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Vital Signs: Prescription Opioid Pain Reliever Use During Pregnancy — 34 U.S. Jurisdictions, 2019

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Abstract

Background: Prescription opioid use during pregnancy has been associated with poor outcomes for mothers and infants. Studies using administrative data have estimated that 14%–22% of women filled a prescription for opioids during pregnancy; however, data on self-reported prescription opioid use during pregnancy are limited.

Methods: CDC analyzed 2019 data from the Pregnancy Risk Assessment Monitoring System (PRAMS) survey in 32 jurisdictions and maternal and infant health surveys in two additional jurisdictions not participating in PRAMS to estimate self-reported prescription opioid pain reliever (prescription opioid) use during pregnancy overall and by maternal characteristics among women with a recent live birth. This study describes source of prescription opioids, reasons for use, want or need to cut down or stop use, and receipt of health care provider counseling on how use during pregnancy can affect an infant.

Results: An estimated 6.6% of respondents reported prescription opioid use during pregnancy. Among these women, 21.2% reported misuse (a source other than a health care provider or a reason for use other than pain), 27.1% indicated wanting or needing to cut down or stop using, and 68.1% received counseling from a provider on how prescription opioid use during pregnancy could affect an infant.

Conclusions and Implications for Public Health Practice: Among respondents reporting opioid use during pregnancy, most indicated receiving prescription opioids from a health care provider and using for pain reasons; however, answers from one in five women indicated misuse. Improved screening for opioid misuse and treatment of opioid use disorder in pregnant patients might prevent adverse outcomes. Implementation of public health strategies (e.g., improving state prescription drug monitoring program use and enhancing provider training) can support delivery of evidence-based care for pregnant women.

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Introduction

During 2017–2018, 42.5% of opioid-related overdose deaths among women in the United States involved a prescription opioid (*1*). Long-term use of prescription opioids is associated with increased risk for misuse (i.e., use in larger amounts, higher frequency, longer duration, or for a different reason than that directed by a prescribing physician) (*2*), opioid use disorder, and overdose (*3*,*4*). According to commercial insurance (*5*) and Medicaid (*6*) claims for reimbursement of pharmacy dispensing, an estimated 14%–22% of women filled at least one opioid prescription during pregnancy (*5*,*6*). Opioid use during pregnancy has been associated with poor infant outcomes, such as neonatal opioid withdrawal syndrome (*7*), preterm birth, poor fetal growth, and stillbirth (*8*). PRAMS* and two additional jurisdictions' maternal and infant health surveys conducted during 2019 were used to describe population-based, self-reported estimates of prescription opioid pain reliever (prescription opioid) use during pregnancy.

Methods

PRAMS is a jurisdiction-specific and population-based surveillance system designed to monitor self-reported behaviors and experiences before, during, and shortly after pregnancy among women with a live birth in the preceding 2–6 months. Detailed PRAMS methodology is published elsewhere (*9*). Supplementary questions on prescription opioid use during pregnancy were asked in 32 jurisdictions participating in PRAMS and on maternal and infant health surveys in two jurisdictions that do not participate in PRAMS.† Data were weighted to adjust for sample design and nonresponse, representing the total population of women with a live birth in each jurisdiction during an approximately 4-month§ or 5-month¶ period in 2019.

Women were asked, "During your most recent pregnancy, did you use any of the following prescription pain relievers?" Use of prescription opioid pain relievers (prescription opioids) during pregnancy was indicated by selection of any of the following: hydrocodone, codeine, oxycodone, tramadol,

* PRAMS currently requires that jurisdictions meet a response rate threshold of 55% for publication. However, because of the critical need to report surveillance data related to the opioid crisis, a response rate threshold was not used to determine inclusion in the analysis. Therefore, data in this report are from all PRAMS jurisdictions participating in the opioid supplement (response rate noted): Alabama (57.6%), Arizona (41.9%), Colorado (59.7%), Connecticut (52.6%), District of Columbia (48.4%), Florida (46.1%), Georgia (53.6%), Illinois (62.6%), Indiana (46.4%), Iowa (56.7%), Kansas (66.0%), Kentucky (61.5%), Louisiana (55.9%), Maryland (47.8%), Massachusetts (61.2%), Missouri (56.5%), Nevada (43.5%), New Hampshire (51.0%), New York (51.4%), North Dakota (57.3%), Oregon (69.6%), Pennsylvania (55.6%), Puerto Rico (81.1%), Rhode Island (57.1%), South Carolina (38.3%), South Dakota (69.4%), Tennessee (55.0%), Utah (71.9%), Vermont (61.6%), Washington (60.6%), West Virginia (42.7%), and Wyoming (56.3%).

† California (response rate: 59.3%) and Ohio (response rate: 34.2%).

§ California collected data during a 4-month period; the weight was adjusted for this analysis to represent mothers giving birth in this approximately 4-month data collection period in 2019.

¶ For PRAMS jurisdictions and Ohio, 5 months of data were weighted to represent women having a live birth during approximately 5 months in 2019.

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hydromorphone or meperidine, oxymorphone, morphine, or fentanyl.** Women who self-reported use during pregnancy were asked to check all that apply to additional questions describing the prescription opioid source and reasons for use.†† Qualitative thematic coding was used to recode "other" written-in text responses into existing and new categories, where possible.§§ Remaining responses were retained as "other/undetermined." Prescription opioid sources were categorized as health care and non–health care provider (based on the responses "I had pain relievers left over from an old prescription," "friend or family member gave them to me," or "I got the pain relievers without a prescription some other way"). Reasons for use were categorized as pain and any reason other than pain (based on the responses "to relax or relieve tension or stress," "to help me with feelings or emotions," "to help me sleep," "to feel good or get high," or "because I was 'hooked' or I had to have them"). Misuse was defined as getting opioids from any source other than a health care provider or using for any reason other than pain. Respondents were also asked about their desire to cut down or stop use ("During your most recent pregnancy, did you want or need to cut down or stop using prescription pain relievers?") and whether they received provider counseling ("At any time during your most recent pregnancy, did a doctor, nurse, or other health care worker talk with you about how using prescription pain relievers during pregnancy could affect a baby?").

Prevalence of prescription opioid use during pregnancy was estimated overall and by maternal characteristics. Maternal age, race/ethnicity, education, trimester of entry into prenatal care, health insurance at delivery, and number of previous live births were derived from birth certificate data. Self-reported cigarette use during the last 3 months of pregnancy and depression during pregnancy were obtained from the surveys. Among women reporting prescription opioid use during pregnancy, estimates were generated for source, reasons for use, want or need to cut down or stop use, and receipt of health care provider counseling on how use during pregnancy could affect an infant. Prevalence of receipt of health care provider counseling was estimated by maternal characteristics. In addition, the percentage of women who wanted or needed to cut down or stop using was estimated among those who reported misuse as defined in this study and those who did not. Chi-squared tests were used to assess the differential distribution of prescription opioid use during pregnancy and receipt of health care provider counseling by maternal characteristics, as well as the want or need to cut down or stop use by misuse classification. Weighted prevalence estimates and 95% confidence intervals (CIs) were calculated using SUDAAN (version 11.0; RTI International).

Results

In 2019, among 21,488 respondents, 20,643 (96.1%) provided information regarding prescription opioid use during their most recent pregnancy. Among these women, 1,405 (6.6%) reported prescription opioid use during pregnancy (Table 1). The prevalence of use was statistically different across the following categories: health insurance at delivery, cigarette smoking during the last 3 months of pregnancy, and depression during pregnancy ($p<0.05$).

Among women who used prescription opioids, 91.3% reported receiving the opioids from a health care provider, 8.9% from a source other than a health care provider (e.g., friend or family member), and 4.3% from other/undetermined sources (Table 2). Specifically, 55.4% of women reported receiving opioids from an obstetrician-gynecologist, midwife, or prenatal care provider and 26.0% from an emergency department doctor. The two most commonly reported non–health care provider sources were having pain relievers left over from an old prescription (5.4%) and obtaining the pain relievers without a prescription some other way (3.0%).

Among women who used prescription opioids, 88.8% reported using the opioids for pain reasons, 14.4% for reasons other than pain, and 4.9% for other/undetermined reasons. In particular, prescription opioids were used to relieve pain from an injury, condition, or surgery that occurred before (22.2%) or during (63.8%) pregnancy or during an unstated time frame (11.7%). Commonly reported reasons for use other than pain were to help sleep (7.9%) and relieve tension or stress (7.7%).

** Survey options for prescription opioids included "Hydrocodone (like Vicodin, Norco, or Lortab)"; "Codeine (like Tylenol #3 or #4, not regular Tylenol"); "Oxycodone (like Percocet, Percodan, OxyContin, or Roxicodone)"; "Tramadol (like Ultram or Ultracet); Hydromorphone or meperidine (like Demerol, Exalgo, or Dilaudid)"; "Oxymorphone (like Opana)"; "Morphine (like MS Contin, Avinza, or Kadian)"; or "Fentanyl (like Duragesic, Fentora, or Actiq)."

†† Respondents were asked, "Where did you get the prescription pain relievers that you used during your most recent pregnancy?" (answer options included "OB-GYN, midwife, or prenatal care provider," "family doctor or primary care provider," "dentist or oral health care provider," "doctor in the emergency room," "I had pain relievers left over from an old prescription," "friend or family member gave them to me," "I got the pain relievers without a prescription some other way," and "other.") and "What were your reasons for using prescription pain relievers during your most recent pregnancy?" (answer options included "to relieve pain from an injury, condition, or surgery I had before pregnancy," "to relieve pain from an injury, condition, or surgery that happened during my pregnancy," "to relax or relieve tension or stress," "to help me with my feelings or emotions," "to help me sleep," "to feel good or get high," "because I was 'hooked' or I had to have them," and "other").

§§ Written-in responses regarding receiving prescription opioids from a health care provider (e.g., gastrointestinal provider, specialist, or surgeon) not listed as an option were coded as "other health care provider." Written-in responses regarding using prescription opioids to relieve pain from a medical condition, but with no indicated timeframe, were coded as "to relieve pain from an injury, condition, or surgery that occurred during an unstated timeframe." Written-in responses indicating use not occurring during pregnancy (e.g., "only during labor and delivery," "did not use during pregnancy") were retained as "other" if no other source or reason was indicated.

TABLE 1. Prevalence of self-reported prescription opioid use during pregnancy by maternal characteristics — 34 U.S. jurisdictions, 2019

Characteristic	No. of respondents*	Prevalence of prescription opioid use during pregnancy	
		No.*	%† (95% CI)
Total	**20,643**	**1,405**	**6.6 (6.0–7.2)**
Age group (yrs)			
≤19	761	56	9.6 (5.8–15.4)
20–24	3,340	246	7.5 (6.0–9.2)
25–34	12,178	822	6.5 (5.7–7.3)
≥35	4,364	281	5.5 (4.6–6.6)
Race/Ethnicity			
White, non-Hispanic	9,833	544	5.9 (5.1–6.8)
Black, non-Hispanic	2,798	255	8.6 (6.9–10.5)
Hispanic	5,072	367	7.0 (5.8–8.4)
Other, non-Hispanic§	2,665	218	6.6 (5.3–8.2)
Education level (yrs)			
<12	2,292	203	8.4 (6.4–11.0)
12	4,568	369	7.1 (6.0–8.4)
>12	13,415	805	6.1 (5.4–6.9)
Trimester of entry into prenatal care			
First	16,241	1,072	6.2 (5.6–6.9)
Second, third, or none	3,124	205	6.3 (4.9–7.9)
Health insurance at delivery¶			
Private**	10,653	591	5.2 (4.6–6.0)
Medicaid	8,317	712	8.5 (7.5–9.7)
Other†† or none	1,068	59	4.4 (2.9–6.5)
No. of previous live births			
None	7,982	504	6.3 (5.4–7.3)
One or more	12,508	885	6.7 (6.0–7.5)
Smoked cigarettes during last 3 mos of pregnancy¶			
Yes	1,279	192	16.2 (12.7–20.4)
No	19,227	1,200	5.9 (5.4–6.5)
Depression during pregnancy¶,§§			
Yes	2,432	295	13.1 (10.7–15.8)
No	12,319	730	5.4 (4.8–6.1)

Abbreviation: CI = confidence interval.
* Unweighted sample size.
† Weighted prevalence (expressed as a percentage).
§ Includes Asian, American Indian, Alaska Native, Native Hawaiian, Pacific Islander, and mixed race/ethnicity.
¶ Indicates chi-squared test p<0.05.
** Includes Civilian Health and Medical Program of the Department of Uniformed Services and TRICARE.
†† Includes Children's Health Insurance Program and other government programs.
§§ California data not available.

Overall, 21.2% of women who used prescription opioids during pregnancy reported misuse; 4.0% reported both a non–health care provider source and use for reasons other than pain. Among women who used prescription opioids during pregnancy, 27.1% indicated wanting or needing to cut down or stop using (Figure). Among women who used prescription opioids during pregnancy, a higher proportion of women with misuse (36.5%) indicated wanting or needing to cut down or stop using, compared with women without misuse (24.5%) (p<0.05).

Among women with prescription opioid use during pregnancy, 68.1% reported that a health care provider counseled them about the effect of use on an infant (Table 3). The prevalence of receiving counseling did not vary by most maternal characteristics assessed except that a lower proportion of women with no previous live births received counseling than did those with one or more previous births (62.0% versus 71.6%; p<0.05).

TABLE 2. Sources of prescription opioids and reasons for use among respondents reporting use during pregnancy (N = 1,405) — 34 U.S. jurisdictions, 2019

Sources of opioids/Reasons for use	No.*	Prevalence %† (95% CI)
Source of prescription opioid	1,335	—
Any health care provider source	1,233	91.3 (88.0–93.7)
Ob/gyn, midwife, or prenatal care provider	787	55.4 (50.4–60.2)
Family doctor or primary care provider	203	14.9 (11.6–18.9)
Dentist or oral health care provider	139	12.8 (9.7–16.8)
Doctor in the emergency department	352	26.0 (22.0–30.4)
Other health care provider	50	2.7 (1.6–4.7)
Any non-health care provider source	132	8.9 (6.7–11.8)
Pain relievers left over from old prescription	74	5.4 (3.6–7.9)
Friend or family member	36	1.9 (1.2–3.1)
Some other way without a prescription	52	3.0 (1.9–4.7)
Other/Undetermined	53	4.3 (2.6–7.1)
Reason for prescription opioid use	1,303	—
Any pain reason	1,131	88.8 (85.9–91.2)
To relieve pain from an injury, condition, or surgery before pregnancy	264	22.2 (18.3–26.7)
To relieve pain from an injury, condition, or surgery during pregnancy	807	63.8 (59.1–68.2)
To relieve pain from an injury, condition, or surgery unstated time frame	183	11.7 (9.1–14.9)
Any reason other than pain	204	14.4 (11.2–18.4)
To relax or relieve tension or stress	118	7.7 (5.5–10.8)
To help with feelings or emotions	45	3.7 (2.0–6.8)
To help sleep	115	7.9 (5.4–11.3)
To feel good or get high	23	1.1 (0.6–2.0)
Because "hooked" or had to use	32	2.4 (1.2–4.8)
Other/Undetermined	88	4.9 (3.7–6.6)
Any misuse (non–health care provider source or reasons other than pain)	277	21.2 (17.3–25.6)

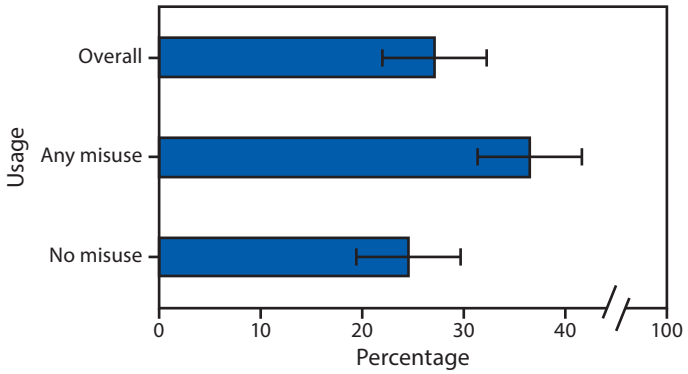
Abbreviations: CI = confidence interval; ob/gyn = obstetrician/gynecologist.
* Unweighted sample size.
† Weighted prevalence (expressed as a percentage) will not sum to 100% because of questions that asked respondents to check all answers that applied.

Discussion

In this population-based sample of women with recent live births in 34 jurisdictions, one in 15 (6.6%) respondents self-reported using prescription opioid pain relievers during pregnancy. This observed prevalence of use during pregnancy in 2019 is lower than estimates of prescription opioid fills from administrative data (e.g., insurance claims) in previous years (*5*,*6*), which do not necessarily correlate with use. Higher use of prescription opioids among women who reported smoking cigarettes or had depression during pregnancy are consistent with findings from studies analyzing administrative Medicaid data (*7*).

In this study, an estimated one in five women using prescription opioids during pregnancy indicated misuse. In addition, more than one in four (27.1%) women with prescription

FIGURE. Percentage of women reporting desire to cut down or stop using prescription opioids among respondents reporting use*,† during pregnancy (N = 1,405) — 34 U.S. jurisdictions, 2019



* "Any misuse" includes report of any sources other than a health care provider (including "I had pain relievers left over from an old prescription," "friend or family member gave them to me," "I got the pain relievers without a prescription some other way" or "other") or reasons other than pain (including "to relax or relieve tension or stress," "to help me with feelings or emotions," "to help me sleep," "to feel good or get high," "because I was 'hooked' or I had to have them" or "other").
† "No misuse" indicates that respondents reported only health care provider sources and pain reasons.

opioid use indicated wanting or needing to reduce or stop their use, potentially because of concerns about the effect of medication on their infant, possible opioid dependence, or opioid use disorder. Among women reporting prescription opioid use, nearly one in three (31.9%) reported not receiving provider counseling on the effects of prescription opioid use on an infant.

Clinical guidance addresses opioid prescribing and tapering during pregnancy, the risks to the mother and infant, and screening and treatment for opioid dependence and opioid use disorder (*3*,*10*). CDC and the American College of Obstetricians and Gynecologists (ACOG) recommend that clinicians and patients discuss and carefully weigh risks and benefits when considering initiation of opioid therapy for chronic pain during pregnancy (*3*,*10*). Opioids, if indicated, should be prescribed only after consideration of alternative pain management therapies (*3*,*10*). Risk for physiologic dependence and possibility of an infant developing neonatal opioid withdrawal syndrome should be discussed (*10*). Clinicians caring for pregnant women are advised to perform verbal screening to identify and address substance use, misuse, and substance use disorders (*10*,*11*). Co-occurring use of other substances (e.g., tobacco) and mental health conditions are more common among pregnant women who are prescribed or misusing prescription opioids than among those who are not (*7*,*12*). Recommended screening and, if applicable, treatment and referral for depression, history of trauma, posttraumatic stress disorder, and anxiety should occur (*10*). Because of the possible risk for spontaneous abortion and premature labor associated with opioid withdrawal (*10*), clinicians are encouraged to consult with other health care providers as necessary if considering tapering opioids during pregnancy (*3*). Medications for opioid use disorder, including buprenorphine or methadone, are recommended because of their association with improved maternal outcomes (*3*,*10*,*13*). Collaboration between obstetric and neonatal providers is important to diagnose, evaluate, and treat neonatal opioid withdrawal syndrome because it can result from medically indicated opioid prescription use, medication for opioid use disorder, or illicit opioid use (*3*,*10*).

TABLE 3. Prevalence of provider counseling on how using prescription opioids during pregnancy could affect a baby among women who self-reported prescription opioid use (N = 1,373) — 34 U.S. jurisdictions, 2019

Characteristic	Total No.*	Prevalence of provider counseling No.*	Prevalence of provider counseling %† (95% CI)
Total	**1,373**	**887**	**68.1 (63.8–72.1)**
Age group (yrs)			
≤19	55	34	62.2 (36.9–82.2)§
20–24	240	153	60.7 (49.6–70.8)
25–34	807	524	71.1 (65.7–75.9)
≥35	271	176	69.0 (60.1–76.6)
Race/Ethnicity			
White, non-Hispanic	528	338	65.2 (58.2–71.6)
Black, non-Hispanic	254	167	70.1 (60.1–78.4)
Hispanic	357	224	72.4 (64.9–78.9)
Other, non-Hispanic¶	214	143	67.4 (56.2–76.9)
Education level (yrs)			
<12	192	118	59.6 (45.1–72.6)
12	361	234	68.8 (60.8–75.9)
>12	793	515	69.4 (63.9–74.4)
Trimester of entry into prenatal care			
First	1,052	688	70.2 (65.4–74.6)
Second, third, or none	200	125	61.6 (49.9–72.2)
Health insurance at delivery			
Private**	582	379	71.6 (65.5–77.0)
Medicaid	694	455	67.6 (61.1–73.5)
Other†† or none	54	32	57.1 (36.7–75.3)§
No. of previous live births§§			
None	494	308	62.0 (54.3–69.2)
One or more	863	570	71.6 (66.5–76.2)
Smoked cigarettes during last 3 mos of pregnancy			
Yes	185	107	64.0 (51.4–75.0)
No	1,175	770	68.7 (64.0–73.0)
Depression during pregnancy¶¶			
Yes	289	195	76.0 (67.2–83.1)
No	709	457	65.9 (59.9–71.4)

Abbreviation: CI = confidence interval.
* Unweighted sample size.
† Weighted prevalence (expressed as a percentage).
§ Denominator is less than <60, so estimate may be unstable.
¶ Includes Asian, American Indian, Alaska Native, Native Hawaiian, Pacific Islander, and mixed race/ethnicity.
** Includes Civilian Health and Medical Program of the Department of Uniformed Services and TRICARE.
†† Includes Children's Health Insurance Program and other government programs.
§§ Indicates chi-squared test p<0.05.
¶¶ California data not available.

Summary

What is already known about this topic?

Data on self-reported prescription opioid use during pregnancy are limited.

What is added by this report?

Analysis of 2019 survey data found that 6.6% of women reported prescription opioid use during pregnancy. Among these women, 21.2% reported misuse (a source other than a health care provider or a reason for use other than pain), 27.1% wanted or needed to cut down or stop using, and 31.9% reported not receiving provider counseling about how use could affect an infant.

What are the implications for public health practice?

Obstetric providers should discuss risks and benefits of opioid therapy for chronic pain during pregnancy, screen all pregnant women for substance use, misuse, and use disorders, including those involving prescription opioids, and provide referral and treatment, as indicated.

Effective public health strategies to support the implementation of evidence-based guidelines might include improving state prescription drug monitoring program use (*14*), provider training (*15*), multidisciplinary state learning communities (*16*), quality improvement collaboratives (*17*), and consumer awareness (*18*). For example, some state perinatal quality collaboratives are implementing the Alliance for Innovation on Maternal Health program's patient safety obstetric care bundle for pregnant and postpartum women with opioid use disorder to implement protocols for screening and referral to treatment (*16*,*19*).

The findings in this report are subject to at least five limitations. First, these population-based data are only generalizable to women with a recent live birth in the 34 jurisdictions included in this report. Because of the need to provide data on the opioid crisis among pregnant women, a response rate threshold was not required for jurisdictions to be included in the analyses. This might further affect generalizability because 13 jurisdictions fell below the current PRAMS threshold of 55% (*9*). Second, prescription opioid use was self-reported and might be underestimated because of stigma and legal implications.[¶¶] Third, question misinterpretation by respondents is possible. For example, <1% indicated no source or reason for use except for a written-in response regarding use during labor and delivery, even though the initial prompt asked women to not include pain relievers used during labor and delivery. Fourth, not all available misuse indicators (e.g., use for longer time than prescribed) were assessed. Finally, the opioid supplement questions do not reflect current diagnostic criteria and cannot be used to estimate the prevalence of opioid use disorder (*20*).

Opioid prescribing consistent with clinical practice guidelines can ensure that patients, particularly those who are pregnant, have access to safer, more effective chronic pain treatment and reduce the number of persons at risk for opioid misuse, opioid use disorder, and overdose. Implementation of public health strategies can complement these efforts to improve the health of mothers and infants. The PRAMS surveillance system can be used to identify opportunities for providers, health systems, and jurisdictions to better support pregnant and postpartum women and their families.

[¶¶] https://www.guttmacher.org/state-policy/explore/substance-use-during-pregnancy.

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Symptom Profiles of a Convenience Sample of Patients with COVID-19 — United States, January–April 2020

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Coronavirus disease 2019 (COVID-19) was first detected in the United States in January 2020 (*1*), and by mid-July, approximately 3.4 million cases had been reported in the United States (*2*). Information about symptoms among U.S. COVID-19 patients is limited, especially among nonhospitalized patients. To better understand symptom profiles of patients with laboratory-confirmed COVID-19 in the United States, CDC used an optional questionnaire to collect detailed information on a convenience sample of COVID-19 patients from participating states. Symptom data were analyzed by age group, sex, hospitalization status, and symptom onset date relative to expansion of testing guidelines on March 8, 2020 (*3*). Among 164 symptomatic patients with known onset during January 14–April 4, 2020, a total of 158 (96%) reported fever, cough, or shortness of breath. Among 57 hospitalized adult patients (aged ≥18 years), 39 (68%) reported all three of these symptoms, compared with 25 (31%) of the 81 nonhospitalized adult patients. Gastrointestinal (GI) symptoms and other symptoms, such as chills, myalgia, headache, and fatigue, also were commonly reported, especially after expansion of testing guidelines. To aid prompt recognition of COVID-19, clinicians and public health professionals should be aware that COVID-19 can cause a wide variety of symptoms.

The CDC COVID-19 case investigation form is a detailed questionnaire that was completed as an optional activity by participating states* for a subset of laboratory-confirmed COVID-19 cases identified through care-seeking, surveillance, or contact tracing. This subset of cases was selected at the state level through convenience sampling, with guidance to include cases with a range of ages and severities. Staff members at local or state health departments or CDC personnel deployed to support health departments interviewed patients or their proxies and reviewed medical records to complete the case investigation form. The case investigation form was used to collect demographic, epidemiologic, and clinical information (including symptoms) about COVID-19 patients. Patients were asked about a series of commonly and less commonly reported symptoms, and then asked to report any additional symptoms. This investigation was determined by CDC to be public health surveillance. Therefore, approval by CDC's Institutional Review Board was not required.

This analysis included only symptomatic persons. Symptom data for a given patient were considered sufficient for analysis if the date of symptom onset was included and if responses indicated the presence or absence of at least 50% of symptoms that were specifically asked about. For this report, fever (measured or subjective), cough, or shortness of breath, all of which have been frequently described among COVID-19 patients, were classified as typical signs or symptoms. GI symptoms included nausea, abdominal pain, vomiting, or diarrhea. Analysis was descriptive, and an absolute difference of ≥15 percentage points was considered notable. Because this was a convenience sample, no statistical tests were performed. Symptom profiles were examined by age, sex, and hospitalization status. Stratifications by age and hospitalization status are presented because this was a nonrepresentative sample. Patients were excluded from stratification by hospitalization status if their age or hospitalization status was unknown or if they were reported to be hospitalized for reasons other than illness severity, such as for public health isolation. Symptoms also were examined by date of onset relative to March 8, 2020, when CDC released a Health Alert Network (HAN) notification giving updated guidance that COVID-19 testing be performed based on clinical judgment, thus widening testing eligibility to include persons with milder illness or atypical symptoms (*3*). Cases also were categorized retrospectively by whether or not they would have met the clinical component of the case definition approved by the Council of State and Territorial Epidemiologists (CSTE) on April 5, 2020 (*4*). That definition requires meeting one or more of three sets of criteria: 1) cough, shortness of breath, or difficulty breathing; 2) at least two of the following symptoms: fever (measured or subjective), chills, rigors,† myalgia, headache, sore throat, or new changes in smell or taste; or 3) severe respiratory illness

* States that participated in this supplemental activity include Alaska, Arizona, California, Connecticut, Georgia, Hawaii, Illinois, Minnesota, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, Virginia, Washington, and Wisconsin.

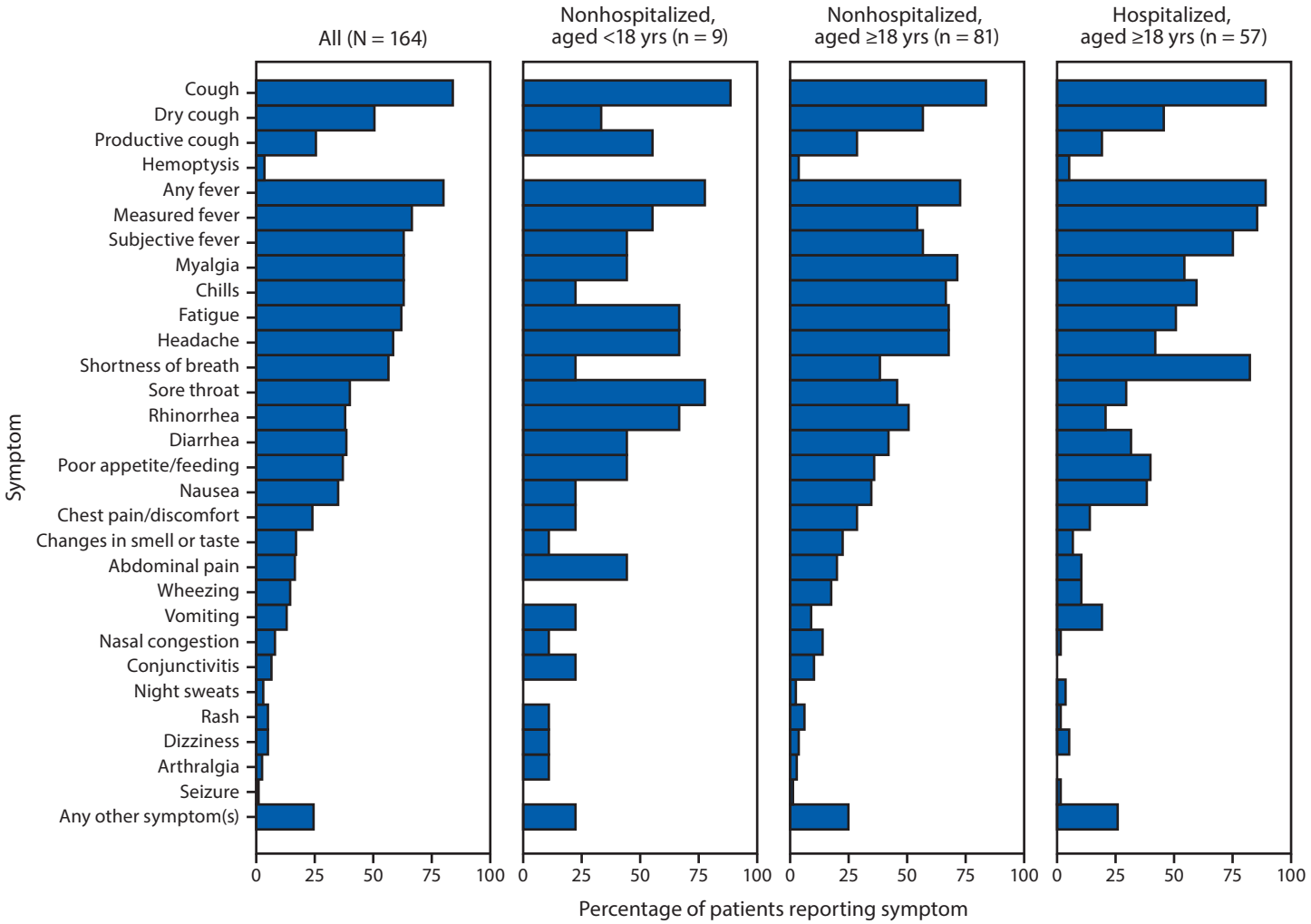
† Rigors, which is included in the CSTE definition, was neither elicited nor reported in any case investigation form received.

with either clinical or radiographic evidence of pneumonia or acute respiratory distress syndrome, without an alternative more likely diagnosis.

Sixteen participating states[§] submitted case investigation forms containing data collected during January 19–June 3, 2020, for 199 COVID-19 patients. Among those patients, 192 (97%) reported experiencing any symptoms, six (3%) reported experiencing no symptoms, and one (<1%) had unknown symptom status. Sufficient symptom data for analysis were available for 164 (85%) patients. Symptom onset ranged from January 14 to April 4. The median patient age was 50 years (range = 1 month–95 years), and 56% of patients were male. Among the sample of 147 (90%) patients for whom age and hospitalization status were known, 90 (61%) were not hospitalized, including nine (10%) aged <18 years and 81 (90%) aged ≥18 years. All of the 57 (39%) patients who were hospitalized for clinical management were aged ≥18 years. Each of the following symptoms was reported by >50% of patients: cough (84%), fever (80%), myalgia (63%), chills (63%), fatigue (62%), headache (59%), and shortness of breath (57%) (Figure). Approximately half of patients

[§] States that submitted data include Alaska, Arizona, California, Connecticut, Georgia, Hawaii, Illinois, Minnesota, Pennsylvania, Rhode Island, Tennessee, Utah, Virginia, Vermont, Washington, and Wisconsin.

FIGURE. Reported symptoms among 164 patients with laboratory-confirmed COVID-19, by age and hospitalization status[*,†,§] — United States, January–April 2020



Abbreviation: COVID-19 = coronavirus disease 2019.

* Seventeen persons with missing age or hospitalization status, or who were hospitalized for public health purposes (isolation), are included in the total but excluded from subgroups.

† Chest pain or discomfort includes the solicited symptom "chest pain," as well as free text key words "chest fullness," "chest tightness," "chest pressure," or "chest discomfort."

§ Symptoms of arthralgia, dizziness, night sweats, nasal congestion, and changes in smell or taste were captured from free text write-in.

reported one or more GI symptoms; among these, diarrhea was reported most frequently (38%) and vomiting least frequently (13%). Among adult patients, shortness of breath was more commonly reported by hospitalized than by nonhospitalized patients (82% versus 38%). In contrast, new changes in smell and taste and rhinorrhea were reported by a higher percentage of nonhospitalized patients (22% and 51%, respectively) than hospitalized patients (7% and 21%, respectively).

Nearly all of the 164 symptomatic patients (96%) reported one or more of the typical signs and symptoms of fever, cough, or shortness of breath; 45% of patients reported all three (Table). Among all adults, the reported prevalence of all three signs and symptoms increased with increasing age; 23 of 61 (38%) persons aged 18–44 years, 24 of 50 (48%) persons aged 45–64 years, and 20 of 36 (56%) persons aged ≥65 years reported all three typical signs and symptoms. However, among the 57 hospitalized adults, 68% of whom reported all three symptoms, prevalence did not differ meaningfully by age or sex. Among 81 nonhospitalized adult patients, 25 (31%) reported all three symptoms. Among 97 patients who reported one or more GI symptoms, 93 (96%) also reported one or more typical symptom.

Among all 164 symptomatic patients, only four would not have met the clinical component of the CSTE case definition. Those four included an infant whose only reported signs were vomiting and increased irritability, and for whom health care was not sought. They also included a woman who reported only chills and a "tickle in her throat" (without cough), who was hospitalized for isolation and had a normal chest radiograph. A second woman reported only fever and did not seek health care. A third woman reported only rhinorrhea and congestion, "never felt sick," and had only a telemedicine consultation. All four patients either had close contact with a patient with confirmed COVID-19 or had traveled to an area with sustained community transmission.

Symptoms reported during a period of broader testing eligibility might reflect a more complete COVID-19 symptom profile. Therefore, symptoms reported in patients who had illness onset before and after testing guidelines were expanded on March 8 were compared. Throughout the analysis period, patients commonly reported the typical signs and symptoms of fever, cough, and shortness of breath, but other symptoms were more commonly reported after March 8 compared with before March 8. For example, one or more signs or symptoms in the CSTE case definition (chills, myalgia, headache, sore throat, or new changes in smell or taste) were reported for 85% of the patients who had onset of symptoms before March 8, compared with 94% of patients with onset after March 8. Among patients with onset before March 8, 48% were reported to have one or more GI symptoms, compared with 68% of patients with onset after March 8. In particular, the percentage of patients reporting diarrhea increased from 20% before March 8 to 53% after that date. Changes in smell or taste were reported much more frequently after March 8 (30%) than before (3%). For cases with onset after March 8, olfactory or taste disorders were reported among 29% of nonhospitalized and 20% of hospitalized patients, and by 37% of females and 20% of males. Other symptoms reported more

TABLE. Reported COVID-19 symptom profiles among a convenience sample of 164 patients with laboratory-confirmed COVID-19* — United States, January–April 2020

	No. (%)			
Symptom profile	Total (N = 164)	Nonhospitalized children (<18 yrs) (n = 9)	Nonhospitalized adults (≥18 yrs) (n = 81)	Hospitalized adults (≥18 yrs) (n = 57)
Typical symptoms†				
No typical symptoms reported	6 (4)	1 (11)	4 (5)	0 (0)
At least one typical symptom reported	158 (96)	8 (89)	77 (95)	57 (100)
All three typical symptoms reported	74 (45)	2 (22)	25 (31)	39 (68)
GI symptoms§				
No GI symptoms reported	67 (41)	2 (22)	29 (36)	27 (47)
At least one GI symptom reported	97 (59)	7 (78)	52 (64)	30 (53)
Three or more GI symptoms reported	16 (10)	1 (11)	7 (9)	7 (12)
Symptom combinations				
Typical symptom(s) with GI symptom(s)	93 (57)	6 (67)	49 (60)	30 (53)
Typical symptom(s) without GI symptom(s)	65 (40)	2 (22)	28 (35)	27 (47)
GI symptom(s) without typical symptom(s)	4 (2)	1 (11)	3 (4)	0 (0)
No GI or typical symptom(s)	2 (1)	0 (0)	1 (1)	0 (0)

Abbreviations: COVID-19 = coronavirus 2019; GI = gastrointestinal.
* Total includes 17 persons with missing age or hospitalization status, or who were hospitalized for public health purposes (isolation). Those 17 persons are excluded from the subgroups.
† Typical symptoms include fever (measured or subjective), cough, or shortness of breath.
§ GI symptoms include diarrhea, vomiting, nausea, or abdominal pain.

commonly after March 8 included rhinorrhea (20% before, 52% after), fatigue (42% before, 77% after), and chest pain or discomfort (8% before, 35% after). After testing expanded, a greater proportion of patients for whom reports were submitted were not hospitalized, but the increased reporting of symptoms other than fever, cough, or shortness of breath was observed in hospitalized and nonhospitalized patients.

Discussion

Among 164 symptomatic COVID-19 patients, nearly all experienced fever, cough, or shortness of breath, and all but four would have met the CSTE clinical case definition. However, a wide variety of other symptoms were also reported; chills, myalgia, headache, fatigue, and the presence of at least one GI symptom (most commonly diarrhea) were each reported by >50% of patients. The occurrence of these symptoms in patients with COVID-19 has also been reported elsewhere (*5*–*7*). Symptoms other than fever, cough, and shortness of breath were reported more commonly after testing guidelines were expanded. This change might reflect an expansion of the types of patients eligible for testing and an increased awareness of other COVID-19 symptoms over time, such as changes in smell or taste. Few differences in symptom profile were notable by age or sex, especially when stratifying by hospitalization status; however, hospitalized patients (many of whom were older) more frequently reported experiencing fever, cough, and shortness of breath. As reported by others, changes in smell or taste were more commonly reported by women than by men (*6*,*8*).

The findings in this report are subject to at least five limitations. First, these cases represent a convenience sample of predominantly symptomatic COVID-19 patients reported by 16 states during a timeframe that included a period when testing was restricted to certain patients. For this reason, results are not generalizable. For instance, hospitalized patients are likely overrepresented as a result of the guidance to sample cases with a "range of severities" and because early in the outbreak, testing was limited to more severe cases. This sampling strategy also precludes estimation of the prevalence of asymptomatic infection because only symptomatic patients are systematically detected as part of standard public health activities. Second, because case investigation forms were occasionally completed by proxy or several weeks after illness onset, some symptoms were unknown or might have been forgotten. Third, case investigation forms completed soon after illness onset might not have captured symptoms that developed later. Fourth, the prevalence of unsolicited ("write-in") symptoms might be underestimated; this might have been most likely in the early phases of the U.S. outbreak, when less was known about the possible spectrum of symptoms. Conversely, the prevalence of fever, cough, and shortness of breath might have been overestimated, even after expansion of testing guidelines, because widespread awareness of these symptoms might have affected testing practices. Finally, sample sizes were small, particularly for children, limiting the ability to draw conclusions about differences by age group.

Summary

What is already known about this topic?

Information about COVID-19 symptoms, especially among nonhospitalized U.S. patients, is limited and not well characterized across the spectrum of illness severity.

What is added by this report?

Fever, cough, or shortness of breath were commonly reported among a convenience sample of U.S. COVID-19 patients with symptom onset during January–April and a range of illness severity; gastrointestinal symptoms and other symptoms, such as chills, myalgia, headache, and fatigue, also were commonly reported.

What are the implications for public health practice?

U.S. COVID-19 patients report a wide range of symptoms across a spectrum of illness severity; these findings can inform clinical case definitions or testing guidance to aid prompt recognition to slow the spread of COVID-19.

Clinicians and public health professionals should be aware that COVID-19 can manifest a range of symptoms. Because prompt identification of COVID-19 patients is important to slow the spread of disease, testing should be considered for patients experiencing 1) fever, cough, or shortness of breath; 2) symptoms included in the CSTE case definition, including chills, myalgia, or headache; 3) other symptoms, including diarrhea or fatigue, especially if reported along with fever, cough, or shortness of breath; and 4) for asymptomatic persons, based on clinical or public health judgment (*9*). Representative symptom data from U.S. patients across the spectrum of COVID-19 illness severity, including data on the timing of symptom development, are needed to inform clinical case definitions and guidance for symptom screening or testing criteria.

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Mumps Cases Disproportionately Affecting Persons Living with HIV Infection and Men Who Have Sex with Men — Chicago, Illinois, 2018

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During January 1–March 2, 2018, the number of mumps cases among adults reported to the Chicago Department of Public Health (CDPH) doubled compared with the same period in 2017. In response, CDPH created a supplementary questionnaire to collect additional information on populations affected and potential transmission routes. An epidemiologic analysis of routine and supplementary data, including spatiotemporal analysis, was performed to describe mumps cases reported to CDPH during 2018. A fourfold increase in mumps cases was reported during 2018 compared with 2017, with men who have sex with men (MSM) and persons living with human immunodeficiency virus (HIV) infection disproportionately represented among cases. A spatiotemporal, residential cluster was identified in a 9–square-mile area within six adjacent communities. The majority of persons affected were MSM, and this area was visited by many other persons with mumps diagnoses. Spatiotemporal analyses could be used in real time to identify case clusters to target public health response efforts, including to guide recommendations for additional measles, mumps, and rubella (MMR) vaccine and to identify specific transmission venues.

Investigation and Findings

During January–March 2018, 14 confirmed or probable mumps cases (*1*) were reported to CDPH. Four cases were among children (aged <18 years), consistent with case counts among children from previous years, and 10 were among adults aged ≥18 years. Although most mumps outbreaks among adults occur in university settings (*2*), none of the 14 patients reported university exposure. Providers had voluntarily reported data on MSM and HIV status on many early patients, although this information was not systematically requested. By April 2018, a total of 23 mumps cases among adults had been reported, including 11 (48%) among MSM, and of these, five were persons living with HIV infection. CDPH undertook an epidemiologic investigation of adults with mumps to identify specific populations affected and transmission settings to more effectively target public health response efforts.

Standard case investigation questionnaires focusing on demographic characteristics, signs and symptoms, and school or university exposures were used; however, because of case predominance among adults and MSM, in April 2018, CDPH developed a supplementary questionnaire with input from the CDPH sexually transmitted infection (STI) division (*3*). That questionnaire focused on adult-specific settings, including gyms, bars, clubs, bathhouses, sex parties, or concerts; and activities such as sharing smoking products or drinks, online dating application meetings, and sexual contact. Both questionnaires were administered to adults who received mumps diagnoses in 2018. The supplementary questionnaires were administered retrospectively to persons with mumps reported to CDPH before April 2018. HIV infection status and most recent available CD4+ count were ascertained through direct provider report or the Enhanced HIV/AIDS Reporting System,* a CDC application that assists health departments with reporting, data management, and analysis. Data from adults with mumps reported during 2018 were analyzed, excluding adults for whom the standard questionnaire was not completed.

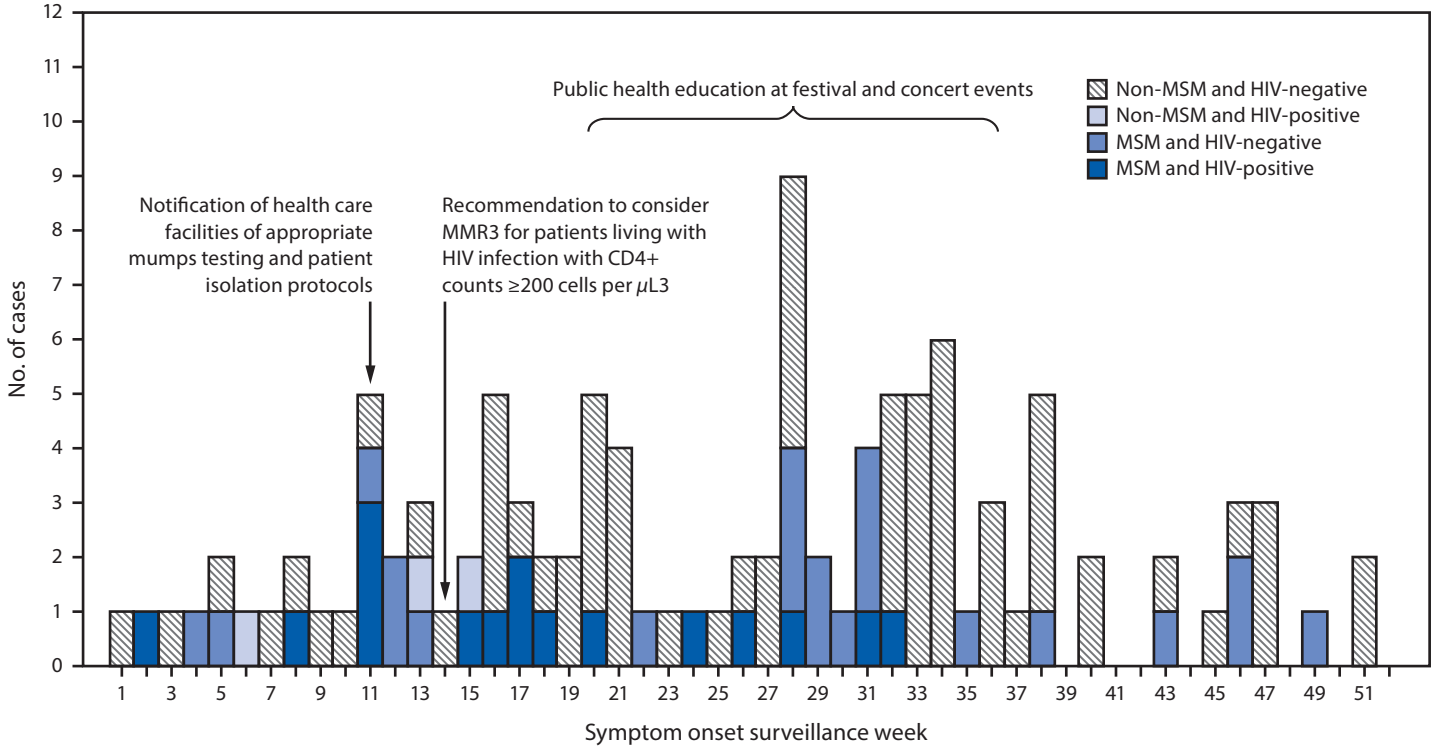
SaTScan (version 9.6; https://www.satscan.org), a free software program for analysis of spatial, temporal, and space-time data, was used in January 2019 for retrospective spatiotemporal cluster detection by patient residence, using a discrete space-time Poisson model. Fisher's exact test was used to identify differences in prevalence estimates using SAS (version 9.4; SAS Institute). Mumps virus genotyping was performed by CDC on mumps patients' buccal swabs or urine samples, and these sequences were compared to identify any differences that might indicate that cases were not related and that more than one outbreak was occurring.

After April 2018, an additional 93 confirmed and probable mumps cases among adults were reported to CDPH, for a total of 116 during January–December 2018. Median patient age was 29 years (interquartile range = 26–38 years). Standard questionnaire data were available from 110 (95%) persons (Figure 1). Among these 110 patients, 76 (69%) were male (Table). Overall, 101 (92%) persons reported having received at least 1 dose of MMR vaccine, although only nine reports could be confirmed through vaccination records. Five patients reported a university exposure; two of these cases were associated with a known university outbreak that occurred outside of Chicago.

Complications reported included trouble hearing (71; 65% patients); lower abdominal pain, a symptom consistent

* https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html.

FIGURE 1. Number of mumps cases among adults aged ≥18 years (N = 110),* by sexual practice, human immunodeficiency virus (HIV) status, and week of symptom onset — Chicago, January–December 2018



Abbreviations: MMR3 = 3rd dose of measles, mumps, and rubella vaccine; MSM = men who have sex with men.
* Excludes six patients who could not be contacted.

with oophoritis (four; 12% of 33 female patients), and symptoms consistent with mastitis (four; 12% of 33 female patients). Among 76 males and one transfeminine† person, 22 (29%) reported orchitis; 13 (59%) orchitis cases were provider-confirmed.

Nineteen (17%) mumps patients were persons living with HIV infection, including 13 (68%) with CD4+ counts available within 18 months before onset of mumps symptoms; 12 (63%) persons had values ≥200 cells μL3. There were no differences in complications among persons living and not living with HIV infection. No person with a reported mumps case named others with a reported mumps case as a contact.

Overall, 35 (32%) mumps diagnoses occurred in emergency departments; 13 (37%) patients required hospitalization. There was a significant difference in the prevalence of hospitalization of mumps patients living with HIV infection (six of 19; 32%) and those who were not (seven of 91; 8%) (p = 0.01). Reasons for hospitalization varied (Table).

Among 110 patients with standard questionnaire data available, supplementary questionnaire data were available for 93 (85%); 29 (31%) reported being women who have sex with men, 27 (29%) as men who have sex with only women, and 37 (34%) as MSM. Among 19 mumps patients living with HIV infection, 16 (84%) were MSM. Sixty-eight (73%) patients reported recent potential exposure to one or more specific close-contact environments (Table).

Among patients with supplementary questionnaire data, a spatiotemporal cluster was identified that included 10 patients with home addresses in a 9–square-mile area within six adjacent communities (Figure 2). Among those 10 persons, eight were MSM, seven visited multiple bars near their homes, and two were bartenders or servers at these bars during their infectious period (from 2 days before until 5 days after parotitis onset). Eighteen other persons with residences geographically dispersed throughout the city developed mumps after visiting bars in the cluster area, and one additional bartender was identified who worked while infectious but did not provide names or locations of workplaces. Overall, 65 mumps patients were either not temporally related to these 10 cases or were geographically dispersed and did not report visiting close-contact environments in the cluster area. Genotype results were available for six patients; all demonstrated the most common nationally

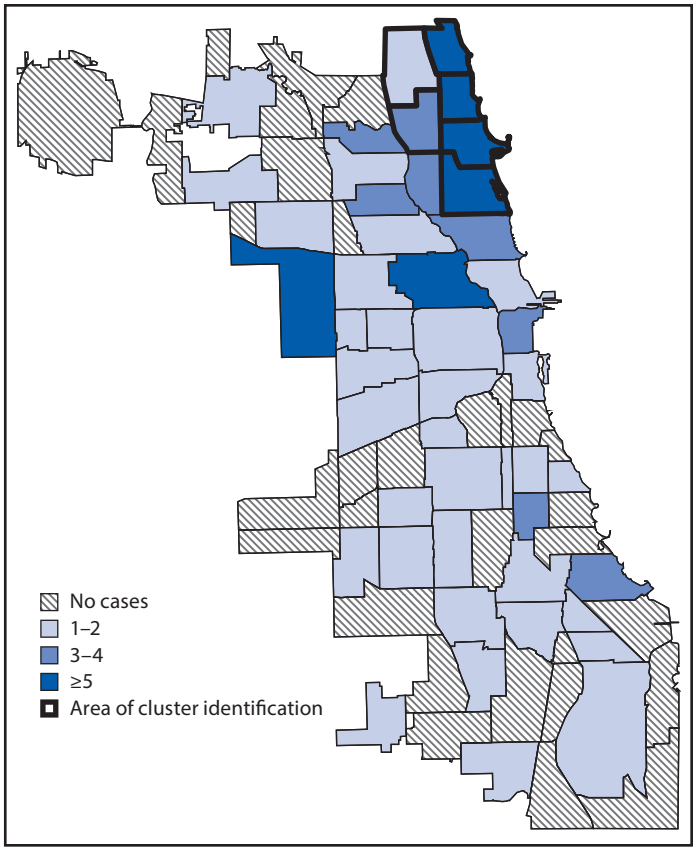
† A person assigned male sex at birth, but who identifies with femininity to a greater extent than masculinity.

TABLE. Characteristics of mumps cases among adults aged ≥18 years* — Chicago, Illinois, January–December 2018

Characteristic	No. (%)
Age, median, years (IQR)	29 (26–38)
Gender	
Male	76 (69)
Female	33 (30)
Transfeminine†	1 (1)
Race/Ethnicity	
White, non-Hispanic	53 (48)
Black, non-Hispanic	32 (29)
Hispanic	21 (19)
Asian, non-Hispanic	3 (3)
Unknown	1 (1)
Complications	
Trouble hearing	71 (65)
Oophoritis§	4 (12)
Mastitis§	4 (12)
Orchitis¶	22 (29)
Hospitalization**	13 (37)
Sexual partner history††	
Men who have sex with men	37 (34)
Women who have sex with men	29 (31)
Men who have sex with only women	27 (29)
Potential exposure locations††	
Bars	57 (84)
Gyms	38 (56)
Concerts	29 (28)
Online dating application meetings	15 (22)
Bathhouses	4 (6)

Abbreviation: IQR = interquartile range.
* N = 110. Excludes six patients who could not be contacted..
† A person assigned male sex at birth, but who identifies with femininity to a greater extent than with masculinity.
§ Among 33 women.
¶ Among 76 males and one transfeminine person.
** The most common reasons for hospital admission included empiric antibiotic treatment because of concern for bacterial infection (three), intravenous hydration and pain control (two), and request for evaluation by otolaryngologists or infectious disease physicians (two).
†† Among those with supplementary data available (N = 93).

FIGURE 2. Number of mumps cases among adults aged ≥18 years (N = 110),* by community area† — Chicago, Illinois, January–December 2018



* Excludes six patients who could not be contacted.
† Chicago is divided into 77 community areas whose boundaries do not change over time (https://www.chicago.gov/city/en/depts/dgs/supp_info/citywide_maps.html).

circulating sequence [MuVi/Sheffield.GBR/1.05 (G)], which provided no additional information on epidemiologic links.

Public Health Response

On March 16, 2018, CDPH released a citywide health alert notifying health care providers of increased mumps reports among adults and provided instructions to confirm mumps using polymerase chain reaction testing. On April 6, CDPH released recommendations and provided education to clinics and health care facilities to administer MMR vaccine to any patients or health care workers without evidence of immunity,§ reinforce infection control measures, and offer a third MMR dose to persons living with HIV infection whose CD4+ counts were ≥200 cells μL3 because of initial concern for increased risk of complications (4–6).

Throughout 2018, CDPH worked with city partners to promote education and awareness of mumps during citywide Pride events. CDPH considered recommending targeted vaccination campaigns among specific populations most affected by illness; however, in the absence of real-time cluster detection analysis and supplementary questionnaire data, CDPH was not readily able to identify additional groups at increased risk who should receive additional MMR doses (4).

Discussion

In 2018 in Chicago, the 116 mumps cases among adults exceeded the number observed during the previous 5 years combined (80); transmission continued throughout 2018, despite infection control activities. MSM and persons living with HIV infection were disproportionately affected,

§ Evidence of immunity includes 1) written documentation of receipt of 1 dose of a mumps-containing vaccine administered on or after the first birthday for preschool-aged children and adults not at high risk, and 2 doses of mumps-containing vaccine for school-aged children and adults at high risk (i.e., health care personnel, international travelers, and students at post high school educational institutions); 2) laboratory evidence of immunity; 3) laboratory confirmation of disease; or 4) birth before 1957.

Summary

What is already known about this topic?

The majority of mumps cases among U.S. adults has been reported in university settings with a readily identified target population for outbreak response.

What is added by this report?

This report describes increased mumps cases in a nonuniversity setting with geographical distribution throughout a large urban center, disproportionately affecting men who have sex with men and persons living with human immunodeficiency virus infection. Challenges in determining transmission settings and effective response plans were identified.

What are the implications for public health practice?

This investigation highlights the use of spatiotemporal analysis to identify mumps clusters in real time as a tool for targeted outbreak interventions and ability to collect potentially sensitive data in the context of adult-specific exposure locations outside of university settings.

accounting for 34% and 17% of cases, respectively, despite these groups representing 5% and <1% of Chicago's population, respectively (*7*,*8*). Cases were widely dispersed across the city. In addition, the proportion of persons reporting complications was higher than that in previous studies (*2*), although typically, these data are limited by their self-reported nature, except for orchitis. As of August 30, 2019, only 11 mumps cases had been reported to CDPH during 2019, indicating a return to baseline activity.

Most recent mumps outbreaks in the United States have occurred at university campuses and other settings where targeted vaccination campaigns can be conducted (*2*). Mumps cases in Chicago during 2018 demonstrate challenges in identifying and containing clusters when persons are geographically dispersed and report multiple close-contact behaviors. Using spatiotemporal analyses, a residential cluster of patients who shared a common exposure (bars in a 9–square-mile area) was retrospectively identified, indicating this approach could be used for mumps investigations. Had spatiotemporal analyses been available in real time, the identified cluster could have been recognized earlier, providing an opportunity to target control measures within a defined location or social network including possible recommendations for a third MMR dose for persons frequenting or working at specific venues. This investigation successfully used a supplementary questionnaire, demonstrating that persons might be willing to provide sensitive information to facilitate public health interventions related to mumps.

As a result of this investigation, CDPH is developing protocols to use spatiotemporal analysis in real time to more rapidly identify clusters of vaccine-preventable diseases, including mumps. CDPH continues to investigate adults with mumps cases using the supplementary questionnaire to determine epidemiologic links and guide recommendations for additional MMR doses.

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Update on Immunodeficiency-Associated Vaccine-Derived Polioviruses — Worldwide, July 2018–December 2019

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Since establishment of the Global Polio Eradication Initiative* in 1988, polio cases have declined >99.9% worldwide; extensive use of live, attenuated oral poliovirus vaccine (OPV) in routine childhood immunization programs and mass campaigns has led to eradication of two of the three wild poliovirus (WPV) serotypes (types 2 and 3) (*1*). Despite its safety record, OPV can lead to rare emergence of vaccine-derived polioviruses (VDPVs) when there is prolonged circulation or replication of the vaccine virus. In areas with inadequate OPV coverage, circulating VDPVs (cVDPVs) that have reverted to neurovirulence can cause outbreaks of paralytic polio (*2*). Immunodeficiency-associated VDPVs (iVDPVs) are isolated from persons with primary immunodeficiency (PID). Infection with iVDPV can progress to paralysis or death of patients with PID, and excretion risks seeding cVDPV outbreaks; both risks might be reduced through antiviral treatment, which is currently under development. This report updates previous reports and includes details of iVDPV cases detected during July 2018–December 2019 (*3*). During this time, 16 new iVDPV cases were reported from five countries (Argentina, Egypt, Iran, Philippines, and Tunisia). Alongside acute flaccid paralysis (AFP) surveillance (*4*), surveillance for poliovirus infections among patients with PID has identified an increased number of persons excreting iVDPVs (*5*). Expansion of PID surveillance will facilitate early detection and follow-up of iVDPV excretion among patients with PID to mitigate the risk for iVDPV spread. This will be critical to help identify all poliovirus excretors and thus achieve and maintain eradication of all polioviruses.

Classification of VDPVs and Identification of iVDPV

Poliovirus isolates are grouped into three categories: WPV, Sabin-related poliovirus, and VDPV (*3*). Sabin-related viruses have limited divergence in the capsid protein (VP1) nucleotide sequences from the corresponding OPV (Sabin) strain: poliovirus types 1 and 3 (PV1 and PV3) are ≤1% divergent; poliovirus type 2 (PV2) is ≤0.6% divergent. VDPVs have clinical characteristics similar to those of WPV. VDPVs are >1% divergent (from PV1 and PV3) or >0.6% divergent (from PV2) in VP1 nucleotide sequences from the corresponding OPV strain (*4*). VDPVs are further classified as 1) circulating vaccine-derived polioviruses (cVDPVs), when there is evidence of community transmission; 2) iVDPVs, when they are isolated from persons with PIDs; and 3) ambiguous VDPVs (aVDPVs), when isolated from persons with no known immunodeficiency and when there is no evidence of community transmission or when isolates from sewage are not genetically linked to other known VDPVs and whose source is unknown (*3*).

A healthy person typically clears poliovirus infection within 6 weeks. However, in persons with PIDs, an inability to mount an adequate humoral immune response can result in persistence of intestinal infection with poliovirus and prolonged viral shedding (*5*,*6*). The iVDPV case definition is a laboratory-confirmed VDPV infection in a person of any age who has a primary humoral (B-cell) or combined humoral and cellular (B- and T-cell) immunodeficiency disorder (*6*). An iVDPV infection is persistent if VDPV is excreted for >6 months and chronic if excreted for >5 years (*6*).

Summary of iVDPV Epidemiology, 1961–2019

The World Health Organization (WHO) has compiled reports of iVDPV excretion since 1961 (*6*). As of May 2020, a total of 149 iVDPV cases had been reported to WHO from January 1961 through December 2019 (Table 1). These cases were detected through AFP surveillance (when paralysis occurred before PID was diagnosed) and by reports of iVDPV isolation from fecal specimens (when stool cultures were obtained from patients with suspected or diagnosed PID to detect enterovirus infection). The number of reported cases has increased over time: 66% of cases were detected during 2010–2019. Most onsets occurred in children aged <2 years (59%); 60% of cases were in males; and 64% of patients had acute flaccid paralysis (AFP) as the first sign. The most common PID diagnoses were various antibody disorders, severe combined immunodeficiency disorder (SCID), and common variable immunodeficiency disorder.

During the reporting period, iVDPV type 2 (iVDPV2) has been the most prevalent serotype (56%), followed by iVDPV type 3 (iVDPV3) (23%) and iVDPV type 1 (iVDPV1) (17%), with 4% heterotypic mixtures (types 1 and 2 in 2% of cases and types 2 and 3 in 2%). Because WPV type 2 had been eradicated, in April 2016, all 155 OPV-using countries and territories switched from trivalent OPV (tOPV, containing

*http://polioeradication.org.

TABLE 1. Summary of 149 immunodeficiency-associated vaccine-derived poliovirus (iVDPV) cases reported in the World Health Organization (WHO) iVDPV registry — worldwide, January 1, 1961–December 31, 2019*

Characteristic	No. (%)
iVDPV cases reported to WHO (1961–2019)	149 (100)
Period detected	
1961–2000	19 (12.8)
2001–2010	31 (20.8)
2011–2020	99 (66.4)
WHO region	
African	10 (6.7)
Eastern Mediterranean	74 (49.7)
European	16 (10.7)
Americas	18 (12.1)
South-East Asian	15 (10.1)
Western Pacific	16 (10.7)
Sex	
Female	64 (40.6)
Male	85 (59.4)
Acute flaccid paralysis	
Yes	95 (63.8)
No	51 (34.2)
Unknown	3 (2.0)
Age group at onset (yrs)	
<1	86 (59.3)
1–5	40 (27.6)
>5	19 (13.1)
Immunodeficiency category	
Antibody disorders (HGG, AGG, XLA)	39 (28.1)
Common variable immunodeficiency	22 (15.8)
SCID and other combined humoral/T-cell deficiencies	46 (33.1)
Other (MHC class II deficiency, centromere instability, ICF syndrome)	20 (14.4)
Unknown	12 (8.6)
Serotype	
1	27 (18.1)
2	83 (55.7)
3	33 (22.1)
1 and 2	3 (2.0)
2 and 3	3 (2.0)
Outcome	
Alive	16 (10.7)
Alive and stopped excreting	52 (34.9)
Dead	65 (43.6)
Unknown/Lost to follow-up	16 (10.7)

Abbreviations: AGG = agammaglobulinemia; HGG = hypogammaglobulinemia; ICF = centromeric region instability, facial anomalies syndrome; MHC = major histocompatibility complex; SCID = severe combined immunodeficiency; XLA = X-linked agammaglobulinemia.
* Data as of May 17, 2020.

types 1, 2, and 3 Sabin strains) to bivalent OPV (bOPV, containing types 1 and 3 Sabin strains), to reduce the risk for paralytic disease from type 2 OPV (from vaccine-associated paralytic polio, which rarely occurs in OPV recipients and their susceptible close contacts; and from VDPV) (*7*). Since the tOPV-to-bOPV switch, the incidence of iVDPV2 cases has declined substantially, with iVDPV1 and iVDPV3 now the most prevalent serotypes (Figure). During 2000–2016, an average of 7.7 cases of iVDPV2 were identified per year (total = 54), compared with 0.67 cases per year (two cases) during 2017–2019. At the most recent follow-up, 16 patients (11%) were alive and still excreting iVDPV, 52 (35%) were alive and had stopped excreting, 65 (44%) had died, and 16 (11%) were lost to follow up (Table 1).

Reported iVDPV Cases, July 1, 2018–December 31, 2019

During July 2018–December 2019, 16 new iVDPV cases were reported from five countries (Argentina, Egypt, Iran, Philippines, and Tunisia) (Table 2). These cases included eight iVDPV1 cases, seven iVDPV3 cases, and one iVDPV2 case, with no heterotypic mixtures. The cases are described below.

Argentina (one case). In 2018 AFP occurred in a girl aged 9 months who had previously received 2 inactivated poliovirus vaccine doses and 1 bOPV dose in November 2017. In November 2018, iVDPV3 (1.4% VP1 divergence) was detected in a stool specimen. The most recent detection (2.9% VP1 divergence) was collected in August 2019; specimens collected since have been negative, the latest in November 2019. This patient had a diagnosis of agammaglobulinemia.

Egypt (10 cases). During July–December 2018, the PID surveillance project in Egypt identified six iVDPV infections, one in a patient who had developed AFP; two cases were iVDPV3 and four iVDPV1. Follow-up revealed that three patients had died, two patients stopped shedding, and one patient shedding iVDPV1 with 2.6% VP1 divergence continued to shed the virus for 22 months after the last reported bOPV dose. During 2019, four patients with iVDPV infection without AFP were detected; three patients had positive test results for iVDPV3, and one patient had a positive test result for iVDPV1. Two patients with iVDPV3 infection stopped excreting after 4 and 6 months.

Iran (three cases). In 2018, three iVDPV1 cases were reported, including a case detected before July 2018 and previously reported. These included cases in a boy aged 8 months with SCID who subsequently died and another in a boy aged 11 months who developed AFP in November 2018 and is continuing to excrete, most recently in April 2020. In July 2019, an iVDPV1 case was reported in a girl aged 7 months who had developed AFP; all seven specimens obtained from this patient contained iVDPV1.

Philippines (one case). An iVDPV2 case was detected in August 2019 in a boy aged 5 years who had received 3 doses of tOPV from 2014 to 2015. At his initial evaluation, he had severe malnutrition, significantly reduced antibody levels, and multiple signs and symptoms pointing to a complex immune disorder; however, no specific PID diagnosis was reported. Follow-up stool specimens collected from September 2019 to May 2020 were positive for VDPV2. Concurrent with the

FIGURE. Immunodeficiency-associated vaccine-derived poliovirus (iVDPV) cases reported, by year and VDPV serotype — worldwide, 2010–2019

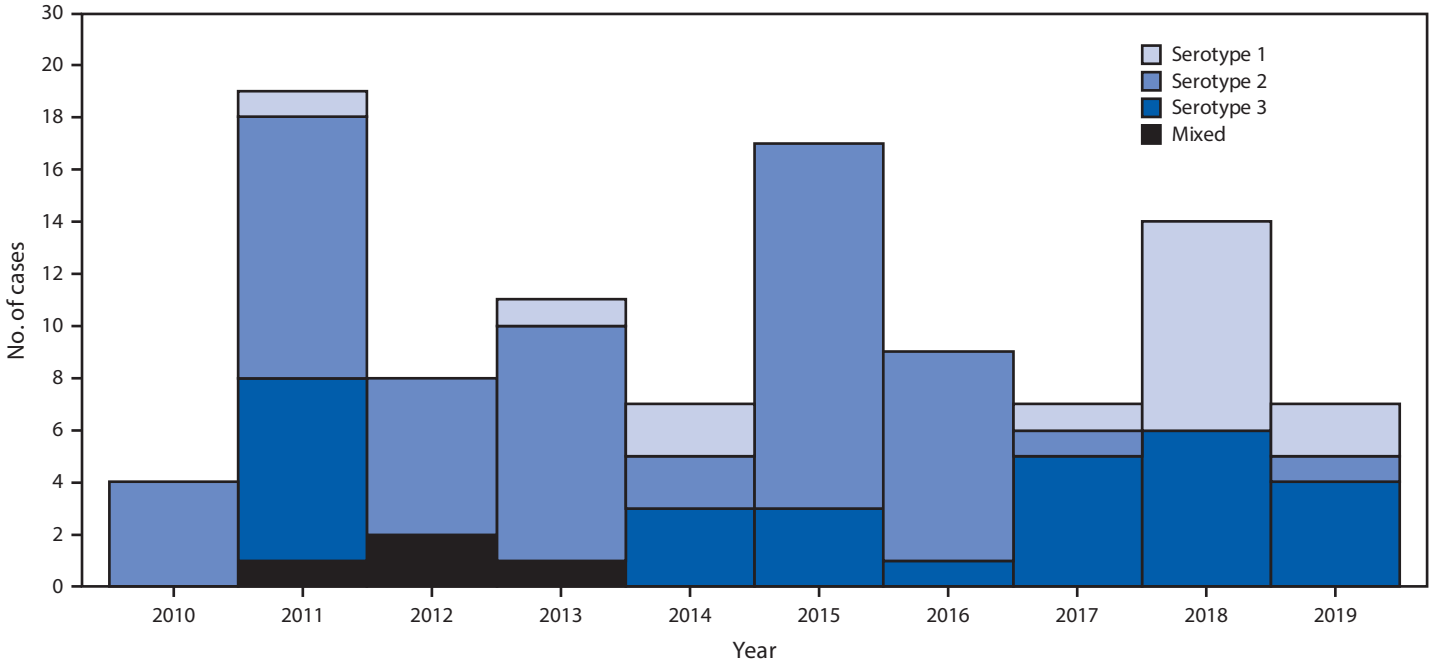

TABLE 2. Immunodeficiency-associated vaccine-derived polioviruses (iVDPVs) detected — worldwide, July 2018–January 2020*

Country	Year detected	Source	PID diagnosis	First positive patient isolate	Serotype	Caspid protein VP1 divergence from Sabin OPV strain† (%)	National 3-dose OPV coverage (%)§	Estimated VDPV replication duration¶ (months)	Outcome**
Argentina	2018	AFP case	AGG	Nov 20, 2018	3	1.3	84	21	Stopped excreting
Egypt	2018	Non-AFP case	CID	Jul 15, 2018	3	1.6	95	10	Stopped excreting
Egypt	2018	Non-AFP case	MHC II deficiency	Aug 23, 2018	1	1.7	95	17	Died
Egypt	2018	Non-AFP case	CID	Sep 13, 2018	1	3.6	95	12	Stopped excreting
Egypt	2018	AFP case	SCID	Oct 18, 2018	1	2.6	95	4	Died
Egypt	2018	Non-AFP case	MHC II deficiency	Dec 16, 2018	3	1.6	95	4	Died
Egypt	2018	Non-AFP case	SCID	Dec 25, 2018	1	1.4	95	22	Alive and excreting
Iran	2018	Non-AFP case	SCID	Aug 14, 2018	1	1.0	99	6	Died
Iran	2018	AFP case	B-cell deficiency	Nov 23, 2018	1	1.6	99	22	Alive and excreting
Egypt	2019	Non-AFP case	Unknown	Feb 03, 2019	3	1.4	95	4	Stopped excreting
Egypt	2019	Non-AFP case	SCID	Mar 13, 2019	1	3.0	95	13	Alive and excreting
Egypt	2019	Non-AFP case	SCID	Jun 18, 2019	3	2.0	95	12	Alive and excreting
Egypt	2019	AFP case	SCID	Aug 28, 2019	3	1.9	95	6	Stopped excreting
Iran	2019	AFP case	AGG	Jul 11, 2019	1	1.3	99	10	Alive and excreting
Philippines	2019	AFP case	Hypokalemia and infectious diarrhea	Aug 29, 2019	2	7.6	66	60	Alive and excreting
Tunisia	2019	AFP case	MHC II deficiency	Mar 12, 2019	3	4.1	97	18	Stopped excreting

Abbreviations: AFP = acute flaccid paralysis; AGG = agammaglobulinemia; CID = combined immunodeficiency disorder; MHC = major histocompatibility complex; OPV = oral poliovirus vaccine; PID = primary immunodeficiency disorder; SCID = severe combined immunodeficiency disorder.

* Data as of May 17, 2020.

† Percentage of divergence is estimated from the number of nucleotide differences in the capsid protein VP1 region from the corresponding parental OPV strain in the latest iVDPV sequence available.

§ Coverage with 3 doses of OPV, based on 2018 data from the World Health Organization (WHO) Vaccine Preventable Diseases Monitoring System (2018 global summary) and WHO-United Nations Children's Fund coverage estimates https://www.who.int/gho/immunization/poliomyelitis/en/. National data might not reflect weaknesses at subnational levels.

¶ Duration of iVDPV replication was estimated from clinical record by assuming that exposure was from last known receipt of OPV (or date of birth where vaccination data was not available).

** Outcome as of last reported information.

Summary

What is already known about this topic?

Immunodeficiency-associated vaccine-derived polioviruses (iVDPVs) emerge among persons with primary immunodeficiencies (PIDs) and rarely can persist. Persistent iVDPV infection can result in paralysis and potentially seed community transmission.

What is added by this report?

After the 2016 global removal of oral poliovirus vaccine type 2 from routine immunization, the reported incidence of iVDPV type 2 infections markedly declined. Increasing surveillance among patients with PID has identified more iVDPV infections without paralysis.

What are the implications for public health practice?

Surveillance for iVDPV infections among patients with PID needs to be strengthened, and development of poliovirus antivirals needs to be accelerated to treat iVDPV infections to achieve and maintain eradication of all polioviruses.

detection of the iVDPV2, a cVDPV2 outbreak was detected in the Philippines (*2*). Current genetic evidence indicates that the virus in the patient with iVDPV2 and cases in the cVDPV2 outbreak have similar genetic distance from parental OPV2 strain (7% VP1 divergence) and might share a common origin.

Tunisia (one case). A boy aged 9 months with human leukocyte antigen (HLA)-class II deficiency developed AFP in March 2019. The infant had previously received inactivated poliovirus vaccine and had no history of OPV vaccination. VDPV3 with 1.3%–4.1% VP1 divergence was detected in stool specimens collected during March–December 2019. The child had stopped excreting by March 2020.

Discussion

Most countries with AFP surveillance detect iVDPV in paralyzed children who then receive a diagnosis of one of the PIDs. However, many iVDPV cases occur in patients with PID without paralysis, and at present, are only detected through special studies or pilot projects of iVDPV surveillance in children with a diagnosed PID. The increase in the number of reported infections during 2010–2019 is likely a consequence of increased efforts to identify infection among patients with PID and improved methods to detect polioviruses. One half of the detected cases were from the WHO Eastern Mediterranean Region, likely related to more recent focus on PID surveillance in that region as well as higher rates of consanguineous marriages, which lead to higher prevalence rates of PID (*8*). WHO has supported several countries in implementing pilot projects for iVDPV surveillance in children with PID, including Egypt, Iran, Pakistan, Sri Lanka, and Tunisia, and more recently, China and India. Additional countries are being identified in other WHO regions and encouraged to implement systematic surveillance in children with PID and without paralysis. WHO and partners have developed guidelines for iVDPV surveillance in patients with PID that should become an integral part of global poliovirus surveillance (*9*).

Detection of cVDPV2 in the Philippines was associated with detection of VDPV2 infection in an immunodeficient patient. This is the first time that an iVDPV and cVDPV linkage has been described in a large outbreak, and further genetic analysis is in progress. It is, however, unclear how or whether the immunodeficient patient contributed to the cVDPV outbreak. The first identified poliovirus of the cVDPV2 outbreak was detected through environmental surveillance with 7% VP1 divergence from parental Sabin type 2 OPV and multiple amino acid changes. The cVDPV2 outbreak was confirmed by isolation of genetically linked virus from multiple additional sewage samples and AFP cases. A higher proportion of nucleotide substitutions leading to amino acid changes is usually found in genomic sequences of identified iVDPV2 from patients with PID.

Continued progress in the development of antiviral medications effective against polioviruses is needed to eliminate virus shedding in persons identified with persistent and chronic iVDPV infections. Pocapavir (a capsid inhibitor) has been administered on compassionate use basis for several patients excreting iVDPV, with mixed results (*10*). Complete clearing of virus has been observed in some recipients; however, rapid development of poliovirus resistance to Pocapavir has been frequently observed (*10*). Therefore, development of a treatment combining Pocapavir with a protease inhibitor currently called V-7404 that is expected to avoid antiviral resistance is continuing. Intravenous immunoglobulin is available to treat patients with PID and poliovirus (as well as nonpolio enterovirus) infection. While antiviral development continues, intravenous immunoglobulin might improve clinical care. Expansion of PID surveillance will facilitate early detection and follow-up of iVDPV excretion among patients with PID to mitigate the risk for iVDPV spread. This will be critical to help identify all poliovirus excretors and thus achieve and maintain eradication of all polioviruses.

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Detection and Genetic Characterization of Community-Based SARS-CoV-2 Infections — New York City, March 2020

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To limit introduction of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), the United States restricted travel from China on February 2, 2020, and from Europe on March 13. To determine whether local transmission of SARS-CoV-2 could be detected, the New York City (NYC) Department of Health and Mental Hygiene (DOHMH) conducted deidentified sentinel surveillance at six NYC hospital emergency departments (EDs) during March 1–20. On March 8, while testing availability for SARS-CoV-2 was still limited, DOHMH announced sustained community transmission of SARS-CoV-2 (*1*). At this time, twenty-six NYC residents had confirmed COVID-19, and ED visits for influenza-like illness* increased, despite decreased influenza virus circulation.† The following week, on March 15, when only seven of the 56 (13%) patients with known exposure histories had exposure outside of NYC, the level of community SARS-CoV-2 transmission status was elevated from sustained community transmission to widespread community transmission (*2*). Through sentinel surveillance during March 1–20, DOHMH collected 544 specimens from patients with influenza-like symptoms (ILS)§ who had negative test results for influenza and, in some instances, other respiratory pathogens.¶ All 544 specimens were tested for SARS-CoV-2 at CDC; 36 (6.6%) tested positive. Using genetic sequencing, CDC determined that the sequences of most SARS-CoV-2–positive specimens resembled those circulating in Europe, suggesting probable introductions of SARS-CoV-2 from Europe, from other U.S. locations, and local introductions from within New York. These findings demonstrate that partnering with health care facilities and developing the systems needed for rapid implementation of sentinel surveillance, coupled with capacity for genetic sequencing before an outbreak, can help inform timely containment and mitigation strategies.

The DOHMH collected deidentified remnant nasopharyngeal swab specimens from patients with ILS and no known virologic diagnosis evaluated at six sentinel EDs during March 1–20, 2020. Because of concern that SARS-CoV-2 could be introduced by travelers returning from China, where the outbreak originated, five EDs were selected because of their high use by patients residing in ZIP codes with ≥20% self-identified Chinese speakers.** Two EDs were in Manhattan, two in Queens, one in Brooklyn, and one in the Bronx. Refrigerated specimens were released to DOHMH 48 hours after collection, and frozen specimens were released 1 week after collection. Specimens collected during March 1–9 were from patients of all ages. Because little was known about pediatric SARS-CoV-2 infection, during March 10–20, DOHMH only collected specimens from patients aged <18 years.

Specimens were sent to CDC on March 23, 2020, for SARS-CoV-2 testing using the 2019-nCoV real-time reverse-transcription–polymerase chain reaction (RT-PCR) assay.†† To conserve resources, pools with up to five specimens were tested together, and individual specimens within positive or inconclusive pools were retested. Nucleic acid from RT-PCR–positive specimens was then extracted and subjected to Oxford Nanopore MinION sequencing, and full genome sequences were generated using methods described previously (*3*). Phylogenetic relations were inferred using the Nextstrain pipeline (*4*), including the 36 positive SARS-CoV-2 sentinel specimens and selected full genome sequences available as of April 1, 2020, from the Global Initiative on Sharing All Influenza Data (GISAID) (*5*). This project was determined by DOHMH and CDC to be nonresearch public health surveillance. Therefore, approval by the agencies' institutional review boards was not required.

Given limited testing availability, and to better understand prevalence of SARS-CoV-2 infections in the absence of NYC population prevalence data, DOHMH calculated the estimated weekly number of persons with undetected SARS-CoV-2 infection in the target population. DOHMH estimated§§ the

* Influenza-like illness is defined as having fever and either cough or sore throat recorded in the ED chief complaint.

† https://www1.nyc.gov/assets/doh/downloads/pdf/hcp/weekly-surveillance03072020.pdf.

§ Influenza-like symptoms are defined as having at least one of the following signs or symptoms recorded in the ED chief complaint: chills, fever, upper respiratory infection, cough, sore throat, runny nose, congestion, headache, or fatigue.

¶ Specimens from all EDs were negative for influenza by polymerase chain reaction testing, two EDs required a negative respiratory syncytial virus test, and two additional EDs required a negative respiratory viral panel.

** Table S1601 (Language Spoken at Home), per American Community Survey, 2013–2017, available at https://data.census.gov/cedsci/.

†† https://www.fda.gov/media/134922/download.

§§ Target population size = ED visits for ILS citywide x (ED visits for ILS at sentinel sites with influenza tests performed/ED visits for ILS at sentinel sites) x (ED visits for ILS at sentinel sites with negative influenza test results/ED visits for ILS at sentinel sites with influenza tests performed).

weekly target population, defined as those persons evaluated at any NYC ED with ILS who had negative test results for influenza (and, in some instances, for other respiratory pathogens). Numbers of ED visits for ILS were obtained using ED syndromic surveillance data and aggregated weekly citywide and by sentinel ED. Each sentinel ED provided DOHMH their weekly influenza testing volume and results. Estimated SARS-CoV-2 prevalence among the target population was calculated using the estimated true prevalence tool[¶¶] assuming 85% test sensitivity (range = 75%–95%) and 99% specificity of the SARS-CoV-2 RT-PCR assay; results were analyzed using R statistical software (version 3.6.3; The R Foundation).

During March 1–20, 544 specimens were collected from the six sentinel EDs (Table). Thirty-six (6.6%) specimens were positive for SARS-CoV-2, including 22 (5.2%) among 425 patients of all ages and 14 (11.8%) among 119 patients aged <18 years. Among the 36 SARS-CoV-2–positive specimens, 32 (89%) were obtained during two 3-day periods: March 8–10 and March 17–19 (Figure).

The estimated SARS-CoV-2 prevalence among patients of all ages in the target population was 0.3% during the week of March 1 and 11.3% during the week of March 8, with an estimated 15 and 1,170 undetected SARS-CoV-2 infections among patients of all ages in the target population during each respective week (Table). The estimated SARS-CoV-2 prevalence among patients aged <18 years in the target population was 2.0% during the week of March 8 and 17.7% during the week of March 15, with an estimated 103 and 227 undetected SARS-CoV-2 infections among patients aged <18 years in the target population during each respective week (Table). During the weeks of March 1 and March 8, there were 26 and 1,917 confirmed cases of COVID-19, respectively, in NYC among persons of all ages. During the weeks of March 8 and March 15, there were 42 and 457 confirmed cases of COVID-19, respectively, in NYC among persons aged <18 years (Table).

Full genome sequences were generated from all 36 positive SARS-CoV-2 specimens. All sequences fell across three arbitrarily defined groups (A, B, and C) (Supplementary Figure, https://stacks.cdc.gov/view/cdc/90347). Two of the NYC sequences clustered in Group A, which contains sequences primarily derived from cases diagnosed in patients in the United States, who were mostly from the state of Washington, and includes other sequences from New York. Seven sequences clustered in Group B, which includes early sequences detected

[¶¶] https://epitools.ausvet.com.au/trueprevalence.

TABLE. Weekly emergency department (ED) sentinel surveillance results and SARS-CoV-2 prevalence estimations among persons with influenza-like symptoms (ILS) of all ages and those <18 years of age — New York City (NYC), March 2020

	Age group			
	All ages		<18 yrs	
Characteristic	Wk beginning Mar 1	Wk beginning Mar 8	Wk beginning Mar 8	Wk beginning Mar 15
ED visits for ILS citywide,* no.	17,137	24,511	7,546	4,464
ED visits for ILS at sentinel sites, no.	1,145	3,019	479	778
ED visits for ILS at sentinel sites with influenza tests performed, no. (%)†	449 (39.2)	1,606 (53.2)	440 (91.9)	252 (32.4)
ED visits for ILS at sentinel sites with negative influenza test results, no. (%)	336 (74.8)	1,275 (79.4)	328 (74.5)	224 (88.9)
Target population, no. of persons§	5,029	10,352	5,167	1,285
Sentinel surveillance specimens collected, no.	244	181	37	82
Specimens positive for SARS-CoV-2, no. (%)	3 (1.2)	19 (10.5)	1 (2.7)	13 (15.9)
Estimated SARS-CoV-2 prevalence in target population,¶ % (CL)**	0.3 (0.0–3.5)	11.3 (6.2–20.0)	2.0 (0.0–17.3)	17.7 (9.1–32.8)
Estimated undetected COVID-19 cases in target population, no. (CL)††	15 (0–176)	1,170 (642–2,070)	103 (0–894)	227 (117–422)
Confirmed COVID-19 cases in NYC,§§ no.	26	1,917	42	457

Abbreviations: CL = confidence limit; COVID-19 = coronavirus disease 2019; Wk = week.

* ILS are defined as having at least one of the following signs or symptoms recorded in the ED chief complaint: chills, fever, upper respiratory infection, cough, sore throat, runny nose, congestion, headache, or fatigue.

† Limited to sentinel EDs that contributed samples during the specified week.

§ Target population is defined as those persons evaluated at any NYC ED with ILS who had negative test results for influenza (and, in some instances, for other respiratory pathogens). The target population is calculated using the following formula: ED visits for ILS citywide x (ED visits for ILS at sentinel sites with influenza tests performed/ED visits for ILS at sentinel sites) x (ED visits for ILS at sentinel sites with negative influenza test results/ED visits for ILS at sentinel sites with influenza tests performed).

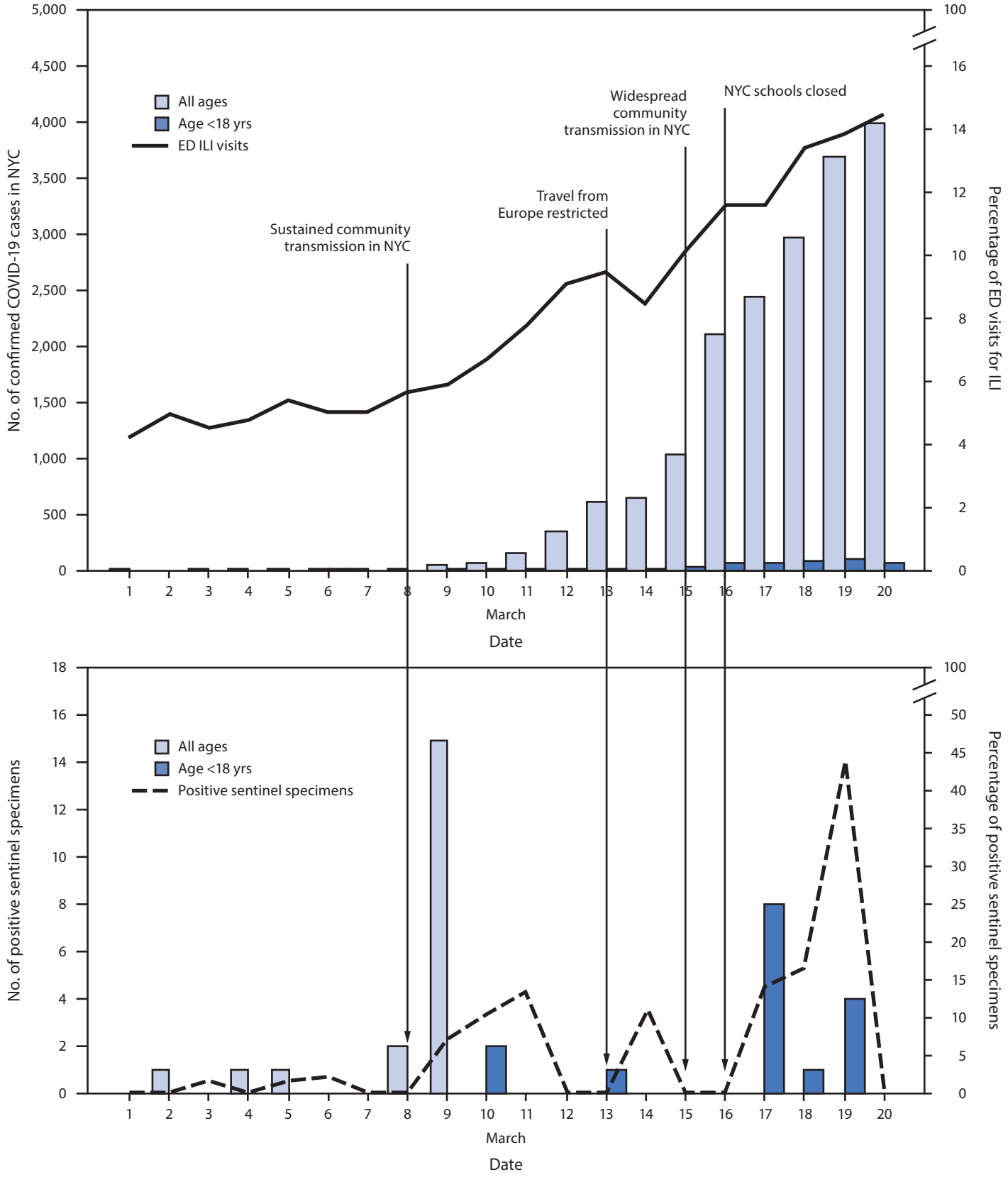
¶ Point estimate calculated using estimated true prevalence tool (https://epitools.ausvet.com.au/trueprevalence), assuming 85% sensitivity and 99% specificity for the SARS-CoV-2 reverse transcription–polymerase chain reaction (RT-PCR) test for nasopharyngeal samples collected from symptomatic patients.

** Lower confidence limit calculated assuming 95% test sensitivity. Upper confidence limit calculated assuming 75% test sensitivity. All calculations assume 99% test specificity.

†† Calculated by multiplying target population by estimated prevalence and by lower and upper confidence limits.

§§ Confirmed cases are defined as having first positive SARS-CoV-2 RT-PCR test result reported to the NYC Department of Health and Mental Hygiene among NYC residents, as of June 18, 2020, with the specimen collected during the week specified.

FIGURE. Daily percentage of emergency department (ED) visits for influenza-like illness (ILI), number of confirmed COVID-19 cases, and number and percentage of sentinel specimens positive for SARS-CoV-2* — New York City, March 1–20, 2020



Abbreviations: COVID-19 = coronavirus disease 2019; NYC = New York City.
* ED vists for ILI reported by date of visit, confirmed cases by date of diagnosis, and sentinel specimens by date of collection.

in China and other global sequences, as well as other sequences from New York. The remaining 27 sequences most closely clustered with New York sequences within Group C, which was largely dominated by sequences detected in Europe and North America.

Discussion

During March 5–14, at approximately the same time as specimens from sentinel surveillance among persons with ILS in NYC were being collected, public health officials in Santa Clara County, California found SARS-CoV-2 prevalence to be 11% in specimens that tested negative for influenza collected from patients of all ages at four sentinel urgent care sites (*6*); in addition, 5.3% of patients with no known travel exposure or contact with a traveler, who were evaluated for mild influenza-like illness March 12–13 and March 15–16 at one medical center in Los Angeles, had positive test results for SARS-CoV-2 (*7*). Both Santa Clara County and Los Angeles used an identified surveillance approach that included collecting patient information on age, sex and travel history, whereas New York City used a deidentified approach. Differences in sampling methods and populations therefore limit direct comparisons; however, value can be found in recognizing various approaches to conducting sentinel surveillance.

During the weeks of March 8 and March 15, there was an increase in confirmed cases of COVID-19 among persons aged <18 years in NYC. During this same period, DOHMH estimated an increase in prevalence and undetected cases of COVID-19 among persons aged <18 years with ILS and negative influenza test results. These reported and estimated increases suggest that further investigation is warranted into the role children play in community transmission and the effect school closures might have as a mitigation strategy.

The sequence from March 2, 2020, (the earliest positive sentinel specimen collected) clustered with early sequences from Europe and United States (Group B), which also cluster with sequences from China. No sentinel sequences were directly connected to sequences from Wuhan, China, where the outbreak originated. This was unanticipated, given that most sentinel EDs were used by patients residing in ZIP codes with a high proportion of Chinese speakers. Rather, the sequence analysis suggests probable introductions of SARS-CoV-2 from Europe, from other U.S. locations, and local introductions from within New York. Domestic airport screening and bans on foreign nationals traveling from China were implemented on February 2;*** however, similar travel restrictions from the Schengen Area in Europe were only implemented March 13.††† Although travel restrictions are an important mitigation strategy, by the time the European restrictions were implemented, importation and community transmission of SARS-CoV-2 had already occurred in NYC.

Based on target population calculations, many SARS-CoV-2 infections likely went undetected during the surveillance period in NYC. Expanding the testing criteria at the beginning of the outbreak to include persons with any travel exposure and with ILS without an alternative diagnosis would have increased the number of cases detected through passive surveillance. Limited testing capability and strict testing criteria led to many COVID-19 cases going undetected, slowed DOHMH's capacity to use surveillance to make timely public health decisions, and ultimately contributed to sustained community transmission (*1*).

The findings in this report are subject to at least six limitations. First, the deidentified surveillance approach precluded collection of epidemiologic information, including any personal identifiers, demographic information, travel and exposure history, and specific sentinel ED, to support interpretation of the genetic links among specimens or further investigate clusters. Second, the change in age eligibility criteria during the surveillance period limited comparisons across weeks. Third, the pooling approach to laboratory testing has the potential to dilute low viral load samples leading to a false-negative result. Fourth, the small number of patients tested led to large

Summary

What is already known about this topic?

To limit SARS-CoV-2 introduction, the United States restricted travel from China on February 2 and from Europe on March 13, 2020. By March 15, community transmission was widespread in New York City (NYC).

What is added by this report?

The NYC Department of Health and Mental Hygiene conducted sentinel surveillance of influenza-like symptoms (ILS) and genetic sequencing to characterize community transmission and determine the geographic origin of SARS-CoV-2 infections. Among 544 specimens tested from persons with ILS and negative influenza test results, 36 (6.6%) were positive. Genetically sequenced positive specimens most closely resembled sequences circulating in Europe.

What are the implications for public health practice?

Partnering with health care facilities and establishing systems for sentinel surveillance with capacity for genetic sequencing before an outbreak can inform timely public health response strategies.

*** https://www.whitehouse.gov/presidential-actions/proclamation-suspension-entry-immigrants-nonimmigrants-persons-pose-risk-transmitting-2019-novel-coronavirus/.

††† https://www.whitehouse.gov/presidential-actions/proclamation-suspension-entry-immigrants-nonimmigrants-certain-additional-persons-pose-risk-transmitting-2019-novel-coronavirus/.

uncertainty in estimated SARS-CoV-2 prevalence and the number of undetected COVID-19 cases in the target population. Fifth, a population survey to estimate the number of infected persons with ILS who did not seek medical attention was not completed until later in the pandemic, so these data could not be used to estimate infection prevalence among the general NYC population. Finally, the potential bias introduced by the sentinel sites selected and populations served affected the generalizability of these findings.

Sentinel surveillance and genetic sequencing, if available early after the emergence or reemergence of a new disease, can guide public health response strategies. DOHMH urges jurisdictions to leverage existing or new infrastructure to establish sentinel surveillance and specimen sequencing in preparation for a subsequent wave in the COVID-19 pandemic and for future outbreaks.

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Morbidity and Mortality Weekly Report

Characteristics of Persons Who Died with COVID-19 — United States, February 12–May 18, 2020

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During January 1, 2020–May 18, 2020, approximately 1.3 million cases of coronavirus disease 2019 (COVID-19) and 83,000 COVID-19–associated deaths were reported in the United States (*1*). Understanding the demographic and clinical characteristics of decedents could inform medical and public health interventions focused on preventing COVID-19–associated mortality. This report describes decedents with laboratory-confirmed infection with SARS-CoV-2, the virus that causes COVID-19, using data from 1) the standardized CDC case-report form (case-based surveillance) (https://www.cdc.gov/coronavirus/2019-ncov/php/reporting-pui.html) and 2) supplementary data (supplemental surveillance), such as underlying medical conditions and location of death, obtained through collaboration between CDC and 16 public health jurisdictions (15 states and New York City).

Case-based surveillance

Demographic and clinical data about COVID-19 cases are reported to CDC from 50 states, the District of Columbia, New York City, and U.S. territories using a standardized case-report form (case-based surveillance) or in aggregate. Data on 52,166 deaths from 47 jurisdictions among persons with laboratory-confirmed COVID-19 were reported individually to CDC via case-based surveillance during February 12–May 18, 2020. Among the 52,166 decedents, 55.4% were male, 79.6% were aged ≥65 years, 13.8% were Hispanic/Latino (Hispanic), 21.0% were black, 40.3% were white, 3.9% were Asian, 0.3% were American Indian/Alaska Native (AI/AN), 0.1% were Native Hawaiian or other Pacific Islander (NHPI), 2.6% were multiracial or other race, and race/ethnicity was unknown for 18.0%. (Table 1). Median decedent age was 78 years (interquartile range (IQR) = 67–87 years). Because information about underlying medical conditions was missing for the majority of these decedents (30,725; 58.9%), data regarding medical conditions were not analyzed further using the case-based surveillance data set. Because most decedents reported to the supplementary data program were also reported to case-based surveillance, no statistical comparisons of the decedent characteristics between the data sets were made.

Supplemental surveillance

To collect more complete data on race/ethnicity, selected underlying medical conditions* by age, and clinical course, CDC solicited supplementary information from medical charts and death certificates of decedents with laboratory-confirmed COVID-19 from state, territorial, and local public health departments. The supplementary data request also sought information on locations of death, which is not collected routinely on the CDC case-report form. Among 56 public health departments contacted by CDC, 16† provided supplementary data on 10,647 COVID-19 deaths that occurred during February 12–April 24, 2020.

* Underlying medical conditions include cardiovascular disease (congenital heart disease, coronary artery disease, congestive heart failure, hypertension, cerebrovascular accident/stroke, valvular heart disease, conduction disorders or dysrhythmias, other cardiovascular disease); diabetes mellitus; chronic lung disease (chronic obstructive pulmonary disease/emphysema, asthma, tuberculosis, other chronic lung diseases); immunosuppression (cancer, human immunodeficiency virus (HIV) infection, identified as being immunosuppressed); chronic kidney disease (chronic kidney disease, end-stage renal disease, other kidney diseases); neurologic conditions (dementia, seizure disorder, other neurologic conditions); chronic liver disease (cirrhosis, alcoholic hepatitis, chronic liver disease, end-stage liver disease, hepatitis B, hepatitis C, nonalcoholic steatohepatitis, other chronic liver diseases); obesity (body mass index ≥30 kg/m^2). Information was collected from decedent medical records or death certificates. For 10 states (10,461 decedents), information was abstracted into state surveillance data structures and transmitted to CDC. For six states (186 decedents), the medical records and death certificates were sent to CDC and abstracted using a standardized form.

† Alaska Department of Health and Social Services; Colorado Department of Public Health and Environment; Indiana State Department of Health; Louisiana Department of Health; Maine Center for Disease Control and Prevention; Michigan Department of Health and Human Services; Minnesota Department of Health; New Jersey Department of Health; New York City Department of Health and Mental Hygiene; North Carolina Department of Health and Human Services; Oregon Health Authority; Tennessee Department of Health; Utah Department of Health; Vermont Department of Health; Washington State Department of Health; Wisconsin Department of Health Services.

Among the 10,647 COVID-19 decedents for whom supplementary data were collected, 60.6% were male, 74.8% were aged ≥65 years, 24.4% were Hispanic, 24.9% were black, 35.0% were white, 6.3% were Asian, 0.1% were AI/AN, 0.1% were NHPI, 2.9% were multiracial or other race, and race/ethnicity was unknown for 6.3% (Table 1). Decedent age varied by race and ethnicity; median age was 71 years (IQR = 59–81 years) among Hispanic decedents, 72 years (IQR = 62–81 years) among all nonwhite, non-Hispanic decedents, and 81 years (IQR = 71–88 years) among white decedents. The percentages of Hispanic (34.9%) and nonwhite (29.5%) decedents who were aged <65 years were more than twice those of white decedents (13.2%) (Figure).

At least one underlying medical condition was reported for 8,134 (76.4%) of decedents for whom supplementary data were collected, including 83.1% of decedents aged <65 years. Overall, the most common underlying medical conditions were cardiovascular disease (60.9%), diabetes mellitus (39.5%), chronic kidney disease (20.8%), and chronic lung disease (19.2%) (Table 2). Among decedents aged <65 years, 83.1% had one or more underlying medical conditions. Among decedents aged ≥85 years, 69.5% had one or more underlying medical conditions. Diabetes was more common among decedents aged <65 years (49.6%) than among those aged ≥85 years (25.9%).

Among decedents for whom supplementary data were reported, 8,976 (84.3%) were hospitalized. Among 3,021 (28.4%) with dates of illness onset and death reported, the median interval from illness onset to death was 10 days (IQR = 6–15 days); among 7,794 decedents with hospital admission and death dates, the median interval from hospital admission to death was 5 days (IQR = 3–8 days). Among the decedents, 62.0% died in hospitals. By age group, the largest percentage who died in the emergency department (6.8%) or at home (1.0%) was aged <65 years (combined total = 7.8%), and decreased with increasing age group, whereas the percentage who died in long-term care facilities increased with increasing age and was highest among decedents aged ≥85 years (12.6%).

Among the decedents during February 12–April 24, 2020, for whom supplementary information was provided, 9,997 (93.9%) resided in New York City, New Jersey, or the state of Washington, three areas with early widespread circulation of SARS-CoV-2; the median age among decedents in these three jurisdictions was 75 years, (IQR = 64–84 years). The median age among decedents residing in the other 13 jurisdictions was similar (78 years, [IQR = 68–85 years]).

TABLE 1. Demographic characteristics of decedents reported through national COVID-19 case-based and supplemental surveillance, by data source — United States, February 12–May 18, 2020

	No. (%)	
	Case-based surveillance*	Supplemental surveillance†
Characteristic	**N = 52,166**	**N = 10,647**
Age, yrs (median, IQR)	78 (67–87)	75 (64–84)
Age group (yrs)		
All <65	10,626 (20.4)	2,681 (25.2)
<18	16 (<0.1)	5 (<0.1)
18–44	1,478 (2.8)	423 (4.0)
45–54	2,675 (5.1)	704 (6.6)
55–64	6,457 (12.4)	1,549 (14.5)
All ≥65	41,528 (79.6)	7,966 (74.8)
65–74	11,245 (21.6)	2,463 (23.1)
75–84	14,148 (27.1)	2,900 (27.2)
≥85	16,135 (30.9)	2,603 (24.4)
Unknown	12 (<0.1)	0 (0)
Sex		
Male	28,899 (55.4)	6,449 (60.6)
Female	22,798 (43.7)	4,194 (39.4)
Other/Unknown	469 (0.9)	4 (<0.1)
Race/Ethnicity		
Hispanic/Latino§	7,175 (13.8)	2,602 (24.4)
White	21,021 (40.3)	3,727 (35.0)
Nonwhite	14,590 (28.0)	3,653 (34.3)
Black	10,964 (21.0)	2,655 (24.9)
Asian	2,048 (3.9)	666 (6.3)
Multiracial/Other race§	1,578 (3.0)	332 (3.1)
Unknown	9,380 (18.0)	665 (6.3)

Abbreviations: COVID-19 = coronavirus disease 2019; IQR = interquartile range; NH = non-Hispanic.

* Includes data from laboratory-confirmed cases reported to CDC as of May 18, 2020.

† Data from laboratory-confirmed cases reported to CDC as of April 24, 2020, from these 16 public health jurisdictions: Alaska Department of Health and Social Services; Colorado Department of Public Health and Environment; Indiana State Department of Health; Louisiana Department of Health; Maine Center for Disease Control and Prevention; Michigan Department of Health and Human Services; Minnesota Department of Health; New Jersey Department of Health; New York City Department of Health and Mental Hygiene; North Carolina Department of Health and Human Services; Oregon Health Authority; Tennessee Department of Health; Utah Department of Health; Vermont Department of Health; Washington State Department of Health; Wisconsin Department of Health Services.

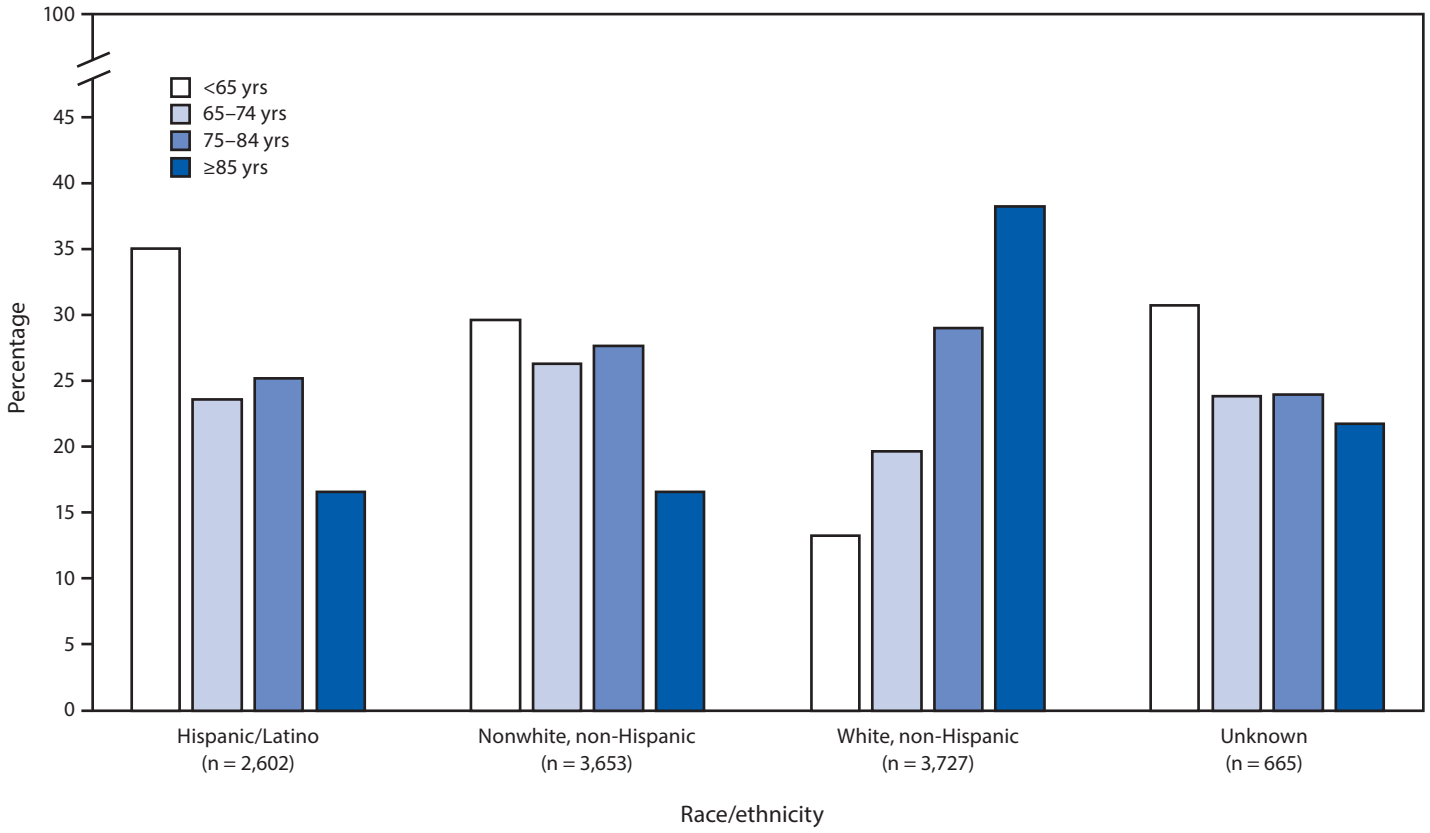
§ Persons who were not reported as Hispanic/Latino were all non-Hispanic.

¶ Includes persons reported as American Indian/Alaska Native (163 in case-based surveillance and 13 in supplementary data set), Native Hawaiian or other Pacific Islander (33 in case-based surveillance and eight in supplementary data set), multiracial, and persons of another race without further specification.

Discussion

Using national case-based surveillance and supplementary data reported from 16 jurisdictions, characteristics of >10,000 decedents with laboratory-confirmed COVID-19 were described. More than one third of Hispanic decedents (34.9%) and nearly one third (29.5%) of nonwhite decedents were aged <65 years, but only 13.2% of white decedents were aged <65 years. Consistent with reports describing the characteristics of deaths in persons with COVID-19 in the United States and China (*2–5*), approximately three fourths of decedents had one or more underlying medical conditions reported (76.4%) or were aged ≥65 years (74.8%). Among reported underlying medical conditions, cardiovascular disease and

FIGURE. Decedent race/ethnicity,* by age group, reported to supplemental COVID-19 surveillance (N = 10,647) — 16 U.S. public health jurisdictions,† February 12–April 24, 2020



Abbreviation: COVID-19 = coronavirus disease 2019.

* The "Nonwhite, non-Hispanic" group includes persons who are black, white, Asian, American Indian/Alaska Native, or Native Hawaiian and other Pacific Islander; the "Unknown" group consists of persons for whom race/ethnicity data were not available.

† Alaska Department of Health and Social Services; Colorado Department of Public Health and Environment; Indiana State Department of Health; Louisiana Department of Health; Maine Center for Disease Control and Prevention; Michigan Department of Health and Human Services; Minnesota Department of Health; New Jersey Department of Health; New York City Department of Health and Mental Hygiene; North Carolina Department of Health and Human Services; Oregon Health Authority; Tennessee Department of Health; Utah Department of Health; Vermont Department of Health; Washington State Department of Health; Wisconsin Department of Health Services.

diabetes were the most common. Diabetes prevalence among decedents aged <65 years (49.6%) was substantially higher than that reported in an analysis of hospitalized COVID-19 patients aged <65 years (35%) and persons aged <65 years in the general population (<20%) (*5*–*7*). Among decedents aged <65 years, 7.8% died in an emergency department or at home; these out-of-hospital deaths might reflect lack of health care access, delays in seeking care, or diagnostic delays. Health communications campaigns could encourage patients, particularly those with underlying medical conditions, to seek medical care earlier in their illnesses. Additionally, health care providers should be encouraged to consider the possibility of severe disease among younger persons who are Hispanic, nonwhite, or have underlying medical conditions. More prompt diagnoses could facilitate earlier implementation of supportive care to minimize morbidity among individuals and earlier isolation of contagious persons to protect communities from SARS-CoV-2 transmission.

The relatively high percentages of Hispanic and nonwhite decedents aged <65 years were notable. The median age of nonwhite persons (31 years) in the United States is lower than that of white persons (44 years); these differences might help explain the higher proportions of Hispanic and nonwhite decedents among those aged <65 years. The median ages among Hispanic and nonwhite decedents (71 and 72 years, respectively) were 9–10 years lower than that of white decedents (81 years). However, the percentage of Hispanic decedents aged <65 years (33.9%) exceeded the percentage of Hispanic persons aged <65 years in the U.S. population (20%); the percentage of nonwhite COVID-19 decedents aged <65 years (40.2%) also exceeded the overall percentage of nonwhite decedents aged <65 years (23%) in the U.S. population (*8*). Further study is needed to understand the reasons for these differences. It is

TABLE 2. Clinical features of decedents collected through COVID-19 supplemental surveillance — 16 public health jurisdictions,* United States, February 12–April 24, 2020

	No. (%)					
		Age group (yrs)				
	Overall	<65	≥65	65–74	75–84	≥85
Characteristic	N = 10,647	n = 2,681	n = 7,966	n = 2,463	n = 2,900	n = 2,603
Race/Ethnicity						
Hispanic/Latino	2,602 (24.4)	908 (33.9)	1,694 (21.3)	611 (24.8)	652 (22.5)	431 (16.6)
White, NH	3,727 (35.0)	492 (18.4)	3,235 (40.6)	732 (29.7)	1,082 (37.3)	1,421 (54.6)
Nonwhite, NH	3,653 (34.3)	1,077 (40.2)	2,576 (32.3)	962 (39.1)	1,007 (34.7)	607 (23.3)
Black, NH	2,655 (24.9)	803 (30.0)	1,852 (23.3)	715 (29.0)	731 (25.2)	406 (15.6)
Asian, NH	666 (6.3)	164 (6.1)	502 (6.3)	157 (6.4)	189 (6.5)	156 (6.0)
Multiracial/Other race†	332 (3.1)	110 (4.1)	222 (2.8)	90 (3.7)	87 (3.0)	45 (1.7)
Unknown	665 (6.3)	204 (7.6)	461 (5.8)	158 (6.4)	159 (5.5)	144 (5.5)
≥1 underlying medical conditions§	8,134 (76.4)	2,228 (83.1)	5,906 (74.1)	1,922 (78.0)	2,175 (75.0)	1,809 (69.5)
≥2 underlying medical conditions§	5,772 (54.2)	1,647(61.4)	4,125 (51.8)	1,403 (57.0)	1,549 (53.4)	1,173 (45.1)
≥3 underlying medical conditions§	3,269 (30.7)	1,012 (37.8)	2,257 (28.3)	803 (32.6)	844 (29.1)	610 (23.4)
Cardiovascular disease¶						
Yes**	6,481 (60.9)	1,633 (60.9)	4,848 (60.9)	1,565 (63.5)	1,773 (61.1)	1,510 (58.0)
No††	145 (1.4)	93 (3.5)	52 (0.7)	26 (1.1)	15 (0.5)	11 (0.4)
Unknown§§	4,021 (37.8)	955 (35.6)	3,066 (38.5)	872 (35.4)	1,112 (38.3)	1,081 (41.5)
Diabetes mellitus						
Yes**	4,210 (39.5)	1,330 (49.6)	2,880 (36.2)	1,107 (45.0)	1,098 (37.9)	675 (25.9)
No††	589 (5.5)	190 (7.1)	399 (5.0)	103 (4.2)	131 (4.5)	165 (6.3)
Unknown§§	5,848 (54.9)	1,161 (43.3)	4,687 (58.8)	1,253 (50.9)	1,671 (57.6)	1,762 (67.7)
Chronic kidney disease¶¶						
Yes**	2,209 (20.8)	589 (22.0)	1,620 (20.3)	530 (21.5)	627 (21.6)	463 (17.8)
No††	711 (6.7)	308 (11.5)	403 (5.1)	129 (5.2)	137 (4.7)	137 (5.3)
Unknown§§	7,727 (72.6)	1,784 (66.5)	5,943 (74.6)	1,804 (73.2)	2,136 (73.7)	2,002 (76.9)
End-stage renal disease						
Yes**	368 (3.5)	171 (6.4)	197 (2.5)	100 (4.1)	70 (2.4)	27 (1.0)
No††	373 (3.5)	211 (7.9)	162 (2.0)	67 (2.7)	46 (1.6)	49 (1.9)
Unknown§§	9,906 (93.0)	2,299 (85.8)	7,607 (95.5)	2,296 (93.2)	2,784 (96.0)	2,526 (97.1)
Chronic lung disease***						
Yes**	2,047 (19.2)	561 (20.9)	1,486 (18.7)	504 (20.5)	574 (19.8)	408 (15.7)
No††	754 (7.1)	328 (12.2)	426 (5.4)	134 (5.4)	132 (4.6)	160 (6.2)
Unknown§§	7,846 (73.7)	1,792 (66.8)	6,054 (76.0)	1,825 (74.1)	2,194 (75.7)	2,034 (78.2)
Neurologic conditions†††						
Yes**	1,376 (12.9)	314 (11.7)	1062 (13.3)	259 (10.5)	350 (12.1)	453 (17.4)
No††	501 (4.7)	220 (8.2)	281 (3.5)	117 (4.8)	86 (3.0)	78 (3.0)
Unknown§§	8,770 (82.4)	2,147 (80.1)	6,623 (83.1)	2,087 (84.7)	2,464 (85.0)	2,071 (79.6)
Immunosuppression§§§						
Yes**	1,661 (15.6)	470 (17.5)	1,191 (15.0)	441 (17.9)	445 (15.3)	305 (11.7)
Unknown§§	8,986(84.4)	2,211 (82.5)	6,775 (85.0)	2,022 (82.1)	2,455 (84.7)	2,297 (88.3)
Chronic liver conditions¶¶¶						
Yes**	247 (2.3)	111 (4.1)	136 (1.7)	67 (2.7)	50 (1.7)	19 (0.7)
No††	705 (6.6)	262 (9.8)	443 (5.6)	146 (5.9)	139 (4.8)	158 (6.1)
Unknown§§	9,695 (91.1)	2,308 (86.1)	7,387 (92.7)	2,250 (91.4)	2,711 (93.5)	2,425 (93.2)
Obesity****						
Yes**	918 (8.6)	575 (21.4)	343 (4.3)	182 (7.4)	103 (3.6)	58 (2.2)
No††	168 (1.6)	127 (4.7)	41 (0.5)	28 (1.1)	9 (0.3)	4 (0.2)
Unknown§§	9,561 (89.8)	1,979 (73.8)	7,582 (95.2)	2,253 (91.5)	2,788 (96.1)	2,540 (97.6)
Clinical course						
Illness duration††††	10 days (6–15)	11 days (7–16)	9 days (6–14)	10 days (7–15)	10 days (6–14)	8 days (5–12)
Hospitalized§§§§						
Yes**	8,976 (84.3)	2,375 (88.6)	6,601 (82.9)	2,170 (88.1)	2,449 (84.4)	1,981 (76.1)
Unknown§§	1,671 (15.7)	306 (11.4)	1,365 (17.1)	293 (11.9)	451 (15.6)	621 (23.9)
Required ICU admission						
Yes**	2,401 (22.6)	1,094 (40.8)	1,307 (16.4)	629 (25.5)	470 (16.2)	208 (8.0)
No††	1,239 (11.6)	464 (17.3)	775 (9.7)	185 (7.5)	272 (9.4)	318 (12.2)
Unknown§§	7,007 (65.8)	1,123 (41.9)	5,884(73.9)	1,649 (67.0)	2,158 (74.4)	2,076 (79.8)

See table footnotes on the next page.

TABLE 2. (*Continued*) Clinical features of decedents collected through COVID-19 supplemental surveillance — 16 public health jurisdictions,* United States, February 12–April 24, 2020

	No. (%)					
		Age group (yrs)				
	Overall	<65	≥65	65–74	75–84	≥85
Characteristic	N = 10,647	n = 2,681	n = 7,966	n = 2,463	n = 2,900	n = 2,603
Required mechanical ventilation						
Yes**	2,994 (28.1)	1,322 (49.3)	1,672 (21.0)	803 (32.6)	588 (20.3)	281 (10.8)
No††	914 (8.6)	263 (9.8)	651 (8.2)	141 (5.7)	228 (7.9)	282 (10.8)
Unknown§§	6,739 (63.3)	1,096 (40.9)	5,643 (70.8)	1,519 (61.7)	2,084 (71.9)	2,039 (78.4)
Length of hospital stay, days (median, IQR)¶¶¶¶	5 (3–8)	6 (3–9)	5 (2–8)	5 (3–9)	5 (3–8)	4 (2–7)
Location of death						
Hospital	6,604 (62.0)	1,575 (58.8)	5,029 (63.1)	1,630 (66.2)	1,884 (65.0)	1,515 (58.2)
Long-term care facility*****	567 (5.3)	31 (1.2)	536 (6.7)	60 (2.4)	148 (5.1)	328 (12.6)
Emergency department	549 (5.2)	181 (6.8)	368 (4.6)	134 (5.4)	138 (4.8)	96 (3.7)
Home	79 (0.7)	27 (1.0)	52 (0.7)	††††	††††	††††
Hospice	28 (0.3)	††††	††††	††††	††††	††††
Other/Unknown§§§§§	2,820 (26.5)	866 (32.3)	1,954 (24.5)	619 (25.1)	703 (24.2)	632 (24.3)

Abbreviations: COVID-19 = coronavirus disease 2019; ICU = Intensive care unit; IQR = Interquartile range; NH = non-Hispanic.

* Alaska Department of Health and Social Services; Colorado Department of Public Health and Environment; Indiana State Department of Health; Louisiana Department of Health; Maine Center for Disease Control and Prevention; Michigan Department of Health and Human Services; Minnesota Department of Health; New Jersey Department of Health; New York City Department of Health and Mental Hygiene; North Carolina Department of Health and Human Services; Oregon Health Authority; Tennessee Department of Health; Utah Department of Health; Vermont Department of Health; Washington State Department of Health; Wisconsin Department of Health Services.

† Includes persons reported as American Indian/Alaska Native (130), Native Hawaiian or other Pacific Islander (eight), multiracial, and persons reported as being of another race without further specification.

§ Includes decedents for whom at least one of the following conditions were reported: cardiovascular disease, diabetes mellitus, chronic kidney disease (including end-stage renal disease), neurologic conditions, immunosuppression, chronic liver conditions, or obesity. Conditions are not mutually exclusive; decedents might have more than one underlying condition.

¶ Includes decedents with hypertension, coronary artery disease, congenital heart disease, congestive heart failure, cerebrovascular accident/stroke, valvular heart diseases, conduction disorders, or other cardiovascular diseases.

** Includes only decedents for whom the condition within the specified category was collected from reviews of medical records.

†† Includes only decedents for whom data abstractors indicated did not have any condition within the specified category.

§§ Includes decedents for whom no data were available to indicate whether the decedent had any of the condition(s) within the specified category.

¶¶ Includes decedents with chronic kidney disease and end-stage renal disease.

*** Includes decedents with chronic obstructive pulmonary disease/emphysema, asthma, and tuberculosis.

††† Includes decedents with dementia, seizure disorders, and other neurologic conditions.

§§§ Includes decedents with any history of cancer, HIV/AIDS, or identified as being immunosuppressed.

¶¶¶ Includes decedents with cirrhosis, alcoholic hepatitis, chronic liver disease, end-stage liver disease, hepatitis B, hepatitis C, or non-alcoholic steatohepatitis.

**** Includes persons with body mass index ≥30 kg/m2.

†††† Among 3,021 (28.4%) persons for whom illness onset and death dates were reported; these data were available for 1,363 decedents aged <65 years, 557 decedents aged 65–74 years, 551 decedents aged 75–84 years, and 550 decedents aged ≥85 years.

§§§§ Includes decedents with a reported hospital admission date or who were reported to have died in a hospital.

¶¶¶¶ Among 7,794 (73.2%) persons with available data regarding time from admission to death; these data were available for 2,178 decedents aged <65 years, 1,909 decedents aged 65–74 years, 2,065 decedents aged 75–84 years, and 1,642 decedents aged ≥85 years.

***** Includes decedents who died in a long-term care facility, skilled nursing facility, assisted living facility, or nursing home.

††††† Cells with numbers <20 were suppressed.

§§§§§ Includes decedents for whom no data on location of death were reported and those for whom "other" was specified for death location without any more specific information.

possible that rates of SARS-CoV-2 transmission are higher among Hispanic and nonwhite persons aged <65 years than among white persons; one potential contributing factor is higher percentages of Hispanic and nonwhite persons engaged in occupations (e.g., service industry) or essential activities that preclude physical distancing (*9*). It is also possible that the COVID-19 pandemic disproportionately affected communities of younger, nonwhite persons during the study period (*10*). Although these data did not permit assessment of interactions between race/ethnicity, underlying medical conditions, and nonbiologic factors, further studies to understand and address these racial/ethnic differences are needed to inform targeted efforts to prevent COVID-19 mortality.

The findings in this report are subject to at least five limitations. First, despite >90% completeness for age and race/ethnicity variables in the supplementary data set, the proportion of missing data for some variables, such as underlying medical conditions, clinical course, and race/ethnicity in case-based surveillance, and location of death, was higher than that for other variables; accordingly, the proportions

reported for these variables should be considered minimum proportions rather than robust estimates. Second, reporting practices varied by jurisdiction, and several states bundled underlying medical conditions into organ system–specific categories (e.g., hypertension was included as cardiovascular disease) or did not code specifically for a given condition (e.g., immunosuppression was only specifically coded in 10 of the jurisdictions). These differences in reporting structure precluded evaluations of specific conditions other than diabetes using the entire data set. Third, generalizability of the findings from either data set to all deaths among persons with COVID-19, either within the individual jurisdictions or across the United States, is unknown; COVID-19 testing practices for decedents might differ among jurisdictions. Fourth, information from the supplementary data set provides additional insight into decedent demographic and clinical characteristics; however, these data are a convenience sample from 16 public health jurisdictions. Therefore, because the age-race structure of the underlying population is not known, age-standardized mortality rates could not be calculated. Although more than 90% of decedents resided in just three jurisdictions, and most are represented in case-based surveillance, they represent a subset of deaths reported during this period. Therefore, neither calculations of mortality rates nor statistical comparisons between the demographic characteristics of the decedents with available supplementary data and those from case-based surveillance were possible. Finally, these data were collected during a period before dexamethasone was shown to reduce deaths among ventilated patients; implementation of dexamethasone and other therapeutics, as well as shifts in the ages of patients and geographic locations of cases might affect the generalizability of these data to the current period.

Despite these limitations, this report provides more detailed demographic and clinical information on a subset of approximately 10,000 decedents with laboratory-confirmed COVID-19. Most decedents were aged >65 years and had underlying medical conditions. Compared with white decedents, more Hispanic and nonwhite decedents were aged <65 years. Additional studies are needed to elucidate associations between age, race/ethnicity, SARS-CoV-2 infection, disease severity, underlying medical conditions (especially diabetes), socioeconomic status (e.g., poverty and access to health care), behavioral factors (e.g., ability to comply with mitigation recommendations and maintain essential work responsibilities), and out-of-hospital deaths. Regional and state level efforts to examine the roles of these factors in SARS-CoV-2 transmission and COVID-19-associated deaths could lead to targeted, community-level, mortality prevention initiatives. Examples include health communication campaigns targeted towards Hispanics and nonwhite persons aged <65 years. These campaigns could encourage social distancing and the need for wearing cloth face coverings in public settings. In addition, health care providers should be encouraged to consider the possibility of disease progression, particularly in Hispanic and nonwhite persons aged <65 years and persons of any race/ethnicity, regardless of age, with underlying medical conditions, especially diabetes.

Summary

What is already known about this topic?

COVID-19 mortality is higher in persons with underlying medical conditions and in those aged ≥85 years.

What is added by this report?

Analysis of supplementary data for 10,647 decedents in 16 public health jurisdictions found that a majority were aged ≥65 years and most had underlying medical conditions. Overall, 34.9% of Hispanic and 29.5% of nonwhite decedents were aged <65 years, compared with 13.2% of white, non-Hispanic decedents. Among decedents aged <65 years, a total of 7.8% died in an emergency department or at home.

What are the implications for public health practice?

Understanding factors contributing to racial/ethnic mortality differences and out-of-hospital deaths might inform targeted communication to encourage persons in at-risk groups to practice preventive measures and promptly seek medical care if they become ill.

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Absence of Apparent Transmission of SARS-CoV-2 from Two Stylists After Exposure at a Hair Salon with a Universal Face Covering Policy — Springfield, Missouri, May 2020

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On July 14, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On May 12, 2020 (day 0), a hair stylist at salon A in Springfield, Missouri (stylist A), developed respiratory symptoms and continued working with clients until day 8, when the stylist received a positive test result for SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). A second hair stylist (stylist B), who had been exposed to stylist A, developed respiratory symptoms on May 15, 2020 (day 3), and worked with clients at salon A until day 8 before seeking testing for SARS-CoV-2, which returned a positive result on day 10. A total of 139 clients were directly serviced by stylists A and B from the time they developed symptoms until they took leave from work. Stylists A and B and the 139 clients followed the City of Springfield ordinance* and salon A policy recommending the use of face coverings (i.e., surgical masks, N95 respirators,† or cloth face coverings) for both stylists and clients during their interactions. Other stylists at salon A who worked closely with stylists A and B were identified, quarantined, and monitored daily for 14 days after their last exposure to stylists A or B. None of these stylists reported COVID-19 symptoms. After stylist B received a positive test result on day 10, salon A closed for 3 days to disinfect frequently touched and contaminated areas. After public health contact tracings and 2 weeks of follow-up, no COVID-19 symptoms were identified among the 139 exposed clients or their secondary contacts. The citywide ordinance and company policy might have played a role in preventing spread of SARS-CoV-2 during these exposures. These findings support the role of source control in preventing transmission and can inform the development of public health policy during the COVID-19 pandemic. As stay-at-home orders are lifted, professional and social interactions in the community will present more opportunities for spread of SARS-CoV-2. Broader implementation of masking policies could mitigate the spread of infection in the general population.

Stylist A worked from day 0 to day 8 with COVID-19 symptoms before receiving a diagnosis of COVID-19 by polymerase chain reaction (PCR) testing. Although self-isolation was recommended after testing on day 6, stylist A continued to work until the test returned a positive result, at which time stylist A was excluded from work by salon A. On day 3, after working with stylist A, stylist B developed respiratory symptoms. During Stylist A's symptomatic period, the two stylists interacted while neither was masked during intervals between clients. Stylist B worked from day 3 to day 8 while symptomatic before self-isolating and seeking PCR testing, which returned a positive result for SARS-CoV-2 on day 10. Stylist A worked with clients for 8 days while symptomatic, as did stylist B for 5 days. During all interactions with clients at salon A, stylist A wore a double-layered cotton face covering, and stylist B wore a double-layered cotton face covering or a surgical mask.

The Greene County Health Department (Missouri) conducted contact tracing for all 139 exposed clients back to the dates that stylists A and B first developed symptoms. The 139 clients were monitored after their last exposure at salon A. Clients were asked to self-quarantine for 14 days and were called or sent daily text messages to inquire about any symptoms; none reported signs or symptoms of COVID-19. Testing was offered to all clients 5 days after exposure, or as soon as possible for those exposed >5 days before contact tracing began. Overall, 67 (48.2%) clients volunteered to be tested, and 72 (51.8%) refused; all 67 nasopharyngeal swab specimens tested negative for SARS-CoV-2 by PCR. Telephone interviews were attempted 1 month after initial contact tracings to collect supplementary information. Among the 139 exposed clients, the Greene County Health Department interviewed 104 (74.8%) persons.

Among the 139 clients, the mean age was 52 years (range = 21–93 years); 79 clients (56.8%) were male (Table 1). Salon appointments ranged from 15 to 45 minutes in length (median = 15 minutes; mean = 19.5 minutes). Among the 104 interviewed clients, 102 (98.1%) reported wearing face coverings for their entire appointment, and two (1.9%) reported wearing face coverings part of the time (Table 2). Types of face covering used by clients varied; 49 (47.1%) wore cloth face coverings, 48 (46.1%) wore surgical masks, five (4.8%) wore N95 respirators, and two (1.9%) did not know what kind of face covering they wore. Overall, 101 (97.1%) interviewed clients reported that their stylist wore a face covering for the entire appointment; three did not know. When asked about the type of face coverings worn by the stylists, 64 (61.5%) reported that their stylist wore a cloth face covering (39; 37.5%) or surgical mask

* Springfield, Missouri, city ordinance went into effect May 6, 2020, restricted seating in waiting areas to 25% of normal capacity and recommended social distancing and use of face coverings for employees and clients when social distancing was not or could not be followed. https://www.springfieldmo.gov/5140/Masks-and-Face-Coverings.

† Particulate-filtering facepiece respirators that filter ≥95% of airborne particles (https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/n95list1.html).

Summary

What is already known about this topic?

Consistent and correct use of cloth face coverings is recommended to reduce the spread of SARS-CoV-2.

What is added by this report?

Among 139 clients exposed to two symptomatic hair stylists with confirmed COVID-19 while both the stylists and the clients wore face masks, no symptomatic secondary cases were reported; among 67 clients tested for SARS-CoV-2, all test results were negative. Adherence to the community's and company's face-covering policy likely mitigated spread of SARS-CoV-2.

What are the implications for public health practice?

As stay-at-home orders are lifted, professional and social interactions in the community will present more opportunities for spread of SARS-CoV-2. Broader implementation of face covering policies could mitigate the spread of infection in the general population.

(25; 24.0%); 40 (38.5%) clients did not know or remember the type of face covering worn by stylists. When asked whether they had experienced respiratory symptoms in the 90 days preceding their appointment, 87 (83.7%) clients reported that they had not. Of those who did report previous symptoms, none reported testing for or diagnosis of COVID-19.

Six close contacts of stylists A and B outside of salon A were identified: four of stylist A and two of stylist B. All four of stylist A's contacts later developed symptoms and had positive PCR test results for SARS-CoV-2. These contacts were stylist A's cohabitating husband and her daughter, son-in-law, and their roommate, all of whom lived together in another household. None of stylist B's contacts became symptomatic.

Discussion

SARS-CoV-2 is spread mainly between persons in close proximity to one another (i.e., within 6 feet), and the more closely a person interacts with an infected person and the longer the interaction, the higher the risk for transmission (*1*). At salon A in Springfield, Missouri, two stylists with COVID-19 symptoms worked closely with 139 clients before receiving diagnoses of COVID-19, and none of their clients developed COVID-19 symptoms. Both stylists A and B, and 98% of the interviewed clients followed posted company policy and the Springfield city ordinance requiring face coverings by employees and clients in businesses providing personal care services. The citywide ordinance reduced maximum building waiting area seating to 25% of normal capacity and recommended the use of face coverings at indoor and outdoor public places where physical distancing was not possible. Both company and city policies were likely important factors in preventing the spread of SARS-CoV-2 during these interactions between clients and stylists. These results support the use of face coverings in places open to the public, especially when social distancing is not possible, to reduce spread of SARS-CoV-2.

TABLE 1. Characteristics* of clients (N = 139) who visited hair salon A and were exposed to stylists A and B with COVID-19 —Springfield, Missouri, May 2020

Characteristic	Value
Demographic characteristic	
Male, no. (%)	79 (56.8)
Age, yrs. mean (range)	52 (21–93)
Encounter information	
Appointment date range	May 12–20 (days 0–8†)
Exposure to stylist A, no. (%)	84 (60.4)
Exposure to stylist B, no. (%)	55 (39.6)
Appointment duration, mins, median (range)	15 (15–45)
Client testing	
Clients tested, no. (%)	67 (48.2)
Negative tests, no. (%)§	67 (100)

Abbreviation: COVID-19 = coronavirus disease 2019.
* All interviews were conducted via telephone by the Greene County Health Department.
† After onset of symptoms in stylist A.
§ Among those tested.

Although SARS-CoV-2 is spread largely through respiratory droplets when an ill person coughs or sneezes (*1*), data suggest that viral shedding starts during the 2-to-3-day period before symptom onset, when viral loads are at their highest (*2*). Although the rate of transmission of SARS-CoV-2 from presymptomatic patients (those who have not yet developed symptoms) and asymptomatic persons (those who do not develop symptoms) is unclear, these persons likely contribute to the spread of SARS-CoV-2 (*3*). With the potential for presymptomatic and asymptomatic transmission, widespread adoption of policies requiring face coverings in public settings should be considered to reduce the impact and magnitude of additional waves of COVID-19.

Previous studies show that both surgical masks and homemade cloth face coverings can reduce the aerosolization of virus into the air and onto surfaces (*4*,*5*). Although no studies have examined SARS-CoV-2 transmission directly, data from previous epidemics (*6*,*7*) support the use of universal face coverings as a policy to reduce the spread of SARS-CoV-2, as does observational data for COVID-19 in an analysis of 194 countries that found a negative association between duration of a face mask or respirator policy and per-capita coronavirus-related mortality; in countries that did not recommend face masks and respirators, the per-capita coronavirus-related mortality increased each week by 54.3% after the index case, compared with 8.0% in those countries with masking policies (CT Leffler, Virginia Commonwealth University, unpublished data, 2020).§ Similar outcomes have been observed for other respiratory virus outbreaks, including the 2002–04 outbreak of Severe Acute Respiratory Syndrome

§ https://doi.org/10.1101/2020.05.22.20109231.

TABLE 2. Hair salon clients' (N = 104) responses to interview questions* about their interactions with two stylists with COVID-19 during salon appointments — Springfield, Missouri, May 12–20, 2020

Interview question	Response	No. (%)
Did you wear a face covering?	Yes, for the entire appointment	102 (98.1)
	Yes, for part of the appointment	2 (1.9)
	No, not at all	0 (—)
	Did not know	0 (—)
What type of face covering did you wear?	Cloth face covering	49 (47.1)
	Surgical mask	48 (46.1)
	N95 respirator†	5 (4.8)
	Did not know	2 (1.9)
	Did not answer question	0 (—)
Did the stylist wear a face covering?	Yes, for the entire appointment	101 (97.1)
	Yes, for part of the appointment	0 (—)
	No, not at all	0 (—)
	Did not know	3 (2.9)
What type of face covering did the stylist wear?	Cloth face covering	39 (37.5)
	Surgical mask	25 (24.0)
	N95 respirator	0 (—)
	Did not know	35 (33.7)
	Did not answer question	5 (4.8)
Did you have a respiratory illness in the past 90 days?	Yes	7 (6.7)
	No	87 (83.7)
	Did not know	1 (1.0)
	Did not answer the question	9 (8.7)

Abbreviation: COVID-19 = coronavirus disease 2019.
* All interviews were conducted via telephone by the Greene County Health Department.
† Particulate-filtering facepiece respirators that filter ≥95% of airborne particles (https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/n95list1.html).

(SARS) (*6*) and the 2007–08 influenza season (*7*). A systematic review on the efficacy of face coverings against respiratory viruses analyzed 19 randomized trials and concluded that use of face masks and respirators appeared to be protective in both health care and community settings (*8*).

The findings in this report are subject to at least four limitations. First, whereas the health department monitored all exposed clients for signs and symptoms of COVID-19, and no clients developed symptoms, only a subset was tested; thus, asymptomatic clients could have been missed. Similarly, with a viral incubation period of 2–14 days, any COVID-19 PCR tests obtained from clients too early in their course of infection could return false-negative results. To help mitigate this possibility, all exposed clients were offered testing on day 5 and were contacted daily to monitor for symptoms until day 14. Second, although the health department obtained supplementary data, no information was collected regarding underlying medical conditions or use of other personal protective measures, such as gloves and hand hygiene, which could have influenced risk for infection. Third, viral shedding is at its highest during the 2 to 3 days before symptom onset; any clients who interacted with the stylists before they became symptomatic were not recruited for contact tracing. Finally, the mode of interaction between stylist and client might have limited the potential for exposure to the virus. Services at salon A were limited to haircuts, facial hair trimmings, and perms. Most stylists cut hair while clients are facing away from them, which might have also limited transmission.

The results of this study can be used to inform public health policy during the COVID-19 pandemic. A policy mandating the use of face coverings was likely a contributing factor in preventing transmission of SARS-CoV-2 during the close-contact interactions between stylists and clients in salon A. Consistent and correct use of face coverings, when appropriate, is an important tool for minimizing spread of SARS-CoV-2 from presymptomatic, asymptomatic, and symptomatic persons. CDC recommends workplace policies regarding use of face coverings for employees and clients in addition to daily monitoring of signs and symptoms of employees, procedures for screening employees who arrive with or develop symptoms at work, and posted messages to inform and educate employees and clients (https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/businesses-employers.html).

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Factors Associated with Cloth Face Covering Use Among Adults During the COVID-19 Pandemic — United States, April and May 2020

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On April 3, 2020, the White House Coronavirus Task Force and CDC announced a new behavioral recommendation to help slow the spread of coronavirus disease 2019 (COVID-19) by encouraging the use of a cloth face covering when out in public (*1*). Widespread use of cloth face coverings has not been studied among the U.S. population, and therefore, little is known about encouraging the public to adopt this behavior. Immediately following the recommendation, an Internet survey sampled 503 adults during April 7–9 to assess their use of cloth face coverings and the behavioral and sociodemographic factors that might influence adherence to this recommendation. The same survey was administered 1 month later, during May 11–13, to another sample of 502 adults to assess changes in the prevalence estimates of use of cloth face coverings from April to May. Within days of the release of the first national recommendation for use of cloth face coverings, a majority of persons who reported leaving their home in the previous week reported using a cloth face covering (61.9%). Prevalence of use increased to 76.4% 1 month later, primarily associated with increases in use among non-Hispanic white persons (54.3% to 75.1%), persons aged ≥65 years (36.6% to 79.2%), and persons residing in the Midwest (43.7% to 73.8%). High rates were observed in April and by May, increased further among non-Hispanic black persons (74.4% to 82.3%), Hispanic or Latino persons (77.3% to 76.2%), non-Hispanic persons of other race (70.8% to 77.3%), persons aged 18–29 years (70.1% to 74.9%) and 30–39 years (73.9% to 84.4%), and persons residing in the Northeast (76.9% to 87.0%). The use of a cloth face covering was associated with theory-derived constructs that indicate a favorable attitude toward them, intention to use them, ability to use them, social support for using them, and beliefs that they offered protection for self, others, and the community. Research is needed to understand possible barriers to using cloth face coverings and ways to promote their consistent and correct use among those who have yet to adopt this behavior.

Survey questions were administered by Porter Novelli Public Services (PN) and ENGINE Insights through PN View 360,* a rapid turnaround survey that can be used to provide insights into behaviors of the public. During April 7–9, 2020, PN administered an Internet survey via an opt-in process to a sample of 503 U.S. adults aged ≥18 years using the Lucid platform (*2*); panel members who had not taken a survey in the previous 20 waves of survey administration were eligible to participate. The survey was administered again during May 11–13, 2020, to a separate sample of 502 adults. Quota sampling and statistical weighting were employed to make the panel representative of the U.S. population by sex, age, region, race/ethnicity, and education. Respondents were informed that their answers were being used for market research and they could refuse to answer any question at any time. No personally identifying information was included in the data file provided to CDC.† Data were obtained from 1,005 total participants, with the analysis focusing on the 839 participants who reported leaving their homes in the past week and therefore had an opportunity to wear a cloth face covering in public. Sensitivity analyses suggested that the composition of the samples of those who did and did not leave the home was comparable across points in time.

Participants were asked about their frequency of going out in public during the preceding week. Standard demographic questions were included to examine age, sex, race/ethnicity, U.S. Census region, current employment status, income level, home ownership status, and education level. Items reflecting theoretical constructs from well-established health behavior theories and models were included (*3*). Questions were asked to assess attitude toward the use of cloth face coverings, behavioral intention to use a cloth face covering, personal agency (i.e., ease and ability) around cloth face covering use, perceived susceptibility to infection with SARS-CoV-2 (the virus that causes COVID-19), perceived norms of cloth face covering use, and outcome expectations of wearing a cloth face covering. The survey asked about sources of information for use of cloth face coverings (e.g., health care providers, e-mail messages, and magazines). Items were measured using five-point Likert-type

* Porter Novelli and ENGINE Insights collaborate on the PN View 360 surveys (http://styles.porternovelli.com/pn-view-panels). ENGINE Insights applies data quality filters that are embedded in every survey automatically and are designed to prevent cheating or speeding.

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

scales ranging from 1 (never, not at all, not important, or strongly disagree) to 5 (always, completely, very important, or strongly agree) and binary scales (no or unchecked and yes or checked). Likert-type response items were dichotomized to assess agreement (strongly agree and agree versus neutral, disagree, and strongly disagree).

The outcome variable of interest was use of a cloth face covering, which was determined by the question "In the past week, when you have gone outside of your home for work, grocery shopping, or other activities that involved interacting with other people, how often did you wear a cloth face covering that covered your nose and mouth?" Cloth face covering use was defined by a response of always, often, or sometimes to this question. Participants were provided instructions that described the difference between a cloth face covering and paper disposable masks, surgical masks, dust masks, or other respirators.[§] All weighted bivariate and regression analyses were conducted using SAS software (version 9.4; SAS Institute).

Among the participants who left their home in the past 7 days, 61.9% reported using a cloth face covering in April, and this percentage increased to 76.4% in May (Table 1). Higher prevalence estimates of cloth face covering use were reported in May compared with April in all sociodemographic groups; the largest differences were reported among non-Hispanic white persons (54.3% to 75.1%), persons aged ≥65 years (36.6% to 79.2%), and persons residing in the Midwest (43.7% to 73.8%). High rates were observed in April and by May, increased further among black persons (74.4% to 82.3%), Hispanic or Latino persons (77.3% to 76.2%), non-Hispanic persons of other race (70.8% to 77.3%), persons aged 18–29 years (70.1% to 74.9%) and 30–39 years (73.9% to 84.4%), and persons residing in the Northeast (76.9% to 87.0%).

Measures of well-established theoretical antecedents of behavior were associated with cloth face covering use overall (Table 2). The prevalence estimates of positive attitude toward behavior (range = 77.9%–81.8%), behavioral intention (84.2%–85.3%), personal agency (78.0%–83.4%), perceived norms (81.5%–81.9%), and outcome expectations (74.4%–77.4%) were associated with cloth face covering use, after adjusting for age, sex, race/ethnicity, and region, and did not change significantly from April to May. Agreement with perceived susceptibility of becoming infected with SARS-CoV-2 among those who wore a cloth face covering in the past week was 81.8%. Persons who reported using cloth face coverings received information about cloth face coverings from a variety of sources. Among those who wore cloth face coverings in the previous week, the most common sources reported were newspapers (83.1%), health care providers (80.8%), and the radio (80.2%). No significant differences across information sources were found between April and May 2020.

Discussion

Days after announcing a new behavioral recommendation on April 3, adults in the United States quickly adopted the practice of using cloth face coverings, and a higher prevalence of use was reported 1 month later, in May 2020. From April to May, the prevalence of reported use of cloth face coverings was higher in all sociodemographic groups in the population, especially among non-Hispanic white persons, persons aged ≥65 years, and persons residing in the Midwest, suggesting widespread acceptance of this recommendation. The increase in cloth face covering use continued to be reported as more persons began leaving their homes and going out in public more frequently from April to May. These findings are consistent with those of other organizations assessing cloth face covering use following the announcement of this recommendation ¶,**,††,§§,¶¶,***,††† (*4*).

Public health authorities, including CDC, have asked persons living in the United States to engage in behaviors that are intended to reduce the risk for SARS-CoV-2 infection and slow the spread of COVID-19 (*1*). Use of cloth face coverings continues to be a recommendation (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html) while long-term prevention measures such as vaccines are being developed. The recommendation to use cloth face coverings was based on evidence suggesting that persons with COVID-19 can transmit the SARS-Cov-2 virus to others before they develop symptoms or have an asymptomatic infection (*5*,*6*). At the time of the initial recommendation, there were shortages of masks used by health care professionals and first responders (e.g., surgical masks and N95 respirators), so CDC stressed the use of cloth face coverings by the public. Over time, medical and nonmedical masks have become more available to health care workers and to the public.

§ "Most of the following questions are about the use of cloth face coverings during a viral outbreak or pandemic. Cloth face coverings, which cover a person's nose and mouth, are typically made of 100% cotton fabric and can be washed and worn over and over again. They are not the same as paper disposable masks, or surgical or N95 masks used by health care workers, or dust masks used in the construction industry."

¶ https://www.ipsos.com/en-us/news-polls/abc-news-coronavirus-poll.

** https://www.rti.org/sites/default/files/covid-19_webinar-series_week_1_masks_and_distancing.pdf?utm_campaign=SSES_SSES_ALL_LeadGen2020&utm_source=IntEmail&utm_medium=Email&utm_content=COVID19SurveyWebinar1PostReg.

†† https://www.kateto.net/COVID19%20CONSORTIUM%20REPORT%20April%202020.pdf.

§§ https://www.cbsnews.com/news/americans-differ-coronavirus-impact-cbs-news-poll.

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††† https://context-cdn.washingtonpost.com/notes/prod/default/documents/bab35974-526c-476f-89ce-8efe8508cb49/note/0b64d5b8-ad35-4ea0-a916-5dab2f070ec7.

TABLE 1. Cloth face covering use among adults aged ≥18 years who left the house in the past week (N = 839), by sex, race/ethnicity, age, region, employment status, income, home ownership, and education, by survey wave — Porter Novelli Internet survey, United States, April–May 2020

	Adults who left the house in past week and used cloth face covering			
	Survey wave			
	April 7–9, 2020 (n = 408)		May 11–13, 2020 (n = 431)	
Characteristic	No.	Weighted % (95% CI)	No.	Weighted % (95% CI)
Total	**255**	**61.9 (56.99–66.89)**	**338**	**76.4 (71.98–80.81)**
Sex				
Men	129	61.0 (54.03–68.09)	170	77.6 (71.19–84.00)
Women	126	62.8 (55.83–69.78)	168	75.3 (69.20–81.38)
Race/Ethnicity				
White, non-Hispanic	154	54.3 (48.11–60.41)	235	75.1 (69.86–80.44)
Black, non-Hispanic	35	74.4 (61.25–87.55)	40	82.3 (70.68–94.01)
Hispanic or Latino	40	77.3 (65.52–89.18)	43	76.2 (63.84–88.65)
Other race,* non-Hispanic	26	70.8 (53.63–87.92)	20	77.3 (59.12–95.54)
Age group (yrs)				
18–29	66	70.1 (60.53–79.75)	69	74.9 (64.71–85.17)
30–39	55	73.9 (63.42–84.49)	83	84.4 (76.37–92.47)
40–49	47	61.4 (49.47–73.31)	53	68.0 (56.02–79.99)
50–64	63	65.9 (56.34–75.55)	78	75.3 (66.60–84.06)
≥65	24	36.6 (24.48–48.64)	55	79.2 (69.17–89.15)
Census region				
Northeast	56	76.9 (66.99–86.92)	66	87.0 (78.28–95.81)
Midwest	34	43.7 (32.25–55.16)	68	73.8 (64.18–83.35)
South	99	62.4 (54.38–70.40)	118	71.0 (63.22–78.72)
West	66	65.2 (55.37–75.01)	86	80.1 (71.76–88.52)
Employment status				
Employed†	184	67.3 (61.35–73.17)	216	79.5 (74.16–84.80)
Not employed§	71	52.7 (44.06–61.38)	122	71.9 (64.46–79.42)
Income				
<$25,000	43	62.1 (50.36–73.76)	55	73.1 (62.71–83.42)
$25,000–$49,999	69	60.3 (50.96–69.65)	82	76.9 (68.07–85.71)
$50,000–$99,999	70	56.3 (46.96–65.75)	101	72.2 (64.08–80.29)
≥$100,000	73	71.3 (62.24–80.27)	100	84.8 (76.82–92.82)
Home ownership				
Own	174	66.0 (59.88–72.08)	202	79.2 (73.69–84.80)
Rent	67	59.0 (49.74–68.29)	110	78.1 (70.64–85.50)
Living with others at no cost	14	39.6 (22.33–56.91)	26	56.6 (40.42–72.75)
Education				
High school or less	78	62.1 (53.53–70.62)	98	71.5 (63.37–79.62)
Some college to bachelor's degree	123	58.8 (51.82–65.86)	180	79.5 (73.76–85.23)
Any postgraduate education	54	72.5 (61.71–83.32)	60	79.1 (68.84–89.33)

Abbreviation: CI = confidence interval.
* Other race includes responses of Native American/Alaska Native, Asian, and other; these were combined because of small sample size.
† Working fulltime, part time, or self-employed.
§ Student, homemaker, retired, or not currently employed.

Continuing to track the sociodemographic differences and behavioral influences of use of cloth face coverings and other face masks over time is important as communities continue to monitor cases, hospitalizations, and deaths and enhance prevention strategies. Public health authorities should continue to communicate clearly the importance of cloth face covering use, especially as evidence emerges about the effectiveness of different types of face coverings and masks for offering protection from infection to self, others, and the community (*7*,*8*). In addition, more research is needed among persons who do not wear cloth face coverings to understand barriers to their use.

The findings in this report are subject to at least five limitations. First, the cross-sectional opt-in survey design precludes the ability to make causal inferences about how sociodemographic and behavioral measures directly affect cloth face covering use. Internet surveys can vary in their quality and methodology (*9*); however, emerging research also identified similar rates of cloth face coverings in May using an independent Internet sample (*4*). Second, items developed for the

TABLE 2. Attitude, behavioral intention, personal agency, perceived susceptibility, perceived norms, outcome expectations, and information sources associated with cloth face covering use among adults who left the house in the past week, by construct and information source — Porter Novelli Internet survey, United States, April–May 2020

	Adults who left house in past week and used cloth face covering					
	Total (N = 593)		April 2020 (n = 255)		May 2020 (n = 338)	
Construct and information source*	No.	Weighted % (95% CI)	No.	Weighted % (95% CI)	No.	Weighted % (95% CI)
Attitude toward behavior						
It is important for me to wear a cloth face covering when I am out in public	487	81.8 (78.36–85.22)	213	75.3 (69.87–80.77)	274	87.8 (83.65–91.97)
It is important for everyone to wear a cloth face covering when they are out in public	493	79.5 (76.07–82.98)	213	71.3 (65.83–76.83)	280	87.3 (83.25–91.39)
I think it is a good idea for me to wear a cloth face covering while out in public	500	78.1 (74.61–81.66)	217	70.7 (65.26–76.13)	283	85.2 (80.81–89.68)
I think it is a good idea for everyone to wear a cloth face covering while out in public	487	77.9 (74.31–81.42)	217	70.7 (65.24–76.10)	270	85.1 (80.70–89.61)
Behavioral intention						
I intend to wear a cloth face covering when I go to public spaces	500	84.2 (81.01–87.44)	213	78.7 (73.38–84.02)	287	89.0 (85.23–92.73)
I plan to wear a cloth face covering every time I go out in a public space	482	85.3 (82.13–88.50)	212	79.7 (74.50–84.95)	270	90.5 (86.78–94.16)
Personal agency						
Wearing a cloth face covering while I am out in public is easy for me	434	83.4 (79.86–86.96)	191	78.6 (73.04–84.26)	243	87.7 (83.26–92.19)
I am able to wear a cloth face covering when I am out in public	510	78.0 (74.53–81.40)	216	70.0 (64.57–75.52)	294	85.2 (81.11–89.32)
Perceived susceptibility						
I think it is likely that I will become infected with COVID-19	179	81.8 (76.04–87.51)	74	74.4 (65.32–83.58)	105	88.1 (80.97–95.19)
Perceived norms						
People who are important to me want me to wear a cloth face covering when I am out in public	468	81.9 (78.41–85.45)	201	76.5 (70.95–82.06)	267	86.7 (82.26–91.09)
People who are important to me believe that I should wear a cloth face covering when I am out in public	474	81.5 (78.03–84.90)	196	74.2 (68.48–79.83)	278	87.6 (83.62–91.65)
Outcome expectations						
I would protect others from coronavirus if I wear a cloth face covering when out in public	481	76.8 (73.19–80.48)	212	69.5 (63.95–75.13)	269	83.9 (79.33–88.51)
I would protect myself from coronavirus if I wear a cloth face covering when out in public	433	77.4 (73.57–81.22)	185	69.2 (63.34–75.16)	248	85.1 (80.32–89.89)
Everyone wearing cloth face coverings while out in public would prevent the spread of coronavirus in our community	439	76.3 (72.48–80.11)	184	68.1 (62.16–74.05)	255	83.8 (79.05–88.54)
Wearing a cloth face covering while out in public would lessen the chance that I could unknowingly spread coronavirus to others	495	74.4 (71.82–78.02)	213	66.3 (60.81–71.74)	282	82.4 (77.81–86.96)
I can help stop the coronavirus outbreak in my community if I wear a cloth face covering while out in public	469	76.1 (72.40–79.82)	201	68.7 (63.03–74.40)	268	83.0 (78.28–87.76)
Sources of information about cloth face coverings						
TV	395	72.1 (68.05–76.08)	173	64.3 (58.27–70.31)	222	79.7 (74.48–84.91)
Internet	278	70.7 (65.84–75.54)	126	66.1 (59.08–73.15)	152	75.3 (68.69–82.01)
Social media	263	69.5 (64.35–74.64)	124	66.9 (59.58–74.13)	139	72.2 (64.90–79.52)
E-mail message	134	78.8 (71.81–85.78)	71	77.8 (68.21–87.40)	63	80.0 (69.80–90.22)
Newspapers	159	83.1 (77.32–88.82)	65	77.3 (67.89–86.71)	94	88.2 (81.45–95.03)
Grocery store	188	77.7 (71.90–83.47)	71	76.1 (66.80–85.45)	117	78.7 (71.26–86.05)
Radio	146	80.2 (73.79–86.62)	71	77.1 (67.75–86.45)	75	83.3 (74.48–92.09)
Health care provider	187	80.8 (75.05–86.54)	65	80.2 (70.79–89.56)	122	81.1 (73.86–88.43)

Abbreviations: CI = confidence interval; COVID-19 = coronavirus disease 2019.
* Likert-type response items were dichotomized to assess agreement (strongly agree and agree versus neutral, disagree, and strongly disagree).
† Adjusted for age, sex, race/ethnicity, and region.

Summary

What is already known about this topic?

On April 3, 2020, the White House Coronavirus Task Force and CDC recommended that persons wear a cloth face covering in public to slow the spread of COVID-19.

What is added by this report?

After the initial recommendation was released, high rates of cloth face covering use were reported in the United States. An increase in the rate of cloth face covering use was observed from April to May and was sustained, particularly among non-Hispanic blacks and other races, Hispanics, persons aged ≤39 years, and persons living in the Northeast.

What are the implications for public health practice?

Public health messages should target audiences not wearing cloth face coverings and reinforce positive attitudes, perceived norms, personal agency, and physical and health benefits of obtaining and wearing cloth face coverings consistently and correctly.

survey have not been used previously to assess use of cloth face coverings and require further study. Third, the use of masks that are not cloth face coverings (e.g., paper disposable masks, surgical masks, dust masks, or other respirators) was not assessed in this analysis. Fourth, the data were self-reported and might be subject to social desirability bias. Finally, this survey did not explore historical, religious, political, or cultural factors, or local mandates that might affect cloth face covering use.

These findings show higher prevalence estimates of the use of cloth face coverings in May 2020 compared with April among all sociodemographic groups. Research among persons who report not wearing a cloth face covering while in public is needed to understand potential barriers and to shape services or messages that would facilitate and encourage adoption of this recommendation. Among constructs known to influence behavior (e.g., attitude, behavioral intention, personal agency, perceived norms, and outcome expectations), there was strong agreement (>74%) among those who wore cloth face coverings. Based on behavioral associations, messages should be targeted to reach populations not wearing cloth face coverings to promote a positive attitude toward cloth face covering use, encourage social networks to be supportive of cloth face covering use, describe positive health outcomes expected from wearing a cloth face covering, and help persons feel confident in their ability to obtain and wear cloth face coverings consistently and correctly.

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Continuation of Mosquito Surveillance and Control During Public Health Emergencies and Natural Disasters

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Mosquitoborne disease outbreaks occur every year in the United States from one or more of the arboviral diseases dengue, West Nile, LaCrosse, Eastern equine encephalitis, and Zika (*1*). Public opinion communicated through traditional and social media and the Internet, competing public health and resource priorities, and local conditions can impede the ability of vector control organizations to prevent and respond to outbreaks of mosquitoborne disease. The Environmental Protection Agency (EPA) and CDC performed a coordinated review of the concerns and challenges associated with continuation of mosquito surveillance and control during public health emergencies and disasters. This report highlights the first joint recommendation from EPA and CDC. Mosquito surveillance and control should be maintained by state and local mosquito control organizations to the extent that local conditions and resources will allow during public health emergencies and natural disasters. Integrated pest management (IPM) is the best approach for mosquito control (*2*). IPM uses a combination of methods, including both physical and chemical means of control (*3*). For chemical means of control, CDC and EPA recommend the use of larvicides and adulticides following the EPA label. It is imperative that public health recommendations be followed to ensure the safety of the pesticide applicator and the public.

Background

Mosquito control and public health agency efforts in mosquito surveillance and abatement are critical for preventing mosquitoborne diseases and protecting public health including during public health emergencies and responses to natural disasters. Initiating or continuing the delivery of mosquito control and public health organization services are essential for protecting public health and mitigating mosquitoborne diseases. This includes the safe, timely, and judicious use of pesticides against adult mosquitoes (adulticides) and larval mosquitoes (larvicides), according to their EPA labels, as part of a comprehensive integrated control effort.

Methods

CDC and EPA performed a coordinated review of the concerns and challenges associated with continuation of mosquito surveillance and control during public health emergencies and disasters. CDC and EPA work closely together and with federal, state, tribal, local, and territorial organizations to protect the public from mosquitoborne diseases. CDC, in close collaboration with public health and mosquito control partners, monitors the potential sources of outbreaks of mosquitoborne diseases, and provides technical assistance for prevention and control activities. CDC/Agency for Toxic Substances and Disease Registry monitors exposures to pesticides in the U.S. population, provides information on health effects of certain pesticides, and responds to community concerns. EPA conducts rigorous scientific analyses to ensure that mosquito control and public health organizations have access to effective pesticides and mosquito control products that will not pose unreasonable risk for adverse effects to human health or the environment when used according to the label.

Rationale and Evidence

Mosquitoborne diseases can pose threats to communities amid public health emergencies or following a natural disaster (e.g., flooding, fires, and hurricanes). To mitigate mosquitoborne disease threats, it is critical that mosquito control and public health organizations continue their surveillance and control programs to the extent that local conditions and resources will allow. A reduction of mosquito surveillance and control efforts can result in increased rates of mosquitoborne illness, and a lapse in services can reduce the efficacy of control strategies after they are reinstituted. For example, properly planning and implementing control strategies to interrupt the mosquito lifecycle require ongoing surveillance, and monitoring can also inform appropriate timing of the application of adulticides and larvicides.

State, tribal, local, and territorial public health and mosquito control organizations play a critical role in protecting the public from mosquitoborne diseases. They serve on the front lines, providing information through their outreach programs to the human and environmental surveillance networks that first identify possible human illness outbreaks and emerging risk. They also manage the mosquito control programs that carry out prevention, public education, and mosquito surveillance and control. These organizations determine whether the use of pesticides for mosquito control is appropriate for their area.

CDC and EPA recommend IPM as the best approach for mosquito control (*2*). IPM uses a combination of methods and can include both physical and chemical means of control

(*3*). CDC and EPA recognize a need for use of adulticides and larvicides as a component of IPM. This is especially true during periods of mosquitoborne disease transmission.

Before a pesticide can be sold or distributed in the United States, it must be registered (licensed) by EPA to ensure that it meets federal safety standards to protect human health and the environment. By law, EPA registration means that the agency has determined a mosquito control pesticide product, when used according to label instructions, can perform its intended function without unreasonable risk to persons or the environment.

When evaluating pesticides, including those for mosquito control, EPA assesses a wide variety of data (e.g., potential long and short-term toxicity, carcinogenic, reproductive and developmental effects, exposure modeling, environmental fate, etc.) to estimate potential risk to persons and the environment from proposed use of the product. Many plant and wildlife species can be found in or near areas where mosquito control pesticides are used, including cities, agricultural fields, and recreational areas, so EPA considers risks in all these areas.

EPA's risk assessments evaluate the potential for harm to adults and children, considering special populations (such as a pregnant woman and her fetus, immunocompromised persons, the elderly, and others) as well as nontarget wildlife, fish, and plants (including endangered species). EPA also assesses the potential for contamination of surface water or ground water from leaching, runoff, and spray drift and how this might affect the long and short-term health of humans and wildlife in the area. When assessing risks from pesticides, the amount of a substance a person or nontarget organism is exposed to is as important as the toxicity of the pesticide. This concept is critical when analyzing the risks from mosquito control pesticides.

Many mosquito adulticides are applied as ultra-low volume (ULV) sprays in very small amounts. ULV sprayers dispense extremely small droplets using precision equipment that must be calibrated annually or more frequently depending on state requirements. A typical ULV adulticide, for example, is applied in droplets of 80 microns or less, which means hundreds of thousands of droplets could fit inside something as small as a pea. Common mosquito adulticides degrade quickly and do not have a residual effect (*4*,*5*). When released from an airplane, these tiny droplets are intended to stay airborne and drift through an area above the ground, killing the mosquitoes in the air on contact. As soon as the pesticide is released from the airplane's nozzle, it begins to degrade, minimizing potential risk for nontarget exposures, including those to humans or the environment.

In cases where the risk assessment reveals potential adverse impacts on humans or the environment, EPA works with the pesticide registrants and users to find ways to reduce the risk. For mosquito control products, the risk might be lowered by such measures as reducing the application rate, increasing the release-height for aircraft, placing limits on usage under certain weather conditions (such as high wind speeds or temperature inversions), and tightly controlling the droplet size, among others.

Summary

What is already known about this topic?

Mosquito surveillance and control programs, established throughout the continental United States, provide data to support timely and effective mosquito control actions to reduce mosquitoes and the risk of mosquitoborne disease.

What is added by this report?

This is the first published policy report by CDC and the Environmental Protection Agency (EPA) to recommend the continuation of mosquito control surveillance and control during nonmosquito-related public health emergencies and natural disasters and to support the use of larvicides and adulticides following the EPA label instructions.

What are the implications for public health practice?

The recommendations support continuation of mosquito control operations and use of resources to monitor and manage mosquitoes when there are competing priorities.

EPA manages the risks of pesticides through its approval of a pesticide's label, requiring use directions and precautions to ensure that the pesticide is only used in a manner that does not cause unreasonable adverse effects. The label language is carefully crafted to ensure that the directions for use and safety measures are appropriate to any potential risk and can be enforced by law. Following label directions is required by law and is necessary to ensure that the use does not cause unreasonable adverse effects.

The decision to perform mosquito control, whether using adulticides or larvicides, should be 1) based on evidence (e.g., increasing virus infection rates in mosquitoes, sentinel animal infections, human cases, increasing mosquito abundance beyond acceptable levels as described by the Federal Emergency Management Agency (*6*) and defined by states); 2) made by professionals trained and certified in the safe handling, storage and application of pesticides; 3) applied using equipment that is properly calibrated; 4) timed to coincide with mosquito activity and minimize exposure to nontargets; and 5) applied strictly following the EPA-approved label. Before mosquito control applications, there should be an assessment of efficacy and resistance to the product. A postapplication evaluation of the efficacy of the application should also be performed. Public notification requirements vary; however, consideration might be given to notifying the public of scheduled pesticide applications and providing information about the pesticide product.

Policy

CDC and EPA strongly recommend the continuation of mosquito surveillance and IPM-based control in the United States during mosquitoborne disease outbreaks, nonmosquito-related public health emergencies, and natural disasters. CDC supports EPA's science-based review of mosquito control adulticides and larvicides for registration and use in the United States that ensures, when applied following the EPA label, that these pesticides will not cause unreasonable adverse effects and will benefit human health.

Discussion

This joint CDC-EPA statement supports mosquito control and public health organizations in planning, performing, and maintaining continuity of mosquito surveillance and control activities, and the use of EPA-registered adulticides and larvicides, under normal and emergency situations. The position should remain in effect during public health emergencies as well as during other unusual circumstances, natural disasters, and mosquitoborne disease outbreaks, and under the condition that other federal or jurisdictional guidance might be in place that should be incorporated into planning and operations.

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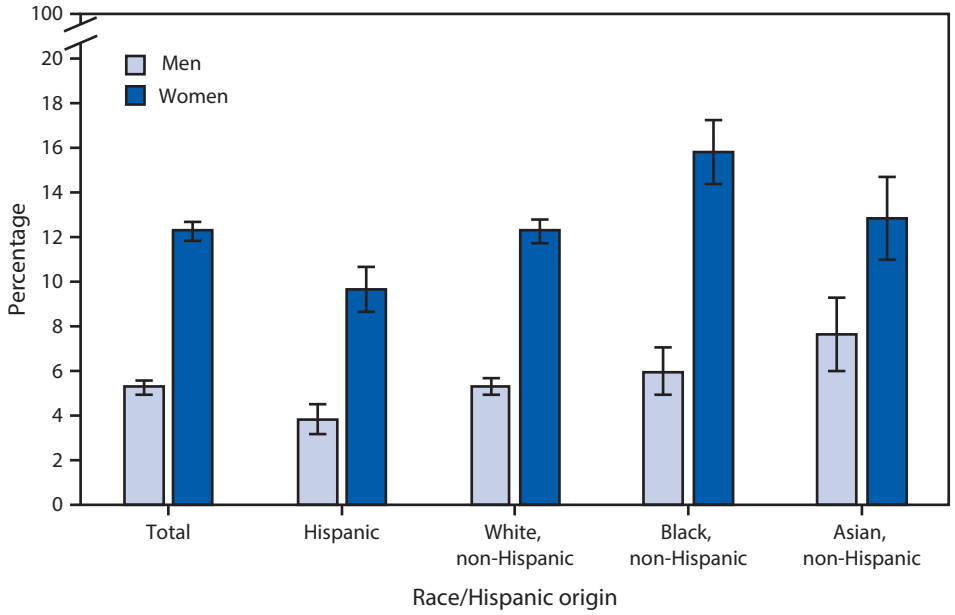
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Who Volunteered or Worked in a Hospital, Medical Clinic, Doctor's Office, Dentist's Office, Nursing Home, or Some Other Health Care Facility,† by Sex, Race, and Hispanic Origin§ — National Health Interview Survey, United States, 2016–2018¶



* With 95% confidence intervals shown with error bars.
† Based on responses to the question "Do you currently volunteer or work in a hospital, medical clinic, doctor's office, dentist's office, nursing home, or some other health-care facility? This includes emergency responders and public safety personnel, part-time and unpaid work in a health care facility as well as professional nursing care provided in the home. [This includes non-health care professionals, such as administrative staff, who work in a health-care facility.]"
§ Refers to persons who are of Hispanic or Latino origin and may be of any race or combination of races. "Non-Hispanic" refers to persons who are not of Hispanic or Latino origin, regardless of race.
¶ Estimates were based on household interviews of a sample of the noninstitutionalized U.S. civilian population and are derived from the National Health Interview Survey Sample Adult component.

During 2016–2018, women aged ≥18 years were more likely to volunteer or work in a hospital, medical clinic, doctor's office, dentist's office, nursing home, or some other health care facility (health care settings) than were men (12.3% compared with 5.2%). Non-Hispanic black (15.8%), Asian (12.8%), and white women (12.3%) were more likely to volunteer or work in health care settings than were Hispanic women (9.6%). Non-Hispanic Asian men (7.6%) were more likely to volunteer or work in health care settings than were black (6.0%), white (5.3%), and Hispanic men (3.8%).

Source: National Health Interview Survey, 2016–2018 data. https://www.cdc.gov/nchs/nhis.htm.

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