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Emergency Department Visits Involving Mental Health Conditions, Suicide-Related Behaviors, and Drug Overdoses Among Adolescents — United States, January 2019–February 2023

Kayla N. Anderson, PhD;[1] Dylan Johns, MS;[2,3] Kristin M. Holland, PhD;[1] Yushiuan Chen, MS;[1] Alana M. Vivolo-Kantor, PhD;[1] Eva Trinh, PhD;[1] Rebecca H. Bitsko, PhD;[4] Rebecca T. Leeb, PhD;[4] Lakshmi Radhakrishnan, MPH;[2] Sarah Bacon, PhD;[1] Christopher M. Jones, PharmD, DrPH[1]

The U.S. adolescent mental and behavioral health crisis is ongoing,* with high pre–COVID-19 pandemic baseline rates† (*1*) and further increases in poor mental health (*2*), suicide-related behaviors (*3*), and drug overdose deaths (*4*) reported during 2020–2021. CDC examined changes in U.S. emergency department (ED) visits for mental health conditions (MHCs) overall and for nine specific MHCs,§ suicide-related behaviors (including suspected suicide attempts), and drug-involved overdoses (including opioids) among children and adolescents aged 12–17 years (adolescents) during January 2019–February 2023, overall and by sex. Compared with fall 2021, by fall 2022, decreases in weekly ED visits were reported among all adolescents, and females specifically, for MHCs overall, suicide-related behaviors, and drug overdoses; weekly ED visits among males were stable. During this same period, increases in weekly ED visits for opioid-involved overdoses were detected. Mean weekly ED visits in fall 2022 for suicide-related behaviors and MHCs overall were at or lower than the 2019 prepandemic baseline, respectively, and drug overdose visits were higher. Differences by sex were observed; levels among females were at or higher than prepandemic baselines for these conditions. These findings suggest some improvements as of fall 2022 in the trajectory of adolescent mental and behavioral health, as measured by ED visits; however, poor mental and behavioral health remains a substantial public health problem, particularly among adolescent females. Early identification and trauma-informed interventions, coupled with expanded evidence-based, comprehensive prevention efforts, are needed to support adolescents' mental and behavioral health.

CDC examined ED visit data for adolescents from facilities consistently reporting data to the National Syndromic Surveillance Program (NSSP) during January 2019–early

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

* Multiple declarations related to the adolescents' mental and behavioral health crisis have been issued by federal authorities (https://www.hhs.gov/sites/default/files/surgeon-general-youth-mental-health-advisory.pdf) and national health care organizations (https://www.aap.org/en/advocacy/child-and-adolescent-healthy-mental-development/aap-aacap-cha-declaration-of-a-national-emergency-in-child-and-adolescent-mental-health/).

† CDC data on adolescent mental and behavioral health can be queried online, including data on fatal and nonfatal overdoses and suicide-related behaviors (https://www.cdc.gov/injury/wisqars/index.html) and self-reported data on mental health, suicide-related behaviors, and substance use (https://nccd.cdc.gov/youthonline/App/Default.aspx).

§ Anxiety, attention-deficit/hyperactivity disorders, bipolar disorders, depression, disruptive behavioral and impulse-control disorders, eating disorders, obsessive-compulsive disorders, tic disorders, and trauma and stressor-related disorders.

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February 2023. A collaboration among CDC, local, and state health departments, and federal, academic, and private sector partners, NSSP receives anonymized medical record data from approximately 75% of EDs nationwide, although fewer than 50% of facilities from California, Hawaii, Minnesota, and Oklahoma currently participate. To reduce artifactual impact from changes in reporting patterns, analyses were restricted to facilities with a coefficient of variation for ED visits of ≤40 and average weekly informative discharge diagnosis ≥75% complete throughout the study period. In addition to displaying continuous trends, school semester surveillance periods in 2022 (spring included calendar weeks 1–23; summer, weeks 24–36; and fall, weeks 37–53) were compared with corresponding periods in 2021 and 2019 to monitor recent changes in ED visits and differences from the prepandemic baseline, respectively. School semester surveillance periods were used after visual inspection of visits related to MHCs, suicide-related behaviors, and drug overdoses for adolescents, which indicated substantial seasonal variation in visit patterns that mirrored U.S. K–12 education semesters (spring semester, summer vacation, fall semester). ED visits of interest were identified using a combination of free-text reason-for-visit (chief complaint), and administrative diagnosis codes (determined using codes from the *International Classification of Diseases, Ninth Edition, Clinical Modification*; *International Classification of Diseases, Tenth Edition, Clinical Modification*; and the Systematized Nomenclature of Medicine) (Supplementary Table, https://stacks.cdc.gov./view/cdc/127852), and did not differentiate by the primary or secondary diagnosis when multiple medical conditions were present as part of the visit record. CDC calculated percent change in mean weekly ED visits overall and by sex.¶ Changes were classified as decreased (≤−10%), stable (>−10% to <10%) or increased (≥10%) to support meaningful change identification and reduce identification of changes resulting from normative national ED visit fluctuations. Visit ratios (VRs)** with 95% CIs were calculated to describe the proportion of ED visits of interest among all adolescent ED visits in the surveillance versus comparison periods. Analyses were conducted using R software (version 4.1.2; The R Foundation). This activity was reviewed by CDC and conducted consistent with applicable federal law and policy.††

During January 2019–February 2023, adolescent ED visits for MHCs (overall and specific), suicide-related behaviors (including

¶ Percent change in weekly ED visits = ([mean weekly ED visits with condition of interest during surveillance period − mean weekly ED visits with condition of interest during comparison period] / mean weekly ED visits with condition of interest during comparison period) x 100%.

** VRs are the proportion of ED visits with condition of interest during the surveillance period, divided by the proportion of ED visits with condition of interest during the comparison period ([ED visits with condition of interest {surveillance period} / all ED visits {surveillance period}] / [ED visits with condition of interest {comparison period} / all ED visits {comparison period}]). Ratios >1 indicate a higher proportion of ED visits with the condition of interest during the surveillance period compared with the comparison period; ratios <1 indicate a lower proportion during the surveillance period compared with the comparison period.

†† 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.

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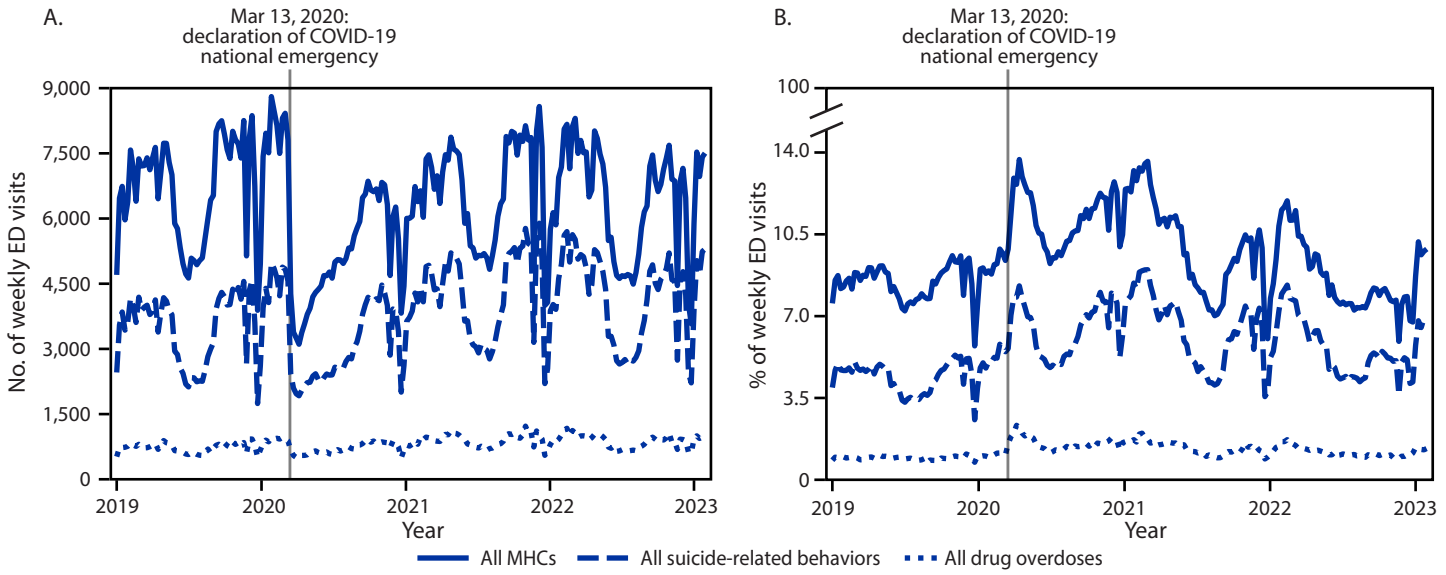
suspected suicide attempts), and drug overdoses (including opioid-involved overdoses) varied over time and by school semester (Figure) (Supplementary Figure, https://stacks.cdc.gov./view/cdc/127853). Mean weekly ED visits for MHCs overall, suicide-related behaviors, and drug overdoses were stable during spring and summer 2022 compared with those during 2021 (Table 1). By fall 2022, mean weekly adolescent ED visits were decreasing for MHCs overall (–11%), suicide-related behaviors (–12%), and drug overdoses (–10%) compared with fall 2021; trends for females mirrored overall patterns, whereas visits among males were stable for each of these outcomes (–7% to 3%). With some exceptions,[§§] visits for MHCs overall, suicide-related behaviors, and all drug overdoses accounted for a smaller proportion of ED visits during 2022 compared with 2021.

From school semesters in 2021 to those in 2022, variation in ED visits for specific MHCs, suspected suicide attempts, and opioid-involved overdoses overall and by sex were observed (Table 1). By fall 2022, compared with fall 2021, mean weekly ED visits for opioid-involved overdoses increased among both females (10%) and males (41%). Compared with the same periods, ED visits for specific MHCs and suspected suicide attempts among females generally mirrored trends in visits for overall MHCs and suicide-related behaviors. Among males, mean weekly ED visits were stable for MHCs overall (–6%) and suicide-related behaviors (–7%), but decreased for some specific MHCs (e.g., anxiety [–10%], depression [–12%], and many less common conditions) and suspected suicide attempts (–13%). Among all adolescent ED visits, those for specific MHCs and suspected suicide attempts accounted for a smaller proportion (VRs = 0.59–0.85 and 0.75, respectively), and opioid-involved overdoses for a larger proportion (VR = 1.16) during fall 2022 compared with fall 2021. With some exceptions, sex-stratified findings were generally similar to these overall trends.

Compared with those during 2019 school semesters, visits for MHCs overall, suicide-related behaviors, and drug overdoses

[§§] The proportions of adolescent ED visits for drug overdose were similar in summer 2022 and 2021. Among males specifically, ED visits for mental health conditions overall, suicide-related behaviors, and drug overdoses were a similar proportion of all ED visits in summer 2022 compared with summer 2021.

FIGURE. Mean weekly number (A) and percentage (B) of emergency department visits*,† for mental health conditions overall,§ all suicide-related behaviors,¶ and all drug overdoses among persons aged 12–17 years — National Syndromic Surveillance Program, United States, January 2019–February 2023††**



Abbreviations: ED = emergency department; ICD-9-CM = *International Classification of Diseases, Ninth Edition, Clinical Modification*; ICD-10-CM = *International Classification of Diseases, Tenth Edition, Clinical Modification*; MHC = mental health condition; NSSP = National Syndromic Surveillance Program; SNOMED = Systematized Nomenclature of Medicine.

* NSSP receives anonymized medical record information from approximately 75% of nonfederal EDs nationwide. NSSP collects free-text reason-for-visit (chief complaint), discharge diagnosis, and patient demographic details. Diagnosis information is collected using ICD-9-CM, ICD-10-CM, and SNOMED codes.

† To reduce artifactual impact from changes in reporting patterns, analyses were restricted to facilities with a coefficient of variation for ED visits ≤40 and average weekly informative discharge diagnosis ≥75% complete throughout the study period.

§ The overall MHC classification identifies any mental health-related ED visits, including those for the nine MHCs included in this analysis (anxiety, attention-deficit/hyperactivity disorders, bipolar disorders, depression, disruptive behavioral and impulse-control disorders, eating disorders, obsessive-compulsive disorders, tic disorders, and trauma and stressor-related disorders), schizophrenia spectrum disorders, additional low prevalence MHCs (e.g., delusional disorders and reactive attachment), and general mental health terms and codes.

¶ The suicide-related behaviors classification identifies ED visits related to suicidal ideation, self-harm, and suspected suicide attempts.

** The drug overdose classification identifies acute drug poisonings from any type of drug.

†† The time series displays data from epidemiologic week 1 for 2019 (December 30, 2018) through epidemiologic week 5 for 2023 (February 4, 2023).

during 2022 varied (Table 2). By fall 2022, compared with fall 2019, mean weekly ED visits were lower than the prepandemic baseline for MHCs overall (–13%) and comparable to baseline for suicide-related behaviors (7%); visits for drug overdoses were higher during fall 2022 (10%) than during fall 2019. Mean weekly ED visits among females were stable for MHCs overall (–8%) but increased for suicide-related behaviors (14%) and drug overdoses (16%) during fall 2022 compared with fall 2019. Among males, mean weekly ED visits in fall 2022 for MHCs overall were lower (–20%) than those during fall 2019, but were stable for suicide-related behaviors (–6%) and drug overdoses (–3%). Among all adolescent ED visits during fall 2022, those for MHCs overall accounted for a lower proportion (VR = 0.87), and those for suicide-related behaviors and drug overdoses for a higher proportion (VRs = 1.07 and 1.10, respectively) than during fall 2019. In fall 2022, VR findings by sex generally mirrored broader trends, especially for females; among males, the proportion of suicide-related behaviors was lower (VR = 0.94) and for drug overdose (VR = 0.97) was similar, compared with fall 2019.

Adolescent ED visits for specific MHCs, suspected suicide attempts, and opioid-involved overdoses, overall and by sex, varied by school semester in 2022 compared with 2019 (Table 2). As of fall 2022, ED visits for eating disorders increased overall (55%; VR = 1.55) and for both sexes, and tic disorders increased among females only (56%; VR = 1.57). ED visits for other specific MHCs were lower than or comparable with visits during fall 2019. Patterns for suspected suicide attempts and opioid-involved overdoses generally followed the broader directional trends for suicide-related behaviors and drug overdoses, respectively.

TABLE 1. Changes in mean weekly number and percentage of emergency department visits[*,†] involving overall[§] and specific mental health conditions, suicide-related behaviors including suspected suicide attempts,[¶] and all drug overdoses including opioid-involved overdoses[**] among persons aged 12–17 years, by school semester — National Syndromic Surveillance Program, United States, 2021–2022[††,§§]

	Surveillance period / Comparison period								
	Spring semester, 2022 (weeks 1–23)[††] / Spring semester, 2021 (weeks 1–23)			Summer, 2022 (weeks 24–36)[††] / Summer, 2021 (weeks 24–36)			Fall semester, 2022 (weeks 37–53)[††] / Fall semester, 2021 (weeks 37–53)		
Mental and behavioral health indicator/Sex	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts[¶¶] (%)	VR (95% CI)[***]	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts[¶¶] (%)	VR (95% CI)[***]	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts[¶¶] (%)	VR (95% CI)[***]
Overall mental health conditions									
All	**7,083**	**273 (4)**	**0.83 (0.83–0.84)**	**5,031**	**–385 (–7)**	**0.97 (0.96–0.98)**	**6,441**	**–767 (–11)**	**0.82 (0.81–0.82)**
Female	4,572	70 (2)	0.83 (0.82–0.84)	3,166	–337 (–10)	0.96 (0.95–0.97)	4,057	–616 (–13)	0.81 (0.80–0.82)
Male	2,493	200 (9)	0.85 (0.84–0.86)	1,850	–51 (–3)	0.99 (0.97–1.01)	2,366	–155 (–6)	0.84 (0.82–0.85)
Anxiety disorders									
All	**2,104**	**–4 (—)**	**0.80 (0.79–0.81)**	**1,697**	**–140 (–8)**	**0.96 (0.95–0.98)**	**1,874**	**–263 (–12)**	**0.80 (0.79–0.81)**
Female	1,486	–16 (–1)	0.81 (0.80–0.82)	1,181	–122 (–9)	0.96 (0.94–0.99)	1,303	–206 (–14)	0.81 (0.79–0.82)
Male	609	11 (2)	0.80 (0.78–0.82)	508	–20 (–4)	0.98 (0.95–1.01)	562	–60 (–10)	0.80 (0.78–0.83)
Depressive disorders									
All	**3,055**	**–66 (–2)**	**0.78 (0.78–0.79)**	**1,801**	**–330 (–15)**	**0.88 (0.87–0.90)**	**2,584**	**–581 (–18)**	**0.74 (0.74–0.75)**
Female	2,202	–102 (–4)	0.78 (0.77–0.79)	1,284	–287 (–18)	0.87 (0.85–0.89)	1,824	–475 (–21)	0.74 (0.73–0.75)
Male	844	35 (4)	0.82 (0.80–0.83)	511	–43 (–8)	0.94 (0.91–0.97)	751	–106 (–12)	0.78 (0.76–0.80)
Attention-deficit/Hyperactivity disorders									
All	**794**	**–16 (–2)**	**0.79 (0.77–0.80)**	**622**	**–52 (–8)**	**0.96 (0.93–0.99)**	**737**	**–97 (–12)**	**0.81 (0.79–0.83)**
Female	318	–18 (–5)	0.77 (0.75–0.80)	245	–22 (–8)	0.98 (0.93–1.02)	291	–47 (–14)	0.80 (0.77–0.83)
Male	472	1 (—)	0.79 (0.76–0.81)	372	–32 (–8)	0.94 (0.90–0.97)	442	–51 (–10)	0.80 (0.77–0.82)

See table footnotes page 507.

TABLE 1. (*Continued*) Changes in mean weekly number and percentage of emergency department visits*,† involving overall§ and specific mental health conditions, suicide-related behaviors including suspected suicide attempts,¶ and all drug overdoses including opioid-involved overdoses among persons aged 12–17 years, by school semester — National Syndromic Surveillance Program, United States, 2021–2022††,§§**

	Surveillance period / Comparison period								
	Spring semester, 2022 (weeks 1–23)†† / Spring semester, 2021 (weeks 1–23)			Summer, 2022 (weeks 24–36)†† / Summer, 2021 (weeks 24–36)			Fall semester, 2022 (weeks 37–53)†† / Fall semester, 2021 (weeks 37–53)		
Mental and behavioral health indicator/Sex	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***
Trauma and stressor-related disorders									
All	**803**	**82 (11)**	**0.89 (0.87–0.91)**	**562**	**−17 (−3)**	**1.01 (0.98–1.05)**	**744**	**−51 (−6)**	**0.85 (0.83–0.88)**
Female	533	41 (8)	0.88 (0.86–0.91)	371	−21 (−5)	1.01 (0.97–1.05)	481	−48 (−9)	0.85 (0.82–0.87)
Male	265	40 (18)	0.92 (0.89–0.96)	187	3 (2)	1.04 (0.98–1.10)	260	−2 (−1)	0.88 (0.85–0.92)
Disruptive behavioral and impulse disorders									
All	**514**	**45 (10)**	**0.88 (0.86–0.90)**	**391**	**−18 (−4)**	**1.00 (0.96–1.04)**	**458**	**−50 (−10)**	**0.82 (0.80–0.85)**
Female	230	17 (8)	0.88 (0.85–0.92)	178	−4 (−2)	1.04 (0.98–1.10)	209	−18 (−8)	0.86 (0.82–0.90)
Male	282	28 (11)	0.87 (0.84–0.90)	211	−14 (−6)	0.95 (0.90–1.00)	247	−33 (−12)	0.79 (0.75–0.82)
Bipolar disorders									
All	**229**	**−23 (−9)**	**0.73 (0.70–0.75)**	**183**	**−29 (−14)**	**0.90 (0.85–0.95)**	**201**	**−32 (−14)**	**0.79 (0.75–0.82)**
Female	148	−12 (−7)	0.76 (0.72–0.79)	114	−20 (−15)	0.91 (0.84–0.97)	130	−20 (−13)	0.81 (0.76–0.86)
Male	80	−12 (−13)	0.68 (0.64–0.72)	68	−10 (−12)	0.89 (0.82–0.98)	70	−12 (−15)	0.75 (0.70–0.82)
Eating disorders									
All	**141**	**4 (3)**	**0.83 (0.79–0.87)**	**104**	**−21 (−17)**	**0.86 (0.80–0.93)**	**115**	**−29 (−20)**	**0.73 (0.69–0.77)**
Female	124	0 (—)	0.82 (0.78–0.86)	91	−20 (−18)	0.87 (0.81–0.94)	100	−28 (−22)	0.73 (0.68–0.78)
Male	15	4 (34)	1.05 (0.89–1.23)	12	−1 (−9)	0.92 (0.74–1.15)	14	−1 (−6)	0.84 (0.70–1.01)
Tic disorders									
All	**42**	**−24 (−36)**	**0.51 (0.47–0.55)**	**30**	**−10 (−25)**	**0.78 (0.69–0.89)**	**34**	**−19 (−36)**	**0.59 (0.53–0.65)**
Female	27	−23 (−46)	0.44 (0.40–0.49)	19	−9 (−32)	0.72 (0.61–0.84)	19	−16 (−46)	0.50 (0.44–0.58)
Male	15	−1 (−9)	0.72 (0.62–0.83)	11	−1 (−7)	0.95 (0.75–1.20)	14	−2 (−14)	0.77 (0.64–0.91)
Obsessive-compulsive disorders									
All	**49**	**−5 (−10)**	**0.72 (0.67–0.78)**	**41**	**−5 (−11)**	**0.93 (0.83–1.04)**	**43**	**−8 (−16)**	**0.77 (0.69–0.85)**
Female	29	−2 (−8)	0.75 (0.68–0.84)	24	0 (—)	1.06 (0.91–1.24)	26	−3 (−9)	0.85 (0.74–0.97)
Male	20	−3 (−11)	0.70 (0.61–0.79)	17	−5 (−23)	0.78 (0.66–0.94)	17	−6 (−26)	0.66 (0.57–0.78)
Suicide-related behaviors									
All	**4,699**	**328 (8)**	**0.86 (0.85–0.87)**	**2,967**	**−196 (−6)**	**0.98 (0.96–0.99)**	**4,219**	**−570 (−12)**	**0.80 (0.80–0.81)**
Female	3,329	131 (4)	0.85 (0.84–0.86)	2,080	−203 (−9)	0.97 (0.95–0.98)	2,943	−478 (−14)	0.80 (0.79–0.81)
Male	1,360	195 (17)	0.92 (0.90–0.93)	880	6 (1)	1.03 (1.00–1.05)	1,267	−91 (−7)	0.83 (0.81–0.85)

See table footnotes on the next page.

TABLE 1. (*Continued*) Changes in mean weekly number and percentage of emergency department visits*,† involving overall§ and specific mental health conditions, suicide-related behaviors including suspected suicide attempts,¶ and all drug overdoses including opioid-involved overdoses among persons aged 12–17 years, by school semester — National Syndromic Surveillance Program, United States, 2021–2022††,§§**

	Surveillance period / Comparison period								
	Spring semester, 2022 (weeks 1–23)†† / Spring semester, 2021 (weeks 1–23)			Summer, 2022 (weeks 24–36)†† / Summer, 2021 (weeks 24–36)			Fall semester, 2022 (weeks 37–53)†† / Fall semester, 2021 (weeks 37–53)		
Mental and behavioral health indicator/Sex	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***
Suspected suicide attempts									
All	**1,213**	**−36 (−3)**	**0.78 (0.77–0.79)**	**843**	**−96 (−10)**	**0.94 (0.91–0.96)**	**1,038**	**−220 (−17)**	**0.75 (0.74–0.77)**
Female	954	−58 (−6)	0.77 (0.76–0.78)	660	−95 (−13)	0.93 (0.90–0.96)	814	−185 (−19)	0.76 (0.74–0.78)
Male	256	23 (10)	0.86 (0.83–0.89)	181	−1 (−1)	1.01 (0.96–1.07)	222	−34 (−13)	0.77 (0.74–0.81)
Drug overdoses overall									
All	**961**	**40 (4)**	**0.84 (0.82–0.85)**	**704**	**−47 (−6)**	**0.98 (0.95–1.01)**	**862**	**−97 (−10)**	**0.82 (0.80–0.84)**
Female	690	4 (1)	0.82 (0.80–0.84)	496	−53 (−10)	0.96 (0.93–0.99)	604	−104 (−15)	0.80 (0.77–0.82)
Male	269	36 (15)	0.90 (0.87–0.94)	207	5 (3)	1.05 (0.99–1.10)	258	7 (3)	0.92 (0.88–0.96)
Opioid-involved overdoses									
All	**36**	**2 (7)**	**0.86 (0.78–0.95)**	**38**	**4 (12)**	**1.17 (1.03–1.33)**	**40**	**8 (27)**	**1.16 (1.03–1.30)**
Female	17	2 (17)	0.96 (0.83–1.11)	16	1 (6)	1.12 (0.92–1.37)	16	1 (10)	1.03 (0.86–1.22)
Male	19	0 (−1)	0.78 (0.68–0.88)	22	3 (16)	1.18 (1.00–1.40)	23	7 (41)	1.25 (1.07–1.47)

Abbreviations: ED = emergency department; ICD-9-CM = *International Classification of Diseases, Ninth Edition, Clinical Modification*; ICD-10-CM = *International Classification of Diseases, Tenth Edition, Clinical Modification*; MHC = mental health condition; NSSP = National Syndromic Surveillance Program; SNOMED = Systematized Nomenclature of Medicine.

* NSSP receives anonymized medical record information from approximately 75% of nonfederal EDs nationwide. NSSP collects free-text reason-for-visit (chief complaint), discharge diagnosis, and patient demographic details. Diagnosis information is collected using ICD-9-CM, ICD-10-CM, and SNOMED codes.

† To reduce artifactual impact from changes in reporting patterns, analyses were restricted to facilities with a coefficient of variation for ED visits ≤40 and average weekly informative discharge diagnosis ≥75% complete throughout the study period.

§ The overall MHC classification identifies all mental health-related ED visits, including the nine MHCs included in this analysis (anxiety, attention-deficit/hyperactivity disorders, bipolar disorders, depression, disruptive behavioral and impulse-control disorders, eating disorders, obsessive-compulsive disorders, tic disorders, and trauma and stressor-related disorders), schizophrenia spectrum disorders, additional low-prevalence MHCs (e.g., delusional disorders and reactive attachment), and general mental health terms and codes.

¶ The suicide-related behaviors classification identifies ED visits related to suicidal ideation, self-harm, and suspected suicide attempts, whereas the suspected suicide attempt classification only includes suspected suicide attempts.

** The drug overdose classification identifies acute drug poisonings from any type of drug, whereas the opioid-involved overdose classification includes acute drug poisonings from illicit (e.g., heroin) or prescription opioids (e.g., oxycodone).

†† School semester surveillance periods during 2022 were as follows: spring, calendar weeks 1–23 (Jan 2–Jun 11, 2022); summer, calendar weeks 24–36 (Jun 12–Sep 10, 2022); and fall, calendar weeks 37–53 (Sep 11–Dec 31, 2022). Corresponding school semester comparison periods during 2021 were as follows: spring, calendar weeks 1–23 (Jan 3–Jun 12, 2021); summer, calendar weeks 24–36 (Jun 13–Sep 11, 2021); and fall, calendar weeks 37–53 (Sep 12, 2021–Jan 1, 2022).

§§ Individual values for females and males might not add up to the total values because of rounding.

¶¶ Percent change in visits per week during each surveillance period was calculated as the difference in mean weekly visits between the surveillance period and the comparison period, divided by the mean weekly visits during the comparison period × 100% ([{mean weekly ED visits with condition of interest during surveillance period − mean weekly ED visits with condition of interest during comparison period} / mean weekly ED visits with condition of interest during the comparison period] × 100%).

*** VR is the proportion of ED visits with condition of interest during the surveillance period, divided by the proportion of ED visits with condition of interest during the comparison period ([ED visits with condition of interest {surveillance period} / all ED visits {surveillance period}] / [ED visits with condition of interest {comparison period} / all ED visits {comparison period}]). Ratios >1 indicate a higher proportion of ED visits with the condition of interest during the surveillance period compared with the comparison period; ratios <1 indicate a lower proportion during the surveillance period compared with the comparison period.

TABLE 2. Mean weekly number and percentage of emergency department visits*,† involving overall§ and specific mental health conditions, suicide-related behaviors including suspected suicide attempts,¶ and all drug overdoses including opioid-involved overdoses among persons aged 12–17 years — National Syndromic Surveillance Program, United States, 2019†† and 2022§§**

	Surveillance period Comparison period								
	Spring semester, 2022 (weeks 1–23)†† Spring semester, 2019 (weeks 1–23)			Summer, 2022 (weeks 24–36)†† Summer, 2019 (weeks 24–36)			Fall semester, 2022 (weeks 37–53)†† Fall semester, 2019 (weeks 37–53)		
Mental and behavioral health indicator/Sex	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit count)¶¶ (%)	VR (95% CI)***
Overall mental health conditions									
All	**7,083**	**252 (4)**	**1.13 (1.13–1.14)**	**5,031**	**−279 (−5)**	**0.97 (0.96–0.98)**	**6,441**	**−943 (−13)**	**0.87 (0.86–0.88)**
Female	4,572	462 (11)	1.22 (1.21–1.23)	3,166	8 (—)	1.04 (1.03–1.05)	4,057	−343 (−8)	0.93 (0.92–0.94)
Male	2,493	−213 (−8)	1.01 (1.00–1.02)	1,850	−294 (−14)	0.88 (0.87–0.89)	2,366	−606 (−20)	0.79 (0.78–0.80)
Anxiety disorders									
All	**2,104**	**159 (8)**	**1.18 (1.17–1.20)**	**1,697**	**−94 (−5)**	**0.98 (0.96–0.99)**	**1,874**	**−331 (−15)**	**0.85 (0.84–0.86)**
Female	1,486	164 (12)	1.23 (1.21–1.25)	1,181	−28 (−2)	1.01 (0.99–1.04)	1,303	−192 (−13)	0.88 (0.86–0.89)
Male	609	−8 (−1)	1.08 (1.06–1.11)	508	−69 (−12)	0.90 (0.87–0.93)	562	−145 (−20)	0.79 (0.77–0.81)
Depressive disorders									
All	**3,055**	**156 (5)**	**1.15 (1.14–1.16)**	**1,801**	**−116 (−6)**	**0.97 (0.95–0.98)**	**2,584**	**−528 (−17)**	**0.83 (0.82–0.84)**
Female	2,202	232 (12)	1.22 (1.21–1.24)	1,284	−32 (−2)	1.01 (0.99–1.03)	1,824	−278 (−13)	0.87 (0.86–0.89)
Male	844	−80 (−9)	1.00 (0.98–1.02)	511	−86 (−14)	0.87 (0.85–0.90)	751	−251 (−25)	0.74 (0.73–0.76)
Attention-deficit/Hyperactivity disorders									
All	**794**	**−236 (−23)**	**0.84 (0.83–0.86)**	**622**	**−290 (−32)**	**0.70 (0.68–0.72)**	**737**	**−445 (−38)**	**0.62 (0.61–0.64)**
Female	318	−55 (−15)	0.93 (0.90–0.96)	245	−92 (−27)	0.75 (0.72–0.79)	291	−139 (−32)	0.68 (0.66–0.71)
Male	472	−181 (−28)	0.79 (0.77–0.81)	372	−200 (−35)	0.66 (0.64–0.69)	442	−308 (−41)	0.58 (0.57–0.60)
Trauma and stressor-related disorders									
All	**803**	**69 (9)**	**1.20 (1.17–1.22)**	**562**	**−2 (—)**	**1.03 (0.99–1.06)**	**744**	**−64 (−8)**	**0.92 (0.90–0.94)**
Female	533	69 (15)	1.26 (1.22–1.29)	371	6 (2)	1.06 (1.01–1.10)	481	−26 (−5)	0.95 (0.93–0.98)
Male	265	−3 (−1)	1.08 (1.05–1.12)	187	−10 (−5)	0.97 (0.92–1.02)	260	−40 (−13)	0.86 (0.82–0.90)
Disruptive behavioral and impulse disorders									
All	**514**	**−66 (−11)**	**0.97 (0.95–0.99)**	**391**	**−102 (−21)**	**0.82 (0.79–0.85)**	**458**	**−148 (−24)**	**0.75 (0.73–0.78)**
Female	230	−16 (−6)	1.02 (0.99–1.06)	178	−33 (−16)	0.87 (0.83–0.92)	209	−46 (−18)	0.82 (0.79–0.86)
Male	282	−49 (−15)	0.93 (0.90–0.96)	211	−69 (−25)	0.77 (0.73–0.81)	247	−102 (−29)	0.70 (0.67–0.73)
Bipolar disorders									
All	**229**	**−61 (−21)**	**0.86 (0.83–0.90)**	**183**	**−86 (−32)**	**0.70 (0.67–0.74)**	**201**	**−116 (−37)**	**0.63 (0.61–0.66)**
Female	148	−26 (−15)	0.93 (0.89–0.98)	114	−50 (−30)	0.72 (0.68–0.77)	130	−61 (−32)	0.69 (0.65–0.72)
Male	80	−35 (−31)	0.76 (0.71–0.80)	68	−37 (−35)	0.66 (0.61–0.72)	70	−55 (−44)	0.55 (0.52–0.60)

See table footnotes on page 510.

TABLE 2. (*Continued*) Mean weekly number and percentage of emergency department visits*,† involving overall§ and specific mental health conditions, suicide-related behaviors including suspected suicide attempts,¶ and all drug overdoses including opioid-involved overdoses among persons aged 12–17 years — National Syndromic Surveillance Program, United States, 2019†† and 2022§§**

	Surveillance period / Comparison period								
	Spring semester, 2022 (weeks 1–23)†† / Spring semester, 2019 (weeks 1–23)			Summer, 2022 (weeks 24–36)†† / Summer, 2019 (weeks 24–36)			Fall semester, 2022 (weeks 37–53)†† / Fall semester, 2019 (weeks 37–53)		
Mental and behavioral health indicator/Sex	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit count)¶¶ (%)	VR (95% CI)***
Eating disorders									
All	**141**	**75 (114)**	**2.34 (2.20–2.49)**	**104**	**44 (72)**	**1.77 (1.62–1.93)**	**115**	**41 (55)**	**1.55 (1.44–1.66)**
Female	124	68 (121)	2.42 (2.27–2.58)	91	39 (75)	1.82 (1.65–2.00)	100	36 (57)	1.57 (1.46–1.70)
Male	15	6 (61)	1.76 (1.49–2.09)	12	4 (46)	1.49 (1.16–1.90)	14	4 (37)	1.36 (1.11–1.67)
Tic disorders									
All	**42**	**13 (44)**	**1.57 (1.43–1.74)**	**30**	**5 (20)**	**1.24 (1.07–1.43)**	**34**	**2 (8)**	**1.07 (0.95–1.21)**
Female	27	14 (108)	2.27 (1.98–2.61)	19	9 (93)	2.00 (1.62–2.47)	19	7 (56)	1.57 (1.31–1.88)
Male	15	−2 (−9)	0.99 (0.85–1.15)	11	−4 (−29)	0.73 (0.59–0.90)	14	−5 (−24)	0.75 (0.63–0.89)
Obsessive-compulsive disorders									
All	**49**	**1 (2)**	**1.12 (1.03–1.22)**	**41**	**−1 (−3)**	**1.00 (0.89–1.13)**	**43**	**−10 (−19)**	**0.81 (0.73–0.90)**
Female	29	6 (28)	1.40 (1.25–1.58)	24	3 (16)	1.20 (1.02–1.41)	26	0 (−2)	0.99 (0.86–1.13)
Male	20	−5 (−21)	0.86 (0.76–0.98)	17	−4 (−21)	0.80 (0.67–0.96)	17	−10 (−36)	0.63 (0.54–0.74)
Suicide-related behaviors									
All	**4,699**	**1,008 (27)**	**1.39 (1.38–1.40)**	**2,967**	**505 (20)**	**1.24 (1.22–1.26)**	**4,219**	**292 (7)**	**1.07 (1.06–1.08)**
Female	3,329	867 (35)	1.48 (1.46–1.49)	2,080	446 (27)	1.32 (1.30–1.34)	2,943	363 (14)	1.15 (1.13–1.16)
Male	1,360	137 (11)	1.22 (1.20–1.24)	880	56 (7)	1.09 (1.06–1.12)	1,267	−74 (−6)	0.94 (0.92–0.95)
Suspected suicide attempts									
All	**1,213**	**328 (37)**	**1.50 (1.47–1.53)**	**843**	**165 (24)**	**1.28 (1.24–1.32)**	**1,038**	**121 (13)**	**1.13 (1.11–1.15)**
Female	954	285 (43)	1.56 (1.53–1.59)	660	150 (30)	1.34 (1.30–1.39)	814	131 (19)	1.20 (1.17–1.23)
Male	256	41 (19)	1.30 (1.25–1.35)	181	14 (8)	1.10 (1.04–1.17)	222	−12 (−5)	0.94 (0.90–0.98)
Drug overdoses overall									
All	**961**	**208 (28)**	**1.40 (1.37–1.42)**	**704**	**96 (16)**	**1.19 (1.16–1.23)**	**862**	**78 (10)**	**1.10 (1.07–1.12)**
Female	690	180 (35)	1.48 (1.45–1.52)	496	87 (21)	1.26 (1.21–1.30)	604	84 (16)	1.17 (1.13–1.20)
Male	269	27 (11)	1.22 (1.17–1.26)	207	8 (4)	1.06 (1.01–1.12)	258	−7 (−3)	0.97 (0.92–1.01)

See table footnotes on the next page.

Discussion

These findings extend previous research that indicated worsening in some aspects of adolescent mental and behavioral health during the COVID-19 pandemic (*2*–*5*) and suggest some improvements in the trajectory of adolescent mental and behavioral health, as measured by ED visits. Declines in adolescent ED visits for overdoses overall from 2021 to 2022 are consistent with other available nonfatal¶¶ and provisional fatal overdose*** data, though comparable data beyond 2021 on mental health and suicidal behaviors are limited. Increases in opioid-involved overdoses warrant further investigation but might be related to the overall rarity of adolescent opioid-involved overdoses, such

¶¶ https://www.cdc.gov/drugoverdose/nonfatal/dashboard/index.html
*** https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm

TABLE 2. (*Continued*) Mean weekly number and percentage of emergency department visits*,† involving overall§ and specific mental health conditions, suicide-related behaviors including suspected suicide attempts,¶ and all drug overdoses including opioid-involved overdoses among persons aged 12–17 years — National Syndromic Surveillance Program, United States, 2019†† and 2022§§**

	Surveillance period Comparison period								
	Spring semester, 2022 (weeks 1–23)†† Spring semester, 2019 (weeks 1–23)			Summer, 2022 (weeks 24–36)†† Summer, 2019 (weeks 24–36)			Fall semester, 2022 (weeks 37–53)†† Fall semester, 2019 (weeks 37–53)		
Mental and behavioral health indicator/Sex	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit counts¶¶ (%)	VR (95% CI)***	Mean weekly ED visit counts, surveillance period	Absolute change in mean weekly ED visit count)¶¶ (%)	VR (95% CI)***
Opioid-involved overdoses									
All	**36**	**15 (73)**	**1.89 (1.69–2.12)**	**38**	**21 (123)**	**2.30 (1.96–2.69)**	**40**	**12 (44)**	**1.44 (1.28–1.63)**
Female	17	7 (70)	1.86 (1.58–2.20)	16	8 (103)	2.11 (1.66–2.67)	16	4 (32)	1.32 (1.10–1.59)
Male	19	8 (75)	1.91 (1.64–2.23)	22	13 (137)	2.42 (1.96–3.00)	23	8 (54)	1.53 (1.30–1.80)

Abbreviations: ED = emergency department; ICD-9-CM = *International Classification of Diseases, Ninth Edition, Clinical Modification*; ICD-10-CM = *International Classification of Diseases, Tenth Edition, Clinical Modification*; MHC = mental health condition; NSSP = National Syndromic Surveillance Program; SNOMED = Systematized Nomenclature of Medicine.

* NSSP receives anonymized medical record information from approximately 75% of nonfederal EDs nationwide. NSSP collects free-text reason-for-visit (chief complaint), discharge diagnosis, and patient demographic details. Diagnosis information is collected using ICD-9-CM, ICD-10-CM, and SNOMED codes.

† To reduce artifactual impact from changes in reporting patterns, analyses were restricted to facilities with a coefficient of variation for ED visits ≤40 and average weekly informative discharge diagnosis ≥75% complete throughout the study period.

§ The overall MHC classification identifies all mental health-related ED visits, including the nine MHCs included in this analysis (anxiety, attention-deficit/hyperactivity disorders, bipolar disorders, depression, disruptive behavioral and impulse-control disorders, eating disorders, obsessive-compulsive disorders, tic disorders, and trauma and stressor-related disorders), schizophrenia spectrum disorders, additional low-prevalence MHCs (e.g., delusional disorders and reactive attachment), and general mental health terms and codes.

¶ The suicide-related behaviors classification identifies ED visits related to suicidal ideation, self-harm, and suspected suicide attempts, whereas the suspected suicide attempt classification only includes suspected suicide attempts.

** The drug overdose classification identifies acute drug poisonings from any type of drug, whereas the opioid-involved overdose classification includes acute drug poisonings from illicit (e.g., heroin) or prescription opioids (e.g., oxycodone).

†† School semester surveillance periods during 2022 were as follows: spring, calendar weeks 1–23 (Jan 2–Jun 11, 2022); summer, calendar weeks 24–36 (Jun 12–Sep 10, 2022); and fall, calendar weeks 37–53 (Sep 11–Dec 31, 2022). Corresponding school semester comparison periods during 2019 were as follows: spring, calendar weeks 1–23 (Dec 30, 2018–June 8, 2019); summer, calendar weeks 24–36 (June 9–Sept 7, 2019); and fall, calendar weeks 37–53 (Sept 8–Dec 28, 2019).

§§ Individual values for females and males might not add up to the total values because of rounding.

¶¶ Percent change in visits per week during each surveillance period was calculated as the difference in mean weekly visits between the surveillance period and the comparison period, divided by the mean weekly visits during the comparison period, × 100% ([{mean weekly ED visits with condition of interest during surveillance period − mean weekly ED visits with condition of interest during comparison period} / mean weekly ED visits with condition of interest during comparison period] × 100%).

*** VR is the proportion of ED visits with condition of interest during the surveillance period, divided by the proportion of ED visits with condition of interest during the comparison period ([ED visits with condition of interest {surveillance period} / all ED visits {surveillance period}] / [ED visits with condition of interest {comparison period} / all ED visits {comparison period}]). Ratios >1 indicate a higher proportion of ED visits with the condition of interest during the surveillance period compared with the comparison period; ratios <1 indicate a lower proportion during the surveillance period compared with the comparison period.

that even a 10% change actually represents a small absolute change in the number of overdoses. Still, any adolescent overdose is concerning, particularly as increased availability of highly potent and lethal counterfeit pills containing illicitly manufactured fentanyl among adolescents via social media platforms††† has heighted awareness recently about increasing overdose risk among younger populations. Despite some recent declines in ED visits for MHCs, suicide-related behaviors, and drug overdoses, poor adolescent mental and behavioral health remains a notable public health problem (*1*–*6*), particularly because ED visits for these conditions remain similar to or higher than already concerningly high prepandemic baselines among females into 2022.

Multiple reasons might account for these findings. Many adolescents have returned to prepandemic-like school and community environments, which might have improved social engagement, reduced isolation, and supported mental and behavioral health for some adolescents (*6*,*7*). Familial or other stressors might also have declined, resulting in fewer adverse childhood experiences,§§§ which are strongly associated with adolescent mental and behavioral health (*8*). CDC has released resources to guide states, communities, and schools in selecting strategies for prevention of suicide,¶¶¶ overdose,**** and adverse childhood experiences,†††† based on the best available evidence. Implementation of these strategies and approaches,

††† https://www.dea.gov/stories/2021/2021-07/2021-07-23/counterfeit-drugs-social-media

§§§ https://www.cdc.gov/injury/priority/aces.html

¶¶¶ https://www.cdc.gov/suicide/pdf/preventionresource.pdf

**** https://www.cdc.gov/drugoverdose/pdf/pubs/2018-evidence-based-strategies.pdf

Summary

What is already known about this topic?

High baseline rates of poor adolescent mental and behavioral health were exacerbated by the COVID-19 pandemic.

What is added by this report?

By fall 2022, weekly ED visits among adolescents, and females in particular, for mental health conditions overall, suicide-related behaviors, and drug overdoses decreased compared with those during fall 2021; weekly ED visits among males were stable. Although sex differences were observed, as of fall 2022, weekly ED visits among females were at or higher than the prepandemic baseline for mental health conditions overall, suicide-related behaviors, and drug overdoses.

What are the implications for public health practice?

Early condition identification and trauma-informed interventions, coupled with evidence-based, comprehensive prevention efforts, are needed to support adolescents' mental and behavioral health.

and others that support adolescents and their families[§§§§] might improve mental and behavioral health for some adolescents. For example, communication campaigns[¶¶¶¶] can improve the rapid identification of behavioral changes, improve adolescent help-seeking behaviors, and support early intervention by parents and trusted adults. Further, federal investments, such as the 988 suicide crisis line[*****] and improvements to accessible behavioral health care (e.g., telehealth)[†††††] might have improved families' ability to identify support before a crisis or get care outside EDs.

Clinicians who work with adolescents being treated in EDs for opioid overdose might consider screening for opioid use disorder and providing timely, FDA-approved medications (*9*); clinicians might also consider screening for depression and anxiety when evaluating adolescents.[§§§§§] Continued promotion of policies and programs that improve access to mental and behavioral health services, coupled with primary prevention efforts that support adolescents and their families, might mitigate risk for mental and behavioral health problems before they begin (*10*). Further prevention, intervention, and response efforts can be implemented to continue improving adolescent mental and behavioral health.

The findings in this report are subject to at least five limitations. First, NSSP data are not nationally representative and data quality variations across facilities could potentially lead to over- or underreporting, potentially affecting visit trends. Second, this analysis used percent change thresholds to support identification of meaningful changes; however, this might under-identify (in the case of common ED visits such as overall MHCs) or over-identify (in the case of rare ED visits such as opioid-involved overdose) concerning trends, because this metric depends upon number of visits for conditions of interest. Third, these data cannot be used to make causal inferences regarding trend changes. Fourth, this analysis could not differentiate between primary or secondary diagnoses when multiple conditions were addressed at the visit. Finally, data are from ED visits which do not represent the full spectrum of adolescent mental and behavioral health challenges; trends warrant confirmation with adolescent self-report data.

Prioritizing implementation of evidence-based prevention and trauma-informed early intervention and treatment strategies that promote mental and behavioral health among adolescents might help prevent MHCs, suicide-related behaviors, and drug overdoses, and improve overall health. CDC supports efforts to promote adolescent well-being and provides resources for clinicians,[¶¶¶¶¶] families,[******] schools,[††††††] and communities.[§§§§§§]

[††††] https://www.cdc.gov/violenceprevention/pdf/preventingACES.pdf

[§§§§] Essentials for Parenting is a free online resource for parents based on the best available evidence on parenting. There are two versions: one for parents of toddlers and preschoolers (https://www.cdc.gov/parents/essentials/index.html) and one for parents of adolescents (https://www.cdc.gov/parents/essentials/teens/index.html). Other resources are also available, such as those from The National Academies of Sciences, Engineering, and Medicine (https://nap.nationalacademies.org/resource/other/dbasse/wellbeing-tools/interactive/).

[¶¶¶¶] Examples include those from CDC (https://www.cdc.gov/howrightnow/) and the Substance Abuse and Mental Health Services Administration (https://www.samhsa.gov/talk-they-hear-you).

[*****] https://www.samhsa.gov/find-help/988

[†††††] https://telehealth.hhs.gov/providers/policy-changes-during-the-covid-19-public-health-emergency/

[§§§§§] The U.S. Preventative Services Task Force recommends screening for major depressive disorder (persons aged 12–18 years; https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/screening-depression-suicide-risk-children-adolescents#citation32) and anxiety (persons aged 8–18 years; https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/screening-anxiety-children-adolescents).

[¶¶¶¶¶] Example resources for clinicians include those related to children's mental health (https://www.cdc.gov/childrensmentalhealth/documents/access-infographic.html) and opioid prescribing (https://www.cdc.gov/opioids/patients/guideline.html).

[******] https://www.cdc.gov/mentalhealth/stress-coping/help-children-cope/index.html

[††††††] https://www.cdc.gov/healthyyouth/whatworks/what-works-safe-and-supportive-environments.htm

[§§§§§§] https://www.cdc.gov/violenceprevention/childabuseandneglect/essentials/

Corresponding author: Kayla N. Anderson, Kanderson5@cdc.gov.

[1]National Center for Injury Prevention and Control, CDC; [2]Office of Public Health Data, Surveillance, and Technology, CDC; [3]ICF International, Atlanta, Georgia; [4]National Center on Birth Defects and Developmental Disabilities, CDC.

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Multistate Outbreak of *Salmonella* Thompson Infections Linked to Seafood Exposure — United States, 2021

Ann Q. Shen, MPH[1]; Alyssa Dalen[1]; Laura Bankers, PhD[1]; Shannon R. Matzinger, PhD[1]; Colin Schwensohn, MPH[2]; Kane Patel, MPH[2,3]; Kelley B. Hise, MPH[2]; Evelyn Pereira, MPH[4]; Jennifer Cripe, MS[4]; Rachel H. Jervis, MPH[1]

In July 2021, the Colorado Department of Public Health and Environment (CDPHE) laboratory identified a cluster of five *Salmonella enterica* serotype Thompson isolates related to one another within one allele difference, using whole genome multilocus sequence typing (wgMLST). These five isolates, submitted to the public health laboratory as is routine process for confirmatory testing of *Salmonella*, were highly related to those identified in a 2020 multistate investigation, during which traceback was conducted for sushi-grade tuna and salmon; a common supplier was not identified. The 2021 investigation commenced on August 5, 2021, with five patients living in Colorado, and one each in Missouri, Washington, and Wisconsin. During August–December 2021, CDC, CDPHE, public health and regulatory officials in several states, and the Food and Drug Administration (FDA) conducted epidemiologic, environmental, and laboratory investigations of this multistate outbreak of *Salmonella* Thompson. Isolates were genetically related to one another and to 2020 isolates within zero to one allele difference. Implicated seafood products were traced to a single seafood distributor, in which the outbreak strain was identified through environmental sampling, and in which inspection identified inadequate sanitization and opportunities for cross-contamination of raw fish. The distributor issued a voluntary recall of 16 seafood items with high potential for contamination and completed remediation actions. This outbreak illustrated the importance of effective cleaning and sanitizing procedures and implementation of controls. When multiple products are recalled during an outbreak investigation, collaboration between public health agencies and implicated facilities can help provide food safety information to restaurants, retailers, and consumers, and to ensure disposal of all recalled products.

Epidemiologic Investigation

A case was defined as an infection with a *S.* Thompson isolate within three allele differences of the outbreak strain by wgMLST, and with illness onset during May 11–October 16, 2021. Local or state health departments first contacted patients to attempt a routine interview to collect information on exposures during the week preceding illness onset, symptoms, and outcomes; seafood consumption was commonly reported. Consequently, a seafood-focused supplementary questionnaire was deployed on August 13, 2021, to reinterview patients. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

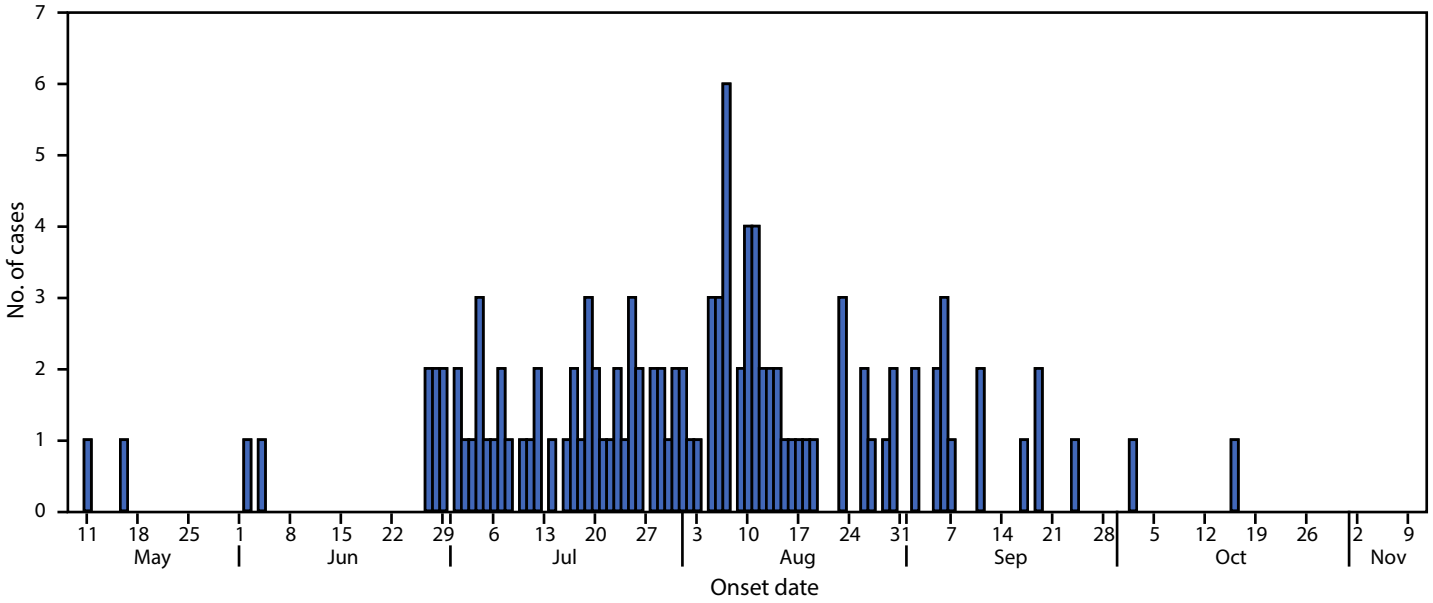
A total of 115 outbreak-related cases were reported from 15 states (Figure 1). Among these, 93 (81%) patients were Colorado residents and 22 (19%) lived in 14 additional states (Figure 2). All but eight patients reported travel to Colorado during their exposure period (the 7 days before illness onset). All 2021 calendar-year isolates were within zero to two allele differences by wgMLST, and were zero to one allele difference from the 2020 *S.* Thompson outbreak isolates. The median age of patients in the 2021 outbreak was 29 years (range = <1–85 years); 61 (53%) were female. Among 111 patients with information available, illness onset occurred during May 11–October 16. Twenty (26%) patients were hospitalized; no deaths were reported. Among 90 patients with exposure information, 76 (84%) reported eating any seafood, and 35 of 85 (41%) reported consuming sushi or raw fish. Both proportions were significantly higher than the proportion of respondents from the FoodNet Population Survey that reported eating any seafood (35%) or sushi or raw fish (8%) during the week before participating in the survey (*1*). FoodNet Population Survey data provide estimates on how often persons in the surveillance area are typically expected to be exposed to a specific food vehicle; deviations from the expected estimate might indicate that a food vehicle should be considered suspect.

Environmental Health Investigation

CDPHE and FDA completed concurrent traceback and traceforward investigations. Traceback investigation involved requesting invoices from all restaurants where patients reported having dined during their exposure period. Records related to tuna, shrimp, salmon, and halibut were reviewed to ascertain common distribution sources. In addition, investigators identified six subclusters, defined as establishments where two or more patients from separate households reported consuming a variety of seafood items during their exposure period. Detailed build sheets (comprehensive instructional documents for food preparation, storage, and plating) from the six subclusters were collected. Five subcluster establishments were restaurants, including one sushi bar located within a grocery store. Traceback identified a

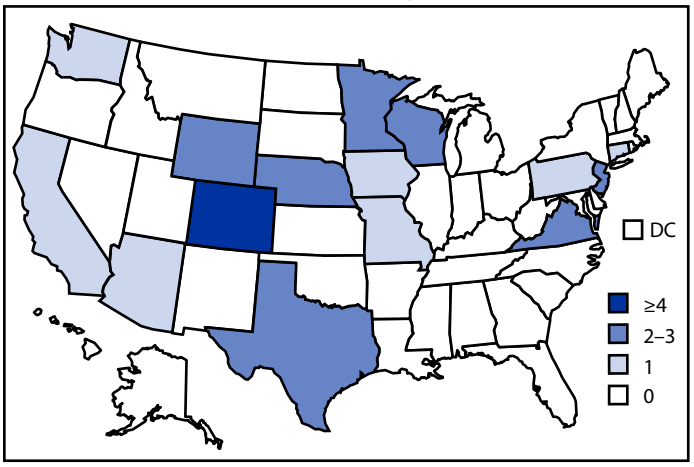
* 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE 1. Illness onset dates* of laboratory-confirmed, outbreak-associated cases of *Salmonella* Thompson (N = 115) — 15 U.S. states,† May–October, 2021§



* Estimated when clinical data were not available.
† Arizona, California, Colorado, Connecticut, Iowa, Minnesota, Missouri, Nebraska, New Jersey, Pennsylvania, Texas, Virginia, Washington, Wisconsin, and Wyoming.
§ As of December 2, 2021.

FIGURE 2. Number of persons infected with the outbreak strain of *Salmonella* Thompson, by state of residence and number of cases per state (N = 115) — United States, May–October 2021



Abbreviation: DC = District of Columbia.

common seafood distributor and processor that directly supplied four of the six subcluster establishments.

CDPHE's Division of Environmental Health Services (DEHS) conducted a traceforward investigation. DEHS collected customer lists and five samples of three unique products from the implicated seafood distributor and processor facility. The outbreak strain was not identified in these five samples.

On September 22, 2021, FDA performed a seafood Hazard Analysis Critical Control Point inspection† with environmental sampling at the implicated distributor and processor facility. The outbreak strain was identified in 13 (9.8%) of 132 environmental swabs of the facility's floor and floor drains. The inspection also identified several opportunities for cross-contamination of raw fish, including the use of high pressure hoses that produced backsplash onto fresh product. Other substantial findings included insufficient sanitizer concentration, condensation dripping onto product contact surfaces, and using gloved hands to remove water from floor drains without changing gloves after contact with the drains (*2*).

Laboratory Investigation

Whole genome sequencing (WGS) was performed on the 21 Colorado isolates from 2020 and 97 of the 2021 isolates at the CDPHE laboratory following the PulseNet or Illumina MiSeq paired-end WGS standard operating procedure (*3*). Assembly and analysis of these isolates was performed using

† A management system in which food safety is addressed through the analysis and control of biologic, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution, and consumption of the finished product. https://www.fda.gov/food/guidance-regulation-food-and-dietary-supplements/hazard-analysis-critical-control-point-haccp

Summary

What is already known about this topic?

Salmonella Thompson is a relatively uncommon serotype not typically associated with seafood. Previous outbreaks have been associated with beef, chicken, and vine-stalk and leafy vegetables.

What is added by this report?

During May–October 2021, 115 persons in 15 states became ill with *S.* Thompson. Most patients reported seafood consumption in Colorado before illness onset. The outbreak strain was identified at a single seafood distributor and processor in Denver, where opportunities for cross-contamination, due to inadequate sanitization, were identified.

What are the implications for public health practice?

Cleaning practices at processing facilities must prevent cross-contamination. Multiagency collaboration to provide food safety information during product recalls is essential to ensure disposal of all recalled products.

BioNumerics, a software application for managing microbiologic data, following PulseNet guidelines.[§] Results were submitted to the PulseNet National Database, which was then queried to pull WGS data for all outbreak-associated samples and environmental samples collected by FDA (*4*). wgMLST was performed on each genome using BioNumerics to generate a similarity matrix (a matrix of the number of allele differences for all possible pairwise comparisons). A clustering analysis was conducted on the matrix using the unweighted pair group method with arithmetic mean algorithm, a method for constructing dendrograms in a stepwise manner, based on order of similarity (Supplementary Figure, https://stacks.cdc.gov/view/cdc/127756).

Overall, WGS results supported the epidemiologic data, indicating a common source of infection for the 2020 and 2021 outbreaks, confirmed in 2021 to be a common seafood distributor and processor. Based on genetic similarity, the largest grouping of outbreak-associated isolates contained 100 samples, including clinical isolates from 2020 and 2021, and nine environmental isolates from 2021, all with zero allele difference. Among 112 clinical isolates, WGS analysis results indicated no concerning antibiotic resistance, signifying no impact on provider treatment recommendations.

Public Health Response

On October 8, 2021, the seafood distributor and processor issued a voluntary recall of 16 raw, fresh seafood products processed onsite (*5*). Potential cross-contamination within the processing environment resulted in the large number of recalled products and compounded the challenge of identifying a specific food vehicle during the investigation. A call with the facility occurred on October 7 to discuss the WGS results, recall, and corrective actions. On October 8, the facility temporarily ceased operations to carry out corrective actions, which included reassessing cleaning and sanitizing procedures and intensifying cleaning and sanitizing of the facility and equipment, eliminating the use of high-pressure hoses, hiring a food safety consultant to assist with the facility's root cause analysis, and revising the environmental monitoring program . On October 8, FDA (*6*), CDC (*7*), and CDPHE (*8*) all issued web posts alerting the public to this outbreak and identifying the facility. FDA carried out additional traceback actions using information collected from the facility regarding suppliers. Multiple upstream domestic and foreign seafood suppliers were identified, but evidence was not available to identify a single contamination source.

CDC, FDA, and CDPHE advised consumers, restaurants, and retailers not to eat, sell, or serve any recalled seafood that was sold in three Colorado grocery stores and several restaurants. Public messaging advised consumers to discard any recalled products they might have purchased fresh and subsequently frozen.

Discussion

The outbreak investigation resulted in a large amount of interview, traceback, and traceforward data, compounding the challenge of identifying a specific food vehicle or source, and limiting the findings. For example, many patients reported eating seafood items at a variety of locations during their exposure periods. Subcluster analysis allowed investigators to focus this information and prioritize data collection from facilities commonly reported by patients. However, the small size and complex nature of each subcluster limited the power of this analysis. The largest subcluster contained only four confirmed outbreak patients, and three subclusters included only two patients each. In one instance, a single patient reported consuming food at more than one subcluster facility, which further complicated the analysis. Reinterviewing patients and asking about dining history at commonly reported restaurants might be beneficial to expanding the size of subclusters and power of data collected. Throughout the investigation, competing priorities limited the capacity of public health agencies, leading to delays in collection of invoices, build sheets, and customer lists. Traceforward actions allowed investigators to supplement supplier information collected by local public health and regulatory agencies with customer lists provided by distributors to identify common distribution patterns among reported facilities. In addition, investigators faced resistance

[§] PulseNet Standard Operating Procedure for the Organism-Specific Surveillance Database Workflow. Doc. No. PND05, Ver. No. 01, Effective date: June 23, 2020.

from restaurant facilities concerned about sharing proprietary information on dishes or supplier invoices.

This investigation illustrates the importance of clear and direct communication to the public and partnerships with local public health and regulatory officials who can leverage existing relationships with local facilities. When an outbreak investigation results in the recall of multiple products, collaboration between public health agencies and implicated facilities can serve to provide food safety information to restaurants, retailers, and consumers, and to ensure disposal of all recalled products. Implementing appropriate cleaning practices at processing facilities that are focused on prevention of cross-contamination is important.

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Corresponding author: Ann Q. Shen, ann.shen@state.co.us.

[1]Colorado Department of Public Health and Environment; [2]Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [3]Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee; [4]Food and Drug Administration, Silver Spring, Maryland.

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Progress Toward Poliomyelitis Eradication — Worldwide, January 2021–March 2023

Scarlett E. Lee, DVM, PhD[1,2]; Sharon A. Greene, PhD[2]; Cara C. Burns, PhD[3]; Graham Tallis, MBBS[4]; Steven G. F. Wassilak, MD[2]; Omotayo Bolu, MBBS[2]

Since the World Health Assembly established the Global Polio Eradication Initiative (GPEI) in 1988, two of the three wild poliovirus (WPV) serotypes (types 2 and 3) have been eradicated, and global WPV cases have decreased by more than 99.9%. Afghanistan and Pakistan remain the only countries where indigenous WPV type 1 (WPV1) transmission has not been interrupted. This report summarizes progress toward global polio eradication during January 1, 2021–March 31, 2023, and updates previous reports (*1*,*2*). In 2022, Afghanistan and Pakistan reported 22 WPV1 cases, compared with five in 2021; as of May 5, 2023, a single WPV1 case was reported in Pakistan in 2023. A WPV1 case was reported on the African continent for the first time since 2016, when officials in Malawi confirmed a WPV1 case in a child with paralysis onset in November 2021; neighboring Mozambique subsequently reported eight genetically linked cases. Outbreaks of polio caused by circulating vaccine-derived polioviruses (cVDPVs) can occur when oral poliovirus vaccine (OPV) strains circulate for a prolonged time in underimmunized populations, allowing reversion to neurovirulence (*3*). A total of 859 cVDPV cases occurred during 2022, an increase of 23% from 698 cases in 2021. cVDPVs were detected in areas where poliovirus transmission had long been eliminated (including in Canada, Israel, the United Kingdom, and the United States). In addition, cocirculation of multiple poliovirus types occurred in multiple countries globally (including Democratic Republic of the Congo [DRC], Israel, Malawi, Mozambique, Republic of the Congo, and Yemen). The 2022–2026 GPEI strategic plan targeted the goal of detecting the last cases of WPV1 and cVDPV in 2023 (*4*). The current global epidemiology of poliovirus transmission makes the likelihood of meeting this target date unlikely. The detections of poliovirus (WPV1 and cVDPVs) in areas where it had been previously eliminated underscore the threat of continued poliovirus spread to any area where there is insufficient vaccination to poliovirus (*3*). Mass vaccination and surveillance should be further enhanced in areas of transmission to interrupt poliovirus transmission and to end the global threat of paralytic polio in children.

Poliovirus Vaccination

In April 2016, trivalent OPV (tOPV), consisting of Sabin strain types 1, 2, and 3, was withdrawn from routine immunization programs and supplementary immunization activities (SIAs)* worldwide and replaced with bivalent OPV (bOPV, containing Sabin-strain types 1 and 3). Routine immunization programs worldwide provide either 3 doses of bOPV and 1–2 doses of injectable inactivated poliovirus vaccine (IPV) or IPV alone. Seroconversion after IPV vaccination protects against disease caused by all three polio serotypes but does not protect against poliovirus transmission. Because of cocirculation of cVDPV2 and other poliovirus serotypes, GPEI authorized administration of tOPV during SIAs in Afghanistan and Pakistan during 2017–2020, in Yemen during 2021–2022, and in areas of Somalia during 2022–2023. In response to cVDPV2 outbreaks, monovalent OPV Sabin type 2 (mOPV2) is approved for outbreak response use in SIAs and has been used most recently in Somalia. Because of the risks for reversion to neurovirulence associated with Sabin-strain OPV2 in areas with low immunity, the World Health Organization (WHO) granted emergency use listing of novel OPV2 (nOPV2) in November 2020 (*5*); nOPV2 is more genetically stable than the Sabin strain (*6*) and has been used in SIAs since March 2021. Challenges of nOPV2 supply during the time of this report have resulted in delayed SIAs in response to cVDPV2 outbreaks (*3*).

In 2021, the estimated global coverage with ≥3 doses of IPV or OPV (Pol3) among infants by age 1 year during routine immunization was 80%†; estimated coverage with 1 full dose or 2 fractional doses§ of IPV (IPV1) in OPV-using countries was 79%. Global coverage with Pol3 and IPV1 declined from 2019 values of 85% and 83%, respectively, when the COVID-19 pandemic severely disrupted health services. In Afghanistan, 2021 national Pol3 coverage was 71% and IPV1 coverage was 67%. Pakistan's 2021 national coverage estimates were 83% for both Pol3 and IPV1. In Malawi, 2021 Pol3 and IPV1 coverage was 89% and 92%, respectively, and in Mozambique, 2021 coverage estimates for Pol3 and IPV1 were 67% and 70%, respectively (*7*). Immunization coverage estimates in subnational levels of these countries are often substantially lower.

During January 1, 2021–March 31, 2023, GPEI supported 48 countries in implementing 219 SIAs, during which approximately 988 million bOPV, 616,000 IPV, 960,000 fractional IPV, 90 million mOPV2, 595 million nOPV2, and 100 million tOPV doses were administered. In 2022, lot

* SIAs are mass immunization campaigns intended to stop poliovirus circulation by immunizing every child aged <5 years with 2 OPV doses, irrespective of previous immunization status.

† 2021 is the most recent year for which data are available.

§ https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases/poliomyelitis-(polio)

quality assurance sampling (LQAS)[¶] surveys after SIAs indicated performance gaps in high-risk districts in Afghanistan, Malawi, Mozambique, and Pakistan (*8–10*).

Poliovirus Surveillance

Poliovirus transmission is primarily detected through case-based syndromic surveillance for acute flaccid paralysis (AFP) in persons aged <15 years, with confirmation of poliovirus by testing stool specimens at one of the 144 WHO-accredited laboratories in the Global Polio Laboratory Network in 91 countries (Table 1). In 2022, AFP surveillance reviews in 34 countries at high risk for poliovirus spread indicated that 26 (76%) countries met targets for the two primary surveillance indicators at the national level.[**] Because of the high proportion of

[¶] LQAS is a rapid survey method used to evaluate the quality of vaccination coverage after SIAs in predefined areas, such as health districts ("lots"). In each lot, six clusters are selected according to probability proportional to size, then 10 houses with eligible children are randomly selected within each cluster, and vaccination status is tallied. If the number of unvaccinated children in the sample is four or more, the SIA quality is interpreted to be of lower quality and mop-up activities are recommended. Conversely, if fewer than four selected children are unvaccinated, the SIA is considered to be of high quality.

[**] 2022 priority countries (2022–2024 Global Polio Surveillance Action Plan priority countries): *African Region*: Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Guinea, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, South Sudan, Tanzania, Togo, Zambia, and Zimbabwe; *Eastern Mediterranean Region*: Afghanistan, Iraq, Pakistan, Somalia, Sudan, Syria, and Yemen; *South-East Asia Region*: Burma (Myanmar); *Western Pacific Region*: Papua New Guinea and Philippines.

TABLE 1. Number of poliovirus cases, by country — worldwide, January 1, 2021–March 31, 2023*

	No. of cases							
	2021		2022		Jan–Mar 2022		Jan–Mar 2023	
Country	WPV1	cVDPV	WPV1	cVDPV	WPV1	cVDPV	WPV1	cVDPV
Countries with WPV1 detections (cVDPV type)								
Afghanistan (2)	4	43	2	0	1	0	0	0
Pakistan (2)	1	8	20	0	0	0	1	0
Malawi (1)	1	0	0	4	0	0	0	0
Mozambique (1,2)	0	2	8	26	1	4	0	3
Countries with reported cVDPV cases (cVDPV type)								
Algeria (2)	0	0	0	3	0	0	0	0
Benin (2)	0	3	0	11	0	0	0	2
Burkina Faso (2)	0	2	0	0	0	0	0	0
Burundi (2)	0	0	0	1	0	0	0	0
Cameroon (2)	0	3	0	3	0	0	0	0
Central African Republic (2)	0	0	0	5	0	0	0	5
Chad (2)	0	0	0	44	0	5	0	5
Côte d'Ivoire (2)	0	0	0	0	0	0	0	1
Democratic Republic of the Congo (1,2)	0	28	0	504	0	58	0	31
Eritrea (2)	0	1	0	1	0	1	0	0
Ethiopia (2)	0	10	0	1	0	0	0	0
Ghana (2)	0	0	0	3	0	0	0	0
Guinea (2)	0	6	0	0	0	0	0	0
Guinea-Bissau (2)	0	3	0	0	0	0	0	0
Indonesia (2)	0	0	0	1	0	0	0	3
Israel (1,3)	0	0	0	1	0	1	0	1
Liberia (2)	0	3	0	0	0	0	0	0
Madagascar (1)	0	13	0	14	0	5	0	9
Mali (2)	0	0	0	2	0	0	0	0
Niger (2)	0	18	0	15	0	2	0	0
Nigeria (2)	0	415	0	48	0	26	0	1
Republic of the Congo (2)	0	2	0	1	0	0	0	0
Senegal (2)	0	17	0	0	0	0	0	0
Sierra Leone (2)	0	5	0	0	0	0	0	0
Somalia (2)	0	1	0	5	0	2	0	1
South Sudan (2)	0	9	0	0	0	0	0	0
Sudan (2)	0	0	0	1	0	0	0	0
Tajikistan (2)	0	35	0	0	0	0	0	0
Togo (2)	0	0	0	2	0	1	0	0
Ukraine (2)	0	2	0	0	0	0	0	0
United States (2)	0	0	0	1	0	0	0	0
Yemen (1,2)	0	69	0	162	0	83	0	0
Total	**6**	**698**	**30**	**859**	**2**	**188**	**1**	**62**

Abbreviations: cVDPV = circulating vaccine-derived poliovirus; WPV1 = wild poliovirus type 1.
* Data are current as of May 5, 2023.

asymptomatic infections, environmental surveillance (ES), the systematic sampling and testing of sewage for poliovirus, can supplement AFP surveillance to detect poliovirus transmission and improve overall surveillance sensitivity. The total number of ES samples collected in countries with poliovirus transmission increased from 8,945 samples from 36 countries in 2021 to 12,259 samples from 40 countries in 2022 (Table 2).

Reported Polio Cases and Isolations

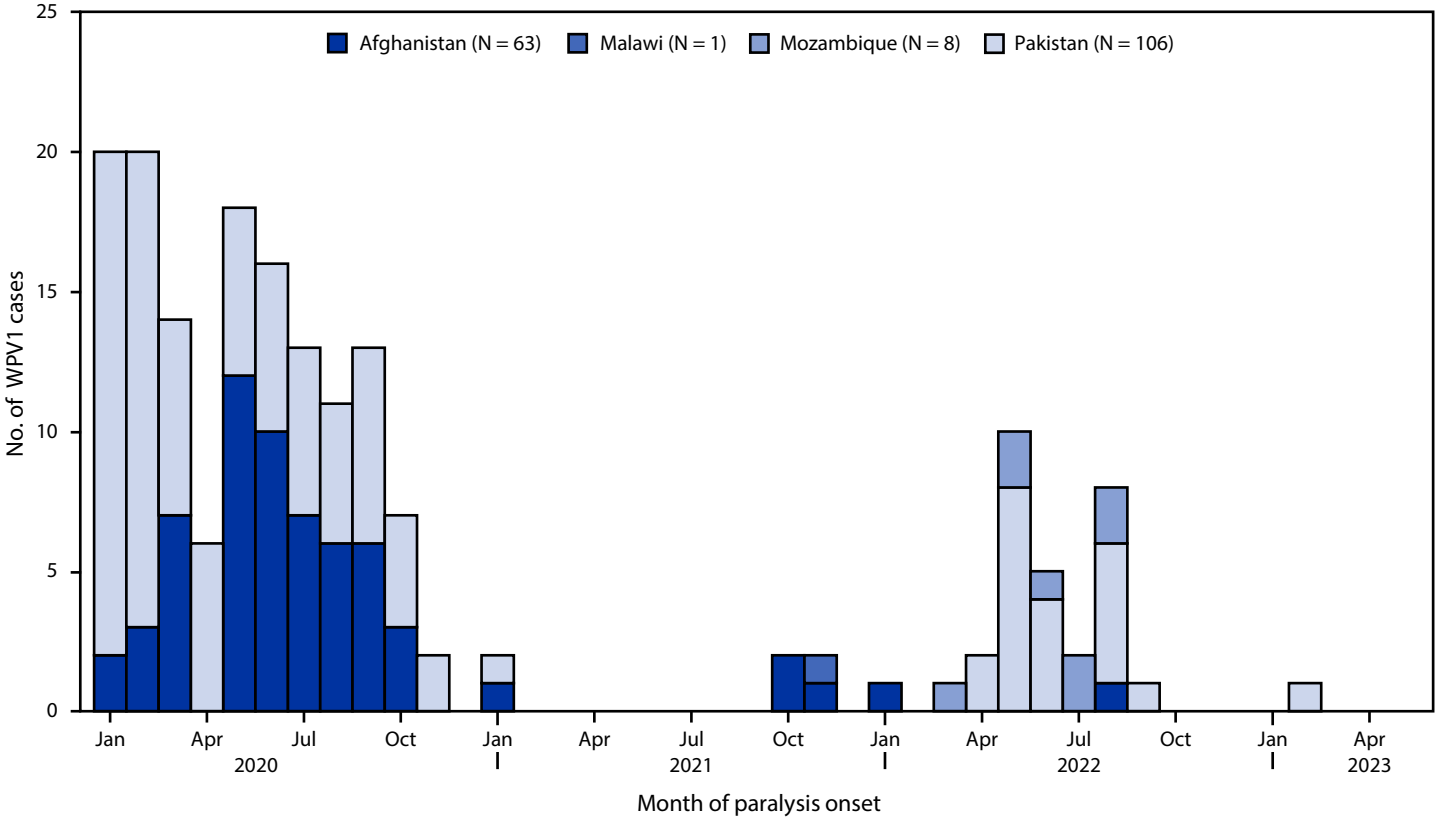
Countries reporting WPV cases and isolations. In 2022, the two remaining countries with endemic WPV1 transmission, Afghanistan and Pakistan, reported two and 20 WPV1 cases, respectively (Figure) (Table 1). In Afghanistan, two cases were reported from two provinces, representing a 50% decrease from the four cases reported from two provinces in

TABLE 2. Number of circulating wild polioviruses and circulating vaccine-derived polioviruses detected through environmental surveillance — worldwide, January 1, 2021–March 31, 2023*

	Reporting period							
	Jan 1–Dec 31, 2021		Jan 1–Dec 31, 2022		Jan 1–Mar 30, 2022		Jan 1–Mar 30, 2023	
Country	No. of samples	No. of positives (%)	No. of samples	No. of positives (%)	No. of samples	No. of positives (%)	No. of samples	No. of positives (%)
Countries with reported WPV1-positive samples (no. and % of isolates refer to WPV1)								
Afghanistan	481	1 (0.2)	702	22 (3.1)	164	0 (—)	172	17 (9.9)
Pakistan	887	65 (7.3)	1220	37 (3.0)	275	0 (—)	362	3 (0.8)
Countries with reported cVDPV-positive samples (cVDPV type) (no. and % of isolates refer to cVDPVs)								
Afghanistan (2)	481	40 (8.3)	702	0 (—)	164	0 (—)	172	0 (—)
Algeria (2)	52	0 (—)	76	18 (23.7)	14	0 (—)	33	8 (24.2)
Benin (2)	143	1 (0.7)	109	8 (7.4)	36	0 (—)	39	3 (7.7)
Botswana (2)	0	0 (—)	22	4 (18.2)	0	0 (—)	25	1 (4.0)
Burkina Faso (2)	110	1 (0.9)	151	0 (—)	38	0 (—)	36	0 (—)
Burundi (2)	40	0 (—)	34	6 (17.6)	7	0 (—)	11	6 (54.5)
Canada (2)	0	0 (—)	58	2 (3.4)	0	0 (—)	12	0 (—)
Cameroon (2)	376	1 (0.3)	410	0 (—)	76	0 (—)	145	0 (—)
Central African Republic (2)	142	1 (0.7)	212	8 (3.7)	39	0 (—)	42	0 (—)
Chad (2)	64	1 (1.6)	86	5 (5.8)	14	0 (—)	14	0 (—)
China (3)	2	1 (50.0)	0	0 (—)	0	0 (—)	0	0 (—)
Côte d'Ivoire (2)	85	0 (—)	157	3 (1.9)	41	2 (4.9)	45	0 (—)
Democratic Republic of the Congo (2)	464	3 (1.0)	327	9 (2.8)	76	0 (—)	81	1 (1.2)
Djibouti (2)	71	7 (9.9)	46	12 (26.1)	10	9 (90.0)	12	0 (—)
Egypt (2)	906	12 (1.3)	645	6 (0.9)	201	4 (2.0)	139	0 (—)
The Gambia (2)	39	9 (23.1)	55	0 (—)	11	0 (—)	3	0 (—)
Ghana (2)	189	0 (—)	197	19 (9.6)	70	0 (—)	41	0 (—)
Guinea (2)	143	2 (1.4)	123	0 (—)	30	0 (—)	33	0 (—)
Iran (2)	71	1 (1.4)	68	0 (—)	17	0 (—)	10	0 (—)
Israel (2,3)	9	5 (55.6)	82	80 (97.6)	25	25 (100.0)	0	0 (—)
Kenya (2)	198	1 (0.5)	200	0 (—)	50	0 (—)	51	0 (—)
Liberia (2)	91	14 (15.4)	43	0 (—)	28	0 (—)	6	0 (—)
Madagascar (1)	393	31 (87.9)	668	96 (14.4)	158	19 (12.0)	169	24 (14.2)
Malawi (2)	0	0 (—)	353	0 (—)	54	0 (—)	56	1 (1.8)
Mauritania (2)	72	7 (9.7)	82	0 (—)	24	0 (—)	12	0 (—)
Niger (2)	204	0 (—)	301	14 (4.7)	79	2 (2.5)	66	1 (1.5)
Nigeria (2)	2,453	303 (12.4)	2218	82 (3.7)	913	46 (5.0)	294	10 (3.4)
Pakistan (2)	887	35 (3.9)	1220	0 (—)	275	0 (—)	362	0 (—)
Palestinian territories (3)	7	7 (100.0)	9	9 (100.0)	9	9 (100.0)	0	0 (—)
Senegal (2)	23	14 (60.9)	286	1 (0.3)	92	0 (—)	77	0 (—)
Republic of the Congo (2)	461	3 (1.0)	238	0 (—)	57	0 (—)	63	0 (—)
Sierra Leone (2)	214	9 (4.9)	204	0 (—)	62	0 (—)	24	0 (—)
Somalia (2)	141	1 (0.7)	231	6 (2.6)	54	1 (1.9)	67	0 (—)
Sudan (2)	103	0 (—)	160	1 (0.6)	40	0 (—)	55	0 (—)
Tajikistan (2)	27	17 (63.0)	1	0 (—)	0	0 (—)	0	0 (—)
Togo (2)	66	0 (—)	87	2 (2.3)	30	1 (3.3)	24	0 (—)
Uganda (2)	100	2 (2.0)	148	0 (—)	33	0 (—)	74	0 (—)
United Kingdom (2)	0	0 (—)	26	6 (23.1)	1	0 (—)	0	0 (—)
United States (2)	0	0 (—)	2068	47 (2.3)	81	0 (—)	952	0 (—)
Yemen (2)	37	13 (35.1)	39	25 (64.1)	15	7 (46.7)	5	0 (—)
Zambia (2)	81	0 (—)	117	3 (2.6)	27	0 (—)	40	0 (—)
Total	**8,945**	**608 (6.8)**	**12,259**	**531 (4.3)**	**2,951**	**125 (4.2)**	**3,290**	**75 (2.3)**

Abbreviations: cVDPV = circulating vaccine-derived poliovirus; WPV1 = wild poliovirus type 1.
* Data are current as of May 5, 2023.

FIGURE. Number of wild poliovirus type 1 cases, by country and month of paralysis onset — worldwide, January 2021–March 2023*



Abbreviation: WPV1 = wild poliovirus type 1.
* Data are current as of May 5, 2023.

2021 (*8*). The 20 cases reported in Pakistan in 2022 were all from security-compromised districts in Khyber Pakhtunkhwa province, representing a nineteenfold increase over the single case reported in 2021 (*9*). As of May 5, a single case of WPV1 was reported in the Khyber Pakhtunkhwa province of Pakistan in 2023. The paralysis onset dates of the latest reported WPV1 case in Afghanistan was August 29, 2022, and in Pakistan was February 20, 2023.

In Afghanistan, among 702 sewage samples collected in 2022, 22 (3%) yielded a WPV1 isolate, representing a 14-fold increase in the percentage of isolates from 0.2% (one WPV1 isolate detected in 473 samples) collected during 2021 (Table 2). In Pakistan, among 1,220 sewage samples collected during 2022, 37 (3%) WPV1-positive isolates were detected, a 57% decrease in the percentage of isolates from 7% (65 WPV1 isolates from 887 samples) in 2021. As of May 5, 2023, the latest WPV1 detections by ES were from samples taken on April 3, 2023, in Afghanistan and on February 21, 2023, in Pakistan.

In 2021, a single paralytic WPV1 case in Malawi was genetically linked to virus circulating in Pakistan and was confirmed in February 2022. In 2022, eight WPV1 cases were detected in Mozambique, genetically linked to the Malawi case, with the latest date of paralysis in August 2022 (*10*).

Countries reporting cVDPV cases and isolations. During January 2021–March 2023, a total of 1,619 cVDPV cases were reported from 36 countries. Six countries reported 225 cVDPV1 cases, 34 countries reported 1,393 cVDPV2 cases, and one country (Israel) reported one cVDPV3 case. DRC, Malawi, Mozambique, Republic of the Congo, and Yemen reported co-circulation of cVDPV1 and cVDPV2, and Israel reported co-circulation of cVDPV2 and cVDPV3. Global cVDPV2 cases decreased by 1.3% in 2022 (673 cases in 20 countries) compared with 2021 (682 cases in 22 countries); the 504 cVDPV cases detected in DRC represent 59% of all globally reported cVDPV cases in 2022. No cVDPV2 cases or ES detections in Afghanistan or Pakistan were reported after July 2021 (*7*,*8*). Global cVDPV1 cases increased by 1,056% (185 cases in five countries) in 2022 compared with 16 cases in two countries in 2021.

Discussion

The 2022 increase in WPV1 cases in Pakistan's security-challenged subdistricts of southern Khyber Pakhtunkhwa province and the ongoing circulation in contiguous districts of eastern Afghanistan form a narrow geographic band of indigenous WPV1 transmission. One major, ongoing challenge to

Summary

What is already known about this topic?

Endemic transmission of wild poliovirus type 1 (WPV1) continues only in Afghanistan and Pakistan.

What is added by this report?

In 2022, Malawi and Mozambique reported WPV1 cases linked to a Pakistan strain, the first WPV1 cases in the African region since 2016. During 2022 and 2023, Afghanistan and Pakistan reported WPV1 cases. Circulating vaccine-derived polioviruses were detected in areas of the world where poliovirus had been eliminated. Cocirculation of more than one poliovirus type occurred in multiple countries.

What are the implications for public health practice?

The detections of poliovirus in areas where it had been previously eliminated underscore the threat of continued poliovirus spread to any area where the population is insufficiently vaccinated against poliovirus.

reaching children with OPV in these reservoir districts is the substantial movement of a subpopulation at high risk between Afghanistan and Pakistan. In Afghanistan, an intensive schedule of SIAs conducted by local authorities during November 2021–September 2022 reached many previously inaccessible, unvaccinated children (*8*). However, 188,447 children residing in Afghanistan's South Region could not be vaccinated during November 2021–September 2022 because of a regional ban on community polio SIAs. In early 2023, authorities in Afghanistan banned women from working outside the home; the ban has not substantially affected the polio program to date. In Pakistan, AFP surveillance gaps and insufficient SIA implementation quality in the areas with security issues pose substantial challenges (*9*). The successful interruption of cVDPV2 transmission in both countries in 2021 following outbreak response SIAs with tOPV and mOPV2 offers optimism that WPV1 transmission can be stopped in the near future. In 2022, both countries resumed cross-border coordination and synchronization of campaigns; intensifying and strengthening these efforts could help to mitigate cross-border WPV1 spread.

The WHO African Region detected its first WPV1 case in >5 years in 2021 in Malawi, with subsequent limited spread in Mozambique. Genomic sequence analyses for both the isolated WPV1 and cVDPV1, which cocirculated in both countries, highlight critical surveillance gaps in the region (*10*). Delays in specimen transport time, as well as some ineffective ES systems and increases in sample processing time have delayed polio detection and the subsequent response. In Mozambique, suboptimal SIA performance and decreased Pol3 coverage leave children vulnerable to further WPV1 and cVDPV transmission. Simultaneous health emergencies resulting from cholera and measles outbreaks, as well as cyclone response, in both countries have challenged the poliovirus outbreak responses. Improved SIA quality is needed to reach chronically missed children, and more sensitive surveillance will be essential in confirming the interruption of poliovirus transmission.

The 2022–2026 GPEI Strategic Plan (*4*) named the end of 2023 as the target for the last detection of both WPV1 and cVDPV2. ES detections of WPV1 transmission in Afghanistan and Pakistan and AFP detection in Pakistan in early 2023 clearly jeopardize achieving the WPV1 target. Similarly, with extensive transmission of cVDPV1 and cVDPV2 in 2023, the cVDPV detection goal is unlikely to be met by the target date. In addition, as of May 5, 2023, emergences of cVDPV2 linked to nOPV2 use had been detected in AFP cases in African countries.[††] Although this finding was expected even with a vaccine with increased genetic stability, considering the number of doses administered, the finding indicates the need to implement high-quality response SIAs to raise immunity in all children, independent of the vaccine type used. The major hurdles to reaching the cVDPV2 GPEI goals in the near future are remaining gaps in surveillance, suboptimal SIA quality in many areas, and a highly limited nOPV2 vaccine supply, resulting in delayed campaigns for a number of countries (*5*).

The detection of cVDPV transmission in regions where poliovirus transmission has long been eliminated (e.g., genetically linked cVDPV2 in Canada, Israel, the United Kingdom, and the United States) together with the importation of WPV1 genetically related to a Pakistan strain into southeastern Africa underscore the threat of continued global poliovirus spread to any area, given global migration and travel (*3*). Further, this risk is growing because of increased postpandemic vaccine hesitancy and pandemic disruptions in immunization services, with decreased Pol3 coverage globally. Progress toward polio eradication requires continued international commitment to strengthening routine immunization, enhancing global surveillance activities, increasing SIA quality, and implementing preventive bOPV SIAs with or without IPV in areas with chronically low routine immunization coverage.

[††] https://polioeradication.org/news-post/gpei-statement-on-cvdpv2-detections-in-burundi-and-democratic-republic-of-the-congo/

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Corresponding author: Scarlett E. Lee; tqz9@cdc.gov.

[1]Epidemic Intelligence Service, CDC; [2]Global Immunization Division, Global Health Center, CDC; [3]Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, CDC; [4]Polio Eradication Department, World Health Organization, Geneva, Switzerland.

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COVID-19 Surveillance After Expiration of the Public Health Emergency Declaration — United States, May 11, 2023

Benjamin J. Silk, PhD[1]; Heather M. Scobie, PhD[1]; William M. Duck, MPH[1,2]; Tess Palmer, MPH[3]; Farida B. Ahmad, MPH[4]; Alison M. Binder, MS[5]; Jodi A. Cisewski, MPH[4]; Seth Kroop, MPA[5]; Karl Soetebier, MAPW[2]; Meeyoung Park, MPH[6]; Aaron Kite-Powell, MS[2]; Andrea Cool, MPH[5,7]; Erin Connelly, MPAff[1]; Stephanie Dietz, PhD[2]; Amy E. Kirby, PhD[8]; Kathleen Hartnett, PhD[2]; Jocelyn Johnston, MHS[3]; Diba Khan, PhD[1]; Shannon Stokley, DrPH[9]; Clinton R. Paden, PhD[1]; Michael Sheppard, MS[2]; Paul Sutton, PhD[4]; Hilda Razzaghi, PhD[9]; Robert N. Anderson, PhD[4]; Natalie Thornburg, PhD[1]; Sarah Meyer, MD[9]; Caryn Womack[1]; Aliki P. Weakland, MPH, MSW[1]; Meredith McMorrow, MD[1]; Lanson R. Broeker, MBA[1,3]; Amber Winn, MPH[1]; Aron J. Hall, DVM[1]; Brendan Jackson, MD[1]; Barbara E. Mahon, MD[1]; Matthew D. Ritchey, DPT[2]

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On January 31, 2020, the U.S. Department of Health and Human Services (HHS) declared, under Section 319 of the Public Health Service Act, a U.S. public health emergency because of the emergence of a novel virus, SARS-CoV-2.* After 13 renewals, the public health emergency will expire on May 11, 2023. Authorizations to collect certain public health data will expire on that date as well. Monitoring the impact of COVID-19 and the effectiveness of prevention and control strategies remains a public health priority, and a number of surveillance indicators have been identified to facilitate ongoing monitoring. After expiration of the public health emergency, COVID-19–associated hospital admission levels will be the primary indicator of COVID-19 trends to help guide community and personal decisions related to risk and prevention behaviors; the percentage of COVID-19–associated deaths among all reported deaths, based on provisional death certificate data, will be the primary indicator used to monitor COVID-19 mortality. Emergency department (ED) visits with a COVID-19 diagnosis and the percentage of positive SARS-CoV-2 test results, derived from an established sentinel network, will help detect early changes in trends. National genomic surveillance will continue to be used to estimate SARS-CoV-2 variant proportions; wastewater surveillance and traveler-based genomic surveillance will also continue to be used to monitor SARS-CoV-2 variants. Disease severity and hospitalization-related outcomes are monitored via sentinel surveillance and large health care databases. Monitoring of COVID-19 vaccination coverage, vaccine effectiveness (VE), and vaccine safety will also continue. Integrated strategies for surveillance of COVID-19 and other respiratory viruses can further guide prevention efforts. COVID-19–associated hospitalizations and deaths are largely preventable through receipt of updated vaccines and timely administration of therapeutics (*1–4*).

Although COVID-19 no longer poses the societal emergency that it did when it first emerged in late 2019, COVID-19 remains an ongoing public health challenge. By April 26, 2023, more than 104 million U.S. COVID-19 cases, 6 million related hospitalizations, and 1.1 million COVID-19–associated deaths were reported to CDC and summarized on CDC's COVID Data Tracker.† COVID-19 was the third leading cause of death during 2020 and 2021§ and the fourth leading cause during 2022 (*5*). To mitigate the consequences of the pandemic, approximately 675 million COVID-19 vaccine doses were administered, including 55 million updated (bivalent) booster doses. Based on seroprevalence data, infection- and vaccine-induced population immunity in the United States was 95% by December 2021 (*6*). As a result, rates of COVID-19–associated hospitalizations and deaths have declined substantially since March 2022 (*7*). This report describes changes to the national COVID-19 surveillance strategy, data sources, and indicators that will be made after the public health emergency declaration expires; these indicators will be displayed as weekly or otherwise scheduled updates to CDC's COVID Data Tracker.

Continued Surveillance After May 11, 2023

Most COVID-19 surveillance data sources will continue to be available after the public health emergency declaration ends on May 11; the reporting cadence of some will change, and three will be discontinued (Table 1). Since December 15, 2022, daily reporting to CDC's National Healthcare Safety Network (NHSN) of aggregate counts of patients with laboratory-confirmed COVID-19 admitted to acute care and critical access U.S. hospitals has been required. After the public health emergency ends on May 11, 2023, a switch to a weekly cadence of national reporting will affect data processing and introduce reporting lag. NSHN data on COVID-19 hospital admissions per 100,000 population will be the primary surveillance indicator to help guide community and individual decisions related to risk and prevention behaviors. These data have similar suitability for tracking local COVID-19 activity as do COVID-19 Community Levels (CCLs) (*8*) and will be

* https://aspr.hhs.gov/legal/PHE/

† https://covid.cdc.gov/covid-data-tracker

§ https://www.cdc.gov/nchs/products/databriefs/db427.htm; https://www.cdc.gov/nchs/products/databriefs/db456.htm

TABLE 1. Changes to national reporting of COVID-19 surveillance data sources and accessibility after the expiration of the public health emergency declaration — United States, May 11, 2023

Surveillance data source	Changes to COVID Data Tracker	Accessibility*
National Healthcare Safety Network†	Continued availability with weekly updates	COVID Data Tracker
National Vital Statistics System§	New availability with weekly updates	COVID Data Tracker
National Syndromic Surveillance Program¶	Continued availability with weekly updates	COVID Data Tracker
National Respiratory and Enteric Viruses Surveillance System**	New availability with weekly updates	COVID Data Tracker
National SARS-CoV-2 Strain Surveillance††	Continued availability with biweekly updates	COVID Data Tracker
National Wastewater Surveillance System§§	Continued availability with daily or weekly updates	COVID Data Tracker
Traveler-based Genomic Surveillance program¶¶	Continued availability with weekly updates	COVID Data Tracker
COVID-NET (sentinel surveillance for COVID-19–associated hospitalizations)***	Continued availability with weekly updates	COVID Data Tracker
Large health care databases†††	Continued availability with monthly or quarterly updates	COVID Data Tracker
COVID-19 vaccination administration§§§	Continued availability with monthly updates	COVID Data Tracker
National Immunization Survey¶¶¶	Continued availability with weekly or monthly updates	COVID Data Tracker and COVIDVaxView
Line-level COVID-19 case reporting****	Continued availability with weekly updates	COVID Data Tracker and https://data.cdc.gov
CELR††††	Discontinued on May 11, 2023	Archived on https://healthdata.gov
ACDC reporting§§§§	Discontinued on May 11, 2023	Archived on https://data.cdc.gov
Community transmission level and COVID-19 community level metrics	Discontinued on May 11, 2023	Archived on https://data.cdc.gov

Abbreviations: ACDC = aggregate cases and death counts; CELR = COVID-19 electronic laboratory reporting; COVID-NET = Coronavirus Disease 2019-Associated Hospitalization Surveillance Network.

* https://covid.cdc.gov/covid-data-tracker; https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/index.html; https://data.cdc.gov; https://healthdata.gov

† https://www.hhs.gov/sites/default/files/covid-19-faqs-hospitals-hospital-laboratory-acute-care-facility-data-reporting.pdf

§ https://www.cdc.gov/nchs/nvss/index.htm

¶ https://www.cdc.gov/nssp/index.html

** https://www.cdc.gov/surveillance/nrevss/index.html

†† https://covid.cdc.gov/covid-data-tracker/#variant-proportions

§§ https://www.cdc.gov/nwss/index.html

¶¶ https://wwwnc.cdc.gov/travel/page/travel-genomic-surveillance

*** https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

††† https://covid.cdc.gov/covid-data-tracker/index.html#hospitalizations-severity

§§§ https://www.cdc.gov/vaccines/covid-19/reporting/index.html; https://www.cdc.gov/coronavirus/2019-ncov/vaccines/reporting-vaccinations.html

¶¶¶ https://www.cdc.gov/vaccines/imz-managers/nis/index.html

**** https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-01_COVID19.pdf

†††† https://www.cdc.gov/coronavirus/2019-ncov/lab/reporting-lab-data.html

§§§§ ACDC data are compiled using automated data extraction from state and jurisdictional websites and dashboards and direct submissions from jurisdictions. ACDC data shifted from daily to weekly cadence in October 2022, with some jurisdictions continuing to report daily totals and others reporting only weekly totals.

updated weekly on COVID Data Tracker at the county,¶ state, regional, and national levels.

Considerable gains in the timeliness of National Vital Statistics System (NVSS) death certificate data processing were accomplished during the pandemic (*9*). Provisional death certificate data from NVSS, including decedents for whom COVID-19 is listed as an underlying or a contributing cause of death, will be the primary data source for monitoring COVID-19 mortality. Among several mortality-based metrics, the percentage of COVID-19–associated deaths among all reported deaths in NVSS will be a new weekly surveillance indicator on COVID Data Tracker that is comparable with a corresponding influenza mortality surveillance indicator (Table 2).** Because the lag in mortality reporting is similar for COVID-19 deaths and deaths overall, this indicator is not biased by incomplete reporting in previous weeks and allows for timely tracking of mortality trends (*8*).

The National Syndromic Surveillance Program (NSSP) has expanded substantially during the COVID-19 pandemic, with data from 6,300 facilities in all 50 states, the District of Columbia, and Guam. NSSP includes 75% of all U.S. ED visits (Table 1); coverage is currently limited in Minnesota and Oklahoma, and discharge diagnosis completeness is currently limited in Missouri. Using NSSP discharge diagnosis data, the weekly percentage of patients who receive a diagnosis of COVID-19 among all ED visits is an indicator that can identify trends earlier than hospital admission rates can (*8*).

Monitoring national and regional trends in the percentage of positive SARS-CoV-2 nucleic acid amplification test (NAAT) results will be based on surveillance data from the National Respiratory and Enteric Virus Surveillance System (NREVSS). This system is an established sentinel network of approximately 450 clinical, public health, and commercial laboratories that voluntarily submit weekly data on numbers of positive test results and total tests performed. As another early indicator, the percentage of positive SARS-CoV-2 test results from NREVSS is a suitable alternative to that obtained through COVID-19 electronic laboratory reporting (CELR), which will not be possible after May 11, because reporting of negative rest results will not be required (*8*). Because SARS-CoV-2 testing volumes and the geographic representation of NREVSS laboratories are heterogeneous (with one to 31 participating laboratories per state), region-level rather than state-level data will be displayed.

¶ County-level hospital data, including new hospital admissions levels, are derived using calculations performed at the Health Service Area (HSA) level. An HSA is defined by CDC's National Center for Health Statistics as a geographic area containing at least one county that is self-contained with respect to the population's provision of routine hospital care. Every county in the United States is assigned to an HSA, and each HSA must contain at least one hospital. Data presented represent admissions and bed use among hospitals within the selected HSA.

** https://www.cdc.gov/flu/weekly/index.htm#NCHSMortality

TABLE 2. Data sources, metrics, and geographic levels for continued COVID-19 surveillance after the expiration of the public health emergency declaration — United States, May 11, 2023

Surveillance data source	Metrics	Geographic level
National Healthcare Safety Network*	Count of COVID-19–associated hospital admissions	County, state, regional per HHS regions, and national
	Rate of COVID-19–associated hospital admissions per 100,000 population	
	% Change in COVID-19–associated hospital admissions from previous wk	
	% of inpatient beds occupied by COVID-19 patients	
	Absolute change in % of inpatient beds occupied by COVID-19 patients from previous wk	
	% of ICU beds occupied by COVID-19 patients	
	Absolute change in % of ICU beds occupied by COVID-19 inpatients from previous wk	
National Vital Statistics System†	% of all COVID-19–associated deaths	State, regional per HHS regions, and national
	Count of COVID-19–associated deaths	
	Rate of COVID-19–associated deaths per 100,000 population (crude and age-adjusted)	
National Syndromic Surveillance Program§	% of ED visits with COVID-19 discharge diagnoses	Select states, regional per HHS regions, and national
	% Change in % of ED visits with COVID-19 from previous wk	
National Respiratory and Enteric Viruses Surveillance System¶	SARS-CoV-2 NAAT % positivity	Regional per HHS regions and national
	% Change in SARS-CoV-2 NAAT % positivity from previous wk	
National SARS-CoV-2 Strain Surveillance**	Weighted and nowcast estimates of variant proportions	Regional per HHS regions and national
National Wastewater Surveillance System††	Current virus levels in wastewater by site	Select counties, states, regional per HHS regions, and national
	% Change in the last 15 days	
	% of wastewater samples with detectable virus	
	Predominant variants by site	
	Relative abundance of variants by site	
Traveler-based Genomic Surveillance program§§	% Test positivity (pooled)	National
	Variant proportions among positive pools	
COVID-NET (sentinel surveillance for COVID-19–associated hospitalizations)¶¶	Rate of COVID-19–associated hospital admissions	Select states and counties (sentinel network)
	COVID-19–associated hospital admissions rates, by age group, sex, and race and ethnicity	
	% of COVID-19–associated hospitalizations by underlying medical conditions	
	% of COVID-19–associated hospitalizations resulting in ICU, IMV, or death	
Large health care databases***	% of hospitalized COVID-19 patients who were admitted to an ICU	Select participating health care organizations
	% of hospitalized COVID-19 patients who received IMV	
	% of hospitalized COVID-19 patients who died	
COVID-19 vaccinations†††	% Up-to-date status	57 of 64 jurisdictions (as of April 25, 2023)
National Immunization Survey§§§	% Vaccinated and intent for vaccination	National (adults and children); state (adults)
	Vaccination status and intent by demographic characteristics and behavioral indicators	

Abbreviations: COVID-NET = Coronavirus Disease 2019-Associated Hospitalization Surveillance Network; ED = emergency department; HHS = U.S. Department of Health and Human Services; ICU = intensive care unit; IMV = invasive mechanical ventilation; NAAT = nucleic acid amplification test.

* https://www.hhs.gov/sites/default/files/covid-19-faqs-hospitals-hospital-laboratory-acute-care-facility-data-reporting.pdf.
† https://www.cdc.gov/nchs/nvss/index.htm
§ https://www.cdc.gov/nssp/index.html
¶ https://www.cdc.gov/surveillance/nrevss/index.html
** https://covid.cdc.gov/covid-data-tracker/#variant-proportions
†† https://www.cdc.gov/nwss/index.html
§§ https://wwwnc.cdc.gov/travel/page/travel-genomic-surveillance.
¶¶ https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html
*** https://covid.cdc.gov/covid-data-tracker/index.html#hospitalizations-severity
††† https://www.cdc.gov/vaccines/covid-19/reporting/index.html; https://www.cdc.gov/coronavirus/2019-ncov/vaccines/reporting-vaccinations.html; https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html
§§§ https://www.cdc.gov/vaccines/imz-managers/nis/index.html

Genomic surveillance to estimate SARS-CoV-2 variant proportions at the national and regional levels will continue with a biweekly cadence and revised analytic methods for weighting based on the probability of selecting positive laboratory specimens for sequencing (*10*). As fewer specimens and sequences become available, a system that is scaled sufficiently to allow for regional estimates will be established in collaboration with the network of public health laboratories that have participated in the National SARS-CoV-2 Strain Surveillance program.[††] The National Wastewater Surveillance System (NWSS) and Traveler-based Genomic Surveillance (TGS) Program are additional sources of surveillance data for monitoring early trends in SARS-CoV-2 infections and variant proportions (NWSS) and for early detection of new variants in travelers entering the United States (TGS) that will continue to be available with daily or weekly updates.[§§]

In addition to NHSN, sentinel surveillance and large health care databases will continue to monitor disease severity and hospitalization-related outcomes. The Coronavirus Disease 2019–Associated Hospitalization Surveillance Network (COVID-NET)[¶¶] uses active, population-based surveillance to estimate rates of laboratory-confirmed COVID-19–associated hospital admissions and also collects detailed clinical information, including underlying conditions, to better understand trends and risk for severe disease. COVID-NET currently comprises 98 counties in 13 states. In addition, three large databases of electronic health care records (BD Insights Research Database [BD], the National Patient-Centered Clinical Research Network [PCORnet], and Premier Healthcare Database's Special COVID-19 Release [Premier])[***] will support monitoring of COVID-19 severity among hospitalized patients (i.e., percentages of patients in intensive care units [ICUs], those receiving invasive mechanical ventilation, and deaths).

Monitoring vaccination coverage, safety,[†††] and VE are ongoing priorities because COVID-19–associated hospitalizations and deaths can be prevented through receipt of updated COVID-19 vaccines (*1*–*3*). Data use agreements established at the start of the pandemic with states, territories, and selected cities to facilitate receipt of comprehensive vaccine administration data from immunization information systems will terminate at the end of the public health emergency declaration. However, most jurisdictions have signed data use agreement extensions and will continue to submit COVID-19 vaccination data. Although future data might not be as complete because reporting requirements vary by state, the National Immunization Survey Child and Adult COVID Modules will continue to provide data on COVID-19 vaccination coverage and intent at the national and state levels via COVID Data Tracker and COVIDVaxView.[§§§] VE platforms will continue to provide robust assessment of the real-world performance of vaccines (e.g., Investigating Respiratory Viruses in the Acutely Ill [IVY] and VISION Networks) (*1*,*2*). However, strategies for evaluating VE will need to incorporate alternative sources of vaccination data (e.g., patient/provider interviews or claims data) if immunization information systems are not sufficiently complete.

To continue facilitating access to national COVID-19 surveillance data, a first-phase, redesigned COVID Data Tracker website will launch on May 11, 2023. These data will continue providing an evidence base of information to guide prioritization of public health action. Numerous surveillance data sources and corresponding metrics and geographic levels will be updated weekly on COVID Data Tracker, with visualizations of trends and maps (Table 2). County-level hospitalization data will continue to include metrics on COVID-19–associated admissions and inpatient and ICU bed occupancy. Metrics for COVID-19–associated deaths (state-level), ED visits for COVID-19 (state-level), and percentage of positive SARS-CoV-2 test results (HHS region-level) will also be displayed. Metric levels will be anchored to levels of hospital admission rates used in the CCLs (*8*). The COVID Data Tracker will also continue to display SARS-CoV-2 variant proportion estimates and wastewater and traveler-based genomic surveillance data, as well as vaccination data and health care data on disease severity. In addition, availability of priority data will continue after May 11, 2023, for health equity, pediatric and special populations (e.g., vaccination coverage among persons who are pregnant and those with disabilities), health care settings (e.g., nursing home residents), and seroprevalence. SARS-CoV-2 infections remain nationally notifiable, and line-level COVID-19 case surveillance data will continue to be available, including public use data at https://data.cdc.gov.

[††] https://www.aphl.org/aboutAPHL/publications/Documents/ID-Influenza-Right-Size-Roadmap-Edition2.pdf; https://www.aphl.org/programs/preparedness/Crisis-Management/COVID-19-Response/Pages/Sequence-Based-Surveillance-Submission.aspx

[§§] State, tribal, local, and territorial health departments participating in the NWSS submit testing data to CDC. CDC standardizes, interprets, and presents these data. How often sites collect wastewater samples and how frequently data are reported to CDC varies by health department. NWSS data for SARS-CoV-2 trends are updated daily, and data for SARS-CoV-2 variants are updated weekly (https://www.cdc.gov/nwss/index.html). The Traveler-Based Genomic Surveillance Program tracks SARS-CoV-2 variants by collecting samples from international air travelers arriving from more than 30 countries at seven major U.S. airports. These samples are then sent to a laboratory network for PCR testing; all positive samples undergo genomic sequencing. https://wwwnc.cdc.gov/travel/page/travel-genomic-surveillance

[¶¶] https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

[***] Data on disease severity among hospitalized COVID-19 patients are obtained from three large health care data sources that contain information from subsets of U.S. hospitals: BD, PCORnet, and Premier. Although none of these sources is national in scope, viewing trends across these three data sources adds to the overall understanding of COVID-19 disease severity. https://covid.cdc.gov/covid-data-tracker/index.html#hospitalizations-severity

[†††] https://www.cdc.gov/vaccinesafety/index.html

[§§§] https://covid.cdc.gov/covid-data-tracker/#vaccine-confidence; https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/interactive.html

Summary

What is already known about this topic?

Authorizations to collect certain public health data expire at the end of the U.S. public health emergency declaration on May 11, 2023.

What is added by this report?

Changes to the national COVID-19 monitoring strategy and COVID Data Tracker capitalize on marked improvements in multiple surveillance systems. Weekly COVID-19 hospital admission levels and the percentage of all COVID-19–associated deaths will be primary surveillance indicators. Emergency department visits and percentage of positive SARS-CoV-2 laboratory test results will help detect early changes in trends. Genomic surveillance will continue to help identify and monitor SARS-CoV-2 variants.

What are the implications for public health practice?

COVID-19 is an ongoing public health problem that will be monitored with sustainable data sources to guide prevention efforts.

Data Collection That Will Be Discontinued After May 11, 2023

After the expiration of the public health emergency on May 11, 2023, authorizations to collect certain types of public health data expire (Table 1). The COVID Data Tracker includes a page for accessing archived data.[¶¶¶] HHS can no longer require reporting of negative SARS-CoV-2 testing results via CELR reporting. This change removes the ability to monitor the national percentage of positive SARS-CoV-2 test results using the CELR data source. CELR data served as a useful early indicator of SARS-COV-2 transmission during the pandemic. However, since a peak of approximately 17.4 million NAATs performed weekly in January 2022, coinciding with the SARS-CoV-2 Omicron variant surge, the reported weekly volume of NAATs performed declined to less than 1 million by April 26, 2023. This decline is related in part to increased use of antigen tests as well as at-home testing.[****] The CELR data have become more variable in quality or altogether unavailable in many jurisdictions over time. CDC's COVID-19 Community Transmission Levels, which were derived, in part, from CELR data, also will be discontinued.

National reporting of aggregate weekly counts of COVID-19 cases and associated deaths, which CDC compiles using automated data extraction from jurisdictional websites and dashboards and direct submissions, will also be discontinued with the expiration of the public health emergency. This transition is consistent with many state and local health authorities' decisions to discontinue public reporting of these data. Aggregate counts of COVID-19 cases have been useful for monitoring changing trends in incidence but have become less representative of actual rates of SARS-CoV-2 infections or levels of transmission over time, related to decreased laboratory testing, increased home testing, changes in reporting practices, and asymptomatic infections. Early in the pandemic, aggregate reporting from health departments provided more up-to-date counts of total deaths than did NVSS, but the timeliness of NVSS is now comparable with that of the aggregate counts (*8*,*9*). As part of the shift from reporting of aggregate death count data to use of NVSS data, date of death will be used rather than report date.

CCLs are based on a composite metric that includes COVID-19 hospital admission rates, inpatient bed utilization among patients with COVID-19, and case rates derived from aggregate reporting of case counts by jurisdictions. Because aggregate weekly case counts will end, CCLs also will end on May 11, 2023. Hospital admissions levels from NHSN closely align with CCLs (*8*) and will replace the CCL metric. Monthly reporting of case, hospitalization, and mortality rates by vaccination status will end with the expiration of the public health emergency.

Discussion

Beginning in 2020, the historic response to the COVID-19 pandemic necessitated rapid improvements in processing, reporting, and visualizing of timely and granular public health surveillance data on an unprecedented scale. In 2023, as part of the transition of COVID-19 from emergency to routine public health program activities, CDC has established the Coronavirus and Other Respiratory Viruses Division,[††††] which is committed to working with state, tribal, local, territorial, federal, and other partners on the prevention of COVID-19 within a sustainable and integrated surveillance strategy that monitors other circulating respiratory viruses and prevention measures, including vaccination, to provide timely and comprehensive situational awareness. In the past year, CDC has developed several public dashboards displaying data on hospitalizations or ED visits for diagnosed or laboratory-confirmed COVID-19, influenza, and respiratory syncytial virus.[§§§§]

Monitoring the impact of COVID-19 and the effectiveness of prevention and control strategies continues to be a public health priority during the transition from the emergency phase of the COVID-19 response to routine public health practice. Approximately 1,000 COVID-19–associated weekly deaths were reported in early April 2023; COVID-19–associated deaths are largely preventable through receipt of updated COVID-19 vaccine and timely administration of therapeutics[¶¶¶¶] (*1*–*4*).

[¶¶¶] https://covid.cdc.gov/covid-data-tracker/#archived

[****] https://data.cdc.gov/Public-Health-Surveillance/U-S-COVID-19-Self-Test-Data/275g-9x8h

[††††] https://www.federalregister.gov/documents/2023/02/13/2023-02930/establishment-of-the-coronavirus-and-other-respiratory-viruses-division

[§§§§] https://www.cdc.gov/ncird/surveillance/respiratory-illnesses/index.html; https://www.cdc.gov/surveillance/resp-net/dashboard.html

[¶¶¶¶] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html

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Corresponding author: Benjamin Silk, bsilk@cdc.gov.

[1]Coronavirus and Other Respiratory Viruses Division, National Center for Immunization and Respiratory Diseases, CDC; [2]Office of Public Health Data, Surveillance, and Technology, CDC; [3]Office of Innovation and Analytics, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia; [4]Division of Vital Statistics, National Center for Health Statistics, CDC; [5]Division of Healthcare Quality and Promotion, National Center for Emerging and Zoonotic Diseases, CDC; [6]Division of Emergency Operations, Center for Preparedness and Response, CDC; [7]Booz Allen Hamilton, McLean, Virginia; [8]Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Diseases, CDC; [9]Immunization Services Division, National Center for Immunization and Respiratory Diseases, CDC.

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Correlations and Timeliness of COVID-19 Surveillance Data Sources and Indicators — United States, October 1, 2020–March 22, 2023

Heather M. Scobie, PhD[1,*]; Mark Panaggio, PhD[2,*]; Alison M. Binder, MS[3]; Molly E. Gallagher, PhD[2]; William M. Duck, MPH[1,4]; Philip Graff, PhD[2]; Benjamin J. Silk, PhD[1]

On May 5, 2023, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

When the U.S. COVID-19 public health emergency declaration expires on May 11, 2023, national reporting of certain categories of COVID-19 public health surveillance data will be transitioned to other data sources or will be discontinued; COVID-19 hospitalization data will be the only data source available at the county level (*1*). In anticipation of the transition, national COVID-19 surveillance data sources and indicators were evaluated for purposes of ongoing monitoring. The timeliness and correlations among surveillance indicators were analyzed to assess the usefulness of COVID-19–associated hospital admission rates as a primary indicator for monitoring COVID-19 trends, as well as the suitability of other replacement data sources. During April 2022–March 2023, COVID-19 hospital admission rates from the National Healthcare Safety Network (NHSN)[†] lagged 1 day behind case rates and 4 days behind percentages of positive test results and COVID-19 emergency department (ED) visits from the National Syndromic Surveillance Program (NSSP). In the same analysis, National Vital Statistics System (NVSS) trends in the percentage of deaths that were COVID-19–associated, which is tracked by date of death rather than by report date, were observable 13 days earlier than those from aggregate death count data, which will be discontinued (*1*). During October 2020–March 2023, strong correlations were observed between NVSS and aggregate death data (0.78) and between the percentage of positive SARS-CoV-2 test results from the National Respiratory and Enteric Viruses Surveillance System (NREVSS) and COVID-19 electronic laboratory reporting (CELR) (0.79), which will also be discontinued (*1*). Weekly COVID-19 Community Levels (CCLs) will be replaced with levels of COVID-19 hospital admission rates (low, medium, or high) which demonstrated >99% concordance by county during February 2022–March 2023. COVID-19–associated hospital admission levels are a suitable primary metric for monitoring COVID-19 trends, the percentage of COVID-19 deaths is a timely disease severity indicator, and the percentages of positive SARS-CoV-2 test results from NREVSS and ED visits serve as early indicators for COVID-19 monitoring. Collectively, these surveillance data sources and indicators can support monitoring of the impact of COVID-19 and related prevention and control strategies as ongoing public health priorities.

Authorizations to collect certain categories of public health data will expire on May 11, 2023 (*1*), including national data on the percentage of positive SARS-CoV-2 test results from CELR (*2*); national reporting of aggregate case and death counts, which CDC compiles from official public health jurisdiction sources, will also be discontinued (*3*). CDC will transition to using provisional mortality data from NVSS as the primary data source on COVID-19 deaths (*4*) and to using SARS-CoV-2 test positivity data from NREVSS, an established sentinel network of more than 450 clinical, public health, and commercial laboratories (*5*). Finally, county COVID-19 hospital admission levels based on admission rates per 100,000 population will replace CCLs[§] as a primary metric for COVID-19 monitoring. CCLs were first designed to assist communities and members of the public in making prevention decisions based on local context and unique needs (*6*).

Statistical measures were used to compare trends in moving 7-day averages for COVID-19 surveillance indicators during October 1, 2020–March 22, 2023, including cross-correlation, autocorrelation, pairwise correlations, and a geographic consistency metric at the state level. Daily averages were available for most data sources; weekly data were available for NVSS,[¶] NREVSS, and aggregate case and death counts after a shift to weekly cadence in October 2022, with some jurisdictions continuing to report daily totals. Cross-correlation was used to estimate the lag (offset in days) in indicators relative to

[*] These authors contributed equally to this report.

[†] As of December 15, 2022, COVID-19 hospital data are required to be reported to CDC's NHSN, which monitors national and local trends in health care system stress, capacity, and community disease levels for approximately 6,000 hospitals in the United States. Data reported by hospitals to NHSN represent aggregated counts and include metrics capturing information specific to hospital capacity, occupancy, hospitalizations, and admissions. Before December 15, 2022, hospitals reported data directly to the U.S. Department of Health and Human Services (HHS) or via a state submission for collection in the HHS Unified Hospital Data Surveillance System.

[§] CCLs are a composite metric using COVID-19 hospital admissions per 100,000 population, the percentage of inpatient beds occupied by COVID-19 patients from NHSN, and COVID-19 cases per 100,000 population from aggregate case reporting at the county or county-equivalent level. Because of the choice of thresholds for each of these data elements, the hospital admissions rate is the primary determinant of the CCL for any county, and CCLs for each county will be as high as or higher than the corresponding COVID-19 hospital admission level (i.e., categorized using identical rate thresholds).

[¶] NVSS data also contained suppressed values for areas and weeks with counts between 1 and 9. Suppressed counts were treated as 1 when calculating percentage of deaths and deaths per 100,000 population. A sensitivity analysis that replaced suppressed counts with 9 obtained similar results.

COVID-19–associated hospital admission rates** during April 1, 2022–March 22, 2023, by calculating Spearman's correlation coefficients by state with reporting lags from −35 days to 35 days over a moving 12-week window; the lag that produced the highest mean correlation was selected. Lags were adjusted to obtain temporal alignment of indicators in subsequent analyses. Pairwise Spearman's correlations were used to evaluate associations between indicators, and mean correlations were calculated and ranked. Spearman's autocorrelations were used to assess the signal-to-noise ratio for each indicator (compared with itself, offset by 7 days). Geographic consistency was evaluated using a metric calculated by computing daily z-scores for each indicator, averaging these scores by U.S. state, and computing the standard deviation over all states. Surveillance indicators with lower values for the geographic consistency metric were less likely to have jurisdictions consistently reporting higher or lower than average indicator values.

A linear regression model†† was fit for each surveillance indicator during October 1, 2020–March 31, 2022, and April 1, 2022–March 22, 2023, to estimate ratios (slopes) relative to the COVID-19–associated hospital admission rates. To categorize indicators for data visualized on maps, the calculated ratios were used to identify thresholds for each indicator that were anchored to hospital admission rates used in the CCLs (10 and 20 admissions per 100,000 population), but the lower two categories were divided to increase resolution during periods of lower incidence (five, 10, 15, and 20 admissions per 100,000 population). Percent agreement for weekly CCLs and COVID-19 hospital admission levels (<10.0, 10.0–19.9, and ≥20.0 per 100,000 population) was calculated among the 3,220 U.S. counties (and county-equivalent areas) during February 24, 2022–March 23, 2023 (i.e., since the CCLs were launched). The analysis was carried out using Python (version 3.8.6; Python Software Foundation) with packages Pandas (version 1.5.2) and NumPy (version 1.21.6) for all correlations. Linear regression was carried out using scikit-learn (version 1.1.1). This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.§§

Normalized trends in surveillance indicators largely aligned over time; differences were observed in lag and proportionality relative to hospital admission rates for both early indicators of COVID-19 activity and disease severity indicators (Figure). Analysis of cross-correlations between surveillance indicators showed that trends in hospital admission rates lagged 1 day behind case rates and 4 days behind the percentages of COVID-19 ED visits and positive test results (either from CELR or NREVSS [i.e., early indicators]) (Table 1). Severity indicators that lagged behind hospital admission rates included inpatient and intensive care unit (ICU) bed occupancy (3–4 days) and deaths (8 days for NVSS and 21 days for aggregate death counts).

Rates of COVID-19–associated hospital admissions and percentages of inpatient beds occupied by COVID-19 patients, deaths that were COVID-19–associated, and ED visits with a diagnosis of COVID-19 had the highest mean correlations for capturing trends across all indicators (Table 2). Hospital admission rates exhibited both a high signal-to-noise ratio and a low geographic consistency, suggesting that this indicator might provide more easily interpretable and reliable information than others. Since October 2020, correlation was strong (*7*) between death rates from NVSS and aggregate death counts (0.79) and between NREVSS and CELR positive test results (0.79); correlation since April 2022 was lower for deaths (0.41) and slightly lower for positive test results (0.70).

Estimated ratios for percentage of positive test results relative to hospital admission rates from both CELR and NREVSS have increased since April 2022 related to decreased testing volumes, although CELR was more affected, possibly related to differential reporting of negative results (Table 1) (Figure).¶¶ The ratios for percentage of ICU beds occupied by COVID-19 patients, percentage of deaths that are COVID-19–associated, and rates of COVID-19 deaths have decreased relative to hospital admissions since April 2022, likely due to decreased severity of recent infections as a consequence of high population levels of vaccine- and infection-induced immunity, improvements in medical treatment, and changes in variants over time.

A comparison of CCL and COVID-19 hospital admission level designations (low, medium, or high) by week during February 2022–March 2023 demonstrated >99% concordance among 3,220 counties (Supplementary Figure, https://stacks.cdc.gov/view/cdc/127731). Most discordant levels were reported during periods of high COVID-19 incidence during February and March 2022. When the levels were discordant, CCLs exceeded the hospital admission levels.

Discussion

This evaluation of national COVID-19 surveillance data sources and indicators was performed in anticipation of the transition from the COVID-19 pandemic response to routine public health activities that require sustainable sources

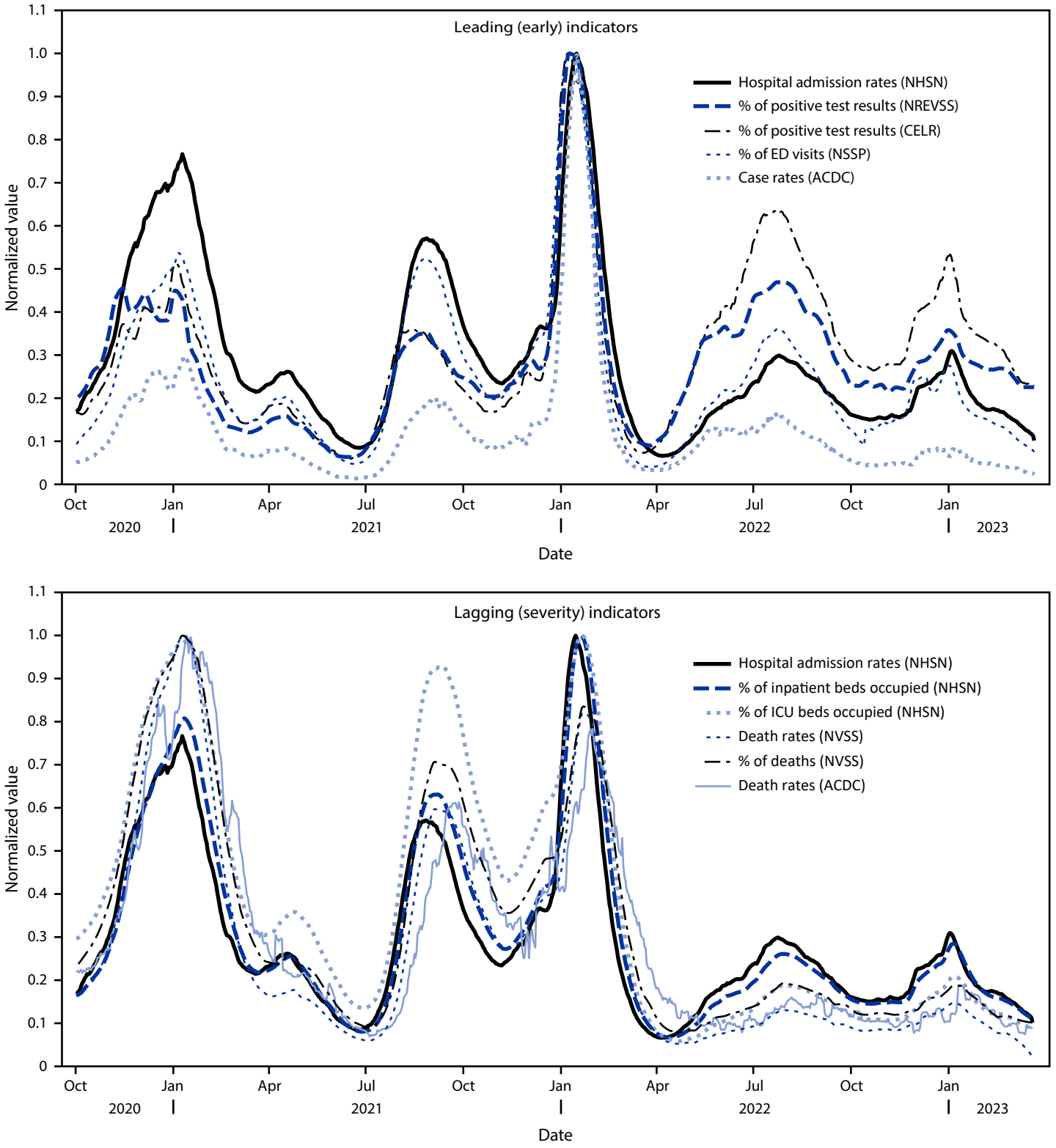
** Negative lags correspond to indicators that precede hospital admissions, and positive lags correspond to indicators that follow admissions. Null values were omitted during these calculations.

†† This model took the form y = mx + b where *x* represents the hospital admission rate, *y* represents the indicator of interest, the slope *m* represents the ratio between indicators, and the intercept *b* was fixed at zero. In this formulation, the ratio can be interpreted as the increase in the indicator of interest (*y*) corresponding to a one-unit increase in admissions per 100,000 population (*x*).

§§ 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.0 Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

¶¶ The CELR data have become more variable in quality or altogether unavailable in many jurisdictions over time.

FIGURE. Trends in normalized values* of leading (A) and lagging (B)† COVID-19 surveillance indicators — United States, October 1, 2020–March 22, 2023



Abbreviations: ACDC = aggregate cases and death counts; CELR = COVID-19 electronic laboratory reporting; ED = emergency department; ICU = intensive care unit; NHSN = National Healthcare Safety Network; NREVSS = National Respiratory and Enteric Viruses Surveillance System; NVSS = National Vital Statistics System.
* Normalized values were obtained by dividing each indicator by its maximum over the displayed time frame, which fixes the peak for each curve at 1.
† Leading or lagging indicators were defined relative to hospital admission rates, which are shown in each panel.

TABLE 1. Summary of estimated time lags and ratios for COVID-19 surveillance indicators relative to hospital admission rates per 100,000 population at the state or territory level, by period — United States, October 1, 2020–March 22, 2023

Data (source)	COVID-19 indicator*	Estimated lag (days) vs. hospital admission rates†	Ratios with hospital admission rates by period§		Category threshold values from May 11, 2023¶
		Apr 1, 2022–Mar 22, 2023	Oct 1, 2020–Mar 31, 2022	Apr 1, 2022–Mar 22, 2023	
COVID-19–associated hospitalizations (NHSN)**	Admissions per 100,000 population	0	1.00	1.00	10 and 20
COVID-19 cases (ACDC)††	Cases per 100,000 population	−1	18.04	15.52	NA
ED visits for COVID-19 (NSSP)§§	% of all ED visits	−4	0.23	0.31	1.5, 3.0, 4.5, and 6.0
COVID-19–associated hospitalizations (NHSN)**	% of inpatient beds occupied	3	0.43	0.40	2.0, 4.0, 6.0, and 8.0
COVID-19–associated hospitalizations (NHSN)**	% of ICU beds occupied	4	0.86	0.44	2.0, 4.0, 6.0, and 8.0
COVID-19–associated deaths (NVSS)¶¶	% of all deaths	8	0.66	0.38	2.0, 4.0, 6.0, and 8.0
COVID-19–associated deaths (NVSS)¶¶	Deaths per 100,000 population	8	0.17	0.07	Auto
COVID-19–associated deaths (ACDC)††	Deaths per 100,000 population	21	0.13	0.08	NA
Positive SARS-CoV-2 test results (CELR)***	% of positive NAAT rest results	−4	0.49	1.37	NA
Positive SARS-CoV-2 test results (NREVSS)†††	% of positive NAAT test results	−4	0.48	1.02	5.0, 10.0, 15.0, and 20.0

Abbreviations: ACDC = aggregate cases and death counts; Auto = automatic assignment of six categories based on dynamic natural breaks; CCL = COVID-19 Community Level; CELR = COVID-19 electronic laboratory reporting; ED = emergency department; HHS = U.S. Department of Health and Human Services; ICU = intensive care unit; NA = not applicable after May 11, 2023; NAAT = nucleic acid amplification test; NHSN = National Healthcare Safety Network; NREVSS = National Respiratory and Enteric Viruses Surveillance System; NSSP = National Syndromic Surveillance Program; NVSS = National Vital Statistics System.

* Moving 7-day averages were used for all indicators. These averages were available daily for all data sources except NVSS and NREVSS, which were available weekly.

† Cross-correlation was used to calculate the lag (number of days) in indicators relative to hospital admissions as follows: Spearman's correlations between indicators compared with hospital admission rates per 100,000 population were computed over a moving 12-week window. The offset (ranging from −35 days to 35 days) in indicators that produced the highest mean correlation across all windows and states is displayed. Negative lags correspond to indicators that lead admissions and positive lags correspond to indicators that lag admissions.

§ A linear regression model $y = mx + b$ was fit where x represents the hospital admission rate, y represents the indicator of interest, m represents the ratio between indicators, and the intercept b was fixed at zero, such that for a one-unit rise in admissions per 100,000 population (x), the indicator of interest (y) will increase by the ratio value.

¶ To categorize indicators for data visualized in maps on COVID Data Tracker, the calculated ratios were used to identify thresholds for each indicator that were anchored to hospital admission rates used in the CCLs (10 and 20 admissions per 100,000 population), but the lower two categories were divided to increase resolution during periods of lower incidence (five, 10, 15, and 20 admissions per 100,000 population).

** As of December 15, 2022, COVID-19 hospital data are required to be reported to CDC's NHSN, which monitors national and local trends in health care system stress, capacity, and community disease levels for approximately 6,000 hospitals in the United States. Data reported by hospitals to NHSN represent aggregated counts and include metrics capturing information specific to hospital capacity, occupancy, hospitalizations, and admissions. Before December 15, 2022, hospitals reported data directly to HHS or via a state submission for collection in the HHS Unified Hospital Data Surveillance System. Full guidance on hospital reporting and a list of data elements and definitions can be found online. https://www.hhs.gov/sites/default/files/covid-19-faqs-hospitals-hospital-laboratory-acute-care-facility-data-reporting.pdf

†† National weekly COVID-19 ACDC data are compiled by CDC using automated data extraction from official jurisdictional data sources (e.g., through application programming interfaces) and direct submissions from jurisdictions. ACDC data shifted from daily to weekly cadence in October 2022, with some jurisdictions continuing to report daily totals and others reporting only weekly totals.

§§ NSSP is a collaboration among CDC, local and state health departments, and academic and private partners to collect and analyze electronic health care data, including data from ED visits. NSSP has expanded substantially during the COVID-19 pandemic, with data from 6,300 facilities in all 50 U.S. states, the District of Columbia, and Guam. NSSP includes 75% of all ED visits in the United States. Data are not shown on COVID Data Tracker for states where ED facility participation is low (currently Minnesota and Oklahoma) or diagnosis information is incomplete (currently Missouri). https://www.cdc.gov/nssp/index.html

¶¶ NVSS collects and reports mortality statistics using U.S. death certificate data. These data are provided through contracts between CDC's National Center for Health Statistics and vital registration systems operating in the various jurisdictions legally responsible for the registration of vital events. NVSS data from U.S. territories, other than Puerto Rico, are not included in provisional mortality reporting. https://www.cdc.gov/nchs/nvss/index.htm

*** CELR has become more variable in quality or altogether unavailable in many jurisdictions over time. With the expiration of the COVID-19 public health emergency, HHS can no longer require reporting of negative SARS-CoV-2 laboratory testing results via CELR. https://www.cdc.gov/coronavirus/2019-ncov/lab/reporting-lab-data.html

††† NREVSS collects weekly aggregate SARS-CoV-2 NAAT results from a sentinel network of reporting laboratories in the United States including clinical, public health and commercial laboratories. These data exclude a small proportion of antigen test results and do not include antibody and at-home test results. NREVSS percent positivity data will be added to COVID Data Tracker after May 11, 2023. https://www.cdc.gov/surveillance/nrevss/index.html

of surveillance data and reliable indicators after the end of the public health emergency declaration on May 11, 2023. The evaluation determined that hospital admission rates are a suitable and timely primary indicator for monitoring COVID-19 trends. Using COVID-19 mortality data from NVSS improves timeliness for monitoring disease severity by up to 13 days. Leading indicators such as the percentage of ED visits with a COVID-19 diagnosis and percentage of

TABLE 2. Mean correlation with other indicators, autocorrelation (signal-to-noise), and geographic consistency of COVID-19 surveillance indicators — April 1, 2022–March 22, 2023

COVID-19 indicator (data source)	Mean correlation with other indicators (rank)*	Autocorrelation with a 7-day lag (rank)†	Geographic consistency metric (rank)§
Hospital admissions per 100,000 population (NHSN)¶	0.57 (1)	0.92 (3)	0.64 (5)
Percentage of inpatient beds occupied (NHSN)¶	0.57 (2)	0.96 (1)	0.73 (10)
Percentage of deaths (NVSS)**	0.56 (3)	0.68 (9)	0.61 (4)
Percentage of ED visits (NSSP)††	0.54 (4)	0.90 (5)	0.55 (2)
Percentage of ICU beds occupied (NHSN)¶	0.54 (5)	0.89 (6)	0.65 (6)
Deaths per 100,000 population (NVSS)**	0.53 (6)	0.72 (8)	0.67 (7)
Cases per 100,000 population (ACDC)§§	0.51 (7)	0.90 (4)	0.58 (3)
SARS-CoV-2 percent positivity (CELR)¶¶	0.48 (8)	0.96 (2)	0.73 (9)
SARS-CoV-2 percent positivity (NREVSS)***	0.43 (9)	0.89 (7)	0.70 (8)
Deaths per 100,000 population (ACDC)§§	0.29 (10)	0.51 (10)	0.47 (1)

positive SARS-CoV-2 test results can capture changes in trends approximately 4 days earlier than hospital admission rates and provide complementary monitoring information, albeit with more limited geographic coverage.

COVID-19–associated hospital admission rates are available down to the level of the health service area, which is mapped to counties (*1*). The high concordance with CCLs is not surprising, because COVID-19 hospital admissions are the primary driver of CCLs and apply identical threshold levels, ensuring continuity beyond the public health emergency. One limitation of the existing level thresholds is insufficient granularity to detect changes during periods of low incidence; further monitoring and analysis would be needed before adjusting thresholds.

Early in the pandemic, aggregate death reporting provided more up-to-date death counts than did NVSS, but timeliness for the two systems has become more similar over time because of improvements in NVSS death certificate data processing (*8*). Analysis of the NVSS data by date of death makes the impact of reporting delays on recent deaths more apparent than aggregate death data by date of report (i.e., backfill death

TABLE 2. (*Continued*) Mean correlation with other indicators, autocorrelation (signal-to-noise), and geographic consistency of COVID-19 surveillance indicators — April 1, 2022–March 22, 2023

Abbreviations: ACDC = aggregate cases and death counts; CCL = COVID-19 Community Level; CELR = COVID-19 electronic laboratory reporting; ED = emergency department; HHS = U.S. Department of Health and Human Services; ICU = intensive care unit; NA = not applicable after May 11, 2023; NAAT = nucleic acid amplification test; NHSN = National Healthcare Safety Network; NREVSS = National Respiratory and Enteric Viruses Surveillance System; NSSP = National Syndromic Surveillance Program; NVSS = National Vital Statistics System.

* Pairwise Spearman's correlations were used to evaluate associations between indicators after adjusting for lag, and mean correlations were calculated and ranked.

† Autocorrelations (Spearman's) were used to assess the signal-to-noise ratio for each indicator (compared with itself but offset by 7 days); indicators were ranked based on autocorrelation.

§ Geographic consistency was evaluated using a metric calculated by computing daily z-scores for each indicator, averaging these scores by state, and computing the standard deviation over all states. Surveillance indicators with lower values for the geographic consistency metric are less likely to have jurisdictions consistently reporting indicator values higher or lower than the average. Indicators were ranked based on their geographic consistency metric.

¶ As of December 15, 2022, COVID-19 hospital data are required to be reported to CDC's NHSN, which monitors national and local trends in health care system stress, capacity, and community disease levels for approximately 6,000 hospitals in the United States. Data reported by hospitals to NHSN represent aggregated counts and include metrics capturing information specific to hospital capacity, occupancy, hospitalizations, and admissions. Before December 15, 2022, hospitals reported data directly to HHS or via a state submission for collection in the HHS Unified Hospital Data Surveillance System. Full guidance on hospital reporting and a list of data elements and definitions can be found online. https://www.hhs.gov/sites/default/files/covid-19-faqs-hospitals-hospital-laboratory-acute-care-facility-data-reporting.pdf

** NVSS collects and reports mortality statistics using U.S. death certificate data. These data are provided through contracts between CDC's National Center for Health Statistics and vital registration systems operating in the various jurisdictions legally responsible for the registration of vital events. NVSS data from U.S. territories, other than Puerto Rico, are not included in provisional mortality reporting. https://www.cdc.gov/nchs/nvss/index.htm

†† NSSP is a collaboration among CDC, local and state health departments, and academic and private partners to collect and analyze electronic health care data, including data from emergency department visits. NSSP has expanded substantially during the COVID-19 pandemic, with data from 6,300 facilities in all 50 U.S. states, the District of Columbia, and Guam. NSSP includes 75% of all emergency department visits in the United States. Data are not shown on COVID Data Tracker for states where ED facility participation is low (currently Minnesota and Oklahoma) or diagnosis information is incomplete (currently Missouri). https://www.cdc.gov/nssp/index.html

§§ National weekly COVID-19 ACDC data are compiled by CDC using automated data extraction from official jurisdictional data sources (e.g., through application programming interfaces) and direct submissions from jurisdictions. ACDC data shifted from daily to weekly cadence in October 2022, with some jurisdictions continuing to report daily totals and others reporting only weekly totals.

¶¶ Percent positivity from CELR have become more variable in quality or altogether unavailable in many jurisdictions over time. With the expiration of the COVID-19 public health emergency, HHS can no longer require reporting of negative SARS-CoV-2 laboratory testing results via CELR. https://www.cdc.gov/coronavirus/2019-ncov/lab/reporting-lab-data.html

*** NREVSS collects weekly aggregate SARS-CoV-2 NAAT results from a sentinel network of reporting laboratories in the United States including clinical, public health and commercial laboratories. These data exclude a small proportion of antigen test results and do not include antibody and at-home test results. NREVSS percent positivity data will be added to COVID Data Tracker after May 11, 2023. https://www.cdc.gov/surveillance/nrevss/index.html

Summary

What is already known about this topic?

COVID-19 monitoring will remain a public health priority after the U.S. public health emergency declaration expires on May 11, 2023.

What is added by this report?

Assessment of available surveillance indicators found that COVID-19 hospital admission levels were concordant with COVID-19 Community Levels. COVID-19–associated hospital admission rates lagged 1 day behind case rates and 4 days behind percentages of COVID-19 emergency department visits and positive SARS-CoV-2 test results. National Vital Statistics System trends in the percentage of COVID-19 deaths strongly correlated with, and were 13 days timelier, than aggregate death count data.

What are the implications for public health practice?

Rates of COVID-19–associated hospital admission and the percentages of positive test results, COVID-19 emergency department visits, and COVID-19 deaths are suitable and timely indicators of trends in COVID-19 activity and severity.

counts are assigned to recent report dates rather than the dates when the deaths occurred). However, NVSS data elements are more complete (e.g., for race and ethnicity), and the percentage of COVID-19 deaths from NVSS is not biased by incomplete reporting in recent weeks because death certificate data from COVID-19 and all causes have similar timeliness (*4*).

Over the course of the pandemic, the NSSP network has expanded considerably with ED visit data available for most jurisdictions (*1*). The data source for percentage of positive SARS-CoV-2 test results will change from CELR to NREVSS after the public health emergency declaration expires and will be reported at the regional level because of limited numbers of reporting laboratories in some states (*1*). Voluntary reporting to NREVSS has been used for many years to track the percentage of positive test results for numerous respiratory viruses including influenza and respiratory syncytial virus (*5*).

The findings in this report are subject to at least three limitations. First, it was not possible to distinguish between lags related to time to event (e.g., time from infection until death) and reporting delays. Further, retrospective findings do not account for reporting lags affecting recent data or potential future changes to reporting cadence (e.g., change from daily to weekly reporting), including for hospitalization data (*1*). As such, the lags presented serve as lower bounds on the effective lag when using these data for real-time monitoring, especially for recent weeks with incomplete reporting. Second, data availability is changing with the end of public health emergency declaration on May 11, 2023, and data availability and quality will likely continue to change over time, potentially affecting their utility for COVID-19 monitoring. The current analysis focused on available data sources moving forward. Finally, this national evaluation used states and territories as a geographic unit of analysis, but findings might vary by jurisdiction based on geographic heterogeneity. This report can serve as a model for similar evaluations that could be undertaken at state levels.

COVID-19 hospital admission rates from NHSN are a timely and suitable primary indicator for monitoring trends in COVID-19 activity. Using the percentage of COVID-19 deaths from NVSS will allow more timely monitoring of COVID-19 severity and mortality trends. The percentage of COVID-19 ED visits and percentage of positive test results can serve as early indicators for COVID-19 trend monitoring. Collectively, these surveillance data sources and indicators can support monitoring of the impact of COVID-19 and related prevention and control strategies as ongoing public health priorities.

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Corresponding author: Heather M. Scobie, vih8@cdc.gov.

[1]Coronavirus and Other Respiratory Viruses Division, National Center for Immunization and Respiratory Diseases, CDC; [2]Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland; [3]Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [4]Office of Public Health Data, Surveillance, and Technology, CDC.

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Notes from the Field

First Reported U.S. Cases of Tinea Caused by *Trichophyton indotineae* — New York City, December 2021–March 2023

Avrom S. Caplan, MD[1]; Sudha Chaturvedi, PhD[2]; YanChun Zhu, MS[2]; Gabrielle C. Todd, PhD[2]; Lu Yin, MD[1]; Adriana Lopez, MD[1]; Lisa Travis, MD[1]; Dallas J. Smith, PharmD[3,4]; Tom Chiller, MD[3]; Shawn R. Lockhart, PhD[3]; Karen A. Alroy, DVM[5]; William G. Greendyke, MD[5]; Jeremy A. W. Gold, MD[3]

Tinea is a common, highly contagious, superficial infection of the skin, hair, or nails caused by dermatophyte molds.* During the past decade, an epidemic of severe, antifungal-resistant tinea has emerged in South Asia because of the rapid spread of *Trichophyton indotineae*,† a novel dermatophyte species; the epidemic has likely been driven by misuse and overuse of topical antifungals and corticosteroids§ (*1*,*2*). *T. indotineae* infections are highly transmissible and characterized by widespread, inflamed, pruritic plaques on the body (tinea corporis), the crural fold, pubic region, and adjacent thigh (tinea cruris), or the face (tinea faciei) (*1*). *T. indotineae* isolates are frequently resistant to terbinafine, a mainstay of tinea treatment (*1*,*3*). *T. indotineae* infections have been reported throughout Asia and in Europe and Canada but have not previously been described in the United States (*3*).

On February 28, 2023, a New York City dermatologist notified public health officials of two patients who had severe tinea that did not improve with oral terbinafine treatment, raising concern for potential *T. indotineae* infection; these patients shared no epidemiologic links. Skin culture isolates from each patient were previously identified by a clinical laboratory as *Trichophyton mentagrophytes* and were subsequently forwarded to the Wadsworth Center, New York State Department of Health, for further review and analysis. Sanger sequencing of the internal transcribed spacer region of the ribosomal gene, followed by phylogenetic analysis performed during March 2023, identified the isolates as *T. indotineae* (Supplementary Figure; https://stacks.cdc.gov/view/cdc/127678). Activity related to this investigation was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.¶

Patient A, a woman aged 28 years, developed a widespread pruritic eruption during summer 2021. She had a first dermatologic evaluation in December 2021, at which time she was in her third trimester of pregnancy. She had no other underlying medical conditions, no known exposures to a person with similar rash, and no recent international travel history. Dermatologists noted large, annular, scaly, pruritic plaques over the neck, abdomen, pubic region, and buttocks (Figure). She received a diagnosis of tinea and began oral terbinafine therapy in January 2022 after the birth of her baby. Because her eruptions did not improve after 2 weeks of therapy, terbinafine was discontinued, and she began itraconazole treatment. The rash resolved completely after completing a 4-week course of itraconazole; however, she is being monitored for potential recurrence of infection and the need for resumption of itraconazole.

Patient B, a woman aged 47 years with no major medical conditions, developed a widespread, pruritic eruption in summer 2022 while in Bangladesh. There, she received treatment with topical antifungal and steroid combination creams and noted that several family members were experiencing similar eruptions. After returning to the United States, she visited an emergency department three times during autumn 2022. She was prescribed hydrocortisone 2.5% ointment and diphenhydramine (visit 1), clotrimazole cream (visit 2), and terbinafine cream (visit 3) with no improvement. In December 2022, she was evaluated by dermatologists who noted widespread, discrete, scaly, annular, pruritic plaques affecting the thighs and buttocks (Figure). She received a 4-week course of oral terbinafine, but her symptoms did not improve. She then received a 4-week course of griseofulvin therapy, resulting in approximately 80% improvement. Itraconazole therapy is being considered pending further evaluation given the recent confirmation of suspected *T. indotineae* infection. Her son and husband, who live in the same house and report similar eruptions, are currently undergoing evaluation.

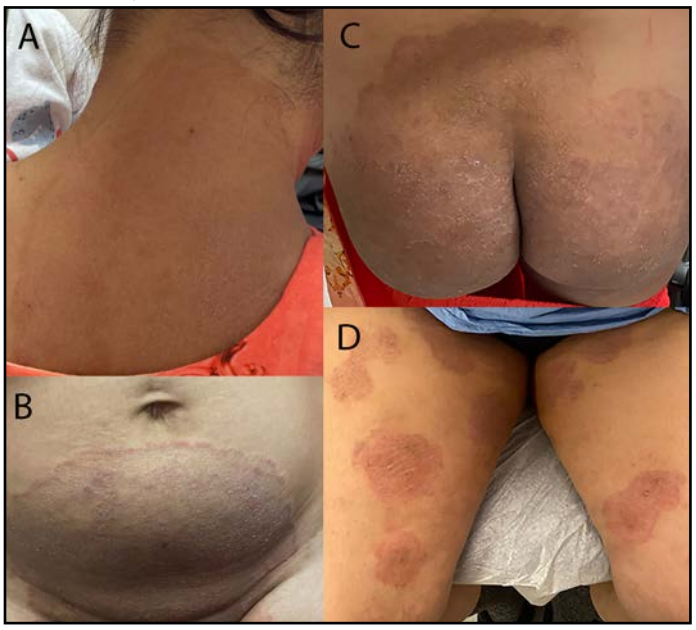
* Commonly known as "ringworm," tinea is most often caused by dermatophyte molds belonging to the genus *Trichophyton*. The infection spreads easily by skin-to-skin contact with infected animals or persons, secondary spread from other affected body sites, and fomites. Most skin infections are localized and resolve with topical antifungal treatment, and oral antifungal therapy is generally reserved for cases that do not improve with topical treatment or those with extensive disease or infection of the hair follicles. https://www.cdc.gov/fungal/diseases/ringworm/definition.html

† The etiologic agent causing the epidemic of drug-resistant tinea in South Asia was initially identified as *T. mentagrophytes* ITS genotype VIII. However, based on recent genomic studies, scientists determined that these frequently terbinafine-resistant *Trichophyton* strains were sufficiently different from *T. mentagrophytes* to be considered a new species, *T. indotineae*.

§ The emergence and spread of *T. indotineae* in South Asian countries have been linked to the inappropriate use of widely available topical combination creams containing antifungals, antibiotics, and high-potency corticosteroids. https://www.cdc.gov/fungal/diseases/ringworm/dermatophyte-resistance.html

¶ 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. Lesions occurring on two patients with first reported U.S. cases of tinea caused by *Trichophyton indotineae*, on patient A's neck, abdomen, and buttocks (A–C)* and on patient B's thighs† (D) — New York City, December 2021–March 2023



Photos/Lu Yin (A–C) and Vignesh Ramachandran (D). Used with patients' permission.

* At initial dermatology evaluation, patient A had large, annular, scaly, and pruritic erythematous plaques of the neck, abdomen, groin, and buttocks.

† At initial dermatology evaluation, patient B had widespread, discrete, scaly, annular, pruritic plaques affecting the thighs and buttocks.

The cases in these two patients highlight several important points. Patient A had no recent international travel history, suggesting potential local U.S. transmission of *T. indotineae*. Health care providers should consider *T. indotineae* infection in patients with widespread tinea, particularly when eruptions do not improve with first-line topical antifungal agents or oral terbinafine. Culture-based identification techniques used by most clinical laboratories typically misidentify *T. indotineae* as *T. mentagraphytes* or *T. interdigitale*; correct identification requires genomic sequencing. Health care providers who suspect *T. indotineae* infection should contact their state or local public health department for assistance with testing,** which is available at certain public health laboratories and specialized academic and commercial laboratories. Successful treatment using oral itraconazole, a triazole antifungal, has been documented. However, providers should be aware of challenges with itraconazole absorption,†† which can lead to variable serum drug concentrations; itraconazole's interactions with other drugs; the need for up to 12 weeks of therapy (*3*); and the documented emergence of triazole resistance (*4*,*5*). Antimicrobial stewardship efforts are essential to minimize the misuse and overuse of prescribed and over-the-counter antifungal drugs and corticosteroids. In addition, health care providers can educate patients about strategies to prevent the spread of the dermatophytes that cause tinea.§§ Finally, public health surveillance efforts and increased testing could help detect and monitor the spread of *T. indotineae*.

** Public health officials who are concerned about potential cases of drug-resistant tinea infections can email fungaloutbreaks@cdc.gov for assistance with recommendations and testing.

†† https://www.accessdata.fda.gov/drugsatfda_docs/label/2010/022484s000lbl.pdf

§§ https://www.cdc.gov/fungal/diseases/ringworm/risk-prevention.html

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Corresponding author: Avrom S. Caplan, Avrom.Caplan@nyulangone.org.

[1]The Ronald O. Perelman Department of Dermatology, NYU Grossman School of Medicine, New York, New York; [2]Wadsworth Center, New York State Department of Health; [3]Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [4]Epidemic Intelligence Service, CDC; [5]New York City Department of Health and Mental Hygiene, New York, New York.

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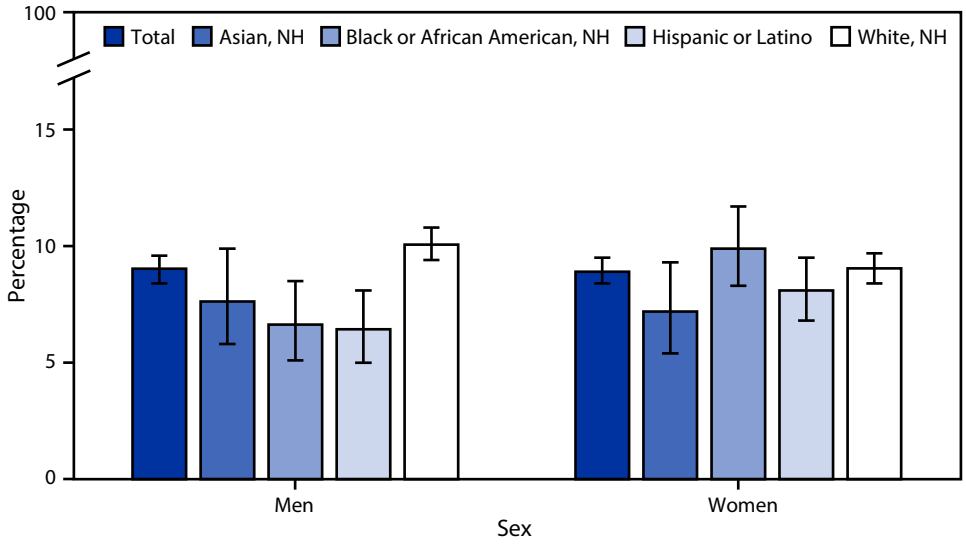
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Percentage* of Adults Aged ≥18 Years Who Had a Repetitive Strain Injury During the Past 3 Months,† by Sex and Race and Hispanic Origin§ — National Health Interview Survey, United States, 2021¶



Abbreviation: NH = non-Hispanic.

* Age-adjusted percentages are based on the 2000 U.S. Census Bureau standard population, using age groups 18–44, 45–64, 65–74, and ≥75 years, with 95% CIs indicated by error bars.

† Based on a positive response to the question, "During the past 3 months, did you have any injuries due to repetitive strain?"

§ Race groups are non-Hispanic; persons of Hispanic origin can be of any race. Total includes all adults, including other race groups not shown separately.

¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2021, 9.0% of men and 8.9% of women aged ≥18 years had a repetitive strain injury during the past 3 months. Non-Hispanic White men (10.1%) were more likely to have a repetitive strain injury than were non-Hispanic Asian (Asian) (7.6%), non-Hispanic Black or African American (Black) (6.6%), and Hispanic or Latino (Hispanic) (6.4%) men. Black women (9.9%) were more likely to have a repetitive strain injury than were Asian women (7.2%); there were no significant differences between other race and Hispanic origin groups for women. Among Black persons, men were less likely to have a repetitive strain injury than were women. Percentages of repetitive strain injuries among other race and Hispanic origin groups were similar between men and women.

Source: National Center for Health Statistics, National Health Interview Survey, 2021. https://www.cdc.gov/nchs/nhis/index.htm

Reported by: Merianne R. Spencer, MPH, MSpencer@cdc.gov; Nazik Elgaddal, MS; Matthew F. Garnett, MPH.

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