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# Heat-Related Deaths — United States, 2004–2018

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Deaths attributable to natural heat exposure, although generally considered preventable (*1*), represent a continuing public health concern in the United States. During 2004–2018, an average of 702 heat-related deaths occurred in the United States annually. To study patterns in heat-related deaths by age group, sex, race/ethnicity, and level of urbanization, and to explore comorbid conditions associated with deaths resulting from heat exposure, CDC analyzed nationally comprehensive mortality data from the National Vital Statistics System (NVSS).* The rate of heat-related mortality tended to be higher among males, persons aged ≥65 years, non-Hispanic American Indian/Alaska Natives, and persons living in noncore nonmetropolitan and large central metropolitan counties. Natural heat exposure was a contributing cause of deaths attributed to certain chronic medical conditions and other external causes. Preparedness and response initiatives directed toward extreme heat events, currently underway at local, state, and national levels, can contribute to reducing morbidity and mortality associated with natural heat exposure. Successful public health interventions† to mitigate heat-related deaths include conducting outreach to vulnerable communities to increase awareness of heat-related symptoms and provide guidance for staying cool and hydrated, particularly for susceptible groups at risk such as young athletes and persons who are older or socially isolated (*2*). Improved coordination across various health care sectors could inform local activities to protect health during periods of high heat. For instance, jurisdictions can monitor weather conditions and syndromic surveillance data to guide timing of risk communication and other measures (e.g., developing and implementing heat response plans, facilitating communication and education activities) to prevent heat-related mortality in the United States. CDC also recommends that federal, state, local, and tribal jurisdictions open cooling centers or provide access to public locations with air conditioning for persons in need of a safe, cool, environment during hot weather conditions. In light of the coronavirus disease 2019 (COVID-19) pandemic, CDC updated its guidance on the use of cooling centers to provide best practices (e.g., potential changes to staffing procedures, separate areas for persons with symptoms of COVID-19, and physical distancing) to reduce the risk for introducing and transmitting SARS COV-2, the virus that causes COVID-19, into cooling centers.§

Heat-related deaths among U.S. residents were identified using *International Classification of Diseases, Tenth Revision* (ICD-10)¶ codes included in the NVSS multiple-cause-of-death

* https://www.cdc.gov/nchs/nvss/index.htm.
† https://www.cdc.gov/disasters/extremeheat/index.html.
§ https://www.cdc.gov/coronavirus/2019-ncov/php/cooling-center.html.
¶ https://www.cdc.gov/nchs/icd/icd10.htm.

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mortality data. Selected heat-related case records included those listing ICD-10 codes X30 (exposure to excessive natural heat), P81.0 (environmental hyperthermia of newborn), or T67 (effects of heat and light) as the underlying cause of death,** or as one of the contributing causes.†† Records with ICD-10 code W92 (exposure to excessive heat of man-made origin) listed anywhere on the death certificate were excluded to restrict the selection to deaths resulting from natural heat exposure. For case records listing heat-related codes for natural heat exposure occurring only as contributing causes, comorbid conditions recorded as the underlying cause of death were further evaluated for the following categories§§: major cardiovascular diseases (I00–I78) (*2*); external causes of morbidity and mortality (V01–Y98 and U01–U03); mental and behavioral disorders (F00–F99); diseases of the respiratory system (J00–J99); endocrine, nutritional and metabolic disorders (E00–E90); diseases of the digestive system (K00–K93); genitourinary disorders (N00–N98); musculoskeletal disorders (M00–M99); and other diseases. Deaths were stratified by age group, sex, race/ethnicity, and level of urbanization and combined with U.S. Census Bureau population estimates for calculating crude rates. Crude rate estimates based on fewer than 20 deaths were deemed unreliable and not reported. Analyses were performed using SAS statistical software (version 9.4; SAS Institute).

During 2004–2018, a total of 10,527 deaths resulting from exposure to heat-related conditions were identified. Approximately 90% (9,757) of these deaths occurred during May–September. The crude rate of heat-related deaths varied from year to year, with highest rates observed over the 15-year period during 2006, 2011, and 2018. Although Arizona, California, and Texas account for only approximately 23% of the U.S. population,¶¶ these three states accounted for approximately one third (3,852; 37%) of heat-related deaths among U.S. residents. Overall, approximately two thirds (70%) of all heat-related deaths occurred in males, and deaths among males outnumbered those among females in all age groups except infants aged <1 year (Table 1). Among the 10,470 decedents for whom age information was available, 748 (7%) were aged <15 years, 2,010 (19%) were aged 15–44 years, 3,693 (35%) were aged 45–64 years, and 4,019 (39%) were aged ≥65 years; the rate of heat-related deaths among persons aged ≥65 years was 0.7 per 100,000 population, the highest across all age groups. For the period 2004–2018, among all race/ethnicity groups, non-Hispanic whites had the highest number of heat-related deaths (6,602); however, non-Hispanic American Indian/Alaska Natives had the highest rate of heat-related deaths (0.6 per 100,000 population) (Table 2). Non-Hispanic

** The underlying cause of death was defined as the disease or injury that initiated the chain of events that led directly and inevitably to death. https://icd.who.int/browse10/Content/statichtml/ICD10Volume2_en_2010.pdf.

†† Contributing conditions, or factors, were defined as diseases, injuries, or complications that contributed to the death and were a result of the underlying cause. https://icd.who.int/browse10/Content/statichtml/ICD10Volume2_en_2010.pdf.

§§ https://www.cdc.gov/nchs/data/dvs/2e_volume1_2017.pdf.

¶¶ https://www.census.gov/2010census/data/.

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**TABLE 1. Number and rate of heat-related deaths, by cause of death category,* age group, and sex — United States, 2004–2018†**

| Age group (yrs) | Cause of death category, no. (rate)§ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Heat-related codes as the underlying cause | | | Heat-related codes as a contributing cause | | | All heat-related deaths | | |
| | Total | Male | Female | Total | Male | Female | Total | Male | Female |
| <1 | 160 (0.3) | 76 (0.2) | 84 (0.3) | 87 (0.1) | 43 (0.1) | 44 (0.2) | 247 (0.4) | 119 (0.4) | 128 (0.4) |
| 1–4 | 303 (0.1) | 178 (0.1) | 125 (0.1) | 125 (0.1) | 76 (0.1) | 49 (0.0) | 428 (0.2) | 254 (0.2) | 174 (0.1) |
| 5–14 | 56 (0.0) | 42 (0.0) | 14 (—)¶ | 17 (—)¶ | 14 (—)¶ | 3 (—)¶ | 73 (0.0) | 56 (0.0) | 17 (—)¶ |
| 15–24 | 234 (0.0) | 203 (0.1) | 31 (0.0) | 94 (0.0) | 77 (0.0) | 17 (—)¶ | 328 (0.0) | 280 (0.1) | 48 (0.0) |
| 25–34 | 430 (0.1) | 378 (0.1) | 52 (0.0) | 230 (0.0) | 195 (0.1) | 35 (0.0) | 660 (0.1) | 573 (0.2) | 87 (0.0) |
| 35–44 | 670 (0.1) | 550 (0.2) | 120 (0.0) | 352 (0.1) | 287 (0.1) | 65 (0.0) | 1,022 (0.2) | 837 (0.3) | 185 (0.1) |
| 45–54 | 1,090 (0.2) | 874 (0.3) | 216 (0.1) | 684 (0.1) | 533 (0.2) | 151 (0.0) | 1,774 (0.3) | 1,407 (0.4) | 367 (0.1) |
| 55–64 | 1,024 (0.2) | 762 (0.3) | 262 (0.1) | 895 (0.2) | 658 (0.2) | 237 (0.1) | 1,919 (0.3) | 1,420 (0.5 | 499 (0.2) |
| 65–74 | 862 (0.2) | 562 (0.3) | 300 (0.2) | 774 (0.2) | 534 (0.3) | 240 (0.1) | 1,636 (0.4) | 1,096 (0.7) | 540 (0.3) |
| 75–84 | 778 (0.4) | 441 (0.5) | 337 (0.3) | 657 (0.3) | 382 (0.4) | 275 (0.2) | 1,435 (0.7) | 823 (1.0) | 612 (0.5) |
| ≥85 | 562 (0.7) | 251 (0.9) | 311 (0.5) | 386 (0.5) | 173 (0.6) | 213 (0.4) | 948 (1.1) | 424 (1.5) | 524 (0.9) |
| Not stated** | 51 (N/A) | 46 (N/A) | 5 (N/A) | 6 (N/A) | 6 (N/A) | 0 (N/A) | 57 (N/A) | 52 (N/A) | 5 (N/A) |
| **All ages** | **6,220 (0.1)** | **4,363 (0.2)** | **1,857 (0.1)** | **4,307 (0.1)** | **2,978 (0.1)** | **1,329 (0.1)** | **10,527 (0.2)** | **7,341 (0.3)** | **3,186 (0.1)** |

**Abbreviation:** N/A = not applicable.

* Heat-related deaths are identified using *International Classification of Diseases, Tenth Revision* cause-of-death codes X30 (exposure to excessive natural heat), P81.0 (environmental hyperthermia of newborn), and T67 (effects of heat and light) listed as the underlying cause or as one of the contributing causes in death records. Records with code W92 (exposure to excessive heat of man-made origin) listed anywhere on the death certificate were excluded from this selection.

† Based on multiple-cause-of-death data from the National Center for Health Statistics (NCHS) Vital Statistics System (https://www.cdc.gov/nchs/nvss/deaths.htm) and NCHS Bridged-Race Population data (https://www.cdc.gov/nchs/nvss/bridged_race.htm). This information is available from https://wonder.cdc.gov.

§ Crude rate per 100,000 population.

¶ Rate estimates based on fewer than 20 deaths were deemed unreliable and not reported.

** Rate estimates were not calculated because a population denominator was unavailable.

blacks had the second highest number of heat-related deaths (1,965) and rate ( 0.3 per 100,000 population). Across various levels of urbanization,*** the highest heat-related mortality rates were observed among persons living in noncore nonmetropolitan (0.3 per 100,000 population) and large central metropolitan counties (0.3 per 100,000 population) (Table 2).

Natural heat exposure–related codes were recorded as the underlying cause in 6,220 (59%) heat-related deaths, with one heat-related death attributed to environmental hyperthermia of a newborn, and the remainder from exposure to excessive natural heat (6,219; 59%) as the underlying cause. For the remaining 4,307 (41%) heat-related deaths, exposure to excessive natural heat, environmental hyperthermia of a newborn, or effects of heat and light were recorded as a contributing cause of death. When heat-related conditions were a contributing factor, as opposed to the underlying cause of death, major cardiovascular diseases (2,112; 49%) or external causes (1,543; 36%) were most often listed as the underlying cause, collectively accounting for approximately 85% of such deaths (Table 3). More specifically, natural heat exposure contributed to 1,463 (34%) deaths from ischemic heart diseases, 438 (10%) deaths from hypertension, and 773 (18%) deaths from alcohol poisoning and drug overdoses.

*** https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.

## Discussion

Heterogeneity in population-level vulnerability to extreme heat events is evident and is distributed differentially across and within communities (*3*). Social determinants of health††† and access to health care vary with levels of urbanization and play a role in determining resiliency of communities to extreme heat events and other disasters. Observed differences in heat-related mortality across racial/ethnic groups can also be associated with social vulnerability, which often tracks with factors leading to heat exposure (e.g., less green space and more heat-absorbing surfaces), health disparities manifested by lower income, and absence of structural adaptations such as air conditioning (*3*). In addition, persons at risk, including those who are older, might have higher susceptibility to heat stress because of impaired thermoregulatory responses, social isolation, or both (*4*); in this analysis, persons aged ≥65 years accounted for approximately 40% of all heat-related deaths and experienced the highest rate of heat-related deaths among all age groups. However, even young and healthy persons are at risk for heat stress when engaging in strenuous outdoor physical activities during hot weather (*5*). Similarly, sex differences in thermoregulatory response and participation in high-risk outdoor occupations, such as working in agriculture and the construction industry, might explain the higher heat-related mortality observed in males (*6*,*7*).

††† https://svi.cdc.gov/.

**TABLE 2. Number and rate of heat-related deaths,* by race/ethnicity and level of urbanization — United States, 2004–2018†**

| Characteristic | No. of deaths (rate)§ |
|---|---|
| **Race/Ethnicity¶** | |
| Hispanic | 1,349 (0.2) |
| American Indian/Alaska Native, non-Hispanic | 241 (0.6) |
| Asian/Pacific Islander, non-Hispanic | 194 (0.1) |
| Black, non-Hispanic | 1,965 (0.3) |
| White, non-Hispanic | 6,602 (0.2) |
| Not stated** | 176 (N/A) |
| **Level of urbanization††** | |
| Large central metro | 4,402 (0.3) |
| Large fringe metro | 1,607 (0.1) |
| Medium metro | 1,764 (0.2) |
| Small metro | 990 (0.2) |
| Micropolitan | 879 (0.2) |
| Noncore | 885 (0.3) |
| **Total** | **10,527 (0.2)** |

**Abbreviation:** N/A = not applicable.

* Heat-related deaths are identified using *International Classification of Diseases, Tenth Revision* cause-of-death codes X30 (exposure to excessive natural heat), P81.0 (environmental hyperthermia of newborn), and T67 (effects of heat and light) listed as the underlying cause or as one of the contributing causes in death records. Records with code W92 (exposure to excessive heat of man-made origin) listed anywhere on the death certificate were excluded from this selection.

† Based on multiple-cause-of-death data from the National Center for Health Statistics Vital Statistics System (https://www.cdc.gov/nchs/nvss/deaths.htm) and NCHS Bridged-Race Population data (https://www.cdc.gov/nchs/nvss/bridged_race.htm). This information is available from https://wonder.cdc.gov.

§ Crude rate per 100,000 population.

¶ American Indian/Alaska Native, Asian/Pacific Islander, black, and white decedents were non-Hispanic; Hispanic decedents could have been of any race.

** Rate estimates were not calculated because a population denominator was unavailable.

†† https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.

Past studies have demonstrated a relationship between ambient temperatures and mortality (*8*). In particular, extreme heat exposure can exacerbate certain chronic medical conditions, including hypertension and heart disease (*4*,*5*). In addition, medications that are typically used to treat these chronic medical conditions such as beta-blockers, diuretics, and calcium-channel blockers, can interfere with thermoregulation and result in a reduced ability to respond to heat stress (*5*). Further, use of alcohol or drugs (e.g., methamphetamine and cocaine.) are known risk factors for heat-related deaths (*5*); in this analysis, exposure to environmental heat was a contributing cause for several alcohol poisoning and drug overdose deaths. A significant increase in mortality risk associated with unintentional cocaine overdose has been reported during periods of extreme heat (*9*). Of note, death records with mental and behavioral disorders as the underlying cause of death had heat-related ICD-10 codes as contributing causes. In addition to compromising the body's ability to cope with heat stress, certain psychiatric conditions can alter risk perception and reduce awareness to prevailing hot conditions (*4*,*10*).

**Summary**

What is already known about this topic?

Deaths attributed to natural heat exposure represent a continuing public health concern. Preparedness and response initiatives that limit exposure during periods of extreme heat can reduce mortality.

What is added by this report?

During 2004–2018, an average of 702 heat-related deaths (415 with heat as the underlying cause and 287 as a contributing cause) occurred in the United States annually. Natural heat exposure was a contributing cause of death attributed to certain chronic medical conditions, alcohol poisoning, and drug overdoses.

What are the implications for public health practice?

A coordinated approach across health care sectors to prevent heat-related mortality can include conducting syndromic surveillance, developing and implementing heat response plans, facilitating communication and education activities, and operating cooling centers.

The findings in this report are subject to at least three limitations. First, heat exposure is a contributing factor to deaths resulting from many causes. Data collected by NVSS might not capture the full spectrum of heat stress–related deaths, especially if excessive heat is not explicitly documented in death records. In addition, heat-related deaths among non-U.S. residents are not presented here because a reliable population denominator is not available for calculating crude rates. Second, persons might be exposed to environmental heat at multiple locations, but deaths reported here are attributed to decedents' place of residence. Finally, detailed NVSS data describing the circumstances of death might be limited and vary on the basis of information available from the medical certification of death process, resources, and the person completing the death certificate. Therefore, in some instances, these data might not provide the necessary information to explain the situation or series of events leading to death from excessive heat exposure (*1*).

Understanding patterns in heat-related mortality associated with comorbidity, age group, sex, race/ethnicity, and urbanization levels could assist CDC and its public health partners in developing more effective surveillance and intervention strategies that integrate environmental health and other public health domains. Implementing these interventions during the COVID-19 pandemic might require additional considerations; for example, staff members of cooling centers need to be able to mitigate risk for transmission of SARS COV-2 among visitors and staff members. Measures to prevent heat-related mortality can include conducting routine and near-real-time surveillance (e.g. syndromic surveillance), developing and implementing

**TABLE 3. Selected underlying causes* of death for which heat-related conditions were listed as a contributing factor† — United States, 2004–2018§**

| Underlying cause of death¶ | No. (%) |
|---|---|
| **Major cardiovascular diseases**** | **2,112 (49)** |
| Hypertensive diseases | 438 (10) |
| Ischemic heart diseases | 1,463 (34) |
| Other cardiovascular diseases | 211 (5) |
| **External causes of morbidity and mortality††** | **1,543 (36)** |
| Alcohol poisoning deaths | 130 (3) |
| Drug overdose deaths | 643 (15) |
| Other external causes of morbidity and mortality | 770 (18) |
| **Mental and behavioral disorders§§** | **174 (4)** |
| Mental and behavioral disorders due to psychoactive substance use | 151 (4) |
| Other mental and behavioral disorders | 23 (0) |
| **Diseases of the respiratory system¶¶** | **127 (3)** |
| Chronic lower respiratory diseases | 116 (3) |
| Other diseases of the respiratory system | 11 (0) |
| **Endocrine, nutritional, and metabolic disorders ***** | **128 (3)** |
| Diabetes mellitus | 78 (2) |
| Other endocrine, nutritional, and metabolic disorders | 50 (1) |
| **Diseases of the digestive system†††** | **48 (1)** |
| Diseases of the liver | 33 (1) |
| Other diseases of the digestive system | 15 (0) |
| **Genitourinary disorders§§§** | **30 (1)** |
| **Musculoskeletal disorders¶¶¶** | **12 (0)** |
| Other diseases | **133 (3)** |
| **Total underlying causes of death with heat-related conditions**** as a contributing factor** | **4,307 (100)** |

* The underlying cause of death was defined as the disease or injury that initiated the chain of events that led directly and inevitably to death. https://icd.who.int/browse10/Content/statichtml/ICD10Volume2_en_2010.pdf.

† Contributing conditions, or factors, were defined as diseases, injuries, or complications that contributed to the death and were a result of the underlying cause. https://icd.who.int/browse10/Content/statichtml/ICD10Volume2_en_2010.pdf.

**TABLE 3. (*Continued*) Selected underlying causes* of death for which heat-related conditions were listed as a contributing factor† — United States, 2004–2018§**

§ Based on multiple-cause-of-death data from the National Center for Health Statistics Vital Statistics System (https://www.cdc.gov/nchs/nvss/deaths.htm). This information is available from https://wonder.cdc.gov.

¶ Deaths were classified using *International Classification of Diseases, Tenth Revision* codes.

** Major cardiovascular diseases were identified using underlying cause-of-death codes I00–I78. Hypertensive diseases and ischemic heart diseases were identified using underlying cause-of-death codes I10–I15 and I20–I25.

†† External causes of mortality were identified using underlying cause-of-death codes V01–Y98 and U01–U03. Alcohol poisoning deaths were identified using underlying cause-of-death codes X45, X65, and Y15. Drug overdose deaths were identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14.

§§ Mental and behavioral disorders were identified using underlying cause-of-death codes F00–F99. Mental and behavioral disorders attributed to psychoactive substance use were identified using underlying cause-of-death codes F10–F19.

¶¶ Diseases of the respiratory system were identified using underlying cause-of-death codes J00–J99. Chronic lower respiratory diseases were identified using underlying cause-of-death codes J40–J47.

*** Endocrine, nutritional and metabolic disorders were identified using underlying cause-of-death codes E00–E90. Diabetes mellitus diseases were identified using underlying cause-of-death codes E10–E14.

††† Diseases of the digestive system were identified using underlying cause-of-death codes K00–K93. Diseases of the liver were identified using underlying cause-of-death codes K70–K77.

§§§ Genitourinary disorders were identified using underlying cause-of-death codes N00–N98.

¶¶¶ Musculoskeletal disorders were identified using underlying cause-of-death codes M00–M99.

**** Heat-related conditions were identified using cause-of-death codes X30 (exposure to excessive natural heat), P81.0 (environmental hyperthermia of newborn), and T67 (effects of heat and light). Records with code W92 (exposure to excessive heat of man-made origin) listed anywhere on the death certificate were excluded from this selection.

heat response plans, facilitating communication and education activities, and operating cooling centers. A coordinated approach across health care sectors is needed to prevent heat-related mortality in the United States.

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# Detection of Ciprofloxacin-Resistant, β-Lactamase–Producing *Neisseria meningitidis* Serogroup Y Isolates — United States, 2019–2020

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Meningococcal disease is a sudden-onset, life-threatening illness caused by the bacterium *Neisseria meningitidis*. Prompt empiric antibiotic treatment can reduce morbidity and mortality among patients, and antibiotic prophylaxis can prevent secondary disease in close contacts. Historically, *N. meningitidis* isolates in the United States have largely been susceptible to the antibiotics recommended for treatment and prophylaxis, including penicillin and ciprofloxacin. This report describes detection of penicillin-resistant and ciprofloxacin-resistant *N. meningitidis* serogroup Y (NmY) isolates in the United States. NmY isolates containing a $bla_{\text{ROB-1}}$ β-lactamase enzyme gene conferring resistance to penicillins (*1*) were recovered from 33 cases reported during 2013–2020. Isolates from 11 of these cases, reported during 2019–2020, harbored a ciprofloxacin resistance–associated mutation in a chromosomal gene (*gyrA*). Cases were reported from 12 geographically disparate states; a majority of cases (22 of 33, 67%) occurred in Hispanic persons. These cases represent a substantial increase in penicillin-resistant and ciprofloxacin-resistant meningococci in the United States since 2013. Ceftriaxone and cefotaxime, the recommended first-line agents for empiric bacterial meningitis treatment, can continue to be used for treatment, but health care providers should ascertain susceptibility of meningococcal isolates to penicillin before switching to penicillin or ampicillin. Ongoing monitoring for antimicrobial resistance among meningococcal isolates and prophylaxis failures will be important to inform treatment and prophylaxis recommendations.

Meningococcal disease is a severe illness with a sudden onset and 10%–15% case-fatality rate. The disease is typically treated empirically with cefotaxime or ceftriaxone, which can be changed to penicillin or ampicillin once *N. meningitidis* is confirmed as the causative pathogen (*2*). Because close contacts of meningococcal disease patients have an elevated risk for disease (*3*), they are recommended to receive antibiotic prophylaxis with ciprofloxacin, rifampin, or ceftriaxone as soon as a suspected meningococcal disease case is identified (*4*).

Resistance to the antibiotics used for meningococcal treatment and prophylaxis has been rare among *N. meningitidis* isolates in the United States (*5*). Although intermediate penicillin susceptibility is common among meningococci, the clinical relevance of this finding is unclear. Penicillin resistance in *N. meningitidis* attributable either to β-lactamase production or to other mechanisms is rare (*5*,*6*). Resistance to ciprofloxacin is also uncommon in the United States with only one identified cluster of three ciprofloxacin-resistant cases during 2007–2008 and infrequent sporadic cases (*5*,*7*,*8*). Because *N. meningitidis* is typically susceptible to clinically relevant antibiotics in the United States, antimicrobial susceptibility testing is not routinely performed on meningococcal isolates (*9*).

In January 2020, an NmY isolate that produced a β-lactamase and was resistant to penicillin and ciprofloxacin was cultured from a meningococcal disease case in a Maryland resident (Gillian Taormina, Benjamin Hanisch, Children's National Hospital, Washington, DC, personal communication; 2020). When a second case of infection with a β-lactamase–producing, ciprofloxacin-resistant NmY isolate was reported by the Maryland Department of Health in February 2020, a systematic analysis of *N. meningitidis* isolates in the United States was conducted to determine whether this resistance pattern was more widespread.

Isolates from meningococcal disease cases are submitted to CDC approximately every 6 months by health departments from all states, Washington, D.C., and New York City. For this investigation, CDC requested that health departments submit to CDC all NmY isolates from cases during 2019–2020 that had not yet been submitted. The request was made through CDC's Epi-X (https://emergency.cdc.gov/epix/index.asp) secure communications network for public health officials with follow-up by e-mail to each state health department. Isolates, or confirmation that no additional isolates were available, were received from 24 state health departments and the District of Columbia.

Whole genome sequencing (WGS) was performed on all available meningococcal isolates from U.S. invasive meningococcal disease cases that occurred during 2011–2020. Sequencing data were analyzed to assess the presence of the $bla_{\text{ROB-1}}$ β-lactamase gene and mutations associated with ciprofloxacin resistance. Isolates with both a β-lactamase gene and ciprofloxacin resistance–associated mutations underwent reference antimicrobial susceptibility testing at CDC to assess β-lactamase activity and susceptibility to penicillin, ciprofloxacin, and third-generation cephalosporins. State health departments provided supplementary epidemiologic data from

case investigation records for cases with isolates containing a $\beta$-lactamase gene.

A total of 2,097 *N. meningitidis* isolates underwent WGS; 372 of these isolates were NmY. Analysis of WGS data identified 11 serogroup Y isolates that contained a $bla_{\text{ROB-1}}$ $\beta$-lactamase gene and a T91I *gyrA* mutation associated with resistance to ciprofloxacin. An additional 22 isolates contained $bla_{\text{ROB-1}}$ but did not have mutations associated with ciprofloxacin resistance; 21 of these isolates were serogroup Y while one was nongroupable (NG). All 33 $\beta$-lactamase–containing isolates were in clonal complex 23 (CC23); 30, including all 11 with ciprofloxacin resistance mutations, were sequence type (ST)-3587; two were ST-15379; and one was ST-13034. The 33 isolates were from cases occurring in 12 states during 2013–2020 (Figure 1) (Figure 2). Antimicrobial susceptibility testing was conducted on the 11 isolates with ciprofloxacin resistance mutations; all were confirmed to produce a $\beta$-lactamase and to be resistant to penicillin and ciprofloxacin but susceptible to third-generation cephalosporins, rifampin, and azithromycin.

A majority of the meningococcal disease cases caused by isolates containing $bla_{\text{ROB-1}}$ occurred in young children and older adults (Table). Notably, although there were no known epidemiologic links among the 33 cases, 22 (67%) occurred in Hispanic persons, including eight of the 11 cases with ciprofloxacin-resistant isolates. Only one case was fatal (case-fatality rate = 3.0%).

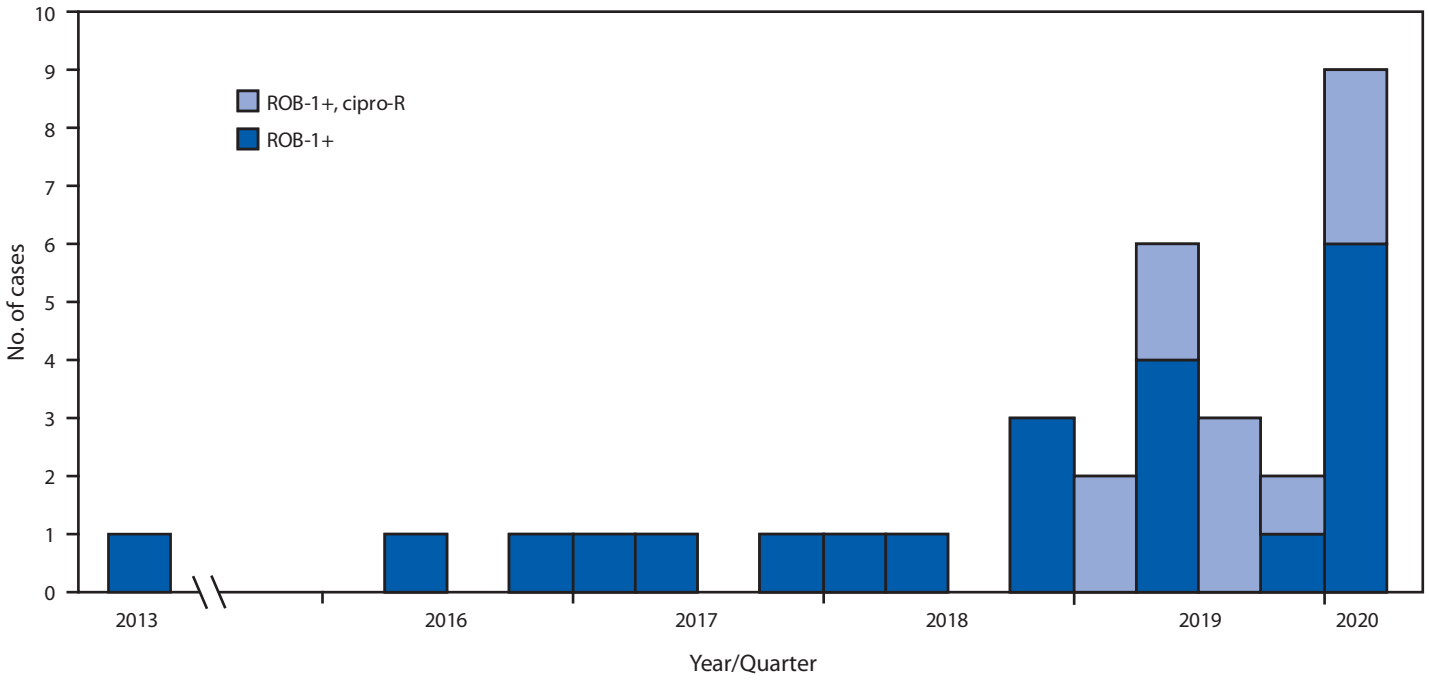
## Discussion

This evaluation identified a novel, emerging strain of penicillin-resistant and ciprofloxacin-resistant, $\beta$-lactamase–producing *N. meningitidis* in the United States. The detection of geographically diverse cases with penicillin-resistant and ciprofloxacin-resistant NmY isolates has implications for treatment and prophylaxis of meningococcal disease in the United States.

Ceftriaxone and cefotaxime are the recommended first-line agents for empiric bacterial meningitis treatment and can continue to be used (*2*). However, given the number of $\beta$-lactamase–producing isolates detected and availability of other effective treatment options, health care providers in the United States should ascertain susceptibility of meningococcal isolates to penicillin before using penicillin or ampicillin for treatment.

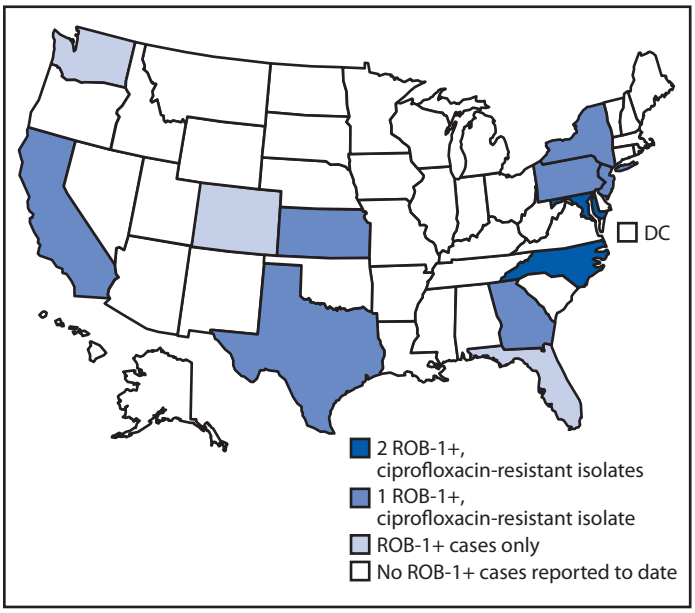
Ongoing monitoring for antimicrobial resistance among meningococcal isolates and for prophylaxis failures will be important to inform whether changes to meningococcal disease prophylaxis guidance is needed. A 2-day course of rifampin or a single injection of ceftriaxone are recommended alternatives to ciprofloxacin for prophylaxis of contacts of persons with meningococcal disease (*4*) but are logistically more challenging to administer. A single dose of azithromycin can also be used for prophylaxis in communities where ciprofloxacin-resistant meningococci have been detected; however, there is only a

**FIGURE 1. Clonal complex 23 *Neisseria meningitidis* isolates (N = 33) with a $bla_{\text{ROB-1}}$ $\beta$-lactamase enzyme gene* alone or in combination with a ciprofloxacin resistance–associated mutation (cipro-R), by quarter — United States, 2013–2020**




* Conferring resistance to penicillins.

**FIGURE 2. Meningococcal disease cases with clonal complex 23 *Neisseria meningitidis* isolates (N = 33) with a $bla_{ROB-1}$ β-lactamase enzyme gene* alone or in combination with a ciprofloxacin resistance–associated mutation, by state — United States, 2013–2020**




**Abbreviation:** DC = District of Columbia.
* Conferring resistance to penicillins.

**TABLE. Epidemiologic and clinical characteristics of meningococcal disease cases caused by $bla_{ROB-1}$-containing *Neisseria meningitidis*, United States, 2013–2020**

| Characteristic | No. (%) | | |
|---|---|---|---|
| | All ROB-1+* | ROB-1+ only | ROB-1+, ciprofloxacin-resistant |
| **Total** | **33** | **22** | **11** |
| **Age group (yrs)** | | | |
| <1 | 6 (18) | 3 (14) | 3 (27) |
| 1–10 | 4 (12) | 3 (14) | 1 (9) |
| 11–23 | 2 (6.1) | 1 (4.5) | 1 (9) |
| 24–44 | 6 (18) | 4 (18) | 2 (18) |
| 45–64 | 10 (30) | 7 (32) | 3 (27) |
| ≥65 | 5 (15) | 4 (18) | 1 (9) |
| **Sex** | | | |
| Male | 18 (54) | 9 (41) | 9 (82) |
| Female | 15 (45) | 13 (59) | 2 (18) |
| **Race/Ethnicity** | | | |
| Hispanic | 22 (67) | 14 (64) | 8 (73) |
| White, non-Hispanic | 4 (12) | 4 (18) | 0 (—) |
| Black† | 6 (18) | 3 (14) | 3 (27) |
| Unknown | 1 (3.0) | 1 (4.5) | 0 (—) |
| **Outcome** | | | |
| Survived | 32 (97) | 21 (95) | 11 (100) |
| Died | 1 (3.0) | 1 (4.5) | 0 (—) |

* ROB-1+ is a β-lactamase enzyme gene that confers resistance to penicillins.
† Ethnicity of two black patients was not reported. Remaining black patients were non-Hispanic.

single published study demonstrating effectiveness of azithromycin for clearing meningococcal carriage (*4*).

It is unknown how widely the β-lactamase–positive, ciprofloxacin-resistant NmY strain detected in the United States might be circulating in other countries. Penicillin-resistant and ciprofloxacin-resistant NmY isolates were detected in El Salvador during 2017–2019, but similar cases have not been reported elsewhere. Single NmY isolates positive for $bla_{ROB-1}$ β-lactamase but susceptible to ciprofloxacin have also been reported from Canada (*6*) and France (*10*). The potential circulation of penicillin-resistant or ciprofloxacin-resistant meningococci in other countries merits further investigation.

These findings show that penicillin-resistant and ciprofloxacin-resistant meningococci are now present in the United States; however, the complete geographic and temporal distribution of these resistant meningococci is unclear, because not all U.S. meningococcal disease cases have isolates available for WGS or antimicrobial susceptibility testing. In 2017 and 2018, CDC received isolates for only 72% and 78% of U.S. meningococcal disease cases, respectively*; submission of isolates from meningococcal disease cases that occurred during 2019–2020 is ongoing. The coronavirus disease 2019 (COVID-19) pandemic has limited the submission of meningococcal isolates and collection of epidemiologic data and precluded phenotypic antimicrobial susceptibility testing on all isolates containing a β-lactamase gene.

To facilitate ongoing monitoring of antimicrobial resistance, state and territorial health departments are asked to continue submitting all meningococcal isolates to CDC for antimicrobial susceptibility testing and WGS and to report any suspected meningococcal treatment or prophylaxis failures. In states that have experienced meningococcal disease cases caused by ciprofloxacin-resistant strains during the past 1–2 years, clinicians and public health staff members should consider antimicrobial susceptibility testing on meningococcal isolates to inform prophylaxis decisions.† Antimicrobial susceptibility testing should not delay the initiation of prophylaxis. Jurisdictions with capacity for β-lactamase screening or WGS might also wish to assess β-lactamase production or presence of β-lactamase genes and ciprofloxacin resistance-associated mutations. States conducting their own antimicrobial susceptibility testing,

* https://www.cdc.gov/meningococcal/downloads/NCIRD-EMS-Report-2017.pdf and https://www.cdc.gov/meningococcal/downloads/NCIRD-EMS-Report-2018.pdf.

† Rigorous protection from droplets and aerosols, including use of a biosafety cabinet, is required when microbiologic procedures are performed on *N. meningitidis* isolates (https://www.cdc.gov/meningitis/lab-manual/chpt11-antimicrobial-suscept-testing.html). Microbiologists who are routinely exposed to *N. meningitidis* isolates should receive meningococcal vaccines in accordance with current Advisory Committee on Immunization Practices recommendations (https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mening.html).

**Summary**

What is already known about this topic?

Most *Neisseria meningitidis* isolates in the United States have been susceptible to antibiotics recommended for treatment and prophylaxis.

What is added by this report?

During 2019–2020, 11 meningococcal isolates from U.S. patients had isolates containing a $bla_{ROB-1}$ β-lactamase gene associated with penicillin resistance and mutations associated with ciprofloxacin resistance. An additional 22 cases reported during 2013–2020 contained $bla_{ROB-1}$ but did not have mutations associated with ciprofloxacin resistance.

What are the implications for public health practice?

Ceftriaxone and cefotaxime can continue to be used for empiric bacterial meningitis treatment; meningococcal isolate susceptibility to penicillin should be determined before switching to penicillin or ampicillin. Prophylaxis failures and antimicrobial resistance among meningococcal isolates should be monitored to inform meningococcal prophylaxis recommendations.

β-lactamase screening, or WGS are requested to share results and sequences with CDC. For cases with isolates determined to be β-lactamase screen-positive or ciprofloxacin-resistant, jurisdictions are requested to obtain and submit a supplementary case report form (https://www.cdc.gov/meningococcal/surveillance/index.html).

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# Outbreak of Severe Hypoglycemia After Ingestion of a Male Enhancement Supplement — Virginia, August–November 2019

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In August 2019, the Virginia Poison Center (VPC) and the Blue Ridge Poison Center (BRPC) were contacted concerning patients experiencing repeated episodes of marked hypoglycemia following ingestion of a male enhancement supplement tablet marketed as "V8" in convenience stores in central Virginia. Over the following 3 months, the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Health (VDH) conducted an investigation and identified 17 patients meeting the case definition (severe hypoglycemia within 48 hours of consuming an over-the-counter male enhancement supplement in a man with no history of use of insulin or other medication used to control blood glucose). Analysis of the V8 tablets revealed that most contained glyburide, a sulfonylurea oral hypoglycemic used in the treatment of diabetes and associated with prolonged hypoglycemia following overdose (*1*). To stem this outbreak, V8 was removed from stores when found, and public service announcements were released. The public health implications of V8 use include the potential for substantial morbidity from hypoglycemic episodes and the potential for mortality if health care services are not accessed in a timely manner when hypoglycemia occurs. The presence of V8 in the market poses a serious threat to public health because of its potentially life-threatening adverse effects.

## Initial Cases

On August 13, 2019, VPC was consulted by an emergency physician at an academic medical center about a man aged 57 years who did not have diabetes and was noted by his wife to have been diaphoretic and agitated the previous day. His symptoms initially resolved after eating lunch but returned later in the day, and he became increasingly agitated. After 12 hours of confusion, he was evaluated in a hospital emergency department, where a basic metabolic panel revealed a blood glucose of 48 mg/dL (normal = 70–100 mg/dL). His mental status returned to baseline following administration of intravenous dextrose and 100 mg of octreotide, a drug that inhibits insulin release and is used as an antidote for recurrent hypoglycemia associated with sulfonylurea toxicity. The man had no known exposure to insulin or other hypoglycemic medications; however, he disclosed recently using V8, an oral male enhancement supplement purchased from a local convenience store in the metropolitan Richmond area. He had been unable to fill his usual prescription for sildenafil (used to treat erectile dysfunction) because of health insurance difficulties and reported ingesting one V8 tablet nightly during August 10–12. The treating physician and poison center suspected sulfonylurea poisoning after a literature review noted a 2009 outbreak of hypoglycemia associated with contaminated counterfeit sildenafil. A sample of the V8 product was collected for testing.

On August 22, BRPC was notified about a man aged 50 years in Lynchburg, Virginia, who did not have diabetes and who was diaphoretic, tremulous, and confused. The local emergency medical services team found his blood glucose to be 32 mg/dL, and he received oral glucose. On arrival to the emergency department, his blood glucose level was in the normal range, but hypoglycemia recurred 1 hour later. He was admitted to a hospital, where his overnight blood glucose levels dropped as low as 42 mg/dL despite intravenous infusion of dextrose-containing fluids and frequent dextrose boluses. He required hospitalization for 3 days for recurring episodes of hypoglycemia. The patient reported no use of insulin or other hypoglycemic medications; however, he did disclose recent use of the V8 supplement, purchased from a local service station in Lynchburg. Because of his prolonged hypoglycemia, the poison center hypothesized that the supplement contained a sulfonylurea. Glyburide and sildenafil were detected in the patient's blood and urine using liquid chromatography quantitative time of flight mass spectrometry (LC-QTOF-MS), and a sample V8 tablet was collected from his personal inventory for testing.

## Outbreak Investigation and Findings

On August 14, an outbreak investigation was launched by VDACS and VDH. A confirmed case of V8-associated hypoglycemia was defined as the development of severe hypoglycemia within 48 hours of consuming an over-the-counter male enhancement supplement in a man with no history of use of insulin or other medication used to control blood glucose. During the 3 months following identification of the first two cases, 15 additional patients were hospitalized for management of hypoglycemia associated with ingestion of V8. All were men ranging in age from 33 to 73 years, and all

met the confirmed case definition (Table). The mean blood glucose level for all confirmed cases at initial evaluation was 30 mg/dL, and the lowest documented level was 11 mg/dL. Three patients had two separate hospitalizations each for recurring hypoglycemia related to use of the supplement. All patients received intravenous dextrose for acute management, and seven also received octreotide. One patient received steroids and two sessions of empiric hemodialysis, although these therapies are not generally recommended for sulfonylurea poisoning. No V8-related deaths were identified. Patients reported that the V8 supplement was sold in service stations and convenience stores in clear jars without an ingredient list or warning label (Figure). The blue tablets found inside closely resembled prescription sildenafil. Patients reported that the supplement was promoted by word of mouth and was purported to enhance male sexual performance.

Samples of V8 were obtained from the patients' personal inventories and from several stores throughout Virginia. Tablets were independently analyzed by the Virginia Division of Consolidated Laboratory Services, the state public health laboratory using liquid chromatography with high-resolution mass spectrometry, and the University of Virginia Department of Pathology's Laboratories using LC-QTOF-MS. The laboratories confirmed that all tablet samples contained sildenafil in amounts ranging from 55 to 156 mg per tablet, and that most tablets contained 90 to 100 mg of glyburide, a dose 5 to 10 times higher than that used in the treatment of diabetes. Blood from three patients was analyzed for the presence of glyburide, and all three tested positive. Glyburide and sildenafil were detected in the urine of a fourth patient.

## Public Health Response

VPC notified the Richmond City Health Department about the first two patients on August 14. Additional assistance was requested from VDH and VDACS to investigate the retail facilities selling V8 and initiate seizure or quarantine of these potentially glyburide-contaminated products. On August 22, VDACS released an initial public service announcement to warn consumers of potentially life-threatening hypoglycemia associated with the use of V8 supplements. Follow-up announcements were released by BRPC on August 26 and September 12, urging consumers not to use the V8 supplement. On September 16, VDH posted a notification to other states on CDC's Epidemic Information Exchange (Epi-X). A statewide press release followed on September 17. The final confirmed case reported to VDH occurred on November 6.

Reports to MedWatch, the Food and Drug Administration (FDA) Safety Information and Adverse Event Reporting

**TABLE. Demographic and clinical data for confirmed cases (N = 17) of hypoglycemia associated with consumption of "V8," an over-the-counter male enhancement supplement — Virginia, August–November 2019**

| Patient | Age (years) | Date of ED visit | Lowest blood glucose (mg/dL) | No. days hospitalized | Reported duration of V8 use before ED visit | Additional treatments* | Regional poison center |
|---|---|---|---|---|---|---|---|
| A | 57 | 08/13/19 | 48 | 1 | 1–3 days | octreotide | VPC |
| B | 63 | 08/14/19 | 26 | 3 | >1 month | octreotide | VPC |
| C | 38 | 08/20/19 | 34 | 1 | 1–3 days | octreotide | VPC |
| D (1)† | 52 | 08/22/19 | 11 | 6 | >1 month | corticosteroids, empiric hemodialysis | BRPC |
| E | 50 | 08/23/19 | 32 | 3 | >1 month | None | BRPC |
| F | 46 | 08/26/19 | 66 | 3 | 7 days | None | BRPC |
| G | 57 | 08/28/19 | 18 | 3 | 1–3 days | None | BRPC |
| D (2)† | 52 | 09/02/19 | 29 | 5 | 1–3 days | octreotide, empiric hemodialysis | BRPC |
| H | 69 | 09/02/19 | 38 | 4 | 1–3 days | octreotide | BRPC |
| I | 33 | 09/07/19 | 30 | 2 | Unknown | octreotide | VPC |
| J (1)† | 63 | 09/08/19 | 18 | 2§ | 1–3 days | None | BRPC |
| J (2)†,¶ | 63 | 09/09/19 | 16 | 2 | 1–3 days | None | BRPC |
| K | 58 | 09/15/19 | 36 | 4 | Unknown | None | VPC |
| L | 40 | 09/16/19 | 29 | 1§ | >1 month | None | BRPC |
| M | 64 | 09/16/19 | 22 | 2 | 1–3 days | None | BRPC |
| N | 49 | 10/06/19 | 39 | 3 | 1–3 days | None | BRPC |
| O (1)† | 73 | 10/26/19 | 35 | 0 | 1–3 days | None | BRPC |
| O (2)† | 73 | 10/27/19 | 22 | 3 | 1–3 days | None | BRPC |
| P | 44 | 10/29/19 | 18 | 2§ | 1–3 days | None | BRPC |
| Q | 34 | 11/06/19 | 47 | 2 | Unknown | octreotide | VPC |

**Abbreviations:** BRPC = Blue Ridge Poison Center; ED = emergency department; VPC = Virginia Poison Center.
* All patients received intravenous dextrose as needed for emergency treatment of hypoglycemia.
† Patients D, J, and O each had two separate ED evaluations for medical care. Patients D and O resumed use of V8 following their first visit for medical care and suffered recurrent hypoglycemic episodes. It is unknown whether patient J resumed use of V8 after initial medical care.
§ Left against medical advice.
¶ Found with altered mental status the same day after leaving against medical advice.

**FIGURE. A jar of "V8," a male enhancement supplement of blue tablets closely resembling prescription sildenafil, purchased from a convenience store — Virginia, 2019**


Photo/Virginia Poison Center

**Summary**

What is already known about this topic?

Over-the-counter products sold as dietary supplements might contain undeclared Food and Drug Administration–approved prescription pharmaceuticals that could pose a substantial health risk to consumers who believe them to be harmless.

What is added by this report?

An unlabeled, over-the-counter product sold in Virginia convenience stores as a male enhancement supplement contained sildenafil and glyburide, a potent hypoglycemic agent, leading to life-threatening episodes of hypoglycemia requiring prolonged hospitalization among users.

What are the implications for public health practice?

Numerous tainted sexual enhancement products remain on the market as over-the-counter products, placing consumers at risk for unknown health complications. Collaborative and timely surveillance and prompt intervention are required to remove products known to cause substantial morbidity.

Program (https://www.fda.gov/safety/medwatch-fda-safety-information-and-adverse-event-reporting-program), were filed as cases occurred. The VDACS investigation into retail facilities resulted in product seizure at 23 locations across Virginia. An FDA investigation into the origin of these products is ongoing.

## Discussion

Over-the-counter supplements have been documented to contain prescription pharmaceuticals or other potentially harmful ingredients (*2*). In 2009, an outbreak of hypoglycemia affecting 150 persons in Singapore was linked to counterfeit sildenafil contaminated with glyburide (*3*). In the outbreak described here, a nonprescription over-the-counter supplement was also documented to contain both sildenafil and glyburide. It is unclear why glyburide was used in the manufacturing of this supplement. It has been hypothesized that the glyburide was added as an available filler. However, given that the tablets contained sildenafil doses within the typical therapeutic dosing range, the inclusion of glyburide as a filler appears less likely. Alternatively, glyburide may have been used to color the tablet blue to resemble prescription sildenafil. This outbreak has major implications for public health because consumers might purchase and use these supplements without awareness of the potential for substantial morbidity (*4*).

This investigation reveals a specific instance of undeclared prescription pharmaceuticals sold at public convenience stores as a dietary supplement and highlights the importance of the role of collaboration between poison centers, treating hospitals, health departments, public health laboratories, and the state university health system for public health surveillance, detection, and response. Prompt response to the outbreak and collaboration among multiple partners likely resulted in more rapid control of the outbreak and protection of the public from greater harm. V8 supplements and other similar products pose a serious risk for injury to consumers, illustrating an emerging risk associated with tainted male enhancement products. V8 and other male enhancement supplements containing undeclared FDA-approved prescription drugs should be removed from the market expeditiously once identified, and further efforts should be made to educate consumers and clinicians about the potential dangers of over-the-counter products sold with undeclared prescription ingredients.

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# Progress Toward Rubella Elimination — Western Pacific Region, 2000–2019

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Rubella is the leading vaccine-preventable cause of birth defects. Rubella typically manifests as a mild febrile rash illness; however, infection during pregnancy, particularly during the first trimester, can result in miscarriage, fetal death, or a constellation of malformations known as congenital rubella syndrome (CRS), commonly including one or more visual, auditory, or cardiac defects (*1*). In 2012, the Regional Committee of the World Health Organization (WHO) Western Pacific Region (WPR)* committed to accelerate rubella control, and in 2017, resolved that all countries or areas (countries) in WPR should aim for rubella elimination† as soon as possible (*2*,*3*). WPR countries are capitalizing on measles elimination activities, using a combined measles and rubella vaccine, case-based surveillance for febrile rash illness, and integrated diagnostic testing for measles and rubella. This report summarizes progress toward rubella elimination and CRS prevention in WPR during 2000–2019. Coverage with a first dose of rubella-containing vaccine (RCV1) increased from 11% in 2000 to 96% in 2019. During 1970–2019, approximately 84 million persons were vaccinated through 62 supplementary immunization activities (SIAs) conducted in 27 countries. Reported rubella incidence increased from 35.5 to 71.3 cases per million population among reporting countries during 2000–2008, decreased to 2.1 in 2017, and then increased to 18.4 in 2019 as a result of outbreaks in China and Japan. Strong sustainable immunization programs, closing of existing immunity gaps, and maintenance of high-quality surveillance to respond rapidly to and contain outbreaks are needed in every WPR country to achieve rubella elimination in the region.

## Immunization Activities

During 1970–2005, rubella vaccination in 11 WPR countries§ focused on preventing CRS by vaccinating adolescent females; this strategy did not prevent all CRS cases, and countries adopted universal infant immunization (Table 1). By 2000, 16 (44%) of the 36 WPR countries that report immunization data to WHO and the United Nations Children's Fund (UNICEF) included RCV1 in the routine immunization schedule; by 2015, all 36 had introduced it. By 2019, 34 (94%) countries had included a second dose of rubella-containing vaccine (RCV2). WHO and UNICEF estimate national RCV1 coverage for 27 countries in the region, using annual government-reported survey and administrative data; for the remaining nine countries,¶ coverage data reported by the immunization program are used.

Population immunity of ≥85% is needed to achieve herd immunity and interrupt endemic rubella virus transmission (*1*). Regional RCV1 coverage increased from 11% in 2000 to 96% in 2019 and has been ≥90% since 2015 because of vaccine introduction and achievement of high vaccination coverage in China (2007) and Vietnam (2015) (Figure). In 2019, 24 (67%) countries achieved ≥90% RCV1 coverage, and 19 (53%) countries achieved ≥90% coverage for RCV1 and RCV2 (Table 1). However, two countries and six islands did not reach 85% RCV1 coverage, leaving 793,850 infants unprotected.

During 1970–2019, 84.3 million persons were vaccinated during 62 SIAs conducted in 27 countries (weighted regional coverage = 81%) (Table 2) (*4*–*8*). Reported administrative coverage was ≥95% in 30 (50%) of 60 SIAs with available data.

*The Western Pacific Region, one of the six regions of the World Health Organization, consists of 37 countries and areas with a population of approximately 1.9 billion, including American Samoa (United States), Australia, Brunei, Cambodia, China, Cook Islands (New Zealand), Micronesia, Fiji, French Polynesia (France), Guam (United States), Hong Kong (China), Japan, Kiribati, Laos, Macau (China), Malaysia, Marshall Islands, Mongolia, Nauru, New Caledonia (France), New Zealand, Niue (New Zealand), Northern Mariana Islands (United States), Palau, Papua New Guinea, Philippines, Pitcairn Islands (United Kingdom), Samoa, Singapore, Solomon Islands, South Korea, Tokelau (New Zealand), Tonga, Tuvalu, Vanuatu, Vietnam, and Wallis and Futuna (France).

†Rubella elimination is defined as the absence of endemic rubella virus transmission in a defined geographical area (e.g., region or country) for ≥12 months in the presence of a well-performing surveillance system.

§Initial rubella vaccination strategy involved vaccination of adolescent females to prevent CRS in the following countries and areas, years, and age groups: Australia (1971–1994, 12–14 years); Brunei (1978–1995, 12–13 years); Fiji (1975–2005, 11–14 years); French Polynesia (France) (1990s, 10 years); Hong Kong (China) (1978–1995, 11 years); Japan (1977–1995, 12–15 years); Macau (China) (1987–2002, 10–13 years); Malaysia (1987–2008, 12 years); New Zealand (1979–1991, 11 years); Niue (New Zealand) (late 1970s, 11–12 years); Singapore (1976–1982, 11–12 years); and South Korea (1994–2001, 16 years).

¶The WHO/UNICEF estimates of national immunization coverage are not calculated for nine areas in the following countries: China (Hong Kong and Macau), France (French Polynesia, New Caledonia, and Wallis and Futuna), New Zealand (Tokelau), and United States (American Samoa, Guam, and Northern Mariana Islands). The Pitcairn Islands (United Kingdom), with a population of <100 persons, does not report to WHO/UNICEF and is excluded from all calculations.

**TABLE 1. Year of introduction, age at vaccination, and estimated coverage with the first and second doses of rubella-containing vaccine (RCV),* and number of confirmed rubella cases† and incidence,§ by country/area— World Health Organization (WHO) Western Pacific Region, 2000, 2010, and 2019**

| Country/Area | Year of introduction | | 2019 RCV schedule, age | | 2000 | | | 2010 | | | 2019¶ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | % Coverage | | No. of cases (incidence)§ | % Coverage | | No. of cases (incidence)§ | % Coverage | | No. of cases (incidence)§ |
| | RCV1 | RCV2 | 1st dose | 2nd dose | RCV1 | RCV2 | | RCV1 | RCV2 | | RCV1 | RCV2 | |
| Australia** | 1989 | 1992 | 12m | 18m | 91 | NR†† | 323 (15) | 94 | 88 | 42 (2) | NR†† | 94 | 22 (1) |
| Brunei** | 1988 | 1996 | 12m | 18m | 99 | 95 | 1 (3) | 94 | 93 | 1 (2) | 97 | 98 | 1 (2) |
| Cambodia | 2012 | 2013 | 9m | 18m | NA§§ | NA§§ | NR†† | NA§§ | NA§§ | 85 (5) | 104 | 93 | 30 (2) |
| China | 2007 | 2010 | 8m | 18m | NA§§ | NA§§ | NR†† | 62 | 62¶¶ | 43,117 (30) | 99 | 99 | 32,568 (23) |
| Hong Kong (CH)** | 1990 | 1996 | 12m | 6y | 100 | 99 | 2,388 (343) | 95 | 99 | 38 (5) | NR†† | 97 | 48 (6) |
| Japan** | 1989 | 2006 | 12m | 5y | 94 | NA§§ | 3,123 (24) | 94 | 97 | 89 (1) | 97¶ | 93¶ | 2,306 (18) |
| Laos | 2011 | 2017 | 9m | 12m | NA§§ | NA§§ | NR†† | NA§§ | NA§§ | 31 (4) | 89 | 63 | 14 (2) |
| Macau (CH)** | 1990 | 1994 | 12m | 18m | 90 | 89 | 20 (37) | 92 | 87 | 2 (3) | 98 | 96 | 79 (122) |
| Malaysia**,*** | 2002 | 2002 | 9m | 12m | NA§§ | NA§§ | NR†† | 95 | 95 | 104 (3) | 97 | 87 | 111 (3) |
| Mongolia | 2009 | 2009 | 9m | 2y | NA§§ | NA§§ | 1,550 (570) | 97 | 95 | 11 (3) | 98 | 98 | 5 (2) |
| New Zealand**,††† | 1990 | 1992 | 15m | 4y | 85 | NR†† | 26 (6) | 91 | 86 | 2 (0) | 92¶ | 90¶ | 1 (0) |
| Papua New Guinea | 2015 | 2015 | 9m | 18m | NA§§ | NA§§ | NR†† | NA§§ | NA§§ | 5 (1) | 33 | 20 | 5 (1) |
| Philippines | 2010 | 2015 | 9m | 12m | NA§§ | NA§§ | NR†† | 10§§§ | NA§§ | 1,440 (14) | 73 | 68 | 198 (2) |
| Singapore** | 1982 | 1990 | 12m | 18m | 96 | 98 | 312 (61) | 95 | 96 | 158 (27) | 95¶ | 84¶ | 7 (1) |
| South Korea | 1983 | 1997 | 12–15m | 4–6y | 95 | 39 | 107 (2) | 98 | 98 | 21 (0) | 97 | 97 | 8 (0) |
| Vietnam | 2015 | NA§§ | 18m | NA§§ | NA§§ | NA§§ | NR†† | NA§§ | NA§§ | 2,300 (24) | 90¶ | NA§§ | 69 (1) |
| **Pacific Island Countries and Territories** | | | | | | | | | | | | | |
| American Samoa (US) | 1980s | 2003¶¶¶ | 12m | 4y | 90 | 94 | 0 (0) | 77 | 65 | NR†† | NR†† | NR†† | NR†† |
| Cook Islands (NZ) | 2006 | 2006 | 15m | 4y | NA§§ | NA§§ | 0 (0) | 99 | 98 | 0 (0) | 99¶ | 99¶ | 0 (0) |
| Fiji** | 2003 | 2004 | 12m | 18m | NA§§ | NA§§ | NR†† | 94 | 94 | 0 (0) | 94¶ | 94¶ | NR†† |
| French Polynesia (FR)** | 2010 | 2010 | 12m | 18m | NA§§ | NA§§ | NR†† | 99 | 84 | 0 (0) | 98¶ | 98¶ | NR†† |
| Guam (US) | 1980s | 1998 | 12m | 4–6y | 93 | 94 | 0 (0) | NR†† | NR†† | 0 (0) | 82¶ | 83¶ | 0 (0) |
| Kiribati | 2004 | 2007 | 12m | 4y | NA§§ | NA§§ | 0 (0) | 89 | 21 | 0 (0) | 84¶ | 79¶ | 0 (0) |
| Marshall Islands | 1982 | 1998 | 12m | 13m | 93 | 6 | 0 (0) | 97 | 90 | 0 (0) | 85 | 64 | 0 (0) |
| Micronesia | 1982 | 1995 | 12m | ≥13m | 85 | 50 | NR†† | 80 | 75 | NR†† | 78 | 52 | 0 (0) |
| Nauru | 2006 | 2006 | 12m | 15m | NA§§ | NA§§ | 0 (0) | 99 | 92 | NR†† | 96 | 96 | 0 (0) |
| New Caledonia (FR) | 1994 | 1994 | 12m | 16m | NR†† | NR†† | NR†† | 99 | 78 | NR†† | 96¶ | 92¶ | NR†† |
| Niue (NZ)** | 1979 | 1998 | 15m | 4y | 99 | 99 | 0 (0) | 99 | 99 | 0 (0) | 100 | 100 | 0 (0) |
| Northern Mariana Islands (US) | 1980s | 1992 | 12m | 4–6y | NA§§ | NA§§ | 0 (0) | 93 | 39 | 0 (0) | 75 | 90 | 0 (0) |
| Palau | 1986 | 1995 | 12m | 15m | 83 | 75 | 0 (0) | 39 | 39 | 0 (0) | 97 | 88 | 0 (0) |
| Samoa | 2003 | 2005 | 12m | 15m | NA§§ | NA§§ | NR†† | 56 | 30 | 0 (0) | 96 | 59 | 0 (0) |
| Solomon Islands | 2013 | 2018 | 12m | 18m | NA§§ | NA§§ | NR†† | NA§§ | NA§§ | 0 (0) | 81 | 55 | 0 (0) |
| Tokelau (NZ) | 2003 | 2005 | 12m | 15m | NA§§ | NA§§ | 0 (0) | 95 | 95 | 0 (0) | 98 | 98 | 0 (0) |
| Tonga | 2002 | 2002 | 12m | 18m | NA§§ | NA§§ | 0 (0) | 86 | 84 | 0 (0) | 99 | 100 | NR†† |
| Tuvalu | 2005 | 2005 | 12m | 18m | NA§§ | NA§§ | 0 (0) | 85 | 87 | 0 (0) | 88¶ | 81¶ | NR†† |
| Vanuatu | 2015 | NA§§ | 12m | NA§§ | NA§§ | NA§§ | NR†† | NA§§ | NA§§ | NR†† | 76 | NA§§ | 0 (0) |
| Wallis and Fortuna (FR) | NR†† | NR†† | 12m | 16m | NA§§ | NA§§ | 4 (272) | NR†† | NR†† | NR†† | 105 | 125 | NR†† |
| **Total Western Pacific Region**** | — | — | — | — | **11** | **11** | **7,854 (36)** | **59** | **59** | **47,446 (25)** | **96** | **91** | **35,472 (18)** |

**Abbreviations:** CH = China; FR = France; NA = not applicable; NR = not reported; NZ = New Zealand; RCV1 = first RCV dose; RCV2 = second RCV dose; RI = routine immunization; UNICEF = United Nations Children's Fund; US = United States.

* Based on data from WHO-UNICEF Estimates of National Immunization Coverage, WHO/UNICEF Joint Reporting Form, or WHO Western Pacific Regional Office databases. https://www.who.int/immunization/monitoring_surveillance/data/en.

† Includes cases confirmed by laboratory testing or epidemiologic linkage, as reported in the WHO/UNICEF Joint Reporting Form or other WHO Western Pacific Regional Office databases or reports. https://www.who.int/immunization/monitoring_surveillance/data/en.

§ Per million population.

¶ 2019 data are as of May 14, 2020; for countries without RCV1 and RCV2 estimates by this date, 2018 coverage values are used.

** Initial rubella vaccination strategy involved vaccination of adolescent females to prevent congenital rubella syndrome in the following countries/areas, years, and age groups: Australia (1971–1994, 12–14 years); Brunei (1978–1995, 12–13 years); Fiji (1975–2005, 11–14 years); French Polynesia (France) (1990s, 10 years); Hong Kong (China) (1978–1995, 11 years); Japan (1977–1995, 12–15 years); Macau (China) (1987–2002, 10–13 years); Malaysia (1987–2008, 12 years); New Zealand (1979–1991, 11 years); Niue (New Zealand) (late 1970s, 11–12 years); Singapore (1976–1982, 11–12 years); and South Korea (1994–2001, 16 years).

†† Not reported because dose was not included in the vaccination schedule for that year.

§§ Not applicable because country did not report coverage or cases in the year specified.

¶¶ RCV2 coverage as described by Su Q, Ma C, Wen N, et al. https://www.sciencedirect.com/science/article/pii/S0264410X18303499?via%3Dihub.

*** 2018 RCV schedule includes an additional dose given at age 7 years.

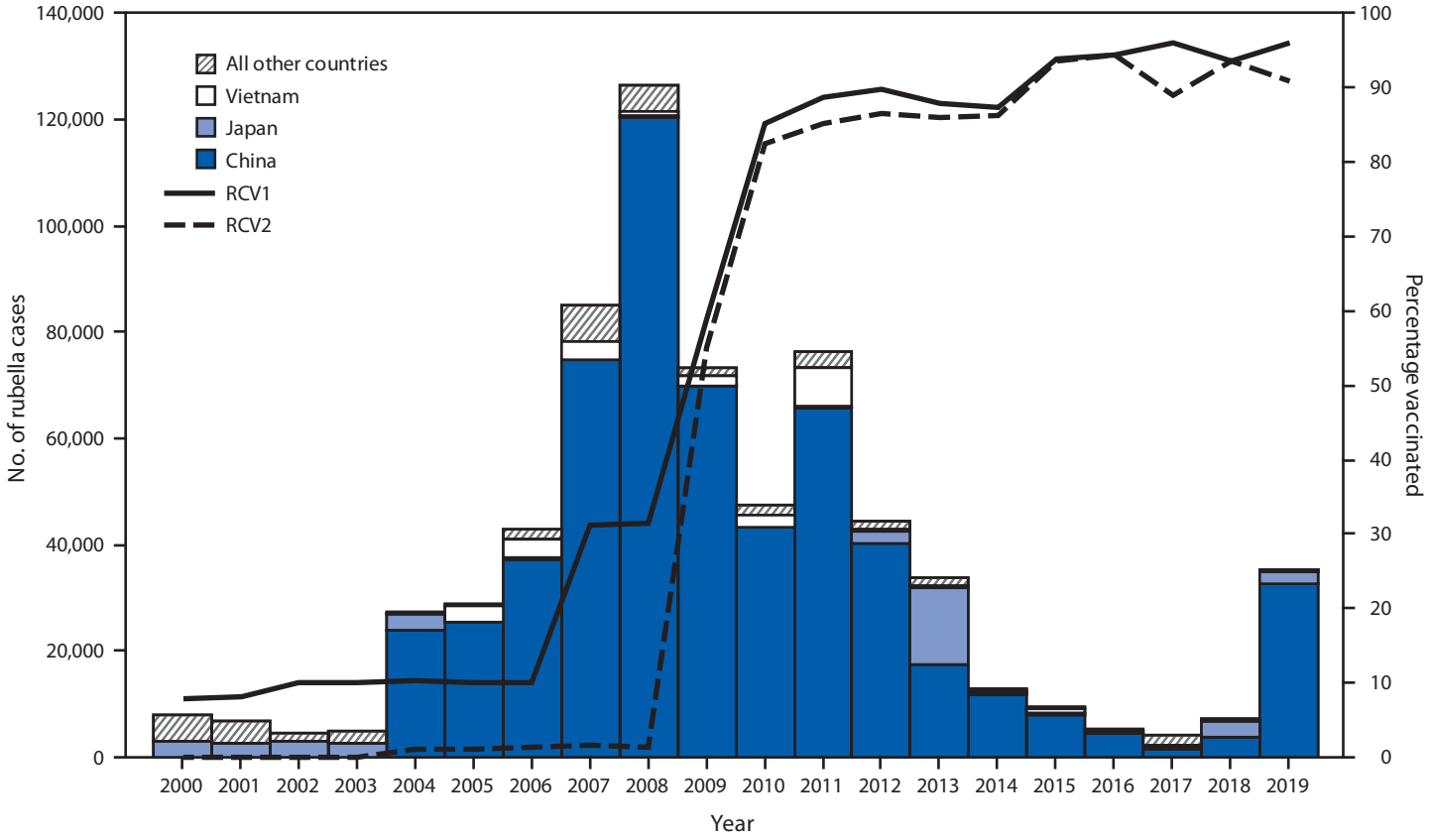
††† Rubella vaccination of children aged 4 years during 1970–1978, then switch to adolescent female vaccination during 1979–1991.

§§§ RCV2 coverage as described by Lopez AL, Raguindin PFN, Silvestre MA, Fabay XCJ, Vinarao AB, Manalastas R. https://www.hindawi.com/journals/ijpedi/2016/8158712/.

¶¶¶ Approximate year of introduction.

**** Regional average coverage and incidence are calculated for the countries reporting information. For coverage if a rubella vaccine was not in the vaccination schedule (NA) a value of zero was used, and the country included in the denominator.

**FIGURE. Confirmed rubella cases,* by year of rash onset and country,† and estimated regional coverage with first and second doses of rubella-containing vaccine§ — World Health Organization (WHO) Western Pacific Region, 2000–2019**




**Abbreviations:** RCV1 = first dose of a rubella-containing vaccine; RCV2 = second dose of a rubella-containing vaccine.

* Confirmed rubella cases reported by countries and areas to WHO. A case of rubella was laboratory-confirmed when rubella-specific immunoglobulin M antibody was detected in serum, rubella-specific RNA was detected by polymerase chain reaction testing, or rubella virus was isolated in cell culture in a person who had not been vaccinated in the 30 days before rash onset; a case of rubella was confirmed by epidemiologic linkage when a case of febrile rash illness was linked in time and place to a laboratory-confirmed rubella case.

† The following countries began reporting rubella surveillance data after 2000: China (2004), Vietnam (2005), Cambodia (2006), Laos (2007), Papua New Guinea (2007), and Malaysia (2010).

§ WHO and United Nations Children's Fund Estimates of National Immunization Coverage, July 15, 2019. https://www.who.int/immunization/monitoring_surveillance/data/en/.

## Surveillance Activities

Case-based measles and rubella surveillance data are requested monthly by WHO from all WPR countries. Most countries** use an acute fever and maculopapular rash case definition to begin a case investigation and laboratory testing. Some countries also report national or sentinel CRS surveillance data. Rubella cases are confirmed by serology or virus detection or an epidemiologic link to a laboratory-confirmed case. Suspected CRS cases can also be clinically†† confirmed. The WHO Global Measles and Rubella Laboratory Network has supported laboratory confirmation and genotyping since 2005. Indicators of combined measles and rubella surveillance performance include 1) the number of febrile rash illness cases discarded as neither measles nor rubella (target: ≥2 per 100,000 population); 2) the percentage

** As of 2019, 32 countries use a case definition of acute fever and maculopapular rash to identify suspected cases of both rubella and measles, leading to laboratory testing for both diseases. The other four countries have separate surveillance systems for rubella and measles. In those countries, a clinician's diagnosis is based on rubella signs and symptoms (described as maculopapular rash and fever [if measured] and either arthritis/arthralgia or lymphadenopathy) and no testing for measles is done; clinically diagnosed rubella cases are not included in the regional surveillance performance indicators.

†† CRS can be clinically confirmed in an infant when a qualified physician detects at least two of the complications listed in group A (cataract or cataracts, congenital glaucoma, congenital heart disease, hearing impairment, or pigmentary retinopathy), or one in group A and one in group B (purpura, splenomegaly, microcephaly, developmental delay, meningoencephalitis, radiolucent bone disease, or jaundice within 24 hours after birth).

of cases with adequate investigations that include all essential data elements[§§] (target: ≥80%); 3) the percentage of cases with adequate blood specimens collected within 28 days of rash onset (target: ≥80%, excluding epidemiologically linked cases); and 4) the percentage of specimens with laboratory results reported within 4 days after receipt in the laboratory (target: ≥80%).

The number of WPR countries reporting rubella data increased from 22 (61%) in 2000 to 29 (81%) in 2019 (Table 1). Five countries,[¶¶] representing 11% of the regional population, have implemented nationwide CRS surveillance; another seven[***] (7% of the population) conduct sentinel surveillance; and four countries[†††] (82% of the population) and the 21 countries included in the Pacific Islands Countries and Territories (<1% of the population) do not conduct CRS surveillance. During 2010–2018, the median regional non-measles/nonrubella discard rate was 3.0 per 100,000 population, ranging from 1.7 (2010) to 9.8 (2018). From 2010 to 2018, the percentage of suspected measles/rubella cases with adequate investigations increased from 76% to 84% and the percentage with adequate blood specimens collected increased from 71% to 82%; the percentage of specimens with laboratory results increased from 48% within 7 days to 76% within 4 days. Regional surveillance indicators are near the target values and all appear to have improved in response to measles outbreaks in 2018.

## Rubella Incidence, Outbreaks, and Genotypes

During 2000–2008, regional rubella incidence increased from 35.5 cases per million population to a peak of 71.3, following initiation of national surveillance in China and Vietnam. Following RCV1 introduction in China, Vietnam, and 18 other countries during 2000–2015, rubella incidence decreased to a historic low of 2.1 per million in 2017 but increased to 18.4 in 2019 (Figure). China, the most populous country, has reported 88% of regional rubella cases since it began reporting in 2004. Nationwide outbreaks occurred in Hong Kong (2000), the Philippines (2001, 2010, and 2017), Samoa (2003), Tokelau (2003), Mongolia (2007), Fiji (2011), Vietnam (2011), Japan (2012–2013),[§§§] Tonga (2002) (Angela Merianos, WHO Pacific Health Security and Communicable Diseases, personal communication, December 2019), and the Solomon Islands (2012) (*8*). The regional rubella resurgence in 2018–2019 (Figure) was driven by transmission among susceptible males aged 30–55 years in Japan (2018–2019) and among unvaccinated adolescents and young adults in China (2019), with spread to other age groups that included pregnant women. These two outbreaks, which involved rubella virus importations from >15 other countries, accounted for 98% of regional rubella cases in 2018–2019. Only a few countries (Japan, Solomon Islands, and Vietnam) identified CRS cases that occurred after outbreaks. Since 2010, three rubella virus genotypes (1E, 2B, and 1J) have been detected in the region. Genotypes 1E and 2B have broad, annual circulation within the region. Genotype 1J was detected in four WPR countries before 2013, but not since.

**Summary**

**What is already known about this topic?**

Before 2000, 16 countries and areas in the Western Pacific Region (WPR) included rubella-containing vaccine (RCV) in the infant immunization program; three more vaccinated adolescent females only.

**What is added by this report?**

All of WPR's 37 countries and areas have introduced RCV in the infant immunization program, achieving 96% regional coverage. Rubella incidence declined to 2.1 cases per million population in 2017 but increased again because of outbreaks in groups with low immunity.

**What are the implications for public health practice?**

WPR has made rapid progress toward rubella elimination and prevention of congenital rubella syndrome since 2010. The 2018–2019 resurgence demonstrates that immunity gaps remain among adolescents and adults; if these are addressed, regional rubella elimination could be rapidly achieved.

## Regional Verification of Rubella Elimination

The Western Pacific Regional Committee (*1*) urged countries to submit measles elimination progress reports for review by the Regional Verification Commission in 2013; verification guidelines were revised in 2017 to include verification of rubella elimination (*1*). As of September 2019, five of seventeen

[§§] Essential data elements include name or identifier, date of birth or age, sex, place of residence, vaccination status or date of last vaccination, date of rash onset, date of notification, date of investigation, date of specimen collection, and place of infection or travel history.

[¶¶] Countries and areas with nationwide surveillance for congenital rubella syndrome include Australia, Hong Kong (China), Japan, New Zealand, and South Korea.

[***] Countries and areas with sentinel-site surveillance for congenital rubella syndrome include Brunei, Cambodia, Laos, Macau (China), Papua New Guinea, Singapore, and Vietnam.

[†††] Countries with no CRS surveillance include China, Malaysia, Mongolia, and Philippines.

[§§§] https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencerubella.html.

**TABLE 2. Characteristics of nationwide rubella supplementary immunization activities (SIAs),* by year and country/area — World Health Organization (WHO) Western Pacific Region, 1970–2019†**

| Country/Area | Year | RCV used | SIA type | Age group targeted | Population reached in targeted age group no. (%) |
|---|---|---|---|---|---|
| American Samoa (US) | 2019 | MMR | M–outbreak | 6m–adults | 12,932 (41) |
| Australia | 1998 | MMR | Catch-up | 1–3.5y | 60,028 (37) |
| | | | | 5–12y | 1,333,980 (75) |
| Brunei | 2008–2009 | MMR | Catch-up | 3–6y | 27,161 (98) |
| Cambodia | 2013 | MR | Catch-up | 9m–14y | 4,576,633 (105)§ |
| | 2016 | MR | M–outbreak | 9m–4y | 766,743 (91) |
| | 2017 | MR | Follow-up | 6m–4y | 1,451,821 (90)¶ |
| Cook Islands (NZ) | 2006 | MR | Catch-up | 1–15y | 5,829 (90) |
| | | | | F: 16–35y | |
| Fiji | 2006 | MR | M–outbreak | 6m–4y | 89,747 (98) |
| | 2017 | MR | Catch-up | 1–11y | 178,069 (95) |
| | 2019 | MR | M–outbreak | 6m–4y | 85,911 (100) |
| | | | | 19y–39y | 257,566 (94) |
| Hong Kong (CH) | 1997 | MMR | Catch-up | 19–39y | 1,100,464 (77) |
| Kiribati | 2006 | MR | Catch-up | 1–14y | 40,568 (95) |
| | | | | F: 15–19y | |
| | 2009 | MMR | Follow-up | 1–4y | 9,865 (107)§ |
| | 2013 | MR | Follow-up | 1–4y | 1,700 (85) |
| | 2019 | MR | Catch-up | 1–14y | 42,838 (107)§ |
| Laos | 2011 | MR | M–outbreak | 9m–19y | 2,614,002 (97) |
| | 2014 | MR | M–outbreak | 9m–9y | 1,569,224 (100) |
| | 2017 | MR | Follow-up | 9m–4y | 703,924 (100) |
| | 2019 | MR | M–outbreak | 6m–9y | 937,064 (60) |
| Malaysia | 1987–1989 | Rubella | Catch-up | F: 15–44y | NR (62) |
| Marshall Islands | 2002 | MMR | Follow-up | 1–4y | 4,383 (77) |
| | 2003 | MMR | M–outbreak | 6m–40y | 37,111 (91) |
| | 2019 | MR | M–outbreak | 1–5y | NR (79) |
| Micronesia | 2014 | MMR | M–outbreak | 6m–49y | 71,388 (87) |
| Mongolia | 2012 | MR | Catch-up | 3–14y | 522,429 (93) |
| | 2016 | MR | M–outbreak | 18–30y | 549,846 (88) |
| | 2019 | MR | Catch-up | 10–18y | 400,961 (96) |
| New Zealand | 1970 | Rubella | Catch-up | 5–9y | NR (95) |
| | 1997 | MMR | M–outbreak | 2–10y | 474,022 (75) |
| | 2001 | MMR | Catch-up | 5–10y | NR (NR) |
| Niue (NZ) | 2003 | MMR | Catch-up | 5–11y | 100 (36) |
| Northern Mariana Islands (US) | 2002 | MMR | Follow-up | 1–6y | 438 (35) |
| | 2018 | MR | Catch-up | 1–18y | 36,175 (74) |
| | 2019 | MR | Catch-up | 19–62y | NR (74) |
| Papua New Guinea | 2015–2016 | MR | M–outbreak | 6m–15y | 1,238,290 (63) |
| | 2019 | MR | Follow-up | 6m–4y | 1,180,422 (101)§ |
| Philippines | 2011 | MR | M–outbreak | 9m–8y | 15,649,907 (84) |
| | 2014 | MR | M–outbreak | 9m–4y | 10,402,489 (91) |
| | 2018 | MMR | M–outbreak | 6m–4y | 4,982,898 (46) |
| | 2019 | MMR | M–outbreak | 5–12y | 2,457,514 (29) |

See table footnotes on page 749.

(29%) countries¶¶¶ (Australia, Brunei, Macau, New Zealand, and South Korea) have been verified to have achieved and sustained rubella elimination (*9*).

¶¶¶ The Regional Verification Commission reviews measles and rubella elimination reports from 17 units: each of 14 WHO member states, two Chinese Special Administrative Regions (Hong Kong and Macau), and the subregion of the Pacific Island Countries and Territories. The Pacific Islands Countries and Territories are reviewed as a single epidemiologic unit; they include American Samoa (United States), Cook Islands, Fiji, French Polynesia (France), Guam (United States), Kiribati, Marshall Islands, Micronesia, Nauru, New Caledonia (France), Niue (New Zealand), Northern Mariana Islands (United States), Palau, Samoa, Solomon Islands, Tokelau (New Zealand), Tonga, Tuvalu, Vanuatu, and Wallis and Futuna (France).

## Discussion

Following the 2012 WHO Regional Committee resolution for rubella control, introduction of combined measles and rubella vaccine accelerated, and nearly all countries in WPR now include 2 RCV doses in the routine immunization program. Regional coverage is high, and rubella incidence declined to a historic low in 2017.

Despite high regional coverage, variation in immunity exists among and within countries. Eight countries were unable to reach protective herd immunity of 85% in their 2018 birth

**TABLE 2. (*Continued*) Characteristics of nationwide rubella supplementary immunization activities (SIAs),* by year and country/area — World Health Organization (WHO) Western Pacific Region, 1970–2019†**

| Country/Area | Year | RCV used | SIA type | Age group targeted | Population reached in targeted age group no. (%) |
|---|---|---|---|---|---|
| Samoa | 2003 | MR | R–outbreak | 1–18y | 47,448 (88) |
| | | | | F: 19–49y | 19,730 (103)§ |
| | 2005 | MR | Follow-up | 9m–2y | 11,610 (86) |
| | 2008 | MR | Follow-up | 9m–4y | 22,864 (91) |
| | 2009 | MR | Disaster | 6m–4y | 21,142 (76) |
| | 2017 | MR | M–outbreak | 1–12y | 57,229 (95) |
| | 2019 | MR | M–outbreak | 6m–50y | 187,369 (93) |
| Singapore | 1997 | MMR | M–outbreak | 12–18y | NR (NR) |
| | 2013 | MMR | Catch-up | 6–7y | 38,436 (95) |
| Solomon Islands | 2012 | MR | R–outbreak | 1–4y | 67,106 (101)§ |
| | 2014 | MR | M–outbreak | 6m–29y | 394,584 (105)§ |
| | 2019 | MR | M–outbreak | 6m–5y | 87,855 (99) |
| South Korea | 2001 | MR | M–outbreak | 8–16y | 5,614,327 (96) |
| | 2006–2009 | MMR | Follow-up | 8y | 2,205,333 (99) |
| Tokelau (NZ) | 2003 | MMR | R–outbreak | 1–15y | 838 (98) |
| | | | | F: CBA** | |
| Tonga | 2002 | MR | R–outbreak | 1–13y | 37,279 (95) |
| | | | | F: 14–40y | 18,321 (95) |
| | 2019 | MR | M–outbreak | 6m–24y | 54,590 (94) |
| Tuvalu | 2005 | MR | Catch-up | 1–34y | 5,469 (96) |
| | 2010 | MR | Follow-up | 1–5y | 1,095 (79) |
| Vanuatu | 2013 | MR | Follow-up | 1–4y | 33,604 (102)§ |
| | 2015 | MR | Catch-up | 1–15y | 103,676 (103)§ |
| Vietnam | 2014–2015 | MR | Catch-up | 1–14y | 19,735,753 (98) |
| | 2016 | MR | Catch-up | 16–17y | 1,787,588 (95) |
| **Total Western Pacific Region** | **1970–2019** | — | — | — | **84,339,251 (81)** |

**Abbreviations:** CBA = childbearing age; CH = China; F = female; FR = France; m = months; M-outbreak = measles outbreak; MMR = measles, mumps, and rubella vaccine; MR = measles and rubella vaccine; NR = not reported; NZ = New Zealand; R-outbreak = rubella outbreak; RCV = rubella-containing vaccine; SIA = supplemental immunization activity; US = United States; y = years.

* Rubella SIAs use a combined measles-rubella vaccine; these SIAs generally use two target age ranges: 1) initial, nationwide catch-up SIAs target all children aged 9 months–14 years, with the goal of eliminating susceptibility to rubella virus in the general population, and 2) follow-up nationwide SIAs generally conducted every 2–4 years target children not included in the previous SIA, who are generally aged 9–59 months (their goal is to protect children who did not respond to the first measles vaccine dose and to provide another opportunity for vaccination). Rubella SIAs also occur as a result of measles outbreak response SIAs when MR or MMR is used for the campaign. The exact age range for follow-up or outbreak SIAs depends on the age-specific incidence of measles, coverage with vaccine containing measles and rubella through routine services, and the time since the last SIA.

† SIAs conducted in 2019 might display interim rather than final numbers of persons vaccinated.

§ Values >100% indicate that the intervention reached more persons than the estimated target population. The numerator was the total children vaccinated, and the denominator was the estimated target calculated for vaccination.

¶ A post-campaign coverage survey estimated that 75% of children within the targeted ages were vaccinated.

** The SIA denominator indicates that >15 birth cohorts were targeted during this rubella outbreak response; it is expected that, similar to what was found for SIAs on other islands with rubella outbreaks at that time, the additional vaccine recipients were women of childbearing age.

cohorts, perpetuating immunity gaps among children. Recent success achieving high coverage also masks susceptibility among older persons. In WPR, immunity gaps developed from historical adolescent female vaccination programs and by introduction of rubella vaccine in the childhood immunization program without vaccinating those who were not age-eligible according to the childhood vaccination schedule at the time of introduction. As long as immunity gaps persist, countries remain vulnerable to importations, outbreaks that include adults, and CRS-affected pregnancies. Lack of coordination toward elimination among countries and regions creates an inequitable strain on achieving and maintaining rubella elimination because of importations via travel and transit.

Strategies to close identified immunity gaps vary by country. Japan is targeting adult males, testing for immunity and vaccinating susceptible persons. Vietnam annually targets children in a portion of districts determined to be at high risk. Other countries have incidentally boosted immunity to rubella by conducting SIAs in response to measles outbreaks, using combined measles-rubella or measles-mumps-rubella vaccine, although rarely in response to rubella outbreaks.

The World Bank classifies 10 countries in the region as low-middle income,**** allowing some opportunities for external support for the routine immunization program, targeted

**** Cambodia, Kiribati, Laos, Micronesia, Mongolia, Papua New Guinea, Philippines, Solomon Islands, Vanuatu, and Vietnam.

immunization activities, and outbreak response support. However, external immunization funding is not currently well-aligned with strategies to achieve a regional elimination goal. The remaining countries must self-finance rubella elimination, given the absence of a broad mechanism for external immunization funding support in middle income countries. In addition, many countries use domestic vaccine suppliers that set vaccine prices and whose production capacity might not meet outbreak response needs. Five countries have been verified as having eliminated endemic rubella transmission; however, other countries with a long history of rubella vaccination and surveillance and with a low annual incidence might also have achieved elimination but have not yet requested verification.

The findings in this report are subject to at least three limitations. First, sensitivity of integrated measles and surveillance for rubella is low because it is a milder illness, resulting in underdetection of cases. Second, direct comparisons among countries might not be valid because of variations in capacity for case investigation and laboratory testing, the monitoring of progress toward elimination, level and source of financing, and the priority given to closing immunity gaps. Finally, the region has countries with widely disparate population sizes, and regional trends might obscure challenges or successes in less populous countries.

The participation of all WPR countries will be needed to attain regional rubella elimination and prevent the devastating consequences of rubella infection during pregnancy. Efforts to achieve these goals include sustaining high population immunity, identifying and addressing existing immunity gaps, and maintaining high-quality surveillance to allow for rapid outbreak detection and prompt response to contain outbreaks.

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Morbidity and Mortality Weekly Report

# Public Attitudes, Behaviors, and Beliefs Related to COVID-19, Stay-at-Home Orders, Nonessential Business Closures, and Public Health Guidance — United States, New York City, and Los Angeles, May 5–12, 2020

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SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), is thought to be transmitted mainly by person-to-person contact (*1*). Implementation of nationwide public health orders to limit person-to-person interaction and of guidance on personal protective practices can slow transmission (*2*,*3*). Such strategies can include stay-at-home orders, business closures, prohibitions against mass gatherings, use of cloth face coverings, and maintenance of a physical distance between persons (*2*,*3*). To assess and understand public attitudes, behaviors, and beliefs related to this guidance and COVID-19, representative panel surveys were conducted among adults aged ≥18 years in New York City (NYC) and Los Angeles, and broadly across the United States during May 5–12, 2020. Most respondents in the three cohorts supported stay-at-home orders and nonessential business closures* (United States, 79.5%; New York City, 86.7%; and Los Angeles, 81.5%), reported always or often wearing cloth face coverings in public areas (United States, 74.1%, New York City, 89.6%; and Los Angeles 89.8%), and believed that their state's restrictions were the right balance or not restrictive enough (United States, 84.3%; New York City, 89.7%; and Los Angeles, 79.7%). Periodic assessments of public attitudes, behaviors, and beliefs can guide evidence-based public health decision-making and related prevention messaging about mitigation strategies needed as the COVID-19 pandemic evolves.

During May 5–12, 2020, a total of 4,042 adults aged ≥18 years in the United States were invited to complete a web-based survey administered by Qualtrics, LLC.† Surveys were conducted among residents of NYC and Los Angeles to enable comparison of the two most populous cities in the United States with each other and with the nationwide cohort (*4*). The nationwide survey did not exclude respondents from NYC and Los Angeles, but no respondent was counted in more than one cohort. Invited participants were recruited using methods to create panels representative of the 2010 U.S. Census by age, gender, race, and ethnicity (*5*). Overall, 2,402 respondents completed surveys (response rate = 59.4%); of these, 2,221 (92.5%) (United States cohort = 1,676, NYC cohort = 286, and Los Angeles cohort = 259) passed quality screening procedures§ (*5*); sample sizes provided a margin of error at 95% confidence levels of 2.4%, 5.7%, and 5.9%, respectively.

Questions about the effects of the COVID-19 pandemic focused on public attitudes, behaviors, and beliefs regarding stay-at-home orders, nonessential business closures, and public health guidance. Chi-squared statistics (threshold of $\alpha = 0.05$) were calculated to examine differences between the survey cohorts and to examine potential associations between reported characteristics (gender, age, race, ethnicity, employment status, essential worker status, rural-urban residence, knowing someone with COVID-19, and knowing someone who had died from COVID-19). Jupyter Notebook (version 6.0.0; Project Jupyter) was used to conduct statistical analyses.

Among respondents in the U.S. cohort (1,676), 16.8% knew someone who had positive test results for COVID-19, compared with 42.0% of respondents in NYC and 10.8% in Los Angeles (Table 1); 5.9% of respondents in the U.S. survey cohort knew someone who had died from COVID-19, compared with 23.1% in NYC and 7.3% in Los Angeles.

Broad support for recommended COVID-19 mitigation strategies was found nationwide (Table 2). Overall, 79.5% of respondents in the U.S. cohort supported government-issued stay-at-home orders and nonessential business closures, whereas 86.7% in NYC and 81.5% in Los Angeles supported these measures. Further, 67.3% of respondents in the United States,

* Respondents were informed that, for the survey, stay-at-home orders mean that all nonessential services (e.g., dine-in restaurants, bars, social venues, gyms, fitness studios, and convention centers) are shut down. Essential services (e.g., groceries, pharmacies, gas stations, food banks, convenience stores, and delivery restaurants) remain open. Banks, local governments, and law enforcement agencies also remain open. Persons are still allowed to leave their homes but encouraged to observe social distancing guidelines. Public events and gatherings are not allowed.

† Eligibility for the nationwide U.S. cohort was determined on the basis of informed consent, age, and residence within the United States. Therefore, consented adult potential respondents residing in NYC and Los Angeles metro areas were eligible to complete surveys as part of the nationwide U.S. or NYC and Los Angeles cohorts.

§ Qualtrics LLC data quality screening procedures included algorithmic and keystroke analysis for attention patterns, click-through behavior, duplicate responses, machine responses, and inattentiveness. Country-specific geolocation verification via IP address mapping was used to ensure respondents were from the United States. Respondents who failed an attention or speed check, along with any responses identified by the data scrubbing algorithms, were excluded from analysis.

76.6% in NYC, and 69.1% in Los Angeles agreed that nonessential workers should stay home. The majority of respondents in NYC and Los Angeles and broadly across the United States agreed with public health guidelines, including recommendations for maintaining 6 feet of distance between persons (>87% in each area) and limiting gatherings to fewer than 10 persons (>82% in each area). At the time of the survey, most also agreed that dining inside restaurants should not be allowed, with agreement higher in NYC (81.5%) than in Los Angeles (71.8%) and in the United States overall (66.6%).

Widespread adherence to recommended COVID-19 mitigation strategies was reported in all three cohorts. Overall, 77.3% of adults nationwide reported self-isolating,[¶] with 84.6% reporting this behavior in NYC and 83.0% in Los Angeles. Most respondents (79.5%) in the United States also reported the behavior of always or often keeping ≥6 feet apart from others, with higher percentages reporting this behavior in NYC (85.7%) and Los Angeles (82.6%). Always or often

[¶] For this survey, self-isolating means having no contact with others outside of the respondent's household unless required for essential services.

**TABLE 1. Self-reported characteristics of invited participants and survey respondents — United States, New York City, and Los Angeles,* May 5–12, 2020**

| | %[†] | | | | | |
|---|---|---|---|---|---|---|
| | United States | | New York City | | Los Angeles | |
| | Invited | Responded | Invited | Responded | Invited | Responded |
| **Characteristic** | **(N = 3,010)** | **(N = 1,676)** | **(N = 507)** | **(N = 286)** | **(N = 525)** | **(N = 259)** |
| **Gender** | | | | | | |
| Female | 55.9 | 56.1 | 52.9 | 55.2 | 52.4 | 52.9 |
| Male | 44.0 | 43.9 | 47.1 | 44.8 | 47.6 | 47.1 |
| Other | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Age group (yrs)** | | | | | | |
| 18–24 | 11.4 | 3.9 | 11.2 | 4.2 | 11.0 | 5.8 |
| 25–34 | 14.8 | 8.5 | 18.5 | 11.5 | 18.1 | 10.4 |
| 35–44 | 17.6 | 15.0 | 15.6 | 14.0 | 17.5 | 12.4 |
| 45–54 | 17.6 | 19.0 | 15.0 | 13.6 | 16.4 | 18.5 |
| 55–64 | 18.0 | 23.4 | 19.3 | 26.9 | 17.1 | 22.0 |
| ≥65 | 20.6 | 30.2 | 20.3 | 29.7 | 19.8 | 30.9 |
| **Race** | | | | | | |
| White | 78.4 | 84.7 | 72.6 | 82.5 | 74.3 | 80.7 |
| Black or African American | 9.2 | 5.0 | 11.2 | 4.5 | 9.1 | 4.6 |
| Asian | 5.7 | 6.2 | 6.1 | 7.3 | 5.7 | 7.3 |
| Multiple race/Other[§] | 6.7 | 4.2 | 10.1 | 5.6 | 10.9 | 7.3 |
| **Ethnicity** | | | | | | |
| Hispanic or Latino | 8.8 | 5.9 | 13.6 | 8.0 | 17.1 | 10.8 |
| Not Hispanic or Latino | 91.2 | 94.1 | 86.4 | 92.0 | 82.9 | 89.2 |
| **Rural-urban residence classification[¶]** | | | | | | |
| Rural | 15.3 | 15.5 | 0.8 | 1.4 | 0.8 | 0.4 |
| Urban | 84.7 | 84.5 | 99.2 | 98.6 | 99.2 | 99.6 |
| **Employment status**** | | | | | | |
| Employed[††] | 62.9 | 49.6 | 71.2 | 58.7 | 68.6 | 52.5 |
| Essential | — | 23.4 | — | 16.1 | — | 23.2 |
| Nonessential | — | 26.2 | — | 42.7 | — | 29.3 |
| Retired | 24.4 | 34.9 | 19.9 | 29.4 | 21.0 | 32.8 |
| Unemployed | 12.8 | 15.5 | 8.9 | 11.9 | 10.5 | 14.7 |
| **Know someone with positive test results for COVID-19** | — | 16.8 | — | 42.0 | — | 10.8 |
| **Know someone who died from COVID-19** | — | 5.9 | — | 23.1 | — | 7.3 |

**Abbreviation:** COVID-19 = coronavirus disease 2019.

* The U.S. survey group did not exclude respondents from New York City and Los Angeles.

† Totals might not all sum to 100 because of rounding.

§ The multiple race/other category includes respondents who self-reported as a race with <2.5% of respondents in any cohort (e.g., American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or more than one race).

¶ Rural-urban classification was determined according to the Federal Office of Rural Health Policy definition of rurality. https://www.hrsa.gov/rural-health/about-us/definition/datafiles.html.

** Employment status as of December 2019.

†† Essential versus nonessential status was not assessed in relation to employment status among invited participants. Totals for this category do not all sum to 100 because of rounding.

**TABLE 2. Attitudes, behaviors, and beliefs related to COVID-19, stay-at-home orders, nonessential business closures, and public health guidance — United States (U.S.),* New York City (NYC), and Los Angeles (LA), May 5–12, 2020**

| Attitudes, behaviors, and beliefs | U.S. (N = 1,676) | NYC (N = 286) | LA (N = 259) | p-value† U.S. vs NYC | p-value† U.S. vs LA | p-value† NYC vs LA |
|---|---|---|---|---|---|---|
| **Attitudes, no. of respondents (%)** | | | | | | |
| **Support stay-at-home order and nonessential business closures** | | | | | | |
| Yes | 1,332 (79.5) | 248 (86.7) | 211 (81.5) | <0.05§ | 0.5097 | 0.1187 |
| No | 344 (20.5) | 38 (13.3) | 48 (18.5) | | | |
| **Nonessential workers should stay home** | | | | | | |
| Agree | 1,128 (67.3) | 219 (76.6) | 179 (69.1) | <0.05§ | 0.6722 | <0.05§ |
| Neither agree nor disagree | 283 (16.9) | 41 (14.3) | 38 (14.7) | | | |
| Disagree | 265 (15.8) | 26 (9.1) | 42 (16.2) | | | |
| **Persons should always keep ≥6-ft of physical distance** | | | | | | |
| Agree | 1,470 (87.7) | 262 (91.6) | 234 (90.3) | 0.1242 | 0.4707 | 0.6377 |
| Neither agree nor disagree | 127 (7.6) | 17 (5.9) | 15 (5.8) | | | |
| Disagree | 79 (4.7) | 7 (2.4) | 10 (3.9) | | | |
| **Groups of 10 or more persons should not be allowed** | | | | | | |
| Agree | 1,381 (82.4) | 247 (86.4) | 226 (87.3) | 0.1245 | 0.1374 | 0.8130 |
| Neither agree nor disagree | 156 (9.3) | 25 (8.7) | 19 (7.3) | | | |
| Disagree | 139 (8.3) | 14 (4.9) | 14 (5.4) | | | |
| **Dining inside restaurants should not be allowed** | | | | | | |
| Agree | 1,117 (66.6) | 233 (81.5) | 186 (71.8) | <0.05§ | 0.1769 | <0.05§ |
| Neither agree nor disagree | 244 (14.6) | 28 (9.8) | 36 (13.9) | | | |
| Disagree | 315 (18.8) | 25 (8.7) | 37 (14.3) | | | |
| **Behaviors, no. of respondents (%)** | | | | | | |
| **In self-isolation¶** | | | | | | |
| Yes | 1,296 (77.3) | 242 (84.6) | 215 (83.0) | <0.05§ | <0.05§ | 0.6954 |
| No | 380 (22.7) | 44 (15.4) | 44 (17.0) | | | |
| **Keep ≥6 ft apart from others** | | | | | | |
| Always | 975 (58.2) | 191 (66.8) | 172 (66.4) | 0.0653 | 0.1576 | 0.8331 |
| Often | 357 (21.3) | 54 (18.9) | 42 (16.2) | | | |
| Sometimes | 138 (8.2) | 16 (5.6) | 17 (6.6) | | | |
| Rarely | 69 (4.1) | 10 (3.5) | 10 (3.9) | | | |
| Never | 137 (8.2) | 15 (5.2) | 18 (6.9) | | | |
| **Avoid groups of 10 or more persons** | | | | | | |
| Always | 1,259 (75.1) | 222 (77.6) | 196 (75.7) | 0.7621 | 0.9568 | 0.8975 |
| Often | 181 (10.8) | 32 (11.2) | 29 (11.2) | | | |
| Sometimes | 59 (3.5) | 9 (3.1) | 7 (2.7) | | | |
| Rarely | 39 (2.3) | 5 (1.7) | 5 (1.9) | | | |
| Never | 138 (8.2) | 18 (6.3) | 22 (8.5) | | | |
| **Been to a public area in the previous week** | | | | | | |
| Yes | 1,533 (91.5) | 260 (90.9) | 235 (90.7) | 0.8436 | 0.7851 | 0.9381 |
| No | 143 (8.5) | 26 (9.1) | 24 (9.3) | | | |
| **Wear cloth face covering when in public**** | | | | | | |
| Always | 925 (60.3) | 208 (80.0) | 183 (77.9) | <0.05§ | <0.05§ | 0.7659 |
| Often | 212 (13.8) | 25 (9.6) | 28 (11.9) | | | |
| Sometimes | 134 (8.7) | 14 (5.4) | 16 (6.8) | | | |
| Rarely | 63 (4.1) | 5 (1.9) | 3 (1.3) | | | |
| Never | 199 (13.0) | 8 (3.1) | 5 (2.1) | | | |
| **Beliefs, no. of respondents (%)** | | | | | | |
| Believe community mitigation strategies are | | | | | | |
| Not restrictive enough | 302 (18.0) | 49 (17.4) | 42 (16.3) | 0.0500 | 0.1699 | <0.05§ |
| The right balance | 1,112 (66.3) | 204 (72.3) | 163 (63.4) | | | |
| Too restrictive | 262 (15.6) | 29 (10.3) | 52 (20.2) | | | |
| **Would feel safe if community mitigation strategies were lifted nationwide at the time of survey** | | | | | | |
| Yes | 431 (25.7) | 53 (18.5) | 69 (26.6) | <0.05§ | 0.8102 | 0.0304 |
| No | 1,245 (74.3) | 233 (81.5) | 190 (73.4) | | | |
| No, but would like restrictions lifted and accept risks | 287 (17.1) | 36 (12.6) | 33 (12.7) | | | |

**Abbreviation:** COVID-19 = coronavirus disease 2019.
* The U.S. survey group did not exclude respondents from New York City and Los Angeles.
† Calculated with Chi-squared test of independence.
§ P-value is statistically significant (p<0.05).
¶ For this survey, self-isolating means having no contact with others outside of the respondent's household unless required for essential services.
** Of respondents who reported having been in a public area in the preceding week.

avoiding groups of 10 or more persons was reported by >85% of adults in the three cohorts. Approximately 90% of respondents reported having been in a public area during the preceding week; among those, 74.1% nationwide reported always or often wearing cloth face coverings when in public, with higher percentages reporting this behavior in NYC (89.6%) and Los Angeles (89.8%).

Overall, 84.3% of adults in the U.S. survey cohort believed their state's COVID-19 community mitigation strategies were the right balance or not restrictive enough, compared with 89.7% in NYC and 79.7% in Los Angeles. As well, 74.3% of respondents in the United States reported they would not feel safe if these restrictions were lifted nationwide at the time the survey was conducted, compared with 81.5% in NYC and 73.4% in Los Angeles. In addition, among those who reported that they would not feel safe, some indicated that they would nonetheless want community mitigation strategies lifted and would accept associated risks (17.1%, 12.6%, and 12.7%, respectively).

Reported prevalence of self-isolation and feeling safe if community mitigation strategies were lifted differed significantly by age, employment status, and essential worker status among adults in the U.S. survey cohort (Table 3). The percentage of respondents who reported that they were in self-isolation was highest among persons aged 18–24 years (92.3%) and lowest among those aged 45–54 years (71.5%). The percentage who reported that they would feel safe if community mitigation strategies were lifted was approximately twice as high among persons aged 18–24 as it was among those aged ≥65 years (43.1% versus 19.2%). Respondents who reported that they were essential workers** accounted for 47.2% of employed respondents in the U.S. cohort and were significantly less likely than were nonessential workers to report self-isolating (63.1% versus 80.6%). Essential workers were also significantly more likely than were nonessential workers to report that they would feel safe if COVID-19 community mitigation strategies were lifted (37.7% versus 23.7%).

Reported prevalences of always or often wearing a cloth face covering in public and maintaining ≥6 feet of physical distance also varied significantly across respondent demographics and characteristics. Respondents who were male, employed, or essential workers were significantly more likely to report having been in public areas in the past week. Among respondents who had been in public areas during the preceding week, significantly higher percentages of women, adults aged ≥65 years, retired persons, and those living in urban areas reported wearing cloth face coverings. A significantly higher percentage of adults aged ≥65 years and nonessential workers reported maintaining 6 feet of physical distance between themselves and others and abiding by the recommendation to avoid gatherings of 10 or more persons than did others. Adherence to recommendations to maintain 6 feet of physical distance and limit gatherings to fewer than 10 persons also differed significantly by employment status and race, respectively, with employed persons less likely than were retired persons to have maintained 6 feet of distance and black persons less likely than were white or Asian persons to have limited gatherings to fewer than 10 persons.

** The definition of essential workers was largely determined on a state-by-state basis.

**Summary**

What is already known about this topic?

Stay-at-home orders and recommended personal protective practices were disseminated to mitigate the spread of COVID-19 in the United States.

What is added by this report?

During May 5–12, 2020, a survey among adults in New York City and Los Angeles and broadly across the United States found widespread support of stay-at-home orders and nonessential business closures and high degree of adherence to COVID-19 mitigation guidelines. Most respondents reported that they would feel unsafe if restrictions were lifted at the time of the survey.

What are the implications for public health practice?

Routine assessment of public priorities can guide public health decisions requiring collective action. Current levels of public support for restrictions and adherence to mitigation strategies can inform decisions about reopening and balancing duration and intensity of restrictions.

## Discussion

There was broad support for stay-at-home orders, nonessential business closures, and adherence to public health recommendations to mitigate the spread of COVID-19 in early- to mid-May 2020. Most adults reported they would not feel safe if government-ordered community mitigation strategies such as stay-at-home orders and nonessential business closures were lifted nationwide at the time the survey was conducted, although a minority of these adults who did not feel safe wanted these restrictions lifted despite the risks.

There was a significant association between age and feeling safe without community mitigation strategies, with younger adults feeling safer than those aged ≥65 years, which might relate to perceived risk for infection and severe disease. As of May 16, adults aged ≥65 years accounted for approximately 80% of reported COVID-19–associated deaths, compared with those aged 15–24 years, who accounted for 0.1% of such

**TABLE 3. Attitudes, behaviors, and beliefs related to COVID-19, stay-at-home orders, nonessential business closures, and public health guidance, by respondent characteristics* — United States, May 5–12, 2020**

**By gender, age group, and ethnicity, %**

| Attitudes, behaviors and, beliefs | Gender | | Age group (yrs) | | | | | | Ethnicity | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | 18–24 | 25–34 | 35–44 | 45–54 | 55–64 | ≥65 | Hispanic | Non-Hispanic |
| **Attitudes** | | | | | | | | | | |
| **Support stay-at-home orders and nonessential business closures** | | | | | | | | | | |
| Yes | 76.3 | 81.9 | 84.6 | 85.2 | 83.7 | 75.2 | 76.0 | 80.4 | 83.8 | 79.2 |
| p-value† | 0.0521 | | | | | 0.1803 | | | 1.0 | |
| **Nonessential workers should stay home** | | | | | | | | | | |
| Agree | 64.9 | 69.2 | 55.4 | 76.8 | 72.2 | 62.7 | 62.0 | 70.8 | 72.7 | 67.0 |
| Disagree | 17.8 | 14.2 | 13.8 | 7.7 | 11.5 | 20.7 | 19.6 | 14.4 | 11.1 | 16.1 |
| p-value† | 0.9043 | | | | | <0.05§ | | | 1.0 | |
| **Persons should always keep ≥6-ft of physical distance** | | | | | | | | | | |
| Agree | 86.5 | 88.6 | 73.8 | 82.4 | 86.9 | 85.0 | 91.1 | 90.5 | 77.8 | 88.3 |
| Disagree | 4.8 | 4.7 | 4.6 | 5.6 | 2.8 | 7.2 | 4.8 | 3.8 | 6.1 | 4.6 |
| p-value† | 1.0 | | | | | <0.05§ | | | <0.05§ | |
| **Groups of 10 or more persons should not be allowed** | | | | | | | | | | |
| Agree | 80.4 | 84.0 | 70.8 | 80.3 | 83.7 | 76.8 | 82.9 | 87.0 | 80.8 | 82.5 |
| Disagree | 9.9 | 7.0 | 10.8 | 8.5 | 6.0 | 11.9 | 9.2 | 6.1 | 5.1 | 8.5 |
| p-value† | 0.7238 | | | | | | | <0.05§ | | 1.0 |
| **Dining inside restaurants should not be allowed** | | | | | | | | | | |
| Agree | 62.2 | 70.1 | 67.7 | 72.5 | 68.3 | 60.8 | 65.6 | 68.6 | 66.7 | 66.6 |
| Disagree | 21.8 | 16.5 | 9.2 | 12.0 | 15.9 | 23.8 | 23.2 | 16.8 | 14.1 | 19.1 |
| p-value† | <0.05§ | | | | | <0.05§ | | | 1.0 | |
| **Behaviors** | | | | | | | | | | |
| **In self-isolation** | | | | | | | | | | |
| Yes | 75.8 | 78.5 | 92.3 | 81.7 | 77.8 | 71.5 | 72.7 | 81.2 | 87.9 | 76.7 |
| p-value† | 1.0 | | | | | <0.05§ | | | 0.1246 | |
| **Keep ≥6 ft apart from others** | | | | | | | | | | |
| Always | 54.6 | 61.0 | 29.2 | 56.3 | 60.3 | 55.2 | 56.4 | 64.6 | 54.5 | 58.4 |
| Often | 22.6 | 20.3 | 30.8 | 23.2 | 18.3 | 21.6 | 23.5 | 19.2 | 18.2 | 21.5 |
| Sometimes | 9.0 | 7.7 | 26.2 | 7.0 | 9.1 | 9.1 | 7.7 | 5.7 | 14.1 | 7.9 |
| Rarely | 5.0 | 3.4 | 9.2 | 5.6 | 2.8 | 4.4 | 4.6 | 3.2 | 7.1 | 3.9 |
| Never | 8.8 | 7.7 | 4.6 | 7.7 | 9.5 | 9.7 | 7.9 | 7.3 | 6.1 | 8.3 |
| p-value† | 0.7508 | | | | | <0.05§ | | | 0.8299 | |
| **Avoid groups of 10 or more persons** | | | | | | | | | | |
| Always | 72.5 | 77.2 | 52.3 | 68.3 | 74.2 | 73.4 | 73.7 | 82.6 | 63.6 | 75.8 |
| Often | 12.2 | 9.7 | 15.4 | 18.3 | 11.9 | 8.8 | 12.0 | 7.9 | 14.1 | 10.6 |
| Sometimes | 3.9 | 3.2 | 15.4 | 2.1 | 4.4 | 4.4 | 3.1 | 1.8 | 6.1 | 3.4 |
| Rarely | 2.4 | 2.2 | 15.4 | 2.8 | 0.4 | 2.2 | 2.0 | 1.8 | 6.1 | 2.1 |
| Never | 8.8 | 7.8 | 1.5 | 8.5 | 9.1 | 11.3 | 9.2 | 5.9 | 10.1 | 8.1 |
| p-value† | 1.0 | | | | | <0.05§ | | | 0.1843 | |
| **Been to a public area in the preceding week** | | | | | | | | | | |
| Yes | 94.7 | 88.9 | 96.9 | 88.0 | 92.5 | 90.6 | 94.4 | 89.5 | 90.9 | 91.5 |
| p-value† | <0.05§ | | | | | 0.3145 | | | 1.0 | |
| **Wear cloth face covering when in public¶** | | | | | | | | | | |
| Always | 54.6 | 65.1 | 44.4 | 59.2 | 57.9 | 56.1 | 55.1 | 71.1 | 57.8 | 60.5 |
| Often | 14.9 | 12.9 | 15.9 | 16.0 | 12.9 | 13.1 | 17.6 | 10.8 | 13.3 | 13.9 |
| Sometimes | 10.1 | 7.6 | 15.9 | 8.8 | 8.6 | 8.7 | 10.3 | 6.6 | 13.3 | 8.5 |
| Rarely | 4.6 | 3.7 | 12.7 | 4.0 | 4.7 | 4.5 | 3.5 | 2.9 | 4.4 | 4.1 |
| Never | 15.8 | 10.6 | 11.1 | 12.0 | 15.9 | 17.6 | 13.5 | 8.6 | 11.1 | 13.1 |
| p-value† | <0.05§ | | | | | <0.05§ | | | 1.0 | |
| **Beliefs** | | | | | | | | | | |
| **State restrictions are** | | | | | | | | | | |
| The right balance | 64.5 | 67.8 | 61.5 | 57.0 | 65.1 | 63.3 | 67.3 | 71.3 | 60.6 | 66.7 |
| Not restrictive enough | 18.0 | 18.1 | 21.5 | 31.7 | 19.0 | 16.9 | 16.1 | 15.4 | 26.3 | 17.5 |
| p-value† | 1.0 | | | | | | | <0.05§ | | 0.7720 |
| **Would feel safe if restrictions were lifted nationwide at the time the survey was conducted** | | | | | | | | | | |
| Yes | 28.8 | 23.3 | 43.1 | 26.8 | 27.4 | 30.1 | 26.3 | 19.2 | 25.3 | 25.7 |
| p-value† | 0.1019 | | | | | <0.05§ | | | 1.0 | |

See table footnotes on page 757.

**TABLE 3. (*Continued*) Attitudes, behaviors, and beliefs related to COVID-19, stay-at-home orders, nonessential business closures, and public health guidance, by respondent characteristics* — United States, May 5–12, 2020**

**By race, employment status, and essential worker status, %**

| Attitudes, behaviors, and beliefs | Race** | | | | Employment status | | | Essential worker†† | |
|---|---|---|---|---|---|---|---|---|---|
| | White | Black | Asian | Multiple race/Other | Unemployed | Retired | Employed | Yes | No |
| **Attitudes** | | | | | | | | | |
| **Support stay-at-home orders and nonessential business closures** | | | | | | | | | |
| Yes | 77.9 | 89.2 | 90.4 | 84.3 | 81.9 | 80.0 | 78.4 | 75.6 | 80.9 |
| p-value† | | <0.05§ | | | | 1.0 | | 0.6953 | |
| **Nonessential workers should stay home** | | | | | | | | | |
| Agree | 66.4 | 63.9 | 78.8 | 72.9 | 68.3 | 69.9 | 65.1 | 58.3 | 71.3 |
| Disagree | 16.8 | 16.9 | 4.8 | 11.4 | 13.9 | 14.9 | 17.1 | 19.6 | 14.8 |
| p-value† | | 0.4225 | | | | 1.0 | | <0.05§ | |
| **Persons should always keep ≥6-ft of physical distance** | | | | | | | | | |
| Agree | 88.2 | 81.9 | 89.4 | 81.4 | 83.0 | 92.5 | 85.8 | 81.7 | 89.5 |
| Disagree | 4.9 | 6.0 | 1.9 | 4.3 | 8.1 | 2.1 | 5.5 | 7.1 | 4.1 |
| p-value† | | 1.0 | | | | <0.05§ | | <0.05§ | |
| **Groups of 10 or more persons should not be allowed** | | | | | | | | | |
| Agree | 82.0 | 84.3 | 89.4 | 78.6 | 79.5 | 87.5 | 79.7 | 74.8 | 84.1 |
| Disagree | 8.9 | 7.2 | 1.9 | 7.1 | 9.7 | 5.8 | 9.6 | 10.7 | 8.7 |
| p-value† | | 1.0 | | | | <0.05§ | | <0.05§ | |
| **Dining inside restaurants should not be allowed** | | | | | | | | | |
| Agree | 65.8 | 75.9 | 72.1 | 64.3 | 66.0 | 69.6 | 64.8 | 59.5 | 69.5 |
| Disagree | 20.5 | 7.2 | 6.7 | 15.7 | 19.3 | 16.9 | 20.0 | 22.4 | 17.8 |
| p-value† | | <0.05§ | | | | 1.0 | | 0.0899 | |
| **Behaviors** | | | | | | | | | |
| **In self-isolation** | | | | | | | | | |
| Yes | 77.2 | 78.3 | 73.1 | 84.3 | 81.1 | 82.7 | 72.4 | 63.1 | 80.6 |
| p-value† | | 1.0 | | | | <0.05§ | | <0.05§ | |
| **Keep ≥6 ft apart from others** | | | | | | | | | |
| Always | 58.2 | 48.2 | 67.3 | 55.7 | 58.3 | 65.8 | 52.8 | 44.8 | 59.9 |
| Often | 21.6 | 20.5 | 17.3 | 21.4 | 21.6 | 19.0 | 22.8 | 26.0 | 20.0 |
| Sometimes | 8.0 | 14.5 | 4.8 | 11.4 | 5.8 | 5.5 | 10.9 | 13.0 | 9.1 |
| Rarely | 3.9 | 9.6 | 1.0 | 5.7 | 5.4 | 2.9 | 4.6 | 6.6 | 2.7 |
| Never | 8.2 | 7.2 | 9.6 | 5.7 | 8.9 | 6.8 | 8.9 | 9.7 | 8.2 |
| p-value† | | 0.5507 | | | | <0.05§ | | <0.05§ | |
| **Avoid groups of 10 or more persons** | | | | | | | | | |
| Always | 76.2 | 56.6 | 77.9 | 71.4 | 73.0 | 81.2 | 71.5 | 65.6 | 76.8 |
| Often | 10.8 | 15.7 | 6.7 | 11.4 | 10.8 | 8.2 | 12.6 | 16.0 | 9.6 |
| Sometimes | 3.0 | 12.0 | 1.9 | 5.7 | 4.2 | 2.2 | 4.2 | 5.6 | 3.0 |
| Rarely | 2.0 | 8.4 | 1.9 | 2.9 | 2.3 | 2.1 | 2.5 | 4.1 | 1.1 |
| Never | 8.0 | 7.2 | 11.5 | 8.6 | 9.7 | 6.3 | 9.1 | 8.7 | 9.6 |
| p-value† | | <0.05§ | | | | 0.1179 | | <0.05§ | |
| **Been to a public area in the preceding week** | | | | | | | | | |
| Yes | 91.8 | 91.6 | 87.5 | 91.4 | 88.4 | 89.1 | 94.1 | 97.5 | 91.1 |
| p-value† | | 1.0 | | | | <0.05§ | | <0.05§ | |
| **Wear cloth face covering when in public¶** | | | | | | | | | |
| Always | 60.1 | 55.3 | 71.4 | 54.7 | 58.5 | 70.4 | 54.2 | 49.3 | 58.8 |
| Often | 13.7 | 19.7 | 9.9 | 14.1 | 10.0 | 11.1 | 16.7 | 20.4 | 13.3 |
| Sometimes | 8.4 | 13.2 | 8.8 | 10.9 | 10.5 | 5.6 | 10.3 | 9.7 | 11.0 |
| Rarely | 3.8 | 7.9 | 3.3 | 7.8 | 2.2 | 3.1 | 5.4 | 6.5 | 4.3 |
| Never | 14.0 | 3.9 | 6.6 | 12.5 | 18.8 | 9.8 | 13.4 | 14.1 | 12.8 |
| p-value† | | 0.3708 | | | | <0.05§ | | 0.1843 | |
| **Beliefs** | | | | | | | | | |
| **State restrictions are** | | | | | | | | | |
| The right balance | 66.7 | 65.1 | 67.3 | 60.0 | 67.6 | 68.7 | 64.3 | 64.9 | 63.8 |
| Not restrictive enough | 16.7 | 28.9 | 22.1 | 25.7 | 18.5 | 17.4 | 18.3 | 14.5 | 21.6 |
| p-value† | | | | 0.0523 | | | 1.0 | | 0.0563 |
| **Would feel safe if restrictions were lifted nationwide at the time the survey was conducted** | | | | | | | | | |
| Yes | 25.8 | 37.3 | 15.4 | 25.7 | 22.4 | 20.7 | 30.3 | 37.7 | 23.7 |
| p-value† | | 0.0765 | | | | <0.05§ | | <0.05§ | |

See table footnotes on page 757.

**TABLE 3. (*Continued*) Attitudes, behaviors, and beliefs related to COVID-19, stay-at-home orders, nonessential business closures, and public health guidance, by respondent characteristics* — United States, May 5–12, 2020**

* Nationwide cohort (n = 1,676) only unless otherwise specified. The six respondent characteristic categories shown in the table (gender, age, ethnicity, race, employment status, and essential worker status) account for 32 of 34 significant associations among the 108 potential interactions evaluated. Responses and p-values values for significant associations with characteristics not presented in the table that are associated with the attitudes, behaviors, and beliefs include the following: Use of cloth face coverings when in public × Rural-urban classification, (p-value = 0.0324); Rural: Always = 51.4%, Often = 15.5%, Sometimes = 10.2%, Rarely = 7.8%, Never = 15.1%; Urban: Always = 62.0%, Often = 13.5%, Sometimes = 8.5%, Rarely = 3.4%, Never = 12.6%; attitude that dining inside restaurants should not be allowed × Know someone with COVID-19 (p-value = 0.0243), Know someone: Agree = 75.1%, Disagree = 12.5%; Do not know someone: Agree = 64.9%, Disagree = 20.1%.
† Calculated with Chi-squared test of independence.
§ P-value is statistically significant.
¶ Of respondents who reported having been in a public area in the preceding week.
** The multiple race/other category includes respondents who self-reported as a race with <2.5% of respondents in any cohort (e.g., American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or more than one race).
†† Of 832 employed respondents in the U.S. cohort.

deaths (*6*). Identifying variations in public attitudes, behaviors, and beliefs by respondent characteristics can inform tailored messaging and targeted nonpharmacological interventions that might help to reduce the spread of COVID-19.

Other variations in attitudes, behaviors, and beliefs by respondent characteristics have implications for implementation of COVID-19 mitigation strategies and related prevention messaging. For example, a lower percentage of respondents in the U.S. survey cohort reported wearing cloth face coverings and self-isolating than did those in NYC and Los Angeles. However, although use of cloth face coverings in NYC and Los Angeles were similar, NYC experienced substantially higher COVID-19-related mortality during the initial months of the pandemic than did Los Angeles (*4*). Nationwide, higher percentages of respondents from urban areas reported use of cloth face coverings than did rural area respondents. Because outbreaks have been reported in rural communities and among certain populations since March 2020 (*7,8*), these data suggest a need for additional and culturally effective messaging around the benefits of cloth face coverings targeting these areas. Essential workers also reported lower adherence to recommendations for self-isolation, 6 feet of physical distancing, and limiting gatherings to fewer than 10 persons. These behaviors might be related to job requirements and other factors that could limit the ability to effectively adhere to these recommendations. Nevertheless, the high rate of person-to-person contact associated with these behaviors increases the risk for widespread transmission of SARS-CoV-2 and underscores the potential value of tailored and targeted public health interventions.

The findings in this report are subject to at least four limitations. First, behaviors and adherence to recommendations were self-reported; therefore, responses might be subject to recall, response, and social desirability biases. Second, responses were cross-sectional, precluding inferences about causality. Third, respondents were not necessarily representative among all groups; notably a lower percentage of African Americans responded than is representative of the U.S. population. In addition, participation might have been higher among persons who knew someone who had tested positive or had died from COVID-19, which could have affected support for and adherence to mitigation efforts. Finally, given that the web-based survey does not recruit participants using population-based probability sampling and respondents might not be fully representative of the U.S. population, findings might have limited generalizability. However, this survey did apply screening procedures to address issues related to web-based panel quality.

Widespread support for community mitigation strategies and commitment to COVID-19 public health recommendations indicate that protecting health and controlling disease are public priorities amid this pandemic, despite daily-life disruption and adverse economic impacts (*5,9*). These findings of high public support might inform reopening policies and the timelines and restriction levels of these mitigation strategies as understanding of public support for and adherence to these policies evolves. Absent a vaccine, controlling COVID-19 depends on community mitigation strategies that require public support to be effective. As the pandemic progresses and mitigation strategies evolve, understanding public attitudes, behaviors, and beliefs is critical. Adherence to recommendations to wear cloth face coverings and physical distancing guidelines are of public health importance. Strong public support for these behaviors suggests an opportunity to normalize safe practices and promote continued use of these and other recommended personal protective behaviors to minimize further spread of COVID-19 as jurisdictions reopen. These findings and periodic assessments of public attitudes, behaviors, and beliefs can also inform future planning if subsequent outbreak waves occur, and if additional periods of expanded mitigation efforts are necessary to prevent the spread of COVID-19 and save lives.

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# Coronavirus Disease 2019 Case Surveillance — United States, January 22–May 30, 2020

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The coronavirus disease 2019 (COVID-19) pandemic resulted in 5,817,385 reported cases and 362,705 deaths worldwide through May, 30, 2020,† including 1,761,503 aggregated reported cases and 103,700 deaths in the United States.§ Previous analyses during February–early April 2020 indicated that age ≥65 years and underlying health conditions were associated with a higher risk for severe outcomes, which were less common among children aged <18 years (*1–3*). This report describes demographic characteristics, underlying health conditions, symptoms, and outcomes among 1,320,488 laboratory-confirmed COVID-19 cases individually reported to CDC during January 22–May 30, 2020. Cumulative incidence, 403.6 cases per 100,000 persons,¶ was similar among males (401.1) and females (406.0) and highest among persons aged ≥80 years (902.0). Among 599,636 (45%) cases with known information, 33% of persons were Hispanic or Latino of any race (Hispanic), 22% were non-Hispanic black (black), and 1.3% were non-Hispanic American Indian or Alaska Native (AI/AN). Among 287,320 (22%) cases with sufficient data on underlying health conditions, the most common were cardiovascular disease (32%), diabetes (30%), and chronic lung disease (18%). Overall, 184,673 (14%) patients were hospitalized, 29,837 (2%) were admitted to an intensive care unit (ICU), and 71,116 (5%) died. Hospitalizations were six times higher among patients with a reported underlying condition (45.4%) than those without reported underlying conditions (7.6%). Deaths were 12 times higher among patients with reported underlying conditions (19.5%) compared with those without reported underlying conditions (1.6%). The COVID-19 pandemic continues to be severe, particularly in certain population groups. These preliminary findings underscore the need to build on current efforts to collect and analyze case data, especially among those with underlying health conditions. These data are used to monitor trends in COVID-19 illness, identify and respond to localized incidence increase, and inform policies and practices designed to reduce transmission in the United States.

State and territorial health departments report daily aggregate counts of COVID-19 cases and deaths to CDC; these were tabulated according to date of report to examine reporting trends during January 22–May 30. In addition to aggregate counts, individual COVID-19 case reports were submitted via a CDC COVID-19 case report form** and the National Notifiable Diseases Surveillance System (NNDSS).†† Jurisdictions voluntarily report confirmed and probable§§ cases from reports submitted by health care providers and laboratories. A laboratory-confirmed COVID-19 case was defined as a person with a positive test result for SARS-CoV-2, the virus that causes COVID-19, from a respiratory specimen, using real-time reverse transcription–polymerase chain reaction testing. COVID-19 case data reported from 50 states, New York City, and the District of Columbia¶¶ were analyzed to examine reported demographic characteristics, underlying health conditions, clinical signs and symptoms, and severe outcomes, including hospitalization, ICU admission, and death. Data were missing for age, sex, and race or ethnicity in

*These authors contributed equally to this report.

† https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports.

§ CDC official counts of cases and deaths, released daily on https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html, are aggregate counts from reporting jurisdictions. Throughout the COVID-19 pandemic, CDC has been tracking both aggregate and individual (i.e., line-list) counts of cases and deaths. For aggregate counts, from January 22 to March 2, 2020, CDC provided laboratory confirmation for all U.S. confirmed cases. Starting March 3, jurisdiction partners validated aggregate counts each night for report out at 12 p.m. the following day by CDC. For individual counts, jurisdiction partners electronically submit standardized information for individual cases of COVID-19 to CDC. From April 14, aggregate and individual counts included confirmed and probable cases and deaths, according to the Council of State and Territorial Epidemiologists position statement Interim 20-ID-01 (https://cdn.ymaws.com/www.cste.org/resource/resmgr/2020ps/interim-20-id-01_covid-19.pdf; https://wwwn.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/).

¶ Incidence was calculated per 100,000 population using 2018 U.S. Census population estimates for U.S. states and the District of Columbia obtained from CDC WONDER (https://wonder.cdc.gov/single-race-population.html).

** https://www.cdc.gov/coronavirus/2019-ncov/php/reporting-pui.html.

†† https://wwwn.cdc.gov/nndss; https://wwwn.cdc.gov/nndss/covid-19-response.html.

§§ According to the Council of State and Territorial Epidemiologists position statement Interim 20-ID-01, a probable case must 1) meet clinical criteria and epidemiologic criteria with no confirmatory laboratory testing performed; 2) have presumptive laboratory evidence, including detection of specific antigen or antibody in a clinical specimen, and meet clinical criteria or epidemiologic criteria; or 3) meet vital records criteria with no confirmatory laboratory testing performed. (https://cdn.ymaws.com/www.cste.org/resource/resmgr/2020ps/interim-20-id-01_covid-19.pdf)

¶¶ Cases reported from U.S. territories were not included in the analysis because of limited case reporting and lack of available demographically stratified census data. Cases excluded from this analysis include those reported from Guam (116), the Northern Mariana Islands (16), Puerto Rico (one), and the U.S. Virgin Islands (71).

<1%, 1%, and 55% of reports, respectively.*** Cases reported without sex or age data were excluded from this analysis as were cases meeting only the probable case definition, along with persons repatriated to the United States from Wuhan, China, or the Diamond Princess cruise ship. Cumulative incidence was estimated using 2018 population estimates. Because of the high prevalence of missing race and ethnicity data, estimates of incidence and proportions of underlying health conditions, symptoms, and severe outcomes by race and ethnicity were not described. Analyses are descriptive and statistical comparisons were not performed.

CDC received notification of the first case of laboratory-confirmed COVID-19 in the United States on January 22, 2020.††† As of May 30, an aggregate 1,761,503 U.S. COVID-19 cases and 103,700 deaths had been reported (Figure).§§§ The 7-day moving average number¶¶¶ of new daily cases peaked on April 12 (31,994) and deaths peaked on April 21 (2,856). As of May 30, the 7-day moving average numbers of new cases were 19,913 per day and deaths were 950 per day.

Among the 1,761,503 aggregate cases reported to CDC during January 22–May 30, individual case reports for 1,406,098 were submitted to CDC case surveillance. After exclusions, data for 1,320,488 (94%) cases were analyzed. Median age was 48 years (interquartile range = 33–63 years). Incidence was 403.6 cases per 100,000 population (Table 1) and was similar among females (406.0) and males (401.1).**** Incidence was higher among persons aged 40–49 years (541.6) and 50–59 years (550.5) than among those aged 60–69 years (478.4) and 70–79 years (464.2). Incidence was highest among persons aged ≥80 years (902.0)†††† and lowest among children aged ≤9 years (51.1). Among the 599,636 (45%) cases with information on both race and ethnicity, 36% of persons were non-Hispanic white, 33% were Hispanic, 22% were black, 4% were non-Hispanic Asian, 4% were non-Hispanic, other or multiple race, 1.3% were AI/AN, and <1% were non-Hispanic Native Hawaiian or other Pacific Islander.

Symptom status (symptomatic versus asymptomatic) was reported for 616,541 (47%) cases; among these, 22,007 (4%) were asymptomatic. Among 373,883 (28%) cases with data on individual symptoms, 70% noted fever, cough, or shortness of breath; 36% reported muscle aches, and 34% reported headache (Table 2). Overall, 31,191 (8%) persons reported loss of smell or taste.§§§§ Among patients aged ≥80 years, 60% reported fever, cough, or shortness of breath. No other symptoms were reported by >10% of persons in this age group.

Among 287,320 (22%) cases with data on individual underlying health conditions, those most frequently reported were cardiovascular disease (32%), diabetes (30%), and chronic lung disease (18%) (Table 2); the reported proportions were similar among males and females. The frequency of conditions reported varied by age group: cardiovascular disease was uncommon among those aged ≤39 years but was reported in approximately half of the cases among persons aged ≥70 years. Among 63,896 females aged 15–44 years with known pregnancy status, 6,708 (11%) were reported to be pregnant.

Among the 1,320,488 cases, outcomes for hospitalization, ICU admission, and death were available for 46%, 14%, and 36%, respectively. Overall, 184,673 (14%) patients were hospitalized, including 29,837 (2%) admitted to the ICU; 71,116 (5%) patients died (Table 3). Severe outcomes were more commonly reported for patients with reported underlying conditions. Hospitalizations were six times higher among patients with a reported underlying condition than those without reported underlying conditions (45.4% versus 7.6%). Deaths were 12 times higher among patients with reported underlying conditions compared with those without reported underlying conditions (19.5% versus 1.6%). The percentages of males who were hospitalized (16%), admitted to the ICU (3%), and who died (6%) were higher than were those for females (12%, 2%, and 5%, respectively). The percentage of ICU admissions was highest among persons with reported underlying conditions aged 60–69 years (11%) and 70–79 years (12%). Death was most commonly reported among persons aged ≥80 years regardless of the presence of underlying conditions (with underlying conditions 50%; without 30%).

## Discussion

As of May 30, a total of 1,761,503 aggregate U.S. cases of COVID-19 and 103,700 associated deaths were reported to CDC. Although average daily reported cases and deaths are declining, 7-day moving averages of daily incidence of COVID-19 cases indicate ongoing community transmission.¶¶¶¶

*** Cases reported as Hispanic were categorized as "Hispanic or Latino persons of any race" regardless of availability of race data.

††† The first laboratory-confirmed case of COVID-19 in the United States was confirmed on January 20, 2020, and reported to CDC on January 22, 2020. The upper quartile of the lag between onset date and reporting to CDC was 15 days.

§§§ From April 15 to May 30, 2020, these aggregate counts include both confirmed and probable cases and deaths. Overall, <1% of cases and 3.1% of deaths were classified as probable.

¶¶¶ The 7-day moving average of new cases and deaths (current day + 6 preceding days / 7) was calculated to smooth expected variations in daily counts.

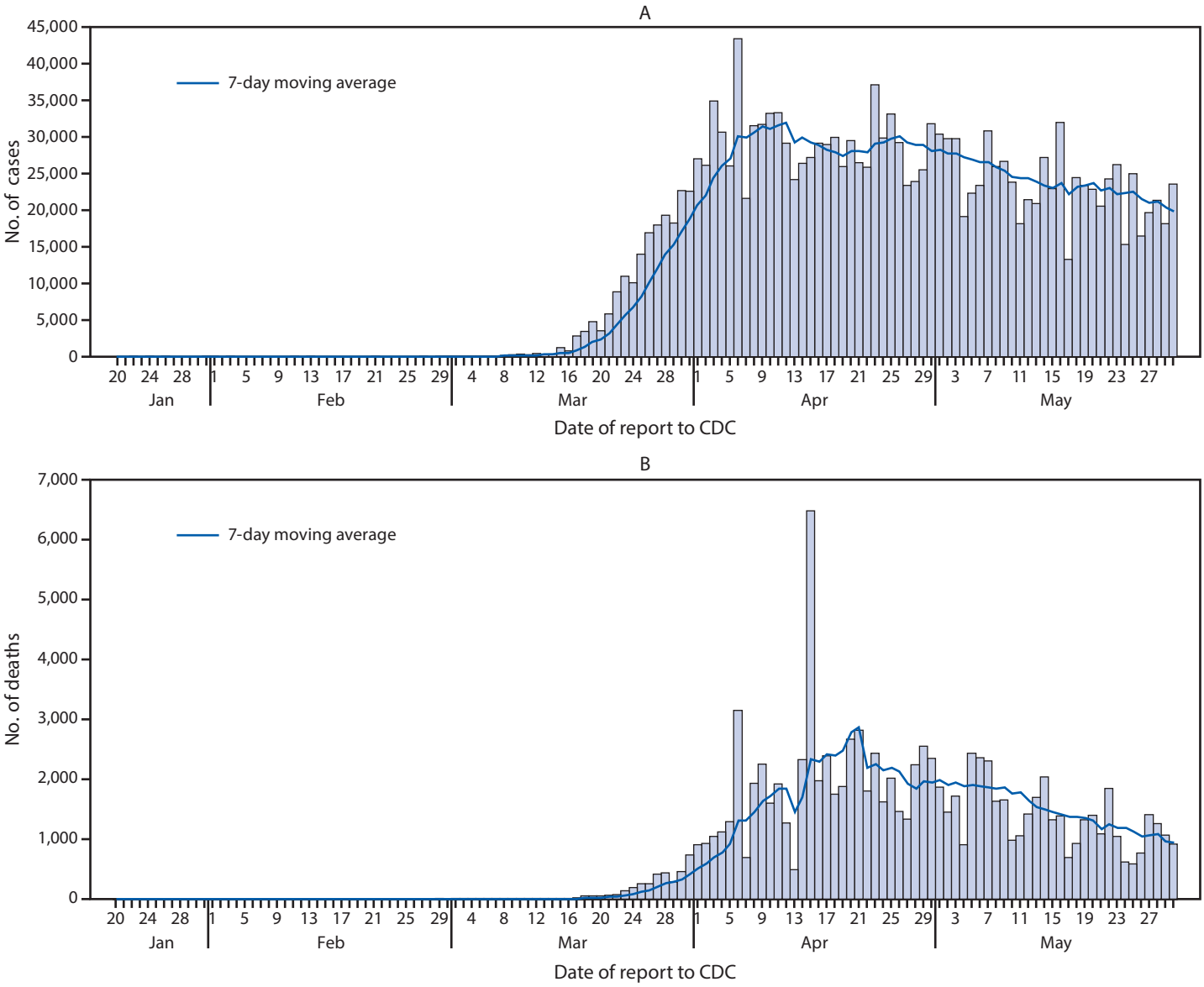
**** In some age groups, males had higher incidence, and in some age groups, females had higher incidence.

†††† Among those aged ≥85 years, incidence was 1,138 per 100,000.

§§§§ Responses include data from standardized fields supplemented with data from free-text fields; therefore, persons exhibiting this symptom might be underreported.

¶¶¶¶ Community transmission is defined by states and reflects varying conditions at the local and state levels.

**FIGURE. Daily number of COVID-19 cases*,†,§,¶ (A) and COVID-19–associated deaths** (B) reported to CDC — United States, January 22–May 30, 2020**




**Abbreviation:** COVID-19 = coronavirus disease 2019.

* From April 14, 2020, aggregate case counts reported by CDC included deaths attributable to both confirmed and probable COVID-19 as classified by reporting jurisdictions, using the Council of State and Territorial Epidemiologists position statement Interim-ID-20-01 (https://cdn.ymaws.com/www.cste.org/resource/resmgr/2020ps/interim-20-id-01_covid-19.pdf).

† The upper quartile of the lag between onset date and reporting to CDC was 15 days.

§ The daily number of deaths reported by jurisdictions on April 14 includes 4,141 deaths newly classified as probable.

¶ Overall <1% of cases reported in aggregate to CDC were classified as probable.

** Overall 3.1% of deaths reported in aggregate to CDC were classified as occuring in persons with probable cases.

The COVID-19 case data summarized here are essential statistics for the pandemic response and rely on information systems developed at the local, state, and federal level over decades for communicable disease surveillance that were rapidly adapted to meet an enormous, new public health threat. CDC aggregate counts are consistent with those presented through the Johns Hopkins University (JHU) Coronavirus Resource Center, which reported a cumulative total of 1,770,165 U.S. cases and 103,776 U.S. deaths on May 30, 2020.***** Differences in aggregate counts between CDC and

***** COVID-19 Dashboard by the Center for Systems Science and Engineering at Johns Hopkins University is a publicly available data tracker that extracts data from state, territorial, and local public health websites (https://coronavirus.jhu.edu/us-map). Data are archived in GitHub (https://github.com/CSSEGISandData/COVID-19/blob/master/csse_covid_19_data/csse_covid_19_daily_reports_us/05-30-2020.csv).

**TABLE 1. Reported laboratory-confirmed COVID-19 cases and estimated cumulative incidence,* by sex† and age group — United States, January 22–May 30, 2020**

| | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| Age group (yrs) | No. (%) | Cumulative incidence* | No. (%) | Cumulative incidence* | No. (%) | Cumulative incidence* |
| 0–9 | 10,743 (1.7) | 52.5 | 9,715 (1.4) | 49.7 | 20,458 (1.5) | 51.1 |
| 10–19 | 24,302 (3.8) | 113.4 | 24,943 (3.7) | 121.4 | 49,245 (3.7) | 117.3 |
| 20–29 | 85,913 (13.3) | 370.0 | 96,556 (14.3) | 434.6 | 182,469 (13.8) | 401.6 |
| 30–39 | 108,319 (16.8) | 492.8 | 106,530 (15.8) | 490.5 | 214,849 (16.3) | 491.6 |
| 40–49 | 109,745 (17.0) | 547.0 | 109,394 (16.2) | 536.2 | 219,139 (16.6) | 541.6 |
| 50–59 | 119,152 (18.4) | 568.8 | 116,622 (17.3) | 533.0 | 235,774 (17.9) | 550.5 |
| 60–69 | 93,596 (14.5) | 526.9 | 85,411 (12.7) | 434.6 | 179,007 (13.6) | 478.4 |
| 70–79 | 53,194 (8.2) | 513.7 | 52,058 (7.7) | 422.7 | 105,252 (8.0) | 464.2 |
| ≥80 | 41,394 (6.4) | 842.0 | 72,901 (10.8) | 940.0 | 114,295 (8.7) | 902.0 |
| **All ages** | **646,358 (100.0)** | **401.1** | **674,130 (100.0)** | **406.0** | **1,320,488 (100.0)** | **403.6** |

**Abbreviation:** COVID-19 = coronavirus disease 2019.
* Per 100,000 population.
† The analytic dataset excludes cases reported through case surveillance that were missing information on sex (n = 19,918) or age (n = 2,379).

**TABLE 2. Reported underlying health conditions* and symptoms† among persons with laboratory-confirmed COVID-19, by sex and age group — United States, January 22–May 30, 2020**

| | No. (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sex | | Age group (yrs) | | | | | | | | |
| Characteristic | Total | Male | Female | ≤9 | 10–19 | 20–29 | 30–39 | 40–49 | 50–59 | 60–69 | 70–79 | ≥80 |
| **Total population** | **1,320,488** | **646,358** | **674,130** | **20,458** | **49,245** | **182,469** | **214,849** | **219,139** | **235,774** | **179,007** | **105,252** | **114,295** |
| **Underlying health condition§** | | | | | | | | | | | | |
| Known underlying medical condition status* | **287,320 (21.8)** | 138,887 (21.5) | 148,433 (22.0) | 2,896 (14.2) | 7,123 (14.5) | 27,436 (15.0) | 33,483 (15.6) | 40,572 (18.5) | 54,717 (23.2) | 50,125 (28.0) | 34,400 (32.7) | 36,568 (32.0) |
| Any cardiovascular disease¶ | **92,546 (32.2)** | 47,567 (34.2) | 44,979 (30.3) | 78 (2.7) | 164 (2.3) | 1,177 (4.3) | 3,588 (10.7) | 8,198 (20.2) | 16,954 (31.0) | 21,466 (42.8) | 18,763 (54.5) | 22,158 (60.6) |
| Any chronic lung disease | **50,148 (17.5)** | 20,930 (15.1) | 29,218 (19.7) | 363 (12.5) | 1,285 (18) | 4,537 (16.5) | 5,110 (15.3) | 6,127 (15.1) | 8,722 (15.9) | 9,200 (18.4) | 7,436 (21.6) | 7,368 (20.1) |
| Renal disease | **21,908 (7.6)** | 12,144 (8.7) | 9,764 (6.6) | 21 (0.7) | 34 (0.5) | 204 (0.7) | 587 (1.8) | 1,273 (3.1) | 2,789 (5.1) | 4,764 (9.5) | 5,401 (15.7) | 6,835 (18.7) |
| Diabetes | **86,737 (30.2)** | 45,089 (32.5) | 41,648 (28.1) | 12 (0.4) | 225 (3.2) | 1,409 (5.1) | 4,106 (12.3) | 9,636 (23.8) | 19,589 (35.8) | 22,314 (44.5) | 16,594 (48.2) | 12,852 (35.1) |
| Liver disease | **3,953 (1.4)** | 2,439 (1.8) | 1,514 (1.0) | 5 (0.2) | 19 (0.3) | 132 (0.5) | 390 (1.2) | 573 (1.4) | 878 (1.6) | 1,074 (2.1) | 583 (1.7) | 299 (0.8) |
| Immunocompromised | **15,265 (5.3)** | 7,345 (5.3) | 7,920 (5.3) | 61 (2.1) | 146 (2.0) | 646 (2.4) | 1,253 (3.7) | 2,005 (4.9) | 3,190 (5.8) | 3,421 (6.8) | 2,486 (7.2) | 2,057 (5.6) |
| Neurologic/ Neurodevelopmental disability | **13,665 (4.8)** | 6,193 (4.5) | 7,472 (5.0) | 41 (1.4) | 113 (1.6) | 395 (1.4) | 533 (1.6) | 734 (1.8) | 1,338 (2.4) | 2,006 (4.0) | 2,759 (8.0) | 5,746 (15.7) |
| **Symptom§** | | | | | | | | | | | | |
| Known symptom status† | **373,883 (28.3)** | 178,223 (27.6) | 195,660 (29.0) | 5,188 (25.4) | 12,689 (25.8) | 51,464 (28.2) | 59,951 (27.9) | 62,643 (28.6) | 70,040 (29.7) | 52,178 (29.1) | 28,583 (27.2) | 31,147 (27.3) |
| Fever, cough, or shortness of breath | **260,706 (69.7)** | 125,768 (70.6) | 134,938 (69.0) | 3,278 (63.2) | 7,584 (59.8) | 35,072 (68.1) | 42,016 (70.1) | 45,361 (72.4) | 51,283 (73.2) | 37,701 (72.3) | 19,583 (68.5) | 18,828 (60.4) |
| Fever†† | **161,071 (43.1)** | 80,578 (45.2) | 80,493 (41.1) | 2,404 (46.3) | 4,443 (35.0) | 20,381 (39.6) | 25,887 (43.2) | 28,407 (45.3) | 32,375 (46.2) | 23,591 (45.2) | 12,190 (42.6) | 11,393 (36.6) |
| Cough | **187,953 (50.3)** | 89,178 (50.0) | 98,775 (50.5) | 1,912 (36.9) | 5,257 (41.4) | 26,284 (51.1) | 31,313 (52.2) | 34,031 (54.3) | 38,305 (54.7) | 27,150 (52.0) | 12,837 (44.9) | 10,864 (34.9) |
| Shortness of breath | **106,387 (28.5)** | 49,834 (28.0) | 56,553 (28.9) | 339 (6.5) | 2,070 (16.3) | 13,649 (26.5) | 16,851 (28.1) | 18,978 (30.3) | 21,327 (30.4) | 16,018 (30.7) | 8,971 (31.4) | 8,184 (26.3) |
| Myalgia | **135,026 (36.1)** | 61,922 (34.7) | 73,104 (37.4) | 537 (10.4) | 3,737 (29.5) | 21,153 (41.1) | 26,464 (44.1) | 28,064 (44.8) | 28,594 (40.8) | 17,360 (33.3) | 6,015 (21.0) | 3,102 (10.0) |
| Runny nose | **22,710 (6.1)** | 9,900 (5.6) | 12,810 (6.5) | 354 (6.8) | 1,025 (8.1) | 4,591 (8.9) | 4,406 (7.3) | 4,141 (6.6) | 4,100 (5.9) | 2,671 (5.1) | 923 (3.2) | 499 (1.6) |
| Sore throat | **74,840 (20.0)** | 31,244 (17.5) | 43,596 (22.3) | 664 (12.8) | 3,628 (28.6) | 14,493 (28.2) | 14,855 (24.8) | 14,490 (23.1) | 13,930 (19.9) | 8,192 (15.7) | 2,867 (10.0) | 1,721 (5.5) |
| Headache | **128,560 (34.4)** | 54,721 (30.7) | 73,839 (37.7) | 785 (15.1) | 5,315 (41.9) | 23,723 (46.1) | 26,142 (43.6) | 26,245 (41.9) | 26,057 (37.2) | 14,735 (28.2) | 4,163 (14.6) | 1,395 (4.5) |
| Nausea/Vomiting | **42,813 (11.5)** | 16,549 (9.3) | 26,264 (13.4) | 506 (9.8) | 1,314 (10.4) | 6,648 (12.9) | 7,661 (12.8) | 8,091 (12.9) | 8,737 (12.5) | 5,953 (11.4) | 2,380 (8.3) | 1,523 (4.9) |
| Abdominal pain | **28,443 (7.6)** | 11,553 (6.5) | 16,890 (8.6) | 349 (6.7) | 978 (7.7) | 4,211 (8.2) | 5,150 (8.6) | 5,531 (8.8) | 6,134 (8.8) | 3,809 (7.3) | 1,449 (5.1) | 832 (2.7) |
| Diarrhea | **72,039 (19.3)** | 32,093 (18.0) | 39,946 (20.4) | 704 (13.6) | 1,712 (13.5) | 9,867 (19.2) | 12,769 (21.3) | 13,958 (22.3) | 15,536 (22.2) | 10,349 (19.8) | 4,402 (15.4) | 2,742 (8.8) |
| Loss of smell or taste | **31,191 (8.3)** | 12,717 (7.1) | 18,474 (9.4) | 67 (1.3) | 1,257 (9.9) | 6,828 (13.3) | 6,907 (11.5) | 6,361 (10.2) | 5,828 (8.3) | 2,930 (5.6) | 775 (2.7) | 238 (0.8) |

**Abbreviation:** COVID-19 = coronavirus disease 2019.
* Status of underlying health conditions known for 287,320 persons. Status was classified as "known" if any of the following conditions were reported as present or absent: diabetes mellitus, cardiovascular disease (including hypertension), severe obesity (body mass index ≥40 kg/m$^2$), chronic renal disease, chronic liver disease, chronic lung disease, immunocompromising condition, autoimmune condition, neurologic condition (including neurodevelopmental, intellectual, physical, visual, or hearing impairment), psychologic/psychiatric condition, and other underlying medical condition not otherwise specified.
† Symptom status was known for 373,883 persons. Status was classified as "known" if any of the following symptoms were reported as present or absent: fever (measured >100.4°F [38°C] or subjective), cough, shortness of breath, wheezing, difficulty breathing, chills, rigors, myalgia, rhinorrhea, sore throat, chest pain, nausea or vomiting, abdominal pain, headache, fatigue, diarrhea (≥3 loose stools in a 24-hour period), or other symptom not otherwise specified on the form.
§ Responses include data from standardized fields supplemented with data from free-text fields. Information for persons with loss of smell or taste was exclusively extracted from a free-text field; therefore, persons exhibiting this symptom were likely underreported.
¶ Includes persons with reported hypertension.
** Includes all persons with at least one of these symptoms reported.
†† Persons were considered to have a fever if information on either measured or subjective fever variables if "yes" was reported for either variable.

**TABLE 3. Reported hospitalizations,*,† intensive care unit (ICU) admissions,§ and deaths¶ among laboratory-confirmed COVID-19 patients with and without reported underlying health conditions,** by sex and age — United States, January 22–May 30, 2020**

| Characteristic (no.) | Outcome, no./total no. (%)†† | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Reported hospitalizations*,† (including ICU) | | | Reported ICU admission§ | | | Reported deaths¶ | | |
| | Among all patients | Among patients with reported underlying health conditions | Among patients with no reported underlying health conditions | Among all patients | Among patients with reported underlying health conditions | Among patients with no reported underlying health conditions | Among all patients | Among patients with reported underlying health conditions | Among patients with no reported underlying health conditions |
| **Sex** | | | | | | | | | |
| Male (646,358) | 101,133/646,358 (15.6) | 49,503/96,839 (51.1) | 3,596/42,048 (8.6) | 18,394/646,358 (2.8) | 10,302/96,839 (10.6) | 864/42,048 (2.1) | 38,773/646,358 (6.0) | 21,667/96,839 (22.4) | 724/42,048 (1.7) |
| Female (674,130) | 83,540/674,130 (12.4) | 40,698/102,040 (39.9) | 3,087/46,393 (6.7) | 11,443/674,130 (1.7) | 6,672/102,040 (6.5) | 479/46,393 (1.0) | 32,343/674,130 (4.8) | 17,145/102,040 (16.8) | 707/46,393 (1.5) |
| **Age group (yrs)** | | | | | | | | | |
| ≤9 (20,458) | 848/20,458 (4.1) | 138/619 (22.3) | 84/2,277 (3.7) | 141/20,458 (0.7) | 31/619 (5.0) | 16/2,277 (0.7) | 13/20,458 (0.1) | 4/619 (0.6) | 2/2,277 (0.1) |
| 10–19 (49,245) | 1,234/49,245 (2.5) | 309/2,076 (14.9) | 115/5,047 (2.3) | 216/49,245 (0.4) | 72/2,076 (3.5) | 17/5,047 (0.3) | 33/49,245 (0.1) | 16/2,076 (0.8) | 4/5,047 (0.1) |
| 20–29 (182,469) | 6,704/182,469 (3.7) | 1,559/8,906 (17.5) | 498/18,530 (2.7) | 864/182,469 (0.5) | 300/8,906 (3.4) | 56/18,530 (0.3) | 273/182,469 (0.1) | 122/8,906 (1.4) | 24/18,530 (0.1) |
| 30–39 (214,849) | 12,570/214,849 (5.9) | 3,596/14,854 (24.2) | 828/18,629 (4.4) | 1,879/214,849 (0.9) | 787/14,854 (5.3) | 135/18,629 (0.7) | 852/214,849 (0.4) | 411/14,854 (2.8) | 21/18,629 (0.1) |
| 40–49 (219,139) | 19,318/219,139 (8.8) | 7,151/24,161 (29.6) | 1,057/16,411 (6.4) | 3,316/219,139 (1.5) | 1,540/24,161 (6.4) | 208/16,411 (1.3) | 2,083/219,139 (1.0) | 1,077/24,161 (4.5) | 58/16,411 (0.4) |
| 50–59 (235,774) | 31,588/235,774 (13.4) | 14,639/40,297 (36.3) | 1,380/14,420 (9.6) | 5,986/235,774 (2.5) | 3,335/40,297 (8.3) | 296/14,420 (2.1) | 5,639/235,774 (2.4) | 3,158/40,297 (7.8) | 131/14,420 (0.9) |
| 60–69 (179,007) | 39,422/179,007 (22.0) | 21,064/42,206 (49.9) | 1,216/7,919 (15.4) | 7,403/179,007 (4.1) | 4,588/42,206 (10.9) | 291/7,919 (3.7) | 11,947/179,007 (6.7) | 7,050/42,206 (16.7) | 187/7,919 (2.4) |
| 70–79 (105,252) | 35,844/105,252 (34.1) | 20,451/31,601 (64.7) | 780/2,799 (27.9) | 5,939/105,252 (5.6) | 3,771/31,601 (11.9) | 199/2,799 (7.1) | 17,510/105,252 (16.6) | 10,008/31,601 (31.7) | 286/2,799 (10.2) |
| ≥80 (114,295) | 37,145/114,295 (32.5) | 21,294/34,159 (62.3) | 725/2,409 (30.1) | 4,093/114,295 (3.6) | 2,550/34,159 (7.5) | 125/2,409 (5.2) | 32,766/114,295 (28.7) | 16,966/34,159 (49.7) | 718/2,409 (29.8) |
| **Total (1,320,488)** | **184,673/1,320,488 (14.0)** | **90,201/198,879 (45.4)** | **6,683/88,441 (7.6)** | **29,837/1,320,488 (2.3)** | **16,974/198,879 (8.5)** | **1,343/88,441 (1.5)** | **71,116/1,320,488 (5.4)** | **38,812/198,879 (19.5)** | **1,431/88,441 (1.6)** |

**Abbreviation:** COVID-19 = coronavirus disease 2019.

* Hospitalization status was known for 600,860 (46%). Among 184,673 hospitalized patients, the presence of underlying health conditions was known for 96,884 (53%).

† Includes reported ICU admissions.

§ ICU admission status was known for 186,563 (14%) patients among the total case population, representing 34% of hospitalized patients. Among 29,837 patients admitted to the ICU, the status of underlying health conditions was known for 18,317 (61%).

¶ Death outcomes were known for 480,565 (36%) patients. Among 71,116 reported deaths through case surveillance, the status of underlying health conditions was known for 40,243 (57%) patients.

** Status of underlying health conditions was known for 287,320 (22%) patients. Status was classified as "known" if any of the following conditions were noted as present or absent: diabetes mellitus, cardiovascular disease including hypertension, severe obesity body mass index ≥40 kg/m$^2$, chronic renal disease, chronic liver disease, chronic lung disease, any immunocompromising condition, any autoimmune condition, any neurologic condition including neurodevelopmental, intellectual, physical, visual, or hearing impairment, any psychologic/psychiatric condition, and any other underlying medical condition not otherwise specified.

†† Outcomes were calculated as the proportion of persons reported to be hospitalized, admitted to an ICU, or who died among total in the demographic group. Outcome underreporting could result from outcomes that occurred but were not reported through national case surveillance or through clinical progression to severe outcomes that occurred after time of report.

JHU might be attributable to differences in reporting practices to CDC and jurisdictional websites accessed by JHU.

Reported cumulative incidence in the case surveillance population among persons aged ≥20 years is notably higher than that among younger persons. The lower incidence in persons aged ≤19 years could be attributable to undiagnosed milder or asymptomatic illnesses among this age group that were not reported. Incidence in persons aged ≥80 years was nearly double that in persons aged 70–79 years.

Among cases with known race and ethnicity, 33% of persons were Hispanic, 22% were black, and 1.3% were AI/AN. These findings suggest that persons in these groups, who account for 18%, 13%, and 0.7% of the U.S. population, respectively, are disproportionately affected by the COVID-19 pandemic. The proportion of missing race and ethnicity data limits the conclusions that can be drawn from descriptive analyses; however, these findings are consistent with an analysis of COVID-19–Associated Hospitalization Surveillance Network (COVID-NET)††††† data that found higher proportions of black and Hispanic persons among hospitalized COVID-19 patients than were in the overall population (*4*). The completeness of race and ethnicity variables in case surveillance has increased from 20% to >40% from April 2 to June 2. Although reporting of race and ethnicity continues to improve, more complete data might be available in aggregate on jurisdictional websites or through sources like the COVID Tracking Project's COVID Racial Data Tracker.§§§§§

††††† COVID-Net is a population-based surveillance system that collects data on laboratory-confirmed COVID-19–associated hospitalizations (https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html).

§§§§§ The COVID Tracking Project is *The Atlantic's* volunteer organization to collect and publish U.S. COVID-19 data (https://covidtracking.com/race/dashboard).

The data in this report show that the prevalence of reported symptoms varied by age group but was similar among males and females. Fewer than 5% of persons were reported to be asymptomatic when symptom data were submitted. Persons without symptoms might be less likely to be tested for COVID-19 because initial guidance recommended testing of only symptomatic persons and was hospital-based. Guidance on testing has evolved throughout the response.¶¶¶¶¶ Whereas incidence among males and females was similar overall, severe outcomes were more commonly reported among males. Prevalence of reported severe outcomes increased with age; the percentages of hospitalizations, ICU admissions, and deaths were highest among persons aged ≥70 years, regardless of underlying conditions, and lowest among those aged ≤19 years. Hospitalizations were six times higher and deaths 12 times higher among those with reported underlying conditions compared with those with none reported. These findings are consistent with previous reports that found that severe outcomes increased with age and underlying condition, and males were hospitalized at a higher rate than were females (*2*,*4*,*5*).

The findings in this report are subject to at least three limitations. First, case surveillance data represent a subset of the total cases of COVID-19 in the United States; not every case in the community is captured through testing and information collected might be limited if persons are unavailable or unwilling to participate in case investigations or if medical records are unavailable for data extraction. Reported cumulative incidence, although comparable across age and sex groups within the case surveillance population, are underestimates of the U.S. cumulative incidence of COVID-19. Second, reported frequencies of individual symptoms and underlying health conditions presented from case surveillance likely underestimate the true prevalence because of missing data. Finally, asymptomatic cases are not captured well in case surveillance. Asymptomatic persons are unlikely to seek testing unless they are identified through active screening (e.g., contact tracing), and, because of limitations in testing capacity and in accordance with guidance, investigation of symptomatic persons is prioritized. Increased identification and reporting of asymptomatic cases could affect patterns described in this report.

Similar to earlier reports on COVID-19 case surveillance, severe outcomes were more commonly reported among persons who were older and those with underlying health conditions (*1*). Findings in this report align with demographic and severe outcome trends identified through COVID-NET (*4*). Findings from case surveillance are evaluated along with enhanced surveillance data and serologic survey results to provide a comprehensive picture of COVID-19 trends, and differences in proportion of cases by racial and ethnic groups should continue to be examined in enhanced surveillance to better understand populations at highest risk.

Since the U.S. COVID-19 response began in January, CDC has built on existing surveillance capacity to monitor the impact of illness nationally. Collection of detailed case data is a resource-intensive public health activity, regardless of disease incidence. The high incidence of COVID-19 has highlighted limitations of traditional public health case surveillance approaches to provide real-time intelligence and supports the need for continued innovation and modernization. Despite limitations, national case surveillance of COVID-19 serves a critical role in the U.S. COVID-19 response: these data demonstrate that the COVID-19 pandemic is an ongoing public health crisis in the United States that continues to affect all populations and result in severe outcomes including death. National case surveillance findings provide important information for targeted enhanced surveillance efforts and development of interventions critical to the U.S. COVID-19 response.

**Summary**

**What is already known about this topic?**

Surveillance data reported to CDC through April 2020 indicated that COVID-19 leads to severe outcomes in older adults and those with underlying health conditions.

**What is added by this report?**

As of May 30, 2020, among COVID-19 cases, the most common underlying health conditions were cardiovascular disease (32%), diabetes (30%), and chronic lung disease (18%). Hospitalizations were six times higher and deaths 12 times higher among those with reported underlying conditions compared with those with none reported.

**What are the implications for public health practice?**

Surveillance at all levels of government, and its continued modernization, is critical for monitoring COVID-19 trends and identifying groups at risk for infection and severe outcomes. These findings highlight the continued need for community mitigation strategies, especially for vulnerable populations, to slow COVID-19 transmission.

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¶¶¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/testing.html.

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[1]CDC COVID-19 Emergency Response.

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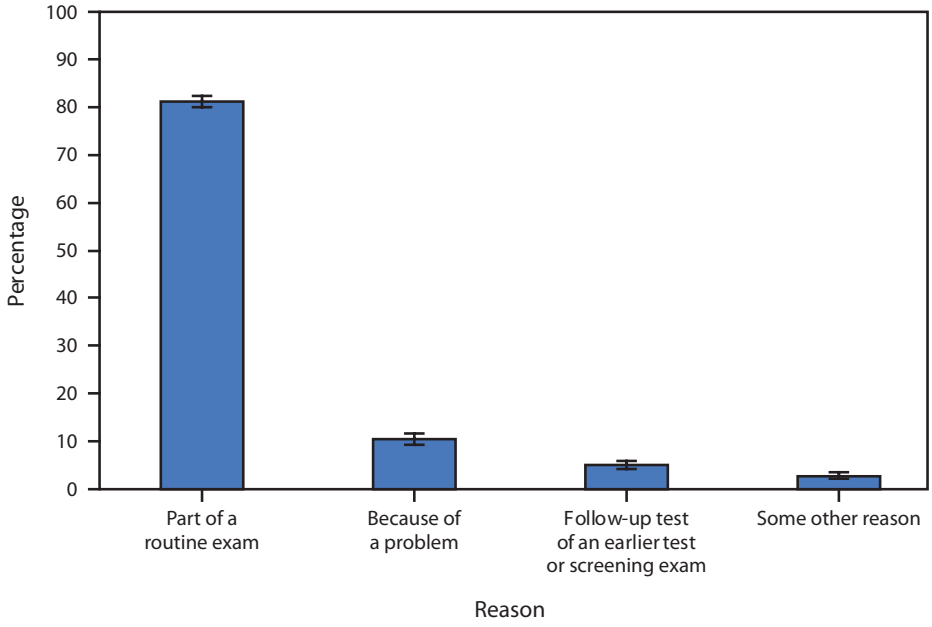
# QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Reason for the Most Recent Colonoscopy,* Among Adults Aged 50–75 Years Who Had a Test in the Past 10 Years — National Health Interview Survey,† United States, 2018




* Based on the questions "When did you have your most recent colonoscopy?" and "What was the main reason you had this colonoscopy?" An estimated 60.6% of adults aged 50–75 years without a personal history of colorectal cancer had a colonoscopy in the past 10 years.

† Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey. Estimates are presented with 95% confidence intervals indicated by error bars. Persons with a personal history of colorectal cancer were excluded from these analyses.

In 2018, 60.6% of U.S. adults aged 50–75 years without a personal history of colorectal cancer had a colonoscopy in the past 10 years. Of these, 81.2% had their most recent colonoscopy as part of routine screening, 10.6% had their most recent colonoscopy because of a problem, 5.2% as a follow-up to an earlier test or screening exam, and 2.8% for some other reason.

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

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