	18,088 (12.1)	7,406 (6.5)	10,934 (3.0)	19,854 (19.0)
Occupation												
Health practitioners O = 3000–3260	**12,208**	5,943 (60.4)	3,245 (23.7)	2,519 (13.6)	501 (2.3)	2,703 (22.8)	9,496 (77.2)	9,884 (66.7)	910 (11.5)	506 (11.4)	410 (1.9)	498 (8.5)
Health technicians and technologists O = 3300–3535	**3,164**	1,760 (67.5)	794 (20.5)	534 (10.1)	76 (1.9)	730 (29.6)	2,428 (70.4)	2,429 (68.8)	297 (12.2)	104 (9.4)	151 (2.7)	183 (6.9)
Health care support (except home health) O = 3600–3655, excluding I = 8170	**3,368**	2,144 (76.5)	697 (14.5)	452 (8.0)	75 (1.0)	368 (11.0)	2,997 (89.0)	2,073 (50.7)	626 (24.2)	123 (4.9)	193 (3.5)	353 (16.7)
Home health patient and personal care aides O = 3600 or 4610, restricted to I = 8170	**1,179**	531 (59.4)	328 (23.2)	236 (13.4)	84 (4.0)	139 (10.2)	1,040 (89.8)	644 (39.0)	253 (30.6)	35 (5.3)	92 (4.9)	155 (20.2)
Protective services O = 3700–3720, 3740–3750, 3800–3860	**2,422**	1,618 (73.5)	584 (21.1)	194 (4.5)	26 (0.9)	1,950 (85.2)	471 (14.8)	1,780 (66.4)	267 (15.3)	38 (1.8)	171 (3.9)	166 (12.6)
Teachers O = 2300–2330	**8,965**	4,741 (66.6)	2,468 (22.5)	1,478 (9.5)	278 (1.5)	1,934 (23.4)	7,020 (76.6)	7,215 (71.6)	708 (12.7)	191 (3.7)	392 (2.5)	459 (9.5)
Industry												
Ambulatory health care I = 7970–8090	**9,679**	4,853 (63.3)	2,444 (21.2)	1,900 (13.0)	482 (2.6)	2,580 (28.5)	7,091 (71.5)	7,424 (63.3)	817 (12.8)	413 (10.6)	460 (2.4)	565 (11.0)
Hospitals I = 8190	**12,155**	6347 (64.1)	3,293 (22.3)	2,175 (11.8)	340 (1.8)	3,000 (27.5)	9,138 (72.5)	8,994 (61.0)	1,339 (15.2)	509 (9.5)	527 (2.6)	786 (11.7)
Nursing homes and rehabilitation I = 8270, 8290	**3,833**	1903 (61.9)	973 (23.9)	762 (11.6)	195 (2.5)	566 (18.4)	3,266 (81.6)	2,621 (54.9)	717 (27.6)	97 (4.8)	162 (2.4)	236 (10.4)
Essential retail I = 4970–4990, 5070, 5090	**4,399**	2,432 (72.2)	998 (16.0)	745 (9.5)	224 (2.4)	2,021 (54.0)	2,372 (46.0)	3,232 (60.3)	304 (8.6)	194 (7.3)	268 (4.0)	401 (19.8)
Food manufacturing I = 1070–1370	**1,682**	954 (71.6)	443 (17.5)	238 (8.0)	47 (3.0)	1,037 (63.7)	642 (36.3)	987 (44.4)	171 (11.4)	35 (5.1)	73 (3.2)	416 (35.9)
Transit, postal, messengers, and couriers I = 6180, 6190, 6370, 6380	**1,932**	836 (61.6)	599 (23.2)	388 (13.0)	109 (2.2)	1,205 (67.5)	723 (32.5)	1,225 (47.0)	339 (25.6)	79 (6.7)	122 (4.6)	167 (16.2)
Trucking I = 6170	**2,418**	1,134 (59.4)	718 (23.6)	447 (14.2)	119 (2.8)	2,109 (89.2)	307 (10.8)	1,729 (55.3)	345 (22.5)	41 (3.3)	123 (3.7)	180 (15.1)

* California, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Washington, and Wisconsin.
† By U.S. Census codes (https://www.census.gov/programs-surveys/cps/technical-documentation/methodology/industry-and-occupation-classification.html).
§ Weighted percentage.
¶ White, Black, and Asian are non-Hispanic. Other are respondents identifying as non-Hispanic and not identifying specifically as Asian, Black, or White. Respondents identifying with multiple races are asked to select the grouping that best represents their race.
** All currently employed non-active duty military respondents to the Industry and Occupation module of the 2017 or 2018 Behavioral Risk Factor Surveillance System.

groups have been subject to long-standing, systemic social inequities that intersect with work-related exposure risks. These include the inability to practice physical distancing at work or to work from home, low wages, lack of paid sick leave, reliance on public or shared transportation, crowded housing, limited access to health care, and the need to hold multiple jobs (*3*,*5*,*6*). Several of these inequities also hinder management of underlying conditions that increase the risk for severe COVID-19 (*7*). These inequities also pertain to groups of essential workers not assessed in this report because of inadequate sample size (e.g., low levels of health care access among food preparers/servers, agricultural workers, and building/grounds maintenance and support, including housekeepers and janitors in health care) (*8*).

The findings in this report are subject to at least eight limitations. First, the industry and occupation module was administered for at least 1 year by 31 states, but the data collected are not nationally representative. Second, the

TABLE 2. Prevalence* and adjusted prevalence ratio (aPR)† of underlying health conditions among essential workers, by occupation§ — Behavioral Risk Factor Surveillance System, 31 U.S. states,¶ 2017–2018

Underlying condition	All workers**	Health practitioners	Health technicians and technologists	Health care support (except home health)	Home health and personal care aides	Protective services	Teachers, pre-K–grade 12
Asthma, current							
% (95% CI)	7.6 (7.4–7.9)	10.0 (8.7–11.5)	9.3 (7.2–11.7)	10.3 (8.5–12.4)	13.2 (9.6–17.6)	6.9 (5.0–9.2)	11.4 (9.8–13.2)
aPR (95% CI)	—	1.08 (0.94–1.25)	0.99 (0.78–1.27)	0.98 (0.80–1.19)	1.31 (0.96–1.78)	1.04 (0.78–1.39)	1.19 (1.02–1.39)
Asthma, ever							
% (95% CI)	12.8 (12.4–13.1)	14.4 (12.7–16.1)	14.6 (11.6–18.2)	14.3 (12.2– 16.7)	17.1 (12.9–22.0)	13.6 (11.0–16.5)	16.6 (14.6–18.8)
aPR (95% CI)	—	1.04 (0.92–1.18)	1.02 (0.81–1.28)	0.90 (0.76–1.06)	1.16 (0.88–1.78)	1.11 (0.92–1.35)	1.17 (1.03–1.33)
Cancer††							
% (95% CI)	3.7 (3.5–3.8)	4.0 (3.5–4.7)	3.5 (2.7–4.6)	3.0 (1.9–4.4)	5.0 (3.2–7.4)	2.6 (1.6–3.9)	4.3 (3.4–5.3)
aPR (95% CI)	—	0.84 (0.72–0.98)	0.85 (0.65–1.12)	0.83 (0.57–1.22)	1.02 (0.68–1.54)	0.96 (0.64–1.44)	0.96 (0.78–1.19)
Coronary heart disease§§							
% (95% CI)	3.0 (2.8–3.2)	2.0 (1.5–2.6)	1.4 (1.0–2.0)	2.2 (1.5–3.2)	4.4 (2.0–8.3)¶¶	2.7 (1.5–4.5)	1.6 (1.1–2.3)
aPR (95% CI)	—	0.75 (0.57–0.99)	0.64 (0.45–0.90)	1.32 (0.92–1.89)	1.80 (0.93–3.45)	0.95 (0.57–1.57)	0.70 (0.48–1.01)
Chronic kidney disease							
% (95% CI)	1.6 (1.5–1.7)	1.3 (1.0–1.7)	1.6 (0.8–2.9)¶¶	1.0 (0.5–1.6)	4.6 (2.0–9.0)¶¶	1.6 (0.8–3.0)¶¶	1.4 (1.0–1.9)
aPR (95% CI)	—	0.79 (0.59–1.05)	1.07 (0.58–2.00)	0.65 (0.37–1.12)	2.53 (1.24–5.14)	1.22 (0.66–2.26)	0.90 (0.64–1.27)
COPD							
% (95% CI)	3.1 (2.9–3.2)	1.7 (1.4–2.1)	3.0 (2.0–4.3)	4.0 (2.9–5.4)	6.2 (4.0–9.0)	2.5 (1.1–4.7)¶¶	2.7 (1.8–3.8)
aPR (95% CI)	—	0.46 (0.37–0.57)	0.91 (0.63–1.30)	1.25 (0.92–1.70)	1.68 (1.14–2.48)	0.89 (0.46–1.71)	0.76 (0.53–1.08)
Diabetes							
% (95% CI)	6.5 (6.3–6.8)	5.6 (4.7–6.5)	5.9 (4.5–7.5)	6.6 (5.2–8.1)	12.2 (8.2–17.4)	7.1 (5.0–9.7)	5.4 (3.9–7.3)
aPR (95% CI)	—	0.85 (0.72–1.00)	1.02 (0.80–1.31)	1.36 (1.10–1.67)	1.70 (1.21–2.39)	1.13 (0.83–1.53)	0.93 (0.69–1.25)
Hypertension* **							
% (95% CI)	23.7 (23.1–24.4)	20.3 (18.1–22.6)	23.2 (18.8–28.2)	21.2 (17.1–25.7)	29.3 (22.4–37.1)	25.6 (20.4–31.3)	17.8 (15.4–20.4)
aPR (95% CI)	—	0.86 (0.78–0.96)	1.11 (0.94–1.31)	1.10 (0.94–1.30)	1.15 (0.89–1.48)	1.04 (0.86–1.26)	0.81 (0.72–0.92)
Obesity (BMI≥30 kg/m2)†††							
% (95% CI)	29.9 (29.4–30.4)	26.1 (23.7–28.5)	37.4 (32.7–42.3)	40.0 (36.6–43.5)	44.8 (36.9–53.0)	39.6 (35.7–43.6)	27.3 (25.1–29.7)
aPR (95% CI)	—	0.86 (0.78–0.93)	1.27 (1.12–1.45)	1.29 (1.19–1.41)	1.38 (1.12–1.69)	1.24 (1.12–1.37)	0.86 (0.79–0.94)
Severe obesity (BMI≥40 kg/m2)†††							
% (95% CI)	4.3 (4.1–4.5)	3.3 (2.7–4.1)	4.1 (3.0–5.6)	9.1 (7.2–11.2)	9.1 (6.0–13.0)	5.5 (3.6–8.0)	4.9 (3.8–6.3)
aPR (95% CI)	—	0.67 (0.54–0.82)	0.86 (0.64–1.16)	1.62 (1.29–2.03)	1.59 (1.09–2.31)	1.26 (0.86–1.86)	0.95 (0.73–1.23)
Stroke							
% (95% CI)	1.2 (1.1–1.3)	0.8 (0.5–1.1)	1.7 (0.5–4.2)¶¶	0.9 (0.5–1.5)	2.0 (0.8–3.9)¶¶	0.3 (0.1–0.7)¶¶	1.3 (0.6–2.4)¶¶
aPR (95% CI)	—	0.67 (0.47–0.95)	1.68 (0.66–4.29)	0.99 (0.60–1.65)	1.50 (0.74–3.09)	0.32 (0.16–0.66)	1.23 (0.67–2.26)

Abbreviations: BMI = body mass index; CI = confidence interval; COPD = chronic obstructive pulmonary disease.

* Unadjusted, weighted estimates.

† Adjusted for age group (18–29, 30–39, 40–49, 50–59, 60–69, ≥70 years), sex, race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic other race, Hispanic). aPR reference group is all other occupations (essential and non-essential) combined.

§ By U.S. Census codes (https://www.census.gov/programs-surveys/cps/technical-documentation/methodology/industry-and-occupation-classification.html).

¶ California, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Washington, and Wisconsin.

** All currently employed non-active duty military respondents to the Industry and Occupation module of the 2017 or 2018 Behavioral Risk Factor Surveillance System.

†† Except non-melanoma skin cancer.

§§ Includes heart attack/myocardial infarction, coronary heart disease, or angina.

¶¶ Relative standard error >30% but ≤50%.

*** 2017 BRFSS data only, available for 22 states: California, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Tennessee, Washington, and Wisconsin.

††† Body mass index (and thus obesity) was missing for 9% of cohort; all other behaviors and conditions missing for <1% of cohort.

prevalence of some conditions (e.g., immunologic, liver disease, heart failure, neurologic) and genetic polymorphisms not elicited by BRFSS that might affect COVID-19 disease severity could not be assessed. Third, BRFSS does not assess the severity of high blood pressure or asthma or distinguish between Type 1 and Type 2 diabetes, and the CHD category includes conditions that might not worsen COVID-19 outcomes. Fourth, the strength of the association between some conditions included here and severe COVID-19 is not yet known. Fifth, the health information obtained, including BMI, is self-reported (or calculated from self-reported data), lacks clinical confirmation, and is subject to recall and social

TABLE 3. Prevalence* and adjusted prevalence ratio (aPR)† of underlying health conditions among essential workers by industry:§ Behavioral Risk Factor Surveillance System, 31 U.S. states,¶ 2017–2018

Underlying condition	All workers**	Ambulatory health care	Hospitals	Nursing homes and rehabilitation	Essential retail	Food manufacturing	Transit	Trucking
Asthma, current								
% (95% CI)	7.6 (7.4–7.9)	9.7 (8.4–11.1)	9.7 (8.4–11.0)	10.1 (8.3–12.0)	9.8 (7.7–12.3)	4.6 (2.7–7.4)	11.1 (7.2–16.0)	4.3 (3.0–5.9)
aPR (95% CI)	—	1.07 (0.93–1.24)	1.06 (0.92–1.21)	1.00 (0.83–1.20)	1.22 (0.97–1.53)	0.65 (0.41–1.04)	1.52 (1.05–2.20)	0.68 (0.50–0.94)
Asthma, ever								
% (95% CI)	12.8 (12.4–13.1)	15.1 (13.4–17.0)	14.6 (12.9–16.5)	15.0 (12.7–17.6)	16.1 (13.5–19.0)	9.1 (6.4–12.3)	13.9 (10.0–18.7)	9.5 (7.3–12.1)
aPR (95% CI)	—	1.11 (0.98–1.25)	1.05 (0.93–1.19)	1.01 (0.86–1.20)	1.17 (0.99–1.38)	0.73 (0.54–0.98)	1.13 (0.84–1.51)	0.82 (0.65–1.05)
Cancer††								
% (95% CI)	3.7 (3.5–3.8)	4.7 (4.0–5.5)	3.7 (3.0–4.4)	4.6 (3.2–6.3)	3.3 (2.4–4.4)	2.7 (1.7–4.1)	4.0 (2.1–6.8)	2.8 (2.0–3.8)
aPR (95% CI)	—	1.05 (0.89–1.25)	0.84 (0.70–1.02)	0.99 (0.73–1.35)	1.02 (0.77–1.36)	0.86 (0.58–1.28)	1.10 (0.66–1.84)	0.82 (0.60–1.11)
Coronary heart disease§§								
% (95% CI)	3.0 (2.8–3.2)	2.7 (1.9–3.7)	2.0 (1.5–2.6)	4.4 (2.8–6.5)	3.0 (2.0–4.4)	4.4 (2.5–7.1)	5.0 (2.5–8.8)	4.2 (3.0–5.8)
aPR (95% CI)	—	1.02 (0.74–1.40)	0.80 (0.62–1.04)	1.90 (1.28–2.82)	1.21 (0.83–1.77)	1.45 (0.93–2.27)	1.49 (0.84–2.66)	1.05 (0.75–1.49)
Chronic kidney disease								
% (95% CI)	1.6 (1.5–1.7)	1.4 (1.1–1.8)	1.3 (0.9–1.8)	1.4 (0.9–2.1)	2.1 (1.1–3.5)	1.1 (0.4–2.5)¶¶	1.8 (1.1–2.7)	1.6 (0.9–2.6)
aPR (95% CI)	—	0.87 (0.66–1.15)	0.78 (0.55–1.10)	0.83 (0.54–1.29)	1.40 (0.81–2.42)	0.72 (0.31–1.65)	1.08 (0.71–1.65)	0.99 (0.60–1.64)
COPD								
% (95% CI)	3.1 (2.9–3.2)	2.5 (1.8–3.3)	2.8 (2.2–3.4)	5.1 (3.8–6.6)	3.7 (2.8–4.9)	2.4 (1.2–4.2)	4.0 (2.6–5.7)	5.3 (3.1–8.3)
aPR (95% CI)	—	0.71 (0.53–0.96)	0.80 (0.64–1.01)	1.43 (1.09–1.88)	1.28 (0.98–1.67)	0.84 (0.48–1.47)	1.27 (0.87–1.85)	1.72 (1.09–2.71)
Diabetes								
% (95% CI)	6.5 (6.3–6.8)	6.3 (5.3–7.4)	6.4 (5.5–7.3)	8.3 (6.6–10.2)	6.5 (5.1–8.2)	7.6 (5.0–11.0)	11.4 (8.3–15.0)	11.1 (8.0–14.9)
aPR (95% CI)	—	0.97 (0.82–1.14)	1.01 (0.87–1.17)	1.29 (1.05–1.59)	1.19 (0.96–1.47)	1.14 (0.82–1.60)	1.40 (1.06–1.84)	1.32 (0.97–1.79)
Hypertension* **								
% (95% CI)	23.7 (23.1–24.4)	23.3 (20.7–26.1)	20.2 (18.0–22.5)	27.7 (23.2–32.5)	22.7 (18.8–26.9)	26.6 (18.9–35.4)	23.2 (18.0–29.1)	29.6 (24.4–35.1)
aPR (95% CI)	—	1.01 (0.90–1.13)	0.90 (0.81–1.00)	1.24 (1.08–1.43)	1.09 (0.93–1.28)	1.12 (0.89–1.42)	0.85 (0.68–1.05)	1.01 (0.85–1.20)
Obesity (BMI≥30 kg/m^2)†††								
% (95% CI)	29.9 (29.4–30.4)	28.5 (26.4–30.7)	30.4 (28.4–32.6)	37.2 (33.9–40.7)	30.4 (27.3–33.5)	28.0 (22.3–34.2)	29.8 (25.5–34.5)	48.2 (43.4–53.0)
aPR (95% CI)	—	0.95 (0.88–1.02)	1.00 (0.93–1.08)	1.17 (1.07–1.28)	1.06 (0.96–1.16)	0.89 (0.72–1.10)	0.91 (0.78–1.07)	1.50 (1.36–1.66)
Severe obesity (BMI≥40 kg/m^2)†††								
% (95% CI)	4.3 (4.1–4.5)	4.0 (3.3–4.8)	5.3 (4.4–6.3)	7.9 (6.3–9.7)	5.6 (4.2–7.2)	2.6 (1.8–3.8)	4.6 (3.0–6.7)	7.7 (5.4–10.5)
aPR (95% CI)	—	0.84 (0.69–1.03)	1.10 (0.91–1.33)	1.47 (1.19–1.83)	1.36 (1.04–1.76)	0.60 (0.41–0.87)	1.02 (0.70–1.49)	1.93 (1.40–2.65)
Stroke								
% (95% CI)	1.2 (1.1–1.3)	1.1 (0.6–1.8)	1.0 (0.7–1.4)	1.3 (0.9–1.9)	1.0 (0.7–1.4)	0.6 (0.3–1.0)	1.3 (0.6–2.3)¶¶	0.9 (0.4–1.8)¶¶
aPR (95% CI)	—	0.94 (0.55–1.61)	0.92 (0.66–1.28)	1.13 (0.75–1.69)	1.09 (0.74–1.59)	0.52 (0.30–0.91)	1.02 (0.55–1.90)	0.70 (0.36–1.38)

Abbreviations: BMI = body mass index; CI = confidence interval; COPD = chronic obstructive pulmonary disease.

* Unadjusted, weighted estimates.

† Adjusted for age group (18–29, 30–39, 40–49, 50–59, 60–69, ≥70 years), sex, race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic other race, Hispanic). aPR reference group is all other industries (essential and non-essential) combined.

§ https://www.census.gov/programs-surveys/cps/technical-documentation/methodology/industry-and-occupation-classification.html.

¶ California, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Washington, and Wisconsin.

** All currently employed non-active duty military respondents to the Industry and Occupation module of the 2017 or 2018 Behavioral Risk Factor Surveillance System.

†† Except non-melanoma skin cancer.

§§ Includes heart attack/myocardial infarction, coronary heart disease, or angina.

¶¶ Relative standard error >30% but ≤50%.

*** 2017 BRFSS data only, available for 22 states: California, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Tennessee, Washington, and Wisconsin.

††† Body mass index (and thus obesity) was missing for 9% of cohort; all other behaviors and conditions missing for <1% of cohort.

desirability biases. Sixth, BMI (and thus obesity/severe obesity) was missing for 8% of respondents. Seventh, the survey does not include information on training about or adherence to workplace exposure mitigation††† strategies. Finally, not all workers in each industry or occupation have the same risk for exposure to infectious disease, and not all essential worker industry and occupation groups were evaluated.

††† https://www.cdc.gov/coronavirus/2019-ncov/community/worker-safety-support/index.html.

In 2017 and 2018, many essential workers had underlying medical conditions, with high prevalences among groups of health care workers at risk for exposure to SARS-CoV-2, including home health aides and nursing home workers. Although health practitioners had low prevalences of the evaluated underlying conditions, some are at increased risk for SARS-CoV-2 exposure during the performance of medical procedures and as a consequence of sustained close contact with their patients.

The Americans with Disabilities Act addresses employment discrimination against workers with disabilities, including disabilities resulting from chronic conditions (*9*). In addition, prioritization of hazard controls and health care access is needed to minimize exposure risks, prevent and address underlying conditions, and ensure access to emerging clinical prevention and treatment measures, so that employees at risk for work-related exposure to SARS-CoV-2 can continue to safely perform their essential workplace functions.

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Corresponding author: Sharon Silver, ssilver@cdc.gov.

[1]Division of Field Studies and Engineering, National Institute for Occupational Safety and Health, CDC.

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Delay or Avoidance of Medical Care Because of COVID-19–Related Concerns — United States, June 2020

Mark É. Czeisler[1,2]; Kristy Marynak, MPP[3,4]; Kristie E.N. Clarke, MD[3]; Zainab Salah, MPH[3]; Iju Shakya, MPH[3]; JoAnn M. Thierry, PhD[3]; Nida Ali, PhD[3]; Hannah McMillan, MPH[3]; Joshua F. Wiley, PhD[1]; Matthew D. Weaver, PhD[1,5,6]; Charles A. Czeisler, PhD, MD[1,5,6]; Shantha M.W. Rajaratnam, PhD[1,2,5,6]; Mark E. Howard, MBBS, PhD[1,2,7]

Temporary disruptions in routine and nonemergency medical care access and delivery have been observed during periods of considerable community transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19) (*1*). However, medical care delay or avoidance might increase morbidity and mortality risk associated with treatable and preventable health conditions and might contribute to reported excess deaths directly or indirectly related to COVID-19 (*2*). To assess delay or avoidance of urgent or emergency and routine medical care because of concerns about COVID-19, a web-based survey was administered by Qualtrics, LLC, during June 24–30, 2020, to a nationwide representative sample of U.S. adults aged ≥18 years. Overall, an estimated 40.9% of U.S. adults have avoided medical care during the pandemic because of concerns about COVID-19, including 12.0% who avoided urgent or emergency care and 31.5% who avoided routine care. The estimated prevalence of urgent or emergency care avoidance was significantly higher among the following groups: unpaid caregivers for adults* versus noncaregivers (adjusted prevalence ratio [aPR] = 2.9); persons with two or more selected underlying medical conditions† versus those without those conditions (aPR = 1.9); persons with health insurance versus those without health insurance (aPR = 1.8); non-Hispanic Black (Black) adults (aPR = 1.6) and Hispanic or Latino (Hispanic) adults (aPR = 1.5) versus non-Hispanic White (White) adults; young adults aged 18–24 years versus adults aged 25–44 years (aPR = 1.5); and persons with disabilities§ versus those without disabilities (aPR = 1.3). Given this widespread reporting of medical care avoidance because of COVID-19 concerns, especially among persons at increased risk for severe COVID-19, urgent efforts are warranted to ensure delivery of services that, if deferred, could result in patient harm. Even during the COVID-19 pandemic, persons experiencing a medical emergency should seek and be provided care without delay (*3*).

During June 24–30, 2020, a total of 5,412 (54.7%) of 9,896 eligible adults¶ completed web-based COVID-19 Outbreak Public Evaluation Initiative surveys administered by Qualtrics, LLC.** The Human Research Ethics Committee of Monash University (Melbourne, Australia) reviewed and approved the study protocol on human subjects research.

* Unpaid caregiver status was self-reported. The definition of an unpaid caregiver for adults was having provided unpaid care to a relative or friend aged ≥18 years to help them take care of themselves at any time in the last 3 months. Examples provided to survey respondents included helping with personal needs, household chores, health care tasks, managing a person's finances, taking them to a doctor's appointment, arranging for outside services, and visiting regularly to see how they are doing.

† Selected underlying medical conditions known to increase the risk for severe COVID-19 included in this analysis were obesity (body mass index [BMI] ≥30 kg/m²), diabetes, high blood pressure, cardiovascular disease, and any type of cancer. BMI was calculated from self-reported height and weight as BMI = weight (lb)/[height (in)]^2 x 703 (https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html). The remaining conditions were assessed using the following question: "Have you ever been diagnosed with any of the following conditions?" with the following four response options: 1) "Never"; 2) "Yes, I have in the past, but don't have it now"; 3) "Yes I have, but I do not regularly take medications or receive treatment"; and 4) "Yes I have, and I am regularly taking medications or receiving treatment." Respondents who answered that they have been diagnosed and chose either response 3 or 4 were considered as having the specified medical condition.

§ Persons who had a disability were defined as such based on a qualifying response to either one of two questions: "Are you limited in any way in any activities because of physical, mental, or emotional condition?" and "Do you have any health conditions that require you to use special equipment, such as a cane, wheelchair, special bed, or special telephone?" https://www.cdc.gov/brfss/questionnaires/pdf-ques/2015-brfss-questionnaire-12-29-14.pdf.

¶ Eligibility to complete a survey during June 24–30, 2020, was determined following electronic contact of potential participants based on a minimum age of 18 years and residence within the United States. Age and residence were assessed using screening questions without indication of eligibility criteria before commencement of the earliest survey (recontacted respondents: April 2–8, 2020; first-time respondents: June 24–30, 2020). Residence was reassessed among recontacted respondents during June 24–30, and one respondent whose primary residence had changed to outside of the United States was excluded from the analysis. Country-specific geolocation verification via IP address mapping was used to ensure respondents were responding from the United States. Informed consent was obtained electronically during June 24–30, 2020, before enrollment into the study as a participant. All surveys underwent Qualtrics, LLC data quality screening procedures, including algorithmic and keystroke analysis for attention patterns, click-through behavior, duplicate responses, machine responses, and inattentiveness. Respondents who failed an attention or speed check, along with any responses that failed data quality screening procedures, were excluded from the analysis (6.6%).

** The COVID-19 Outbreak Public Evaluation (COPE) Initiative (www.thecopeinitiative.org) is designed to assess public attitudes, behaviors, and beliefs related to the coronavirus disease 2019 (COVID-19) pandemic, and to evaluate the mental and physical health consequences of the pandemic. The COPE Initiative surveys included in this analysis were administered by Qualtrics, LLC (https://www.qualtrics.com/), a commercial survey company with a network of participant pools comprising hundreds of suppliers and with varying recruitment methodologies that include digital advertisements and promotions, word-of-mouth and membership referrals, social networks, television and radio advertisements, and offline mail-based approaches.

This activity was also reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.†† Respondents were informed of the study purposes and provided electronic consent before commencement, and investigators received anonymized responses. The 5,412 participants included 3,683 (68.1%) first-time respondents and 1,729 (31.9%) persons who had completed a related survey§§ during April 2–8, 2020. Among the 5,412 participants, 4,975 (91.9%) provided complete data for all variables in this analysis. Quota sampling and survey weighting¶¶ were employed to improve cohort representativeness of the U.S. population by gender, age, and race/ethnicity.

Respondents were asked "Have you delayed or avoided medical care due to concerns related to COVID-19?" Delay or avoidance was evaluated for emergency (e.g., care for immediate life-threatening conditions), urgent (e.g., care for immediate non–life-threatening conditions), and routine (e.g., annual check-ups) medical care. Given the potential for variation in interpretation of whether conditions were life-threatening, responses for urgent and emergency care delay or avoidance were combined for analysis. Covariates included gender; age; race/ethnicity; disability status; presence of one or more selected underlying medical conditions known to increase risk for severe COVID-19; education; essential worker status***; unpaid adult caregiver status; U.S. census region; urban/rural classification†††; health insurance status; whether respondents knew someone who had received a positive SARS-CoV-2 test result or had died from COVID-19; and whether the respondents believed they were at high risk for severe COVID-19. Comparisons within all these subgroups were evaluated using multivariable Poisson regression models§§§ with robust standard errors to estimate prevalence ratios adjusted for all covariates, 95% confidence intervals, and p-values to evaluate statistical significance ($\alpha = 0.05$) using the R survey package (version 3.29) and R software (version 4.0.2; The R Foundation).

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

§§ https://www.medrxiv.org/content/10.1101/2020.04.22.20076141v1.

¶¶ Statistical raking and weight trimming were employed to improve the cross-sectional June cohort representativeness of the U.S. population by gender, age, and race/ethnicity according to the 2010 U.S. Census.

*** Essential worker status was self-reported. For the aPRs, essential workers were compared with all other respondents (including those who were nonessential workers, retired, unemployed, and students).

††† Rural-urban classification was determined by using self-reported ZIP codes according to the Federal Office of Rural Health Policy definition of rurality. https://www.hrsa.gov/rural-health/about-us/definition/datafiles.html.

§§§ Reference groups were chosen for ease of interpretation. For example, the household income level of $50,000–$99,999 was selected as the reference group because the median household income was $61,937 in the United States in 2018. https://www.census.gov/content/dam/Census/library/publications/2019/acs/acsbr18-01.pdf.

As of June 30, 2020, among 4,975 U.S. adult respondents, 40.9% reported having delayed or avoided any medical care, including urgent or emergency care (12.0%) and routine care (31.5%), because of concerns about COVID-19 (Table 1). Groups of persons among whom urgent or emergency care avoidance exceeded 20% and among whom any care avoidance exceeded 50% included adults aged 18–24 years (30.9% for urgent or emergency care; 57.2% for any care), unpaid caregivers for adults (29.8%; 64.3%), Hispanic adults (24.6%; 55.5%), persons with disabilities (22.8%; 60.3%), persons with two or more selected underlying medical conditions (22.7%; 54.7%), and students (22.7%; 50.3%). One in four unpaid caregivers reported caring for adults who were at increased risk for severe COVID-19.

In the multivariable Poisson regression models, differences within groups were observed for urgent or emergency care avoidance (Figure) and any care avoidance (Table 2). Adjusted prevalence of urgent or emergency care avoidance was significantly higher among unpaid caregivers for adults versus noncaregivers (2.9; 2.3–3.6); persons with two or more selected underlying medical conditions versus those without those conditions (1.9; 1.5–2.4); persons with health insurance versus those without health insurance (1.8; 1.2–2.8); Black adults (1.6; 1.3–2.1) and Hispanic adults (1.5; 1.2–2.0) versus White adults; young adults aged 18–24 years versus adults aged 25–44 years (1.5; 1.2–1.8); and persons with disabilities versus those without disabilities (1.3; 1.1–1.5). Avoidance of urgent or emergency care was significantly lower among adults aged ≥45 years than among younger adults.

Discussion

As of June 30, 2020, an estimated 41% of U.S. adults reported having delayed or avoided medical care during the pandemic because of concerns about COVID-19, including 12% who reported having avoided urgent or emergency care. These findings align with recent reports that hospital admissions, overall emergency department (ED) visits, and the number of ED visits for heart attack, stroke, and hyperglycemic crisis have declined since the start of the pandemic (*3–5*), and that excess deaths directly or indirectly related to COVID-19 have increased in 2020 versus prior years (*2*). Nearly one third of adult respondents reported having delayed or avoided routine medical care, which might reflect adherence to community mitigation efforts such as stay-at-home orders, temporary closures of health facilities, or additional factors. However, if routine care avoidance were to be sustained, adults could miss opportunities for management of chronic conditions, receipt of routine vaccinations, or early detection of new conditions, which might worsen outcomes.

TABLE 1. Estimated prevalence of delay or avoidance of medical care because of concerns related to COVID-19, by type of care and respondent characteristics — United States, June 30, 2020

Characteristic	No. (%)†	Type of medical care delayed or avoided*					
		Urgent or emergency		Routine		Any	
		%†	P-value§	%†	P-value§	%†	P-value§
All respondents	**4,975 (100)**	**12.0**	—	**31.5**	—	**40.9**	—
Gender							
Female	2,528 (50.8)	11.7	0.598	35.8	<0.001	44.9	<0.001
Male	2,447 (49.2)	12.3		27.0		36.7	
Age group, yrs							
18–24	650 (13.1)	30.9	<0.001	29.6	0.072	57.2	<0.001
25–44	1,740 (35.0)	14.9		34.2		44.8	
45–64	1,727 (34.7)	5.7		30.0		34.5	
≥65	858 (17.3)	4.4		30.3		33.5	
Race/Ethnicity							
White, non-Hispanic	3,168 (63.7)	6.7	<0.001	30.9	0.020	36.2	<0.001
Black, non-Hispanic	607 (12.2)	23.3		29.7		48.1	
Asian, non-Hispanic	238 (4.8)	8.6		31.3		37.7	
Other race or multiple races, non-Hispanic¶	150 (3.0)	15.5		23.9		37.3	
Hispanic, any race or races	813 (16.3)	24.6		36.4		55.5	
Disability**							
Yes	1,108 (22.3)	22.8	<0.001	42.9	<0.001	60.3	<0.001
No	3,867 (77.7)	8.9		28.2		35.3	
Underlying medical condition††							
No	2,537 (51.0)	8.2	<0.001	27.9	<0.001	34.7	<0.001
One	1,328 (26.7)	10.4		33.0		41.2	
Two or more	1,110 (22.3)	22.7		37.7		54.7	
2019 household income, USD							
<25,000	665 (13.4)	13.9	0.416	31.2	0.554	42.8	0.454
25,000–49,999	1,038 (20.9)	11.1		30.9		38.6	
50,000–99,999	1,720 (34.6)	12.5		30.5		41.1	
≥100,000	1,552 (31.2)	11.2		33.0		41.4	
Education							
Less than high school diploma	65 (1.3)	15.6	0.442	24.7	0.019	37.9	0.170
High school diploma	833 (16.7)	12.3		28.1		38.1	
Some college	1,302 (26.2)	13.6		29.7		40.3	
Bachelor's degree	1,755 (35.3)	11.2		34.8		43.6	
Professional degree	1,020 (20.5)	10.9		31.2		39.5	
Employment status							
Employed	3,049 (61.3)	14.6	<0.001	31.5	0.407	43.3	<0.001
Unemployed	630 (12.7)	8.7		34.4		39.5	
Retired	1,129 (22.7)	5.3		29.9		33.8	
Student	166 (3.3)	22.7		30.5		50.3	
Essential worker status§§							
Essential worker	1,707 (34.3)	19.5	<0.001	32.4	0.293	48.0	<0.001
Nonessential worker	1,342 (27.0)	8.4		30.3		37.3	
Unpaid caregiver status¶¶							
Unpaid caregiver for adults	1,344 (27.0)	29.8	<0.001	41.0	<0.001	64.3	<0.001
Not unpaid caregiver for adults	3,631 (73.0)	5.4		27.9		32.2	
U.S. Census region***							
Northeast	1,122 (22.6)	11.0	0.008	33.9	0.203	42.5	0.460
Midwest	936 (18.8)	8.5		32.0		38.7	
South	1,736 (34.9)	13.9		29.6		40.7	
West	1,181 (23.7)	13.0		31.5		41.5	
Rural/Urban classification†††							
Urban	4,411 (88.7)	12.3	0.103	31.5	0.763	41.2	0.216
Rural	564 (11.3)	9.4		30.9		38.2	
Health insurance status							
Yes	4,577 (92.0)	12.4	0.036	32.6	<0.001	42.3	<0.001
No	398 (8.0)	7.8		18.4		24.8	
Know someone with positive test results for SARS-CoV-2§§§							
Yes	989 (19.9)	8.8	0.004	40.7	<0.001	46.6	<0.001
No	3,986 (80.1)	12.8		29.2		39.5	

See table footnotes on the next page.

TABLE 1. (*Continued*) Estimated prevalence of delay or avoidance of medical care because of concerns related to COVID-19, by type of care and respondent characteristics — United States, June 30, 2020

Characteristic	No. (%)†	Type of medical care delayed or avoided*					
		Urgent or emergency		Routine		Any	
		%†	P-value§	%†	P-value§	%†	P-value§
Knew someone who died from COVID-19							
Yes	364 (7.3)	10.1	0.348	41.4	<0.001	46.3	0.048
No	4,611 (92.7)	12.2		30.7		40.5	
Believed to be in group at high risk for severe COVID-19							
Yes	981 (19.7)	10.0	0.050	42.5	<0.001	49.4	<0.001
No	3,994 (80.3)	12.5		28.8		38.8	

Abbreviations: CI = confidence interval; COVID-19 = coronavirus disease 2019; USD = U.S. dollars.

* The types of medical care avoidance are not mutually exclusive; respondents had the option to indicate that they had delayed or avoided more than one type of medical care (i.e., routine medical care and urgent/emergency medical care).

† Statistical raking and weight trimming were employed to improve the cross-sectional June cohort representativeness of the U.S. population by gender, age, and race/ethnicity according to the 2010 U.S. Census.

§ The Rao-Scott adjusted Pearson chi-squared test was used to test for differences in observed and expected frequencies among groups by characteristic for avoidance of each type of medical care (e.g., whether avoidance of routine medical care differs significantly by gender). Statistical significance was evaluated at a threshold of $\alpha = 0.05$.

¶ "Other" race includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or Other.

** Persons who had a disability were defined as such based on a qualifying response to either one of two questions: "Are you limited in any way in any activities because of physical, mental, or emotional condition?" and "Do you have any health conditions that require you to use special equipment, such as a cane, wheelchair, special bed, or special telephone?" https://www.cdc.gov/brfss/questionnaires/pdf-ques/2015-brfss-questionnaire-12-29-14.pdf.

†† Selected underlying medical conditions known to increase the risk for severe COVID-19 included in this analysis were obesity, diabetes, high blood pressure, cardiovascular disease, and any type of cancer. Obesity is defined as body mass index ≥30 kg/m^2 and was calculated from self-reported height and weight (https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html). The remaining conditions were assessed using the question "Have you ever been diagnosed with any of the following conditions?" with response options of 1) "Never"; 2) "Yes, I have in the past, but don't have it now"; 3) "Yes I have, but I do not regularly take medications or receive treatment"; and 4) "Yes I have, and I am regularly taking medications or receiving treatment." Respondents who answered that they have been diagnosed and chose either response 3 or 4 were considered as having the specified medical condition.

§§ Essential worker status was self-reported.

¶¶ Unpaid caregiver status was self-reported. Unpaid caregivers for adults were defined as having provided unpaid care to a relative or friend aged ≥18 years at any time in the last 3 months. Examples provided to survey respondents included helping with personal needs, household chores, health care tasks, managing a person's finances, taking them to a doctor's appointment, arranging for outside services, and visiting regularly to see how they are doing.

*** Region classification was determined by using the U.S. Census Bureau's Census Regions and Divisions. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf.

††† Rural-urban classification was determined by using self-reported ZIP codes according to the Federal Office of Rural Health Policy definition of rurality. https://www.hrsa.gov/rural-health/about-us/definition/datafiles.html.

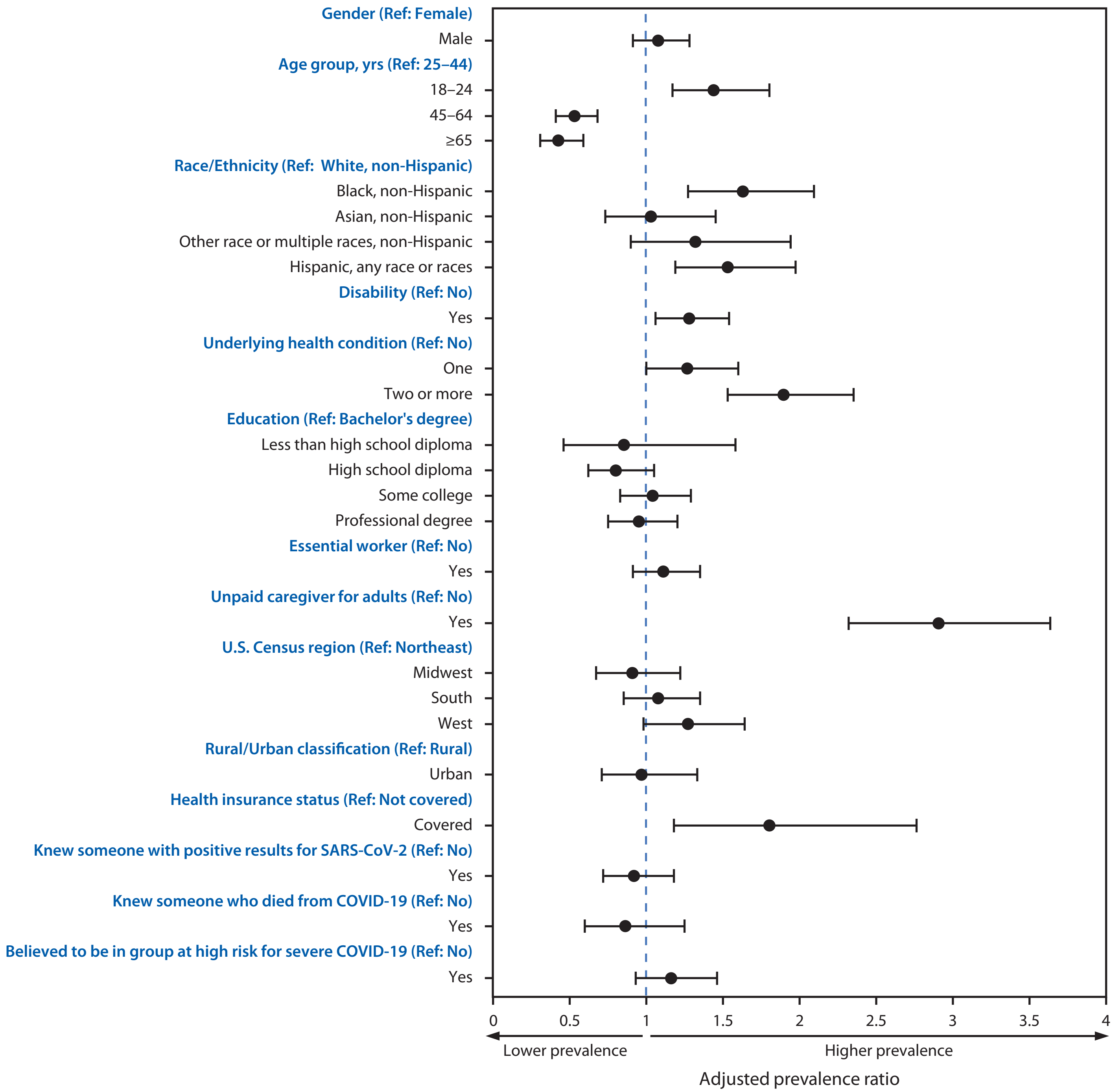
§§§ For this question, respondents were asked to select the following statement, if applicable: "I know someone who has tested positive for COVID-19."

Avoidance of both urgent or emergency and routine medical care because of COVID-19 concerns was highly prevalent among unpaid caregivers for adults, respondents with two or more underlying medical conditions, and persons with disabilities. For caregivers who reported caring for adults at increased risk for severe COVID-19, concern about exposure of care recipients might contribute to care avoidance. Persons with underlying medical conditions that increase their risk for severe COVID-19 (*6*) are more likely to require care to monitor and treat these conditions, potentially contributing to their more frequent report of avoidance. Moreover, persons at increased risk for severe COVID-19 might have avoided health care facilities because of perceived or actual increased risk of exposure to SARS-CoV-2, particularly at the onset of the pandemic. However, health care facilities are implementing important safety precautions to reduce the risk of SARS-CoV-2 infection among patients and personnel. In contrast, delay or avoidance of care might increase risk for life-threatening medical emergencies. In a recent study, states with large numbers of COVID-19–associated deaths also experienced large proportional increases in deaths from other underlying causes, including diabetes and cardiovascular disease (*7*). For persons with disabilities, accessing medical services might be challenging because of disruptions in essential support services, which can result in adverse health outcomes. Medical services for persons with disabilities might also be disrupted because of reduced availability of accessible transportation, reduced communication in accessible formats, perceptions of SARS-CoV-2 exposure risk, and specialized needs that are difficult to address with routine telehealth delivery during the pandemic response. Increasing accessibility of medical and telehealth services¶¶¶ might help prevent delay of needed care.

Increased prevalences of reported urgent or emergency care avoidance among Black adults and Hispanic adults compared with White adults are especially concerning given increased COVID-19-associated mortality among Black adults and Hispanic adults (*8*). In the United States, the age-adjusted COVID-19 hospitalization rates are approximately five times higher among Black persons and four times higher among Hispanic persons than are those among White

¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/hcp/telehealth.html.

FIGURE. Adjusted prevalence ratios*,† for characteristics§,¶,,†† associated with delay or avoidance of urgent or emergency medical care because of concerns related to COVID-19 — United States, June 30, 2020**



Abbreviation: COVID-19 = coronavirus disease 2019.

* Comparisons within subgroups were evaluated using Poisson regressions used to calculate a prevalence ratio adjusted for all characteristics shown in figure.

† 95% confidence intervals indicated with error bars.

§ "Other" race includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or Other.

¶ Selected underlying medical conditions known to increase the risk for severe COVID-19 were obesity, diabetes, high blood pressure, cardiovascular disease, and any type of cancer. Obesity is defined as body mass index ≥30 kg/m^2 and was calculated from self-reported height and weight (https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html). The remaining conditions were assessed using the question "Have you ever been diagnosed with any of the following conditions?" with response options of 1) "Never"; 2) "Yes, I have in the past, but don't have it now"; 3) "Yes I have, but I do not regularly take medications or receive treatment"; and 4) "Yes I have, and I am regularly taking medications or receiving treatment." Respondents who answered that they have been diagnosed and chose either response 3 or 4 were considered as having the specified medical condition.

** Essential worker status was self-reported. For the adjusted prevalence ratios, essential workers were compared with all other respondents (including those who were nonessential workers, retired, unemployed, and students).

†† Unpaid caregiver status was self-reported. Unpaid caregivers for adults were defined as having provided unpaid care to a relative or friend aged ≥18 years to help them take care of themselves at any time in the last 3 months.

TABLE 2. Characteristics associated with delay or avoidance of any medical care because of concerns related to COVID-19 — United States, June 30, 2020

Characteristic	Weighted* no.	Avoided or delayed any medical care		
		aPR†	(95% CI†)	P-value†
All respondents	**4,975**	—	—	—
Gender				
Female	2,528	Referent	—	—
Male	2,447	0.81	(0.75–0.87)§	<0.001
Age group, yrs				
18–24	650	1.12	(1.01–1.25)§	0.035
25–44	1,740	Referent	—	—
45–64	1,727	0.80	(0.72–0.88)§	<0.001
≥65	858	0.72	(0.64–0.81)§	<0.001
Race/Ethnicity				
White, non-Hispanic	3,168	Referent	—	—
Black, non-Hispanic	607	1.07	(0.96–1.19)	0.235
Asian, non-Hispanic	238	1.04	(0.91–1.18)	0.567
Other race or multiple races, non-Hispanic¶	150	0.87	(0.71–1.07)	0.196
Hispanic, any race or races	813	1.15	(1.03–1.27)§	0.012
Disability**				
Yes	1,108	1.33	(1.23–1.43)§	<0.001
No	3,867	Referent	—	—
Underlying medical condition††				
No	2,537	Referent	—	—
One	1,328	1.15	(1.05–1.25)§	0.004
Two or more	1,110	1.31	(1.20–1.42)§	<0.001
Education				
Less than high school diploma	65	0.72	(0.53–0.98)§	0.037
High school diploma	833	0.79	(0.71–0.89)§	<0.001
Some college	1,302	0.85	(0.78–0.93)§	0.001
Bachelor's degree	1,755	Referent	—	—
Professional degree	1,020	0.90	(0.82–0.98)§	0.019
Essential workers vs others§§				
Essential workers	1,707	1.00	(0.92–1.09)	0.960
Other respondents (nonessential workers, retired persons, unemployed persons, and students)	3,268	Referent	—	—
Unpaid caregiver status¶¶				
Unpaid caregiver for adults	1,344	1.64	(1.52–1.78)§	<0.001
Not unpaid caregiver for adults	3,631	Referent	—	—
U.S. Census region***				
Northeast	1,122	Referent	—	—
Midwest	936	0.93	(0.83–1.04)	0.214
South	1,736	0.90	(0.82–0.99)§	0.028
West	1,181	0.99	(0.89–1.09)	0.808

See table footnotes on the next page.

persons (*9*). Factors contributing to racial and ethnic disparities in SARS-CoV-2 exposure, illness, and mortality might include long-standing structural inequities that influence life expectancy, including prevalence and underlying medical conditions, health insurance status, and health care access and utilization, as well as work and living circumstances, including use of public transportation and essential worker status. Communities, health care systems, and public health agencies can foster equity by working together to ensure access to information, testing, and care to assure maintenance and management of physical and mental health.

The higher prevalence of medical care delay or avoidance among respondents with health insurance versus those without insurance might reflect differences in medical care-seeking behaviors. Before the pandemic, persons without insurance sought medical care much less frequently than did those with insurance (*10*), resulting in fewer opportunities for medical care delay or avoidance.

The findings in this report are subject to at least five limitations. First, self-reported data are subject to recall, response, and social desirability biases. Second, the survey did not assess reasons for COVID-19–associated care avoidance, such as adherence to public health recommendations; closure of health care provider facilities; reduced availability of public transportation; fear of exposure to infection with SARS-CoV-2; or availability, accessibility, and acceptance or recognition of

TABLE 2. (*Continued*) Characteristics associated with delay or avoidance of any medical care because of concerns related to COVID-19 — United States, June 30, 2020

Characteristic	Weighted* no.	Avoided or delayed any medical care		
		aPR†	(95% CI†)	P-value†
Rural/Urban classification†††				
Urban	4,411	1.00	(0.89–1.12)	0.993
Rural	564	Referent	—	—
Health insurance status				
Yes	4,577	1.61	(1.31–1.98)§	<0.001
No	398	Referent	—	—
Know someone with positive test results for SARS-CoV-2§§§				
Yes	989	1.22	(1.12–1.33)§	<0.001
No	3,986	Referent	—	—
Knew someone who died from COVID-19				
Yes	364	0.99	(0.88–1.12)	0.860
No	4,611	Referent	—	—
Believed to be in a group at high risk for severe COVID-19				
Yes	981	1.33	(1.23–1.44)§	<0.001
No	3,994	Referent	—	—

Abbreviations: aPR = adjusted prevalence ratio; CI = confidence interval; COVID-19 = coronavirus disease 2019.

* Statistical raking and weight trimming were employed to improve the cross-sectional June cohort representativeness of the U.S. population by gender, age, and race/ethnicity according to the 2010 U.S. Census.

† Comparisons within subgroups were evaluated using Poisson regressions used to calculate a prevalence ratio adjusted for all characteristics listed, as well as a 95% CI and p-value. Statistical significance was evaluated at a threshold of $\alpha = 0.05$.

§ P-value calculated using Poisson regression among respondents within a characteristic is statistically significant at levels of $p<0.05$.

¶ "Other" race includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or Other.

** Persons who had a disability were defined based on a qualifying response to either one of two questions: "Are you limited in any way in any activities because of physical, mental, or emotional condition?" and "Do you have any health conditions that require you to use special equipment, such as a cane, wheelchair, special bed, or special telephone?" https://www.cdc.gov/brfss/questionnaires/pdf-ques/2015-brfss-questionnaire-12-29-14.pdf.

†† Underlying medical conditions were obesity, diabetes, high blood pressure, cardiovascular disease, and any type of cancer. Obesity is defined as body mass index ≥30 kg/m^2 and was calculated from self-reported height and weight (https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html). The remaining conditions were assessed using the question "Have you ever been diagnosed with any of the following conditions?" with response options of 1) "Never"; 2) "Yes, I have in the past, but don't have it now"; 3) "Yes I have, but I do not regularly take medications or receive treatment"; and 4) "Yes I have, and I am regularly taking medications or receiving treatment." Respondents who answered that they have been diagnosed and chose either response 3 or 4 were considered as having the specified medical condition.

§§ Essential worker status was self-reported. For the adjusted prevalence ratios, essential workers were compared with all other respondents (including those who were nonessential workers, retired, unemployed, and students).

¶¶ Unpaid caregiver status was self-reported. Unpaid caregivers for adults were defined as having provided unpaid care to a relative or friend aged ≥18 years at any time in the last 3 months. Examples provided to survey respondents included helping with personal needs, household chores, health care tasks, managing a person's finances, taking them to a doctor's appointment, arranging for outside services, and visiting regularly to see how they are doing.

*** Region classification was determined by using the U.S. Census Bureau's Census Regions and Divisions. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf.

††† Rural/urban classification was determined by using self-reported ZIP codes according to the Federal Office of Rural Health Policy definition of rurality. https://www.hrsa.gov/rural-health/about-us/definition/datafiles.html.

§§§ For this question, respondents were asked to select the following statement, if applicable: "I know someone who has tested positive for COVID-19."

telemedicine as a means of providing care in lieu of in-person services. Third, the survey did not assess baseline patterns of care-seeking or timing or duration of care avoidance. Fourth, perceptions of whether a condition was life-threatening might vary among respondents. Finally, although quota sampling methods and survey weighting were employed to improve cohort representativeness, this web-based survey might not be fully representative of the U.S. population for income, educational attainment, and access to technology. However, the findings are consistent with reported declines in hospital admissions and ED visits during the pandemic (*3*–*5*).

CDC has issued guidance to assist persons at increased risk for severe COVID-19 in staying healthy and safely following treatment plans**** and to prepare health care facilities to safely deliver care during the pandemic.†††† Additional public outreach in accessible formats tailored for diverse audiences might encourage these persons to seek necessary care. Messages could highlight the risks of delaying needed care, especially among persons with underlying medical conditions, and the importance of timely emergency care. Patient concerns related to potential exposure to SARS-CoV-2 in health care settings could be addressed by describing facilities' precautions to reduce exposure risk.

**** https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

†††† https://www.cdc.gov/coronavirus/2019-ncov/hcp/us-healthcare-facilities.html.

Summary

What is already known about this topic?

Delayed or avoided medical care might increase morbidity and mortality associated with both chronic and acute health conditions.

What is added by this report?

By June 30, 2020, because of concerns about COVID-19, an estimated 41% of U.S. adults had delayed or avoided medical care including urgent or emergency care (12%) and routine care (32%). Avoidance of urgent or emergency care was more prevalent among unpaid caregivers for adults, persons with underlying medical conditions, Black adults, Hispanic adults, young adults, and persons with disabilities.

What are the implications for public health practice?

Understanding factors associated with medical care avoidance can inform targeted care delivery approaches and communication efforts encouraging persons to safely seek timely routine, urgent, and emergency care.

Further exploration of underlying reasons for medical care avoidance is needed, including among persons with disabilities, persons with underlying health conditions, unpaid caregivers for adults, and those who face structural inequities. If care were avoided because of concern about SARS-CoV-2 exposure or if there were closures or limited options for in-person services, providing accessible telehealth or in-home health care could address some care needs. Even during the COVID-19 pandemic, persons experiencing a medical emergency should seek and be provided care without delay (*3*).

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Corresponding author: Kristy Marynak, KMarynak@cdc.gov.

[1]Turner Institute for Brain and Mental Health, Monash University, Melbourne, Australia; [2]Austin Health, Melbourne, Australia; [3]CDC COVID-19 Response Team; [4]Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland; [5]Brigham and Women's Hospital, Boston, Massachusetts; [6]Harvard Medical School, Boston, Massachusetts; [7]University of Melbourne, Melbourne, Australia.

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Community and Close Contact Exposures Associated with COVID-19 Among Symptomatic Adults ≥18 Years in 11 Outpatient Health Care Facilities — United States, July 2020

Kiva A. Fisher, PhD[1]; Mark W. Tenforde, MD, PhD[1,2]; Leora R. Feldstein, PhD[1]; Christopher J. Lindsell, PhD[3,4]; Nathan I. Shapiro, MD[3,5]; D. Clark Files, MD[3,6]; Kevin W. Gibbs, MD[3,6]; Heidi L. Erickson, MD[3,7]; Matthew E. Prekker, MD[3,7]; Jay S. Steingrub, MD[3,8]; Matthew C. Exline, MD[3,9]; Daniel J. Henning, MD[3,10]; Jennifer G. Wilson, MD[3,11]; Samuel M. Brown, MD[3,12]; Ithan D. Peltan, MD[3,12]; Todd W. Rice, MD[3,4]; David N. Hager, MD, PhD[3,13]; Adit A. Ginde, MD[3,14]; H. Keipp Talbot, MD[3,4]; Jonathan D. Casey, MD[3,4]; Carlos G. Grijalva, MD[3,4]; Brendan Flannery, PhD[1]; Manish M. Patel, MD[1]; Wesley H. Self, MD[3,4]; IVY Network Investigators; CDC COVID-19 Response Team

Community and close contact exposures continue to drive the coronavirus disease 2019 (COVID-19) pandemic. CDC and other public health authorities recommend community mitigation strategies to reduce transmission of SARS-CoV-2, the virus that causes COVID-19 (*1*,*2*). Characterization of community exposures can be difficult to assess when widespread transmission is occurring, especially from asymptomatic persons within inherently interconnected communities. Potential exposures, such as close contact with a person with confirmed COVID-19, have primarily been assessed among COVID-19 cases, without a non-COVID-19 comparison group (*3*,*4*). To assess community and close contact exposures associated with COVID-19, exposures reported by case-patients (154) were compared with exposures reported by control-participants (160). Case-patients were symptomatic adults (persons aged ≥18 years) with SARS-CoV-2 infection confirmed by reverse transcription–polymerase chain reaction (RT-PCR) testing. Control-participants were symptomatic outpatient adults from the same health care facilities who had negative SARS-CoV-2 test results. Close contact with a person with known COVID-19 was more commonly reported among case-patients (42%) than among control-participants (14%). Case-patients were more likely to have reported dining at a restaurant (any area designated by the restaurant, including indoor, patio, and outdoor seating) in the 2 weeks preceding illness onset than were control-participants (adjusted odds ratio [aOR] = 2.4; 95% confidence interval [CI] = 1.5–3.8). Restricting the analysis to participants without known close contact with a person with confirmed COVID-19, case-patients were more likely to report dining at a restaurant (aOR = 2.8, 95% CI = 1.9–4.3) or going to a bar/coffee shop (aOR = 3.9, 95% CI = 1.5–10.1) than were control-participants. Exposures and activities where mask use and social distancing are difficult to maintain, including going to places that offer on-site eating or drinking, might be important risk factors for acquiring COVID-19. As communities reopen, efforts to reduce possible exposures at locations that offer on-site eating and drinking options should be considered to protect customers, employees, and communities.

This investigation included adults aged ≥18 years who received a first test for SARS-CoV-2 infection at an outpatient testing or health care center at one of 11 Influenza Vaccine Effectiveness in the Critically Ill (IVY) Network sites* during July 1–29, 2020 (*5*). A COVID-19 case was confirmed by RT-PCR testing for SARS-CoV-2 RNA from respiratory specimens. Assays varied among facilities. Each site generated lists of adults tested within the study period by laboratory result; adults with laboratory-confirmed COVID-19 were selected by random sampling as case-patients. For each case-patient, two adults with negative SARS-CoV-2 RT-PCR test results were randomly selected as control-participants and matched by age, sex, and study location. After randomization and matching, 615 potential case-patients and 1,212 control-participants were identified and contacted 14–23 days after the date they received SARS-CoV-2 testing. Screening questions were asked to identify eligible adults. Eligible adults for the study were symptomatic at the time of their first SARS-CoV-2 test.

CDC personnel administered structured interviews in English or five other languages† by telephone and entered data into REDCap software (*6*). Among 802 adults contacted and who agreed to participate (295 case-patients and 507 control-participants), 332 reported symptoms at the time of initial SARS-CoV-2 testing and were enrolled in the study. Eighteen interviews were excluded because of nonresponse to the community exposure questions. The final analytic sample (314) included 154 case-patients (positive SARS-CoV-2 test results) and 160 control-participants (negative SARS-CoV-2

* Baystate Medical Center, Springfield, Massachusetts; Beth Israel Deaconess Medical Center, Boston, Massachusetts; University of Colorado School of Medicine, Aurora, Colorado; Hennepin County Medical Center, Minneapolis, Minnesota; Intermountain Healthcare, Salt Lake City, Utah; Ohio State University Wexner Medical Center, Columbus, Ohio; Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina; Vanderbilt University Medical Center, Nashville, Tennessee; John Hopkins Hospital, Baltimore, Maryland; Stanford University Medical Center, Palo Alto, California; University of Washington Medical Center, Seattle, Washington). Participating states include California, Colorado, Maryland, Massachusetts, Minnesota, North Carolina, Ohio, Tennessee, Utah, and Washington.

† Other languages included Spanish, Arabic, Vietnamese, Portuguese, and Russian.

test results). Among nonparticipants, 470 were ineligible (i.e., were not symptomatic or had multiple tests), and 163 refused to participate. This activity was reviewed by CDC and participating sites and conducted consistent with applicable federal law and CDC policy.[§]

Data collected included demographic characteristics, information on underlying chronic medical conditions,[¶] symptoms, convalescence (self-rated physical and mental health), close contact (within 6 feet for ≥15 minutes) with a person with known COVID-19, workplace exposures, mask-wearing behavior, and community activities ≤14 days before symptom onset. Participants were asked about wearing a mask and possible community exposure activities (e.g., gatherings with ≤10 or >10 persons in a home; shopping; dining at a restaurant; going to an office setting, salon, gym, bar/coffee shop, or church/religious gathering; or using public transportation) on a five-point Likert-type scale ranging from "never" to "more than once per day" or "always"; for analysis, community activity responses were dichotomized as never versus one or more times during the 14 days before illness onset. For each reported activity, participants were asked to quantify degree of adherence to recommendations such as wearing a face mask of any kind or social distancing among other persons at that location, with response options ranging from "none" to "almost all." Descriptive and statistical analyses were performed to compare case-patients with control-participants, assessing differences in demographic characteristics, community exposures, and close contact. Although an effort was made initially to match case-patients to control-participants based on a 1:2 ratio, not all potential participants were eligible or completed an interview, and therefore an unmatched analysis was performed. Unconditional logistic regression models with generalized estimating equations with exchangeable correlation structure correcting standard error estimates for site-level clustering were used to assess differences in community exposures between case-patients and control-participants, adjusting for age, sex, race/ethnicity, and presence of one or more underlying chronic medical conditions. In each model, SARS-CoV-2 test result (i.e., positive or negative) was the outcome variable, and each community exposure activity was the predictor variable. The first model included the full analytic sample (314). A second model was restricted to participants who did not report close contact to a person with COVID-19 (89 case-patients and 136 control-participants). Statistical analyses were conducted using SAS software (version 9.4; SAS Institute).

Compared with case-patients, control-participants were more likely to be non-Hispanic White (p<0.01), have a college degree or higher (p<0.01), and report at least one underlying chronic medical condition (p = 0.01) (Table). In the 14 days before illness onset, 71% of case-patients and 74% of control-participants reported always using cloth face coverings or other mask types when in public. Close contact with one or more persons with known COVID-19 was reported by 42% of case-patients compared with 14% of control-participants (p<0.01), and most (51%) close contacts were family members.

Approximately one half of all participants reported shopping and visiting others inside a home (in groups of ≤10 persons) on ≥1 day during the 14 days preceding symptom onset. No significant differences were observed in the bivariate analysis between case-patients and control-participants in shopping; gatherings with ≤10 persons in a home; going to an office setting; going to a salon; gatherings with >10 persons in a home; going to a gym; using public transportation; going to a bar/coffee shop; or attending church/religious gathering. However, case-patients were more likely to have reported dining at a restaurant (aOR = 2.4, 95% CI = 1.5–3.8) in the 2 weeks before illness onset than were control-participants (Figure). Further, when the analysis was restricted to the 225 participants who did not report recent close contact with a person with known COVID-19, case-patients were more likely than were control-participants to have reported dining at a restaurant (aOR = 2.8, 95% CI = 1.9–4.3) or going to a bar/coffee shop (aOR = 3.9, 95% CI = 1.5–10.1). Among 107 participants who reported dining at a restaurant and 21 participants who reported going to a bar/coffee shop, case-patients were less likely to report observing almost all patrons at the restaurant adhering to recommendations such as wearing a mask or social distancing (p = 0.03 and p = 0.01, respectively).

Discussion

In this investigation, participants with and without COVID-19 reported generally similar community exposures, with the exception of going to locations with on-site eating and drinking options. Adults with confirmed COVID-19 (case-patients) were approximately twice as likely as were control-participants to have reported dining at a restaurant in the 14 days before becoming ill. In addition to dining at a restaurant, case-patients were more likely to report going to a bar/coffee shop, but only when the analysis was restricted to participants without close contact with persons with known COVID-19 before illness onset. Reports of exposures in restaurants have been linked to air circulation (*7*). Direction, ventilation, and intensity of airflow might affect virus transmission, even if social distancing measures and mask use are implemented according to current guidance. Masks cannot

[§] Activity was determined to meet the requirements of public health surveillance as defined in 45 CFR 46.102(l)(2).

[¶] Cardiac condition, hypertension, asthma, chronic obstructive pulmonary disease, immunodeficiency, psychiatric condition, diabetes, or obesity.

TABLE. Characteristics of symptomatic adults ≥18 years who were outpatients in 11 academic health care facilities and who received positive and negative SARS-CoV-2 test results (N = 314)* — United States, July 1–29, 2020

	No. (%)		
Characteristic	Case-patients (n = 154)	Control participants (n = 160)	P-value
Age group, yrs			
18–29	44 (28.6)	39 (24.4)	0.18
30–44	46 (29.9)	62 (38.7)	
45–59	46 (29.9)	35 (21.9)	
≥60	18 (11.7)	24 (15.0)	
Sex			
Men	75 (48.7)	72 (45.0)	0.51
Women	79 (51.3)	88 (55.0)	
Race/Ethnicity†			
White, non-Hispanic	92 (59.7)	124 (77.5)	<0.01
Hispanic/Latino	29 (18.8)	12 (7.5)	
Black, non-Hispanic	27 (17.5)	19 (11.9)	
Other, non-Hispanic	6 (3.9)	5 (3.1)	
Education (missing = 3)			
Less than high school	16 (10.5)	3 (1.9)	<0.01
High school degree or some college	60 (39.2)	48 (30.4)	
College degree or more	77 (50.3)	107 (67.7)	
At least one underlying chronic medical condition§	**75 (48.7)**	**98 (61.2)**	**0.01**
Community exposure 14 days before illness onset¶			
Shopping	131 (85.6)	141 (88.1)	0.51
Home, ≤10 persons	79 (51.3)	84 (52.5)	0.83
Restaurant	63 (40.9)	44 (27.7)	0.01
Office setting	37 (24.0)	47 (29.6)	0.27
Salon	24 (15.6)	28 (17.6)	0.63
Home, >10 persons	21 (13.6)	24 (15.0)	0.73
Gym	12 (7.8)	10 (6.3)	0.60
Public transportation	8 (5.2)	10 (6.3)	0.68
Bar/Coffee shop	13 (8.5)	8 (5.0)	0.22
Church/Religious gathering	12 (7.8)	8 (5.0)	0.32
Restaurant: others following recommendations such as wearing a face covering or mask of any kind or social distancing (n = 107)			
None/A few	12 (19.0)	1 (2.3)	0.03
About half/Most	25 (39.7)	21 (47.7)	
Almost all	26 (41.3)	22 (50.0)	
Bar: others following recommendations such as wearing a face covering or mask of any kind or social distancing (n = 21)			
None/A few	4 (31.8)	2 (25.0)	0.01
About half/Most	7 (53.8)	0 (0.0)	
Almost all	2 (15.4)	6 (75.0)	

See table footnotes on the next page.

be effectively worn while eating and drinking, whereas shopping and numerous other indoor activities do not preclude mask use.

Among adults with COVID-19, 42% reported close contact with a person with COVID-19, similar to what has been reported previously (*4*). Most close contact exposures were to family members, consistent with household transmission of SARS-CoV-2 (*8*). Fewer (14%) persons who received a negative SARS-CoV-2 test result reported close contact with a person with known COVID-19. To help slow the spread of SARS-CoV-2, precautions should be implemented to stay home once exposed to someone with COVID-19,** in addition to adhering to recommendations to wash hands often, wear masks, and social distance.†† If a family member or other close contact is ill, additional prevention measures can be taken to reduce transmission, such as cleaning and disinfecting the home, reducing shared meals and items, wearing gloves, and wearing masks, for those with and without known COVID-19.§§

The findings in this report are subject to at least five limitations. First, the sample included 314 symptomatic patients who actively sought testing during July 1–29, 2020 at 11 health care facilities. Symptomatic adults with negative SARS-CoV-2 test results might have been infected with other respiratory

** https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html.

†† https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/index.html.
§§ https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/index.html.

TABLE. (*Continued*) Characteristics of symptomatic adults ≥18 years who were outpatients in 11 academic health care facilities and who received positive and negative SARS-CoV-2 test results (N = 314)* — United States, July 1–29, 2020

Characteristic	No. (%) Case-patients (n = 154)	No. (%) Control participants (n = 160)	P-value
Previous close contact with a person with known COVID-19 (missing = 1)			
No	89 (57.8)	136 (85.5)	<0.01
Yes	65 (42.2)	23 (14.5)	
Relationship to close contact with known COVID-19 (n = 88)			
Family	33 (50.8)	5 (21.7)	<0.01
Friend	9 (13.8)	4 (17.4)	
Work colleague	11 (16.9)	6 (26.1)	
Other**	6 (9.2)	8 (34.8)	
Multiple	6 (9.2)	0 (0.0)	
Reported use of cloth face covering or mask 14 days before illness onset (missing = 2)			
Never	6 (3.9)	5 (3.1)	0.86
Rarely	6 (3.9)	6 (3.8)	
Sometimes	11 (7.2)	7 (4.4)	
Often	22 (14.4)	23 (14.5)	
Always	108 (70.6)	118 (74.2)	

* Respondents who completed the interview 14–23 days after their test date. Five participants had significant missingness for exposure questions and were removed from the analysis. Patients were randomly sampled from 11 academic health care systems that are part of the Influenza Vaccine Effectiveness in the Critically Ill Network sites (Baystate Medical Center, Springfield, Massachusetts; Beth Israel Deaconess Medical Center, Boston, Massachusetts; University of Colorado School of Medicine, Aurora, Colorado; Hennepin County Medical Center, Minneapolis, Minnesota; Intermountain Healthcare, Salt Lake City, Utah; Ohio State University Wexner Medical Center, Columbus, Ohio; Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina; Vanderbilt University Medical Center, Nashville, Tennessee; John Hopkins Hospital, Baltimore, Maryland; Stanford University Medical Center, Palo Alto, California; University of Washington Medical Center, Seattle, Washington). Participating states include California, Colorado, Maryland, Massachusetts, Minnesota, North Carolina, Ohio, Tennessee, Utah, and Washington.

† Other race includes responses of Native American/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, and other; these were combined because of small sample sizes.

§ Reported at least one of the following underlying chronic medical conditions: cardiac condition, hypertension, asthma, chronic obstructive pulmonary disease, immunodeficiency, psychiatric condition, diabetes, or obesity.

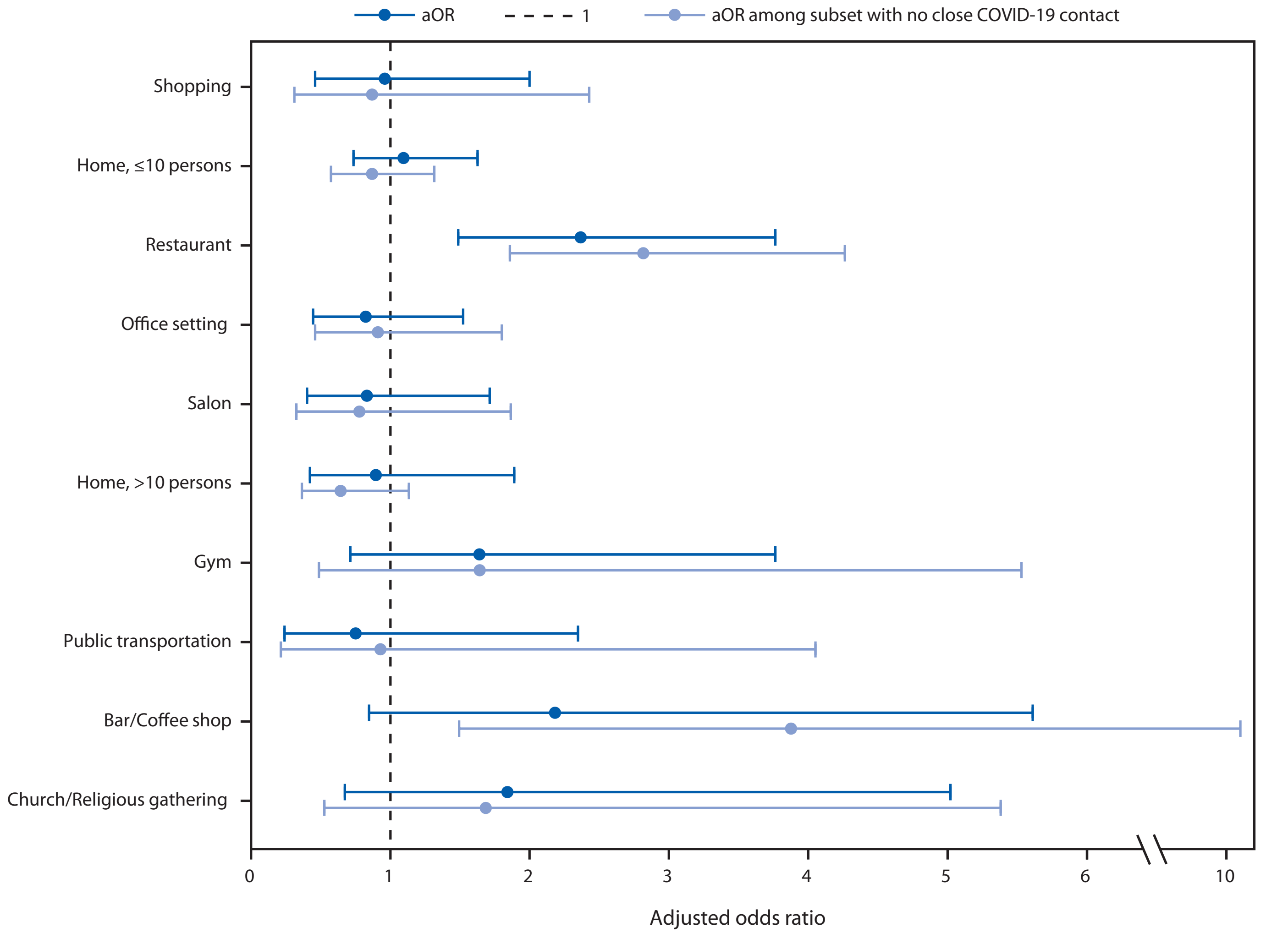
¶ Community exposure questions asked were "In the 14 days before feeling ill about how often did you:" with options of "shop for items (groceries, prescriptions, home goods, clothing, etc.)" (missing = 1); "have people visit you inside your home or go inside someone else's home where there were more than 10 people"; "have people visit you inside your home or go inside someone else's home where there were 10 people or less"; "go to church or a religious gathering/place of worship" (missing = 1); "go to a restaurant (dine-in, any area designated by the restaurant including patio seating)" (missing = 1); "go to a bar or coffee shop (indoors)" (missing = 2); "use public transportation (bus, subway, streetcar, train, etc.)" (missing = 1); "go to an office setting (other than for healthcare purposes)" (missing = 1); "go to a gym or fitness center" (missing = 1); and "go to a salon or barber (e.g., hair salon, nail salon, etc.)" (missing = 1). Response options were coded as never versus at least once in the 14 days prior to illness onset. Some participants had missing data for exposure questions:

** Other includes patients of health care workers (9), patron of a restaurant (1), spouse of employee (1), day care teacher (1), member of a religious congregation (1), and unspecified (1).

viruses and had similar exposures to persons with cases of such illnesses. Persons who did not respond, or refused to participate, could be systematically different from those who were interviewed for this investigation. Efforts to age- and sex-match participating case-patients and control-participants were not maintained because of participants not meeting the eligibility criteria, refusing to participate, or not responding, and this was accounted for in the analytic approach. Second, unmeasured confounding is possible, such that reported behaviors might represent factors, including concurrently participating in activities where possible exposures could have taken place, that were not included in the analysis or measured in the survey. Of note, the question assessing dining at a restaurant did not distinguish between indoor and outdoor options. In addition, the question about going to a bar or coffee shop did not distinguish between the venues or service delivery methods, which might represent different exposures. Third, adults in the study were from one of 11 participating health care facilities and might not be representative of the United States population. Fourth, participants were aware of their SARS-CoV-2 test results, which could have influenced their responses to questions about community exposures and close contacts. Finally, case or control status might be subject to misclassification because of imperfect sensitivity or specificity of PCR-based testing (*9*,*10*).

This investigation highlights differences in community and close contact exposures between adults who received a positive SARS-CoV-2 test result and those who received a negative SARS-CoV-2 test result. Continued assessment of various types of activities and exposures as communities, schools, and workplaces reopen is important. Exposures and activities where mask use and social distancing are difficult to maintain, including going to locations that offer on-site eating and drinking, might be important risk factors for

FIGURE. Adjusted odds ratio (aOR)* and 95% confidence intervals for community exposures† associated with confirmed COVID-19 among symptomatic adults aged ≥18 years (N = 314) — United States, July 1–29, 2020



Abbreviation: COVID-19 = coronavirus disease 2019.

* Adjusted for race/ethnicity, sex, age, and reporting at least one underlying chronic medical condition. Odds ratios were estimated using unconditional logistic regression with generalized estimating equations, which accounted for Influenza Vaccine Effectiveness in the Critically Ill Network site-level clustering. A second model was restricted to participants who did not report close contact to a person known to have COVID-19 (n = 225).

† Community exposure questions asked were "In the 14 days before feeling ill about how often did you: shop for items (groceries, prescriptions, home goods, clothing, etc.); have people visit you inside your home or go inside someone else's home where there were more than 10 people; have people visit you inside your home or go inside someone else's home where there were 10 people or less; go to church or a religious gathering/place of worship; go to a restaurant (dine-in, any area designated by the restaurant including patio seating); go to a bar or coffee shop (indoors); use public transportation (bus, subway, streetcar, train, etc.); go to an office setting (other than for healthcare purposes); go to a gym or fitness center; go to a salon or barber (e.g., hair salon, nail salon, etc.)." Response options were coded as never versus at least once in the 14 days before illness onset.

SARS-CoV-2 infection. Implementing safe practices to reduce exposures to SARS-CoV-2 during on-site eating and drinking should be considered to protect customers, employees, and communities¶¶ and slow the spread of COVID-19.

¶¶ https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/personal-social-activities.html#restaurant; https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/business-employers/bars-restaurants.html; https://www.cdc.gov/coronavirus/2019-ncov/images/community/Rest_Bars_RiskAssessment.jpg.

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Zhanar Haimovich, Northrop Grumman; Sherri Pals, Division of Global HIV & TB, Center for Global Health, CDC.

Corresponding author: Kiva A. Fisher, eocevent458@cdc.gov.

Summary

What is already known about the topic?

Community and close contact exposures contribute to the spread of COVID-19.

What is added by this report?

Findings from a case-control investigation of symptomatic outpatients from 11 U.S. health care facilities found that close contact with persons with known COVID-19 or going to locations that offer on-site eating and drinking options were associated with COVID-19 positivity. Adults with positive SARS-CoV-2 test results were approximately twice as likely to have reported dining at a restaurant than were those with negative SARS-CoV-2 test results.

What are the implications for public health practice?

Eating and drinking on-site at locations that offer such options might be important risk factors associated with SARS-CoV-2 infection. Efforts to reduce possible exposures where mask use and social distancing are difficult to maintain, such as when eating and drinking, should be considered to protect customers, employees, and communities.

[1]CDC COVID-19 Response Team; [2]Epidemic Intelligence Service, CDC; [3]Influenza Vaccine Effectiveness in the Critically Ill (IVY) Network; [4]Vanderbilt University Medical Center, Nashville, Tennessee; [5]Beth Israel Deaconess Medical Center, Boston, Massachusetts; [6]Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina; [7]Hennepin County Medical Center, Minneapolis, Minnesota; [8]Baystate Medical Center, Springfield, Massachusetts; [9]Ohio State University Wexner Medical Center, Columbus, Ohio; [10]University of Washington Medical Center, Seattle, Washington; [11]Stanford University Medical Center, Palo Alto, California; [12]Intermountain Healthcare, Salt Lake City, Utah; [13]Johns Hopkins Hospital, Baltimore, Maryland; [14]University of Colorado School of Medicine, Aurora, Colorado.

IVY Network Investigators

Kimberly W. Hart, Vanderbilt University Medical Center; Robert McClellan, Vanderbilt University Medical Center; Hsi-nien Tan, Vanderbilt University Medical Center; Adrienne Baughman, Vanderbilt University Medical Center.

CDC COVID-19 Response Team

Nora A. Hennesy, CDC COVID-19 Response Team; Brittany Grear, CDC COVID-19 Response Team; Michael Wu, CDC COVID-19 Response Team; Kristin Mlynarczyk, CDC COVID-19 Response Team; Luc Marzano, CDC COVID-19 Response Team; Zuwena Plata, CDC COVID-19 Response Team; Alexis Caplan, CDC COVID-19 Response Team; Samantha M. Olson, CDC COVID-19 Response Team; Constance E. Ogokeh, CDC COVID-19 Response Team; Emily R. Smith, CDC COVID-19 Response Team; Sara S. Kim, CDC COVID-19 Response Team; Eric P. Griggs, CDC COVID-19 Response Team; Bridget Richards, CDC COVID-19 Response Team; Sonya Robinson, CDC COVID-19 Response Team; Kaylee Kim, CDC COVID-19 Response Team; Ahmed M. Kassem, CDC COVID-19 Response Team; Courtney N. Sciarratta, CDC COVID-19 Response Team; Paula L. Marcet, CDC COVID-19 Response Team.

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Infants with Congenital Disorders Identified Through Newborn Screening — United States, 2015–2017

Marci K. Sontag, PhD[1,2]; Careema Yusuf, MPH[3]; Scott D. Grosse, PhD[4]; Sari Edelman, MPH[3]; Joshua I. Miller, MPH[1,2]; Sarah McKasson, MPH[1,2]; Yvonne Kellar-Guenther, PhD[1,5]; Marcus Gaffney[4]; Cynthia F. Hinton, PhD[6]; Carla Cuthbert, PhD[6]; Sikha Singh, MHS[3]; Jelili Ojodu, MPH[3]; Stuart K. Shapira, MD, PhD[4]

Newborn screening (NBS) identifies infants at risk for congenital disorders for which early intervention has been shown to improve outcomes (*1*). State public health programs are encouraged to screen for disorders on the national Recommended Uniform Screening Panel (RUSP), which increased from 29 disorders in 2005 to 35 in 2018.* The RUSP includes hearing loss (HL) and critical congenital heart defects, which can be detected through point-of-care screening, and 33 disorders detected through laboratory screening of dried blood spot (DBS) specimens. Numbers of cases for 33 disorders on the RUSP (32 DBS disorders and HL) reported by 50 U.S. state programs were tabulated. The three subtypes of sickle cell disease (SCD) listed as separate disorders on the RUSP (S,S disease; S,beta-thalassemia; and S,C disease) were combined for the current analysis, and the frequencies of the resulting disorders were calculated relative to annual births. During 2015–2017, the overall prevalence was 34.0 per 10,000 live births. Applying that frequency to 3,791,712 live births in 2018,† approximately 12,900 infants are expected to be identified each year with one of the disorders included in the study. The most prevalent disorder is HL (16.5 per 10,000), and the most prevalent DBS disorders are primary congenital hypothyroidism (CH) (6.0 per 10,000), SCD (4.9 per 10,000), and cystic fibrosis (CF) (1.8 per 10,000). Notable changes in prevalence for each of these disorders have occurred since the previous estimates based on 2006 births (*2*). The number of infants identified at a national level highlights the effect that NBS programs are having on infant health through early detection, intervention, and potential improved health, regardless of geographic, racial/ethnic, or socioeconomic differences.

A 2008 report estimated that in 2006, 6,439 U.S. infants were identified with any of 27 DBS disorders included on the RUSP (*2*). Because complete data were available from only four states, that estimate was derived from nonlinear modeling techniques applied to 2001–2006 NBS data reported by those states, extrapolated to 2006 U.S. births adjusted for the race/ethnicity distributions (*2*). The objectives of the current study were to update national estimates of infants with NBS disorders included on the RUSP and to compare these updated prevalence estimates with those previously reported.

The current study is based on data reported for 33 of the 35 disorders included on the RUSP among infants born during 2015–2017, the most recent years of available national data. States reported aggregate numbers of confirmed cases of 32 RUSP DBS disorders to the Association of Public Health Laboratories' Newborn Screening Technical assistance and Evaluation Program (NewSTEPs) (*3*), a Health Resources and Services Administration-funded data repository. States were requested to apply uniform case definitions established by clinical and public health experts and adopted by NewSTEPs (*4*). All 50 state programs reported data to NewSTEPs; however, several states were unable to report data for some of the DBS disorders included in this study. In addition, four disorders (severe combined immunodeficiency, glycogen storage disease type II [Pompe disease], mucopolysaccharidosis type 1, and X-linked adrenoleukodystrophy) were added to the RUSP since 2006, for which screening was implemented in some states during the 3-year data collection time frame. Aggregate numbers of confirmed cases of HL among 2015–2017 births were reported from 48 states to CDC's Early Hearing Detection and Intervention (EHDI) Hearing Screening and Follow-up Survey (HSFS) (*5*).§ Colorado did not report HL data for the 2015–2017 period, and Minnesota reported data for 2017 only. The District of Columbia did not report data for any of the DBS NBS disorders, so it was excluded from the analysis.

Because SCD is generally considered a condition comprising multiple subtypes,¶ the three SCD subtypes on the RUSP were combined into a single disorder for the current assessment. Two RUSP disorders were not included in this assessment: critical congenital heart defects, because few states require reports (*6*), and spinal muscular atrophy, because it was not added to the RUSP until after the 2015–2017 period covered in this study.**

Annual births for each state during 2015–2017 and nationally in 2018 (the most recent year with data) were ascertained from CDC WONDER.†† For each of the disorders, prevalence

* https://www.hrsa.gov/advisory-committees/heritable-disorders/rusp/index.html.
† https://www.cdc.gov/nchs/nvss/births.htm.

§ https://www.cdc.gov/ncbddd/hearingloss/ehdi-data.html.
¶ https://www.cdc.gov/ncbddd/sicklecell/facts.html.
** https://www.hrsa.gov/sites/default/files/hrsa/advisory-committees/heritable-disorders/rusp/previous-nominations/sma-consumer-summary.pdf.
†† https://wonder.cdc.gov/.

estimates for 2015–2017 were calculated. For each disorder, denominator data included only births during months for which universal screening was available in the state and the state reported data for the disorder to NewSTEPs or HSFS. To estimate annual case counts, the 2015–2017 prevalence rates calculated empirically in this assessment were applied to the total U.S. birth cohort for 2018. Prevalence estimates for NBS disorders among infants born during 2015–2017 were compared with estimates among infants born in 2006. For 27 DBS disorders on the RUSP, 2006 estimates were ascertained from the NBS modeling study report (*2*). These data were supplemented with HL data reported to HSFS for 2006.

Prevalence estimates for each of the disorders and all disorders combined are presented for all 50 states (Table), and the prevalence of each disorder is presented by state in a heat map (Supplementary Table, https://stacks.cdc.gov/view/cdc/93107). During 2015–2017, the birth prevalences for any of the disorders, any of the DBS disorders, and HL were estimated at 34.0, 17.5, and 16.5 per 10,000, respectively. Prevalences of individual DBS disorders varied from 0.01 to 6.0 per 10,000. The most prevalent DBS disorders were CH (6.0 per 10,000), SCD (4.9 per 10,000), and CF (1.8 per 10,000); together, these accounted for 73% of all cases of DBS disorders.

The estimated 2006 prevalence of any DBS disorder on the RUSP, other than type 1 tyrosinemia, was 15.6 per 10,000 (6,439 per 4,138,349) births (*2*). The estimated number of HL cases in 2006 based on HSFS data was 4,097 (9.9 per 10,000) (Table). Thus, the total 2006 prevalence estimate for any of the assessed disorders on the RUSP was 25.5 per 10,000 infants. The RUSP disorders prevalence estimate of 34.0 per 10,000 reported here for infants born during 2015–2017 is a 33% increase since 2006, with more than three-quarters (78%) of that increase driven by HL.

Notable changes in prevalence between 2006 and 2015–2017 occurred for several disorders. Among the more prevalent DBS disorders, the observed rate during 2015–2017 was lower than the modeled rate in 2006 for CF (-1.19 per 10,000) and higher for SCD (0.65 per 10,000) and CH (0.79 per 10,000). The observed rate for HL during 2015–2017 was substantially higher (16.5 per 10,000) than the rate based on 2006 HSFS data (9.9 per 10,000). Variable prevalences by state were observed, with HL, CH, and SCD being the most prevalent in most states (Supplementary Table, https://stacks.cdc.gov/view/cdc/93107).

Applying the 2015–2017 prevalence estimate of 34.0 per 10,000 live births to the number of U.S. live births in 2018 (3,791,712), approximately 12,900 infants (6,646 with DBS disorders and 6,259 with HL) are expected to be identified annually with one of the included NBS disorders.

Discussion

This is the first published report of the prevalence of NBS disorders in the United States using cases reported by all 50 states. Based on 2018 live births, approximately 12,900 U.S. infants are predicted to be identified each year through NBS with one of the included RUSP disorders (DBS and HL). This total reflects only a modest increase of 3.2% in the number of infants identified with a DBS disorder between 2006 (6,439 infants) and the expected number in 2018 (6,646 infants), even though four new disorders with an estimated 459 infants identified in 2018 (7.1% increase) were added to the RUSP since 2006. This small increase in the number of reported cases is less than one half of the expected increase from the new disorders if the number of births had remained the same. It is the net result of an increase in the prevalence of identified infants with DBS disorders since 2006 for both existing and new RUSP disorders and a marked reduction in the number of births in the United States after 2006. In contrast, the number of infants identified with HL increased substantially from an estimated 4,097 in 2006 to an expected 6,259 in 2018; this large increase likely reflects improvements in follow-up documentation by EHDI programs (*5*).

Although the overall prevalence of DBS disorders increased from 2006 (15.6 per 10,000) to 2015–2017 (17.5 per 10,000), changes in individual disorder prevalence estimates varied. Random variation and small numbers might have affected the estimates for each period. Notable changes in prevalence for each of the three most prevalent DBS disorders were observed. First, the lower prevalence of CF during 2015–2017 compared with 2006 might reflect a reduction in live births with CF under the influence of widespread neonatal and prenatal screening and reproductive counseling (*7*). Second, the increase in CH prevalence might be a continuation of long-term trends related to a higher proportion of U.S. births to Hispanic parents, among other factors (*8*). Finally, the higher prevalence of SCD might reflect more births to parents originating from countries where SCD is relatively common[§§] (*9*). Variations in prevalence of individual disorders across states might reflect differences in the geographic distribution of disease-causing genetic variants and differences in screening methods, case definitions, follow-up, and reporting practices.

The findings in this report are subject to at least four limitations. First, the prevalence rates calculated for the newest disorders that have been added to the RUSP are based on data from only a few states across a short period, making these rates less robust than the rates for the other disorders. However, changes in estimated prevalences for these rare disorders are not likely

[§§] https://www.pewsocialtrends.org/2015/04/09/a-rising-share-of-the-u-s-black-population-is-foreign-born/.

TABLE. Aggregate newborn screening disorder frequency, prevalence, and expected cases compared with modeled 2006 data for selected disorders, based on frequencies reported in four states, 2001–2006* — 50 state NBS programs, United States, 2015–2017

Disorder	No. of cases reported 2015–2017†	No. of births§	Rate (cases per 10,000 births)	2006 modeled rate*	Rate difference	Expected no. of cases per year¶
Amino acid disorders						
Classical phenylketonuria and hyperphenylalaninemia	691	11,750,876	0.59	0.52	0.07	223
Maple syrup urine disease	64	11,750,876	0.05	0.06	−0.01	21
Homocystinuria	18	11,750,876	0.02	0.03	−0.01	6
Citrullinemia, type I	75	11,750,876	0.06	0.06	0.01	24
Argininosuccinic aciduria	59	11,750,876	0.05	0.02	0.03	19
Tyrosinemia, type I	22	11,750,876	0.02	NR*	—*	7
Organic acid disorders						
Isovaleric acidemia	84	11,750,876	0.07	0.08	−0.01	27
Glutaric acidemia, type I	104	11,750,876	0.09	0.09	−0.00	34
3-Hydroxy-3-methylglutaric aciduria	6	11,750,876	0.01	0.01	−0.00	2
3-Methylcrotonyl-CoA carboxylase deficiency	293	11,750,876	0.25	0.24	0.01	95
Methylmalonic acidemia (methylmalonyl-CoA mutase)	22	11,750,876	0.02	0.12	−0.10	7
Propionic acidemia	63	11,750,876	0.05	0.04	0.02	20
Methylmalonic acidemia (cobalamin disorders)	43	11,750,876	0.04	0.03	0.01	14
Holocarboxylase synthase deficiency	6	11,750,876	0.01	0.01	−0.00	2
β-Ketothiolase deficiency	8	11,750,876	0.01	0.02	−0.01	3
Fatty acid oxidation disorders						
Medium-chain acyl-CoA dehydrogenase deficiency	689	11,750,876	0.59	0.58	0.01	222
Very long-chain acyl-CoA dehydrogenase deficiency	206	11,750,876	0.18	0.17	0.01	66
Long-chain L-3 hydroxyacyl-CoA dehydrogenase deficiency	26	11,750,876	0.02	0.03	−0.01	8
Trifunctional protein deficiency	6	11,750,876	0.01	0.00	0.00	2
Carnitine uptake defect/carnitine transport defect	138	11,750,876	0.12	0.21	−0.09	45
Hemoglobinopathies						
SCD (includes S,S disease, S,beta-thalassemia, and S,C disease)	5,808	11,750,876	4.94	4.29	0.65	1,874
Endocrine disorders						
Primary congenital hypothyroidism	6,629	11,049,582	6.00	5.21	0.79	2,275
Congenital adrenal hyperplasia	819	11,750,876	0.70	0.49	0.21	264
Lysosomal storage disorders						
Glycogen storage disease, type II (Pompe)	62	1,828,917	0.34	—**	—**	129
Mucopolysaccharidosis, type 1	11	965,027	0.11	—**	—**	43
Other DBS screening disorders						
Biotinidase deficiency	477	11,750,876	0.41	0.15	0.26	154
Cystic fibrosis	2,145	11,750,876	1.83	3.02	−1.19	692
Classical galactosemia	249	11,750,876	0.21	0.54	−0.33	80
Severe combined immunodeficiencies	220	9,763,119	0.23	—**	—**	85
X-linked adrenoleukodystrophy	83	1,561,394	0.53	—**	—**	202
Point-of-care screening disorders††						
Hearing loss	19,167	11,611,293	16.51	9.90§§	6.61	6,259
Infants expected to be detected with an NBS disorder						**12,905**
Prevalence per 10,000 births						34.0
Infants expected to be detected via DBS screening						**6,646**
Prevalence per 10,000 births, DBS only						17.5

Abbreviations: DBS = dried blood spot; NBS = newborn screening; NR = not reported; SCD = sickle cell disease.

* https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5737a2.htm. Tyrosinemia, type I was not included because of unreliable data at the time of the report.

† Data were not available for the following disorders and states: primary congenital hypothyroidism from New York (2015–2017) and hearing loss from Colorado (2015–2017) and Minnesota (2015, 2016).

§ The number of births includes only births that occurred during 2015–2017 that each state conducted screening for the disorder and reported data to the Association of Public Health Laboratories, Newborn Screening Technical assistance and Evaluation Program or CDC's Hearing Screening and Follow-up Survey.

¶ Disorder frequency based on 3,791,712 live births nationally (50 states and the District of Columbia [DC]) in 2018; all case numbers are rounded estimates.

** Not included on the Recommended Uniform Screening Panel in 2006.

†† State level data for critical congenital heart defects, the other point-of-care screen on the Recommended Uniform Screening Panel, are not included in this table as data are not available from most states despite universal screening in the United States for these disorders.

§§ Prevalence based on hearing loss cases reported by 45 states and DC in 2006 to CDC's Hearing Screening and Follow-up Survey.

to have a large impact on the overall rate of infants identified with an NBS disorder. Second, the study did not include two disorders on the RUSP (spinal muscular atrophy and critical congenital heart defects) because of lack of data; future studies could incorporate these disorders once reliable national data are available. Third, differences among the reporting practices of both NBS and EHDI programs potentially limit the interpretation of these data. Although NewSTEPs recommends uniform case definitions (*5*), not all NBS programs applied these definitions to the cases submitted. Finally, state prevalence estimates for individual disorders might be affected by 1) newborns born in one state and screened in another or 2) newborns from surrounding states born and screened in a state other than their resident state; however, national-level estimates would not be affected. A strength of the study is that the prior prevalence estimates of NBS disorders are modeled estimates based on four states, whereas the current study relies on reported numbers of disorders from 50 states.

The number of infants identified by NBS at a national level highlights the scope of the effect that NBS programs are having as they identify infants at risk for significant morbidity and mortality and refer them for recommended intervention. NBS continues to be a major public health achievement, offering population-based early detection, intervention, and potential improved outcomes to all infants, regardless of geographic, racial/ethnic, or socioeconomic differences (*10*).

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Corresponding author: Marci K. Sontag, msontag@ciinternational.com, 303-867-1315.

[1]Center for Public Health Innovation, CI International, Littleton, Colorado; [2]Department of Epidemiology, Colorado School of Public Health, University of Colorado Denver, Anschutz Medical Campus, Aurora, Colorado; [3]Association of Public Health Laboratories, Silver Spring, Maryland; [4]National Center on Birth Defects and Developmental Disabilities, CDC; [5]Department of Community and Behavioral Health, Colorado School of Public Health, University of Colorado Denver, Anschutz Medical Campus, Aurora, Colorado; [6]Newborn Screening and Molecular Biology Branch, Division of Laboratory Sciences, CDC.

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Summary

What is already known about this topic?

Previous modeled estimates of the number of infants identified by newborn screening (NBS), in conjunction with CDC's Hearing Screening and Follow-up Survey data, predicted approximately 10,500 cases of NBS disorders in the United States in 2006 (25.5 per 10,000 births).

What is added by this report?

This first national report based on reported cases from all 50 states estimates that approximately 12,900 births might be identified each year with an NBS disorder included in the study (34.0 per 10,000 births).

What are the implications for public health practice?

NBS continues to be one of the most successful public health interventions, offering early detection and intervention to all infants, regardless of geographic, ethnic, or socioeconomic differences.

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Newborn Screening Practices and Alpha-Thalassemia Detection — United States, 2016

M.A. Bender, MD, PhD[1]; Careema Yusuf, MPH[2]; Tim Davis[3]; M. Christine Dorley, PhD[4]; Maria del Pilar Aguinaga, PhD[5]; Amanda Ingram[6]; Ming S. Chan, PhD[7]; Joseph C. Ubaike[8]; Kathryn Hassell, MD[9]; Jelili Ojodu, MPH[2]; Mary Hulihan, DrPH[10]

Alpha-thalassemia comprises a group of inherited disorders in which alpha-hemoglobin chain production is reduced. Depending on the genotype, alpha-thalassemia results in moderate to profound anemia, hemolysis, growth delays, splenomegaly, and increased risk for thromboembolic events; certain patients might require chronic transfusions. Although alpha-thalassemia is not a core condition of the United States Recommended Uniform Screening Panel* for state newborn screening programs, methodologies used by some newborn screening programs to detect sickle cell disease, which is a core panel condition, also detect a quantitative marker of alpha-thalassemia, hemoglobin (Hb) Bart's, an abnormal type of hemoglobin. The percentage of Hb Bart's detected correlates with alpha-thalassemia severity. The Association of Public Health Laboratories' Hemoglobinopathy Workgroup conducted a survey of state newborn screening programs' alpha-thalassemia screening methodologies and reporting and follow-up practices. Survey findings indicated that 41 of 44 responding programs (93%) report some form of alpha-thalassemia results and 57% used a two-method screening protocol. However, the percentage of Hb Bart's used for thalassemia classification, the types of alpha-thalassemia reported, and the recipients of this information varied widely. These survey findings highlight the opportunity for newborn screening programs to revisit their policies as they reevaluate their practices in light of the recently released guideline from the Clinical and Laboratory Standards Institute (CLSI) on Newborn Screening for Hemoglobinopathies (*1*). Although deferring to local programs for policies, the report used a cutoff of 25% Hb Bart's in its decision tree, a value many programs do not use. Standardization of screening and reporting might lead to more timely diagnoses and health care services and improved outcomes for persons with a clinically significant alpha-thalassemia.

Thalassemias are the most common single gene disorders (*2*), with approximately 5% of the world's population having an alpha-thalassemia variant (*3*). Public health data for the United States are lacking, but in California, 1 in 10,000 newborns has an alpha-thalassemia syndrome (*4*). Prevalence is highest among Laotians and Cambodians and is also found among African, Chinese, Filipino, Mediterranean, Vietnamese, and Thai persons, as well as among those with Middle Eastern ancestry (*3*). Genetic mutations in the alpha-globin gene cluster on chromosome 16 are responsible for alpha-thalassemia, resulting in inefficient production of red blood cells, which affects organ function and growth and results in anemia and iron overload. Most alpha-thalassemias are due to deletion mutations, but there are also less common nondeletion mutations (*5*). Because screening platforms vary in their resolution and sensitivity for detection and quantification of aberrant hemoglobin species, using a different platform for the first round of screening compared with the second round maximizes the number of persons identified with Hb Bart's levels indicative of alpha-thalassemia.

To better understand newborn screening programs' alpha-thalassemia screening practices, the Association of Public Health Laboratories' Hemoglobinopathy Workgroup initiated the first nationwide survey of U.S. newborn screening programs in October 2016. An eight-question survey was e-mailed to all 53 U.S. newborn screening programs. Nonrespondents received reminder e-mails and telephone calls in an effort to maximize the response rate. The e-mail, which was addressed to the main contacts at each newborn screening program (i.e., laboratory directors, laboratory managers, and follow-up staff members), was sent with a survey link, encouraging collaboration to complete one survey per newborn screening program. Questions covered the methods used for testing, number of screening tests used, procedures for reporting of results, and follow-up protocols.

At the end of the survey period, 44 (83%) of the 53 newborn screening programs responded to the survey. All 44 responding programs used methods capable of screening for alpha-thalassemia, and 41 (93%) reported the results. Twenty-five (57%) programs reported use of two modalities for screening for alpha-thalassemia, 14 (32%) reported use of one screening modality only, and two (4.5%) did not provide sufficient information to determine whether they use one or two methods. Among the 25 newborn screening programs that reported using two screening modalities, 15 (60%) used isoelectric focusing (IEF) as their first test, and 10 (40%) used high performance liquid chromatography (HPLC). For a secondary method, 15 (60%) used HPLC, and 10 (40%) used IEF. Among the

* https://www.hrsa.gov/advisory-committees/heritable-disorders/rusp/index.html.

14 programs using only one test, eight used IEF, and six used HPLC. The CLSI report does not preferentially recommend a particular method or whether to use one or both technologies.

Patients with more deleted alpha-genes have increased levels of Hb Bart's and increased clinical severity (Table 1). Each form of alpha-thalassemia is associated with a range of Hb Bart's, and individual programs determine what thresholds or cutoffs they will use for screening. The Hb Bart's cutoff percentage used for classifying alpha-thalassemia types varied widely among programs (Table 2), as did the means of reporting of results indicative of alpha-thalassemias. Some reported only that Hb Bart's was present, some reported a single form of suspected alpha-thalassemia (e.g., Hb H disease) (*3*), and others reported multiple suspected forms (e.g., Hb H disease and alpha-thalassemia trait). Reasons for not reporting elevated Hb Bart's included the lack of an HPLC setup, inability to confirm or quantify levels, as no Hb Bart's standard is commercially available, and the absence of alpha-thalassemia on the Recommended Uniform Screening Panel.

Programs that report results indicative of alpha-thalassemia disseminate the results differently. The majority of laboratories report to newborn screening follow-up programs, which are responsible for disseminating screening results and recommendations for confirmatory testing, and to the provider; parents are less likely to receive direct notification. Other recipients of screening results include birthing hospitals, hematologists, regional sickle cell specialty centers, and contracted specialists. Overall, 33 (80%) of 41 newborn screening programs that report results provided recommendations for patient retesting or follow-up. These recommendations were largely dependent on the percentage of Hb Bart's; recommendations included confirmatory testing, complete blood count, reticulocyte count, genetic counseling, and referral to a pediatric hematologist.

Discussion

This report describes the first nationwide survey to determine whether newborn screening programs report alpha-thalassemia screening results and how they report the findings on phenotype/genotype and follow-up practices to health care providers and parents. Overall, >90% of responding programs report some level of elevated Hb Bart's. As a result, the newborns identified with a form of alpha-thalassemia by these programs might be able to access specialty medical care at a young age, if needed. Nonetheless, the findings of this analysis also reveal considerable program-to-program variability in 1) the screening platforms used, 2) the process or cut-offs used to define specific forms of potential alpha-thalassemia, 3) the types of alpha-thalassemia reported, and 4) how and to whom information is reported.

A concerning finding is that 20% of programs that report results indicative of alpha-thalassemia do not make recommendations for follow-up; this suggests a potential opportunity for further research to determine whether standardization across programs might lead to improved health outcomes. The finding that few of the newborn screening programs notify parents about positive alpha-thalassemia results is not unique to this condition. Similar findings have been reported regarding notification of parents of newborn screening results indicating sickle cell disease and sickle cell trait (*6*). However, this practice suggests another possible area for study to determine whether early parental knowledge and education might result in more timely initiation of care for affected children.

The potential impact of working to standardize newborn screening for alpha-thalassemia extends far beyond the identification during infancy of those with disease states, as well as those who are carriers. It also suggests an opportunity to collect data that could better define the birth incidence and spectrum of this condition in the United States. Clinically, newborn screening for elevated Hb Bart's allows those with Hb H disease to receive appropriate referrals to hematologists and thereby avoid complications of untreated disease. Newborn screening could also reduce the risk for those with alpha-thalassemia trait, who might receive a misdiagnosis of iron deficiency, from receiving inappropriate courses of iron therapy as well as delays in receipt of a definitive diagnosis. Early identification also provides the opportunity for genetic counseling and education with a focus on identifying mothers at risk for a hydrops fetalis pregnancy and risk to maternal health from a stillbirth, in addition to the risk to the fetus's life. This is becoming increasingly important as interventions to rescue, and even cure, such pregnancies in utero are improving (*7*). Newborn screening for alpha-thalassemia provides an opportunity for the education of affected families and their health care providers about this condition as part of the follow-up component of the newborn screening program.

The findings in this report are subject to at least one limitation. Nine programs (17%) did not respond to the survey, although it was determined that four of the nonrespondents are known to send specimens to programs that did respond to the survey. As such, this survey represents information from newborn screening programs that cover 86% of births in the United States.

The infrastructure for universal newborn screening and reporting of alpha-thalassemia in the United States already exists, and there are many opportunities for standardizing and streamlining the process. The results of this survey could guide further discussion, development of definitions, and dissemination of evidence-based best practices and expert

TABLE 1. Clinical characteristics of different forms of alpha-thalassemia

No. of alpha (α) loci deleted	Genotype (alpha [α] gene configuration)	Classification	Clinical features	Hb and RBC indices*,†	% Hb Bart's in newborns§ (values vary depending on testing method)
0	(αα/αα)	Normal	Normal	Hb: Male: 5.9 ± 1.0 g/dL Female: 14.0 ± 0.9 g/dL MCV: Male: 89.1 ± 5.01 fl Female: 87.6 ± 5.5 fl MCH: Male: 30.9 ± 1.91 fl Female: 30.2 ± 2.1 fl	None
1	(α–/αα)	Silent alpha-thalassemia carrier: alpha-thalassemia 2 heterozygote	None	Hb: Male: 14.3 ± 1.4 g/dL Female: 12.6 ± 1.2 g/dL MCV: 81.2 ± 6.9 fl MCH: 26.2 ± 2.3 pg/cell	1–3
2	(α–/α–) or (–/αα)	Alpha-thalassemia trait: alpha-thalassemia 2 homozygote or alpha-thalassemia 1 heterozygote	Mild anemia, microcytosis	Hb: Male: 13.9 ± 1.7 g/dL Female: 12.0 ± 1.0 g/dL MCV 71.6 ± 4.1 fl MCH 22.9 ± 1.3 pg/cell	3–6
3	(α–/–)	Hb H disease/alpha-thalassemia intermedia	Moderate to severe anemia	Hb: Male: 10.9 ± 1.0 g/dL Female: 9.5 ± 0.8 g/dL MCV: Children: 56 ± 5 fL Adults: 61 ± 4 fl MCH: 18.4 ± 1.2 pg/cell	5–30
4	(–/–)	Homozygous alpha-thalassemia/ alpha-thalassemia major/ Bart's hydrops fetalis	Fetal death with hydrops fetalis	Hb: 3–8 g/dL MCV: 136 ± 5 fL 31.9 ± 9 pg/cell	100

Abbreviations: fl = femtoliter (10^{-15} liter); Hb = hemoglobin; Hb H = hemoglobin H; MCH = mean corpuscular hemoglobin; MCV = mean corpuscular volume; pg = picogram (10^{-12} gram); RBC = red blood cell.
* Higgs DR, Bowden DK. Clinical and laboratory features of the alpha-thalassemia syndromes. In: Steinberg MH, Forget PG, Higgs DR, Nagel RL, eds. Disorders of hemoglobin: genetics, pathophysiology, and clinical management. Cambridge, United Kingdom: Cambridge University Press; 2001:431–69.
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§ Hb Bart's is not present after age 1 year.

TABLE 2. Reporting and recipients of alpha-thalassemia screening results — 41 newborn screening programs, United States, 2016

Characteristic	Alpha-thalassemia type				
	Alpha-thalassemia major	Hb H disease	Alpha-thalassemia trait	Silent alpha-thalassemia carrier	Other (i.e., unspecified Bart's)
No. (%) of programs reporting results	15 (37)	20 (49)	20 (49)	7 (17)	22 (54)
Recipient of results*					
Physician	9	14	14	5	13
Parent	2	3	3	1	1
NBS follow-up	11	16	16	5	16
Other	1	2	2	1	12
Unknown	3	3	2	1	1
No. (%) of programs that provided percentage cutoffs of Hb Bart's for reporting out results	7 (17)	6 (15)	9 (22)	3 (7)	9 (22)
Cutoff percentage of Hb Bart's for reporting out results					
Average	64	21.5	9.1	7	15
Minimum	25	11	2	3	3
Maximum	100	31	20	11	25

Abbreviation: Hb H = hemoglobin H.
* Categories are not mutually exclusive; newborn screening programs report out multiple results.

guidelines for improving upon this work†,§ (*1*,*8*). As the demographics of the U.S. population change to include more persons from areas where alpha-thalassemia is prevalent (e.g., Southeast Asia, China, and the Middle East) (*3*), the number of U.S. residents with a form of alpha-thalassemia might also increase. Uniformity of screening, diagnosis, and treatment for alpha-thalassemia could play an important role in increasing timely and appropriate health care. An increase in the number

† https://www.aphl.org/programs/newborn_screening/Pages/Hemoglobinopathies.aspx.
§ https://thalassemia.com/documents/SOCGuidelines2012.pdf.

Summary

What is already known about this topic?

Despite a 5% global prevalence, alpha-thalassemia is not a core condition on the United States Recommended Uniform Screening Panel for state newborn screening (NBS) programs. However, NBS methodologies used to detect sickle cell disease, reported by all states, also detect alpha-thalassemia.

What is added by this report?

A 2016 survey of NBS programs found that although most programs report at least one form of suspected alpha-thalassemia, the methodologies, thresholds used, forms of disease reported, and processes for reporting vary widely.

What are the implications for public health practice?

Standardization of technical and reporting procedures could provide data to better understand the public health impact and clinical outcomes of alpha-thalassemia, ensure appropriate health care, and improve outcomes.

of newborn screening programs reporting alpha-thalassemia results for multiple suspected forms of the condition might 1) improve access to specialty care before the occurrence of severe complications, 2) increase genetic counseling, and 3) provide data needed to better understand the public health impact and clinical outcomes of alpha-thalassemia in the United States. Meanwhile, efforts continue toward developing definitions for uniform minimum capabilities for testing and uniform suggested follow-up.

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Corresponding author: M.A. Bender, mbender@FredHutch.org, 206-667-4125.

[1]Department of Pediatrics, University of Washington, Clinical Research Division, Fred Hutchinson Cancer Research Center, Seattle, Washington; [2]Association of Public Health Laboratories, Silver Spring, Maryland; [3]Washington State Newborn Screening, Shoreline, Washington; [4]Tennessee Department of Health Laboratory Services, Nashville, Tennessee; [5]Department of Obstetrics and Gynecology and Meharry Sickle Cell Center, Department of Internal Medicine, Nashville, Tennessee; [6]Tennessee Department of Health Family Health and Wellness; [7]Florida Department of Health; [8]Connecticut State Department of Public Health, Katherine A. Kelley State Public Health Laboratory, Rocky Hill, Connecticut; [9]Division of Hematology, University of Colorado, Aurora, Colorado; [10]Division of Blood Disorders, National Center on Birth Defects and Developmental Disabilities, CDC.

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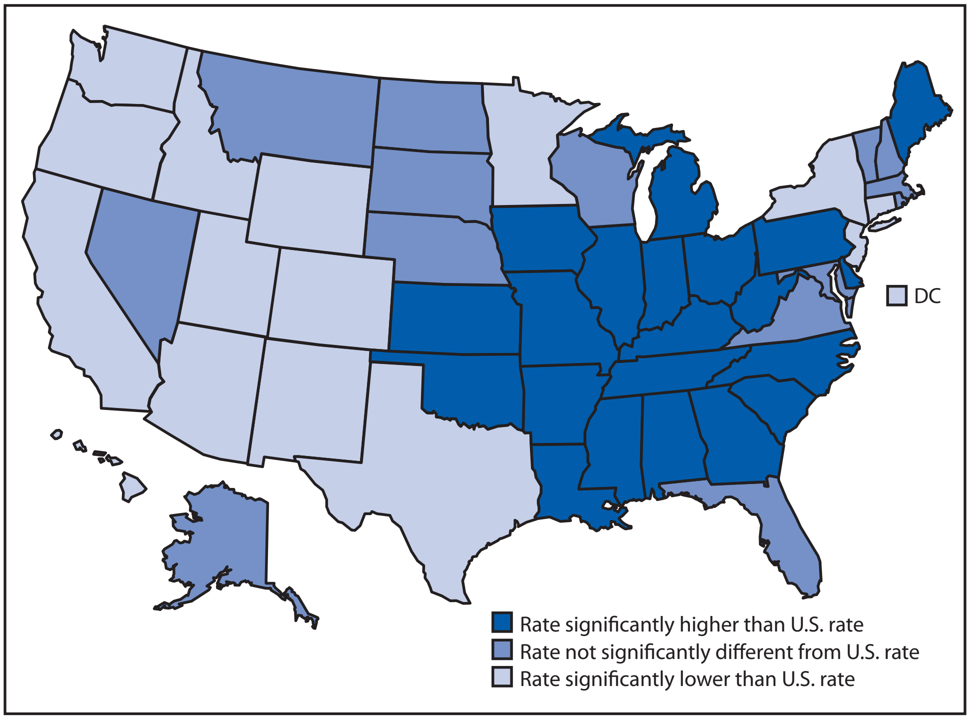
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Lung Cancer Death* Rates,† by State — National Vital Statistics System, United States, 2018



Abbreviation: DC = District of Columbia.

* As underlying cause of death, lung cancer deaths are identified with *International Classification of Diseases, Tenth Revision* codes C33 and C34.

† Deaths per 100,000 population are age-adjusted to the 2000 U.S. standard population, for a U.S. rate of 34.8.

In 2018, the age-adjusted lung cancer death rate in the United States was 34.8 per 100,000. Twenty-one states had a higher lung cancer death rate than the national rate, 15 states and DC had lower death rates, and 14 states had rates that were not statistically different from the national rate. Most states with higher death rates were in the Midwest or Southeast. The five states with the highest age-adjusted lung cancer death rates were Kentucky (53.5), West Virginia (50.8), Mississippi (49.6), Arkansas (47.4), and Oklahoma (46.8). The five jurisdictions with the lowest lung cancer death rates were Utah (16.4), New Mexico (22.5), Colorado (23.0), DC (24.6), and California (25.0).

Sources: National Center for Health Statistics. National Vital Statistics System, mortality data. https://www.cdc.gov/nchs/nvss/deaths.htm; CDC. CDC WONDER online database. https://wonder.cdc.gov/ucd-icd10.html.

Reported by: Sibeso N. Joyner, MPH, uvi1@cdc.gov, 301-458-4254; Deepthi Kandi, MS.

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