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Trends in Stimulant Prescription Fills Among Commercially Insured Children and Adults — United States, 2016–2021

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Prescription stimulant use, primarily for the treatment of attention-deficit/hyperactivity disorder (ADHD), has increased among adults in the United States during recent decades, while remaining stable or declining among children and adolescents (*1*,*2*). MarketScan commercial claims data were analyzed to describe trends in prescription stimulant fills before and during the COVID-19 pandemic (2016–2021) by calculating annual percentages of enrollees aged 5–64 years in employer-sponsored health plans who had one or more prescription stimulant fills overall and by sex and age group. Overall, the percentage of enrollees with one or more prescription stimulant fills increased from 3.6% in 2016 to 4.1% in 2021. The percentages of females aged 15–44 years and males aged 25–44 years with prescription stimulant fills increased by more than 10% during 2020–2021. Future evaluation could determine if policy and health system reimbursement changes enacted during the pandemic contributed to the increase in stimulant prescriptions. Stimulants can offer substantial benefits for persons with ADHD, but also pose potential harms, including adverse effects, medication interactions, diversion and misuse, and overdoses. Well-established clinical guidelines exist for ADHD care, but only for children and adolescents* (*3*); clinical practice guidelines for adult ADHD could help adults also receive accurate diagnoses and appropriate treatment.

CDC analyzed claims data from the Merative MarketScan Commercial Database, a national convenience sample of deidentified health care claims from enrollees in employer-sponsored insurance plans. CDC accessed 2016–2021 MarketScan data using Treatment Pathways 4.0, an online analytic platform that includes plans with complete data on prescription drug fills, to calculate the annual percentages of persons continuously enrolled throughout the calendar year with one or more prescription stimulant† fills. All prescription stimulants were included in the analyses, regardless of whether the enrollee had any claims with an ADHD diagnosis code present. Percentages and annual percent change (APC) were calculated for enrollees aged 5–64 years overall and by sex and age group; primary results were calculated by 5-year age groups, but some results were summarized by wider age groups to describe broader patterns. Among persons with one or more prescription stimulant fills during the calendar year, the mean number of prescription stimulant fills during that year and the percentage of persons

* https://chadd.org/for-professionals/clinical-practice-guidelines/

† Prescription stimulants included in this analysis were amphetamine and mixed amphetamine salts, dexmethylphenidate, dextroamphetamine, lisdexamfetamine, methamphetamine, and methylphenidate.

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who met a case definition for receipt of care for ADHD[§] were calculated. Statistical testing was not performed because the size of the MarketScan database often results in significant p-values that are not clinically meaningful. All point estimates are presented, and changes >10% are highlighted. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[¶]

Across all years, the percentages of male and female enrollees with one or more prescription stimulant fills were highest among those aged 5–19 and 15–24 years, respectively. Overall, the percentage of enrollees with prescription stimulant fills increased from 3.6% in 2016 to 4.1% in 2021, with percentages and APC varying by sex and age (Table) (Figure 1) (Figure 2). During 2016–2020, percentages remained stable or decreased among females aged ≤24 years (average APC range = –1.8% to 0.1%) and increased modestly among those aged 25–64 years (average APC range = 2.3% to 6.6%). However, during 2020–2021, the percentage of females with one or more prescription stimulant fills increased substantially among most age groups, with the largest changes among those aged 15–44 and 50–54 years (APC range = 14.3% to 19.2%).

During 2016–2020, the pattern among males was similar to that among comparably aged females: the percentage with prescription stimulant fills decreased slightly among those aged ≤24 years (average APC range = –3.8% to –1.7%) and remained stable or increased modestly among those aged ≥25 years (average APC range = 0% to 6.5%). During 2020–2021, the percentage of males with prescription fills decreased among those aged ≤19 years and increased substantially among those aged 25–44 years and 50–54 years (APC range = 11.1% to 14.7%).

Among persons with one or more prescription stimulant fills, the annual mean number of fills ranged from 7.4 to 7.6 (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/125800). Most persons aged 5–19 years (≥75%) and adults aged 20–64 years (53%–77%) with one or more prescription stimulant fills met the case definition for receipt of ADHD care in the preceding or current calendar year; these percentages were relatively stable during the study period (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/125800).

Discussion

The percentage of persons with employer-sponsored insurance who received prescription stimulants increased during 2016–2021, with notable increases among adolescent and adult females and adult males. The largest single-year increases

[§] To meet the case definition for receipt of ADHD care, enrollees were required to have two or more health care encounters with an ADHD *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis code of 314.X or an *International Classification of Diseases, Tenth Revision, Clinical Modification* diagnosis code of F90 occurring ≥7 days apart, or one or more visits with an ADHD diagnosis code and two or more prescriptions for ADHD medications (any stimulant included in the analysis or atomoxetine, clonidine, or guanfacine) filled ≥14 days apart; these criteria had to be met during the preceding or current calendar year.

[¶] 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.

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TABLE. Percentage of persons aged 5–64 years with at least one stimulant prescription fill, by sex, age group, calendar year, average annual percent change (2016–2020), and annual percent change (2020–2021) — MarketScan commercial databases, United States, 2016–2021

Sex and age group, yrs	Percentage, by year						Average annual % change,* 2016–2020	Annual % change,* 2020–2021
	2016	2017	2018	2019	2020	2021		
Sample size (millions)	**20.7**	**19.0**	**17.4**	**16.0**	**15.6**	**13.3**	—	—
Both sexes, all ages	**3.6**	**3.7**	**3.6**	**3.7**	**3.8**	**4.1**	**1.4**	**7.9**
Female, all	**3.2**	**3.3**	**3.3**	**3.4**	**3.6**	**4.1**	**3.0**	**13.9**
5–9	3.0	3.0	2.9	2.9	2.9	2.9	−0.8	0
10–14	4.8	4.9	4.7	4.8	4.8	5.2	0	8.3
15–19	5.3	5.2	4.9	5.1	5.3	6.1	0.1	15.1
20–24	5.6	5.5	5.2	5.1	5.2	6.2	−1.8	19.2
25–29	4.2	4.4	4.4	4.5	4.6	5.4	2.3	17.4
30–34	3.5	3.8	3.9	4.1	4.4	5.1	5.9	15.9
35–39	3.1	3.4	3.5	3.7	4.0	4.7	6.6	17.5
40–44	3.0	3.1	3.1	3.3	3.5	4.0	4.0	14.3
45–49	2.6	2.8	2.9	3.0	3.2	3.5	5.3	9.4
50–54	2.1	2.2	2.2	2.4	2.5	2.9	4.5	16.0
55–59	1.6	1.7	1.7	1.8	1.9	2.0	4.4	5.3
60–64	1.2	1.3	1.3	1.4	1.4	1.5	4.0	7.1
Male, all	**3.9**	**4.0**	**4.0**	**4.0**	**4.0**	**4.2**	**0.6**	**5.0**
5–9	7.3	7.3	7.0	7.1	6.8	6.7	−1.7	−1.5
10–14	10.8	10.9	10.6	10.7	10.2	9.9	−1.4	−2.9
15–19	7.9	7.8	7.5	7.4	7.2	7.1	−2.3	−1.4
20–24	5.6	5.5	5.2	5.0	4.8	5.0	−3.8	4.2
25–29	4.0	4.1	4.1	4.1	4.2	4.7	1.2	11.9
30–34	3.4	3.6	3.8	3.9	4.1	4.7	4.8	14.6
35–39	2.7	2.9	3.0	3.3	3.4	3.9	6.0	14.7
40–44	2.1	2.2	2.3	2.5	2.7	3.0	6.5	11.1
45–49	1.7	1.8	1.9	2.1	2.1	2.3	5.5	9.5
50–54	1.3	1.4	1.4	1.5	1.6	1.8	5.4	12.5
55–59	1.0	1.0	1.1	1.1	1.2	1.3	4.8	8.3
60–64	0.9	0.9	0.9	0.9	0.9	0.9	0	0

* Annual percent change is calculated as the difference between percentage in one year and that in the preceding year, divided by the previous year's percentage.

occurred during 2020–2021, with the annual change exceeding 10% in many age groups. Consistently across the study period, most persons with prescription stimulant fills had health care encounters with ADHD diagnosis codes, and persons with prescription stimulant fills averaged more than seven fills per year, suggesting that most were receiving ongoing care for ADHD.

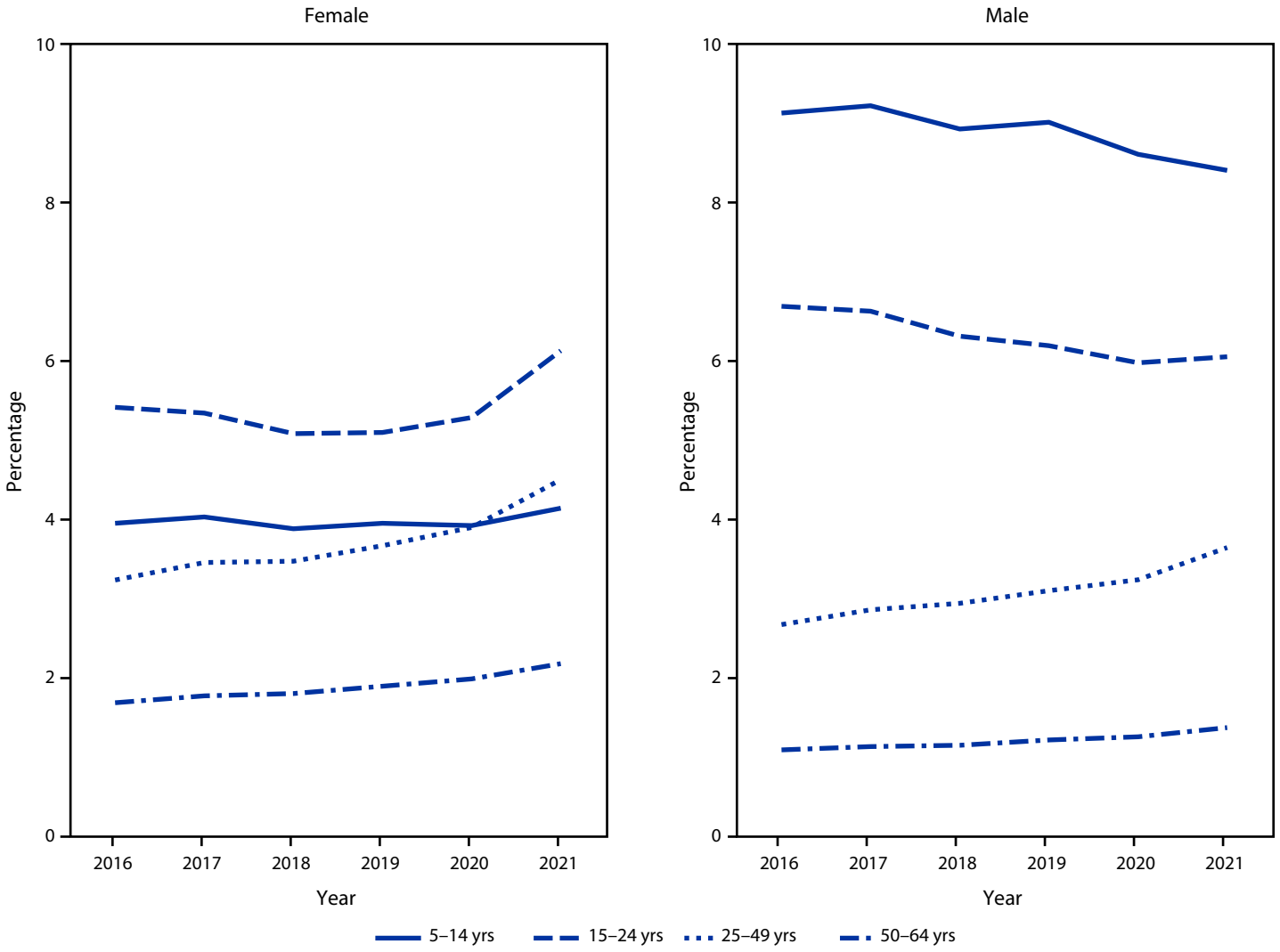
During this study period, the highest percentages of stimulant prescriptions were among males aged 5–19 years, although these percentages decreased over time. Historically, ADHD has been defined as a childhood disorder more common among boys (*3*), but it is increasingly recognized as a potentially lifelong condition that might be underdiagnosed or undertreated in both girls and adults (*3*,*4*). Appropriate diagnosis and effective treatment can help improve functioning for persons with ADHD (*3*); prescription stimulants have demonstrated effectiveness in reducing ADHD symptoms in children and adults (*3*,*4*).

The prevalence of diagnosed ADHD and associated treatment in adults has increased in recent decades (*1*,*2*,*5*). The current study adds to evidence** that the increasing trend in the percentage of adults receiving prescriptions for stimulants has continued during the COVID-19 pandemic, with a notable upturn during 2020–2021. The pandemic has had negative impacts on mental health (*6*,*7*), which might have led to or exacerbated ADHD symptoms. To adapt to the pandemic environment, policy and health system reimbursement changes were implemented, such as expansion of telehealth and easing of the requirement for having an in-person visit with a clinician before receiving a prescription for stimulants or other Schedule II controlled substances†† (*8*). The combination of potential increased need and reduced barriers to access prescription stimulants might have encouraged more adults with ADHD symptoms to seek diagnosis and treatment. Although improved access to ADHD care through telehealth during the pandemic might have benefitted some persons with ADHD symptoms, it might have also introduced the potential for inadequate ADHD evaluations and inappropriate stimulant prescribing. Continued evaluation of public health emergency response policies and their use beyond the immediate emergency, such as expanded use of telehealth for prescribing, could increase understanding of long-term benefits or harms of these

** https://www.trillianthealth.com/insights/the-compass/sharp-uptick-in-adderall-prescribing-for-adults-ages-22-44-amid-covid-19-pandemic

†† https://www.kff.org/womens-health-policy/issue-brief/opportunities-and-barriers-for-telemedicine-in-the-u-s-during-the-covid-19-emergency-and-beyond/

FIGURE 1. Percentage of persons aged 5–64 years with at least one stimulant prescription fill, by sex, age group, and calendar year — MarketScan commercial databases, United States, 2016–2021

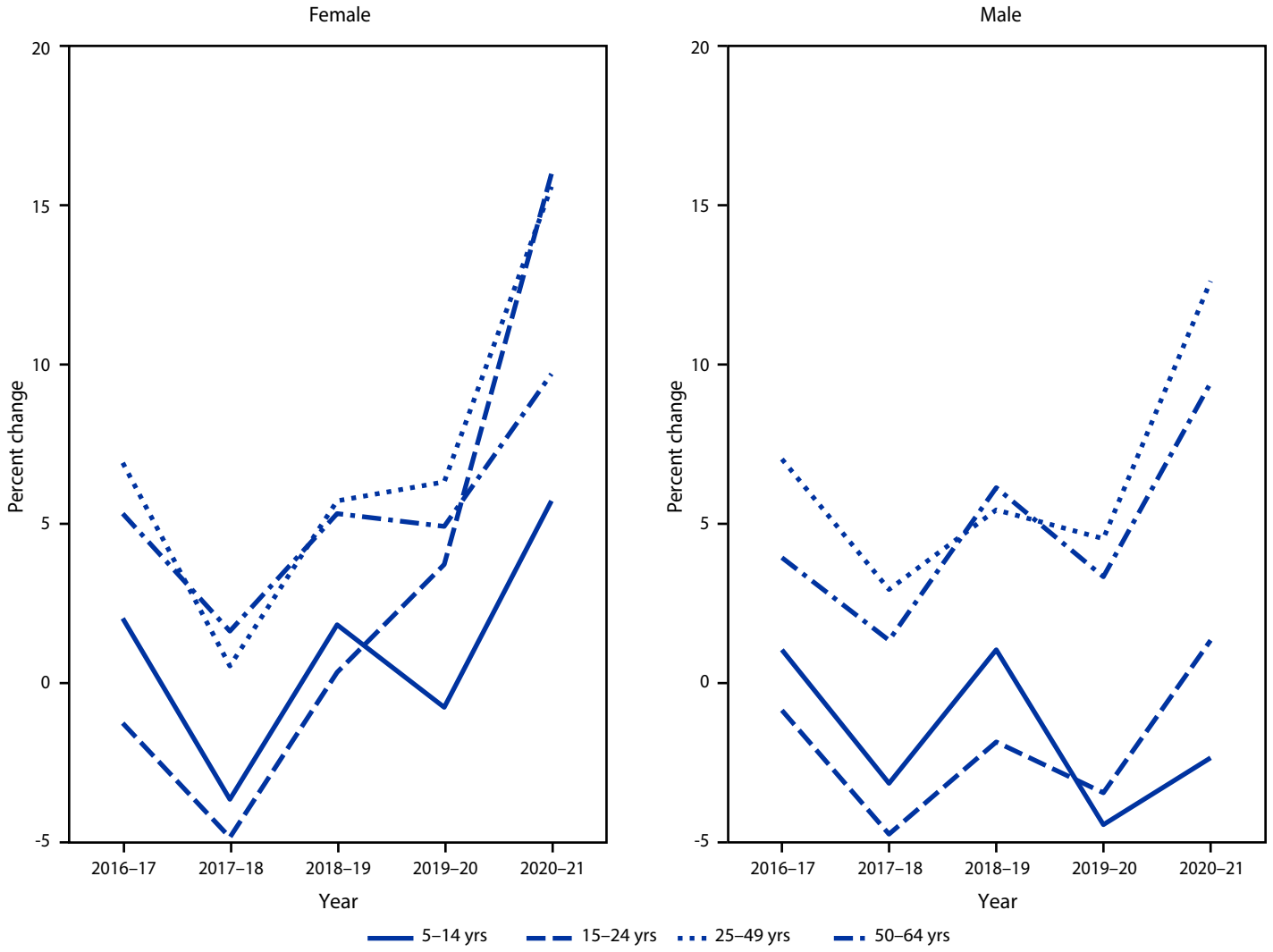


policies, including whether these policies increase equitable access to mental health care and the parameters needed to promote best practices (*8*).

The large increase in the percentage of adults receiving prescription stimulants during the COVID-19 pandemic draws attention to the need for clinical practice guidelines for ADHD in adults. Well-established professional guidelines for diagnostic procedures and treatment algorithms exist for children and adolescents with ADHD (*3*); however, no similar diagnostic and treatment guidelines for ADHD among adults are available in the United States (*9*). This gap in guidance for adult ADHD care is a public health concern because of challenges associated with the differential diagnosis of ADHD (*4*,*9*) and general inadequate access to mental health providers (*10*) trained to diagnose and manage ADHD. Clinicians from varying specialties are approached for ADHD care, and report differing levels of training and relative comfort with diagnosing and managing ADHD (*1*,*2*,*9*). Stimulants are one type of treatment that can benefit persons with ADHD, but the potential harms associated with these medications, including adverse effects, interactions with other medications, and risk of diversion, misuse, and overdose (*1–4*) necessitate judicious prescribing and patient monitoring. Clinical guidelines similar to those developed for children and adolescents by pediatric medical associations could help clinicians provide best practice care for adult ADHD and support their patients to achieve better outcomes.

The findings in this report are subject to at least seven limitations. First, the data were derived from a large convenience sample of persons with employer-sponsored insurance whose health care use patterns might differ from those of persons with other types of insurance or no insurance. Second, the

FIGURE 2. Relative annual percent change in percentage of persons aged 5–64 years with at least one stimulant prescription fill, by sex and age group — MarketScan commercial databases, United States, 2016–2021



data do not include the necessary demographic information to examine these trends by race and ethnicity, socioeconomic status, or other characteristics beyond sex and age, in which differences in equity might exist. Third, prescribing policy changes related to the pandemic varied by state (*8*) and might have differential effects, but state-level results are not reported here. Fourth, these results are based on insurance claims, and will not include medications or other ADHD care procured out-of-pocket or obtained through other means. Fifth, the claims data do not include information on the presence of or changes in ADHD symptoms, environmental changes that might have influenced impairment, access to diagnosis and treatment, quality of care, prescribing provider type, or if stimulants were prescribed to treat something other than ADHD; these factors might have varied throughout the study period. In addition, these data do not contain information on whether the encounter during which the prescription was made occurred via telehealth; therefore, the changes in stimulant prescribing patterns described in this study cannot be directly attributed to changes in telehealth availability and related policies. Sixth, because diagnosis codes are not included on prescription drug claims, it cannot be assumed that all prescription stimulants were prescribed to treat ADHD. However, fills for any ADHD medication, including prescription stimulants, were included as part of the case definition for ADHD care. Finally, APC is sensitive to baseline percentage; small absolute fluctuations in groups with lower baseline percentages will result in larger relative percent changes; thus, APC should be interpreted with caution when comparing across groups.

The percentage of persons receiving prescription stimulant fills increased during 2016–2021, including large increases during 2020–2021 and among adolescent and adult females and

Summary

What is already known about this topic?

Prescriptions for stimulants, primarily used to treat attention-deficit/hyperactivity disorder (ADHD), were increasing for adults before the COVID-19 pandemic. Policies enacted during the pandemic expanded access to prescription stimulants via telehealth.

What is added by this report?

The percentage of adolescent and adult females and adult males receiving prescription stimulant fills increased during 2016–2021, particularly during 2020–2021.

What are the implications for public health practice?

Growing recognition of ADHD in adults and increases in prescription stimulant fills raise questions about current adult ADHD care. Development of clinical recommendations for diagnosing and managing adult ADHD could help guide safe and appropriate stimulant prescribing. Evaluation of policies enacted during the pandemic could identify benefits and harms of those policies.

adult males. These results could guide continued monitoring of and research concerning factors contributing to increases in stimulant prescribing and other changes in care for ADHD symptoms before and during the pandemic, and how they might differ among adults and adolescent females. This study also suggests a growing need for resources to help clinicians accurately diagnose, manage, and treat adults with ADHD. The development and implementation of clinical practice guidelines for adult ADHD could be one component of an approach to facilitating the provision of high-quality care to adults with ADHD.

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Emergency Department Visits for Firearm Injuries Before and During the COVID-19 Pandemic — United States, January 2019–December 2022

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During the COVID-19 pandemic, the U.S. firearm homicide rate increased by nearly 35%, and the firearm suicide rate remained high during 2019–2020 (*1*). Provisional mortality data from the National Vital Statistics System indicate that rates continued to increase in 2021: the rates of firearm homicide and firearm suicide in 2021 were the highest recorded since 1993 and 1990, respectively (*2*). Firearm injuries treated in emergency departments (EDs), the primary setting for the immediate medical treatment of such injuries, gradually increased during 2018–2019 (*3*); however, more recent patterns of ED visits for firearm injuries, particularly during the COVID-19 pandemic, are unknown. Using data from the National Syndromic Surveillance Program (NSSP),* CDC examined changes in ED visits for initial firearm injury encounters during January 2019–December 2022, by year, patient sex, and age group. Increases in the overall weekly number of firearm injury ED visits were detected at certain periods during the COVID-19 pandemic. One such period during which there was a gradual increase was March 2020, which coincided with both the declaration of COVID-19 as a national emergency† and a pronounced decrease in the total number of ED visits. Another increase in firearm injury ED visits occurred in late May 2020, concurrent with a period marked by public outcry related to social injustice and structural racism (*4*), changes in state-level COVID-19–specific prevention strategies,§ decreased engagement in COVID-19 mitigation behaviors (*5*), and reported increases in some types of crime (*4*). Compared with 2019, the average number of weekly ED visits for firearm injury was 37% higher in 2020, 36% higher in 2021, and 20% higher in 2022. A comprehensive approach is needed to prevent and respond to firearm injuries in communities, including strategies that engage community and street outreach programs, implement hospital-based violence prevention programs, improve community physical environments, enhance secure storage of firearms, and strengthen social and economic supports.

CDC used near real-time electronic health record data from NSSP to examine changes in ED visits for initial firearm injury encounters during the COVID-19 pandemic. Temporal trends were assessed for three surveillance periods (calendar years 2020, 2021, and 2022) and compared with visits from calendar year 2019. Only facilities consistently reporting more complete data¶ during 2019–2022 were included. Firearm injury ED visits were identified using a categorization including administrative diagnosis codes and free-text reason-for-visit (chief complaint terms), developed and validated by CDC in partnership with state, tribal, local, and territorial health departments** (Supplementary Table, https://stacks.cdc.gov/view/cdc/125985). The mean number of weekly ED visits for firearm injuries, percent change in mean weekly ED visits for firearm injuries,†† and visit ratios (VRs)§§ with 95% CIs were examined overall, and by age group (0–14, 15–24, 25–34, 35–64, and ≥65 years) for females and males. All analyses were conducted using R software (version 4.1.2; R Foundation). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.¶¶

Coinciding with the declaration of COVID-19 as a national emergency on March 13, 2020, the weekly number of firearm injury ED visits began to increase, despite a steep decline in the total number of ED visits (Figure). The weekly number

* NSSP is a collaboration among CDC, local and state health departments, and federal, academic, and private sector partners. NSSP receives medical record data from approximately 75% of EDs nationwide, although fewer than 50% of facilities from California, Hawaii, Minnesota, and Oklahoma currently participate in NSSP. https://www.cdc.gov/nssp/index.html

† https://www.federalregister.gov/documents/2020/03/18/2020-05794/declaring-a-national-emergency-concerning-the-novel-coronavirus-disease-covid-19-outbreak

§ https://www.nga.org/coronavirus-reopening-plans/

¶ To reduce artifactual impact from changes in reporting patterns, analyses were restricted to facilities with more consistent reporting of more complete data (coefficient of variation ≤40 and average weekly informative discharge diagnosis ≥75% complete during 2019–2022). https://www.cdc.gov/nssp/dqc/articles/how-data-quality-filters-work.html

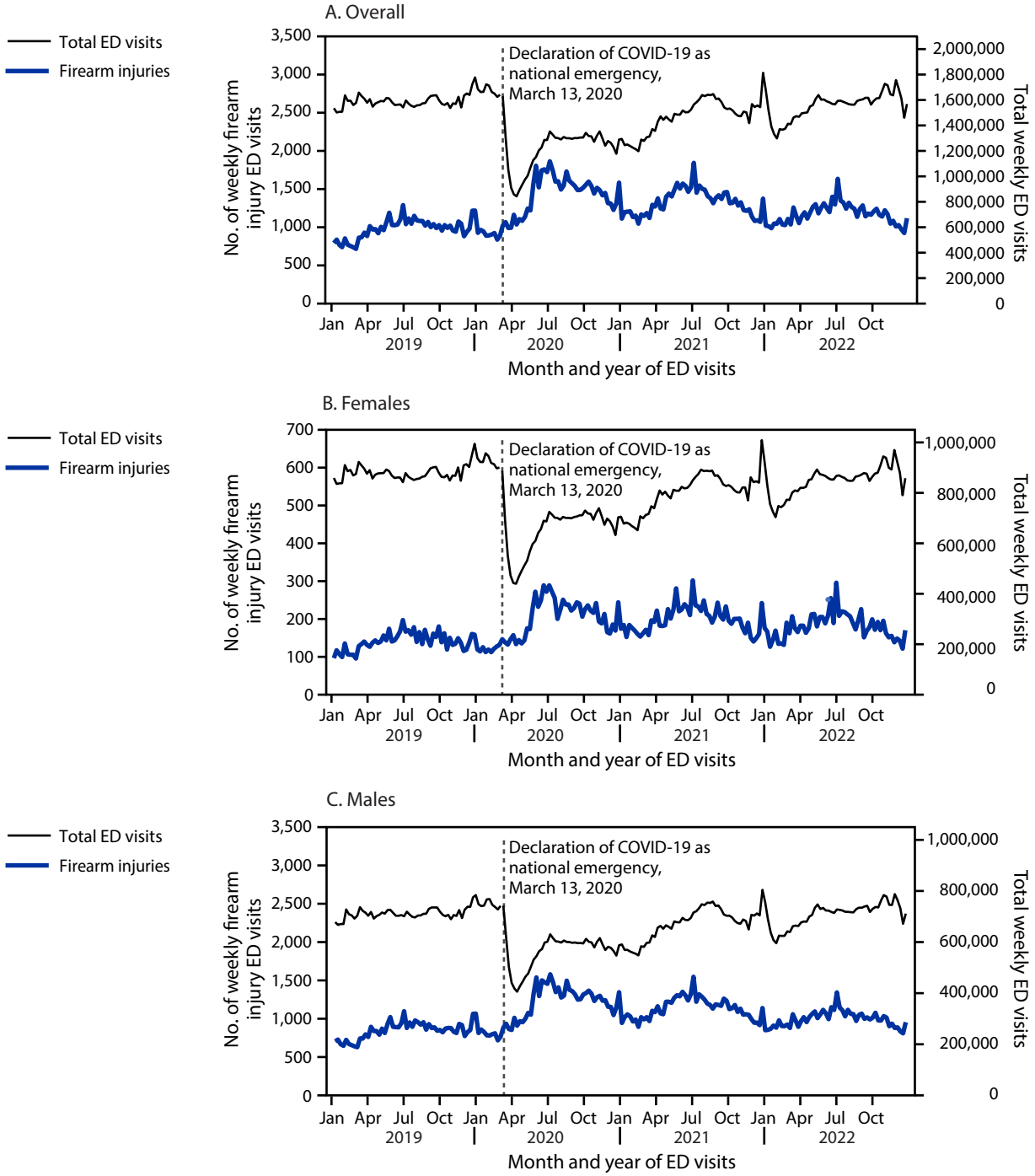
** NSSP collects chief complaint, discharge diagnosis, and patient demographics. Diagnosis information is collected using codes from the *International Classification of Diseases, Ninth Revision, Clinical Modification*; *International Classification of Diseases, Tenth Revision, Clinical Modification*; and Systematized Nomenclature of Medicine. Diagnostic codes and free-text keywords were combined using Boolean searches to create categorizations to identify visits for an initial encounter for a firearm injury (including unintentional, intentional self-directed, assault, undetermined intent, legal intervention, and terrorism) and negate subsequent encounters or sequelae.

†† Percent change in visits per week during each surveillance period was calculated as ([mean weekly ED visits for firearm injury during surveillance period – mean weekly ED visits for firearm injury during comparison period] / mean weekly ED visits for firearm injury during comparison period) × 100.

§§ VR = (ED visits for firearm injury [surveillance period] / all ED visits [surveillance period]) / (ED visits for firearm injury [comparison period] / all ED visits [comparison period]). Ratios >1 indicate a higher proportion of ED visits for firearm injury during the surveillance period than the comparison period; ratios <1 indicate a lower proportion during the comparison period than during the surveillance period; 95% CIs that do not include 1 were considered statistically significant.

¶¶ 45 C.F.R. part 46.102(l)(2), 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.

FIGURE. Weekly number of emergency department visits for firearm injury,* overall (A) and among females (B) and males† (C) — National Syndromic Surveillance Program,§ United States, January 2019–December 2022¶



Abbreviations: ED = emergency department; NSSP = National Syndromic Surveillance Program.

* ED visits for an initial firearm injury encounter were identified by querying a categorization developed and validated by CDC in partnership with state, tribal, local, and territorial health departments. The following intent types were included in the definition: unintentional, intentional self-directed, assault, undetermined intent, legal intervention, and terrorism.

† The y-axis scales differ among overall, female, and male figure panels.

§ NSSP is a collaboration among CDC, local and state health departments, and federal, academic, and private sector partners. NSSP receives medical record data from approximately 75% of EDs nationwide, although fewer than 50% of facilities from California, Hawaii, Minnesota, and Oklahoma currently participate in NSSP. https://www.cdc.gov/nssp/index.html

¶ Data through December 2022 are included even though November and December are not included on the x-axes.

of firearm injury ED visits also sharply increased during the week of May 24, 2020, and remained high for the rest of 2020. Trends were similar among females and males.

During the study period, compared with 2019, mean weekly ED visits for firearm injury were 37% higher in 2020, 36% higher in 2021, and 20% higher in 2022, with differences by sex-specific age group (Table). Among both females and males, mean weekly ED visits for firearm injuries were consistently highest among persons aged 15–24 years across the entire study period. However, the largest increases in the proportion of firearm injury ED visits were among persons aged 0–14 years during 2020 (VRs = 2.81 for females and 2.31 for males, respectively), 2021 (VRs = 2.20 and 1.85), and 2022 (VRs = 1.49 and 1.44), compared with 2019.

Discussion

Increases in firearm injury ED visits were detected at certain periods during the COVID-19 pandemic. Beginning the week of March 13, 2020, concurrent with the declaration of COVID-19 as a national emergency,† implementation of community mitigation measures, and a decline in ED visits overall, the weekly number of firearm injury ED visits began to increase. A sharp increase in the weekly number of firearm injury ED visits occurred beginning the week of May 24, 2020,

TABLE. Mean weekly number of emergency department visits, percent change* in emergency department visits, and visit ratios† of emergency department visits for firearm injury,§ overall and by sex and age group — National Syndromic Surveillance Program,¶ United States, January 2019–December 2022

	2019	2020**			2021**			2022**		
Sex/Age group, yrs	Mean weekly no. of firearm injury ED visits	Mean weekly no. of firearm injury ED visits	% Change in mean weekly no. of firearm injury ED visits	VR (95% CI)	Mean weekly no. of firearm injury ED visits	% Change in mean weekly no. of firearm injury ED visits	VR (95% CI)	Mean weekly no. of firearm injury ED visits	% Change in mean weekly no. of firearm injury ED visits	VR (95% CI)
All	**979.3**	**1,341.5**	**37.0**	**1.66 (1.64–1.68)**	**1,328.3**	**35.6**	**1.46 (1.44–1.48)**	**1,170.0**	**19.5**	**1.22 (1.20–1.23)**
Females										
Overall	**139.6**	**190.9**	**36.7**	**1.70 (1.64–1.75)**	**198.0**	**41.9**	**1.55 (1.51–1.60)**	**179.7**	**28.7**	**1.33 (1.29–1.37)**
0–14	6.7	11.3	69.3	2.81 (2.47–3.21)	11.4	71.1	2.20 (1.93–2.52)	9.5	43.1	1.49 (1.30–1.71)
15–24	45.8	64.5	40.8	1.76 (1.67–1.86)	66.4	45.0	1.60 (1.52–1.69)	62.1	35.5	1.47 (1.40–1.55)
25–34	38.2	54.5	42.6	1.71 (1.62–1.81)	55.5	45.2	1.59 (1.50–1.68)	49.6	29.7	1.41 (1.33–1.49)
35–64	41.5	50.7	22.2	1.45 (1.37–1.53)	54.5	31.4	1.40 (1.33–1.49)	51.0	22.9	1.29 (1.22–1.36)
≥65	7.5	10.0	33.7	1.57 (1.38–1.79)	10.2	37.0	1.42 (1.24–1.62)	7.6	1.0	0.96 (0.83–1.10)
Males										
Overall	**839.8**	**1,150.6**	**37.0**	**1.62 (1.60–1.64)**	**1,130.3**	**34.6**	**1.42 (1.41–1.44)**	**990.3**	**17.9**	**1.18 (1.17–1.20)**
0–14	22.1	30.1	36.1	2.31 (2.14–2.49)	31.8	43.7	1.85 (1.72–2.00)	30.9	39.9	1.44 (1.33–1.55)
15–24	291.9	404.6	38.6	1.67 (1.64–1.70)	383.7	31.4	1.42 (1.39–1.45)	343.8	17.7	1.24 (1.21–1.27)
25–34	250.2	351.1	40.3	1.55 (1.51–1.58)	339.2	35.6	1.40 (1.37–1.43)	286.6	14.6	1.21 (1.18–1.24)
35–64	222.3	297.5	33.8	1.47 (1.43–1.50)	310.7	39.8	1.42 (1.38–1.45)	287.2	29.2	1.31 (1.28–1.35)
≥65	53.2	67.3	26.4	1.38 (1.31–1.45)	64.9	21.9	1.20 (1.14–1.26)	41.8	-21.5	0.72 (0.68–0.76)

Abbreviations: ED = emergency department; NSSP = National Syndromic Surveillance Program; VR = visit ratio.

* Percent change in visits per week during each surveillance period was calculated as ([mean weekly ED visits for firearm injury during surveillance period − mean weekly ED visits for firearm injury during comparison period] / mean weekly ED visits for firearm injury during comparison period) × 100.

† VR = (ED visits for firearm injury [surveillance period] / all ED visits [surveillance period]) / (ED visits for firearm injury [comparison period] / all ED visits [comparison period]). Ratios >1 indicate a higher proportion of ED visits for firearm injury during the surveillance period than the comparison period; ratios <1 indicate a lower proportion during the comparison period than during the surveillance period; 95% CIs that do not include 1 were considered statistically significant.

§ ED visits for an initial firearm injury encounter were identified by querying a categorization developed and validated by CDC in partnership with state, tribal, local, and territorial health departments. The following intent types were included in the definition: unintentional, intentional self-directed, assault, undetermined intent, legal intervention, and terrorism.

¶ NSSP is a collaboration among CDC, local and state health departments, and federal, academic, and private sector partners. NSSP receives medical record data from approximately 75% of EDs nationwide, although fewer than 50% of facilities from California, Hawaii, Minnesota, and Oklahoma currently participate in NSSP. https://www.cdc.gov/nssp/index.html

** Comparison period is calendar weeks 1–52 (December 30, 2018–December 28, 2019).

Summary

What is already known about this topic?

During the COVID-19 pandemic, U.S. firearm homicide and suicide rates increased substantially.

What is added by this report?

Weekly numbers of firearm injury emergency department (ED) visits began to increase in March 2020 even as the total number of ED visits declined, and sharply increased in late May 2020. Compared with visits during 2019, visits during 2020, 2021, and 2022 were 37%, 36%, and 20% higher, respectively.

What are the implications for public health practice?

A comprehensive approach to preventing and responding to firearm injuries is needed, including strategies that engage community and street outreach programs, implement hospital-based violence prevention programs, improve community physical environments, enhance secure storage of firearms, and strengthen social and economic supports.

which remained elevated throughout 2020. Although this report did not assess causes for the observed increases or differentiate by intent type, the rise in visits in late May 2020 corresponded with a period of increased social unrest over strained law enforcement–community relations and longstanding systemic inequities, structural racism, and trauma experienced by racial and ethnic minority groups in the United States*** (*4*,*6*); changes in the implementation of and engagement in COVID-19 mitigation measures (*5*); and reported increases in some types of crime (*4*). Additional research is needed to better understand recent trends in firearm injuries by intent, sociodemographic characteristics, and contextual factors to help guide tailored prevention efforts and address inequities in the risk for firearm injuries (*1*).

The overall increases in firearm injury ED visits during the COVID-19 pandemic highlighted in this study are consistent with previous research that indicated increasing national rates of firearm violence during the COVID-19 pandemic (*7*) and increases in the number of pediatric ED visits for firearm injuries during 2020 and 2021 compared with 2019 (*8*). The mean weekly number and proportion of firearm injury ED visits were higher during 2020, 2021, and 2022 compared with 2019. These patterns were observed for both sexes and across most age groups, with the youngest age group (0–14 years) experiencing the largest increase in the proportion of firearm injury ED visits. Challenges faced by children and adolescents during the COVID-19 pandemic might have influenced their risk for firearm injury, including disruptions to daily routines and schooling (e.g., social isolation, physical distancing, and increased time spent at home, potentially increasing access to firearms in the home); changes in health care access (e.g., limited access to mental health services); and diminished security and safety (e.g., housing and financial insecurity, increased exposure to violence, threat of illness, and uncertainty about the future).††† Previous studies have also cited increases in firearm purchases and limited parental supervision as potential factors associated with heightened risk for firearm injuries among children and adolescents during the COVID-19 pandemic (*9*,*10*).

The findings in this study are subject to at least six limitations. First, NSSP ED visit data are collected using a convenience sample with geographic variations in coverage; findings are not generalizable to nonparticipating facilities and allow for limited inference regarding the underlying prevalence of firearm injuries outside EDs. However, NSSP ED visit data represent approximately 75% of U.S. EDs§§§; national trends observed in this analysis are likely representative of firearm injuries resulting in emergency care during the pandemic. Second, variations in data quality and coding practices might over- or underestimate visit trends. To address this, data were only analyzed from facilities with consistent reporting during the period of study, and the number of these EDs remained relatively constant over time. Third, the categorization used in this study captures firearm injuries overall and does not differentiate by intent. Fourth, the cross-sectional nature of this analysis, which uses electronic health record data, does not allow for causal inferences regarding changes in visit trends or contributing factors. Fifth, this study assessed changes in firearm injury ED visit counts rather than rates, which have been difficult to interpret during the COVID-19 pandemic because of changes in ED utilization that substantially affected the denominator typically used to calculate ED visit rates; still, the large number of weekly firearm injury ED visits, broad NSSP coverage, and 4-year study period allowed for a robust analysis of trends over time. Finally, some patient demographic information and facility characteristics were unavailable or incomplete at the aggregated national level. Future and ongoing collaborations with local and state health departments to refine intent-specific categorizations, improve reporting of patient and facility-level information, and assess patterns of firearm injuries by more detailed geographic characteristics (e.g., county, or rural or urban status) and with consideration of seasonality patterns might further strengthen the use of ED data for firearm injury surveillance.

A comprehensive approach is needed to prevent and respond to firearm injuries and address the social and economic inequities that contribute to the risk for violence. Near real-time ED data can equip public health practitioners, clinicians,

*** https://www.cdc.gov/minorityhealth/racism-disparities/impact-of-racism.html

††† https://www.cdc.gov/mentalhealth/stress-coping/parental-resources/index.html

§§§ https://www.cdc.gov/nssp/participation-coverage-map.html

researchers, and other partners to quickly identify trends in firearm injuries and develop tailored prevention strategies that fit the needs of their communities. Such strategies might include engaging community and street outreach programs that use trusted community members to de-escalate violent conflicts and connect those with the most need to critical support services, implementing hospital-based programs that intervene with victims of violence, improving community physical environments through vacant lot remediation and greening initiatives, enhancing secure firearm storage to reduce access to means among persons at risk for harming themselves or others, and strengthening social and economic supports for persons and families.¶¶¶

¶¶¶ https://www.cdc.gov/violenceprevention/pdf/yv-technicalpackage.pdf

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Safe Listening at Venues and Events with Amplified Music — United States, 2022

John Eichwald, MA[1]; Christa L. Themann, MA[2]; Franco Scinicariello, MD[3]

Nearly one in four (24.4%) U.S. adults aged 20–69 years show evidence of noise-induced hearing loss (*1*). Among those reporting exposure to noise outside of work, 19.9% showed possible noise-induced hearing loss. Exposure to non–job-related noise can be substantial (*2*). Loud music from personal listening devices and entertainment venues might place more than 1 billion teenagers and young adults at risk for hearing loss worldwide (*3*). Early noise exposure might increase the risk for age-related hearing loss later in life (*4*). CDC analyzed data from the 2022 FallStyles survey (conducted by Porter Novelli via the Ipsos' KnowledgePanel) on U.S. adult perceptions regarding preventing hearing loss from amplified music at venues or events. More than one half of U.S. adults agreed with one or more of the following protective actions: limiting sound levels, posting warning signs, and using hearing protection when music at such events reaches potentially hazardous levels. Hearing and other health professionals can make use of existing materials available from the World Health Organization (WHO), CDC, and other professional organizations to raise awareness about noise risks and promote protective behaviors.

The 2022 FallStyles survey, conducted during September 1–24, is a nationally representative internet panel comprising 4,514 noninstitutionalized adults aged ≥18 years. The response rate was 78.1%. Results were weighted to the March 2021 supplement of the U.S. Current Population Survey proportions on eight selected demographic variables: sex, age, household income, race and ethnicity, household size, highest level of educational attainment, U.S. Census Bureau region, and metropolitan residency status (living in or near an urbanized area with a population of ≥50,000). Panel members were recruited by mail, using probability-based sampling by address to reach respondents regardless of whether they had landline telephones or Internet access.* If needed, households were provided a laptop or tablet computer and Internet access. Personal identifiers were not included in the data file. Panelists who completed the survey received cash-equivalent rewards worth approximately $5.

Respondents were asked three questions about sound levels at both indoor and outdoor recreational venues and events at which enjoyment of amplified music was a central purpose of attendance. Respondents were asked how much they agreed or disagreed with each of the following statements: "Sound levels at venues or events should be limited to reduce risk of hearing loss"; "Warning signs should be posted if sound at a venue or event could exceed safe levels"; and "I would wear hearing protection if it was provided when sound at a venue or event could exceed safe levels." Participants indicated their responses on a 5-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree). Answers were combined into three categories: 1) strongly agree or agree (agree), 2) neither agree nor disagree, and 3) disagree or strongly disagree (disagree). Multinomial logistic regression was used to calculate adjusted odds ratios (aORs), 95% CIs, and p-values. The following covariates were all included in the model: sex (male or female), age, race and ethnicity, educational attainment, household income, U.S. Census Bureau region of residence, and metropolitan residency status. This analysis was conducted using SAS statistical software (version 9.4; SAS Institute); p-values <0.05 were considered statistically significant. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.†

Most respondents were female (50.9%), and 62.8% were non-Hispanic White (White) (Table 1). More than one half of respondents (54.1%) agreed that sound levels should be limited at venues or events to reduce risk of hearing loss (Figure); 75.4% agreed that warning signs should be posted if sound at a venue or event could exceed safe levels, and 61.2% agreed that they would wear hearing protection if it was provided when sound at a venue or event could exceed safe levels.

After adjusting for multiple covariates, women agreed significantly more often than did men that sound levels should be limited and that warning signs should be posted (aOR = 1.2 and 1.5, respectively) (Table 2). Respondents aged ≥63 years agreed significantly more often than did younger adults that sound levels should be limited (2.3), warning signs should be posted (1.4), and that they would wear hearing protection if provided (1.4). However, adults aged 33–47 years and 48–62 years agreed significantly less often that warning signs should be posted (0.6 and 0.7, respectively). Compared with White adults, non-Hispanic Black or African American (Black) adults agreed significantly less often (0.8) with limiting sound levels. Hispanic or Latino (Hispanic) adults agreed significantly more often with displaying warning signs (1.3).

Agreement with both limiting sound levels and wearing hearing protection progressively increased with the respondent's

* https://styles.porternovelli.com/consumer-youthstyles/

† 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.

TABLE 1. Selected characteristics of surveyed adults aged ≥18 years — Porter Novelli FallStyles survey, United States, 2022

Characteristic	Unweighted no.	Weighted no.	Total respondents weighted, % (95% CI)
Sex			
Male	1,788	1,730	**49.1 (47.1–51.0)**
Female	1,738	1,796	**50.9 (49.0–52.9)**
Age group, yrs, quartiles			
18–32	450	896	**25.4 (23.4–27.4)**
33–47	685	851	**24.1 (22.4–25.8)**
48–62	650	873	**24.8 (23.2–26.3)**
≥63	1,441	906	**25.7 (24.3–27.1)**
Race and ethnicity*			
Black or African American, non-Hispanic	314	421	**11.9 (10.6–13.3)**
White, non-Hispanic	2,576	2,213	**62.8 (60.8–64.8)**
Hispanic or Latino	375	589	**16.7 (15.0–18.4)**
Other or multiple races, non-Hispanic	261	303	**8.6 (7.4–9.8)**
Education			
No high school diploma	181	330	**9.4 (7.9–10.8)**
High school diploma	873	999	**28.3 (26.5–30.1)**
Some college or associate degree	991	957	**27.1 (25.5–28.8)**
Bachelor's degree or higher	1,481	1,240	**35.2 (33.4–36.9)**
Household income, USD			
<25,000	383	450	**12.8 (11.4–14.2)**
25,000–74,999	1,098	1,175	**33.3 (31.5–35.2)**
75,000–149,999	1,210	1,097	**31.1 (29.4–32.8)**
≥150,000	835	804	**22.8 (21.2–24.4)**
U.S. Census Bureau region of residence†			
Northeast	668	608	**17.3 (15.9–18.7)**
Midwest	791	727	**20.6 (19.1–22.6)**
South	1,246	1,347	**38.2 (36.3–40.1)**
West	821	844	**23.9 (22.2–25.6)**
Metropolitan residency status§			
Nonmetropolitan	438	469	**13.3 (12.0–14.6)**
Metropolitan	3,088	3,057	**86.7 (85.4–88.0)**

Abbreviation: USD = U.S. dollars.

* Persons who identified as Black or African American, White, or other or multiple races were all non-Hispanic. Persons who identified as Hispanic might be of any race.

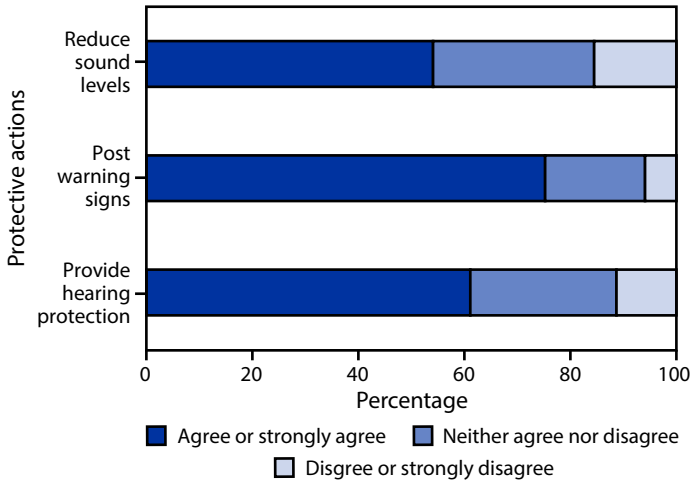
† https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

§ Metropolitan residency status is defined as living in or near an urbanized area with a population of ≥50,000.

level of educational attainment. Compared with those with less than a high school education, adults with a high school diploma, with some college or associate degree, and with a bachelor's degree or higher agreed significantly more often with limiting sound levels (aOR = 1.5, 2.1, and 3.1, respectively) and wearing hearing protection (1.5, 1.9, and 2.8, respectively). Only adults with some college and those with at least a bachelor's degree agreed significantly more often than did those with less education that warning signs should be posted in venues and events where sound could exceed safe levels (1.5 and 2.4, respectively).

Compared with respondents who reported an annual household income of <$25,000, those with an income of >$150,000 agreed significantly more often (aOR = 1.4) that warning signs should be posted. U.S. Census Bureau region and metropolitan residency status made little difference in perceptions regarding safe listening to amplified music at venues and events, with the exception of adults in metropolitan areas who agreed significantly that warning signs should be posted (1.5).

FIGURE. Percentage of agreement or disagreement among adults aged ≥18 years about actions* to protect hearing at indoor or outdoor recreational venues and events at which enjoyment of amplified music is a central purpose of attendance — Porter Novelli FallStyles survey, United States, 2022



* Respondents were asked how much they agreed or disagreed with the following statements: 1) "Sound levels at venues or events should be limited to reduce risk of hearing loss"; 2) "Warning signs should be posted if sound at a venue or event could exceed safe levels"; and 3) "I would wear hearing protection if it was provided when sound at a venue or event could exceed safe levels."

Discussion

The results from this survey indicate that U.S. adults are largely aware of the hazard posed by high sound levels at concerts and other events. More importantly, results indicate an encouraging openness to protective actions, such as limiting sound levels, posting warning signs, and use of hearing protection. More than one half of the respondents agreed that sound levels at venues or events should be limited to reduce risk for hearing loss, approximately three quarters of respondents agreed that warning signs should be posted if sound at a venue or event could exceed safe levels, and approximately three in five respondents agreed they would wear hearing protection if it was provided when sound at a venue or event could exceed safe levels. Survey results suggest targeting educational efforts for the use of hearing protection toward respondents aged <63 years. Raising the awareness among certain demographic groups (e.g., younger persons, Black persons, and Hispanic persons) about limiting sound levels and displaying of warning signs might be warranted.

TABLE 2. Adjusted odds ratios comparing characteristics of adults who agree with event and venue noise level reduction actions with those of adults who neither agree nor disagree — Porter Novelli FallStyles survey, United States, 2022

Characteristic	Agreement,* aOR† (95% CI)		
	Sound levels at venues or events should be limited to reduce risk of hearing loss§	Warning signs should be posted if sound at a venue or event could exceed safe levels¶	I would wear hearing protection if it was provided when sound at a venue or event could exceed safe levels**
Sex			
Male	Ref	Ref	Ref
Female	1.2 (1.0–1.4)††	1.5 (1.3–1.8)††	1.1 (0.9–1.3)
Age group, yrs, quartiles			
18–32	Ref	Ref	Ref
33–47	1.0 (0.9–1.3)	0.6 (0.5–0.8)††	0.8 (0.6–1.0)
48–62	1.2 (0.9–1.5)	0.7 (0.5–0.9)††	1.0 (0.8–1.2)
≥63	2.3 (1.8–2.8)††	1.4 (1.1–1.8)††	1.4 (1.1–1.7)††
Race and ethnicity§§			
Black or African American, non-Hispanic	0.8 (0.6–1.0)††	0.8 (0.6–1.0)	1.0 (0.8–1.3)
White, non-Hispanic	Ref	Ref	Ref
Hispanic or Latino	1.0 (0.8–1.3)	1.3 (1.0–1.7)††	1.1 (0.9–1.3)
Other or multiple races, non-Hispanic	1.0 (0.8–1.3)	0.8 (0.6–1.2)	0.9 (0.7–1.2)
Education			
No high school diploma	Ref	Ref	Ref
High school diploma	1.5 (1.1–2.0)††	1.1 (0.8–1.5)	1.5 (1.1–1.9)††
Some college or associate degree	2.1 (1.5–2.8)††	1.5 (1.1–2.1)††	1.9 (1.4–2.6)††
Bachelor's degree or higher	3.1 (2.3–4.2)††	2.4 (1.7–3.4)††	2.8 (2.1–3.8)††
Household income, USD			
<25,000	Ref	Ref	Ref
25,000–74,999	1.1 (0.9–1.4)	1.2 (0.9–1.6)	1.0 (0.8–1.3)
75,000–149,999	1.0 (0.7–1.3)	1.1 (0.8–1.4)	0.9 (0.7–1.1)
≥150,000	1.1 (0.8–1.4)	1.4 (1.0–2.0)††	1.2 (0.9–1.7)
U.S. Census Bureau region of residence¶¶			
Northeast	Ref	Ref	Ref
Midwest	0.9 (0.7–1.1)	1.0 (0.8–1.4)	1.0 (0.8–1.3)
South	0.9 (0.7–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
West	0.9 (0.7–1.1)	0.9 (0.7–1.2)	1.0 (0.7–1.2)
Metropolitan residency status* **			
Nonmetropolitan	Ref	Ref	Ref
Metropolitan	1.1 (0.8–1.3)	1.5 (1.1–2.0)††	1.0 (0.8–1.3)

Abbreviations: aOR = adjusted odds ratio; Ref = referent group; USD = U.S. dollars.

* "Agreement" includes both "strongly agree" and "agree" responses.

† aORs and 95% CIs calculated using multinomial logistic regression.

§ Panelists were asked to indicate level of agreement with the following statement: "Sound levels at venues or events should be limited to reduce risk of hearing loss."

¶ Panelists were asked to indicate level of agreement with the following statement: "Warning signs should be posted if sound at a venue or event could exceed safe levels."

** Panelists were asked to indicate level of agreement with the following statement: "I would wear hearing protection if it was provided when sound at a venue or event could exceed safe levels."

†† Statistical difference at p<0.05 compared with Ref.

§§ Persons who identified as Black or African American, White, or other or multiple races were all non-Hispanic. Persons who identified as Hispanic might be of any race.

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

*** Metropolitan residency status is defined as living in or near an urbanized area with a population of ≥50,000.

Summary

What is already known about this topic?

Exposure to loud music from personal listening devices and entertainment venues can pose a risk to hearing; nearly 25% of U.S. adults aged 20–69 years show evidence of noise-induced hearing loss.

What is added by this report?

More than one half of U.S. adults aged ≥18 years are open to actions being taken at events and venues with amplified music to protect their hearing, such as limiting sound levels, posting of warning signs, and using hearing protection when provided.

What are the implications for public health practice?

Health care practitioners can help persons understand their risks from high sound levels and manage their exposures. Resources are available to help raise awareness of noise risks and promote protective behaviors.

However, stated intent to take protective action does not always result in the action being taken. In an earlier Porter Novelli Styles survey, approximately 80% of U.S. adults aged ≥18 years reported never or seldom using hearing protection at loud athletic or entertainment events. An additional 10% reported using hearing protection only some or about one half the time (*5*). Interventions focusing on translating intent into behavior are needed. Healthy People 2030, the nation's public health agenda, includes an objective to increase the proportion of adults who use hearing protection devices when exposed to loud sounds (*6*).

In 2022, WHO published a Global Standard recommending sound levels at venues and events be limited to no more than 100 dB(A) equivalent continuous sound level§ over any 15-minute period. The limit was set to reduce "unnecessarily hazardous sound levels" while still allowing for artistic expression and enjoyment of amplified music. WHO acknowledged the limit "does not, and cannot, eliminate all risk of an individual audience member suffering sound-induced hearing injury," particularly among those who frequently attend loud music events (*7*). WHO's standard provides examples of preventive actions to reduce risk for hearing loss for audience members. These include those surveyed in this report: limiting sound levels, posting warning signs when sound could exceed safe levels, and providing hearing protection, such as earplugs, with appropriate instructions for audience members.

The findings in this report are subject to at least four limitations. First, the data obtained in this survey were self-reported. Second, the survey relied on respondents' perceptions of loudness and the risk for hearing loss. Third, respondents' perceptions might be influenced by their experience of attending such

§ The equivalent continuous sound level is the constant sound level that would have the same total energy as the fluctuating sound level during the same period.

events, but data on these experiences (e.g., whether or how often respondents attended events with amplified music) were not collected. Finally, although survey responses were weighted by the U.S. demographic characteristics, how accurately this weighting has corrected any bias in this internet panel sample remains unknown.

Music-induced hearing loss is entirely preventable. Hearing and other health professionals can make use of existing materials available from WHO (https://www.who.int/activities/making-listening-safe), CDC (https://www.cdc.gov/nceh/hearing_loss/toolkit), and a variety of professional organizations (e.g., http://dangerousdecibels.org/ and https://hearinghealthfoundation.org/keeplistening) to raise awareness of noise-related risks and promote protective behaviors, such as lowering the volume, using hearing protection, and taking breaks from noisy activities. Interventions should focus on helping persons understand the risks of high sound levels and managing their exposures so they can enjoy music for a lifetime without the debilitating effects of hearing loss.

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JYNNEOS Vaccination Coverage Among Persons at Risk for Mpox — United States, May 22, 2022–January 31, 2023

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From May 2022 through the end of January 2023, approximately 30,000 cases of monkeypox (mpox) have been reported in the United States and >86,000 cases reported internationally.* JYNNEOS (Modified Vaccinia Ankara vaccine, Bavarian Nordic) is recommended for subcutaneous administration to persons at increased risk for mpox (*1*,*2*) and has been demonstrated to provide protection against infection (*3*–*5*). To increase the total number of vaccine doses available, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) on August 9, 2022, recommending administration of the vaccine intradermally (0.1 mL per dose) for persons aged ≥18 years who are recommended to receive it (*6*); intradermal administration can generate an equivalent immune response to that achieved through subcutaneous injection using approximately one fifth the subcutaneous dose (*7*). CDC analyzed JYNNEOS vaccine administration data submitted to CDC from jurisdictional immunization information systems (IIS)† to assess the impact of the EUA and to estimate vaccination coverage among the population at risk for mpox. During May 22, 2022–January 31, 2023, a total of 1,189,651 JYNNEOS doses (734,510 first doses and 452,884 second doses)§ were administered. Through the week of August 20, 2022, the predominant route of administration was subcutaneous, after which intradermal administration became predominant, in accordance with FDA guidance. As of January 31, 2023, 1-dose and 2-dose (full vaccination) coverage among persons at risk for mpox is estimated to have reached 36.7% and 22.7%, respectively. Despite a steady decline in mpox cases from a 7-day daily average of more than 400 cases on August 1, 2022, to five cases on January 31, 2023, vaccination for persons at risk for mpox continues to be recommended (*1*). Targeted outreach and continued access to and availability of mpox vaccines to persons at risk are important to help prevent and minimize the impact of a resurgence of mpox.

Since the beginning of the 2022 mpox outbreak through January 31, 2023, a total of 30,157 mpox cases and 32 associated deaths have been reported in the United States.¶ Most *Monkeypox virus* infections during the current outbreak have been transmitted through close, intimate contact (primarily sexual) with symptomatic persons (*8*). Based on the epidemiology of the current outbreak, CDC recommends mpox vaccination for persons at increased risk for mpox, including, but not limited to 1) persons with known or presumed exposure; 2) gay, bisexual, or other men who have sex with men (MSM) and transgender, nonbinary, or gender-diverse persons with multiple recent sexual partners; 3) MSM and transgender, nonbinary, or gender-diverse persons with a newly diagnosed sexually transmitted disease; 4) persons who have had sex at or related to attending a commercial sex venue or another large social-cultural gathering during the previous 6 months; 5) those with sexual partners with any of the aforementioned risks; and 6) persons with HIV or other causes of immune suppression who have had recent or anticipate future *Monkeypox virus* exposure through any of these scenarios.** Preliminary studies have indicated that JYNNEOS provides protection against mpox, with unvaccinated persons having 7–14 times higher incidence than do vaccinated persons, depending on the number of doses received (*3*–*5*).

Health care providers submitted mpox vaccination data to their jurisdictions' IIS; these data were then submitted to CDC. IIS data include information about the vaccine (e.g., manufacturer, dose, and administration route), recipient (e.g., age, sex,†† race and ethnicity, and residence), and provider (location and provider type). This analysis includes data from JYNNEOS vaccine administered to residents in the 50 U.S. states, the District of Columbia (DC), New York City, Philadelphia, Puerto Rico, the U.S. Virgin Islands, Guam, and the Northern Mariana Islands, during May 22, 2022–January 31, 2023.

JYNNEOS vaccination coverage (the estimated proportion of the population recommended for vaccination that has been vaccinated) was calculated by jurisdiction.§§ The numerator used in calculating each jurisdiction's coverage included data

* https://www.cdc.gov/poxvirus/mpox/response/2022/world-map.html

† Residency was ascertained by vaccine recipient self-report; in the absence of a residential address, the location of vaccination was used in some locations. New York City and Philadelphia were allocated and report vaccine doses to CDC separately from the rest of New York and Pennsylvania and are therefore included as separate jurisdictions in this report.

§ 2,257 doses were reported as third, fourth, fifth, sixth, or seventh doses.

¶ https://www.cdc.gov/poxvirus/mpox/response/2022/index.html

** https://www.cdc.gov/poxvirus/mpox/vaccines/index.html

†† Assessing vaccination based on gender identity was not possible because this information is not routinely collected during vaccine administration, and existing IIS systems do not include this variable.

§§ U.S. Virgin Islands, Guam, and the Northern Mariana Islands are not included in coverage estimates because of data suppression restrictions.

submitted to CDC on all persons aged ≥13 years with valid residence information in each jurisdiction who have been partially or fully vaccinated[¶¶] with JYNNEOS. The denominator, representing the population at increased risk for *Monkeypox virus* exposure (*8*), was estimated as the number of MSM who were indicated to receive HIV preexposure prophylaxis (PrEP) (among those aged ≥16 years) plus the number of MSM with HIV (among those aged ≥13 years) in each jurisdiction, using data that are publicly available via CDC AtlasPlus.[***] The estimated population was then increased by 25% for each jurisdiction to account for additional persons eligible for vaccination (e.g., MSM who are at increased risk for mpox but do not have indications for PrEP, cis-female or transgender partners of MSM, close contacts [of any age] of persons with known or suspected mpox, and persons at risk for occupational exposure to orthopoxviruses)[†††] (Supplementary Table; https://stacks.cdc.gov/view/cdc/126171).[§§§] This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[¶¶¶]

During May 22, 2022–January 31, 2023, 57 jurisdictions administered a total of 1,189,651 doses of JYNNEOS vaccine, 734,510 (61.7%) of which were first doses, 452,884 (38.1%) of which were second doses, and 2,257 (0.2%) of which were reported as dose 3 or higher (Table). The majority of the 734,510 persons who received ≥1 dose of vaccine were male (91.4%) and aged 25–49 years (64.2%). Among the 91% of first-dose recipients for whom race and ethnicity data were available, 51.2% were non-Hispanic White, 22.7% were Hispanic or Latino, 12.4% were non-Hispanic Black or African American (Black), 7.4% were non-Hispanic Asian, 5.6% were non-Hispanic multiracial, and <1% were non-Hispanic American Indian or Alaska Native and non-Hispanic Native Hawaiian or other Pacific Islander. The most common vaccination locations included public health clinics (39.5%), commercial vaccination service providers (13.4%),[****] medical practices (10.2%), hospitals (8.8%), and Federally Qualified Health Centers (6.2%). The highest number of both first and second doses were administered to persons living in the West U.S. Census Bureau region (261,936 and 160,457 doses, respectively); >80% of all vaccine recipients reported living in counties categorized as urban.

The distribution of administration routes differed between the first and second doses. Overall, 45.9% of first doses were administered intradermally, 50.6% were administered subcutaneously, and 3.5% were administered by other routes. Among the second doses, 85.7% were administered intradermally, 11.7% subcutaneously, and 2.6% by other routes. The change from predominantly subcutaneous to predominantly intradermal administration occurred after the week of August 20, 2022 (Figure 1).

National first and second dose JYNNEOS coverage among persons at increased risk for mpox were estimated to be 36.7% and 22.7%, respectively. Coverage estimates varied by jurisdiction, ranging from 7.4% (West Virginia) to 94.8% (DC) for first dose coverage and 4.6% (West Virginia) to 66.2% (DC) for second dose coverage. Jurisdictions estimated to have achieved ≥50% coverage for first dose (partial vaccination) were DC (94.8%), New York City (88.8%), California (61.4%), Rhode Island (58.9%), Massachusetts (53.9%), and New York (excluding New York City) (50.1%) (Figure 2).

Discussion

The national public health response strategy for mpox has resulted in administration of >1 million JYNNEOS vaccine doses. Although approximately one in eight first dose recipients were reported to be Black, this group accounts for approximately one in three mpox cases[††††] (*9*), underscoring the importance of deploying strategies, including vaccination, that advance health equity among populations most affected by mpox. The smaller dose needed for intradermal administration increased the available vaccine supply, with each vial providing up to 5 doses compared with a single subcutaneous dose (*7*). The intradermal administration authorization by FDA was widely implemented within 2 weeks of issuance of the EUA in early August 2022.

Estimating vaccination coverage among persons at risk is useful for implementing and assessing public health action. Mpox vaccination coverage varied widely by jurisdiction. Three of the six jurisdictions estimated to have 1-dose coverage rates of ≥50% were also among the jurisdictions with the highest case counts (New York City, California, and New York [excluding New York City]).[§§§§] Twenty-two jurisdictions are estimated to have ≤25% first-dose coverage. DC is the only jurisdiction estimated to have achieved >50% 2-dose coverage. Reasons for low or high coverage were not assessed in this analysis, but potential reasons for low coverage in some jurisdictions could include lower vaccine accessibility and awareness, fewer vaccine providers, lower vaccine confidence and demand, and concern

[¶¶] Fully vaccinated is defined as receipt of 2 JYNNEOS doses on different days, irrespective of time interval, with the second dose received ≥14 days earlier.
[***] https://gis.cdc.gov/grasp/nchhstpatlas/tables.html
[†††] https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/smallpox.html
[§§§] Estimated population calculation based on consensus within CDC mpox response and is consistent with the mpox vaccine allocation strategy. https://aspr.hhs.gov/Mpox/Pages/default.aspx
[¶¶¶] 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.
[****] Broad category used by IIS, includes public and private service providers.
[††††] https://www.cdc.gov/poxvirus/mpox/response/2022/demographics.html
[§§§§] https://www.cdc.gov/poxvirus/mpox/response/2022/us-map.html

TABLE. Characteristics of persons who received first and second doses of JYNNEOS vaccine — United States, May 22, 2022–January 31, 2023*

Characteristic	No. (%)† First dose§	Second dose
Total	**734,510 (100)**	**452,884 (100)**
Sex		
Female	62,191 (8.6)	28,066 (6.3)
Male	659,659 (91.4)	419,140 (93.7)
Unknown	12,660 (—)	5,638 (—)
Age group, yrs		
0–4	302 (0.04)	66 (0.01)
5–11	406 (0.06)	130 (0.03)
12–17	586 (0.08)	216 (0.05)
18–24	57,931 (7.9)	26,218 (5.8)
25–39	338,539 (46.1)	196,260 (43.3)
40–49	133,140 (18.1)	86,834 (19.2)
50–64	160,038 (21.8)	111,727 (24.7)
≥65	43,557 (5.9)	31,393 (6.9)
Unknown	11 (—)	0 (—)
Race and ethnicity¶		
AI/AN, non-Hispanic	2,762 (0.4)	1,602 (0.4)
Asian, non-Hispanic	49,675 (7.4)	30,624 (7.3)
Black or African American, non-Hispanic	83,014 (12.4)	48,472 (11.5)
NH/OPI, non-Hispanic	1,730 (0.3)	1,004 (0.2)
White, non-Hispanic	341,419 (51.2)	228,158 (54.2)
Hispanic or Latino	151,647 (22.7)	88,554 (21.0)
Multiple/Other, non-Hispanic	37,063 (5.6)	22,903 (5.4)
Unknown	67,200 (—)	31,527 (—)
U.S. Census Bureau region**		
Northeast	180,986 (24.8)	100,575 (22.3)
Midwest	90,297 (12.4)	56,163 (12.5)
South	197,700 (27.0)	133,002 (29.5)
West	261,936 (35.8)	160,457 (35.6)
Urbanicity††		
Urban	563,246 (82.3)	346,002 (81.0)
Suburban	108,810 (15.9)	73,126 (17.1)
Rural	12,646 (1.8)	7,919 (1.9)
Unknown	49,808 (—)	25,797 (—)
Location of vaccine administration		
Public health provider (public health clinic)	246,938 (39.5)	139,766 (36.2)
Commercial vaccination service provider	84,029 (13.4)	64,334 (16.6)
Medical practice	63,682 (10.2)	41,627 (10.8)
Hospital	55,332 (8.8)	25,192 (6.5)
Public health provider (FQHC)	38,780 (6.2)	26,047 (6.7)
Health center (community)	22,641 (3.6)	15,064 (3.9)
Health center (other)	20,464 (3.3)	12,494 (3.2)
Pharmacy	19,859 (3.2)	14,085 (3.6)
Other	73,845 (11.8)	47,856 (12.4)
Unknown	108,940 (—)	66,379 (—)
Administration route§§		
Intradermal	288,979 (45.9)	346,410 (85.7)
Subcutaneous	318,805 (50.6)	47,359 (11.7)
Other	21,791 (3.5)	10,304 (2.6)
Unknown	75,794 (—)	30,250 (—)
Estimated coverage of persons at risk, %¶¶	36.7	22.7
Range of jurisdiction values	7–95	5–66

TABLE. (*Continued*) Characteristics of persons who received first and second doses of JYNNEOS vaccine — United States, May 22, 2022–January 31, 2023*

Sources: CDC Immunization Data Lake and AtlasPlus.
Abbreviations: AI/AN = American Indian or Alaska Native; FQHC = Federally Qualified Health Center; mpox = monkeypox; MSM = men who have sex with men; NCHS = National Center for Health Statistics; NH/OPI = Native Hawaiian or other Pacific Islander; PrEP = HIV preexposure prophylaxis.

* Data current as of March 7, 2023.

† Percentages calculated using nonmissing data.

§ 2,257 doses were reported as third, fourth, fifth, sixth, or seventh doses.

¶ Combined information about a person's race and Hispanic ethnicity. Persons reporting Hispanic ethnicity were categorized as Hispanic or Latino (Hispanic) and might be of any race; persons reporting non-Hispanic ethnicity were categorized as White, Black, Asian, AI/AN, NH/OPI, or other/multiracial (more than one race category selected) based on race; persons with missing data for either race or ethnicity were categorized as unknown race and ethnicity (9.1% of first dose recipients and 7.0% of second dose recipients did not have race and ethnicity data reported).

** https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf. As of January 31, 2023, vaccine allocations (vials) for each U.S. Census Bureau region were as follows: 275,906 (Northeast), 169,419 (Midwest), 428,686 (South), and 302,895 (West) (https://aspr.hhs.gov/SNS/Pages/JYNNEOS-Distribution.aspx). A total of 6,246 vaccine recipients were in U.S. territories and freely associated states and were not categorized in a U.S. Census Bureau region.

†† Urbanicity was classified based on the vaccine recipient's county of residence using the NCHS Urban-Rural Classification Scheme for Counties 2013: urban includes large central metropolitan, medium metropolitan, and small metropolitan counties; suburban includes large fringe metropolitan counties; rural includes micropolitan and noncore counties. A total of 69,441 vaccine recipients had an unknown or missing county of residence; 6,264 vaccine recipients were in U.S. territories and freely associated states and were not categorized as urban, suburban, or rural.

§§ Does not include vaccine administrations for jurisdictions reporting aggregate data. Analyses do not include vaccine doses reported by Texas and vaccine doses administered to recipients aged <18 years reported by Idaho because of aggregate reporting to CDC.

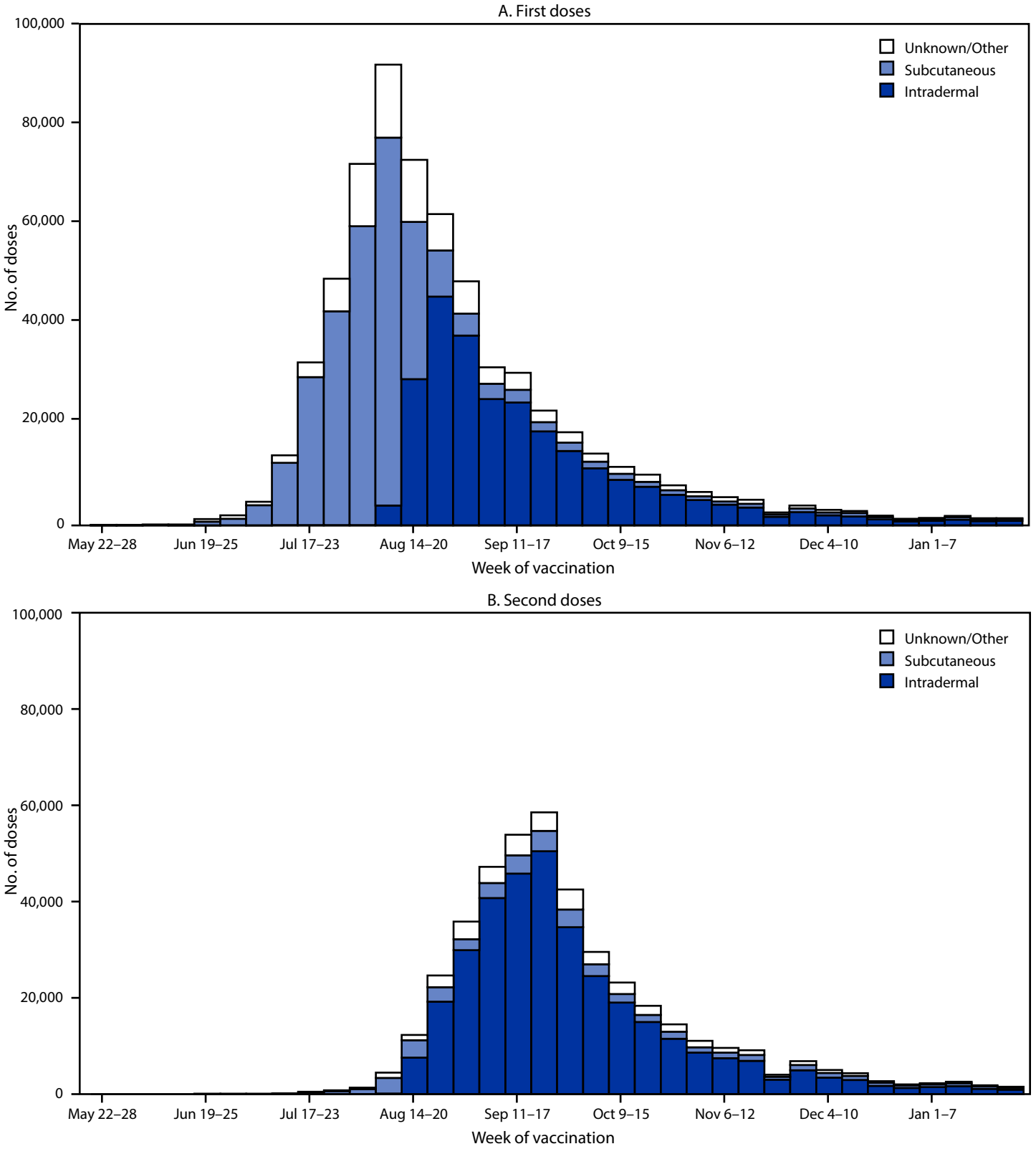
¶¶ Estimated mpox vaccination coverage is the proportion of all persons aged ≥13 years who have been vaccinated divided by the population recommended to receive the vaccine. The denominator, representing the population at increased risk for *Monkeypox virus* exposure, is estimated as the number of MSM who are eligible for PrEP (among those aged ≥16 years) plus the number of MSM living with HIV (among those aged ≥13 years) in each jurisdiction. These data are publicly available via CDC AtlasPlus (https://gis.cdc.gov/grasp/nchhstpatlas/tables.html) as of 2021 (PrEP-eligible MSM) and 2020 (MSM with HIV). This estimated population has been increased by 25% for each jurisdiction to account for additional persons eligible for vaccination (e.g., cis-female or transgender partners of MSM and close contacts of persons with known or suspected mpox). Data current as of March 16, 2023.

about stigma. CDC recommends that all persons eligible for mpox vaccination get vaccinated; however, national vaccination coverage targets have not been established. Vaccine allocation and distribution were prioritized by risk for exposure to *Monkeypox virus* and for areas with higher case counts, making more doses available in highly affected jurisdictions during the period of peak vaccine demand.¶¶¶¶

The findings in this report are subject to at least four limitations. First, coverage estimates include assumptions based on national data applied to subnational jurisdictions. For example, the increase by 25% of the vaccine-eligible population might not be appropriate for each jurisdiction. Consequently, coverage estimates for some jurisdictions might be biased. Second, residence information was self-reported and might be incomplete; in cases for which residence was not provided to the vaccination site, the site's location might have been used. Overall, among vaccinations reported to CDC, residence data were missing for 8%. Third,

¶¶¶¶ https://aspr.hhs.gov/SNS/Pages/JYNNEOS-Distribution.aspx

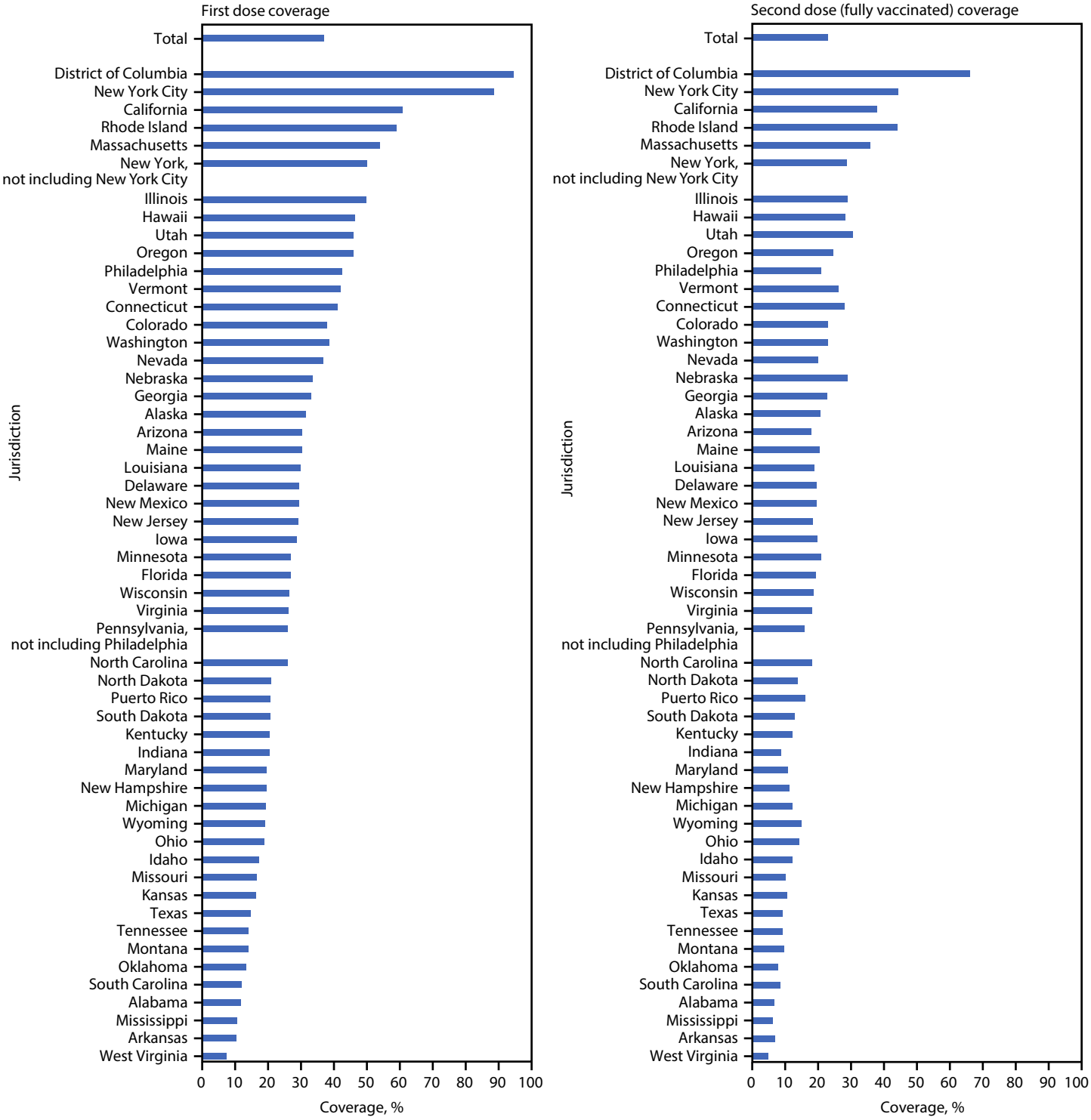
FIGURE 1. Route of administration of first and second JYNNEOS vaccine doses, by week of vaccination* — United States, May 22, 2022–January 28, 2023



Source: CDC Immunization Data Lake.

* Data reported to CDC as of 4:00 a.m. Eastern Time on March 7, 2023. Weeks in which n<30 are not shown. Data does not include vaccine administration for jurisdictions reporting aggregate data. Analyses do not include vaccine administration reported by Texas or reported for recipients aged <18 years by Idaho because of aggregate reporting to CDC.

FIGURE 2. First and second* JYNNEOS vaccination coverage estimates, by jurisdiction† — United States, May 22, 2022–January 31, 2023§



Sources: CDC Immunization Data Lake and AtlasPlus.

* Fully vaccinated is defined as receipt of 2 JYNNEOS doses on different days, irrespective of time interval, with the second dose received ≥14 days earlier.

† Residency was ascertained by vaccine recipient self-report; in the absence of a residential address, the location of vaccination was used in some locations. New York City and Philadelphia were allocated and report vaccine doses to CDC separately from the rest of New York and Pennsylvania and are therefore included as separate jurisdictions in this report.

§ Data reported to CDC as of March 16, 2023. U.S. Virgin Islands, Guam, and the Northern Mariana Islands are not included in coverage estimates because of data suppression restrictions.

Summary

What is already known about this topic?

JYNNEOS vaccine is effective in preventing monkeypox (mpox) among persons at risk.

What is added by this report?

During the current multinational outbreak, U.S. 1- and 2-dose vaccination coverage reached an estimated 37% and 23%, respectively, among persons at risk, with wide variation among jurisdictions. The predominant administration route switched from subcutaneous to intradermal after the week of August 20, 2022, in accordance with Food and Drug Administration recommendations.

What are the implications for public health practice?

Despite administration of >1 million vaccine doses, only 23% of the at-risk population has been fully vaccinated. Targeted outreach and continued access to and availability of mpox vaccines to persons at risk is important to help prevent and minimize the impact of a resurgence of mpox.

some vaccination-related data elements are not available for all jurisdictions; therefore, national estimates for some characteristics might not include all jurisdictions. For example, some jurisdictions do not report recipients' sex or race and ethnicity. Finally, information on sexual orientation and gender identity are not routinely collected during vaccine administration, and existing IIS systems do not include those variables; therefore, it is not possible to assess how vaccine recipients identify.

Although the number of mpox cases has decreased sharply, much is unknown about the risk for potential reintroduction of the virus and resurgence of disease in the United States. Thus, the need to improve vaccination coverage among populations at risk, increase vaccine equity, and increase the number of persons fully vaccinated (*10*) remain important public health goals to prevent or minimize the impact of a resurgence of mpox. Given the increased protection provided by full vaccination compared with partial vaccination (*3*), providing second doses to those who are partially vaccinated should also be prioritized. Continued targeted local outreach to persons at increased risk for mpox and to disproportionately affected groups and community partners to address inequities is recommended. Ongoing access to vaccine administration data from jurisdictions is important for public health decision-making and improving equitable vaccination coverage among those at risk.

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Notes from the Field

Cluster of Blastomycosis Among Neighborhood Residents — St. Croix County, Wisconsin, 2022

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Blastomycosis, caused by the fungus *Blastomyces*, is a rare but potentially serious infection in humans and animals. *Blastomyces* is endemic in Wisconsin, which reports the highest incidence of *Blastomyces* infection in the country, with an estimated annual statewide incidence of 2.1 cases per 100,000 residents. Some high-incidence counties report 20–40 cases per 100,000 population (*1*,*2*). *Blastomyces* is also found in other midwestern, south-central, and southeastern states, and lives in moist, organic soils and decaying wood and leaves. Infections typically occur when *Blastomyces* spores are inhaled. *Blastomyces* infections do not spread between humans and animals through the air. Blastomycosis usually begins with mild respiratory symptoms, which often self-resolve, but can progress to a severe, and occasionally fatal, disease without antifungal treatment. In February 2022, a veterinarian in St. Croix County, Wisconsin, alerted the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and the Wisconsin Department of Health Services (DHS) of four dogs with diagnoses of blastomycosis, all living within a 1-mile area. Review of surveillance data identified two human cases reported in the same area within 3 weeks of the canine cases. With 1–5 human cases reported annually, St. Croix County is not considered an area with hyperendemic transmission.

In response to this cluster, Wisconsin DHS and DATCP issued alerts to physicians and veterinarians in the surrounding counties, emphasizing the importance of timely diagnosis and treatment of blastomycosis. In Wisconsin, blastomycosis is reportable in humans but not in animals, and this alert encouraged local veterinarians to report cases potentially associated with this cluster. St. Croix County Public Health sent a letter to residents of the affected neighborhoods alerting them to the cluster and encouraging them to seek care if they had compatible symptoms. During January–March 2022, four persons and five dogs received a clinical diagnosis of blastomycosis. Two of the human cases received a diagnosis only after notification of the ongoing cluster. The five dogs with blastomycosis initially had mild to moderate symptoms: four experienced cough, difficulty breathing, lethargy, fever, and poor appetite. One dog had only a subcutaneous mass that contained *Blastomyces* yeast visible on microscopy. Urine antigen tests were positive for all infected dogs. Among the four persons with a clinical diagnosis of blastomycosis, all experienced cough, fever, and shortness of breath; symptom onset ranged from early October 2021 to early February 2022; two patients had presumptive laboratory evidence of infection, and two had confirmatory laboratory evidence.[†] Two patients had severe disease and required hospitalization, including one adult patient who died. Antifungal medications are used to treat blastomycosis in humans and dogs and are often required for extended periods, depending on disease severity; all five canine and four human cases were treated with antifungal medications. Before January 2022, no blastomycosis cases had been reported in residents of this neighborhood during the preceding 10 years, although one dog reportedly died of blastomycosis during the previous year.

Environmental assessments identified a river and unpaved paths running through the neighborhoods under investigation. Construction in this neighborhood during the past decade might have dispersed *Blastomyces* spores. A more comprehensive investigation was launched to characterize potential environmental exposure sources in this community. Analysis of these data is ongoing.

Although blastomycosis is infrequently reported, clusters have occurred primarily among persons engaging in recreational activities along waterways or in areas with ongoing excavation (*3*–*5*). Clinicians should consider blastomycosis among patients with compatible symptoms who live in or have traveled to known areas of endemicity, especially among patients with respiratory symptoms that do not resolve with antibiotic treatment. Available diagnostic tests for blastomycosis include fungal culture, cytologic smear, histopathology, identification of *Blastomyces*-specific nucleic acids through polymerase chain reaction or DNA probe, antigen assay, or antibody detection by immunodiffusion or enzyme immunoassay. This investigation highlights the critical contribution of a multidisciplinary One Health[§] approach in public health in which an astute veterinarian recognized and reported the canine cases leading to identification of the cluster.

[*] These authors contributed equally to this report.

[†] https://ndc.services.cdc.gov/case-definitions/blastomycosis-2020/

[§] https://www.cdc.gov/onehealth/index.html

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