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Vital Signs: Characteristics of Drug Overdose Deaths Involving Opioids and Stimulants — 24 States and the District of Columbia, January–June 2019

Julie O'Donnell, PhD[1]; R. Matt Gladden, PhD[1]; Christine L. Mattson, PhD[1]; Calli T. Hunter, MPH[1]; Nicole L. Davis, PhD[1]

Abstract

Introduction: Provisional estimates indicate that drug overdose deaths increased in 2019 after a slight decrease in 2018. In 2018, overdose deaths primarily involved opioids, with continued increases in deaths involving illicitly manufactured fentanyls (IMFs). Deaths involving stimulants such as cocaine and methamphetamine are also increasing, mainly in combination with opioids.

Methods: CDC analyzed data on drug overdose deaths during January–June 2019 from 24 states and the District of Columbia (DC) in the State Unintentional Drug Overdose Reporting System to describe characteristics and circumstances of opioid- and stimulant-involved overdose deaths.

Results: Among 16,236 drug overdose deaths in 24 states and DC, 7,936 (48.9%) involved opioids without stimulants, 5,301 (32.6%) involved opioids and stimulants, 2,056 (12.7%) involved stimulants without opioids, and 943 (5.8%) involved neither opioids nor stimulants. Approximately 80% of overdose deaths involved one or more opioid, and IMFs were involved in three of four opioid-involved overdose deaths. IMFs, heroin, cocaine, or methamphetamine (alone or in combination) were involved in 83.8% of overdose deaths. More than three in five (62.7%) overdose deaths had documentation of at least one potential opportunity for overdose prevention intervention.

Conclusions and implications for public health practice: Identifying opportunities to intervene before an overdose death and implementing evidence-based prevention policies, programs, and practices could save lives. Strategies should address characteristics of overdoses involving IMFs, such as rapid overdose progression, as well as opioid and stimulant co-involvement. These efforts should be complemented by efforts to prevent initiation of prescription opioid and stimulant misuse and illicit drug use.

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Introduction

Provisional estimates indicate that drug overdose deaths (overdose deaths) increased in 2019 after a slight decrease from 2017 to 2018 (*1*,*2*).* Approximately two thirds of overdose deaths in 2018 involved an opioid, but the opioid types and combinations contributing to deaths are changing (*1*–*3*). For example, although overdose deaths involving prescription opioids and heroin decreased from 2017 to 2018, those involving synthetic opioids excluding methadone (primarily illicitly manufactured fentanyl [IMF]) and co-involving stimulants increased (*2*,*3*). Deaths co-involving cocaine and IMF, and involving psychostimulants with abuse potential (e.g., methamphetamine) with and without opioids have driven recent increases in stimulant-involved overdose deaths (*3*,*4*). The specific drugs and drug combinations involved in overdose deaths have implications for substance use disorder treatment regimens and outcomes, overdose prevention strategies (e.g., avoidance of using drugs when alone) (*5*), and overdose response (e.g., stimulant use can affect the response to administered naloxone) (*6*).

Targeting common fatal overdose circumstances with effective and promising public health interventions can prevent deaths (*7*). Examples include treating underlying substance use disorder (*8*), targeting important touchpoints to facilitate linkage to treatment (e.g., during treatment for a nonfatal drug overdose or upon release from incarceration) (*9*,*10*), providing mental health treatment (*11*), and expanding community naloxone distribution (*12*).

This report describes decedent demographic characteristics and circumstances surrounding overdose deaths during January–June 2019 among 25 jurisdictions participating in CDC's State Unintentional Drug Overdose Reporting System (SUDORS),† and it highlights the involvement of opioids and stimulants, separately and in combination.

Methods

Twenty-one jurisdictions participating in SUDORS reported all unintentional and undetermined intent overdose deaths that occurred during January–June 2019; four additional states reported overdose deaths in a subset of counties.§,¶ Jurisdictions abstract data from death certificates and medical examiner/coroner reports, including death scene investigation findings and all drugs detected by postmortem toxicology testing. Detected drugs were classified as involved in (i.e., contributing to) overdose deaths if the medical examiner/coroner

* https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm.

† SUDORS began in 2016 as part of CDC's Enhanced State Opioid Overdose Surveillance (ESOOS) program, which funded 12 states, with an additional 20 states and the District of Columbia (DC) funded in 2017 to abstract data on opioid overdose deaths. In 2019, SUDORS expanded to collect data on all drug overdose deaths from 47 states and DC (collectively referred to as jurisdictions) as part of CDC's Overdose Data to Action (OD2A) program. https://www.cdc.gov/drugoverdose/od2a/index.html.

§ Alaska, Connecticut, DC, Delaware, Georgia, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, North Carolina, Ohio, Oklahoma, Rhode Island, Tennessee, Utah, Vermont, West Virginia, and Wisconsin reported data on all overdose deaths within the jurisdiction. Illinois, Indiana, Pennsylvania, and Washington reported data from a subset of counties that accounted for 86.6%–88.7% of all unintentional and undetermined intent drug overdose deaths in those states in 2017 (SUDORS funding requirement was to report data from counties accounting for ≥75% of the drug overdose deaths in the state in 2017, the most recent year of statewide data available at the time of funding).

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listed them as causing death on the death certificate or in the medical examiner/coroner report.**

Overdose deaths were grouped by opioid and stimulant involvement into four mutually exclusive categories: 1) opioids without stimulants, 2) opioids and stimulants, 3) stimulants without opioids, and 4) neither opioids nor stimulants. Also, overdose deaths were grouped into the 10 most frequently occurring mutually exclusive combinations of opioid type or types (illicitly manufactured fentanyls†† [referred to as IMFs, which include fentanyl and fentanyl analogs], heroin,§§ prescription opioids,¶¶ other illicit synthetic opioids [e.g., U-47700]), and stimulant type or types (cocaine, methamphetamine, other illicit stimulants [e.g., MDMA], and prescription stimulants***). Overdose death combinations included deaths involving one drug type (e.g., involving IMFs without other opioid or stimulant involvement) and deaths involving two or more types (e.g., co-involved IMFs and cocaine), but did not reflect nonopioid, nonstimulant drug involvement (e.g., benzodiazepines). The following potential intervention opportunities (per evidence††† in the medical examiner/coroner report) were assessed: 1) recent institutional release (<1 month),§§§ 2) previous nonfatal overdose, 3) mental health diagnosis, 4) ever having been treated for substance use disorder, 5) bystander present when fatal overdose occurred, and 6) fatal drug use witnessed.

Frequencies and percentages of decedent demographics, overdose location,¶¶¶ geographic region**** of the jurisdictions, and potential opportunities for intervention were stratified by opioid/stimulant involvement. Pairwise chi-squared testing was used to detect statistically significant differences ($p<0.01$) among percentages. Because of the potential for incomplete data, the analysis of potential opportunities for intervention only included deaths with overdose-specific circumstances noted in the medical examiner/coroner report (15,295; 94.2% of overdose deaths). Analyses were conducted using SAS statistical software (version 9.4; SAS Institute).

Results

Twenty-five jurisdictions reported 16,236 overdose deaths during January–June 2019. Among these, 7,936 (48.9%) involved opioids without stimulants, 5,301 (32.6%) involved opioids and stimulants, 2,056 (12.7%) involved stimulants without opioids, and 943 (5.8%) involved neither opioids nor stimulants (Table). In all regions, overdose deaths involving opioids without stimulants were most common (36.9%–54.1%), followed by deaths involving opioids and stimulants (30.6%–33.8%), then deaths involving stimulants without opioids (7.4%–27.1%) (Figure 1). This pattern was most prominent in Northeastern and Midwestern jurisdictions, where deaths involving opioids (with or without stimulants) accounted for 87.6% and 83.0%, respectively, of all overdose deaths.

¶ Data are reported to SUDORS in half-year increments (January–June and July–December) based on when deaths occurred. Jurisdictions that participated in SUDORS under ESOOS (32 states and DC) were eligible to report data for deaths that occurred during January–June 2019. Twenty-five of the 33 jurisdictions eligible to report data for that period submitted complete data at the time of analysis and were included in this report. Data for this report were downloaded on July 7, 2020, and might differ from other reports because death data might be updated over time, and SUDORS supplements death certificate data with medical examiner/coroner reports.

** When the cause of death indicated multiple drugs were involved but did not indicate specific drugs, all drugs detected by postmortem toxicology testing were classified as involved in the drug overdose death. For example, if the cause of death was "multidrug overdose" and toxicology results were positive for five drugs, all five were classified as involved.

†† Fentanyl was classified as likely illicitly manufactured or likely prescription using toxicology, scene, and witness evidence. In the absence of sufficient evidence to classify fentanyl as illicit or prescription (<7% of deaths involving fentanyl), it was classified as illicit because the vast majority of fentanyl overdose deaths involve illicit fentanyl. With few exceptions, fentanyl analogs are considered illicit because they do not have a legitimate medical use in humans. The three fentanyl analogs with legitimate human medical use are alfentanil, remifentanil, and sufentanil. Fewer than 10 deaths involved any of these three analogs, and they were classified as prescription opioids rather than illicit fentanyl. All other fentanyl analogs were included in the category of illicitly manufactured fentanyls.

§§ If morphine was detected along with 6-acetylmorphine (a metabolite of heroin indicating heroin use), it was classified as heroin. Detection of morphine in the absence of 6-acetylmorphine was classified as likely heroin using toxicology evidence of heroin impurities or other illicit drugs detected or scene or witness evidence that indicated injection drug use, illicit drug use, or a history of heroin use.

¶¶ Drugs coded as prescription opioids were alfentanil, buprenorphine, codeine, dextrorphan, hydrocodone, hydromorphone, levorphanol, loperamide, meperidine, methadone, morphine, noscapine, oxycodone, oxymorphone, pentazocine, prescription fentanyl, propoxyphene, remifentanil, sufentanil, tapentadol, and tramadol. Also included as prescription opioids were brand names (e.g., Opana) and metabolites (e.g., nortramadol) of these drugs and combinations of these drugs and nonopioids (e.g., acetaminophen-oxycodone). Morphine was included as prescription only if scene or witness evidence did not indicate likely heroin use, and if 6-acetylmorphine was not also detected.

*** Drugs coded as prescription stimulants were amphetamine (in the absence of methamphetamine), atomoxetine, ephedrine, and methylphenidate.

††† Reported evidence of decedent and overdose characteristics in SUDORS is likely an underestimation of the true prevalence of those characteristics because SUDORS uses information from medical examiner/coroner reports, which are completed for death investigations, not specifically for SUDORS, and therefore might not reflect all information about the deaths or decedents.

§§§ Release within the month before death from institutional settings, such as prisons/jails, residential treatment facilities, and psychiatric hospitals.

¶¶¶ This is the location where the overdose occurred such as decedent's home, the home of a person other than the decedent, or a motor vehicle.

**** Jurisdictions were grouped as Midwestern (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin), Northeastern (Connecticut, Maine, Massachusetts, New Jersey, Pennsylvania, Rhode Island, Vermont), Southern (DC, Delaware, Georgia, Kentucky, North Carolina, Oklahoma, Tennessee, West Virginia), or Western (Alaska, Nevada, Utah, Washington), according to U.S. Census region groupings. This report includes 50% of jurisdictions in the Midwest region, 78% of those in the Northeastern region, 47% of those in the Southern region, and 31% of those in the Western region, so groupings should not be interpreted as fully representative of the corresponding Census regions.

TABLE. Demographic characteristics of decedents, location of overdose, and drug type involved in drug overdose deaths, by opioid/stimulant involvement — State Unintentional Drug Overdose Reporting System (SUDORS), 25 jurisdictions, January–June 2019

Characteristic	No. (%)				
		Categories of opioid/stimulant involvement			
	All drug overdose deaths	Opioids/ No stimulants	Opioids/ Stimulants	Stimulants/ No opioids	No opioids or stimulants
No. (%) of all overdose deaths	16,236 (100)	7,936 (48.9)	5,301 (32.6)	2,056 (12.7)	943 (5.8)
Sex[*,†]					
Male	11,117 (68.5)	5,487 (69.1)	3,652 (68.9)	1,482 (72.1)	496 (52.6)
Female	5,118 (31.5)	2,448 (30.9)	1,649 (31.1)	574 (27.9)	447 (47.4)
Race/Ethnicity[*,§]					
White, non-Hispanic	12,104 (75.2)	6,180 (78.5)	3,825 (72.7)	1,318 (65.2)	781 (83.3)
Black, non-Hispanic	2,553 (15.9)	1,002 (12.7)	945 (18.0)	507 (25.1)	99 (10.6)
Other, non-Hispanic	359 (2.2)	144 (1.8)	118 (2.2)	79 (3.9)	18 (1.9)
Hispanic	1,076 (6.7)	545 (6.9)	373 (7.1)	118 (5.8)	40 (4.3)
Age group, yrs[*,§]					
<15	19 (0.1)	—[¶]	—[¶]	—[¶]	—[¶]
15–24	930 (5.7)	530 (6.7)	293 (5.5)	63 (3.1)	44 (4.7)
25–34	4,017 (24.7)	2,079 (26.2)	1,491 (28.1)	286 (13.9)	161 (17.1)
35–44	4,112 (25.3)	1,960 (24.7)	1,529 (28.8)	421 (20.5)	202 (21.4)
45–54	3,585 (22.1)	1,656 (20.9)	1,136 (21.4)	579 (28.2)	214 (22.7)
55–64	2,871 (17.7)	1,364 (17.2)	733 (13.8)	566 (27.5)	209 (22.2)
≥65	701 (4.3)	336 (4.3)	115 (2.2)	141 (6.9)	109 (11.6)
Location of overdose[*,§]					
Any home setting	12,705 (82.4)	6,484 (85.0)	4,052 (79.9)	1,506 (78.3)	663 (84.2)
Decedent's own home	9,779 (63.5)	5,198 (68.1)	2,893 (57.1)	1,156 (60.1)	532 (67.6)
Home setting but not decedent's home	2,926 (19.0)	1,286 (16.9)	1,159 (22.9)	350 (18.2)	131 (16.6)
Any nonhome setting	2,705 (17.6)	1,145 (15.0)	1,018 (20.1)	418 (21.7)	124 (15.8)
Hotel/Motel	711 (4.6)	265 (3.5)	344 (6.8)	77 (4.0)	25 (3.2)
Motor vehicle	423 (2.7)	186 (2.4)	160 (3.2)	66 (3.4)	12 (1.5)
Supervised residential facility	220 (1.4)	145 (1.9)	53 (1.0)	12 (0.6)	11 (1.4)
Other	1,351 (8.8)	549 (7.2)	461 (9.1)	263 (13.7)	78 (9.9)
Evidence of route of drug use[*,**]					
Injection[§]	4,212 (27.3)	2,138 (28.1)	1,782 (34.8)	246 (12.6)	46 (6.3)
Smoking[††]	1,415 (9.2)	385 (5.1)	753 (14.7)	255 (13.0)	22 (3.0)
Ingestion[§§]	2,267 (14.7)	1,265 (16.6)	616 (12.0)	208 (10.6)	178 (24.3)
Snorting/Sniffing[†]	1,651 (10.7)	875 (11.5)	639 (12.5)	120 (6.1)	17 (2.3)
Other route	107 (0.7)	—[¶]	—[¶]	—[¶]	—[¶]
No information about route[¶¶]	7,724 (50.1)	3,707 (48.7)	2,222 (43.4)	1,298 (66.4)	498 (67.9)

See table footnotes on the next page.

More than two thirds (68.5%) of decedents were male, and three quarters (75.2%) were non-Hispanic White (Table). Among overdose deaths involving opioids (with and without stimulants), most decedents (53.3%) were aged 25–44 years; among overdose deaths involving stimulants without opioids, most decedents (55.7%) were aged 45–64 years. Evidence of injection drug use[††††] was more common among opioid-involved deaths than among deaths that did not involve opioids.

Most overdose deaths (83.8%) involved one or more of four illicit drugs (IMFs [61.5%], cocaine [28.3%], heroin [28.2%], or methamphetamine [17.6%]) (Table); nearly one half (49.8%) of these deaths involved two or more of those drugs. IMFs were involved in 80.4% of opioid overdose deaths with stimulants and in 72.2% without stimulants. Heroin was involved in 34.6% of opioid overdose deaths, and 73.6% of heroin overdose deaths co-involved IMFs (data not shown). Either cocaine or methamphetamine was involved in nearly all stimulant overdose deaths (96.2% with opioids, 97.5% without). Prescription opioids were involved more often in deaths involving opioids without stimulants (30.7%) than in those with stimulants (17.2%).

The 10 most frequently occurring opioid and stimulant combinations accounted for 76.9% of overdose deaths (Figure 2). Six drug combinations, including the three most common, involved IMFs and 1) no other opioid or stimulant (19.8% of deaths), 2) cocaine (10.5%), 3) heroin (10.3%), 4) heroin and cocaine (5.1%), 5) methamphetamine (3.7%),

[††††] Route of drug use is likely underestimated, because physical evidence varies among routes (e.g., syringes/needles as evidence of injection and pipes as evidence of smoking) and can be subject to scene-cleaning by bystanders before death investigations. High percentages of deaths with no information about route of drug use result from lack of physical or witness evidence, lack of documentation of evidence, or data entry error.

TABLE. (*Continued*) Demographic characteristics of decedents, location of overdose, and drug type involved in drug overdose deaths, by opioid/stimulant involvement — State Unintentional Drug Overdose Reporting System (SUDORS), 25 jurisdictions, January–June 2019

Characteristic	No. (%)				
	All drug overdose deaths	Categories of opioid/stimulant involvement			
		Opioids/ No stimulants	Opioids/ Stimulants	Stimulants/ No opioids	No opioids or stimulants
Opioid involvement* **					
Any opioids	13,237 (81.5)	7,936 (100.0)	5,301 (100.0)	N/A	N/A
IMFs§	9,988 (61.5)	5,727 (72.2)	4,261 (80.4)	N/A	N/A
Heroin§	4,579 (28.2)	2,606 (32.8)	1,973 (37.2)	N/A	N/A
Prescription opioids§	3,354 (20.7)	2,440 (30.7)	914 (17.2)	N/A	N/A
Other illicit synthetic opioids§	12 (0.1)	—¶	—¶	N/A	N/A
Stimulant involvement* **					
Any stimulants	7,357 (45.3)	N/A	5,301 (100.0)	2,056 (100.0)	N/A
Cocaine§	4,598 (28.3)	N/A	3,633 (68.5)	965 (46.9)	N/A
Methamphetamine§	2,857 (17.6)	N/A	1,766 (33.3)	1,091 (53.1)	N/A
Prescription stimulants§	329 (2.0)	N/A	272 (5.1)	57 (2.8)	N/A
Other illicit stimulants†††	69 (0.4)	N/A	46 (0.9)	23 (1.1)	N/A
Involvement of common illicit drugs (IMFs, heroin, cocaine, and methamphetamine)					
IMFs or heroin§	11,197 (69.0)	6,351 (80.0)	4,846 (91.4)	N/A	N/A
Cocaine or methamphetamine§	7,106 (43.8)	N/A	5,101 (96.2)	2,005 (97.5)	N/A
IMFs, heroin, cocaine, or methamphetamine§	13,605 (83.8)	6,351 (80.0)	5,249 (99.0)	2,005 (97.5)	N/A
1 of these 4 drugs involved§	6,824 (50.2)	4,369 (68.8)	501 (9.5)	1,954 (97.5)	N/A
2 or more of the 4 drugs involved§	6,781 (49.8)	1,982 (31.2)	4,748 (90.5)	51 (2.5)	N/A

Abbreviations: IMFs = illicitly manufactured fentanyls; N/A = not applicable.

* Numbers might not sum to the overall totals because of missing values excluded (sex: 1 missing value; race/ethnicity: 144 missing values; age group: 1 missing value; location of overdose: 826 missing values); percentages might not sum to 100% because of rounding or because routes of drug use are not mutually exclusive.

† Pairwise chi-squared testing found statistically significant differences ($p<0.01$) for all comparisons except opioid/no stimulant versus opioid/stimulant.

§ Pairwise chi-squared testing found statistically significant differences ($p<0.01$) for all comparisons.

¶ Data suppressed because cell contained fewer than 10 deaths or to prevent calculation of another suppressed cell.

** Sample limited to deaths for which the medical examiner/coroner report was available and at least one overdose-specific circumstance field was abstracted. N = 15,415 (94.9% of the total 16,236 sample).

†† Pairwise chi-squared testing found statistically significant differences ($p<0.01$) for all comparisons except opioid/no stimulant versus no opioid/no stimulant and stimulant/opioid versus stimulant/no opioid.

§§ Pairwise chi-squared testing found statistically significant differences ($p<0.01$) for all comparisons except stimulant/opioid versus stimulant/no opioid.

¶¶ Pairwise chi-squared testing found statistically significant differences ($p<0.01$) for all comparisons except stimulant/no opioid versus no opioid/no stimulant.

*** Specific opioids and stimulants listed are not mutually exclusive, so percentages will not sum to 100%. Of the deaths involving any opioid, 171 were not classified into one of the listed opioid types because of lack of specificity.

††† Pairwise chi-squared testing found no statistically significant differences ($p<0.01$) for stimulant/opioid versus stimulant/no opioid comparison.

and 6) prescription opioids (3.3%). Deaths without IMFs involved a single opioid without other opioids or stimulants (only prescription opioids [9.2%], only heroin [3.2%]) or a single stimulant without other opioids or stimulants (only methamphetamine [6.3%], only cocaine [5.5%]).

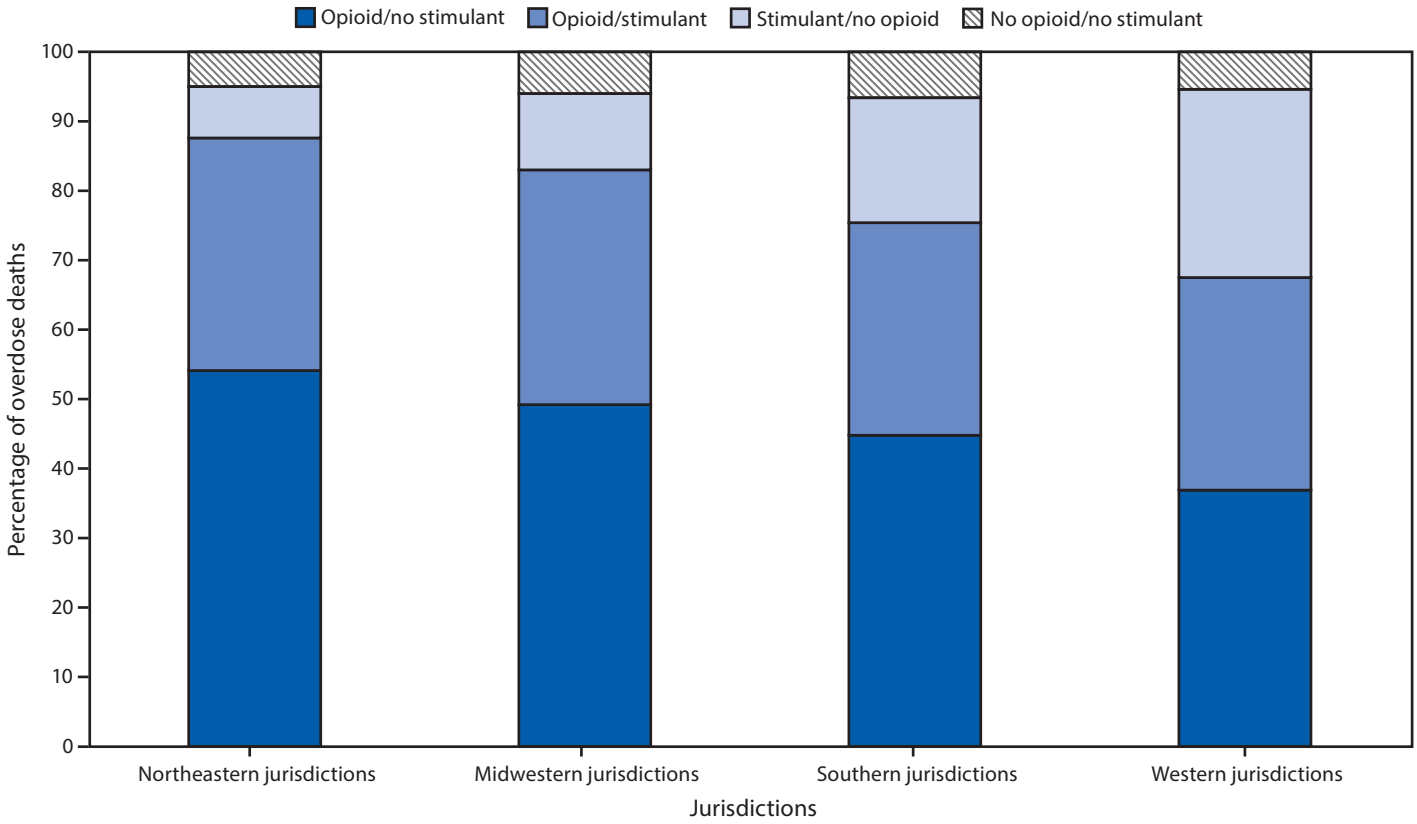
More than three in five overdose deaths (62.7%) had evidence of at least one potential opportunity for intervention (Figure 3). Approximately one in ten opioid overdose deaths had evidence of past-month institutional release (10.7% with stimulants; 10.8% without stimulants) or previous overdose (10.9%; 12.1%). Mental health diagnoses were documented for one quarter (25.8%) of overdose deaths. Evidence of current or past substance use disorder treatment was more common among opioid overdose deaths (18.6% with stimulants; 19.1% without stimulants) than nonopioid overdose deaths (<10%). Among overdose deaths, 37% occurred with a bystander present.

Discussion

This report provides three critical insights that can inform overdose prevention efforts. First, approximately 80% of overdose deaths involved opioids, and three of four opioid overdose deaths involved IMFs. The supply of IMFs and overdose deaths involving synthetic opioids excluding methadone (primarily IMFs) are projected to have increased for the seventh straight year in 2019 (*1*).[§§§§] Second, IMFs, heroin, cocaine, or methamphetamine (alone or in combination) were involved in nearly 85% of overdose deaths. Complicating intervention and treatment efforts, one half of these deaths involved two or more of these four drugs. Third, potential opportunities for intervention, which could be targeted for overdose prevention, were documented in approximately 60% of overdose deaths.

[§§§§] https://www.nflis.deadiversion.usdoj.gov/DesktopModules/ReportDownloads/Reports/13408NFLISDrugMidYear2019.pdf; https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm.

FIGURE 1. Distribution of opioid/stimulant involvement in drug overdose deaths, by geographic region* — State Unintentional Drug Overdose Reporting System (SUDORS), 25 jurisdictions, January–June 2019†



* *Midwestern:* Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Northeastern:* Connecticut, Maine, Massachusetts, New Jersey, Pennsylvania, Rhode Island, and Vermont; *Southern:* Delaware, District of Columbia, Georgia, Kentucky, North Carolina, Oklahoma, Tennessee, and West Virginia; *Western:* Alaska, Nevada, Utah, and Washington.

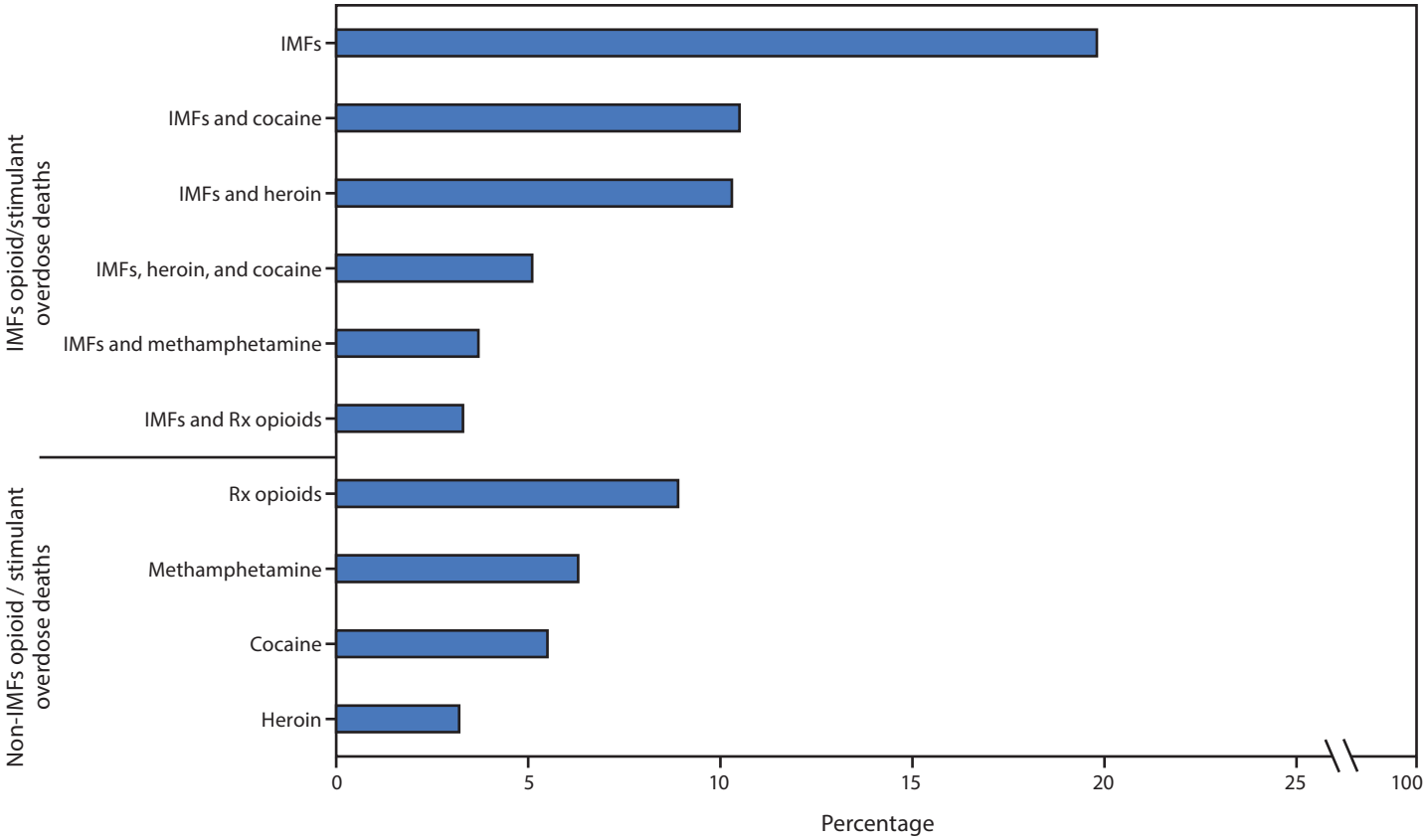
† Pairwise chi-squared testing found statistically significant differences ($p<0.01$) for each pairwise comparison of regions.

Interventions should address characteristics of overdoses involving IMFs. First, IMFs can be highly potent (e.g., fentanyl has 50–100 times the potency of morphine; carfentanil has 30–100 times the potency of fentanyl) (*13*), and use might quickly progress to overdose (*5*,*14*), especially when injected. Consequently, improving overdose response time by expanding community naloxone distribution, increasing naloxone prescribing and dispensing from pharmacies, and encouraging persons to not use drugs when alone might reduce IMF overdose deaths (*5*,*12*). Second, powdered IMFs are often sold as or mixed with white powdered heroin (primarily east of the Mississippi River) with or without the knowledge of the person buying the products, but deaths involving IMFs and products containing IMFs are less prevalent in western black tar heroin markets.¶¶¶¶ Mixing of IMFs into heroin, and in some places IMFs supplanting the heroin supply, is increasing over time, consistent with findings that more than seven in 10 (73.6%) heroin-involved overdose deaths co-involved IMFs. Pressing IMFs into counterfeit prescription pills resembling both prescription opioids and other drugs (e.g., benzodiazepines) has allowed IMFs to spread into additional drug markets. IMFs are difficult to mix consistently, resulting in possibly varying concentrations of IMFs between and within products, or persons might use IMFs when expecting to use heroin, other opioids, or (rarely) nonopioids; either could increase the risk for overdose.***** Interventions conducted by risk reduction organizations (e.g., syringe services programs) to reduce overdoses among persons exposed to IMFs (e.g., naloxone distribution) and to link populations at high risk (e.g., persons who inject drugs) with prevention and treatment services might

¶¶¶¶ https://www.dea.gov/sites/default/files/2020-01/2019-NDTA-final-01-14-2020_Low_Web-DIR-007-20_2019.pdf.

***** https://www.dea.gov/sites/default/files/2020-01/2019-NDTA-final-01-14-2020_Low_Web-DIR-007-20_2019.pdf.

FIGURE 2. Percentage of drug overdose deaths involving the 10 most common combinations of opioids and stimulants (mutually exclusive), by involvement of illicitly manufactured fentanyls (IMFs) — State Unintentional Drug Overdose Reporting System (SUDORS), 25 jurisdictions, January–June 2019*,†



Abbreviation: Rx = prescription.

* Drug overdose deaths involving IMFs with no other opioids or stimulants was the most frequent combination among Northeastern (24.3%), Midwestern (21.2%), and Southern (15.4%) jurisdictions.

† Drug overdose deaths involving methamphetamine with no other opioids or stimulants was the most frequent combination among Western jurisdictions (22.1%).

mitigate these overdose risks (*15*).†††††† Finally, timely response by public health and public safety officials to growing threats such as mixing of IMFs in nonopioid products, and outbreaks involving fentanyl analogs (e.g., carfentanil) is warranted.§§§§§

In this report, one third (32.6%) of overdose deaths co-involved opioids and stimulants. Co-use of opioids and stimulants elevates fatal overdose risk and is associated with poorer medical, mental health, and substance use disorder treatment outcomes (*16*). Supporting increased access to medications for opioid use disorder¶¶¶¶¶ and evidence-based treatments for stimulant use disorders (*17*) can help mitigate risks. Research into more effective treatments for co-occurring opioid and stimulant use disorder is also needed. Methamphetamine was involved in approximately one half of stimulant overdose

†††††† https://www.cdc.gov/ssp/syringe-services-programs-summary.html.

§§§§§ https://www.dea.gov/sites/default/files/2020-01/2019-NDTA-final-01-14-2020_Low_Web-DIR-007-20_2019.pdf; https://emergency.cdc.gov/han/han00413.asp.

¶¶¶¶¶ https://www.hhs.gov/opioids/about-the-epidemic/hhs-response/better-access/index.html.

Summary

What is already known about this topic?

After decreasing from 2017 to 2018, provisional data indicate that drug overdose deaths increased in 2019, driven by opioid-involved and stimulant-involved overdose deaths.

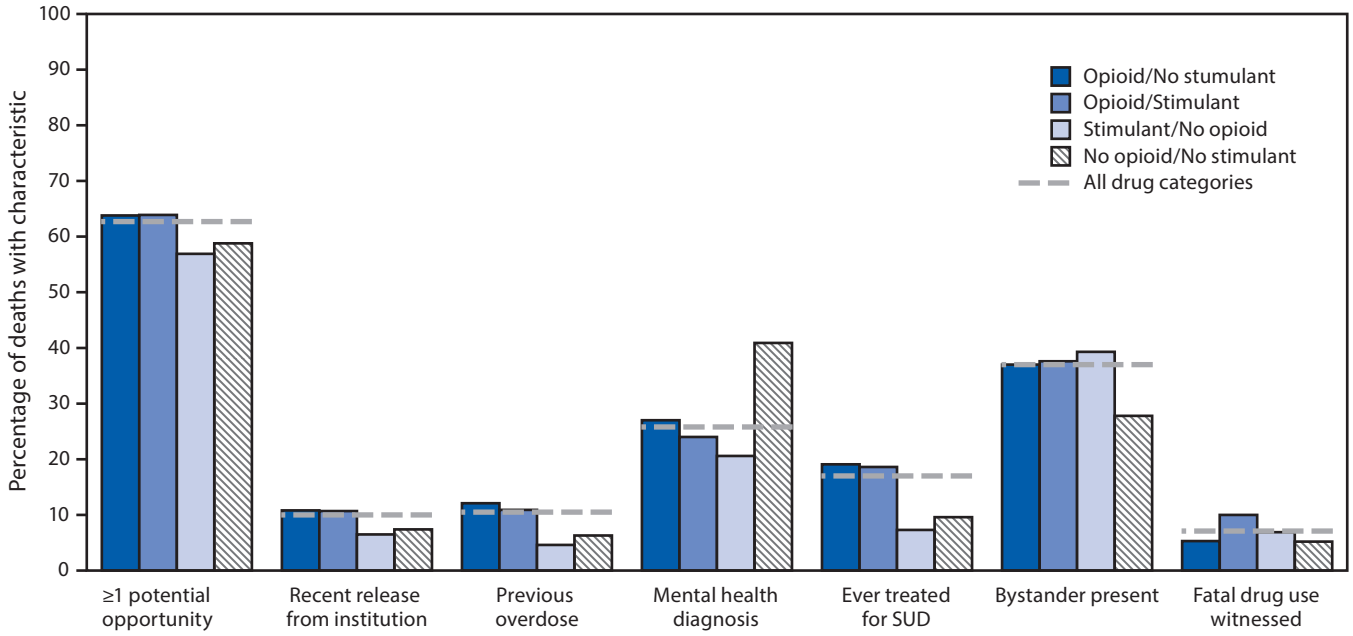
What is added by this report?

Illicitly manufactured fentanyls (IMFs), heroin, cocaine, or methamphetamine (alone or in combination) were involved in 83.8% of overdose deaths during January–June 2019; at least one potential opportunity for intervention was identified in 62.7% of overdose deaths.

What are the implications for public health practice?

Targeting crucial opportunities for intervention with evidence-based overdose prevention programs can help reverse increases in drug overdose deaths. Interventions to reduce overdose deaths involving illicit opioids and stimulants, particularly IMFs, are needed and should be complemented by efforts to prevent initiation of prescription drug misuse and illicit drug use.

FIGURE 3. Potential opportunities for intervention, by opioid/stimulant involvement — State Unintentional Drug Overdose Reporting System (SUDORS), 25 jurisdictions, January–June 2019*,†,§,¶,**



Abbreviation: SUD = substance use disorder.

* Sample for this figure limited to deaths for which the medical examiner/coroner report was available, at least one overdose-specific circumstance field was abstracted, and none of the fields for characteristics had missing data. N = 15,295 (94.2% of the total 16,236 sample).

† Pairwise chi-squared testing for at least one potential opportunity, recent release from institution, previous overdose, and ever treated for SUD found statistically significant differences ($p<0.01$) for all comparisons except opioid/no stimulant versus opioid/stimulant and stimulant/no opioid versus no opioid/no stimulant.

§ Pairwise chi-squared testing for mental health diagnosis found statistically significant differences ($p<0.01$) for all comparisons.

¶ Pairwise chi-squared testing for bystander present found statistically significant differences ($p<0.01$) for opioid/no stimulant, opioid/stimulant, and stimulant/no opioid versus no opioid/no stimulant.

** Pairwise chi-squared testing for fatal drug use witnessed found statistically significant differences ($p<0.01$) for all comparisons except opioid/no stimulant versus no opioid/no stimulant and stimulant/no opioid versus no opioid/no stimulant.

deaths without opioids. The methamphetamine supply has increased substantially since 2011,****** with accompanying increases in methamphetamine-related treatment admissions (*18*) and overdose deaths involving psychostimulants with abuse potential (e.g., methamphetamine) (*1*,*4*). Tracking of and response to these increases might help prevent further deaths.

Public health interventions targeting overdose risk factors identified in this report have shown effectiveness, especially for opioid overdose prevention (*7*). Recent release from an institution and previous overdose were both reported for approximately one in 10 opioid overdose deaths. Initiating or continuing medications for opioid use disorder among persons leaving prison (*7*,*10*) and expanding linkage to care programs targeting persons treated for a nonfatal overdose (*7*,*9*) can mitigate overdose risk. Also, outreach to groups at higher risk for overdose (e.g., persons who inject drugs) shows promise in reducing drug overdose deaths (*7*,*15*). For one quarter of deaths, there was evidence of a mental health diagnosis. Integrating substance use disorder and mental health treatment can improve treatment outcomes, which could help reduce drug overdoses (*11*,*19*). Finally, presence of a bystander at nearly four in 10 opioid- and stimulant-involved overdose deaths suggests a need to increase bystander naloxone training, access, and use (*5*,*12*). CDC, through the Overdose Data to Action program, is supporting expansions of programs linking persons at risk for overdose to treatment and risk reduction programs.

The findings in this report are subject to at least five limitations. First, the 25 jurisdictions are not nationally representative, and four states reported a subset of overdose deaths. Western states are underrepresented, likely resulting in an underestimation of methamphetamine overdose deaths that more frequently occur in the West (*20*). Second, toxicology testing and drug involvement determination varies over time and across jurisdictions. Third, all drugs detected are listed as involved when the cause of death does not specify drugs (e.g., multitoxicity death), which might overestimate drug involvement. Testing, drug involvement determination, and coding biases are minimized by focusing on commonly tested drugs frequently involved in deaths. Fourth, medical examiner/

****** https://www.nflis.deadiversion.usdoj.gov/DesktopModules/ReportDownloads/Reports/13408NFLISDrugMidYear2019.pdf.

coroner reports likely underestimate intervention opportunities as investigators might have limited information. Finally, details about potential opportunities for intervention were limited (e.g., no information about whether a decedent was referred to treatment after a prior overdose), and they should therefore not necessarily be interpreted as missed opportunities.

Drug overdose interventions should address the combination and lethality of drugs being used (e.g., IMFs in combination with stimulants) and also work to prevent initiation of prescription drug misuse (e.g., inappropriate prescribing) and illicit drug use. The finding of this report that nearly 85% of overdose deaths involved IMFs, heroin, cocaine, or methamphetamine reflects rapid and continuing increases in the supply of IMFs and methamphetamine, coupled with illicit co-use of opioids and stimulants. This report also highlights important intervention opportunities for persons who use illicit drugs (especially IMFs), including the presence of bystanders, recent release from institutions, and high-risk routes of drug use (e.g., injection) that can be targeted to both prevent overdoses (e.g., by enhancing linkage to evidence-based treatment and risk reduction services) and improve response to overdoses to prevent deaths.

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Corresponding author: Julie O'Donnell, irh8@cdc.gov, 404-498-5005.

[1]Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC.

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Timing of State and Territorial COVID-19 Stay-at-Home Orders and Changes in Population Movement — United States, March 1–May 31, 2020

Amanda Moreland, JD[1]; Christine Herlihy, MS[2]; Michael A. Tynan[3]; Gregory Sunshine, JD[1,3]; Russell F. McCord, JD[1,3]; Charity Hilton[2]; Jason Poovey, MS[2]; Angela K. Werner, PhD[3]; Christopher D. Jones, PhD[3]; Erika B. Fulmer, MHA[3]; Adi V. Gundlapalli, MD, PhD[3]; Heather Strosnider[3]; Aaron Potvien, PhD[2]; Macarena C. García, DrPH[3]; Sally Honeycutt, MPH[3]; Grant Baldwin, PhD[3]; CDC Public Health Law Program; CDC COVID-19 Response Team, Mitigation Policy Analysis Unit

SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), is thought to spread from person to person primarily by the respiratory route and mainly through close contact (*1*). Community mitigation strategies can lower the risk for disease transmission by limiting or preventing person-to-person interactions (*2*). U.S. states and territories began implementing various community mitigation policies in March 2020. One widely implemented strategy was the issuance of orders requiring persons to stay home, resulting in decreased population movement in some jurisdictions (*3*). Each state or territory has authority to enact its own laws and policies to protect the public's health, and jurisdictions varied widely in the type and timing of orders issued related to stay-at-home requirements. To identify the broader impact of these stay-at-home orders, using publicly accessible, anonymized location data from mobile devices, CDC and the Georgia Tech Research Institute analyzed changes in population movement relative to stay-at-home orders issued during March 1–May 31, 2020, by all 50 states, the District of Columbia, and five U.S. territories.* During this period, 42 states and territories issued mandatory stay-at-home orders. When counties subject to mandatory state- and territory-issued stay-at-home orders were stratified along rural-urban categories, movement decreased significantly relative to the preorder baseline in all strata. Mandatory stay-at-home orders can help reduce activities associated with the spread of COVID-19, including population movement and close person-to-person contact outside the household.

Data on state and territorial stay-at-home orders were obtained from government websites containing executive or administrative orders or press releases for each jurisdiction. Each order was analyzed and coded into one of five mutually exclusive categories: 1) mandatory for all persons; 2) mandatory only for persons in certain areas of the jurisdiction; 3) mandatory only for persons at increased risk in the jurisdiction; 4) mandatory only for persons at increased risk in certain areas of the jurisdiction; or 5) advisory or recommendation (i.e., nonmandatory). Jurisdictions that did not issue an order were coded as having no state- or territory-issued order.† These data underwent secondary review and quality assurance checks and were published in a freely available data set (*4*).

Publicly accessible, anonymized location data from mobile devices were obtained to estimate county-level raw data regarding movement (*5*). Population movement was estimated by computing the percentage of individual mobile devices (e.g., mobile phones, tablets, or watches) reporting each day that were completely at home (i.e., had not moved beyond a 150-meter radius of its common nighttime location) within a given county, using a 7-day rolling average to smooth each county's pre- and postorder time series values. This analysis used four types of order index dates, based only on mandatory orders: 1) the start date of each state or territorial stay-at-home order for each county in that jurisdiction; 2) the relaxation or expiration date of each state or territorial stay-at-home order for each county in that jurisdiction; 3) the effective date of the first state-issued stay-at-home order (i.e., California); and 4) the first date a state-issued stay-at-home order ended (i.e., Alaska).§

To assess changes in movement when mandatory state or territorial stay-at-home orders went into effect and ended, counties were first stratified along rural-urban categories

*American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands.

† Coding of orders was based on the legal language in each state or territorial order; this analysis did not assess order enforcement, public perception, or the impact of other mitigation policies. An order was coded mandatory if it contained language requiring persons to stay home (e.g., persons "shall," "must," or "are directed to") or advisory or recommendation if it contained permissive language suggesting persons stay home (e.g., persons "should," "are encouraged to," or "are urged to"). Orders were coded mandatory only for persons in certain areas of the jurisdiction if the order expressly required persons in certain areas (e.g., counties) to stay home but did not require persons in other areas to stay home. Orders were coded mandatory only for persons at increased risk in the jurisdiction if they expressly required persons who meet certain high-risk criteria (e.g., aged >65 years or those with chronic medical conditions) to stay home while permitting others to leave their homes.

§ Given the set of state-issued mandatory stay-at-home orders described, and any particular state order associated with state s that goes into effect at time t, one can define pre- and postorder windows for each county, c in s. A given county, c's preorder window will contain observed values for the movement metric of interest, m, during the n-day period before the order index date, t, and the postorder window will contain observed values for m during the n-day period after t. In this way, each county's preorder window serves as a county- and COVID-specific baseline, in that (for sufficiently small values of n), the values observed during this period reflect both county-specific invariants and the impact of the pandemic on behavior in the absence of state- or territory-issued community mitigation policies.

to ensure that counties with similar population sizes were grouped together.[¶] A box plot was constructed for each rural-urban category to examine the distribution of county mean percentages of devices at home during the pre- and postorder periods associated with each index date. Because it was not assumed that movement values follow a normal distribution for all counties and periods, a clustered Wilcoxon signed rank test was then performed for each stratum, with counties as clusters, on the constituent counties' median pre- and post-order values associated with each index date. A lower-tailed test was used for index dates related to the start of state and territorial orders, and an upper-tailed test was used for index dates related to the end of state and territorial orders[**] (*6*). Strata-level statistical significance was assessed at the 99% confidence level ($\alpha = 0.01$). Analyses were performed using Python (version 3.6; Python Software Foundation) and R (version 3.5; The R Foundation). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[††]

During March 1–May 31, 42 states and territories issued mandatory stay-at-home orders, affecting 2,355 (73%) of 3,233 U.S. counties (Figure 1). The first territorial order was issued by Puerto Rico (March 15), and the first state order by California (March 19). Eight jurisdictions issued only an advisory order or recommendation to stay home, and six did not issue any stay-at-home orders. Most jurisdictions issued multiple orders during the observation period, and coding varied among individual orders. The duration and termination of each order varied by jurisdiction. During the observation period, 22 jurisdictions transitioned from a mandatory order to an advisory order, 11 rescinded or allowed orders to expire without extending, and the order in one jurisdiction was ruled invalid by the state's supreme court.[§§] The first state to rescind or allow a stay-at-home order to expire was Alaska (April 24). Eight jurisdictions had mandatory orders applicable to at least some part of the population that extended beyond May 31.

Differences in county-level mean population movement during the pre- and postorder periods varied by index date and rural-urban strata (Figure 2). Decreased median population movement was observed in 2,295 (97.6%) of the 2,351 counties for which population movement data were available. Mandatory stay-at-home orders were associated with decreased population movement (i.e., higher median percentage of devices at home) during the 28-day period after the order start date, relative to the baseline 28-day period before the order start date. This relationship was significant in all rural-urban strata (Supplementary Table, https://stacks.cdc.gov/view/cdc/92406). Among the 2,355 counties subject to mandatory stay-at-home orders, 436 (19%) had an order that expired on or before May 3, which is the latest possible expiration date that allows for a 28-day postorder observation period.[¶¶] Movement significantly increased (i.e., lower median percentage of devices at home) in the period immediately after the expiration or lifting of orders in all rural-urban strata.

The 14-day period immediately after the first state stay-at-home order was issued in the United States was associated with a significant decrease in movement in all rural-urban strata relative to the 14-day period immediately preceding its implementation.[***] The period after the first state relaxed a stay-at-home order was associated with increased population movement at the strata level among states or territories that had not relaxed a stay-at-home order in the same period.[†††]

Discussion

Based on location data from mobile devices, in 97.6% of counties with mandatory stay-at-home orders issued by states or territories, these orders were associated with decreased median population movement after the order start date, relative to the period before the order was implemented. Reduced population movement helps prevent close contact among persons outside the household, potentially limiting exposure to persons infected with SARS-CoV-2. This suggests that stay-at-home orders can help protect the public's health by limiting potential exposure to SARS-CoV-2 and reducing community transmission of COVID-19.

The implementation of stay-at-home orders might affect population movement differently depending on when and where orders are issued and to whom they apply. The observed

[¶] The U.S. Department of Agriculture's Rural-Urban Continuum Codes are used to stratify counties in this analysis. https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation/.

[**] https://arxiv.org/abs/1706.03409v1.

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

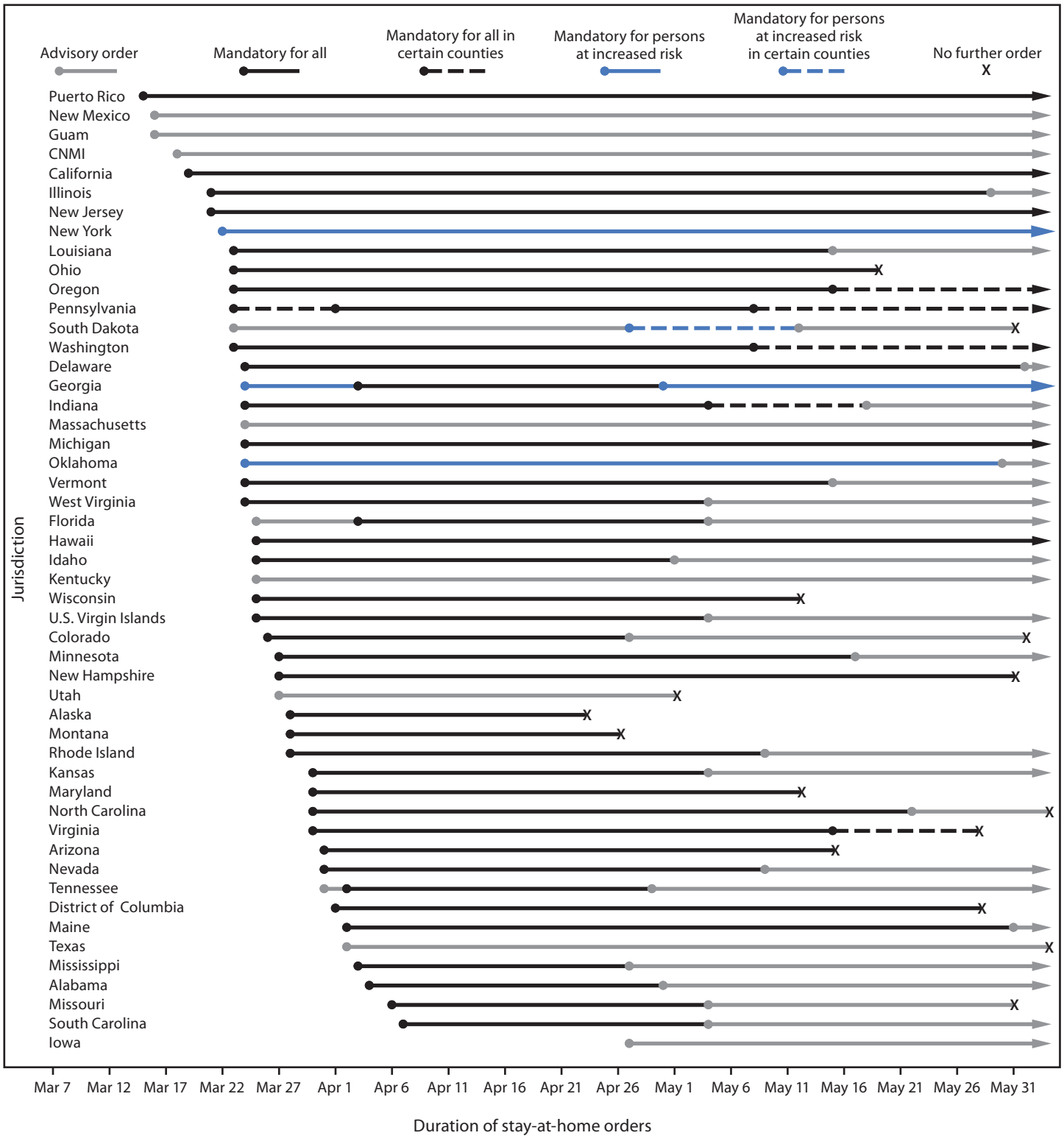
[§§] https://www.wicourts.gov/sc/opinion/DisplayDocument.pdf?content=pdf&seqNo=260868.

[¶¶] The comparison of movement data while orders were in effect versus after expiration excludes counties located in the 14 states and territories that never implemented a mandatory stay-at-home order during the observation period, as well as counties in 35 states and territories with mandatory orders that expired after May 3, or were still in place as of May 31, 2020, because bifurcation of county-level population movement data into 28-day pre- and postindex-date windows is not possible in such cases, given data available at the time of publication. All rural-urban strata were represented in the subset of counties after accounting for the postorder period.

[***] This analysis includes 1,242 counties for which population movement data were available and which were located in jurisdictions that never issued a mandatory order or had not issued a mandatory order by the end of the 14-day postorder period and excluded the remaining 1,984 counties in states or territories that enacted an order during this period.

[†††] This analysis includes 2,274 counties for which population movement data were available and which were located in jurisdictions that never issued a mandatory order or still had a mandatory order in place at the end of the 14-day postorder period and excluded the remaining 952 counties in states or territories that relaxed an order during this period.

FIGURE 1. Type and duration of COVID-19 state and territorial stay-at-home orders,* by jurisdiction — United States,† March 1–May 31, 2020

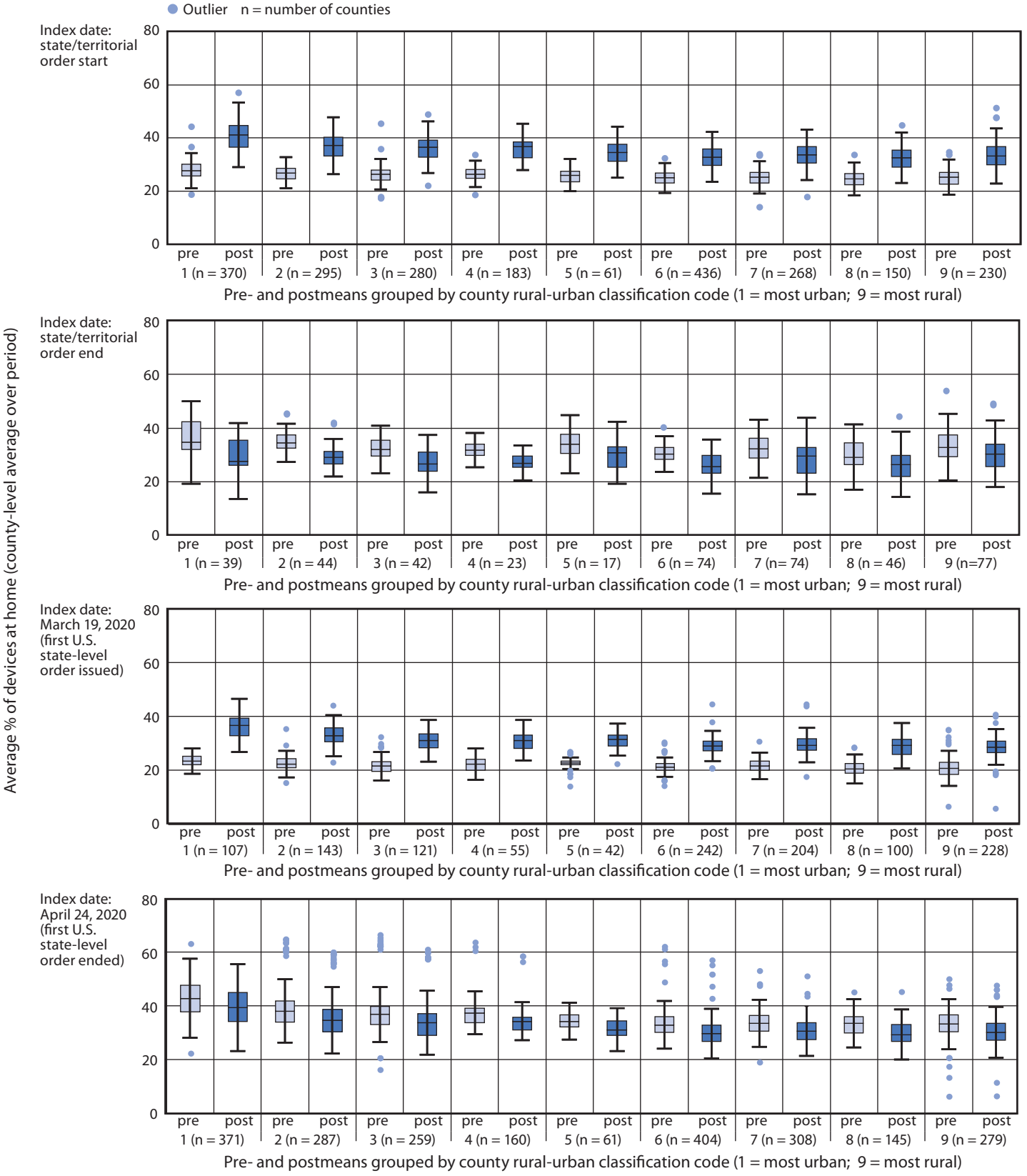


Abbreviations: COVID-19 = coronavirus disease 2019; CNMI = Northern Mariana Islands.

* Including the type of stay-at-home order implemented, to whom it applied, and the period for which it was in place.

† Jurisdictions that did not issue any orders requiring or recommending persons to stay home during the observation period were not included in this figure. Jurisdictions without any orders were American Samoa, Arkansas, Connecticut, Nebraska, North Dakota, and Wyoming.

FIGURE 2. Distribution of county-level mean percentage of mobile devices at home pre- and postindex date periods (relative to the start and end of stay-at-home orders), by rural-urban classification — United States, March 1–May 31, 2020



decrease in population movement after the implementation of the first state-issued mandatory stay-at-home order in California suggests that the implementation of certain public health policies might influence behaviors in other areas, in addition to persons directly subject to the action. However, this observation occurred in the context of other variables, which might have influenced behaviors, including the declaration of COVID-19 as a pandemic, declaration of national or state emergencies, media attention to fatalities and increased demands on hospitals, gathering bans, closures of schools and businesses, and cancellation of sporting events.

Increases in population movement were evident among counties in jurisdictions where stay-at-home orders were lifted, as well as in other communities as orders began to lift nationwide. Such increases might be driven in part by persons resuming preorder movement behaviors in response to the lifting of orders where they lived, or in response to perceived reduced risk associated with the lifting of orders elsewhere. Many other factors might have also played a role, and additional studies are needed to determine which factors caused population movement to increase across jurisdictions after the first state stay-at-home order ended.[§§§]

Further research is needed to assess the impact of reduced population movement and other community mitigation strategies on the spread of COVID-19. For example, understanding the relationship between stay-at-home orders in contiguous counties and movement might explain how same-state and neighboring-state policy changes can affect public health by mitigating or exacerbating external environmental and social factors affecting population movement.[¶¶¶] As the pandemic continues and jurisdictions consider reimplementing mitigation policies, additional studies are needed to assess the impact of reissuing stay-at-home orders.

The findings in this report are subject to at least five limitations. First, although relative device coverage largely correlates with U.S. population density, some regions or demographic groups might be over- or underrepresented.[****] Second, persons might have multiple mobile devices and might not take certain devices with them when they leave the home (e.g., tablets) or might take multiple devices with them simultaneously (e.g., phones and smart watches). Third, although the clustered Wilcoxon signed rank test is used with counties as clusters because each county's median pre- and postorder values are paired comparisons rather than independent observations, potential spatial dependence among counties is not addressed. Fourth, this report does not assess whether population movement was affected by nationwide protests during the observation period.[††††] Finally, this report analyzes the relationship between stay-at-home orders and population movement and does not assess the complex relationship between stay-at-home orders and illness incidence rates or deaths.

Mandatory stay-at-home orders can help reduce activities associated with community spread of COVID-19, including population movement and close person-to-person contact outside the household. Mandatory stay-at-home orders were associated with reduced population movement in most counties during the early months of the COVID-19 pandemic, and the relaxation of those orders was associated with increased movement. Although stay-at-home orders might assist in limiting potential exposure to SARS-CoV-2 and have had public support (*7*), such orders substantially disrupt daily life and have resulted in adverse economic impact (*8*). Further studies are needed to assess the timing and conditions under which stay-at-home orders might be best used to protect health, minimize negative impacts, and ensure equitable enforcement of community mitigation policies. These findings can inform public policies to potentially slow the spread of COVID-19 and control other communicable diseases in the future.

Summary

What is already known about this topic?

Stay-at-home orders are a community mitigation strategy used to reduce the spread of COVID-19 in the United States.

What is added by this report?

States and territories that issued mandatory stay-at-home orders experienced decreased population movement in most counties. The period after the first state relaxed a stay-at-home order was associated with increased population movement in states or territories that had not relaxed a stay-at-home order in the same period.

What are the implications for public health practice?

Stay-at-home orders can reduce activities associated with community spread of COVID-19, including population movement and close person-to-person contact outside the household. These findings can inform future public policies to reduce community spread of COVID-19.

[§§§] Additional factors that might have played a role include perceived reduced movement-associated risk because of social distancing and use of personal protective equipment, as well as the need to return to work, procure essential goods, seek health care, or exercise, particularly when persons might have suspended such activities at the onset of the pandemic or while under stay-at-home orders.

[¶¶¶] Potential confounders include protest activity, COVID-19 incidence rates, and socioeconomic factors.

[****] Mobile device data do not include characteristics of persons using these devices; therefore, results are not disaggregated by sociodemographic characteristics, nor do these data account for relative differences in population movement (e.g., number of trips out of the home, social distancing, or method of transportation). Additional information on data and bias correction is available at https://www.safegraph.com/blog/what-about-bias-in-the-safegraph-dataset.

[††††] https://www.nytimes.com/article/george-floyd-protests-timeline.html; https://www.nytimes.com/2020/04/18/us/texas-protests-stay-at-home.html.

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CDC COVID-19 Response Team, Mitigation Policy Analysis Unit

Amanda Brown, CDC COVID-19 Response Team, Mitigation Policy Analysis Unit; Ryan Cramer, CDC COVID-19 Response Team, Mitigation Policy Analysis Unit; Siobhan Gilchrist, CDC COVID-19 Response Team, Mitigation Policy Analysis Unit; Rachel Hulkower, CDC COVID-19 Response Team, Mitigation Policy Analysis Unit; Alexa Limeres, CDC COVID-19 Response Team, Mitigation Policy Analysis Unit; Adebola Popoola, CDC COVID-19 Response Team, Mitigation Policy Analysis Unit.

Corresponding author: Gregory Sunshine, gsunshine@cdc.gov.

[1]CDC Public Health Law Program; [2]Georgia Tech Research Institute, Atlanta, Georgia; [3]CDC COVID-19 Response Team.

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Nonfatal Occupational Injuries to Younger Workers — United States, 2012–2018

Rebecca J. Guerin, PhD[1]; Audrey A. Reichard, MPH[2]; Susan Derk, MA[2]; Kitty J. Hendricks, MA[2]; Lauren M. Menger-Ogle, PhD[1]; Andrea H. Okun, DrPH[1]

Adolescents and young adults represent approximately 13% of the U.S. workforce (*1*). Compared with adult workers, young workers (aged 15–24 years) experience higher rates of job-related injury (*2*,*3*). To describe injuries among young workers and inform research and prevention activities, CDC's National Institute for Occupational Safety and Health (NIOSH) analyzed national data for 2012–2018 from the occupational supplement to the National Electronic Injury Surveillance System* (NEISS-Work) and for 2018 from the Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII).† During the 7-year period, an estimated 3.2 million (95% confidence interval [CI] = 2.6–3.7) nonfatal, job-related injuries to young workers were treated in hospital emergency departments (EDs). From 2012 to 2018, annual rates of work-related injuries§ treated in the ED (ED-treated injuries) declined overall across all age groups but ranged from 1.2 to 2.3 times higher for workers aged 15–24 years compared with those for adults aged 25–44 years. Workers aged 18–19 years had the highest rate of ED-treated injuries. In 2018, among all age groups, workers in service occupations¶ had the highest percentage of injuries requiring at least 1 day away from work. Among workers aged 15–17 years, those in the leisure and hospitality industry had the highest percentage of work-related injuries requiring at least 1 day away from work. Occupational injuries can have long-term impacts on health (*4*). The disproportionate risk of injury among young workers highlights the need for sustained, targeted public health efforts to prepare this population with essential workplace safety and health competencies before they enter the workforce and to provide high-quality safety training and close supervision on the job. NIOSH and its partners developed a free curriculum to teach adolescents workplace safety and health competencies, which includes identification of workplace hazards and methods for addressing them, how to understand their rights and responsibilities as workers, and how to voice concerns about work safety issues (*5*).

Data from NEISS–Work,** and the BLS SOII,†† the two main sources of national data on worker injuries,§§ were used for these analyses. NEISS-Work and SOII have substantially different methodologies for determining injury estimates (*2*) and together provide a more detailed picture of injuries to young workers. NEISS-Work data capture occupational injuries from a nationally stratified, statistically weighted probability sample of hospital EDs; however, standardized industry and occupation codes are not available for these data.¶¶

SOII captures federal and state injury and illness data from employers' Occupational Safety and Health Administration logs,*** classified by industry††† and occupation.§§§ SOII estimates are based on a statistically weighted probability sample of employer reports collected annually from approximately 230,000 private industry and public sector establishments.¶¶¶ The analysis of SOII data is limited to injury cases that required at least 1 day away from work. For both NEISS-Work and SOII, injury events or exposures are classified according to the Occupational Injury and Illness Classification System.****

NEISS-Work and SOII estimates for work-related injuries to workers aged 15–17 years (protected under child labor laws††††),

* https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data.
† https://www.bls.gov/iif/soii-overview.htm.
§ Per 10,000 full-time equivalent (FTE) workers; one FTE = 2,000 hours worked per year.
¶ Service occupations include those in Standard Occupational Classification groups 31–39, such as health care support occupations, protective service occupations, food preparation and serving related occupations, building and grounds cleaning and maintenance, and personal care and service occupations. https://www.bls.gov/soc/2018/soc_2018_manual.pdf.

** The Consumer Product Safety Commission (CPSC) collects the NEISS-Work data as a supplement to its NEISS surveillance of injuries related to consumer products. The NEISS-Work data are mutually exclusive of the consumer product-related data CPSC collects. Because of hospital closures and nonparticipation, the number of hospitals varied throughout the study period. The present analysis was conducted using raw data files provided to CDC/NIOSH. NEISS-Work data are available from the Work-Related Injury Statistics Query System. https://wwwn.cdc.gov/wisards/workrisqs.
†† Analysis of custom query data with modified age cohorts from SOII. https://www.bls.gov/iif/soii-data.htm#dafw.
§§ Illnesses are excluded in the analysis because they are not captured in NEISS-Work and account for <5% of SOII cases.
¶¶ Cases are included in NEISS-Work when ED personnel identify a work-related injury occurring to a noninstitutionalized, civilian employee working for compensation, working on a farm, or volunteering for an organized group.
*** https://www.osha.gov/recordkeeping/index.html.
††† https://www.census.gov/eos/www/naics.
§§§ https://www.bls.gov/soc/.
¶¶¶ SOII excludes all work-related fatalities and nonfatal work injuries and illnesses for those self-employed, workers on farms with ≤10 employees, private household workers, volunteers, and federal government workers.
**** https://www.bls.gov/iif/oshoiics.htm.
†††† The Fair Labor Standards Act of 1938 child labor provisions prohibit employment of minors in certain jobs and under conditions harmful to their health or well-being. They include restrictions on hours of work for youths aged <16 years and delineate hazardous occupations (so-called "hazardous orders") for farm (<16 years) and nonfarm jobs (<18 years). Most states have enacted additional protections for working youths. https://www.dol.gov/agencies/whd/compliance-assistance/handy-reference-guide-flsa#9.

18–19 years, and 20–24 years were compared with estimates for workers aged 25–44 years.[§§§§] NEISS-Work data were analyzed for the years 2012–2018 and the U.S. Census Bureau's Current Population Survey[¶¶¶¶] labor force denominator estimates were used to calculate annual rates (*1*). Average 7-year rates were calculated by dividing the sum of the yearly numerator estimates by the sum of the yearly denominator estimates. Variances of the estimates were pooled to calculate 95% CIs.[*****] BLS source data in SOII are not formulated for the customized age groups used in this analysis to allow for rate calculations and aggregate counts across years; therefore, only the most current year of data (2018) were included in the analysis. For SOII, relative standard errors were converted to 95% CIs.[†††††] Because of missing race/ethnicity data (approximately 32% in NEISS-Work and 45% in SOII), injuries by race/ethnicity were not examined. Analyses were conducted using SAS statistical software (version 9.4; SAS Institute).

During 2012–2018, an estimated 12 million (95% CI = 9.7–14.2) occupational injuries to workers aged 15–44 years were treated in EDs with an average annual rate of 215 injuries per 10,000 full-time equivalent (FTE) workers (95% CI = 177–254). During the 7-year period, an estimated 3.2 million (95% CI = 2.6–3.7) nonfatal, job-related injuries to workers aged 15–24 years were treated in hospital emergency departments (Table 1). The highest injury rate (404 per 10,000 FTE) occurred among workers aged 18–19 years. Within each of the four age categories, the rate of injury was 1.4 to 1.5 times higher among males than among females (Table 1). Annual rates of injuries among young workers aged 15–24 years were 1.2–2.3 times higher than those for workers aged 25–44 years (Figure).

Contact with objects and equipment was the leading cause of occupational ED-treated injuries among all age groups examined, with rates of injuries ranging from 64 per 10,000 FTE among workers aged 25–44 years to 182 per 10,000 FTE among workers aged 18–19 years (Table 1). Lacerations and punctures were the most common type of ED-treated injuries reported among workers aged <25 years, with injury rates ranging from 66 to 99 per 10,000 FTE, whereas strains and sprains were most common among workers aged 25–44 years (injury rate of 47 per 10,000 FTE).

Analyses of SOII data indicate that in 2018, contact with objects or equipment was the leading cause of injury requiring at least 1 day away from work among workers aged 15–17 years (49%), 18–19 years (44%), and 20–24 years (34%), and the leading cause of such injuries among workers aged 25–44 years was overexertion (32%) (Table 2). Among workers aged 15–17 years, those in the leisure and hospitality industry had the highest percentage of work-related injuries requiring at least 1 day away from work (56% of injuries within this age group), with most of these injuries occurring among workers in the accommodation and food services subsector (48% of injuries within this age group). Among workers in age groups 18–19, 20–24, and 25–44 years, those in the trade, transportation, and utilities industry had the highest percentages of injuries requiring at least 1 day away from work, with the largest portions of these injuries occurring among workers in the retail trade subsector. Across all age groups, workers in service occupations had the highest percentages of injuries requiring at least 1 day away from work, including 66% among workers aged 15–17 years.

Discussion

Despite a decline in overall ED-treated injury rates from 2012 to 2018, workers aged 15–24 years experienced higher rates of injury than did workers aged 25–44 years. Consistent with previous analyses (*3*), the highest rate of ED-treated injury occurred among workers aged 18–19 years.

Despite progress toward reducing injury rates among workers aged 15–24 years,[§§§§§] workers in this age group continue to experience a disproportionately high rate of occupational injury when compared with adults (aged 25–44 years). As reported previously (*3*), within all age groups, higher rates of ED-treated injuries occurred among males than among females. Given that approximately one half of workers aged 15–17 years with a reported injury were employed in the leisure and hospitality industry and that most of these injuries occurred in accommodation and food services, preventive interventions targeting employers in this industry and subsector could reduce work-related injuries among young workers.

The disparity in the number of injuries among young workers has been reported in other countries (*6,7*). Evidence suggests that contributors to increased injury risk among younger workers include the following: workplace hazards associated with young worker jobs; violations of child labor laws; fast pace of work; minority status; and lack of skills, experience, supervision, and high-quality safety training. Young workers might be less likely to recognize workplace hazards, voice safety concerns, and be aware of their legal protections (*3,6–8*).

The findings in this report are subject to at least three limitations. First, NEISS-Work data include only workers treated in EDs and not in other health care settings (*3*), and unpublished

[§§§§] Limiting the analysis to workers aged 25–44 years allows a rate comparison with workers who more closely resemble young persons in terms of physical health status.

[¶¶¶¶] https://www.census.gov/programs-surveys/cps.html.

[*****] https://wwwn.cdc.gov/wisards/workrisqs/rate.aspx.

[†††††] The Current Population Survey is collected by the U.S. Census Bureau for the Bureau of Labor Statistics. https://www.bls.gov/iif/osh_rse.htm.

[§§§§§] Healthy People 2020 occupational safety and health objective OSH-2.3: reduce work-related injuries among adolescent workers (aged 15–19 years). https://www.healthypeople.gov/2020/topics-objectives/topic/occupational-safety-and-health/objectives.

TABLE 1. National estimates and rates* for nonfatal occupational injuries treated in U.S. hospital emergency departments, by selected patient characteristics — National Electronic Injury Surveillance System occupational supplement, United States, 2012–2018

	Age group of worker, yrs							
	15–17		18–19		20–24		25–44†	
Characteristic	NE x1,000 (95% CI)	Rate per 10,000 (95% CI)	NE x1,000 (95% CI)	Rate per 10,000 (95% CI)	NE x1,000 (95% CI)	Rate per 10,000 (95% CI)	NE x1,000 (95% CI)	Rate per 10,000 (95% CI)
Total	**164 (131–197)**	**281 (223–339)**	**600 (484–716)**	**404 (325–482)**	**2,409 (1,980–2,838)**	**287 (236–337)**	**8,856 (7,228–10,484)**	**195 (160–230)**
Sex								
Male	97 (76–118)	326 (249–404)	370 (296–444)	469 (372–567)	1,538 (1,258–1,818)	338 (277–398)	5,947 (4,835–7,060)	229 (187–270)
Female	67 (53–81)	234 (181–288)	230 (185–275)	330 (262–397)	871 (714–1,029)	226 (186–267)	2,908 (2,366–3,451)	150 (123–178)
Type of injury§								
Laceration/Puncture	47 (36–59)	81 (61–102)	146 (115–178)	99 (78–119)	555 (445–665)	66 (53–79)	1,608 (1,290–1,927)	35 (29–42)
Strain/Sprain	28 (22–33)	47 (38–57)	112 (84–140)	75 (57–94)	483 (372–594)	57 (44–70)	2,119 (1,588–2,650)	47 (35–58)
Contusion/Abrasion/ Crushing	20 (15–24)	34 (26–42)	86 (66–106)	58 (44–71)	362 (289–435)	43 (35–52)	1,245 (986–1,505)	27 (22–33)
Dislocation/Fracture	11 (7–14)	18 (12–24)	32 (24–39)	21 (16–26)	120 (95–145)	14 (11–17)	526 (440–613)	12 (10–13)
Other/Not stated	59 (44–74)	101 (75–127)	224 (178–271)	151 (120–182)	889 (716–1,061)	106 (86–126)	3,357 (2,678–4,035)	74 (59–89)
Event or exposure¶								
Contact with objects/ equipment	73 (56–91)	125 (95–156)	270 (214–326)	182 (144–219)	985 (796–1,174)	117 (95–139)	2,888 (2,361–3,415)	64 (52–75)
Overexertion/Bodily reaction	27 (21–33)	46 (35–56)	137 (103–171)	92 (69–115)	595 (469–720)	71 (56–85)	2,618 (2,034–3,202)	58 (45–70)
Exposure to harmful substance/ environment	24 (17–31)	41 (29–53)	73 (56–89)	49 (38–60)	294 (234–354)	35 (28–42)	985 (763–1,207)	22 (17–27)
Fall/Slip/Trip	22 (17–28)	38 (29–48)	67 (50–83)	45 (34–56)	260 (207–312)	31 (25–37)	1,126 (915–1,336)	25 (20–29)
Violence/Other injuries by persons or animals	12 (9–15)	20 (15–25)	35 (27–44)	24 (18–30)	194 (150–237)	23 (18–28)	840 (626–1,054)	19 (14–23)
Other events	6 (3–9)	10 (6–15)	19 (14–24)	13 (9–16)	82 (69–95)	10 (8–11)	399 (333–465)	9 (7–10)

Abbreviations: CI = confidence interval; FTE = full-time equivalent; NE = national estimate.
* Nonfatal injury rates are per 10,000 FTE workers; one FTE = 2,000 hours worked/year. U.S. Census Bureau's Current Population Survey labor force denominator estimates were used to calculate rates.
† Analysis limited to workers aged 25–44 years to allow a rate comparison with workers who more closely resemble young workers in terms of physical health status.
§ Type of injury is defined by the nature of the most severe injury as described by attending physician or other medical staff.
¶ Event or exposure is defined by the Bureau of Labor Statistics as the way in which the injury was produced or inflicted.

SOII data used for analysis capture only those injuries serious enough to require at least 1 day away from work. Thus, both national data sources represent an undercount of the actual prevalence of work-related nonfatal injuries. Second, the two data sources differ substantially in their estimates and methodologies (*1*), and therefore might be considered complementary, but not comparable. Finally, the inability to calculate rates for injuries requiring at least 1 day away from work for the customized age groups analyzed limits characterization of the true magnitude of the work-related injury problem.

A comprehensive, public health strategy is needed for protecting young workers. Employers are responsible for maintaining safe and healthy workplaces, which includes complying with safety, health, and child labor laws; closely supervising young workers; and delivering job-specific safety training. Schools can be a primary venue for providing foundational workplace safety education to youths. NIOSH and its partners developed and evaluated a free curriculum, Talking Safety (*5*,*9*), to teach adolescents workplace safety and health competencies, including identification of workplace hazards and methods for addressing them, how to understand their rights and responsibilities as workers, and how to voice concerns about worker safety issues. Talking Safety has been demonstrated to be effective at educating adolescents on foundational workplace safety

Summary

What is already known about this topic?

Young workers (aged 15–24 years) experience higher rates of job-related injury than do adult workers (aged 25–44 years).

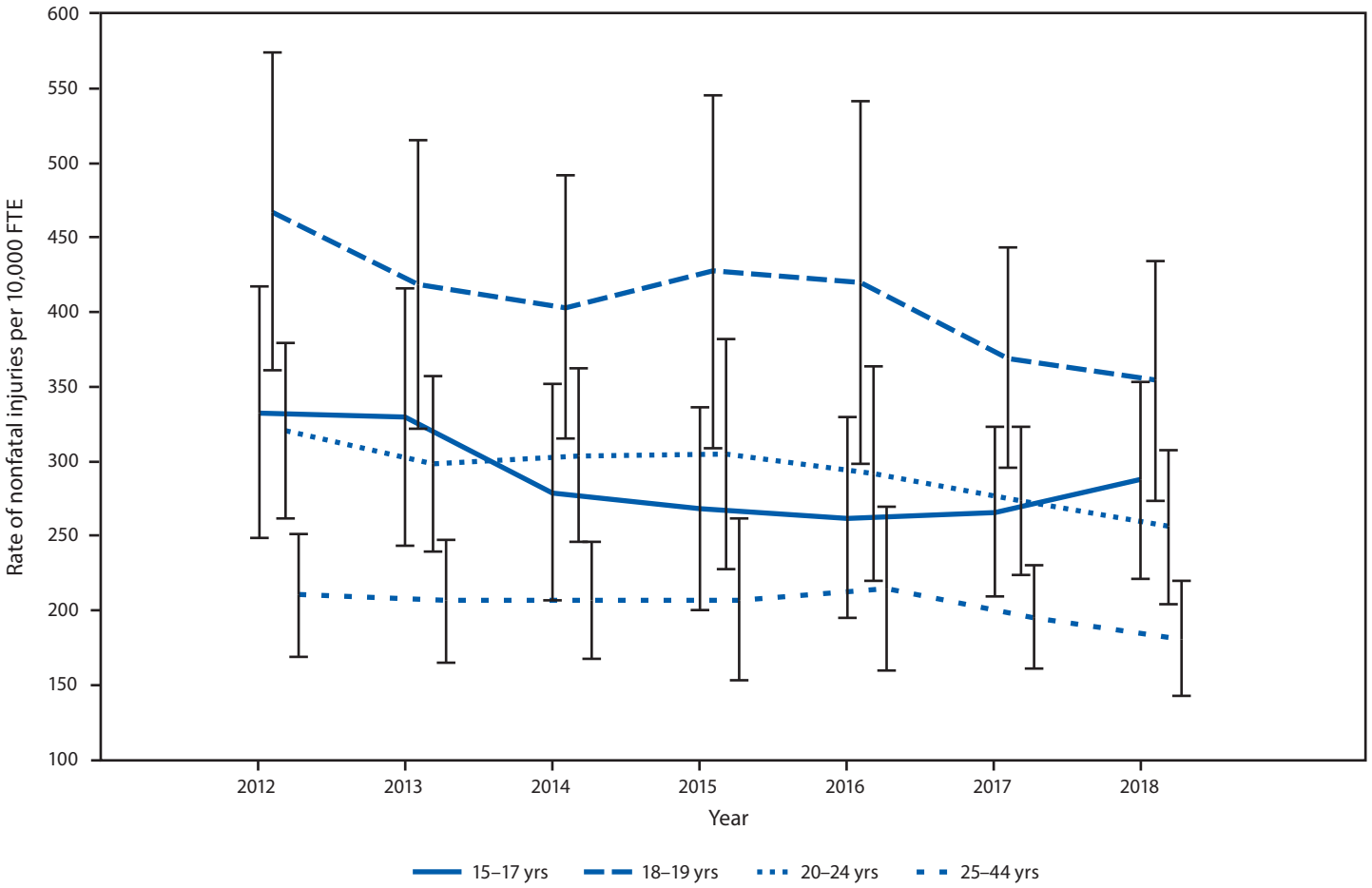
What is added by this report?

During 2012–2018, an estimated 3.2 million nonfatal injuries to young workers were treated in hospital emergency departments, with the highest rates among workers aged 18–19 years. Data from 2018 indicate that the leisure and hospitality industry contributed the highest percentage of injuries to workers aged 15–17 years requiring at least 1 day away from work.

What are the implications for public health practice?

A comprehensive, public health strategy for protecting young workers requires designing and maintaining safer worksites, legislation and enforcement, and education and training.

FIGURE. Rate of hospital emergency department–treated nonfatal occupational injuries,* by age group — National Electronic Injury Surveillance System occupational supplement, United States, 2012–2018†



Abbreviation: FTE = full time equivalent.
* Nonfatal injury rates are per 10,000 FTE workers; one FTE = 2,000 hours worked/year. U.S. Census Bureau's Current Population Survey labor force denominator estimates were used to calculate rates.
† With 95% confidence intervals indicated by error bars.

competencies, and research provides support for using this curriculum to prepare the future workforce for safe and healthy employment (*9*,*10*). State and federal agencies that perform critical enforcement activities can also promote workplace safety as an essential element of job preparation initiatives. Parents and health care providers can discuss workplace safety topics with their children and patients. Local, state, and federal injury and illness surveillance systems must also provide more comprehensive reporting of the magnitude of injuries to young workers (*2*) to inform development and implementation of evidence-based prevention strategies.

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Corresponding author: Rebecca J. Guerin, rguerin@cdc.gov, 513-533-8435.

[1]Division of Science Integration, National Institute for Occupational Safety and Health, CDC; [2]Division of Safety Research, National Institute for Occupational Safety and Health, CDC.

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TABLE 2. National estimates*and percentages† of total injuries requiring ≥1 day away from work,§ by age group and selected characteristics—Survey of Occupational Injuries and Illnesses,¶ United States, 2018**

	Age group of worker, yrs							
	15–17		18–19		20–24		25–44††	
Characteristic	NE (95% CI)	%	NE (95% CI)	%	NE (95% CI)	%	NE (95% CI)	%
Total	**5,830 (5,510–6,150)**	**100**	**21,630 (20,952–22,308)**	**100**	**97,050 (95,148–98,952)**	**100**	**461,770 (454,529–469,011)**	**100**
Sex								
Male	3,020 (2,795–3,245)	52	13,640 (13,132–14,148)	63	60,620 (59,313–61,927)	63	287,480 (282,409–292,551)	62
Female	2,800 (2,586–3,014)	48	7,990 (7,614–8,366)	37	36,250 (35,326–37,174)	37	172,350 (169,310–175,390)	37
Industry								
Leisure and hospitality	3,270 (2,956–3,584)	56	4,310 (3,938–4,682)	20	13,520 (12,672–14,368)	14	36,700 (34,758–38,642)	8
Accommodation and food services	2,780 (2,469–3,091)	48	3,600 (3,240–3,960)	17	11,480 (10,670–12,290)	12	30,900 (29,083–32,717)	7
Trade, transportation and utilities	1,000 (878–1,122)	17	7,450 (7,070–7,830)	34	29,770 (28,778–30,762)	31	111,830 (108,761–114,899)	24
Retail trade	940 (817–1,063)	16	4,870 (4,545–5,195)	23	16,420 (15,615–17,225)	17	46,600 (44,591–48,609)	10
Educational and health services	290 (238–342)	5	2,150 (2,003–2,297)	10	13,210 (12,770–13,650)	14	68,160 (66,557–69,763)	15
Health care and social assistance	220 (175–265)	4	1,840 (1,703–1,977)	9	12,230 (11,799–12,661)	13	63,320 (61,707–64,933)	14
Manufacturing	70 (44–96)	1	2,090 (1,938–2,242)	10	9,220 (8,841–9,599)	10	48,640 (47,305–49,975)	11
Construction		0	1,740 (1,467–2,013)	8	7,700 (7,006–8,394)	8	37,990 (35,458–40,522)	8
Professional and business services	350 (255–445)	6	650 (516–784)	3	7,250 (6,596–7,904)	8	27,220 (25,193–29,247)	6
Other services except public administration	320 (185–455)	5	1,280 (966–1,594)	6	2,730 (2,190–3,270)	3	9,680 (8,124–11,236)	2
Occupation								
Service	3,870 (3,620–4,120)	66	8,180 (7,795–8,565)	38	30,570 (29,731–31,409)	31	141,840 (139,338–144,342)	31
Transportation and material moving	500 (411–589)	9	4,050 (3,788–4,312)	19	15,840 (15,281–16,399)	16	78,970 (77,267–80,673)	17
Sales and related	460 (374–546)	8	2,090 (1,906–2,274)	10	7,430 (7,066–7,794)	8	20,750 (20,099–21,401)	4
Office and administrative support	210 (153–267)	4	1,210 (1,070–1,350)	6	7,140 (6,790–7,490)	7	27,840 (27,076–28,604)	6
Production	20 (1–39)	0	2,040 (1,860–2,220)	9	7,970 (7,595–8,345)	8	41,690 (40,628–42,752)	9
Construction and extraction	20 (4–36)	0	1,820 (1,649–1,991)	8	8,110 (7,729–8,491)	8	38,900 (37,909–39,891)	8
Installation, maintenance, and repair	100 (61–139)	2	810 (697–923)	4	7,570 (7,199–7,941)	8	36,350 (35,424–37,276)	8
Healthcare practitioners and technical	60 (28–92)	1	240 (178–302)	1	4,230 (3,965–4,495)	4	27,710 (26,950–28,470)	6

See table footnotes on the next page.

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TABLE 2. (*Continued*) National estimates*and percentages† of total injuries requiring ≥1 day away from work,§ by age group and selected characteristics— Survey of Occupational Injuries and Illnesses,¶ United States, 2018**

	Age group of worker, yrs							
	15–17		18–19		20–24		25–44††	
Characteristic	NE (95% CI)	%	NE (95% CI)	%	NE (95% CI)	%	NE (95% CI)	%
Nature of injury§§								
Cut/Laceration/Puncture	1,630 (1,467–1793)	28	4,680 (4,396–4,964)	22	15,200 (14,664–15,736)	16	45,560 (44,488–46,632)	10
Sprain/Strain/Tear	1,000 (873–1,127)	17	5,170 (4,876–5,464)	24	29,120 (28,321–29,919)	30	162,710 (159,840–165,580)	35
Soreness/Pain	650 (548–752)	11	2,960 (2,740–3,180)	14	15,670 (15,117–16,223)	16	85,800 (84,118–87,482)	19
Bruise/Contusion	330 (258–402)	6	2,400 (2,202–2,598)	11	9,770 (9,349–10,191)	10	40,180 (39,156–41,204)	9
Fracture	580 (483–677)	10	1,270 (1,128–1,412)	6	5,860 (5,538–6,182)	6	32,310 (31,423–33,197)	7
Heat (thermal) burns	620 (520–720)	11	1,050 (920–1,180)	5	2,930 (2,712–3,148)	3	6,670 (6,330–7,010)	1
Event/Exposure¶¶								
Contact with object/ equipment	2870 (2,651–3,089)	49	9,440 (9,033–9,847)	44	33,370 (32,520–34,220)	34	117,960 (115,648–120,272)	26
Overexertion/Bodily reaction	620 (520–720)	11	4,280 (4,012–4,548)	20	23,420 (22,731–24,109)	24	147,350 (144,751–149,949)	32
Fall/Slip/Trip	1,280 (1,137–1,423)	22	4,000 (3,741–4,259)	18	19,030 (18,396–19,664)	20	97,630 (95,716–99,544)	21
Violence/Other injuries by persons or animals	110 (68–152)	2	1,650 (1,488–1,812)	8	8,110 (7,729–8,491)	8	43,100 (42,086–44,114)	9
Exposure to harmful substances/environments***	770 (660–880)	13	1,630 (1,467–1,793)	8	6,050 (5,730–6,370)	6	22,550 (21,843–23,257)	5
Transportation incidents	180 (126–234)	3	590 (493–687)	3	6,510 (6,178–6,842)	7	29,850 (29,031–30,669)	6
No. of days away from work								
1	1,390 (1,240–1,540)	24	4,500 (4,227–4,773)	21	17,190 (16,617–17,763)	18	67,140 (65,692–68,588)	15
2	800 (687–913)	14	2,940 (2,721–3,159)	14	13,570 (13,065–14,075)	14	53,980 (52,710–55,250)	12
3–5	1,100 (968–1,232)	19	5,170 (4,876–5,464)	24	19,360 (18,753–19,967)	20	87,350 (85,638–89,062)	19
6–10	650 (548–752)	11	3,050 (2829–3,271)	14	14,020 (13,498–14,542)	14	54,140 (52,867–55,413)	12
11–20	1,150 (1,015–1,285)	20	2,490 (2,290–2,690)	12	10,860 (10,413–11,307)	11	50,620 (49,429–51,811)	11
21–30	130 (85–175)	2	890 (771–1,009)	4	5,120 (4,829–5,411)	5	27,920 (27,154–28,686)	6
≥31	600 (502–698)	10	2,590 (2,387–2,793)	12	16,920 (16,356–17,484)	17	120,620 (118,256–122,984)	26

Abbreviations: FTE = full-time equivalent; NE = national estimate.

* Per 10,000 FTE workers; one FTE = 2,000 hours worked/year.

† Only categories and subcategories with ≥5% of all cases for at least one of the age groups are represented in the table; therefore, totals may not sum to 100.

§ Includes cases with injuries that result in days away from work with or without restricted work activity.

¶ Unpublished data from Survey of Occupational Injuries and Illnesses (SOII), U.S. Department of Labor, Bureau of Labor Statistics (BLS).

** Only the most current year of data (2018) available at the time the analysis was conducted is included because rates and aggregate counts for injuries requiring at least 1 day away from work cannot be calculated for the age groups analyzed for the SOII data.

†† Analysis limited to workers aged 25–44 years to allow a rate comparison with workers who more closely resemble young workers in terms of physical health status.

§§ Nature of injury is defined by BLS as the physical characteristics of the disabling injury.

¶¶ Event or exposure is defined by BLS as the way in which the injury was produced or inflicted.

*** Exposure to harmful substances or environments includes exposure to hot objects or heat burns.

Hydroxychloroquine and Chloroquine Prescribing Patterns by Provider Specialty Following Initial Reports of Potential Benefit for COVID-19 Treatment — United States, January–June 2020

Lara Bull-Otterson, PhD[1,2]; Elizabeth B. Gray, MPH[2]; Daniel S. Budnitz, MD[3,4]; Heather M. Strosnider, PhD[1,5]; Lyna Z. Schieber, MD, DPhil[1,6]; Joseph Courtney, PhD[1,5]; Macarena C. García, DrPH[1,7]; John T. Brooks, MD[8]; William R. Mac Kenzie, MD[1,7]; Adi V. Gundlapalli, MD, PhD[1,9]

Hydroxychloroquine and chloroquine, primarily used to treat autoimmune diseases and to prevent and treat malaria, received national attention in early March 2020, as potential treatment and prophylaxis for coronavirus disease 2019 (COVID-19) (*1*). On March 20, the Food and Drug Administration (FDA) issued an emergency use authorization (EUA) for chloroquine phosphate and hydroxychloroquine sulfate in the Strategic National Stockpile to be used by licensed health care providers to treat patients hospitalized with COVID-19 when the providers determine the potential benefit outweighs the potential risk to the patient.* Following reports of cardiac and other adverse events in patients receiving hydroxychloroquine for COVID-19 (*2*), on April 24, 2020, FDA issued a caution against its use† and on June 15, rescinded its EUA for hydroxychloroquine from the Strategic National Stockpile.§ Following the FDA's issuance of caution and EUA rescindment, on May 12 and June 16, the federal COVID-19 Treatment Guidelines Panel issued recommendations against the use of hydroxychloroquine or chloroquine to treat COVID-19; the panel also noted that at that time no medication could be recommended for COVID-19 pre- or postexposure prophylaxis outside the setting of a clinical trial (*3*). However, public discussion concerning the effectiveness of these drugs on outcomes of COVID-19 (*4*,*5*), and clinical trials of hydroxychloroquine for prophylaxis of COVID-19 continue.¶ In response to recent reports of notable increases in prescriptions for hydroxychloroquine or chloroquine (*6*), CDC analyzed outpatient retail pharmacy transaction data to identify potential differences in prescriptions dispensed by provider type during January–June 2020 compared with the same period in 2019. Before 2020, primary care providers and specialists who routinely prescribed hydroxychloroquine, such as rheumatologists and dermatologists, accounted for approximately 97% of new prescriptions. New prescriptions by specialists who did not typically prescribe these medications (defined as specialties accounting for ≤2% of new prescriptions before 2020) increased from 1,143 prescriptions in February 2020 to 75,569 in March 2020, an 80-fold increase from March 2019. Although dispensing trends are returning to prepandemic levels, continued adherence to current clinical guidelines for the indicated use of these medications will ensure their availability and benefit to patients for whom their use is indicated (*3*,*4*), because current data on treatment and pre- or postexposure prophylaxis for COVID-19 indicate that the potential benefits of these drugs do not appear to outweigh their risks.

Hydroxychloroquine and chloroquine prescriptions dispensed through outpatient retail pharmacies in the United States during January–June 2019 and January–June 2020 were examined using deidentified pharmacy transactions from the IQVIA National Prescription Audit database.** This database includes 92% of all outpatient retail prescriptions dispensed in the United States; prescription estimates were projected by IQVIA to represent all retail outpatient medication dispensing at the state and national levels.

New prescriptions for hydroxychloroquine and chloroquine were defined as those dispensed to a patient without a history of prescription for these medications in the preceding 12 months. Hydroxychloroquine accounted for approximately 99% of prescriptions dispensed during the study period. Refill/switch prescriptions were defined as those dispensed either as a refill of a previous prescription or as a new prescription with a change in medication strength or brand or switches between medications within the same therapeutic category (i.e., bidirectional switches of hydroxychloroquine and chloroquine). New and refill/switch prescriptions dispensed before reports of potential benefit on medication use for COVID-19 (during January–June 2019) were compared with new and refill/switch prescriptions during January–June 2020. Fold changes in the numbers of new prescriptions were calculated and defined as the ratio between the estimated number of prescriptions in March, April, May, and June 2020, with respect to the same

* https://www.fda.gov/media/136534/download.
† https://www.fda.gov/drugs/drug-safety-and-availability/fda-cautions-against-use-hydroxychloroquine-or-chloroquine-covid-19-outside-hospital-setting-or.
§ https://www.fda.gov/media/138945/download.
¶ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7330261/.

** IQVIA projected prescription estimates using proprietary methods and information internal to the company. https://www.iqvia.com/locations/united-states/solutions/commercial-operations/essential-information/prescription-information.

months in 2019. The percentage of total dispensed prescriptions by specialty group was calculated using the total number of dispensed prescriptions by specialty group, divided by the overall total number of dispensed prescriptions for the month; the percentage of new prescriptions by a specialty group was calculated by dividing the new prescriptions dispensed for the specialty group by the total prescriptions for the specialty group. The percentage of new prescriptions dispensed to males was calculated as the number of new prescriptions for males divided by the total number of new prescriptions.

Prescriptions were not included if they were dispensed by mail order; mail-dispensed prescriptions accounted for <7.5% of dispensed hydroxychloroquine and chloroquine. Prescriptions by veterinarians were also excluded.

Prescriptions included information on the prescriber's medical specialty, as defined by the American Medical Association (AMA) self-designated practice specialties.[††] For this study, clinicians prescribing hydroxychloroquine or chloroquine were categorized based on the frequency of prescribing of hydroxychloroquine or chloroquine before the COVID-19 pandemic. Specialists from rheumatology, dermatology, allergy, and nephrology, who might have had experience using these drugs for indicated medical conditions within their specialty before the pandemic (collectively termed routine prescribers) were responsible for 62% of new hydroxychloroquine or chloroquine prescriptions in 2019. Allopathic and osteopathic physicians, who included internal medicine, family practice, general practice, and pediatrics, and nurse practitioners, physician assistants, and prescribers with unspecified specialty (per AMA classification) were grouped for this study into primary care prescribers; this group provided 35% of the new prescriptions in 2019. Other specialists were considered nonroutine prescribers[§§] if, in 2019, their specialty prescribed ≤2% of hydroxychloroquine or chloroquine prescriptions. Nonroutine prescribing specialties are less likely under normal circumstances to directly manage patients with autoimmune disorders or provide prescriptions for malaria prophylaxis.

[††] http://www.dmddata.com/2009_05_sdps.pdf.

[§§] Nonroutine specialties included addiction medicine, allergy/immunology, anesthesiology, cardiology, cardiothoracic surgery, cardiovascular surgery, clinical neurophysiology, clinical pharmacology, colon and rectal surgery, critical care, critical care medicine, dentistry, dermatopathology, diagnostic laboratory, diagnostic laboratory immunology, emergency medicine, endocrinology, gastroenterology, general preventive medicine, general surgery, genetics, geriatric psychiatry, geriatrics, hematology, hepatology, hospice and palliative medicine, infectious disease, medical microbiology, naturopathic doctor, neurologic surgery, neurology, neurosurgery-critical care, nuclear medicine, nutrition, obstetrics/gynecology, obstetrics/gynecology-critical care, occupational medicine, oncology, ophthalmology, optometry, orthopedic surgery, orthopedic surgery of spine, other, other surgery, otolaryngology, otology, pain medicine, pathology, pediatric critical care, pediatric neurosurgery, pharmacist, physical medicine and rehab, plastic surgery, podiatry, psychiatry, psychology, pulmonary critical care, pulmonary diseases, radiology, sleep medicine, sports medicine, surgery, thoracic surgery, and urology.

The overall estimated number of hydroxychloroquine or chloroquine prescriptions dispensed in March and April 2020 increased from 819,906 in 2019 to 1,312,859 in 2020 (Table). In 2019, 92% of prescriptions were refill/switch prescriptions. Refill/switch prescriptions increased 1.4-fold, from 377,222 in March 2019 to 536,804 in March 2020, and remained elevated in April (456,489; 1.2-fold higher than in April 2019) (Figure 1). New prescriptions for hydroxychloroquine or chloroquine in March 2020 (222,382) were 7.2-fold higher than the 30,737 prescriptions in March 2019; in April, the number of new prescriptions (106,184) was 3.3-fold higher than the 31,748 in April 2019 (Table).

Overall, 54% of new prescriptions in March and April 2020 were written by primary care prescribers. In March 2020, primary care prescribers wrote more new prescriptions than did routine prescribers, writing 10,350 dispensed prescriptions in 2019 compared with 108,705 in 2020, a 10.5-fold increase (Figure 2). Primary care prescribers continued to be the largest source of new prescriptions in April 2020, writing 67,055 prescriptions (63% of total new prescriptions).

During March and April 2020, nonroutine prescribers accounted for the largest percentage increase in new prescriptions compared with the same period in 2019 (81.3-fold and 18.1-fold increases in March and April, respectively). The nonroutine prescribing specialties with the highest prescribing volume and growth in March 2020 were ophthalmology, anesthesiology, and cardiology.

During March and April 2019, most new prescriptions were dispensed to females (81%). In 2020, the estimated number of total new prescriptions for males was 93,776 in March (16.1-fold higher than March 2019), and 40,055 in April (6.8-fold higher than April 2019), accounting for 42% and 38% of all new prescriptions in March and April, respectively.

In May and June 2020, refill/switch prescriptions declined but remained elevated: 436,823 in May (1.1-fold higher than May 2019) and 461,670 in June (1.3-fold higher than June 2019). New prescriptions in May 2020 declined to 37,537 (7.9%) of all dispensed hydroxychloroquine or chloroquine prescriptions, with a similar number of dispensed prescriptions (38,803; 7.8%) in June 2020. In May 2020, the percentage of new prescriptions by those in nonroutine prescribing specialties declined to 18.5% from 82.5% in March and 54.2% in April.

Discussion

In the United States, during March and April 2020, monthly hydroxychloroquine and chloroquine outpatient prescribing was higher than it was during the previous year. These medications are routinely prescribed for lupus and rheumatoid arthritis (hydroxychloroquine) and for antimalarial prophylaxis malaria treatment (chloroquine), and the annual rate

TABLE. Estimated hydroxychloroquine or chloroquine retail dispensing, by prescriber category — United States, January–June, 2019 and 2020*

Specialty/Prescription characteristic	2019						2020					
	Jan	Feb	Mar	Apr	May	June	Jan	Feb	Mar	Apr	May	June
All providers (routine, primary care or unspecified, and nonroutine)												
No. of total prescriptions	414,278	373,985	407,959	411,947	420,901	396,620	413,345	383,435	759,186	562,673	474,360	500,473
Refill/Switch prescriptions†	383,105	345,244	377,222	380,199	387,761	366,750	381,260	352,959	536,804	456,489	436,823	461,670
Fold change in refill/switch prescriptions from 2019	—	—	—	—	—	—	1.0	1.0	1.4	1.2	1.1	1.3
New prescriptions, no. (% of total)	31,173 (7.5)	28,741 (7.7)	30,737 (7.5)	31,748 (7.7)	33,140 (7.9)	29,871 (7.5)	32,085 (7.8)	30,476 (7.9)	222,382 (29.3)	106,184 (18.9)	37,537 (7.9)	38,803 (7.8)
New prescriptions for males, no. (% new)	6,049 (19.4)	5,495 (19.1)	5,834 (19.0)	5,960 (18.8)	6,393 (19.3)	5808 (19.4)	5,791 (18)	5,664 (18.6)	93,776 (42.2)	40,055 (37.7)	9,916 (26.4)	9213 (23.7)
Fold change in new prescriptions from 2019	—	—	—	—	—	—	1.0	1.1	7.2	3.3	1.1	1.3
% New prescriptions from combined primary care or routine specialty	96.9	97.0	97.0	97.1	96.8	96.9	97.4	96.2	66.0	84.3	94.0	94.9
Routine prescribers**												
% of total prescriptions	64.1	64.2	64.6	64.7	64.9	64.9	64.2	64.1	49.7	53.9	61.5	62.1
No. of prescriptions	265,495	240,259	263,559	266,599	273,155	257,508	265,571	245,842	377,271	303,253	291,741	310,839
Refill/Switch prescriptions†	246,518	222,477	244,101	246,401	252,400	238,899	245,640	227,261	339,163	280,823	274,218	290,907
Fold change in refill/switch prescriptions from 2019	—	—	—	—	—	—	1.0	1.0	1.4	1.1	1.1	1.2
New prescriptions, no. (% in-group total)	18,977 (7.1)	17,782 (7.4)	19,458 (7.4)	20,198 (7.6)	20,755 (7.6)	18,609 (7.2)	19,931 (7.5)	18,581 (7.6)	38,108 (10.1)	22,430 (7.4)	17,523 (6.0)	19,932 (6.4)
New prescriptions for males, no. (% new)	3,279 (17.3)	3,074 (17.3)	3,398 (17.5)	3,488 (17.3)	3,590 (17.3)	3290 (17.7)	3,276 (16.4)	3,067 (16.5)	9,559 (25.1)	4,292 (19.1)	3,143 (17.9)	3,518 (17.6)
Fold change new prescriptions from 2019	—	—	—	—	—	—	1.1	1.0	2.0	1.1	0.9	1.1
Primary care or unspecified specialty prescribers¶												
% of total prescriptions	33.9	33.7	33.4	33.3	33.1	33.1	33.9	33.9	38.2	40.6	35.9	35.5
No. of prescriptions	140,386	126,216	136,376	137,242	139,124	131,153	140,090	130,024	290,277	228,584	170,469	177,664
Refill/switch prescriptions†	129,164	116,131	126,026	126,616	127,805	120,830	128,768	119,272	181,572	161,529	152,703	160,767
Fold change in refill/switch prescriptions from 2019	—	—	—	—	—	—	1.0	1.0	1.4	1.3	1.2	1.3
New prescriptions, no. (% in-group total)	11,222 (8.0)	10,085 (8.0)	10,350 (7.6)	10,626 (7.7)	11,319 (8.1)	10,323 (7.4)	11,322 (8.1)	10,752 (8.3)	108,705 (37.4)	67,055 (29.3)	17,766 (10.4)	16,897 (9.5)
New prescriptions for males, no. (% new)	2,494 (22.2)	2,189 (21.7)	2,194 (21.2)	2,239 (21.1)	2,486 (22.0)	2256 (21.8)	2,322 (20.5)	2,211 (20.6)	48,283 (44.4)	27,978 (41.7)	5,838 (32.9)	4,931 (29.2)
Fold change new prescriptions from 2019	—	—	—	—	—	—	1.0	1.1	10.5	6.3	1.6	1.6
Nonroutine prescribers§												
% of total prescriptions	2.0	2.0	2.0	2.0	2.1	2.0	1.9	2.0	12.1	5.5	2.6	2.4
No. of prescriptions	8,397	7,510	8,024	8,107	8,622	7,960	7,684	7,569	91,639	30,836	12,150	11,970
Refill/Switch prescriptions†	7,423	6,636	7,095	7,183	7,556	7,021	6,852	6,426	16,070	14,137	9,902	9,996
Fold change in refill/switch prescriptions from 2019	—	—	—	—	—	—	0.9	1.0	2.3	2.0	1.3	1.4
New prescriptions, no. (% in-group total)	974 (11.6)	874 (11.6)	929 (11.6)	924 (11.4)	1,066 (12.4)	939 (11.8)	832 (10.8)	1,143 (15.1)	75,569 (82.5)	16,699 (54.2)	2,248 (18.5)	1,974 (16.5)
New prescriptions for males, no. (% new)	275 (28.2)	232 (26.5)	242 (26.0)	233 (25.2)	317 (29.7)	263 (28.0)	193 (23.2)	386 (33.8)	35,934 (47.6)	7785 (46.6)	934 (41.5)	765 (38.7)
Fold change new prescriptions from 2019	—	—	—	—	—	—	0.9	1.3	81.3	18.1	2.1	2.1

* Prescription data for 2017 and 2018 were also examined but found consistent with 2019, without remarkable month to month variation.

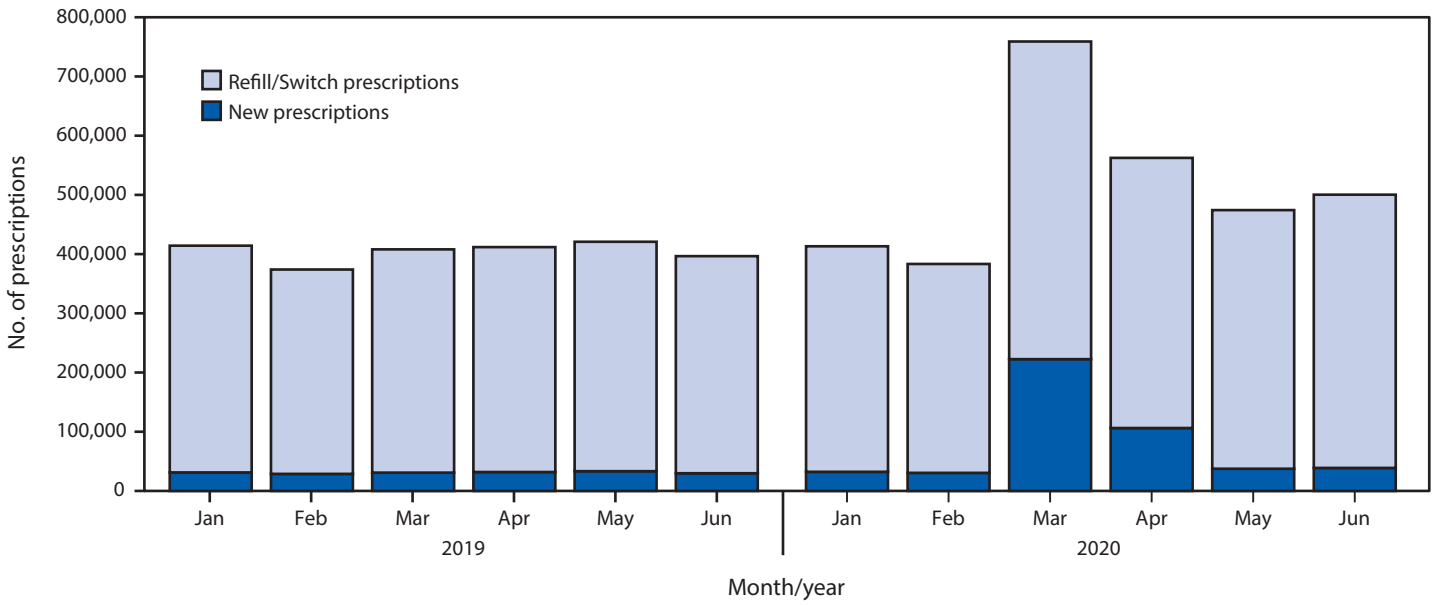
† Refill/switch prescriptions include dispensed prescriptions that were either a refill or a new prescription for a different dose or a switch in brand.

§ Nonroutine = addiction medicine, allergy/immunology, anesthesiology, cardiology, cardiothoracic surgery, cardiovascular surgery, clinical neurophysiology, clinical pharmacology, colon and rectal surgery, critical care, critical care medicine, dentistry, dermatopathology, diagnostic laboratory, diagnostic laboratory immunology, emergency medicine, endocrinology, gastroenterology, general preventive medicine, general surgery, genetics, geriatric psychiatry, geriatrics, hematology, hepatology, hospice and palliative medicine, infectious disease, medical microbiology, naturopathic doctor, neurologic surgery, neurology, neurosurgery-critical care, nuclear medicine, nutrition, obstetrics/gynecology, obstetrics/gynecology-critical care, occupational medicine, oncology, ophthalmology, optometry, orthopedic surgery, orthopedic surgery of spine, other, other surgery, otolaryngology, otology, pain medicine, pathology, pediatric critical care, pediatric neurosurgery, pharmacist, physical medicine and rehab, plastic surgery, podiatry, psychiatry, psychology, pulmonary critical care, pulmonary diseases, radiology, sleep medicine, sports medicine, surgery, thoracic surgery, and urology.

¶ Primary care/unspecified = family practice, general practice, internal medicine, internal medicine/pediatrics, nurse practitioner, osteopathic medicine, pediatrics, physician assistant, and specialty unspecified.

** Routine = allergy, dermatology, nephrology, and rheumatology.

FIGURE 1. Estimated refill/switch* and new retail prescriptions for hydroxychloroquine or chloroquine dispensed in the United States — January–June, 2019–2020



* Refill/switch prescriptions include dispensed prescriptions that were either a refill of an existing prescription or a new prescription for a different dose or a brand switch.

of prescribing has not varied substantially from year to year (*6*). In contrast, new prescriptions written by primary care prescribers and nonroutine prescribing specialists increased significantly in 2020. Primary care prescribers provided 54% of new prescriptions dispensed at outpatient retail pharmacies during March–April 2020; the largest percentage increase in new prescriptions compared with the same period in 2019 was among nonroutine prescribers.

A large increase in new prescriptions occurred for adult males (16.1-fold increase in March 2020 compared with March 2019). This increase in hydroxychloroquine prescribing for males is notable given that females are historically more likely to receive a new hydroxychloroquine prescription for autoimmune disease, consistent with described prevalence of autoimmune disorders among females (78%) (*7*). By May and June 2020, the numbers of new prescriptions and the number of new prescriptions from nonroutine prescribing specialties had declined and were approaching those of 2019. These declines might have been influenced by publication of additional studies indicating that the medications were not found to be effective for treatment of COVID-19 and by FDA safety warning (*8*).

The findings in this report are subject to at least four limitations. First, mail-order prescriptions were not included in the study, nor were prescriptions given in inpatient settings, so data do not indicate total medication use nationwide. However, the data are weighted to be nationally representative, although they are based on a sample of 92% of outpatient prescriptions.

Summary

What is already known about this topic?

Hydroxychloroquine and chloroquine are approved to treat autoimmune diseases and to prevent and treat malaria. Earlier this year, they were widely reported to be of potential benefit in the prevention and treatment of COVID-19; however, current data indicate that the potential benefits of these drugs do not outweigh their risks.

What is added by the report?

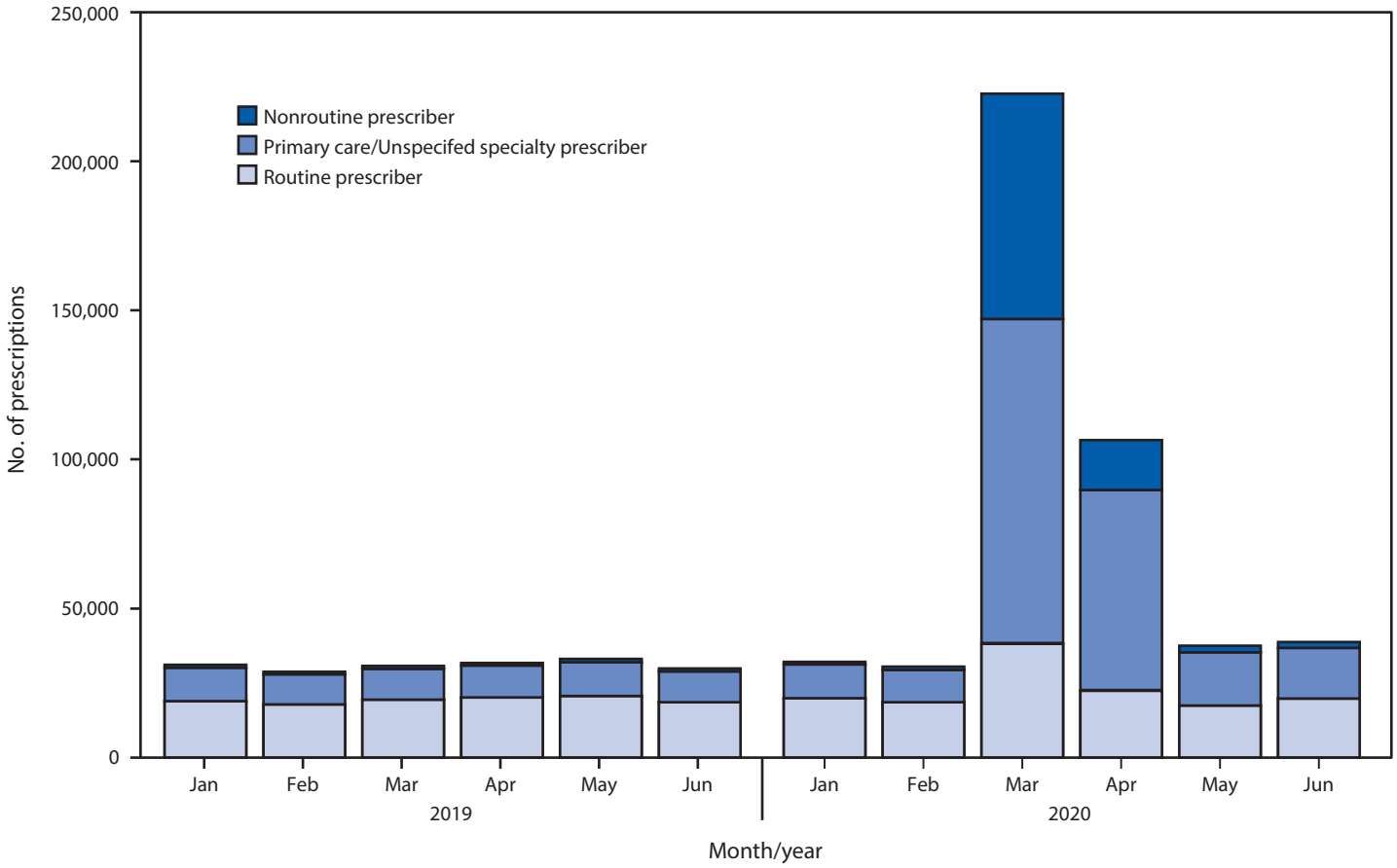
New prescriptions by specialists who did not typically prescribe these medications (defined as specialties accounting for ≤2% of new prescriptions before 2020) increased from 1,143 prescriptions in February 2020 to 75,569 in March 2020, an 80-fold increase from March 2019.

What are the implications for public health practice?

Attention to updated clinical guidance, especially by nonroutine prescribers, will help safeguard supplies and ensure safe use of hydroxychloroquine and chloroquine for patients with approved indications.

Second, because specialty information was lacking for nurse practitioners, physician assistants, and unspecified specialties, these prescribers were categorized as primary care; however, it is possible that these providers were working in routine or nonroutine prescriber practices. In addition, allopathic and osteopathic physicians with internal medicine and subspecialty training potentially were not classified by subspecialty. Third, among patients receiving prescriptions, clinical indications,

FIGURE 2. Estimated new retail prescriptions of hydroxychloroquine or chloroquine dispensed, by prescriber category* — United States, January–June, 2019–2020



* *Nonroutine prescribers* = addiction medicine, allergy/immunology, anesthesiology, cardiology, cardiothoracic surgery, cardiovascular surgery, clinical neurophysiology, clinical pharmacology, colon and rectal surgery, critical care, critical care medicine, dentistry, dermatopathology, diagnostic laboratory, diagnostic laboratory immunology, emergency medicine, endocrinology, gastroenterology, general preventive medicine, general surgery, genetics, geriatric psychiatry, geriatrics, hematology, hepatology, hospice and palliative medicine, infectious disease, medical microbiology, naturopathic doctor, neurological surgery, neurology, neurosurgery-critical care, nuclear medicine, nutrition, obstetrics/gynecology, obstetrics/gynecology-critical care, occupational medicine, oncology, ophthalmology, optometry, orthopedic surgery, orthopedic surgery of spine, other, other surgery, otolaryngology, otology, pain medicine, pathology, pediatric critical care, pediatric neurosurgery, pharmacist, physical medicine and rehab, plastic surgery, podiatry, psychiatry, psychology, pulmonary critical care, pulmonary diseases, radiology, sleep medicine, sports medicine, surgery, thoracic surgery, and urology. *Primary care/unspecified prescribers* = family practice, general practice, internal medicine, internal medicine/pediatrics, nurse practitioner, osteopathic medicine, pediatrics, physician assistant, and specialty unspecified. *Routine prescribers* = allergy, dermatology, nephrology, and rheumatology.

patients' underlying medical conditions, and concurrent medications were unknown. Finally, no information was available to confirm whether the medication was taken or stored for future use or if any adverse events occurred.

If prescribing or prescribed these drugs, providers and patients should be familiar with the potential for drug interactions and adverse events associated with hydroxychloroquine or chloroquine use (*8*,*9*). The importance of obtaining a patient's complete medical and medication history to evaluate risks should be emphasized to nonroutine prescribers of hydroxychloroquine or chloroquine. In the setting of polypharmacy and comorbid conditions, such as preexisting heart conditions, performing an electrocardiogram to evaluate the QT interval before starting these medications is advisable, because hydroxychloroquine or chloroquine can prolong the QT interval, leading to malignant arrhythmias such as torsade de pointes or ventricular fibrillation (*9*). Because of the long-terminal half-life of hydroxychloroquine (>40 days) (*10*), patients could continue to be at risk for drug interactions and adverse cardiac events after the course of therapy is completed.

Although federal guidelines now recommend against using hydroxychloroquine or chloroquine for the treatment or prevention of COVID-19, dispensing policies and restrictions vary significantly by state (*8*). Policies by boards of pharmacy in some states, such as New Jersey, require hydroxychloroquine prescriptions to include a diagnosis, documentation of a

positive diagnostic test, and be limited to a 14-day supply.¶¶ In Texas, similar restrictions instituted in May expired in July.*** Several other states advise caution in prescribing hydroxychloroquine or chloroquine for COVID-19, while allowing for clinical judgement without policy limitations. Although dispensing of hydroxychloroquine or chloroquine prescriptions has been declining since March 2020, continued attention to updated clinical guidance (*3*,*4*), especially by nonroutine prescribers, will help safeguard supplies and ensure safe use of these medications for patients with approved indications.†††

¶¶ https://www.nj.gov/oag/newsreleases20/DCA_AO_2020-01.pdf.
*** https://www.pharmacy.texas.gov/files_pdf/291.30.pdf.
††† https://www.accessdata.fda.gov/scripts/drugshortages/default.cfm.

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Jay C. Butler, Michael F. Iademarco.

Corresponding author: Lara Bull-Otterson, lbull@cdc.gov.

[1]Innovation, Technology, and Analytics Task Force, CDC COVID-19 Emergency Response Team; [2]Division of Health Informatics and Surveillance, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; [3]Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [4]Health System and Worker Safety Task Force, CDC COVID-19 Emergency Response Team; [5]Division of Environmental Health Science and Practice, National Center for Environmental Health, CDC; [6]Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC; [7]Office of the Director, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; [8]Chief Medical Officer, CDC COVID-19 Response Team; [9]Public Health Informatics Office, Center for Surveillance, Epidemiology, and Laboratory Services, CDC.

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Preventing and Mitigating SARS-CoV-2 Transmission — Four Overnight Camps, Maine, June–August 2020

Laura L. Blaisdell, MD[1]; Wendy Cohn, PhD[2]; Jeff R. Pavell, DO[3]; Dana S. Rubin, MD[4]; Jeffrey E. Vergales, MD[5]

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The World Health Organization declared coronavirus disease 2019 (COVID-19) a pandemic on March 11, 2020.* Shortly thereafter, closures of 124,000 U.S. public and private schools affected at least 55.1 million students through the end of the 2019–20 school year.† During the summer of 2020, approximately 82% of 8,947 U.S. overnight camps did not operate.§ In Maine, only approximately 20% of 100 overnight camps opened.¶ An overnight camp in Georgia recently reported SARS-CoV-2, the virus that causes COVID-19, transmission among campers and staff members when nonpharmaceutical interventions (NPIs) were not strictly followed (*1*); however, NPIs have been successfully used to mitigate SARS-CoV-2 transmission among military basic trainees (*2*). During June–August 2020, four overnight camps in Maine implemented several NPIs to prevent and mitigate the transmission of SARS-CoV-2, including prearrival quarantine, pre- and postarrival testing and symptom screening, cohorting, use of face coverings, physical distancing, enhanced hygiene measures, cleaning and disinfecting, and maximal outdoor programming. During the camp sessions, testing and symptom screening enabled early and rapid identification and isolation of attendees with COVID-19. Among the 1,022 attendees (staff members and campers) from 41 states, one territory, and six international locations, 1,010 were tested before arrival; 12 attendees who had completed a period of isolation after receiving a diagnosis of COVID-19 2 months before arrival were not tested. Four (0.4%) asymptomatic attendees received positive SARS-CoV-2 test results before arrival; these persons delayed their arrival, completed 10 days of isolation at home, remained asymptomatic, and did not receive any further testing before arrival or for the duration of camp attendance. Approximately 1 week after camp arrival, all 1,006 attendees without a previous diagnosis of COVID-19 were tested, and three asymptomatic cases were identified. Following isolation of these persons and quarantine of their contacts, no secondary transmission of SARS-CoV-2 occurred. These findings can inform similar multilayered public health strategies to prevent and mitigate the introduction and transmission of SARS-CoV-2 among children, adolescents, and adults in congregate settings, such as overnight camps, residential schools, and colleges.

Summer camps are a $26 billion dollar industry; approximately 15,000 day and overnight camps in the United States employ approximately 1.5 million staff members and host an estimated 26 million children annually. The Maine Department of Health and Human Services (DHHS) licenses Maine summer camps, which serve 20,000–25,000 children from the United States and other countries each year. Previous studies suggest that isolation and physical distancing measures likely mitigated disease during the influenza pandemic of 1918 and prevented spread of the coronavirus SARS-CoV, which caused the severe acute respiratory syndrome (SARS) epidemic in 2003 (*3*,*4*). During the 2009 influenza A virus (pH1N1) pandemic, CDC issued guidance for influenza prevention and control in camp settings focusing on early identification and isolation of ill persons and enhanced hygiene.** Camps operating in Maine during the pH1N1 2009 season followed public health guidance and implemented recommended preventive measures. Although many camps reported influenza-like illness and outbreaks, major disruptions were not reported (*5*).

To prevent, identify, and mitigate spread of COVID-19, four Maine overnight summer camps with similar size, session duration, and camper and staff member characteristics opened with uniform NPIs, including precamp quarantine, pre- and postarrival testing and symptom screening, cohorting, and physical distancing between cohorts. In addition, camps required use of face coverings, enhanced hygiene measures, enhanced cleaning and disinfecting, maximal outdoor programming, and early and rapid identification of infection and isolation.

All attendees were instructed to quarantine with their family unit (unless parents were essential workers††) for 10–14 days before camp arrival. No camp restricted attendance from any part of the country or globally but did advise on mode of travel (preferred mode was direct to camp in family vehicle; riders on camp buses wore face coverings, with physical distancing monitored by staff members; and air travelers were instructed to wear face coverings while traveling). Study activities were conducted by the medical directors and health staff members at each camp and under exempt approval by the Institutional Review Board of the University of Virginia.

* https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020.
† https://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html.
§ https://www.acacamps.org/press-room/aca-facts-trends.
¶ https://mainecamps.org.
** https://www.cdc.gov/h1n1flu/camp.htm.
†† Families of essential workers were instructed to limit interaction with camper to the degree possible in the 10–14 days leading up to camp.

Attendees with COVID-19 were defined as detection of SARS-CoV-2 by reverse transcription–polymerase chain reaction (RT-PCR) testing. Approximately 5–7 days (mean = 2.4–9.4 days) before camp arrival, 1,010 of the 1,022 attendees were tested for SARS-CoV-2 by RT-PCR at the attendees' primary care providers or at commercial laboratories that provided services directly to consumers, including camps and schools according to Food and Drug Administration's Emergency Use Authorizations. Attendees with self-reported symptoms consistent with COVID-19 as defined by CDC (https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html) before camp arrival were referred to their primary care provider for further evaluation. Three of four camps mandated submission of test results before camp entry, and delays in receipt of test results caused one camp to isolate 15 campers until negative results were known, up to 4 days after camp arrival.

To address potential late exposures or exposures during travel, all camps quarantined attendees by cohort for 14 days after camp arrival, regardless of testing or screening results. Each camp implemented NPIs with careful attention to the population served, physical attributes of the camp, and camp-specific daily programming to identify and mitigate high-transmission–risk activities occurring between cohorts. All attendees received instruction on hygiene measures such as cough and sneeze etiquette and hand hygiene, with the requirement to clean hands with soap and water or hand sanitizer containing a minimum of 60% ethanol or 70% isopropanol before and after all activity periods, meals, and other high-touch interactions. Compliance with all NPIs was monitored by staff members. Staff members did not leave camp during the session for days off.

After camp arrival, campers and staff members were screened by health staff members at least daily (at one camp twice daily) for fever (temperature >100.4°F [38°C]) with infrared thermometers and through direct questioning for symptoms consistent with COVID-19. Programmatic changes to usual camp activities included limiting indoor activities that mixed cohorts, staggering dining periods or dining outdoors, cohort-specific programming, and limiting sports to those that allowed for physical distancing between staff members and cohorts. Stable cohorts were based on living quarters (e.g., bunk assignment) or age division and ranged in number from 5–44 attendees. If interacting outside the cohort, attendees were required to wear face coverings and maintain a physical distance of 6 feet for a minimum of 14 days. Bathroom use was organized by cohort using separate bathrooms or staggering use. In general, cleaning and disinfection of the camps followed the Maine Center for Disease Control and American Camp Association Field Guide for Camps on Implementation of CDC Guidance.[§§] Shared items were cleaned and disinfected as much as possible, with high touch areas (e.g., door handles or railings) being cleaned more frequently. Personal sports equipment and shared items were disinfected immediately after use, or a minimum of 24 hours was required before subsequent use. Kitchens followed standard protocols, as well as state COVID-19 protocols for restaurants. Bathrooms were cleaned and disinfected twice daily. Camps attempted to use single-use items, such as milk cartons and single-use condiment packs or silverware, to the extent possible.

RT-PCR testing was repeated a mean of 4.1 to 9.1 days after camp arrival for 1,006 attendees, with results available approximately 2–3 days later; no attendees declined testing. Attendees with positive SARS-CoV-2 test results or those who reported symptoms consistent with COVID-19 were isolated immediately, and their cohort was quarantined until the attendee received a negative test result.

Before the 1,022 attendees departed for camp, four (0.4%) asymptomatic attendees received positive SARS-CoV-2 test results and delayed their arrival; they were subsequently isolated for 10 days at their homes, were not retested before camp entry, were considered to not have COVID-19 at time of camp arrival, and did not receive any further testing for the duration of their attendance. Twelve attendees (nine staff members and three campers) were not tested before travel to camp because they had completed a period of isolation after experiencing symptoms and having received positive SARS-CoV-2 RT-PCR test results in the 2 months before camp opening. The remaining 1,006 attendees received negative SARS-CoV-2 test results.

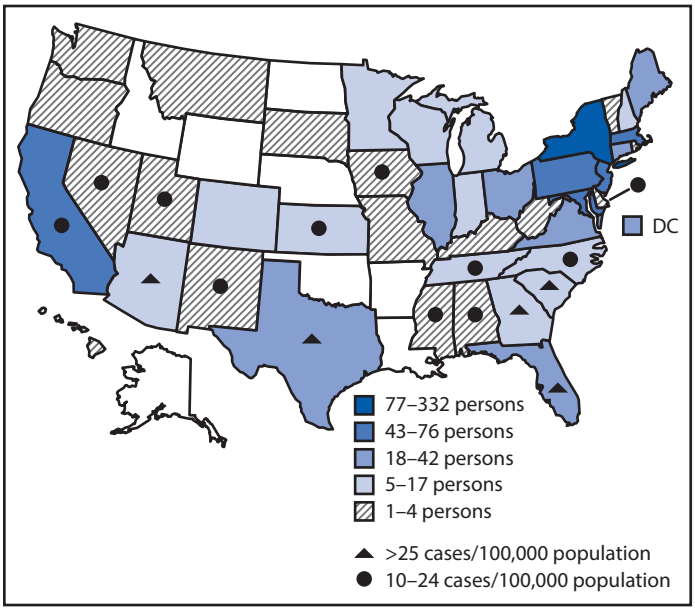
During June–August, the combined attendance of the four camps included 642 children and 380 staff members, aged 7–70 years, from 41 states with a variety of 7-day average rate of SARS-CoV-2 infection (Figure); 1.8% of camp attendees[¶¶] (10 staff members and eight campers) came from six international locations (Bermuda, Canada, Mexico, South Africa, Spain, and United Kingdom) and Puerto Rico (Table 1). Camp sessions ranged from 44 to 62 days (including a 14-day staff member orientation) during June 15–August 16, 2020. The number of campers in cabins (including dormitory-style quarters) ranged from five to 44 campers (Table 2). No attendee reported a condition that precluded wearing a face covering, and all attendees were observed to comply with use of face coverings and physical distancing.

Daily symptom checks identified 12 attendees (one staff member and 11 campers) (1.2%) with signs or symptoms compatible with COVID-19; symptomatic persons were immediately isolated and tested, and their cohorts were quarantined until test results were available. All 12 isolated attendees received negative test results, after which isolation and cohort quarantine were discontinued.

[§§] https://www.acacamps.org/resource-library/coronavirus/camp-business/camp-operations-guide-summer-2020.

[¶¶] Camps were for children aged 8–15 years. Staff members are aged >15 years.

FIGURE. Camp population, by home state* and by 7-day daily average rate of SARS-CoV-2 infection† in home state as calculated on July 1, 2020§ — four overnight camps, Maine, June–August 2020



* Combined attendance by quintiles of home state of the four camps included 642 children and 380 staff members aged 7–70 years, representing 41 states; 18 attendees (10 staff members and eight campers) originating from six international locations (Bermuda, Canada, Mexico, South Africa, Spain, and United Kingdom) and Puerto Rico are not shown on the map. States with incidence <10 cases per 100,000 population not designated. Jenks natural breaks used for attendee classification by home state.
† Average case rate indexed to the state-specific population sourced by Harvard Global Health Institute (https://globalepidemics.org).
§ July 1, 2020, is when the state of Maine allowed overnight camps to open for business.

Three asymptomatic attendees at three different camps (two staff members and one camper) (0.3%) received positive SARS-CoV-2 test results after arrival at camp and were rapidly isolated and their cohorts (sized five, six, and 30 attendees) quarantined for 14 days per state and CDC guidance. Both asymptomatic staff members isolated for 10 days and received negative test results twice 24 hours apart at the end of their isolation. The asymptomatic camper was isolated on day 3 after testing when positive test results were received. The camper was retested on days 4 and 5 after a positive test result and released from isolation on day 8 after a second negative result was received (per CDC isolation termination guidelines at that time). The 30 members of the camper's cohort were retested on days 3 and 4 after the asymptomatic camper's initial positive test result. No cohort members received a positive test result, and all were released from quarantine on day 8 after the asymptomatic camper's positive test result. No secondary transmission was identified.

TABLE 1. Characteristics of campers and staff members,* — four overnight camps, Maine, June–August 2020

Characteristic	No. (%)*
Total	**1,022 (100)**
Sex	
Male	470 (46)
Female	552 (54)
Role	
Camper	642 (63)
Staff member	380 (37)
Age group, yrs†	
7–8	30 (3)
9–10	135 (13)
11–12	175 (17)
13–14	184 (18)
15–18	133 (13)
19–21	151 (15)
22–29	126 (12)
30–49	45 (4)
50–70	43 (4)
Home region§	
Middle Atlantic	438 (43)
South	187 (18)
New England	173 (17)
Midwest	105 (10)
West Coast	100 (10)
International¶	18 (2)

* Percentages might not sum to 100% because of rounding.
† Age was ascertained at time of camp entry.
§ Domestic home regions defined according to U.S. Census regions: *New England*: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. *Middle Atlantic*: New Jersey, New York, Pennsylvania. *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.
¶ International included six international locations (Bermuda, Canada, Mexico, South Africa, Spain, and United Kingdom) and Puerto Rico.

Discussion

Diligent use of multiple NPIs was successful in preventing and mitigating SARS-CoV-2 transmission in four Maine overnight camps. Although no single intervention can prevent SARS-CoV-2 transmission, a multilayered use of NPIs allowed camps to prevent transmission and quickly identify campers or staff members with SARS-CoV-2 infection to successfully mitigate spread. Camps did not rely on testing as a sole NPI. Notably, stable, small, segregated cohorts allowed camps to isolate and quarantine a wide age range of younger attendees with potential COVID-19 symptoms and exposures while continuing camp operations in other cohorts.

Testing and quarantine before staff member and camper arrival was essential to identifying SARS-CoV-2 infection and preventing introduction of virus into these congregate settings of younger adults who might be only mildly symptomatic or

TABLE 2. Camp session dates,* number of camp days, median cabin population, and enrollment, by camp — four overnight camps, Maine, June–August 2020

Characteristic	Camp A	Camp B	Camp C	Camp D
Camp session dates	Jun 25–Aug 8, 2020	Jun 25–Aug 8, 2020	Jun 15–Aug 18, 2020	Jun 23–Aug 9, 2020
Total camp days	44	44	62	47
Median 2020 cabin population (range)†	7 (7–10)	12 (5–44)	5 (5–25)	8 (5–30)
Total 2020 enrollment	276	287	202	257
Campers (n = 642)	156	180	140	166
Staff members (n = 380)	120	107	62	91
Total usual enrollment§	380	400	240	327
Campers	250	230	155	200
Staff members	130	170	85	127
Percentage of usual enrollment, %§	72.6	71.8	84.2	78.6

* Camp sessions inclusive of additional 14-day staff member orientation.
† Includes dormitory style quarters with common living areas.
§ Usual enrollment was defined as normal capacity of each camp during 2017–2019.

Summary

What is already known about this topic?

Nonpharmaceutical interventions (NPIs) have been shown to decrease spread of communicable disease. Data on the effectiveness of NPIs on the prevention and mitigation of SARS-CoV-2 transmission among children and adolescents in congregate settings are limited.

What is added by this report?

During the 2020 summer camp season, four Maine overnight camps with 1,022 attendees from 41 states and international locations implemented a multilayered prevention and mitigation strategy that was successful in identifying and isolating three asymptomatic COVID-19 cases and preventing secondary transmission.

What are the implications for public health practice?

Understanding successful interventions to prevent and mitigate SARS-CoV-2 transmission in overnight camps has important implications for similar congregate settings such as day camps and schools with the same age range.

presymptomatic (*6*–*9*). Prearrival testing with timely results, strict quarantining, and NPI use during transit were important, as was conscientious NPI use in the first 2 weeks after arrival. Testing after camp arrival identified three asymptomatic attendees with positive SARS-CoV-2 RT-PCR test results, but because these attendees were isolated and their cohorts quarantined, no transmission in the congregate setting or cohort occurred. Screening for symptoms after camp arrival identified 12 attendees who were isolated, and their cohorts were quarantined while awaiting test results. Both isolated and quarantined groups returned to the general camp population after the symptomatic attendees received negative SARS-CoV-2 test results.

The findings in this report are subject to at least five limitations. First, the degree of adherence to NPIs was not measured. Second, not testing all campers and staff members at the end of sessions might have missed asymptomatic transmission. Third, all camps were single sessions and interventions might not have similar results in multiple session overnight camps. Fourth, travel was assumed to be from home state as documented but intermediate travel might have occurred and attendees might not possess the same risk as other persons in their state. Finally, the low rate of COVID-19 in this study increases the likelihood that NPIs would be effective for at least some duration.

These findings demonstrate that multilayered public health prevention and mitigation strategies in an overnight camp setting can identify and prevent SARS-CoV-2 transmission, regardless of the prevalence of SARS-CoV-2 transmission in the domestic and international communities from which campers and staff members are arriving. Prearrival quarantine and testing, access to timely test results, cohorting, and the ability to isolate and quarantine during camp allowed prevention and early identification of infection that might not be practicable or feasible in all settings. These findings have important implications for the successful implementation of COVID-19 mitigation strategies in other overnight camps, residential schools, and colleges.

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Corresponding author: Laura L. Blaisdell, blaisl@mmc.org.

[1]Center for Outcomes Research and Evaluation, Department of Pediatrics, Maine Medical Center Research Institute and Maine Medical Center, Portland, Maine; [2]Department of Public Health Sciences, University of Virginia School of Medicine, Charlottesville, Virginia; [3]Englewood Health, Inc., Englewood, New Jersey; [4]Department of Pediatrics and Psychiatry, Boston University School of Medicine, Boston, Massachusetts; [5]Department of Pediatrics, University of Virginia School of Medicine, Charlottesville, Virginia.

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Seroprevalence of SARS-CoV-2 Among Frontline Health Care Personnel in a Multistate Hospital Network — 13 Academic Medical Centers, April–June 2020

Wesley H. Self, MD[1]; Mark W. Tenforde, MD, PhD[2]; William B. Stubblefield, MD[1]; Leora R. Feldstein, PhD[2]; Jay S. Steingrub, MD[3]; Nathan I. Shapiro, MD[4]; Adit A. Ginde, MD[5]; Matthew E. Prekker, MD[6]; Samuel M. Brown, MD[7]; Ithan D. Peltan, MD[7]; Michelle N. Gong, MD[8]; Michael S. Aboodi, MD[8]; Akram Khan, MD[9]; Matthew C. Exline, MD[10]; D. Clark Files, MD[11]; Kevin W. Gibbs, MD[11]; Christopher J. Lindsell, PhD[1]; Todd. W. Rice, MD[1]; Ian D. Jones, MD[1]; Natasha Halasa, MD[1]; H. Keipp Talbot, MD[1]; Carlos G. Grijalva, MD[1]; Jonathan D. Casey, MD[1]; David N. Hager, MD, PhD[12]; Nida Qadir, MD[13]; Daniel J. Henning, MD[14]; Melissa M. Coughlin, PhD[2]; Jarad Schiffer, MS[2]; Vera Semenova, PhD[2]; Han Li, PhD[2]; Natalie J. Thornburg, PhD[2]; Manish M. Patel, MD[2]; CDC COVID-19 Response Team; IVY Network

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Health care personnel (HCP) caring for patients with coronavirus disease 2019 (COVID-19) might be at high risk for contracting SARS-CoV-2, the virus that causes COVID-19. Understanding the prevalence of and factors associated with SARS-CoV-2 infection among frontline HCP who care for COVID-19 patients are important for protecting both HCP and their patients. During April 3–June 19, 2020, serum specimens were collected from a convenience sample of frontline HCP who worked with COVID-19 patients at 13 geographically diverse academic medical centers in the United States, and specimens were tested for antibodies to SARS-CoV-2. Participants were asked about potential symptoms of COVID-19 experienced since February 1, 2020, previous testing for acute SARS-CoV-2 infection, and their use of personal protective equipment (PPE) in the past week. Among 3,248 participants, 194 (6.0%) had positive test results for SARS-CoV-2 antibodies. Seroprevalence by hospital ranged from 0.8% to 31.2% (median = 3.6%). Among the 194 seropositive participants, 56 (29%) reported no symptoms since February 1, 2020, 86 (44%) did not believe that they previously had COVID-19, and 133 (69%) did not report a previous COVID-19 diagnosis. Seroprevalence was lower among personnel who reported always wearing a face covering (defined in this study as a surgical mask, N95 respirator, or powered air purifying respirator [PAPR]) while caring for patients (5.6%), compared with that among those who did not (9.0%) (p = 0.012). Consistent with persons in the general population with SARS-CoV-2 infection, many frontline HCP with SARS-CoV-2 infection might be asymptomatic or minimally symptomatic during infection, and infection might be unrecognized. Enhanced screening, including frequent testing of frontline HCP, and universal use of face coverings in hospitals are two strategies that could reduce SARS-CoV-2 transmission.

HCP who care for patients with COVID-19 are at risk for exposure and infection during patient care–related activities (*1*,*2*), and once infected, can spread SARS-CoV-2 to patients, coworkers, and others in the community. Therefore, understanding the frequency of SARS-CoV-2 infection among frontline HCP and characteristics associated with infection among HCP is important for planning effective strategies for minimizing SARS-CoV-2 spread in health care settings and associated communities (*3*,*4*).

Most persons who are infected with SARS-CoV-2 develop antibodies to SARS-CoV-2 proteins within 1–2 weeks of infection (*5*). Serologic testing for SARS-CoV-2 antibodies, albeit having variable sensitivity and specificity (*6*), might provide a useful marker for identifying past SARS-CoV-2 infection. In this study, SARS-CoV-2 antibodies were measured among HCP who regularly cared for patients with COVID-19, with the aim of identifying past infection and describing characteristics associated with seropositive test results.

This study was conducted by the Influenza Vaccine Effectiveness in the Critically Ill (IVY) Network, which is a collaboration of academic medical centers in the United States conducting epidemiologic studies on influenza and COVID-19 (*1*). Thirteen IVY Network medical centers from 12 states participated.* Each hospital enrolled a convenience sample of HCP (*1*) who regularly had direct patient contact in hospital-based units caring for adult COVID-19 patients since February 1, 2020, including emergency departments (EDs), intensive care units (ICUs), and hospital wards. Targeted enrollment was 250 participants per hospital, and volunteers were enrolled during April 3–June 19. HCP who were not working because of illness or quarantine were not enrolled. Participants underwent phlebotomy for serum collection and answered survey questions about demographic characteristics, medical history, symptoms, previous clinical testing for acute SARS-CoV-2 infection, and PPE practices while caring for patients in areas with COVID-19 patients. Participants were classified as having symptoms of an acute

*Harborview Medical Center, Washington; Oregon Health & Sciences University, Oregon; University of California Los Angeles, California; Hennepin County Medical Center, Minnesota; Vanderbilt University Medical Center, Tennessee; Ohio State University Wexner Medical Center, Columbus, Ohio; Wake Forest University, North Carolina; Montefiore Medical Center, New York; Beth Israel Deaconess Medical Center, Massachusetts; Baystate Medical Center, Massachusetts; Intermountain Medical Center, Utah; UCHealth University of Colorado Hospital, Colorado; and Johns Hopkins Hospital, Maryland.

Summary

What is already known about this topic?

Little is known about the prevalence and features of SARS-CoV-2 infection among frontline U.S. health care personnel.

What is added by this report?

Among 3,248 personnel observed, 6% had antibody evidence of previous SARS-CoV-2 infection; 29% of personnel with SARS-CoV-2 antibodies were asymptomatic in the preceding months, and 69% had not previously received a diagnosis of SARS-CoV-2 infection. Prevalence of SARS-CoV-2 antibodies was lower among personnel who reported always wearing a face covering while caring for patients (6%), compared with those who did not (9%).

What are the implications for public health practice?

A high proportion of SARS-CoV-2 infections among health care personnel appear to go undetected. Universal use of face coverings and lowering clinical thresholds for testing could be important strategies for reducing hospital transmission.

viral illness if they reported any of the following signs or symptoms from February 1, 2020, until the enrollment date: fever (temperature >99.5°F [37.5°C]), cough, shortness of breath, myalgias, sore throat, vomiting, diarrhea, or change in sense of taste or smell. Participants were asked whether they thought that they previously had COVID-19 (*7*). Participants also self-reported PPE use in the past week and whether they personally experienced at least one episode of PPE shortage since February 1, 2020, defined as inability to access at least one of the following forms of PPE when it was wanted for patient care: surgical masks, N95 respirators, PAPRs, gowns, gloves, or face shields.

CDC received serum specimens and completed testing for SARS-CoV-2 antibodies with an enzyme-linked immunosorbent assay against the extracellular domain of the SARS-CoV-2 spike protein.[†] This assay uses anti-pan–immunoglobulin (Ig) secondary antibodies that detect any SARS-CoV-2 immunoglobulin isotype, including IgM, IgG, and IgA. A specimen was considered reactive if it had a signal to threshold ratio >1.0 at a serum dilution of 1:100, correcting for background. Previous validation work with this assay demonstrated approximate sensitivity of 96% and specificity of 99%. Local area community incidence of COVID-19 was estimated from SARS-CoV-2 test results reported at hospital-area county public health departments. Local area community incidence was calculated as the total number of reported COVID-19 cases at the health departments from the beginning of the pandemic through 7 days after the first date of HCP enrollment at the participating hospital divided by county population and multiplied by 1,000 (*8*).

[†] https://www.biorxiv.org/content/10.1101/2020.04.24.057323v2.

Participants were classified as having positive serology (i.e., SARS-CoV-2 antibodies detected at or above the threshold) or negative serology (i.e., SARS-CoV-2 antibodies below the threshold). Characteristics of the seropositive and seronegative groups were compared using Wilcoxon rank-sum tests for continuous variables and Pearson's chi-squared tests or Fisher's exact tests for categorical variables. Statistical analyses were conducted using Stata software (version 16; StataCorp). This activity was reviewed by the Institutional Review Boards at the participating medical centers and by CDC and was conducted consistent with applicable federal law and institutional policies.[§]

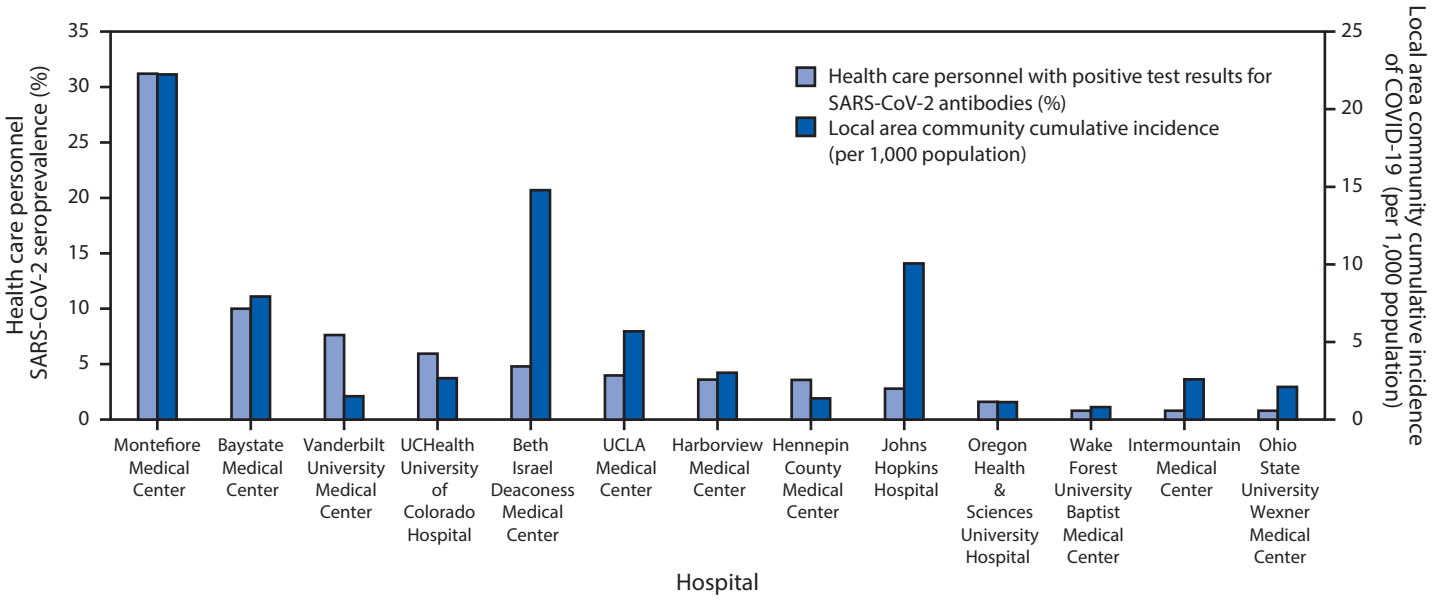
Among 3,248 enrolled HCP, 1,445 (44%) were nurses, 919 (28%) were physicians, nurse practitioners, or physician assistants, 235 (7%) were respiratory therapists, and 648 (20%) had other clinical roles; the clinical role of one HCP was unknown. The median age of participants was 36 years, and most (80%) reported no underlying medical conditions. Among participants, 1,292 (40%) reported working primarily in an ICU, 1,139 (35%) primarily in an ED, and 817 (25%) primarily in other locations. Among the 3,248 participants, 194 (6.0%) had detectable SARS-CoV-2 antibodies. Seroprevalence varied widely by medical center, ranging from 0.8% (three facilities) to 31.2%, with generally higher seroprevalence at medical centers within counties with high local area community cumulative incidence of COVID-19 (Figure).

Characteristics of Health Care Personnel With and Without SARS-CoV-2 Antibodies

SARS-CoV-2 antibody detection differed among participants according to demographic characteristics. Seropositivity was lower among females (5.3%) than among males (7.2%) (p = 0.03) and among non-Hispanic White participants (4.4%) than among participants of other racial/ethnic groups (9.7%) (p<0.001). Symptoms of an acute viral illness since February 1, 2020, were more prevalent in participants with antibodies detected (71%) than in those without antibodies detected (43%) (p<0.001) (Table). Notably, of 194 participants with antibodies detected, 86 (44%) reported that they did not believe they previously had COVID-19, 56 (29%) reported no symptoms of an acute viral illness since February 1, 2020, and 133 (69%) had not previously had positive test results for acute SARS-CoV-2 infection. A previous positive test was reported by 61 participants, representing 31% of the 194 participants with antibodies detected and 66% of 92 participants with both antibodies detected and previous SARS-CoV-2 testing completed.

[§] 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

FIGURE. SARS-CoV-2 seroprevalence among a convenience sample of frontline health care personnel and local area community cumulative incidence of COVID-19* — 13 academic medical centers, United States, April–June 2020†



Abbreviation: COVID-19 = coronavirus disease 2019.

* Calculated as the total number of reported community COVID-19 cases within a hospital-area county or counties between the beginning of the pandemic and 7 days after the first day of health care personnel enrollment at the hospital divided by population of the county or counties x 1,000.

† The medical centers, counties, and dates of enrollment included: Montefiore Medical Center, Bronx, New York (Bronx, Kings, New York, Queens, and Richmond counties, May 4–5, 2020); Baystate Medical Center, Springfield, Massachusetts (Hampden County, April 22–29, 2020); Vanderbilt University Medical Center, Nashville, Tennessee (Davidson County, April 3–13, 2020); UCHealth University of Colorado Hospital, Aurora, Colorado (Adams, Arapahoe, and Denver counties, April 16–20, 2020); Beth Israel Deaconess Medical Center, Boston, Massachusetts (Suffolk County, April 20–27, 2020); UCLA Medical Center, Los Angeles, California (Los Angeles County, May 26–June 5, 2020); Harborview Medical Center, Seattle, Washington (King County, April 30–May 11, 2020); Hennepin County Medical Center, Minneapolis, Minnesota (Hennepin County, April 23-28, 2020); Johns Hopkins Hospital, Baltimore, Maryland (Baltimore County and Baltimore City, June 12–19, 2020); Oregon Health & Sciences University Hospital, Portland, Oregon (Multnomah County, May 6–7, 2020); Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina (Forsyth County April 29–May 7, 2020); Intermountain Medical Center, Murray, Utah (Salt Lake County, April 30, 2020); Ohio State University Wexner Medical Center, Columbus, Ohio (Franklin, Delaware, Licking, Madison, Pickaway, and Fairfield counties, April 20–May 21, 2020).

Personal Protective Equipment Use

Use of a face covering during all clinical encounters in the week preceding enrollment was reported by 2,904 (89%) participants. Detection of SARS-CoV-2 antibodies was less common among participants who reported using a face covering for all clinical encounters (6%) than among those who did not (9%) (p = 0.012). Shortages of any PPE equipment since February 1, 2020, were reported by 398 (12%) participants; shortages of N95 respirators (reported by 5% of participants) were those most commonly reported. In eight of the 13 medical centers, >10% of participants reported a PPE shortage. A higher percentage of participants who reported a PPE shortage had detectable SARS-CoV-2 antibodies (9%) than did those who did not report a PPE shortage (6%) (p = 0.009).

Discussion

Among a convenience sample of HCP who routinely cared for COVID-19 patients in 13 U.S. academic medical centers from February 1, 2020, 6% had evidence of previous SARS-CoV-2 infection, with considerable variation by location that generally correlated with community cumulative incidence. Among participants who had positive test results for SARS-CoV-2 antibodies, approximately one third did not recall any symptoms consistent with an acute viral illness in the preceding months, nearly one half did not suspect that they previously had COVID-19, and approximately two thirds did not have a previous positive test result demonstrating an acute SARS-CoV-2 infection. These findings suggest that some SARS-CoV-2 infections among frontline HCP are undetected and unrecognized, possibly because of the minimally symptomatic or subclinical nature of some infections, underreporting of symptoms, or nonsystematic testing of some personnel with symptomatic infections.

This study resulted in the identification of two factors potentially associated with SARS-CoV-2 infection among HCP: PPE shortages and interacting with patients without wearing a face covering. These findings highlight the importance of maintaining PPE supplies at hospitals caring for COVID-19 patients and, assuming adequate supply, adhering to policies that encourage the use of masks for all interactions between HCP and patients. Universal masking has been associated with a significantly lower rate of infection among HCP (*9*).

TABLE. Characteristics, previous symptoms, and previous testing for acute SARS-CoV-2 infection among a convenience sample of frontline health care personnel, by SARS-CoV-2 serology results — 13 academic hospitals,* United States, April–June 2020

Characteristic†	SARS-CoV-2 serology result, no. (%)		p-value§
	Positive (n = 194)	Negative (n = 3,054)	
Median age (IQR), years	38 (31–48)	35 (30–45)	0.077
Sex			
Females	113 (58)	2,014 (66)	0.029
Males	81 (42)	1,040 (34)	
Race/Ethnicity			
White, non-Hispanic	102 (54)	2,192 (73)	<0.001
Black, non-Hispanic	35 (19)	171 (6)	
Asian, non-Hispanic	25 (13)	340 (11)	
Other race, non-Hispanic	4 (2)	73 (2)	
Hispanic	23 (12)	228 (8)	
Chronic medical conditions and substance use			
Any comorbidity¶	37 (19)	607 (20)	0.790
Asthma	14 (7)	302 (10)	0.220
Diabetes mellitus	2 (1)	68 (2)	0.440
Hypertension	19 (10)	213 (7)	0.140
Autoimmune disease	2 (1)	88 (3)	0.170
Current smoker	3 (2)	125 (4)	0.085
Primary location of clinical work			
Emergency department	61 (31)	1,078 (35)	0.089
Intensive care unit	80 (41)	1,212 (40)	
Hospital ward	22 (11)	436 (14)	
Other	31 (16)	328 (11)	
Clinical role			
Nurse	73 (38)	1,372 (45)	0.002
Physician, nurse practitioner, or physician assistant	52 (27)	867 (28)	
Respiratory therapist	10 (5)	225 (7)	
Paramedic	3 (2)	53 (2)	
Other**	56 (29)	536 (18)	
Typical no. of clinical workdays per week since February 1, 2020, median (IQR), days	3 (3–5)	3 (3–4)	0.003
Participant reported belief that he or she previously had COVID-19	108 (56)	554 (18)	<0.001
Specific signs or symptoms reported			
Cough	78 (40)	780 (26)	<0.001
Sore throat	57 (29)	764 (25)	0.180
Myalgias	67 (35)	445 (15)	<0.001
Fever	58 (30)	367 (12)	<0.001
Shortness of breath	40 (21)	315 (10)	<0.001
Vomiting	17 (9)	77 (3)	<0.001
Diarrhea	38 (20)	292 (10)	<0.001
Dysgeusia	55 (28)	84 (3)	<0.001
Anosmia	54 (28)	77 (3)	<0.001
Cough or fever or shortness of breath	106 (55)	932 (31)	<0.001
Any of the above symptoms reported	138 (71)	1,309 (43)	<0.001
If any symptoms reported, time from symptom onset to serology specimen collection, median (IQR), days	30 (18–42)	34 (20–60)	0.005
SARS-CoV-2 testing for acute infection completed clinically before serology testing††			
Test not done	102 (53)	2,547 (83)	<0.001
Test done	92 (47)	507 (17)	
Test positive	61 (66% of 92 tested)	6 (1% of 507 tested)	
Test negative or indeterminate	31 (34% of 92 tested)	501 (99% of 507 tested)	

See table footnotes on the next page.

The findings in this report are subject to at least four limitations. First, bias might have occurred if personnel at higher or lower risk for infection were less or more likely to volunteer to participate; for example, HCP not working because of illness or quarantine were not recruited and might have been at higher risk for SARS-CoV-2 infection. Second, seroprevalence could be underestimated if participants who were infected had not yet mounted an antibody response or if antibody titers had declined since infection (*10*). Third, information on facility-level infection prevention and control practices that could further

TABLE. (*Continued*) Characteristics, previous symptoms, and previous testing for acute SARS-CoV-2 infection among a convenience sample of frontline health care personnel, by SARS-CoV-2 serology results — 13 academic hospitals,* United States, April–June 2020

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

* Seropositive indicates that participants had antibody levels to SARS-CoV-2 detected above a threshold value, whereas seronegative indicates that antibody levels were below the threshold. Participants were from a convenience sample of health care personnel who reported regularly having direct patient contact since February 1, 2020, in units that cared for COVID-19 patients, from one of 13 academic medical centers (Harborview Medical Center [Washington], Oregon Health & Sciences University [Oregon], University of California Los Angeles [California], Hennepin County Medical Center [Minnesota], Vanderbilt University Medical Center [Tennessee], Ohio State University Wexner Medical Center [Ohio], Wake Forest University [North Carolina], Montefiore Medical Center [New York], Beth Israel Deaconess Medical Center [Massachusetts], Baystate Medical Center [Massachusetts], Intermountain Medical Center [Utah], UCHealth University of Colorado Hospital [Colorado], and Johns Hopkins Hospital [Maryland]).

† Some participants had missing data for characteristics: age (25), race/ethnicity (55), clinical role (one), typical number of clinical workdays per week (five), whether or not they believed they previously had COVID-19 (one).

§ Wilcoxon rank-sum tests for continuous variables and Pearson's chi-squared tests or Fisher's exact tests for categorical variables.

¶ Participants were asked whether they had 11 chronic medical conditions, including asthma, chronic obstructive pulmonary disease, other chronic lung condition, chronic heart failure, coronary artery disease, diabetes mellitus, hypertension, autoimmune disease, active cancer, or an immunosuppressive condition, or required chronic renal replacement therapy (dialysis).

** Clinical role of the 56 participants with positive serology for SARS-CoV-2 who identified their clinical role as "other" included: patient care technician (22), radiology technician (11), occupational or physical therapist (eight), nursing leadership (five), social worker (three), public safety officer (two), behavioral health worker (one), chaplain (one), speech pathologist (one), housekeeping (one), laboratory technician (one).

†† Six participants had negative test results for SARS CoV-2 antibodies and reported a positive clinical test for SARS-CoV-2 before serology testing; among these six participants, 20, 29, 31, 35, 36, and 46 days had elapsed from the clinical test and specimen collection for study serology testing.

affect exposure risk was not collected. Also, multivariable models to adjust for confounding were not performed. Finally, among seropositive HCP, exposure that led to SARS-CoV-2 infection could have occurred within the hospital setting or the community and this study could not distinguish between these potential sources of exposure. In general, seroprevalence among HCP across sites correlated with community COVID-19 incidence. SARS-CoV-2 exposures in the hospital could also have occurred between health care providers (e.g., within shared workspaces).

Evidence of previous SARS-CoV-2 infection was detected in 6% of frontline HCP from 13 academic medical centers within the first several weeks of U.S. transmission, although prevalence varied considerably by location. A high proportion of personnel with antibodies did not suspect that they had been previously infected. The risk for transmission of SARS-CoV-2 from HCP to others within hospitals might be mitigated by adherence to recommended practices such as universal use of face coverings and suggestions to have dedicated cohorts of HCP caring for patients with COVID-19. In addition to maintaining PPE supplies and instituting universal face covering policies for HCP at work, enhanced screening, including frequent testing of frontline HCP, and universal use of face coverings in hospitals are strategies that could reduce SARS-CoV-2 transmission.

IVY Network

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CDC COVID-19 Response Team

Mohammed Ata Ur Rasheed, CDC COVID-19 Response Team; Lisa Mills, CDC COVID-19 Response Team; Sandra N. Lester, CDC COVID-19 Response Team; Brandi Freeman, CDC COVID-19 Response Team; Bailey Alston, CDC COVID-19 Response Team; Muyiwa Ategbole, CDC COVID-19 Response Team; Peter Browning, CDC COVID-19 Response Team; Li Cronin, CDC COVID-19 Response Team; Ebenezer David, CDC COVID-19 Response Team; Rita Desai, CDC COVID-19 Response Team; Monica Epperson, CDC COVID-19 Response Team; Yamini Gorantla, CDC COVID-19 Response Team; Tao Jia, CDC COVID-19 Response Team; Pete Maniatis, CDC COVID-19 Response Team; Kristina Ortiz, CDC COVID-19 Response Team; So Hee Park, CDC COVID-19 Response Team; Palak Patel, CDC COVID-19 Response Team; Yunlong Qin, CDC COVID-19 Response Team; Heather Tatum, CDC COVID-19 Response Team; Briana Zellner, CDC COVID-19 Response Team.

Corresponding author: Wesley H. Self, wesley.self@vumc.org.

[1]Vanderbilt University Medical Center, Nashville, Tennessee; [2]CDC COVID-19 Response Team; [3]Baystate Medical Center, Springfield, Massachusetts; [4]Beth Israel Deaconess Medical Center, Boston, Massachusetts; [5]University of Colorado School of Medicine, Aurora, Colorado; [6]Hennepin County Medical Center, Minneapolis, Minnesota; [7]Intermountain Healthcare, Salt Lake City, Utah; [8]Montefiore Medical Center, Bronx, New York; [9]Oregon Health & Sciences University Hospital, Portland, Oregon; [10]Ohio State University Wexner Medical Center, Columbus, Ohio; [11]Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina; [12]Johns Hopkins Hospital, Baltimore, Maryland; [13]UCLA Medical Center, Los Angeles, California; [14]Harborview Medical Center, Seattle, Washington.

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Notes from the Field:

Phenibut Exposures Reported to Poison Centers — United States, 2009–2019

Janessa M. Graves, PhD[1]; Julia Dilley, PhD[2]; Sanjay Kubsad[3]; Erica Liebelt, MD[4]

Phenibut (β-phenyl-γ-aminobutyric acid) is an unregulated* drug developed in Russia in the 1960s for use as an antianxiety medication with cognitive enhancement properties (*1*). Online retailers recently have contributed to a growing U.S. market for phenibut, which is advertised for anxiety, relaxation, and sleep (*1*,*2*). Phenibut use and misuse can result in sedation, respiratory depression, and reduced levels of consciousness, as well as withdrawal symptoms including anxiety, agitation, and acute psychosis (*3*). Regional poison center data suggest that phenibut exposures have increased in recent years (*3*). To characterize the frequency of phenibut-related exposures in the United States, data on human exposure calls to U.S. poison centers during January 2009–December 2019 were extracted from the national database maintained by the American Association of Poison Control Centers.†

Phenibut exposures were identified as poison center calls involving human exposure to phenibut; searches included synonyms (i.e., phenygam or 4-amino-3-phenylbutyric acid)§ (*4*). Exposures do not necessarily represent a poisoning or overdose. All exposure calls involving single or multiple substances were included¶; calls requesting information on phenibut were not included. The analysis summarized the demographic characteristics, caller location (e.g., health care facility or residence), exposure routes, clinical health effects, and outcomes.

For each poison center call, a case record for a single exposure event (case) is generated, delineating the patient's history, physical examination, clinical assessment, and recommendations provided. Health care providers (e.g., nurses, pharmacists, and physicians) provide ongoing case management through follow-up calls until the acute toxicologic condition has resolved; therefore, each case might involve more than one call. Multiple data elements are recorded (e.g., reason for poisoning, patient age, substances, clinical effects, therapies, and medical outcomes), as determined by the providers managing the exposures at each poison center. Health care providers managing cases identify the exposure agents by manufacturer name or synonym. Providers use standard National Poison Data System definitions to enable consistent reporting among poison centers and across years of data.

During 2009–2019, U.S. poison centers reported calls for 1,320 phenibut exposures from all 50 U.S. states and the District of Columbia. For most (1,122; 85.0%) cases, calls originated from health care facilities. Most exposures (58.4%) occurred among adults aged 18–34 years (mean = 31.7 years, standard deviation = 13.1 years, interquartile range = 22–38 years). The majority of reported exposures were in men (75.5%).

The number of cases increased sharply over the study period, particularly since 2015, when regional poison centers became able to use "phenibut" as a relevant term to capture exposures (Figure). Phenibut exposures with known formulations most often involved solids (e.g., tablets) (65.1%) or powder (24.8%). Reported exposures were predominantly ingestions (93.2%), although 2.8% involved inhalation, and 4.0% involved other routes of exposure, including dermal. Unintentional exposures were more common among persons aged <18 years (21.9%). A significantly higher percentage of exposures among children aged <10 years (93.3%) was unintentional, compared with 6.3% of those among adults ($p<0.001$). Coingested substances (i.e., exposure to more than one drug or agent) were reported in 29.6% of cases in persons aged <18 years and in 40.2% of all adult cases ($p = 0.04$).

Commonly reported adverse health effects included drowsiness or lethargy (29.0%), agitation (30.4%), tachycardia (21.9%), and confusion (21.3%). Coma was reported in 80 (6.2%) cases, including one involving an adolescent. In one half (49.6%) of cases, the exposure resulted in moderate effects (i.e., no long-term impairment). Major effects (i.e., life-threatening or resulting in significant disability or disfigurement) occurred in one in eight (12.6%) reported exposures, and three deaths were reported. Among exposures in which phenibut was the only drug or agent involved, 10.2% were associated with major effects, including one death.

The reason for the increase in phenibut-related exposures during 2009–2019 is not known; growing popularity and

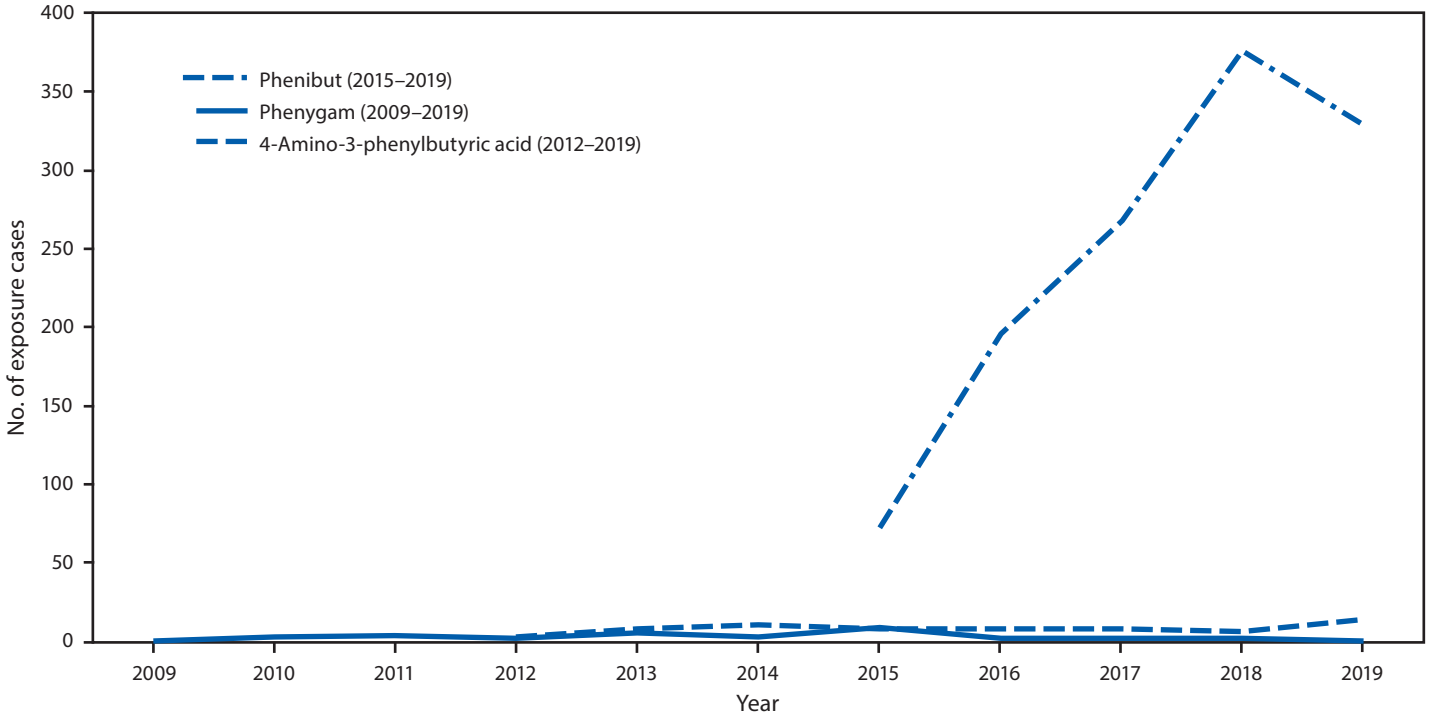
* In the United States, phenibut is legal to possess, but not approved as a licensed pharmaceutical drug by the Food and Drug Administration (FDA). Although it is available for purchase online as a nutritional supplement, FDA has ruled that phenibut does not meet the definition of a dietary ingredient and cannot be listed as an ingredient in dietary supplements marketed in the United States (https://www.fda.gov/food/dietary-supplement-products-ingredients/phenibut-dietary-supplements). FDA does analyze the content of phenibut-containing products, including the strength and purity of ingredients; few studies have been published describing the purity of phenibut-containing products.

† Data reflect information provided when an actual or potential exposure to a substance is reported. The American Association of Poison Control Centers is not able to verify the accuracy of every report made to member centers. Additional exposures might not be reported, and these data might not represent the complete incidence of national exposures to any substance.

§ Phenibut has been reported as "phenygam" in the National Poison Data System database since before the study timeline; "4-amino-3-phenylbutyric acid" and "phenibut" were added in 2012 and 2015, respectively.

¶ Phenibut exposures are not confirmed by laboratory testing; no commercially available test is available and phenibut is not detected on routine urine drug screens.

FIGURE. Number of human exposure cases related to phenibut use reported to poison centers, by year — National Poison Data System, United States, January 2009–December 2019



availability of the product through online retailers might be contributing factors. The increase in phenibut exposures underscores the need for heightened awareness of phenibut as an emerging substance of use and misuse in the United States. Adverse health effects reported to poison centers, such as drowsiness or lethargy, agitation, and confusion, are consistent with those described in previous reports (*3*). Exposures were associated with long-term health effects, including death. Easy online access to phenibut (*2*) and the potential for dependence (*5*) are additional reasons for concern. Phenibut is uncontrolled and legal to possess in the United States. Educational efforts to increase awareness among the public and clinicians regarding the emerging popularity and dangers of phenibut might help prevent adverse health effects and outcomes, including death.

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Corresponding author: Janessa Graves, janessa.graves@wsu.edu, 509-324-7257.

[1]Washington State University, College of Nursing, Spokane, Washington; [2]Oregon Health Authority Public Health Division & Multnomah County Health Department, Portland, Oregon; [3]University of Washington, School of Medicine, Seattle, Washington; [4]Washington State Poison Center, Seattle, Washington.

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Erratum

Vol. 69, No. 32

In the report "COVID-19–Associated Multisystem Inflammatory Syndrome in Children — United States, March–July 2020," on page 1078, in Table 2, under "Laboratory test," the test listed in the sixth row should have read "CRP, peak (mg/**dL**)."

Notice to Readers

Forthcoming Correction and Republication of the Report "Deaths and Years of Potential Life Lost From Excessive Alcohol Use — United States, 2011–2015"

Recently, the authors of the report "Deaths and Years of Potential Life Lost From Excessive Alcohol Use — United States, 2011–2015" (*1*) informed *MMWR* Editors that some results were inaccurate as a result of a data input error that occurred during an update to the online Alcohol-Related Disease Impact application (*2*), which was used in the study. This error resulted in an overall underestimate of average annual alcohol-attributable deaths by 1,862 and years of potential life lost by 79,844 for the United States during 2011–2015. On September 3, 2020, corrections were made in the online Alcohol-Related Disease Impact application to the alcohol-attributable fractions for five acute causes of death: drownings, fall injuries, fire injuries, firearm injuries, and homicide. The updated national and state estimates are now available in the Alcohol-Related Disease Impact application (*2*). The authors conducted a reanalysis and verification of the data, and a revised report will be published in the coming weeks.

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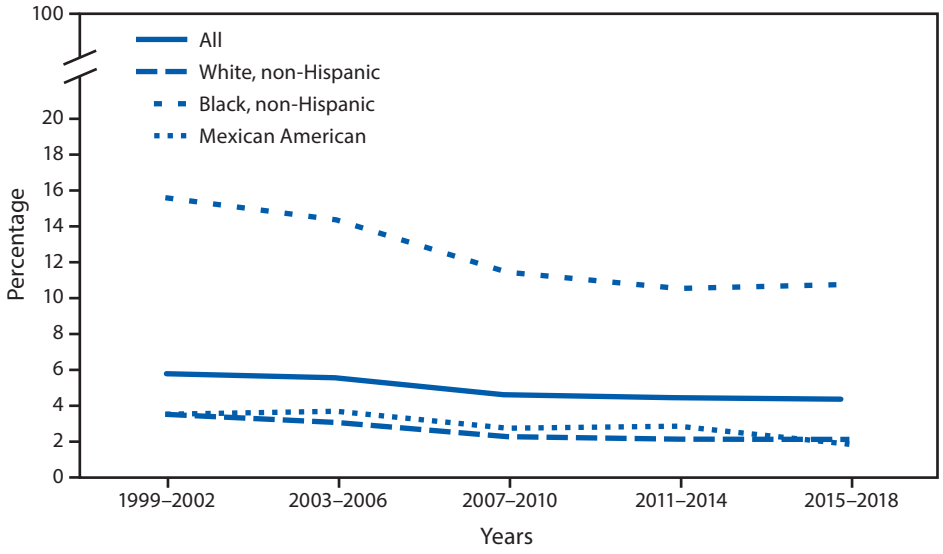
2. CDC. Alcohol-related disease impact application. Atlanta, GA: US Department of Health and Human Services, CDC; 2020. https://www.cdc.gov/ardi

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Prevalence* of Past or Present Infection with Hepatitis B Virus† Among Adults Aged ≥18 Years, by Race and Hispanic Origin — National Health and Nutrition Examination Survey, 1999–2018



* Percentages are age-adjusted by the direct method to the 2000 projected U.S. population using age groups 18–29, 30–39, 40–49, 50–59, and ≥60 years.

† Estimates of past or present infection with hepatitis B virus are based on tests for antibody to hepatitis B core antigen in serum collected during the examination component of the National Health and Nutrition Examination Survey.

The prevalence of past or present infection with hepatitis B virus among adults aged ≥18 years declined from 5.7% in 1999–2002 to 4.3% in 2015–2018. A decline among non-Hispanic White (3.5% to 2.1%), non-Hispanic Black (15.6% to 10.8%), and Mexican American (3.5% to 1.8%) adults also occurred over the same period. Prevalence was higher among non-Hispanic Black adults than among both non-Hispanic White and Mexican American adults for all periods.

Sources: Kruszon-Moran D, Paulose-Ram R, Martin CB, Barker L, McQuillan G. Prevalence and trends in hepatitis B virus infection in the United States, 2015–2018. NCHS Data Brief, no 361. https://www.cdc.gov/nchs/products/databriefs/db361.htm; National Center for Health Statistics, National Health and Nutrition Examination Survey, 1999–2002 to 2015-2018. https://www.cdc.gov/nchs/nhanes/index.htm.

Reported by: Deanna Kruszon-Moran, MS, ddk0@cdc.gov, 301-458-4328; Geraldine M. McQuillan, PhD.

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