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Impact of COVID-19 on Cervical Cancer Screening Rates Among Women Aged 21–65 Years in a Large Integrated Health Care System — Southern California, January 1–September 30, 2019, and January 1–September 30, 2020

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On March 19, 2020, the governor of California issued a statewide stay-at-home order to contain the spread of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19).* The order reduced accessibility to and patient attendance at outpatient medical visits,† including preventive services such as cervical cancer screening. In-person clinic visits increased when California reopened essential businesses on June 12, 2020.§ Electronic medical records of approximately 1.5 million women served by Kaiser Permanente Southern California (KPSC), a large integrated health care system, were examined to assess cervical cancer screening rates before, during, and after the stay-at-home order. KPSC policy is to screen women aged 21–29 years every 3 years with cervical cytology alone (Papanicolaou [Pap] test); those aged 30–65 years were screened every 5 years with human papillomavirus (HPV) testing and cytology (cotesting) through July 15, 2020, and after July 15, 2020, with HPV testing alone, consistent with the latest recommendations from U.S. Preventive Services Task Force.¶ Compared with the 2019 baseline, cervical cancer screening rates decreased substantially during the stay-at-home order. Among women aged 21–29 years, cervical cytology screening rates per 100 person-months declined 78%. Among women aged 30–65 years, HPV test screening rates per 100 person-months decreased 82%. After the stay-at-home order was lifted, screening rates returned to near baseline, which might have been aided by aspects of KPSC's integrated, organized screening program (e.g., reminder systems and tracking persons lost to follow-up). As the pandemic continues, groups at higher risk for developing cervical cancers and precancers should be evaluated first. Ensuring that women receive preventive services, including cancer screening and appropriate follow-up in a safe and timely manner, remains important.

* https://covid19.ca.gov/img/N-33-20.pdf
† https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/ResumingCalifornia%E2%80%99sDeferredandPreventiveHealthCare.aspx
§ https://covid19.ca.gov/safer-economy
¶ https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/cervical-cancer-screening. KPSC was using one of three USPSTF-recommended strategies before July 15, 2020, then switched to another HPV-based strategy after that date.

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This study examined cervical cancer screening rates in women before the stay-at-home order (January 1–March 18, 2020), during the stay-at-home order (March 19–June 11, 2020), and after the stay-at-home order was lifted (June 12–September 30, 2020), compared with the same periods during January 1–September 30, 2019. Electronic medical records of women aged 21–65 years who were enrolled KPSC members for ≥1 day during this period were examined. Women with no cervix (e.g., total hysterectomy) or with a history of precancer (cervical intraepithelial neoplasia grades 2–3) or cervical cancer were excluded using relevant diagnosis and procedure codes (Supplementary Table, https://stacks.cdc.gov/view/cdc/100500). Age-specific cervical cancer screening tests per 100 person-months (cervical cancer screening rates) were calculated. Analyses were conducted using SAS (version 9.4; SAS Institute) and R (version 4.0.3; The R Foundation) software. This activity was reviewed and approved by the Kaiser Permanente Southern California Institutional Review Board, and informed consent was waived.**

The cohort included 1,455,244 women enrolled as KPSC members during January 1–September 30, 2019, and 1,492,442 women during January 1–September 30, 2020. KPSC membership enrollment was stable, with similar age group and race/ethnicity distributions in both periods (Table 1).

** 45 C.F.R. part 46; 21 C.F.R. part 56.

TABLE 1. Demographic characteristics of study population,* by age group† and race/ethnicity — Kaiser Permanente Southern California, January 1–September 30, 2019 and January 1–September 30, 2020

Characteristic	No. (%), Jan 1–Sep 30 2019	No. (%), Jan 1–Sep 30 2020
Total	1,455,244	1,492,442
Age group, yrs		
21–29	358,136 (24.61)	357,251 (23.94)
30–65	1,097,108 (75.39)	1,135,191 (76.06)
Race/Ethnicity		
Hispanic	609,057 (41.85)	617,566 (41.38)
American Indian/Alaska Native, non-Hispanic	3,032 (0.21)	3,004 (0.20)
Asian/Pacific Islander, non-Hispanic	186,841 (12.84)	186,405 (12.49)
Black, non-Hispanic	112,664 (7.74)	112,043 (7.51)
White, non-Hispanic	415,531 (28.55)	406,041 (27.21)
Multiple	7,211 (0.50)	7,304 (0.49)
Other	26,197 (1.80)	27,926 (1.87)
Unknown	94,711 (6.51)	132,153 (8.85)

* Women members of Kaiser Permanente Southern California aged 21–65 years with a cervix who do not have a history of precancer (cervical intraepithelial neoplasia grades 2–3) or cervical cancer.

† Age was defined as age at mid-year (June 30). Women could be eligible in one or both years.

Among women aged 21–29 years, screening rates in 2020 were 8% lower before the stay-at-home order, 78% lower during the stay-at-home order, and 29% lower after the stay-at-home order was lifted compared with rates during 2019. Among women aged 30–65 years, screening rates in 2020 were 3% lower before the stay-at-home order, 82% lower during the stay-at-home order, and 24% lower after the stay-at-home

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order was lifted compared with rates during 2019 (Table 2). For both age groups, cervical cancer screening rates reached a nadir in April 2020 (Figure). The decreases in screening rates in 2020 compared with those in 2019 were similar across all racial and ethnic groups in KPSC.

Discussion

KPSC patient data provided an opportunity to evaluate the impact of the COVID-19 pandemic on cervical cancer screening because of the availability of a large volume of data from a diverse population and capacity of detailed monitoring and reporting. Cervical cancer screening rates at KPSC were substantially lower during the COVID-19 pandemic than during the comparable period in the preceding year. Screening rates declined in both routinely screened age groups during the stay-at-home order compared with rates during 2019, with similar declines across all racial and ethnic groups. Rates are compatible with findings of decreased cancer screening rates during 2020 in other parts of the United States (*1*–*4*). For example, the electronic health record vendor Epic Systems Corporation reviewed 2.7 million patient records from 39 organizations spanning 23 states and found a 67% decline in mean weekly cervical cancer screening volume during spring 2020, an estimated 40,000 delayed or missed screenings compared with equivalent weeks during spring 2017–2019 (*1*). One model of screening in the United Kingdom showed that a 6-month screening disruption could lead to an increased risk for cervical cancer (*5*). Such findings raise questions about how to prioritize screening of women who are overdue for screening or build screening capacity.

The COVID-19 pandemic has posed extraordinary challenges for providers and patients to maintain cancer screening (*6*). During the stay-at-home order, California cancelled elective surgeries, including some gynecologic procedures. At KPSC, although outpatient clinics never closed, and screening visits could be scheduled, in-person visits were made largely for urgent medical issues. While providing care, clinic staff members and providers faced challenges implementing COVID-19 protocols (e.g., COVID-19 prescreening, maintenance of physical distancing, use of personal protective equipment, and disinfecting surfaces and equipment).[††] Patients experienced new barriers to access (e.g., new work and childcare schedules) and fear of SARS-CoV-2 infection from community exposure. KPSC offered telehealth appointments as an option during the stay-at-home order to maximize patient and staff member safety, resulting in a sharply increased number of telehealth visits.[§§] Patient reluctance to come for in-person visits decreased after reopening, as providers became accustomed to new protocols and patients increased their activity outside the home. These factors likely accounted for the increase in screening rates after reopening.

The COVID-19 pandemic has highlighted a critical need for effective cancer screening methods for patients who cannot or prefer not to have in-person appointments. For colorectal cancer screening, KPSC has been using self-sampling fecal immunochemical test (FIT) kits available by mail or pharmacy and has continued mailing these to patients' homes during the pandemic without interruptions. This approach might serve as a model for future cervical cancer screening through self-collected samples for HPV testing. The Food and Drug

[††] https://www.acs4ccc.org/wp-content/uploads/2020/10/ACS_Guidance_on_Cancer_Screening-Report_October-2020_Toolkit.pdf
[§§] https://emergency.cdc.gov/coca/calls/2020/callinfo_120820.asp

TABLE 2. Comparison of cervical cancer screening rates*,† before, during, and after stay-at-home order,§ by age group — Kaiser Permanente Southern California, January 1–September 30, 2019 and January 1–September 30, 2020

	Pap tests rate†			HPV tests rate†		
	Women aged 21–29 yrs			Women aged 30–65 yrs		
Period (relative to stay-at-home order)	2019	2020	Rate ratio¶ (95% CI)	2019	2020	Rate ratio¶ (95% CI)
Jan 1–Mar 18 (before stay-at-home order)	3.00	2.78	0.92 (0.91–0.94)	1.89	1.82	0.97 (0.95–0.98)
Mar 19–Jun 11 (during stay-at-home order)	2.63	0.59	0.22 (0.22–0.23)	1.69	0.30	0.18 (0.17–0.18)
Jun 12–Sep 30 (after stay-at-home order)	2.64	1.89	0.71 (0.70–0.73)	1.66	1.26	0.76 (0.75–0.77)

Abbreviations: CI = confidence interval; HPV = human papillomavirus; Pap = Papanicolaou cervical cancer test.

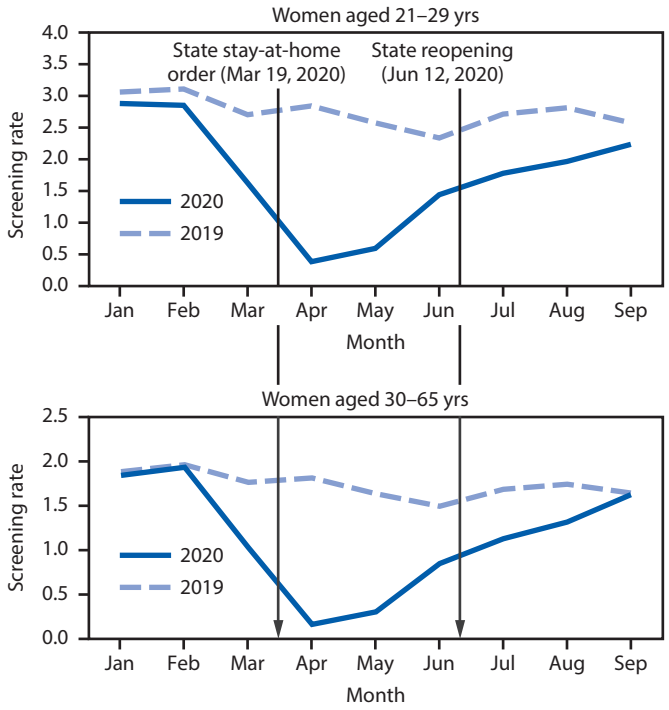
* Cervical cancer screening test used is a Pap test for women aged 21–29 years, and Pap test and HPV testing for women aged 30–65 years through July 15, 2020, and HPV testing alone after July 15, 2020. A combination of HPV testing and HPV and Pap (cotesting) is used in this group per U.S. Preventive Services Task Force guidelines; HPV testing rate was examined for simplicity.

† Tests per 100 person-months. For women aged 21–29 years, rates were calculated as (Pap tests per person-month) x 100. For women aged 30–65 years, rates were calculated as (HPV tests per person-month) x 100.

§ Three contiguous but distinct periods in the year 2020 were analyzed. "Before Stay-At-Home Order" refers to all clinic encounter dates in 2020 before the state of California announced its stay-at-home executive order on March 19, 2020 (i.e., January 1–March 18, 2020). "During Stay-At-Home Order" refers to the entire period in which the state stay-at-home order was in effect, from the announcement of the order to the reopening of most essential businesses in Phase 3 of the reopening plan supervised by the California Department of Public Health (March 19–June 11, 2020). "After Stay-At-Home Order " is inclusive of all dates after the reopening until the study cutoff date (June 12–September 30, 2020).

¶ 2020 Rate/2019 Rate.

FIGURE. Routine cervical cancer screening rates*,† among women aged 21–65 years in a large integrated health care system, by age group — Kaiser Permanente Southern California, January 1–September 30, 2019, and January 1–September 30, 2020



* Cervical cancer screening test used is Pap test for women aged 21–29 years, and Pap test and human papillomavirus (HPV) testing for women aged 30–65 years through July 15, 2020, and HPV test alone after July 15, 2020.

† Tests per 100 person-months. For women aged 21–29 years, rates were calculated as (Pap tests per person-month) x 100. For women aged 30–65 years, rates were calculated as (HPV tests per person-month) x 100.

Administration has not yet approved self-sampling for HPV tests, but the evidence base for self-sampling demonstrates good accuracy and high acceptability among women (*7*). Self-collected HPV testing improves screening participation among women who are underscreened (*8*). Adoption of self-sampling for HPV testing might help maximize patient safety and overcome the barrier of fear of SARS-CoV-2 infection from clinic visits. However, for women who have abnormal screening results, follow-up care at a clinic could remain a challenge.

The findings in this report are subject to at least three limitations. First, it is possible that some tests considered screening tests were actually for surveillance of women with a history of cervical precancers or abnormal screening results, although women with a known history of cervical precancer and cancer were excluded. However, this potential misclassification is likely to be similar for 2019 and 2020, and thus unlikely to affect the comparisons. Second, the KPSC findings might not be generalizable to other health care settings, given differences in regional and clinic policies and individual patient health insurance status and access. KPSC is an integrated health system with an organized cervical cancer screening program through which women receive invitations to obtain screening at appropriate intervals; these continued during the stay-at-home order. Although the decreases in cervical cancer screening rates in 2020 compared with those in 2019 at KPSC were similar across all racial and ethnic groups, this might not be the case in other settings. Cervical cancer incidence and mortality rates are disproportionately higher in Hispanic women and non-Hispanic Black women than in non-Hispanic White women because of existing disparities.¶¶ A larger decrease and a slower return in screening rates might be experienced in other health care settings, such as safety-net clinics with persons who are medically underserved, where the level of access and health systems interventions (e.g., patient reminder systems, telemedicine) vary significantly across groups and individual persons (*9*). Finally, the screening history of women who returned for cervical cancer screening after reopening was unknown. It is unclear whether women who came for screening after the stay-at-home order was lifted in June 2020 were those who missed screening during the stay-at-home order or those who were due for screening after the reopening. Such information is needed to determine whether women who are due for cervical cancer screening are screened.

The COVID-19 pandemic is ongoing; California implemented limited and regional stay-at-home orders during November 21, 2020–January 25, 2021, affecting all California counties with widespread community transmission of SARS-CoV-2.***,††† During the pandemic and postpandemic periods, evidence-based approaches to education, health promotion, and information

Summary

What is already known about this topic?

Cancer screening rates, including cervical cancer screening rates, have declined during the COVID-19 pandemic.

What is added by this report?

During California's stay-at-home order, cervical cancer screening rates among approximately 1.5 million women in the Kaiser Permanente Southern California (KPSC) network decreased approximately 80% compared with baseline. The decrease was similar across all racial/ethnic groups of KPSC and returned to near normal after reopening.

What are the implications for public health practice?

Sustained disruptions could lead to increased risk for cervical cancers and precancers. During a pandemic, bringing populations at higher risk back to screening first, such as those with abnormal results or increased risk for precancers and cancers, is important.

¶¶ https://gis.cdc.gov/Cancer/USCS/DataViz.html

*** https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/limited-stay-at-home-order.aspx

††† https://covid19.ca.gov/stay-home-except-for-essential-needs

dissemination could be used to convey the importance of screening for cervical cancers and precancers. Continued monitoring of women in different clinical settings is needed to address delays and interruptions to cancer screening. Health systems might triage women for return screening appointments based on risk level and screening history, including enhanced efforts to reach those who are past due for screening or who need follow-up (*10*). Focusing public health interventions on bringing higher risk populations back to screening first, such as those with abnormal results or increased risk for precancers and cancers, is suggested per guidance from the American Cancer Society, the American College of Obstetricians and Gynecologists,[§§§] and the American Society for Colposcopy and Cervical Pathology.[¶¶¶] As the pandemic continues, public health interventions to address decreases in cancer screening rates will be critical to avoid increased incidence of advanced cancers because of delayed detection.

[§§§] https://www.acog.org/womens-health/faqs/coronavirus-covid-19-and-womens-health-care

[¶¶¶] https://www.asccp.org/covid-19

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Morbidity and Mortality Weekly Report

Trends in Outbreak-Associated Cases of COVID-19 — Wisconsin, March–November 2020

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During September 3–November 16, 2020, daily confirmed cases of coronavirus disease 2019 (COVID-19) reported to the Wisconsin Department of Health Services (WDHS) increased at a rate of 24% per week, from a 7-day average of 674 (August 28–September 3) to 6,426 (November 10–16) (*1*). The growth rate during this interval was the highest to date in Wisconsin and among the highest in the United States during that time (*1*). To characterize potential sources of this increase, the investigation examined reported outbreaks in Wisconsin that occurred during March 4–November 16, 2020, with respect to their setting and number of associated COVID-19 cases.

Outbreaks were defined as the occurrence of two or more confirmed COVID-19 cases* among persons who worked or lived together or among persons who attended the same facility or event, did not share a household, and were identified within 14 days of each other (by symptom onset date or sample collection date). During March 4–November 16, local and tribal health departments in Wisconsin reported suspected COVID-19 outbreaks to WDHS using established reporting criteria†; 5,757 reported outbreaks meeting the outbreak definition were included in the analysis. Confirmed cases of COVID-19 that were linked§ to these outbreaks were analyzed by symptom onset date (or sample collection date), the reported setting¶ of the associated outbreak or outbreaks during three periods: before and during Wisconsin's Safer At Home order** (March 4–May 12), summer and return-to-school (May 13–September 2), and the exponential growth phase†† (September 3–November 16). This activity was reviewed by CDC and was conducted in a manner consistent with applicable federal law and CDC policy.§§

A total of 57,991 confirmed cases of COVID-19 were linked to 5,757 outbreaks during March 4–November 16, accounting for 18.3% of 316,758 confirmed cases in Wisconsin during this period (Table). Overall, outbreaks at long-term care facilities (26.8%), correctional facilities (14.9%), and colleges or universities (15.0%) accounted for the largest numbers of outbreak-associated cases in Wisconsin. Before and during Wisconsin's Safer At Home order, 4,552 outbreak-associated cases were linked to 507 reported outbreaks. Outbreaks at manufacturing or food processing facilities (2,146 cases; 47.1%) and long-term care facilities (1,324 cases; 29.1%) accounted for the majority of outbreak-associated cases during this period (Figure). During May 13–September 2, a total of 13,506 cases were linked to 2,444 outbreaks. Long-term care facilities (2,850 cases; 21.1%) and manufacturing or food processing facilities (2,672 cases; 19.8%) continued to account for the largest number of outbreak-associated cases during this period. However, a variety of other settings including restaurants and bars (1,633 cases; 12.1%) and other workplaces (1,320 cases; 9.8%) accounted for an increasing proportion of outbreak-associated cases until mid-August, when a sharp increase in college- and university-associated outbreaks was observed (1,739 cases; 12.9%). Beginning on September 3, COVID-19 cases in Wisconsin increased exponentially overall and within outbreak settings. During this phase of increasing community transmission, 39,933 cases were associated with 3,861 reported outbreaks, which accounted for 16.7% of 239,629 confirmed cases in Wisconsin. Among outbreak-associated cases, 11,386 (28.5%) were associated with long-term care facilities, 7,397 (18.5%) with correctional facilities, 7,178 (18.0%) with colleges or universities, and 5,703 (14.3%) with

* Confirmed cases of COVID-19 were defined according to Council of State and Territorial Epidemiologists 2020 interim case definition requiring detection of SARS-CoV-2 RNA using a molecular amplification test (https://wwwn.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/08/05/).

† Suspected outbreaks were reportable to the Wisconsin Department of Health Services if two or more patients with confirmed COVID-19 (one or more patients for long-term care facilities) had symptom onset dates (or sample collection dates) within 28 days, worked or lived together, or attended the same facility or event, and did not share a household. For colleges and universities, some local and tribal health departments reported outbreaks for cases among students and faculty who attended the same institution. Only reported outbreaks that met additional inclusion criteria (two or more confirmed cases with symptom onset or sample collection within 14 days) were included in the analysis.

§ Cases were linked to multiple outbreaks if multiple associations were identified and determined to be epidemiologically linked to multiple settings during the case investigation interview.

¶ Outbreak setting categories included long-term care facilities, correctional or detention facilities, kindergarten through grade 12 schools or child care facilities, colleges or universities, manufacturing or food processing facilities, restaurants or bars, retail or other public establishments, events or gatherings, health care facilities, other group housing, other workplaces, and other settings.

** https://evers.wi.gov/Documents/COVID19/EMO28-SaferAtHome.pdf

†† The beginning of exponential growth phase (September 3) marked the date on which the weekly average number of new confirmed cases began to increase exponentially after declining for 5 consecutive weeks (July 26–September 2). Daily and weekly confirmed cases in Wisconsin are available (https://www.dhs.wisconsin.gov/covid-19/cases.htm).

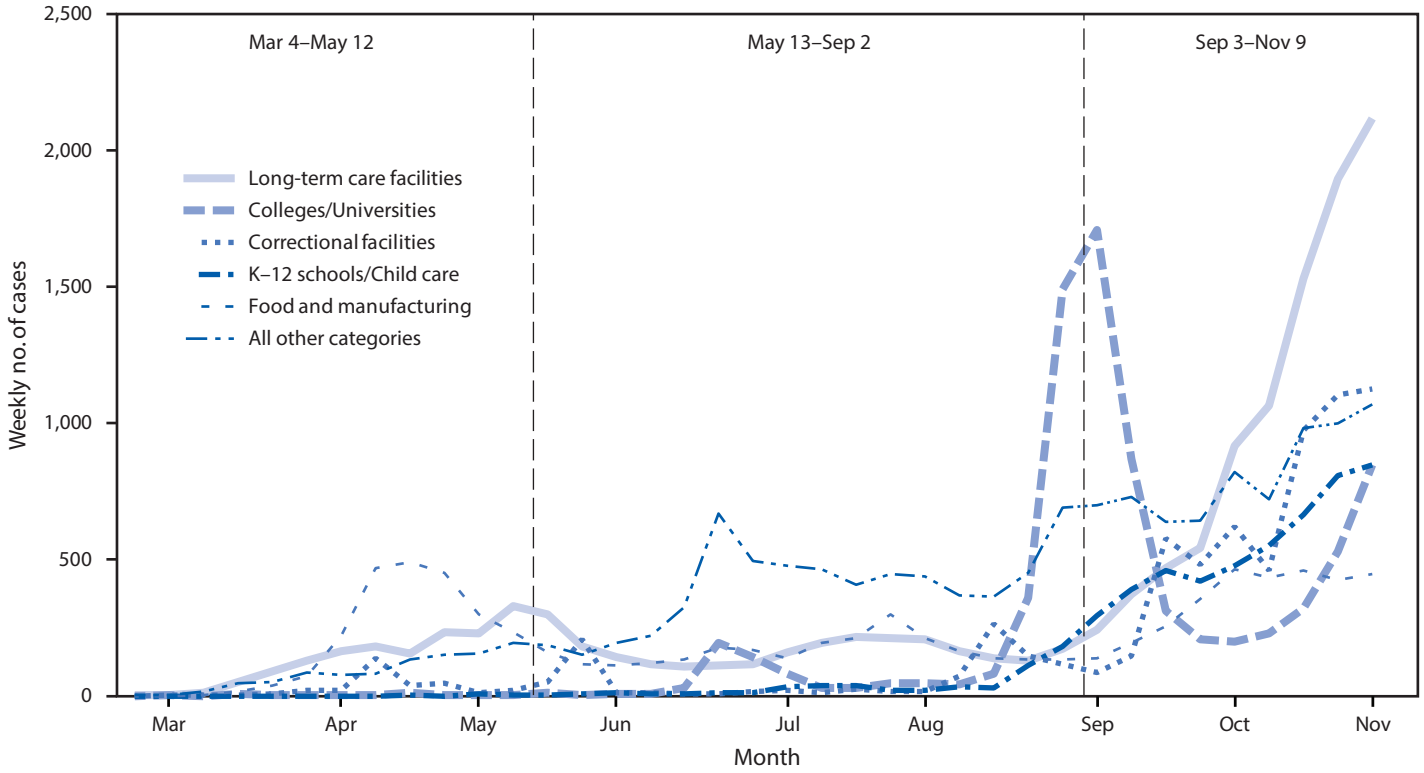
§§ Activity was determined to meet the requirements of public health surveillance as defined in 45 CFR 46.102(l)(2).

TABLE. Laboratory-confirmed COVID-19 cases associated with outbreaks, by settings and period of the COVID-19 response — Wisconsin, March–November 2020

Outbreak setting	No. (%)			
	Mar 4–May 12	May 13–Sep 2	Sep 3–Nov 16	Total
Long-term care facility	1,324 (29.1)	2,850 (21.1)	11,386 (28.5)	**15,529 (26.8)**
College or university	36 (0.8)	1,739 (12.9)	7,178 (18.0)	**8,689 (15.0)**
Correctional facility	307 (6.7)	964 (7.1)	7,397 (18.5)	**8,661 (14.9)**
K–12 school or child care facility	10 (0.2)	461 (3.4)	5,704 (14.3)	**6,145 (10.6)**
Food production or manufacturing facility*	2,146 (47.1)	2,672 (19.8)	3,631 (9.1)	**8,436 (14.5)**
Restaurant or bar	82 (1.8)	1,633 (12.1)	917 (2.3)	**2,628 (4.5)**
Retail or public establishment	45 (1.0)	814 (6.0)	1,053 (2.6)	**1,902 (3.3)**
Event or gathering	39 (0.9)	761 (5.6)	1,113 (2.8)	**1,885 (3.3)**
Health care facility	115 (2.5)	444 (3.3)	1,214 (3.0)	**1,768 (3.0)**
Other group housing facility	249 (5.5)	352 (2.6)	781 (2.0)	**1,375 (2.4)**
Other workplaces†	292 (6.4)	1,320 (9.8)	1,985 (5.0)	**3,585 (6.2)**
Other settings	48 (1.1)	794 (5.9)	1,424 (3.6)	**2,222 (3.8)**
Total§	**4,552**	**13,506**	**39,933**	**57,991**

Abbreviations: COVID-19 = coronavirus disease 2019; K–12 = kindergarten through grade 12.
* Includes food production and processing, meat processing , manufacturing facilities, and distribution or warehouse facilities.
† Includes agriculture, farming, forestry, construction, contracting, office or other indoor workplace, public safety, transportation, and utilities.
§ Some cases were associated with multiple outbreak settings because multiple epidemiologic linkages were identified during the outbreak investigation; thus, the sum of all categories exceeds the total number of cases listed for each period.

FIGURE. Trends* in the number of laboratory-confirmed COVID-19 cases associated with outbreaks, by setting† and period of the COVID-19 response — Wisconsin, March–November 2020



Abbreviations: COVID-19 = coronavirus disease 2019; K–12 = kindergarten through grade 12.
* Data from November 10–16, 2020 are not displayed in the figure, but are represented in the counts that appear in text and footnotes.
† All other categories includes restaurant or bar (4.2%), retail or other public establishment (3.1%), event or gathering (3.0%), health care facility (2.8%), other group housing (2.2%), other workplaces (5.7%), and other settings (3.5%).

Summary

What is already known about this topic?

COVID-19 incidence grew sharply in Wisconsin during September–November 2020; however, the underlying cause of this rapid growth is unknown.

What is added by this report?

An examination of COVID-19 outbreaks in Wisconsin showed that cases linked to outbreaks on college and university campuses increased sharply in August 2020 and were followed by outbreaks in other high-risk congregate settings. Overall, outbreaks at long-term care facilities (26.8%), correctional facilities (14.9%), and colleges or universities (15.0%) accounted for the largest numbers of outbreak-associated cases in Wisconsin.

What are the implications for public health practice?

COVID-19 surveillance and mitigation planning should be prioritized for highly affected settings such as long-term care facilities, correctional facilities, and colleges and universities, which could represent early indicators of broader community transmission.

schools or child care facilities. During this period of exponential growth, the number of cases associated with long-term care and correctional facilities increased by an average of 24% and 23% per week, respectively.

Discussion

The majority of outbreak-associated COVID-19 cases in Wisconsin occurred in long-term care facilities, correctional facilities, and colleges and universities; however, various settings were affected by COVID-19 outbreaks over the course of March–November 2020. During Wisconsin's Safer At Home order, outbreaks were concentrated in manufacturing and food processing facilities, which continued to operate as essential businesses under the statewide order. This aligned with national data showing a high incidence of COVID-19 outbreaks at meat processing facilities across the United States during this time, including among beef and pork processing facilities in Wisconsin (*2*). During early summer (June–July), outbreaks continued to occur in long-term care facilities and manufacturing and food processing facilities; restaurants and bars, other workplaces, events, and other public establishments were increasingly reported as outbreak settings, which might have corresponded to fewer restrictions on social gatherings and decreased risk perception among some groups during this period (*3*).

In late August, a rapid increase in cases associated with outbreaks at colleges and universities in Wisconsin occurred, correlating with return to campus for many of these institutions. This pattern was consistent with national trends for COVID-19 among young adults aged 18–22 years (*4*) and corresponded with outbreaks observed at colleges and universities in other states during this time (*5*). In Wisconsin, the college and university surge occurred at the beginning of a period of increasing community transmission, which was characterized by exponential growth in COVID-19 incidence across the state and a surge of outbreaks in high-risk congregate settings such as long-term care facilities and correctional facilities. The extent to which COVID-19 outbreaks on college and university campuses led to increased community transmission and subsequent outbreaks in other high-risk congregate settings could not be directly assessed in this investigation. Nonetheless, the temporal correlation observed builds on prior evidence of increased incidence of COVID-19 among U.S. counties where in-person university instruction occurred in August 2020 (*6*), suggesting that outbreaks on college and university campuses could represent early indicators of community transmission and should be prioritized for surveillance and mitigation planning.

The findings in this report are subject to at least three limitations. First, an absence of reported outbreaks in some settings should not be interpreted as an absence of COVID-19 cases in these settings, because local and tribal health departments in Wisconsin directed limited resources to investigate outbreaks in high-risk congregate settings. Therefore, lower-risk settings might be underrepresented. Second, local and tribal health departments could not verify epidemiologic linkages for all cases in all outbreaks, and some outbreak-associated cases could have occurred in other settings not represented in this analysis. Finally, use of these surveillance data alone cannot determine whether outbreaks in one setting are directly responsible for increases in community transmission or outbreaks in other settings; more detailed epidemiologic or genomic data are needed to explore whether such temporal correlations are causally related.

Examining trends in COVID-19 outbreaks over time provides an important indicator of COVID-19 incidence across sectors in response to changing behaviors and policies. State, local, and tribal health departments should continue to collect and report such information, particularly among highly affected sectors such as long-term care facilities and correctional facilities. Further, given the importance of college and university outbreaks as potential early indicators of outbreaks in other settings, colleges and universities should work with public health officials to strengthen surveillance and mitigation strategies to prevent COVID-19 transmission.

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Response to a COVID-19 Outbreak on a University Campus — Indiana, August 2020

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Institutions of higher education adopted different approaches for the fall semester 2020 in response to the coronavirus disease 2019 (COVID-19) pandemic. Approximately 45% of colleges and universities implemented online instruction, more than one fourth (27%) provided in-person instruction, and 21% used a hybrid model (*1*). Although CDC has published COVID-19 guidance for institutions of higher education (*2*–*4*), little has been published regarding the response to COVID-19 outbreaks on college and university campuses (*5*). In August 2020, an Indiana university with approximately 12,000 students (including 8,000 undergraduate students, 85% of whom lived on campus) implemented various public health measures to reduce transmission of SARS-CoV-2, the virus that causes COVID-19. Despite these measures, the university experienced an outbreak involving 371 cases during the first few weeks of the fall semester. The majority of cases occurred among undergraduate students living off campus, and several large off-campus gatherings were identified as common sources of exposure. Rather than sending students home, the university switched from in-person to online instruction for undergraduate students and instituted a series of campus restrictions for 2 weeks, during which testing, contact tracing, and isolation and quarantine programs were substantially enhanced, along with educational efforts highlighting the need for strict adherence to the mitigation measures. After 2 weeks, the university implemented a phased return to in-person instruction (with 85% of classes offered in person) and resumption of student life activities. This report describes the outbreak and the data-driven, targeted interventions and rapid escalation of testing, tracing, and isolation measures that enabled the medium-sized university to resume in-person instruction and campus activities. These strategies might prove useful to other colleges and universities responding to campus outbreaks.

Preparations for Fall Semester

In May 2020, a medium-sized Indiana university announced plans to reopen for in-person instruction for the fall semester. In preparation, the university implemented various public health measures, including rearranging physical infrastructure in high-traffic areas, reducing population density in classrooms and common spaces, enhancing cleaning and disinfection protocols, and requiring masks on campus, including outdoors, when physical distancing of 6 feet could not be maintained. Residence halls maintained usual occupancy levels, although students requesting accommodation for medical reasons were offered individual rooms. The university established an on-campus testing site, identified isolation and quarantine space, hired contact tracers, implemented a daily health check platform (a required online assessment of COVID-19 symptoms and exposures), and developed COVID-19–related data systems (*6*).

Classes began on August 10. The university required preentry SARS-CoV-2 reverse transcription–polymerase chain reaction (RT-PCR) testing for all students 7–10 days before their arrival on campus.* Of the 11,836 students tested, 33 (0.28%) received positive test results and were not allowed on campus until they were cleared to discontinue isolation 10 days after symptom onset or test date (*7*).

Despite these measures, the university experienced an outbreak (defined as an excess of cases compared with the baseline dates of August 3–15) soon after the semester started. To describe the campus outbreak and the university's response to continue the semester in person, university leaders and a local public health official reviewed university data on daily health checks, testing, contact tracing, isolation, and quarantine. Symptom and testing data, which are combined with university administrative data (e.g., faculty, staff member, or student designation; residence hall; class schedules; and seating charts), were analyzed to estimate symptom prevalence among various subgroups to identify emerging transmission patterns and assist in identifying close contacts. This activity was determined to be public health surveillance as defined in 45 CFR 46.102(l).†

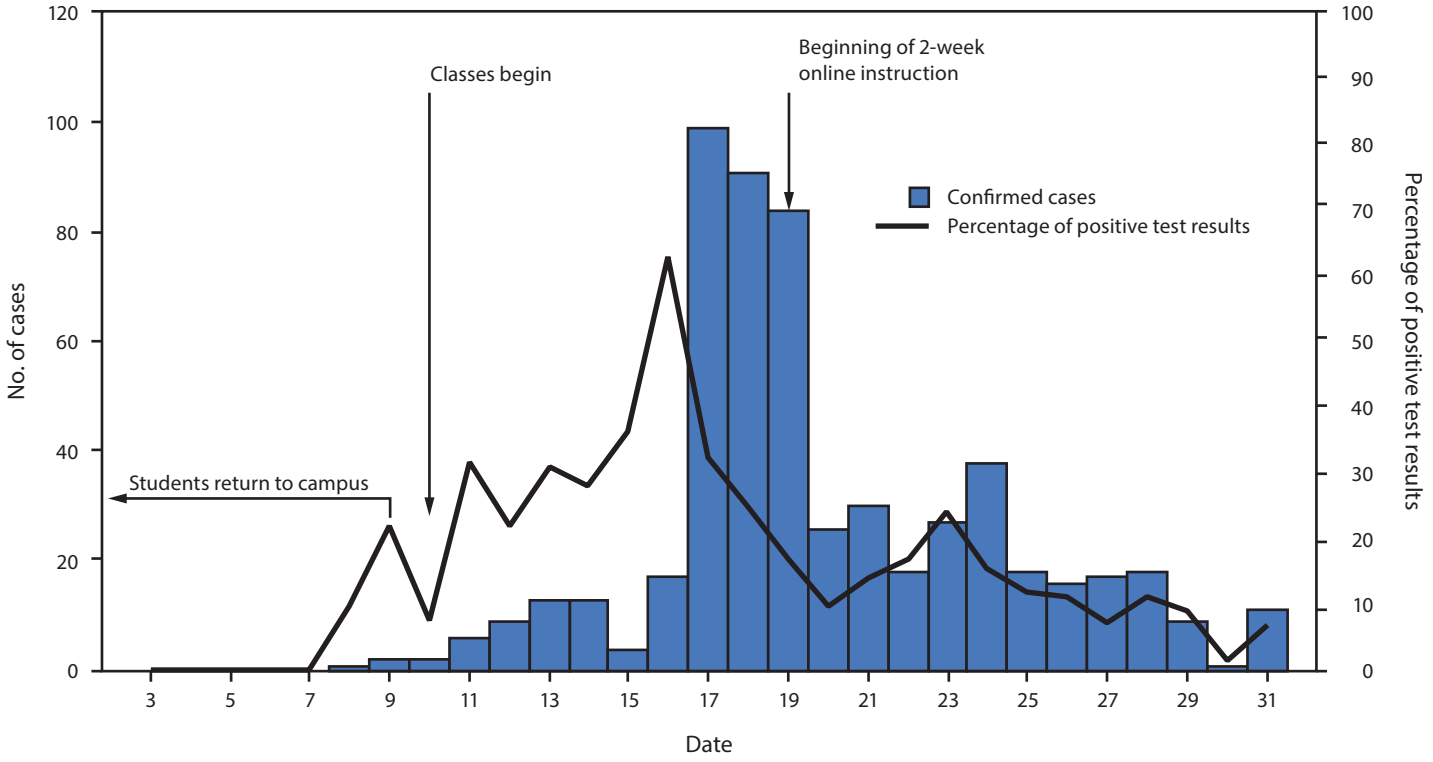
Campus Outbreak and Response

During August 3–15, a total of 56 persons received positive SARS-CoV-2 test results (an average of 4.3 per day, representing 11.7% of all tests performed); 90% of cases were identified through testing of symptomatic persons, with the remainder identified through screening tests of student athletes. During August 16–22, the university experienced an outbreak (Figure 1), with 371 confirmed cases (an average of 26.5 cases per day, representing 15.3% of all tests performed), 355 (96%) of which were in undergraduate students and 13 (3%) in graduate students; 62% of affected undergraduate students lived off campus. One faculty member and two staff members

* Students received an at-home nasal self-swabbing kit by express delivery, with a return mailer for the testing facility of a national commercial laboratory, where RT-PCR tests were performed, with results transmitted to the student and to University Health Services.

† Protection of Human Subjects, 45 C.F.R. part 46.

FIGURE 1. Number of COVID-19 cases confirmed through diagnostic testing,* by test date, and percentage of positive diagnostic test results before and during a COVID-19 outbreak on a university campus — Indiana, August 2020†



Abbreviations: COVID-19 = coronavirus disease 2019; RT-PCR = reverse transcription–polymerase chain reaction.
* Diagnostic tests were ordered for symptomatic persons or close contacts of persons with a confirmed case. A rapid antigen test was performed first, followed by an RT-PCR test if the rapid test was negative. (This figure only includes diagnostic test results and does not include results from screening tests.)
† Student leaders began returning in late July; however, the majority of students returned during August 3–9, after residence halls opened on August 3.

received positive test results. Contact tracing identified several large, off-campus parties where campus masking and physical distancing guidelines were not followed as common sources of exposure for approximately two thirds of cases among undergraduate students.

On August 19, the university implemented a switch to online instruction for all undergraduate classes for a minimum of 2 weeks; graduate and professional classes continued in person. Several temporary campus restrictions were instituted as well, including restricting undergraduate students who lived off campus from the campus (except to access campus health services) and requiring on-campus students to minimize nonessential activities and to remain on campus at all times for at least 2 weeks. Residence halls were restricted to persons who lived or worked in them, student organizations were required to meet remotely, and indoor recreational facilities were temporarily closed. Students were required to eat outside, maintaining 6 feet of distance from others, or in their residence hall rooms, and gatherings were limited to ≤10 persons (both on campus and off campus, although this was difficult to enforce off campus), with mandatory masking and physical distancing. In addition, masks were mandated at all times in all spaces, except in a person's assigned residence hall room or private office.

During the 2-week period of online instruction, the university focused on facilitating access to testing; expanding contact tracing, isolation, and quarantine operations; and implementing screening tests for asymptomatic persons, as well as enhancing the data systems to support these measures. Before the outbreak, modifications to the daily health check platform could be made only by the software provider on a set schedule, limiting the ability of the university to respond to changing circumstances. Improvements to this platform facilitated data retrieval, allowing a more detailed view of symptom prevalence and the ability to automate test orders when necessary.

To reduce barriers to testing,§ the university increased the test site hours and capacity. Orders for diagnostic testing were

§ Persons with COVID-19 symptoms received testing using the Sofia SARS Antigen Fluorescent Immunoassay (Quidel) rapid antigen test. Those with positive test results were isolated. Those with negative tests were also isolated, pending the results of a follow-up RT-PCR test on a nasal swab specimen, performed by a local commercial laboratory primarily using a Roche platform (https://www.labcorp.com/coronavirus-disease-covid-19/providers).

automated in response to the presence of primary COVID-19 symptoms (temperature >100.4°F [38°C], new onset of shortness of breath or difficulty breathing, or new loss of sense of taste or smell). Persistent secondary COVID-19 symptoms (minor symptoms, such as headache or rhinorrhea, lasting ≥2 days) or reported close contact with a person with COVID-19 also automatically generated test orders, eliminating the need for clinicians to triage and authorize testing. Rapid antigen tests were used as the front-line diagnostic test because they facilitated rapid isolation and quarantine. Persons with negative antigen test results who were symptomatic or determined to be close contacts received a follow-up RT-PCR test, with results typically available within 36 hours.

The university enhanced contact tracing efforts and redefined workflows to facilitate timely identification and quarantine of close contacts of persons with confirmed COVID-19. During the 2-week outbreak, the contact tracing team expanded from nine full-time staff members to 11 full-time and 13 part-time workers. A new Daily Care and Concern Team was established to ensure that students in isolation and quarantine received meals and other needed resources; this team, consisting of 12 reassigned university staff members and 60 volunteers, also telephoned everyone in isolation and quarantine daily to monitor for worsening symptoms. The university initially reserved 250 beds for isolation and quarantine purposes, increasing to 1,007 beds during the surge of cases, through use of apartments and hotels on or adjacent to campus. During August 16–29, a total of 1,250 students were placed in isolation and quarantine; students with access to adequate facilities (i.e., allowed them to sleep separately from others and had access to a private bathroom) were permitted to isolate or quarantine off campus. In addition to the 371 cases identified during the first week of the outbreak, another 160 were identified during the second week of the outbreak. Slightly more than one half (52%) of the newly positive test results were in persons who were already in quarantine. Among 802 persons in quarantine during this 2-week period, 83 (10.3%) ultimately received a positive SARS-CoV-2 test result. In the week after the return to in-person instruction, an average of four cases per day were identified.

An enhanced communications campaign was created to underscore the importance of adhering to campus public health protocols. The campaign included e-mails from university administrators and campus leaders, video messages, and virtual town hall meetings. The proportion of e-mails sent to the student e-mail distribution list that were viewed (a measure of the reach of these education efforts) was 84.1%.

Implementation of Screening

Before the outbreak, testing had been focused on symptomatic persons; routine screening tests were performed for student athletes but had not yet been implemented for the broader university community. After recognition of the outbreak, the university began screening asymptomatic persons with RT-PCR tests on specimens collected by supervised, self-administered nasal swabs. The capacity for screening testing increased throughout the semester (Figure 2). Each round of screening was informed by the previous round and by diagnostic testing trends, using a Bayesian stratified, staggered-entry rotating cohort design (*8*). Persons were grouped into various cohorts (e.g., those who lived in a particular residence hall), and a fraction of each cohort was sampled in each round. Some screening slots were reserved for the evaluation of persons in areas with increased risk for transmission (i.e., potential hotspots). The team responsible for the general campus screening strategy was able to adapt based on disease prevalence in certain groups, such as by college, membership group (club or team), residence hall, or even the floor or wing of a residence hall, to allow oversampling. Diagnostic testing, which was performed for symptomatic persons and for close contacts of persons with SARS-CoV-2 infection, increased from an average of 17.9 tests per day before the outbreak to 208.4 per day during the 2-week outbreak. Likewise, screening increased to 205 tests per day by the end of August.

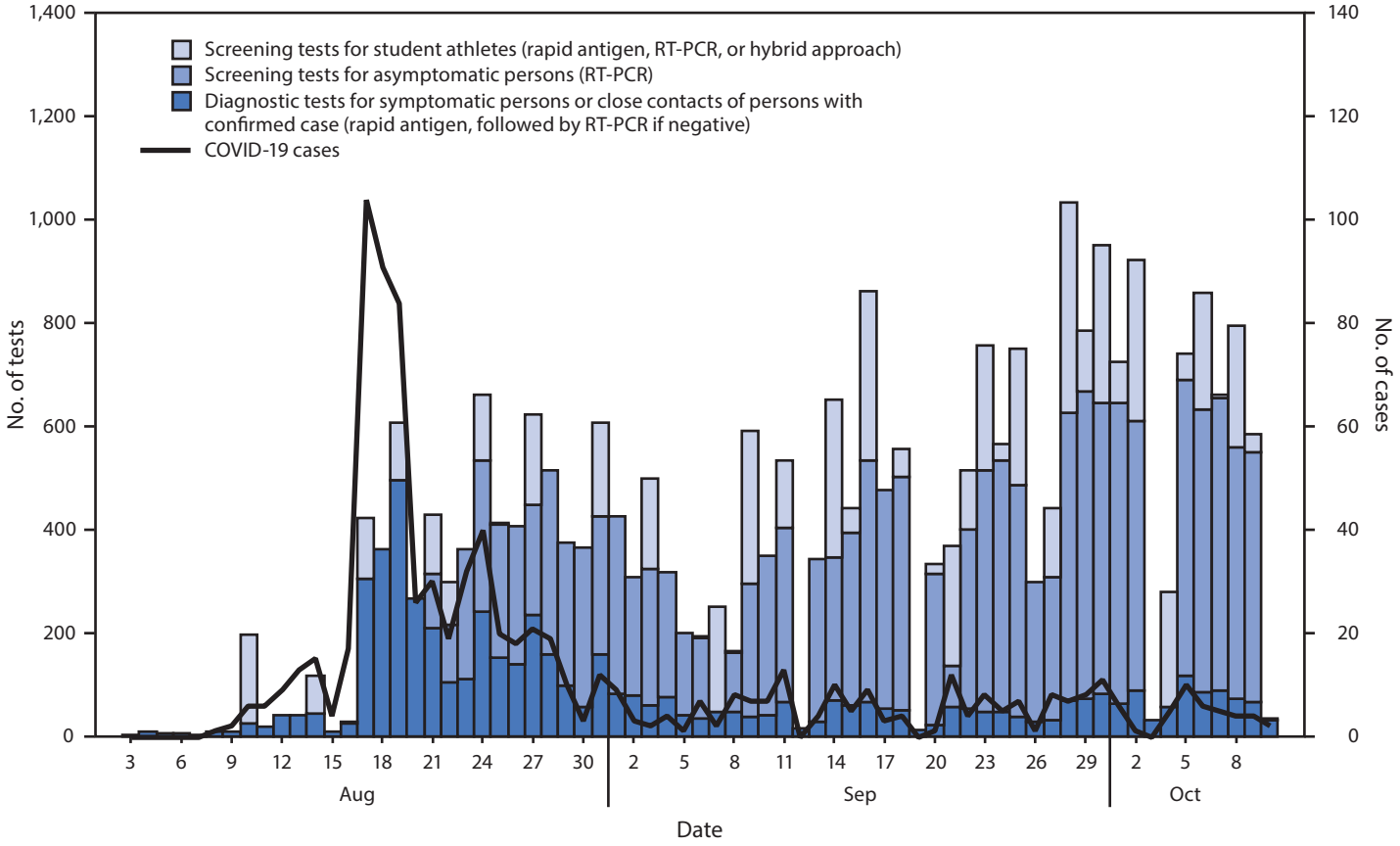
Based on the decreasing case numbers, increased testing capacity, and enhanced ability to analyze and respond based on data, lower-level undergraduate classes resumed on September 2 (2 weeks after online instruction began), with upper-level undergraduate classes resuming a few days later. Other campus restrictions were gradually relaxed (e.g., coming to or leaving campus and residence hall visitation), and student activities were phased in over the subsequent 7–10 days; however, the requirement for universal masking remains.

During the week ending October 10, 2020, a total of 3,981 tests were performed (521 diagnostic and 3,460 screening tests; overall, 0.9% of test results were positive). The mean 7-day rolling average was five new cases per day, comparable to the overall incidence in the county at the time.

Discussion

A COVID-19 outbreak on a university campus is a substantial challenge but was managed on a medium-sized campus while students remained in residence (*5*). Analysis of administrative data (e.g., undergraduate versus graduate students and on-campus versus off-campus students or activities) facilitated identification of potential problems, which was critical to designing a specific, tailored response. The stratified rotating cohort approach to screening that was implemented at the university can be used as an alternative to repeated campus-wide testing of all students and might be more feasible for resource-constrained institutions. A swift, marked increase

FIGURE 2. Number of COVID-19 tests performed, by test indication, and number of COVID-19 cases before, during, and after a COVID-19 outbreak on a university campus — Indiana, August–October 2020



Abbreviations: COVID-19 = coronavirus disease 2019; RT-PCR = reverse transcription–polymerase chain reaction.

in testing, contact tracing, and isolation measures requires a substantial commitment of physical, personnel, and financial resources, which might not be readily available at all colleges and universities of comparable size. In addition, encouraging student adherence to mitigation strategies as a means to eventually continuing the semester in person was critical to the success of these efforts.

The findings in this report are subject to at least two limitations. First, the daily health check relied on self-reported symptoms, and no consequences were associated with failing to complete the health check. This might have led to an underestimate in the number of cases because symptoms might have gone unrecognized or underreported (and thus automated test orders not generated). Conversely, in the absence of widespread screening, any unrecognized cases could have contributed to further spread on campus. Second, although the university provided an on-campus testing site, persons were also able to obtain testing at other community locations, which might have delayed reporting of results or otherwise affected the university's ability to respond to cases identified among members of the university community, as well as possibly resulting in an underestimate. This underscores the importance of universities working closely with the local health department to facilitate timely reporting of cases and identification of close contacts.

Immediate, aggressive measures to decrease SARS-CoV-2 transmission through enhanced testing, timely contact tracing, provision of adequate isolation and quarantine space, increased screening of asymptomatic persons, and communication promoting adherence to mitigation strategies can help control COVID-19 outbreaks while minimizing disruptions to in-person instruction. This approach is consistent with recommendations for universities with outbreaks to avoid sending students home to avoid spreading infections into local and other communities (*9*).

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Summary

What is already known about this topic?

Although various implementation strategies for SARS-CoV-2 testing on college and university campuses have been described, little has been published regarding successful responses to COVID-19 outbreaks on campus.

What is added by this report?

In response to a COVID-19 outbreak on a university campus in August 2020, rapid implementation of multiple measures, including aggressive testing, tracing, and isolation; enhanced data systems; and communication focused on adherence to mitigation strategies, resulted in a rapid decrease in new cases and allowed in-person learning to resume.

What are the implications for public health practice?

Enhanced testing, timely contact tracing, provision of adequate isolation and quarantine space, increased screening of asymptomatic persons, and communication promoting adherence to mitigation strategies can help control COVID-19 outbreaks on college and university campuses while minimizing disruptions to in-person instruction.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Notes from the Field

An Outbreak of West Nile Virus — Arizona, 2019

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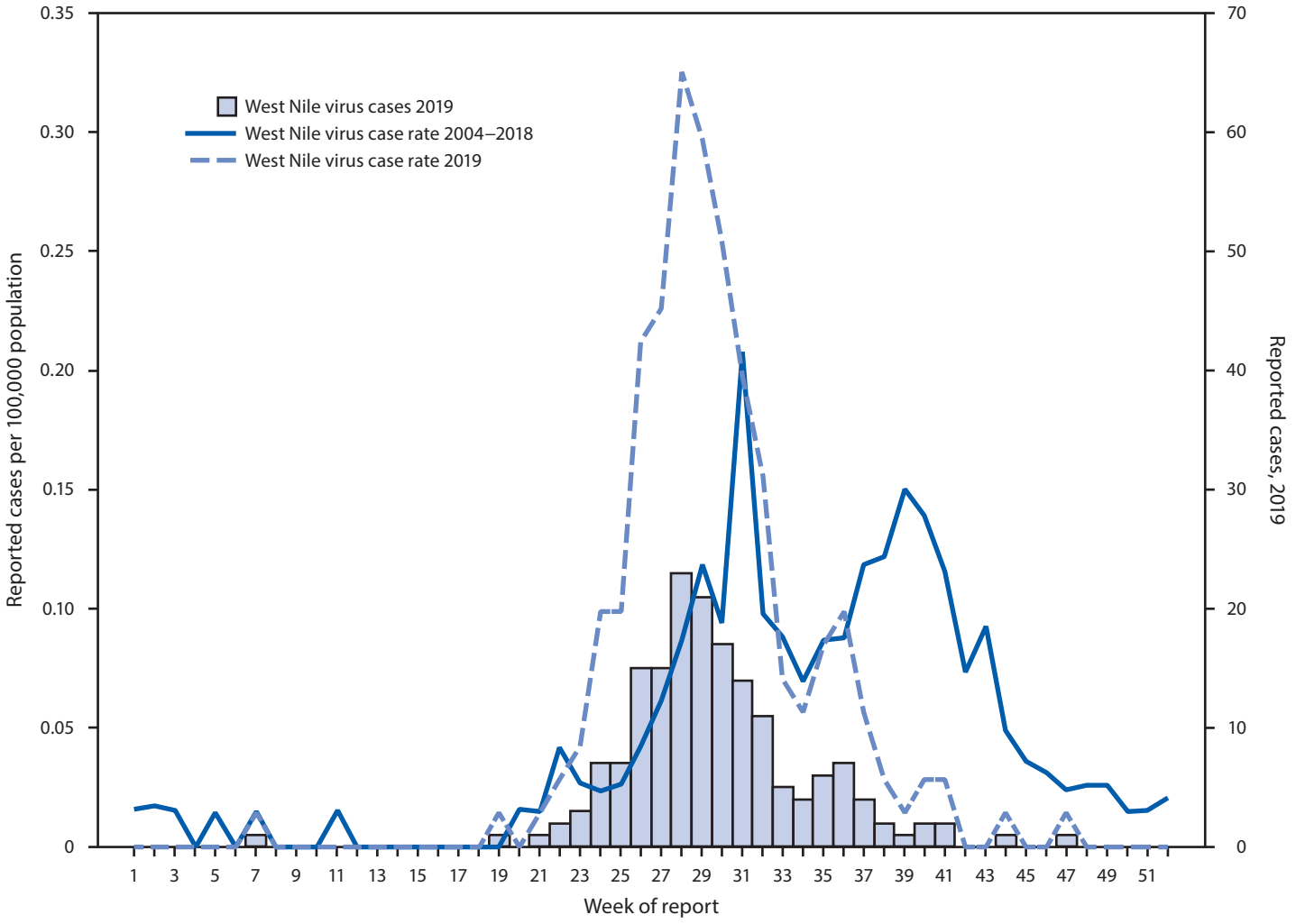
West Nile virus (WNV), a mosquitoborne flavivirus,* was first identified in the United States in 1999 and first reported in Arizona in 2003 (with 12 human cases); 391 human cases were reported in 2004. Since that time, a median of 103 cases (range = 21–391) have been reported in Arizona annually.† During week 28 in 2019, the Arizona Department of Health Services (ADHS) recorded the highest weekly WNV case count (23) ever reported in Arizona (an incidence of 0.32 cases per 100,000 population) (Figure). This prompted ADHS to investigate the outbreak's severity to inform prevention, resource allocation, and public messaging.

The 2019 total of 174 WNV cases reported in Arizona was the largest number in the state since 2004, and the second largest number of any state in the United States for that year (*1*). The 2019 incidence in Arizona (2.4 cases per 100,000 population; 65% confirmed) was 50% above the median annual incidence for 2005–2018 (1.6 cases per 100,000 population). Maricopa County, which includes the greater metropolitan Phoenix area, reported 3.7 cases per 100,000 population (the highest county rate since 2004). Cases were classified according to the national WNV surveillance case definition (*2*).

* https://www.cdc.gov/vhf/virus-families/flaviviridae.html

FIGURE. West Nile virus disease cases and incidence per 100,000 population — Arizona, 2004–2019



Arizona usually experiences a biphasic WNV season during the summer monsoon rains, with first peak cases occurring in early August and the second peak in late September (*3*). In 2019, the first peak occurred during week 28 (mid-July), 3 weeks earlier than the mean first peak during 2004–2018 (week 31, range = 26–46). The second peak in 2019 occurred during week 35 (end of August), 3 weeks earlier than the mean during 2004–2018 (week 38, range = 36–46). The number of cases during the first peak in 2019 was 72% above the 2004–2018 first peak average, whereas the number of cases during the second peak was 22% below the second peak average for these years.

In 2019, among 174 WNV cases reported across the state, 132 (76%) were identified as neuroinvasive diseases (130 were either meningitis or encephalitis), similar to recent state and national trends (*1*,*4*). Demographics of persons infected in 2019 did not differ significantly from those infected during previous years in Arizona; 58% of cases were in males and the median age was 64 years (range = 6–92 years). The case-fatality rate for all 174 cases was 10%, similar to historical statewide data (median = 7%, range = 0–22%). Statewide, 23 WNV viremic blood donors were reported in 2019, 52% higher than the historical median for available years (2006–2018) (*1*).

In Maricopa County, 0.60% (417 of 69,487) mosquito pools tested positive for WNV in 2019 compared with 0.18% (124 of 67,146) in 2018 and 0.34% (209 of 60,486) in 2017 (*5*). In addition, the vector index[§] (WNV transmission activity in mosquito populations) (*6*) reached 19.4 in early June 2019, the highest ever detected in the county. This increase in vector index preceded the peak of human WNV cases in Maricopa County by approximately 6 weeks. Arizona experienced a particularly wet fall/winter 2018[¶]; an increase in vegetation during spring 2019 might have boosted the mosquito and bird populations and amplified WNV sooner than usual, leading to earlier and more human WNV infections (*7*).

ADHS and Maricopa County informed health care providers and the public about the outbreak and distributed educational materials and mosquito repellent across the state. CDC, ADHS, and Maricopa County further investigated WNV presence in the bird and mosquito populations around the Phoenix area.

Ongoing investigation by ADHS, CDC, local vector control agencies, and university partners into factors influencing mosquito abundance, WNV transmission (amplification and suppression), or other factors, such as modeling weather patterns with bird and mosquito population dynamics (*7*), insecticide resistance of mosquitoes, or WNV strain analysis in birds and mosquitoes might help inform future public health prevention and response activities regarding WNV outbreaks.

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[†] https:/www.azdhs.gov/preparedness/epidemiology-disease-control/mosquito-borne/west-nile-virus/index.php#information

[§] The vector index is calculated by determining the average number of infected mosquitoes collected per trap in an area, therefore it parallels the mosquito pool positivity.

[¶] https://www.weather.gov/psr/Year_in_Review_2018

Allergic Reactions Including Anaphylaxis After Receipt of the First Dose of Moderna COVID-19 Vaccine — United States, December 21, 2020–January 10, 2021

CDC COVID-19 Response Team; Food and Drug Administration

On January 22, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/).*

As of January 20, 2021, a total of 24,135,690 cases of coronavirus disease 2019 (COVID-19) and 400,306 associated deaths had been reported in the United States (https://covid.cdc.gov/covid-data-tracker/#cases_casesper100klast7days). On December 18, 2020, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for Moderna COVID-19 vaccine administered as 2 doses, 1 month apart to prevent COVID-19. On December 19, 2020, the Advisory Committee on Immunization Practices (ACIP) issued an interim recommendation for use of Moderna COVID-19 vaccine (*1*). As of January 10, 2021, a reported 4,041,396 first doses of Moderna COVID-19 vaccine had been administered in the United States, and reports of 1,266 (0.03%) adverse events after receipt of Moderna COVID-19 vaccine were submitted to the Vaccine Adverse Event Reporting System (VAERS). Among these, 108 case reports were identified for further review as possible cases of severe allergic reaction, including anaphylaxis. Anaphylaxis is a life-threatening allergic reaction that occurs rarely after vaccination, with onset typically within minutes to hours (*2*). Among these case reports, 10 cases were determined to be anaphylaxis (a rate of 2.5 anaphylaxis cases per million Moderna COVID-19 vaccine doses administered), including nine in persons with a documented history of allergies or allergic reactions, five of whom had a previous history of anaphylaxis. The median interval from vaccine receipt to symptom onset was 7.5 minutes (range = 1–45 minutes). Among eight persons with follow-up information available, all had recovered or been discharged home. Among the remaining case reports that were determined not to be anaphylaxis, 47 were assessed to be nonanaphylaxis allergic reactions, and 47 were considered nonallergic adverse events. For four case reports, investigators have been unable to obtain sufficient information to assess the likelihood of anaphylaxis. This report summarizes the clinical and epidemiologic characteristics of case reports of allergic reactions, including anaphylaxis and nonanaphylaxis allergic reactions, after receipt of the first dose of Moderna COVID-19 vaccine during December 21, 2020–January 10, 2021, in the United States. CDC has issued updated interim clinical considerations for use of mRNA COVID-19 vaccines currently authorized in the United States (*3*) and interim considerations for preparing for the potential management of anaphylaxis (*4*).

Using methods previously described (*5*), CDC and FDA identified reports of suspected anaphylaxis in VAERS, the national passive surveillance (i.e., spontaneous reporting) system for monitoring adverse events after immunization (*6*). CDC physicians screened VAERS reports describing suspected severe allergic reactions and anaphylaxis and applied Brighton Collaboration case definition criteria for anaphylaxis* (*7*). After initial screening, reports with sufficient evidence to suggest anaphylaxis were followed up by collecting information from medical records and through direct outreach to health care facilities and treating health care providers, and, in some cases, vaccine recipients. Physician reviewers classified all initially identified case reports as anaphylaxis or not anaphylaxis and used clinical judgment to further categorize reports that were considered not anaphylaxis as nonanaphylaxis allergic reactions or nonallergic adverse events. Nonallergic adverse events, mostly vasovagal (e.g., fainting or the sensation of fainting) or suspected anxiety-related, were excluded from the final analyses. Anaphylaxis and nonanaphylaxis allergic reaction cases with symptom onset occurring later than the day after vaccination (i.e., outside the 0–1-day risk window) were also excluded because of the difficulty in clearly attributing allergic reactions with onset later than this to vaccination.†

During December 21, 2020–January 10, 2021, the administration of 4,041,396 first doses of Moderna COVID-19 vaccine (2,465,411 to females [61%], 1,450,966 to males [36%], and 125,019 to persons whose sex was not recorded [3%]) was reported to CDC. During the same period, reports of 1,266 (0.03%) adverse events after receipt of the first dose of Moderna COVID-19 vaccine had been submitted to VAERS. Among these, 108 case reports were identified for further review as possible cases of severe allergic reaction, including

* Brighton level 1 represents the highest level of diagnostic certainty that a reported case is indeed a case of anaphylaxis; levels 2 and 3 represent successively lower levels of diagnostic certainty. Level 4 is a case reported as "anaphylaxis" but that does not meet the Brighton Collaboration case definition. Level 5 is a case that was neither reported as anaphylaxis nor meets the case definition.

† Anaphylaxis and nonanaphylaxis allergic reaction cases with symptom onset occurring later than the day after vaccination (i.e., outside of the 0–1-day risk window) were excluded because of the difficulty in clearly attributing allergic reactions with onset outside this risk window to vaccination.

anaphylaxis, based on descriptions of signs and symptoms; 10 of these reports, all describing events in females, met the Brighton Collaboration case definition criteria for anaphylaxis (Table 1), corresponding to an initial estimated rate of 2.5 anaphylaxis cases per million first Moderna COVID-19 vaccine doses administered. The median age of persons with anaphylaxis was 47 years (range = 31–63 years). The median interval from vaccine receipt to symptom onset was 7.5 minutes (range = 1–45 minutes); nine patients had onset within 15 minutes, and one had onset after 30 minutes (Figure). In all 10 reports, patients received epinephrine as part of initial emergency treatment; the route of administration was confirmed or presumed to be intramuscular based on the description of treatment and the clinical course of the event as documented in the VAERS report. Six patients were hospitalized (including five in intensive care, four of whom required endotracheal intubation), and four were treated in an emergency department; eight patients with follow-up information available are known to have been discharged home or had recovered at the time of report to VAERS. No deaths from anaphylaxis were reported after receipt of Moderna COVID-19 vaccine. Nine of the 10 anaphylaxis case reports included a patient history of allergies or allergic reactions, including to drugs (six), contrast media (two), and foods (one); five patients had experienced an episode of anaphylaxis in the past, none of which was associated with receipt of a vaccine (Table 2). No geographic clustering of anaphylaxis cases was observed, and the cases occurred after receipt of doses from multiple vaccine lots. At the time of this publication, despite follow-up efforts, investigators have been unable to obtain sufficient information to assess the likelihood of anaphylaxis in four of the initial 108 suspected cases reported.

Among the 43 cases of nonanaphylaxis allergic reaction after receipt of Moderna COVID-19 vaccination with symptom onset within the 0–1-day risk window, 26 (60%) were classified as nonserious.[§] Commonly reported symptoms included pruritus, rash, itchy sensations in the mouth and throat, sensations of throat closure, and respiratory symptoms. The median patient age was 43 years (range = 22–96 years), and 39 (91%) of the reported reactions occurred in women. The median interval from vaccine receipt to symptom onset was 15 minutes (range = <1 minute–24 hours); in 30 (73%) cases, onset occurred within 30 minutes, in 11 cases, onset occurred after 30 minutes, and for two cases, time of onset was missing. For 26 (60%) case reports, a past history of allergies or allergic reactions, mostly to foods and drugs, was documented (Figure).

Discussion

Early safety monitoring of Moderna COVID-19 vaccine detected 10 cases of anaphylaxis after reported administration of 4,041,396 first doses of Moderna COVID-19 vaccine (2.5 cases per million Moderna COVID-19 vaccine doses administered) as well as cases of less severe nonanaphylaxis allergic reactions, based on U.S. data for December 21, 2020–January 10, 2021. Anaphylaxis is potentially life-threatening and requires immediate treatment (*4*). Based on this early monitoring, anaphylaxis after receipt of Moderna COVID-19 vaccine appears to be a rare event; however, comparisons of anaphylaxis risk with that associated with non–COVID-19 vaccines are constrained at this time by the limited data available this early in the COVID-19 vaccination program. A previous analysis of the Pfizer-BioNTech COVID-19 vaccine, also an mRNA vaccine, estimated an initial rate of 11.1 cases per million doses administered after receipt of the first dose of the Pfizer-BioNTech vaccine (*5*). CDC and FDA will continue enhanced monitoring for anaphylaxis among recipients of COVID-19 vaccines and will review case reports to VAERS.

In nine of 10 cases of anaphylaxis after receipt of Moderna COVID-19 vaccine, patients had symptom onset within 30 minutes of vaccination, and nine anaphylaxis patients also had a history of allergies or allergic reactions, including some with previous anaphylaxis events; up to 30% of persons in the general population might have some type of allergy or history of allergic reactions.[¶] All 10 anaphylaxis cases reported after receipt of Moderna COVID-19 vaccine occurred in women. Whereas a previous review of anaphylaxis reports to VAERS found that 80% of cases reported in adults involved females (*8*), the current finding could be affected by the observation that more women than men had received a first dose of Moderna COVID-19 vaccine during the analytic period (61% of doses administered versus 36%, respectively). In a previous analysis of the Pfizer-BioNTech COVID-19 vaccine, two thirds of first doses were administered in women (*5*). The clinical and epidemiologic characteristics of anaphylaxis case reports after receipt of Moderna COVID-19 vaccine are similar to those reported after receipt of the Pfizer-BioNTech COVID-19 vaccine (*5*). For both vaccines, symptom onset after vaccination occurred quickly, usually within minutes. A strong female predominance of anaphylaxis case reports exists for both vaccines. Finally, many persons experiencing anaphylaxis after receiving either vaccine had a history of allergies or allergic reactions, with several having experienced an anaphylaxis episode in the past.

[§] Four of the initial 47 nonanaphylaxis allergic reactions were excluded from the final analysis. Based on the Code of Federal Regulations, a serious adverse event is defined if one of the following is reported: death, life-threatening illness, hospitalization or prolongation of hospitalization, permanent disability, congenital anomaly, or birth defect. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr = 312.32

[¶] https://www.aaaai.org/about-aaaai/newsroom/allergy-statistics

TABLE 1. Characteristics of reported cases of anaphylaxis (n = 10) after receipt of the first dose of Moderna COVID-19 vaccine — Vaccine Adverse Events Reporting System (VAERS), United States, December 21, 2020–January 10, 2021

Age, yrs	Sex	Past history: Allergies or allergic reactions*	Past history: Previous anaphylaxis episode	Onset after receipt (mins)	Signs and symptoms	Treatment setting†	Epi received	Brighton level§	Outcome or disposition¶
37	F	Penicillin, phenytoin, ibuprofen	No	1	Respiratory failure, vomiting	Inpatient	Yes	2	Discharged home
39	F	Penicillin, aloe	Yes, penicillin	2	Decreased peripheral perfusion, persistent dry cough, nausea	Inpatient	Yes	3	Discharged home
63	F	Acetaminophen, azithromycin	No	4	Periorbital edema, nausea	ED	Yes	2	Not specified
55	F	Multiple unspecified environmental and food allergies	Yes, unspecified	5	Hypotension, wheezing	Inpatient	Yes	2	Not specified
31	F	No	No	5	Diffuse erythematous rash, throat swelling	ED	Yes	1	Discharged home
49	F	Gadolinium, iodine	Yes, gadolinium, iodine	10	Diffuse erythematous rash, tongue swelling, wheezing	ED	Yes	1	Recovered at time of report
37	F	Unspecified intravenous contrast dye, penicillin	Yes, intravenous contrast dye	11	Generalized urticarial rash, tongue swelling	Inpatient	Yes	1	Discharged home
50	F	Unspecified allergies or allergic reactions	Yes, unspecified	12	Diffuse erythematous rash, wheezing	Inpatient	Yes	1	Discharged home
57	F	Multiple drugs including penicillin and sulfa	No	13	Periorbital edema, tongue swelling	ED	Yes	1	Recovered at time of report
44	F	Morphine, codeine	No	45	Diffuse erythematous rash, marked tongue swelling	Inpatient	Yes	1	Discharged home

Abbreviations: COVID-19 = coronavirus disease 2019; ED = emergency department; Epi = epinephrine; F = female.

* As documented in the VAERS report or medical records, or through confirmation with the treating health care provider or the patients themselves.

† Inpatient hospitalization.

§ The Brighton Collaboration case definition uses combinations of symptoms to define levels of diagnostic certainty. Brighton level 1 represents the highest level of diagnostic certainty that a reported case is indeed a case of anaphylaxis; levels 2 and 3 are successively lower levels of diagnostic certainty. Level 4 is a case reported as anaphylaxis but that does not meet the Brighton Collaboration case definition. Level 5 is a case that was neither reported as anaphylaxis nor meets the case definition (https://doi.org/10.1016/j.vaccine.2007.02.064).

¶ As documented in the description of the adverse event in the VAERS report in Box 18 or as documented in recovery status in Box 20.

Similar patient characteristics in case reports of nonanaphylaxis allergic reactions were observed among the two vaccines.

The findings in this report are subject to at least two limitations. First, analyses of passive surveillance data include reporting biases, both underreporting because of lack of awareness or compliance with reporting requirements and reporting guidance, as well as stimulated reporting related to increased awareness from media or other public information sources. Second, incomplete information in reports and potential data lags because of processing times might result in an undercount of cases, and lags in reporting for vaccine doses administered might underestimate denominator data. However, reporting efficiency to VAERS for clinically severe adverse events is believed to be high (*9*). It is reasonable to expect that diagnosis and reporting of an acute and clinically severe condition such as anaphylaxis occurs relatively quickly, and VAERS is likely sensitive at capturing anaphylaxis cases occurring after COVID-19 vaccination.

Mortality from COVID-19 in populations at increased risk for severe illness is substantial (*10*), and treatment options

Summary

What is already known about this topic?

Anaphylaxis is a severe, life-threatening allergic reaction that occurs rarely after vaccination.

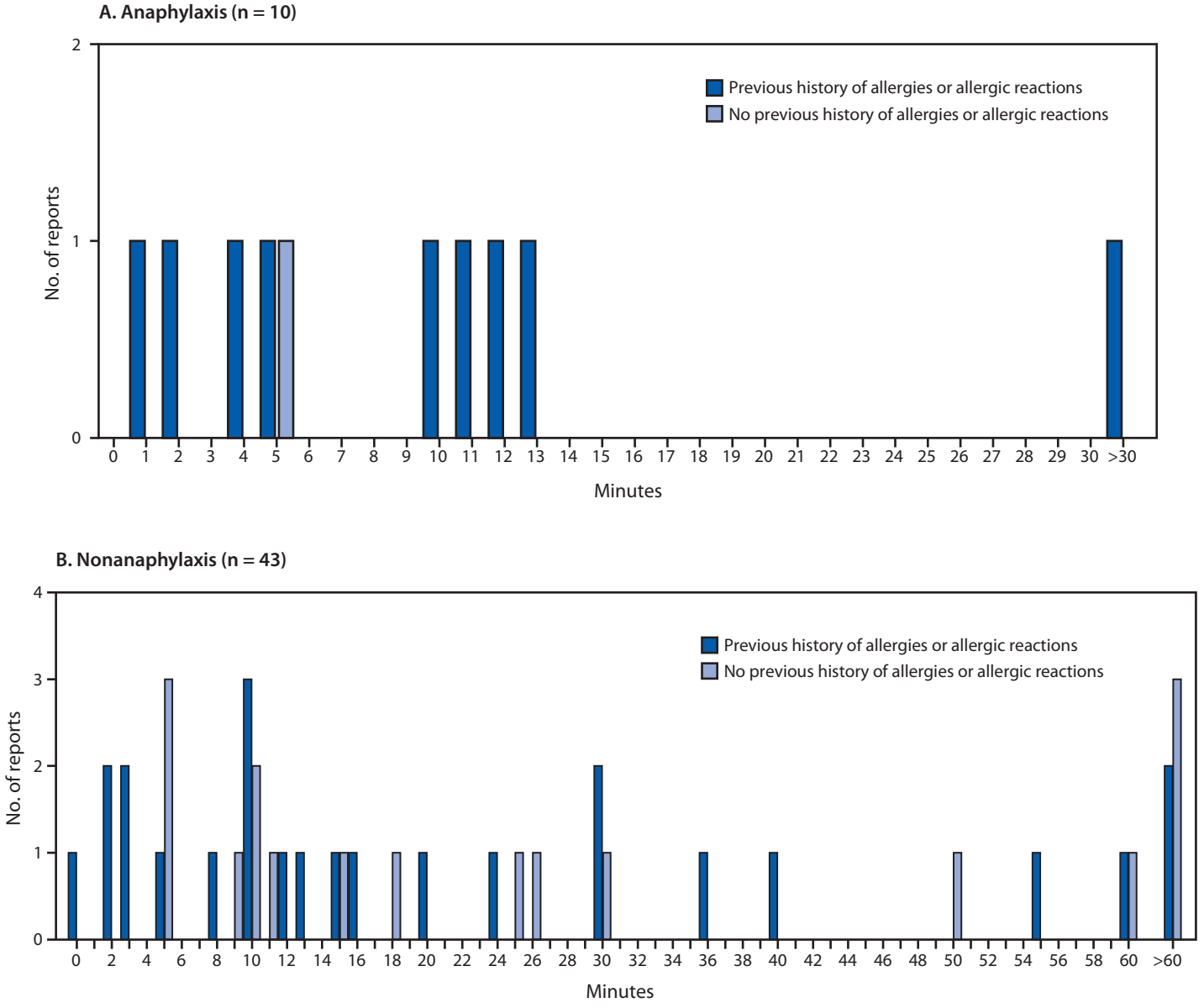
What is added by this report?

During December 21, 2020–January 10, 2021, monitoring by the Vaccine Adverse Event Reporting System detected 10 cases of anaphylaxis after administration of a reported 4,041,396 first doses of Moderna COVID-19 vaccine (2.5 cases per million doses administered). In nine cases, onset occurred within 15 minutes of vaccination. No anaphylaxis-related deaths were reported.

What are the implications for public health practice?

Locations administering COVID-19 vaccines should adhere to CDC guidance, including screening recipients for contraindications and precautions, having necessary supplies and staff members available to manage anaphylaxis, implementing recommended postvaccination observation periods, and immediately treating suspected anaphylaxis with intramuscular epinephrine injection.

FIGURE. Minutes from vaccine receipt to onset of anaphylaxis (A)* and nonanaphylaxis allergic reactions (B)† after receipt of the first dose of Moderna COVID-19 vaccine — Vaccine Adverse Events Reporting System (VAERS), United States, December 21, 2020–January 10, 2021



Abbreviation: COVID-19 = coronavirus disease 2019.

* The interval from vaccine receipt to symptom onset was >30 minutes for one anaphylaxis case (45 minutes).

† The interval from vaccine receipt to symptom onset was ≥60 minutes for three nonanaphylaxis patients who had a documented history of allergies or allergic reactions at 60, 90, and 98 minutes and for four who did not have a documented history of allergies or allergic reactions (60 minutes, 10 hours, 20 hours, and 24 hours). The interval from vaccine receipt to symptom onset was missing in two case reports, both of which documented a history of allergies or allergic reactions. Four cases of nonanaphylaxis allergic reactions with symptom onset occurring later than the day after vaccination (i.e., outside of the 0–1-day risk window) were excluded from the final analysis.

are limited. Widespread vaccination against COVID-19 with highly effective vaccines represents a critical tool in efforts to control the pandemic and save lives. CDC and FDA will continue to monitor for adverse events, including anaphylaxis, after administration of COVID-19 vaccines and will regularly assess the benefits and risks of vaccination in the context of the evolving epidemiology of the pandemic. Continued monitoring in VAERS and additional monitoring in population-based surveillance systems, such as the CDC's Vaccine Safety Datalink (https://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/vsd/index.html), will help to further characterize the risk for anaphylaxis after administration of COVID-19 vaccines.

TABLE 2. Characteristics of patients with reported anaphylaxis and nonanaphylaxis allergic reactions after receipt of the first dose of Moderna COVID-19 vaccine — Vaccine Adverse Events Reporting System (VAERS), United States, December 21, 2020–January 10, 2021

Characteristic	Type of reported reaction, no. (%)	
	Anaphylaxis (n = 10)	Nonanaphylaxis allergic reactions (n = 43)*
Median age, yrs (range)	47 (31–63)	43 (22–96)
Female	10 (100)	39 (91)
Minutes to symptom onset, median (range)	7.5 (1–45)	15 (<1–1,440 [24 hrs])
Symptom onset ≤15 mins	9 (90)	21 (51)†
Symptom onset ≤30 mins	9 (90)	30 (73)†
Documented history of allergies or allergic reactions	9 (90)§	26 (60)

Abbreviation: COVID-19 = coronavirus disease 2019.

* Four of the initial 47 nonanaphylaxis allergic reaction reports were excluded from the final analysis because symptom onset occurred later than the day after vaccination (i.e., outside the 0–1-day risk window).

† Two nonanaphylaxis allergic reaction reports were missing information on time of symptom onset; percentage calculated among 41 case reports with onset documented.

§ Five anaphylaxis reports included a patient history of a previous anaphylaxis episode.

CDC guidance on use of mRNA COVID-19 vaccines and management of anaphylaxis is available (*3*,*4*). Persons with an immediate allergic reaction to the first dose of an mRNA COVID-19 vaccine should not receive additional doses of either of the mRNA COVID-19 vaccines. In addition to screening for contraindications and precautions before administering COVID-19 vaccines, vaccine locations should have the necessary supplies and trained staff members available to manage anaphylaxis, implement postvaccination observation periods, immediately treat persons experiencing anaphylaxis signs and symptoms with intramuscular injection of epinephrine, and transport patients to facilities where they can receive advanced medical care. In addition, all patients should be instructed to seek immediate medical care if they develop signs or symptoms of an allergic reaction after their observation period ends and they have left the vaccination location. Health care providers can play an important role in vaccine safety monitoring by being vigilant in recognizing and reporting adverse events after immunization to VAERS at https://vaers.hhs.gov/reportevent.html.

Acknowledgments

Investigators from the Clinical Immunization Safety Assessment Project.

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Implementation and Evolution of Mitigation Measures, Testing, and Contact Tracing in the National Football League, August 9–November 21, 2020

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On January 25, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The National Football League (NFL) and the NFL Players Association (NFLPA) began the 2020 football season in July, implementing extensive mitigation and surveillance measures in facilities and during travel and gameplay. Mitigation protocols* were evaluated and modified based on data from routine reverse transcription–polymerase chain reaction (RT-PCR) tests for SARS-CoV-2, the virus that causes coronavirus 2019 (COVID-19); proximity tracking devices; and detailed interviews. Midseason, transmission was observed in persons who had cumulative interactions of <15 minutes' duration, leading to a revised definition of high-risk contacts that required consideration of mask use, setting and room ventilation in addition to proximity and duration of interaction. The NFL also developed an intensive protocol that imposed stricter infection prevention precautions when a case was identified at an NFL club. The intensive protocol effectively prevented the occurrence of high-risk interactions, with no high-risk contacts identified for 71% of traced cases at clubs under the intensive protocol. The incorporation of the nature and location of the interaction, including mask use, indoor versus outdoor setting, and ventilation, in addition to proximity and duration, likely improved identification of exposed persons at higher risk for SARS-CoV-2 infection. Quarantine of these persons, along with testing and intensive protocols, can reduce spread of infection.

The NFL consists of 32 member clubs based in 24 states. The NFL-NFLPA implemented a standard COVID-19 mitigation protocol in July that included mandatory masking; physical distancing; frequent handwashing; facility disinfection; restricted facility access; and regular, frequent testing of players and staff members (*1*). Contact tracing was performed by trained staff members and supported by KINEXON wearable proximity devices (https://kinexon.com) that were required to be worn by players and personnel when in club environments (*2*). Device recordings captured consecutive and cumulative minutes/seconds of interactions among persons within 1.8 meters (6 feet) of one another. When testing identified a new COVID-19 case, trained staff members conducted interviews to identify contacts including and beyond device-identified persons (e.g., nonclub activities, social interactions, and times when the device was not worn). RT-PCR tests, with results available in 24 hours, were initially conducted 6 days per week for players and most staff members.† Analyses were performed to actively evaluate the efficacy of the NFL-NFLPA protocols in limiting high-risk interactions and preventing COVID-19, including comprehensive review of RT-PCR results, device-recorded interactions, and contact tracing interviews. This activity was reviewed by CDC and was conducted consistent with applicable federal law, CDC, and NFL-NFLPA policy.§

Over the course of the monitoring period (August 9–November 21), 623,000 RT-PCR tests were performed among approximately 11,400 players and staff members; 329 (approximately 2.9%) laboratory-confirmed cases of COVID-19 were identified. After intake screening,¶ in August and early September, fewer than 10 COVID-19 cases were identified per week for the following 7 weeks (Figure), during which time the standard protocol was in effect, which emphasized physical distancing, masking, limited numbers of persons in specific areas, and other important behavioral and facility-related parameters. However, during September 27–October 10, a total of 41 cases

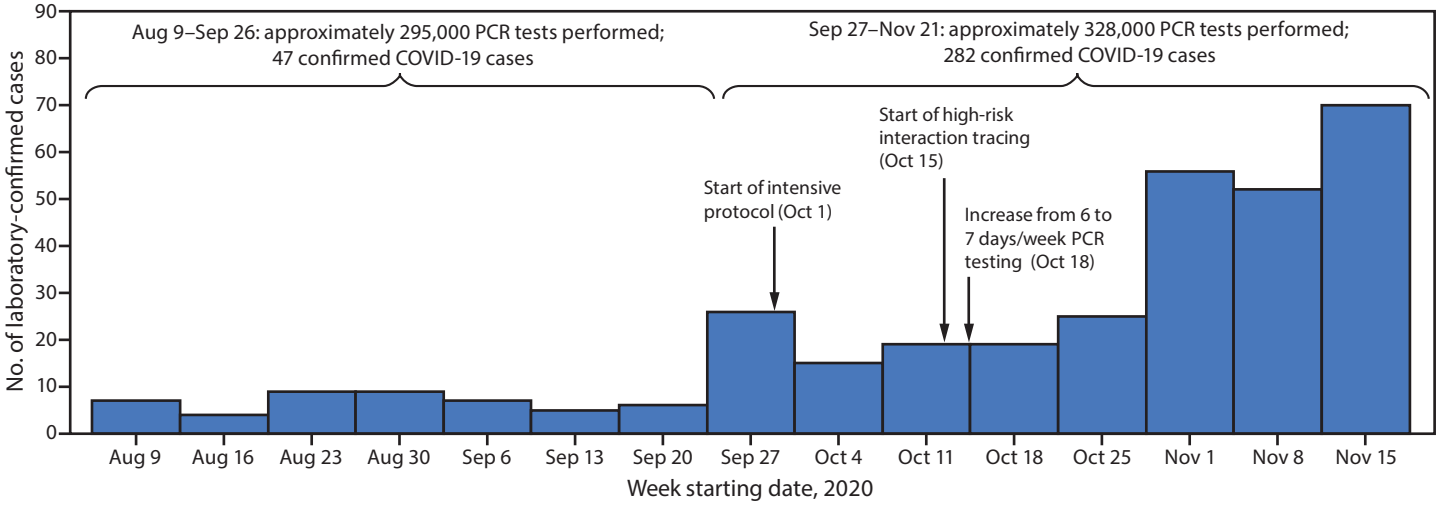
* https://www.playsmartplaysafe.com/wp-content/uploads/2020/10/nfl-nflpa-covid-protocols-updated-10.16.20-final.pdf

† A single lab provider with five geographically dispersed laboratories, BioReference Laboratories, provided <24-hour turnaround nucleic acid amplification testing, with Roche Cobas, Hologic Panther, and ThermoFisher QuantStudio as the primary molecular platforms. Tests were administered via anterior nasal swabs. Staff members whose job functions required regular direct access to players for >10 minutes at a time and those who would regularly be in close proximity to players were tested 6 days per week (approximately two thirds of staff members). Consultants who were only in contact with players on a periodic basis were tested less frequently and immediately before access to players and club personnel. Other staff members who performed facility, stadium, or event services but did not require close contact with other persons were tested once per week.

§ 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; March 15, 2020 NFL-NFLPA Collective Bargaining Agreement, Article 39, Section 18, Appendix X.

¶ Before reporting to the club facility for preentry testing, players and staff members completed a symptom and exposure questionnaire. Staff members were tested via RT-PCR test nasal swab on two occasions separated by 72 hours. After two negative tests, entry into the facility was allowed and daily testing began. Players were RT-PCR tested on day 1, day 2, and day 4. If players had negative test results on days 1, 2, and 4, they were allowed to enter the facility with daily RT-PCR testing beginning on day 5. Quarantine was required during intake testing. Daily symptom screening continued through intake testing and throughout the monitoring period. Antibody testing was offered but not required and did not impact behavioral requirements mandated by the NFL-NFLPA COVID-19 protocols.

FIGURE. Laboratory-confirmed* COVID-19 cases (N = 329) and mitigation strategies† implemented — National Football League, United States, August 9–November 21, 2020



Abbreviations: COVID-19 = coronavirus disease 2019; PCR = polymerase chain reaction.

* Reverse-transcription PCR tests were processed on two platforms (Roche Cobas and ThermoFisher QuantStudio) and transcription-mediated amplification on one platform (Hologic Panther Aptima).

† Twenty-nine clubs spent 431 days under the intensive protocol beginning October 1; 189 high-risk contacts of 215 cases were identified and subsequently quarantined beginning October 15.

were identified among players and staff members, 21 of which were believed to have resulted from within-club transmission at a single club, requiring closure of that club's facilities. Subsequent contact tracing identified multiple instances of transmission that likely occurred during <15 minutes of cumulative interaction within 1.8 meters (6 feet). Among the 21 persons with suspected within-club transmission, 12 had no device-recorded interactions of ≥15 consecutive minutes with a person with confirmed COVID-19, including eight who had no interactions >5 consecutive minutes and seven who had no interactions >15 cumulative minutes per day (with no other known exposures to a person with COVID-19). Interviews revealed that, among the brief interactions that did occur, some were during unmasked meetings in small rooms or while eating. Persons who contracted COVID-19 within this single-club transmission group received negative test results for several days after exposure (i.e., after club activities ceased) before receiving a positive result.

After this cluster of cases, several league-wide changes were implemented. The first involved the clubs moving to an intensive protocol for 7 days when a positive test result was received; the intensive protocol mandated further restrictions for the entire club to mitigate spread (Table 1). The intensive protocol was implemented for any club if any players or staff members with facility access contracted COVID-19, or if the team played a game against an opposing player who received a next-day positive result from his game-day test. During October 1–November 21, among the 32 clubs, 29 spent 431 days under the intensive protocol. During this time, the median number of within-facility interactions of ≥15 consecutive minutes at <1.8 meters (<6 feet) per club per day decreased by 60%, from 60 to 24, and interactions of ≥2 consecutive minutes decreased by 28%, from 1,691 to 1,222. The second change involved increasing testing frequency from 6 to 7 days per week. A third league-wide change was expansion of contact tracing and transmission risk assessment focusing on high-risk contact identification, which comprised four main components. These were, in addition to consideration of duration of exposure and specific distance between persons, assessment of face mask use (e.g., medical mask versus cloth face covering, proper mask use for both infected person and contact, and any mask removal to eat or drink) and setting and ventilation (e.g., outdoor, indoor large volume, indoor small volume, and during transportation).** Expanded contact tracing covered all club-related contacts of persons with confirmed COVID-19 within the preceding 48 hours, including those outside the facility, with interviews regarding the full context of exposure and medical expert evaluation of the risk level for each interaction. Designation of a high-risk contact generally required concern by medical experts about the interaction involving two or more components; mask use and outdoor settings were considered protective. For example, short car rides with partial mask use were considered high-risk, whereas prolonged interaction (>15 minutes) in well-ventilated settings (e.g., outdoors) with proper mask use were not. Contact tracing

** Modified from https://english.elpais.com/society/2020-10-28/a-room-a-bar-and-a-class-how-the-coronavirus-is-spread-through-the-air.html. Accessed November 20, 2020.

TABLE 1. Summary of standard and intensive COVID-19 mitigation protocols — National Football League/National Football League Players Association, United States, August–November 2020

Standard protocol	Intensive protocol (modifications/stipulations)*
Meetings	
Conducted virtually to the extent possible	All meetings must be held virtually
If in-person meetings are necessary, clubs must make efforts to conduct them outdoors with physical distancing and masking	If in-person necessary, meetings must be held outdoors or in large domed (tented) practice field with physical distancing, masking, and with all attendees wearing proximity tracking devices, with specific approval by medical experts
In-person meetings without physical distancing prohibited	
Meetings with >15 persons must be virtual, unless physical distancing is possible	
Practice/Walkthrough	
All staff members must wear masks at all times on the practice field, and all players must wear masks on the practice field when feasible; surgical masks preferred, and gaiters, valved/vented masks prohibited	All players must wear masks or Oakley face shield during practices at all times without exception
	Staff members must wear masks at all times; gaiters, valved/vented masks prohibited
Masks mandatory during walkthroughs	Players may remove helmets/masks for breaks but must maintain >6 feet (1.8 meters) of distance
Weight room	
Maximum capacity of 15 players (no limit on staff members)	Maximum capacity of 10 players and five staff members
Must maintain 6 feet (1.8 meters) of distance	Further emphasis on appropriate distancing
All staff members must wear masks	Players and staff members must wear masks at all times
Players encouraged to wear masks but not mandatory	
Medical treatment/rehabilitation	
Masks required during medical treatment and rehabilitation inside the club facility; surgical masks preferred	Players must wear a surgical grade mask at all times and a face shield when possible
	Staff members must wear a face shield and surgical grade mask and gloves at all times
RT-PCR testing	
Negative RT-PCR test result from the previous day before facility entrance is permitted	RT-PCR test results returned for all players from previous day before any players or staff members are permitted in the facility (negative result required for entry)
Cafeteria/Meal area	
Meal room access limited	No seating permitted in cafeteria or meal area (grab-and-go only)
Tables distanced to allow for 10 feet between persons while consuming food and drink	
Clubs expected to discourage group dining	
Clubs expected to stagger mealtimes	
Whenever possible, premade meals should be provided in individually packaged containers or bags for takeout	
Disposable utensils, plates and single-use condiments must be used	
Buffet-style, communal and self-serve spreads prohibited	
Locker rooms	
Locker room reconfigured to allow for 6 feet (1.8 meters) between players; if not possible, clubs must consider other measures (e.g., plexiglass dividers between lockers and temporary lockers in tented areas)	Locker room use strongly discouraged
Minimize time players spend in locker room	Use must be <15 minutes per person per session
Minimize number of players in the locker room	Limited to smaller groups
Masks required at all times, except in the shower	
Gatherings	
Groups of more than three persons prohibited from gathering outside of facility or team travel	No in-person contacts among players or essential staff members outside of facility or team travel

Abbreviations: COVID-19 = coronavirus disease 2019; RT-PCR = reverse transcription–polymerase chain reaction.
* The intensive protocol includes all the components of the standard protocol, with modifications or stipulations listed.

interviews and adjudication of high-risk contact status were typically completed within 18 hours of a positive test result. All contacts of COVID-19 patients, regardless of duration of interaction, were instructed to remain out of club facilities until high-risk status determination was complete. Persons could also be designated high-risk contacts if a household member received a positive test result (*3*); self-reporting of cases among household members was required. The mandatory minimum

quarantine for high-risk contacts was 5 days postexposure, shorter than that recommended in CDC guidance (*4*); this was deemed acceptable because daily RT-PCR testing with <24-hour turnaround was available. Upon release from quarantine, high-risk contacts continued daily testing and symptom monitoring, enabling rapid identification and isolation of persons who received positive test results after quarantine.

During October 15–November 21, a total of 189 NFL players and staff members were identified as high-risk contacts of 215 persons with confirmed COVID-19 and were subsequently quarantined. Among these, 20 (11%) persons from 12 clubs received positive test results (mean and median interval from exposure to positive RT-PCR sample collection = 5 days [range = 1–9 days]) (Table 2). Seven of these 20 contacts received positive test results after release from 5-day quarantine; however, they continued to test daily and adhere to strict mitigation measures, and no within-club secondary transmission was identified among these persons. Among those exposed outside of the home, all reported partial or no mask use, and the majority of exposures were external to the NFL environment (e.g., sharing a vehicle and eating at a restaurant). Among 107 traced cases among clubs already in the intensive protocol at the time of positive test result, 76 persons (71%) had no high-risk contacts identified.

TABLE 2. Characteristics of high-risk interactions* between persons who were identified as high-risk contacts of a COVID-19 patient, quarantined, and subsequently received a positive SARS-CoV-2 test result (N = 20) — National Football League (NFL), United States, October 15–November 21, 2020

Characteristic	No.†
Total contacts	**20**
Household contacts (family member or roommate)§	8
Nonhousehold contacts¶	12
Work environment	4
Within 1.8 m (6 ft)**	2
>15 cumulative minutes of contact	4
No facial covering or partial facial covering	4
Indoors (club facility/hotel††)	4
Involved dining	4
Nonwork environment	8
Within 1.8 m (6 ft)	8
>15 cumulative minutes of contact	7
No or partial face covering	8
Indoors§§	8
Involved dining¶¶	5

Abbreviation: COVID-19 = coronavirus disease 2019.
* Identified through expanded contact tracing. The 20 high-risk contacts were from 12 clubs.
† If information about the specific interaction was unknown, person was excluded.
§ Two of the eight household high-risk contacts worked and lived with the index person with COVID-19 and likely also had work environment interactions but are excluded from that analysis because of the high-risk level of household exposures.
¶ Based on KINEXON device data and interviews (n = 4) or interviews only (n = 8). Multiple interactions are possible.
** Unknown for two of four.
†† Three of the four were exposed in a team hotel; one of the four was exposed in an NFL club facility.
§§ Five of the eight were exposed at a party/social gathering, one of the eight in a restaurant, and two of the eight in a car.
¶¶ Unknown for one contact.

Discussion

Real-time evaluation of surveillance data and response to suspected COVID-19 transmission events within NFL clubs led to important changes in NFL-NFLPA COVID-19 protocols. Compulsory 7-day intensive protocol implementation for clubs with any exposure to COVID-19, mandatory 5-day quarantine of high-risk contacts, and daily RT-PCR testing effectively reduced exposure and facilitated earlier case identification. Daily testing allowed early, albeit not immediate, identification of infection (*5*), necessitating quarantine after exposure; high frequency testing also facilitated real-time program evaluation.

To date, the ability to define a close contact has been limited. An investigation from a Vermont corrections facility confirmed that cumulative brief interactions exceeding 15 minutes in total could lead to transmission (*6*). However, among 21 NFL cases for which contact tracing indicated likely within-club transmission, seven infected persons had no interactions exceeding 15 cumulative minutes per day within 1.8 meters (6 feet) of a person with COVID-19, as confirmed by wearable proximity devices. This finding led to a revised high-risk contact definition that included ascertainment of mask use and setting, in addition to duration of exposure and proximity.

Although proximity devices provided detailed information about possible high-risk interactions, prompt, detailed, contact tracing beyond proximity device data was needed to identify high-risk behaviors and enable quarantine of exposed persons. All high-risk contacts who subsequently received a COVID-19 diagnosis were identified, at least in part, from information obtained through interviews. Indoor unmasked activities, ridesharing in personal vehicles, and eating and drinking in close proximity were of particular risk, as has been previously reported (*7*).

An intensive protocol designed for this environment and deployed to facilities with known exposure was an effective mitigation measure. Some NFL clubs chose to retain intensive protocol restrictions beyond mandatory periods; implementation and completion of an intensive protocol can serve an important motivator and reminder of the need for diligence (*8*). The quarantine of exposed persons and ability of the full employee population to move into a more restrictive protocol during periods of increased risk is an intervention that could be extended to settings such as long-term care facilities, schools, and high-density environments (*9*). The intensive protocol was likely critical in preventing transmission of SARS-CoV-2 because seven of 20 quarantined high-risk contacts did not receive a positive test result until completing their 5-day

Summary

What is already known about this topic?

COVID-19 contact tracing is important to prevent transmission, but risk characterization is difficult.

What is added by this report?

The National Football League observed SARS-CoV-2 transmission after <15 minutes of cumulative interaction, leading to a revised definition of a high-risk contact that evaluated mask use and ventilation in addition to duration and proximity of interaction. Intensive mitigation protocols effectively reduced close interactions.

What are the implications for public health practice?

Assessment of the context of each interaction, including mask use, indoor versus outdoor setting, and ventilation, in addition to duration and proximity, can improve identification of high-risk contacts during contact tracing. Postexposure quarantine based on redefined high-risk criteria, combined with testing and environment-specific intensive protocols, can protect communities before and after case identification.

quarantine. In scenarios without daily testing, duration of both quarantine and intensive protocol implementation might require extension. Intensive protocol restrictions can be tailored to each environment to include, at minimum, more extensive masking and outdoor venue use and further restrictions in access, room volume, in-person meetings, and mealtime interactions.

The increase in cases identified in NFL clubs in October and November mirrored the increased incidence in the United States during that time (*10*). These infections were primarily related to community exposures, based on contact tracing interviews and exemplified by the high proportion of persons who contracted COVID-19 after household exposure. Although the intensive protocol and high-risk contact designations were primarily intended to prevent work-related exposures, employees were regularly educated about risks from household and community exposure. Implementation of the intensive protocol decreased within-facility exposures despite increasing community transmission of COVID-19 across the country during this time.

The findings in this report are subject to at least three limitations. First, wearable device metrics rely on adherence; individual-level compliance is unknown. Second, determination of high-risk contact status is interview-based and subject to recall and reporting bias; household exposures are based on self-report. Finally, source and date of transmission cannot be confirmed.

COVID-19 mitigation measures must be continually optimized based on available data. In the NFL, COVID-19 transmission was identified in persons with <15 minutes of consecutive or cumulative interaction and was reduced through implementation of an intensive protocol focused on environmental change, increased personal protection, avoidance of high-risk interactions such as vehicle sharing, eating in the same room or common areas, and expansion of the components of contact tracing to incorporate high-risk contact designations. Although the protocols implemented by the NFL were resource-intensive, strategies such as accounting for specific characteristics of the close contact, in addition to time and duration, and creation of an intensive protocol are applicable to other settings, including essential workplaces, long-term care facilities, and schools.

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COVID-19 Cases and Transmission in 17 K–12 Schools — Wood County, Wisconsin, August 31–November 29, 2020

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On January 26, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The coronavirus disease 2019 (COVID-19) pandemic has disrupted in-person learning in the United States, with approximately one half of all students receiving online-only instruction since March 2020.* Discontinuation of in-person schooling can result in many hardships (*1*) and disproportionately affects families of lower socioeconomic status (*2*). Current evidence suggests that transmission of SARS-CoV-2, the virus that causes COVID-19, in kindergarten through grade 12 (K–12) schools might not significantly contribute to COVID-19 spread nationwide (*3*). During August 31–November 29, 2020, COVID-19 cases, spread, and compliance with mask use were investigated among 4,876 students and 654 staff members who participated in in-person learning in 17 K–12 schools in rural Wisconsin. School-attributable COVID-19 case rates were compared with rates in the surrounding community. School administration and public health officials provided information on COVID-19 cases within schools. During the study period, widespread community transmission was observed, with 7%–40% of COVID-19 tests having positive results. Masking was required for all students and staff members at all schools, and rate of reported student mask-wearing was high (>92%). COVID-19 case rates among students and staff members were lower (191 cases among 5,530 persons, or 3,453 cases per 100,000) than were those in the county overall (5,466 per 100,000). Among the 191 cases identified in students and staff members, one in 20 cases among students was linked to in-school transmission; no infections among staff members were found to have been acquired at school. These findings suggest that, with proper mitigation strategies, K–12 schools might be capable of opening for in-person learning with minimal in-school transmission of SARS-CoV-2.

Among 18 selected schools in Wood County, Wisconsin, 17 agreed to participate in this study of COVID-19 in schools and compliance with mask use. One school opted not to participate based on teacher preference. Surveillance was initiated by a small group of physician and medical student researchers. Participating schools were from three public school districts, one private school district, and one independent private school. Eight schools were elementary (grades K–6) with 1,529 students attending in-person, and nine were secondary (grades 7–12) with 3,347 students attending in-person. An estimated 12.4% of Wood County's children were attending virtually.

A number of infection mitigation measures were employed at the schools. The Legacy Foundation of Central Wisconsin provided funding for the districts to purchase 2–3-layer cloth face coverings for all students, and all students received three to five masks as a result of this grant. All schools were under district and statewide mask mandates during the study period. Students were asked to wear masks when within 6 feet of another person outdoors and at all times indoors. A classroom cohort included students from one grade level who avoided mixing with other students and ranged in size from 11 to 20 students. All classes and lunch periods were held indoors. Schools generally attempted to seat students near the same person within their cohort, if possible. Staff members were instructed to wear masks, maintain a distance of 6 feet from all persons, if possible, and limit time in shared indoor spaces. If a student was excluded from in-person school because of COVID-19 symptoms, that student's siblings also were excluded from school. No systematic COVID-19 screening was conducted in the schools or the community.

A free online survey using Google Forms (https://www.google.com/intl/en-GB/forms/about) was distributed to all eligible classroom teachers (305) by the school administration or the research team. Information regarding the total number of students expected to attend school in-person, number of students actually attending in-person, and number of students donning or wearing masks when expected to do so was obtained from these surveys. Teachers were instructed to complete the survey once per week during a single class and were instructed to complete the survey based on what they were observing at that time on survey day. Information on masking compliance among staff members was not collected.

Information was obtained from the Wood County public health COVID-19 dashboard† on weekly cases and percentage of positive COVID-19 test results in the community. A COVID-19 case was defined as a positive SARS-CoV-2 reverse transcription–polymerase chain reaction (RT-PCR) test result. COVID-19 cases in schools were reported by public health or school administration officials using deidentified data. Infection source and whether the infection was likely acquired

* Accessed January 13, 2021. https://cai.burbio.com/school-opening-tracker/

† Accessed December 10, 2020. https://woodwi.maps.arcgis.com/apps/opsdashboard/index.html#/da7f0d6815494e4b85e614e042671b14

in school or outside of school were determined by case investigations conducted by school administration and the public health department. When a school was alerted to a positive case in a student or staff member, school officials identified persons who had had close contact with the patient through interviews with the patient, parents, and school staff members. Close contact was defined as being within 6 feet for longer than 15 cumulative minutes during a 24-hour period.[§] Patients' close contacts were required to quarantine in their homes, and if they experienced symptoms during the quarantine period, they were further investigated to determine whether in-school spread might have occurred.

Descriptive statistics were used to calculate school and district average masking compliance as well as percentage of students absent based on the weekly surveys. The protocol was reviewed by the Aspirus Wausau Hospital Institutional Review Board and determined to be exempt from human subjects review because it met the requirements under 45 CFR 46. 104 (d) (2) and underwent a limited review as required under 46.111 (a) (7).

A total of 4,876 students and 654 staff members contributed data to the study. Wood County in central Wisconsin has a population of approximately 73,000, with just under 100 persons per square mile. According to a 2019 U.S. Census Bureau estimate,[¶] 92.0% of the population in Wood County identified as non-Hispanic White, median income was $54,913, and 10.7% of persons met poverty thresholds.[**] During the 13-week study period (August 31–November 29), a total of 3,393 COVID cases were reported in Wood County (cumulative incidence = 5,466 per 100,000 persons), including 191 cases within the participating schools (cumulative incidence = 3,454 per 100,000). Cases occurred in 133 students and 58 staff members. Among these 191 cases, seven (3.7%) were attributed to in-school SARS-CoV-2 transmission (Figure 1), and all occurred among students. Five cases of transmission occurred within elementary school cohorts, and two occurred within secondary school cohorts. Three of these seven cases occurred in one class in one elementary school, and the other four occurred at separate schools. No in-school transmission between separate classroom cohorts was reported. Weekly COVID-19 incidence ranged from 34 to 1,189 per 100,000 persons in the community, and from 72 to 699 cases per 100,000 among students and staff members in the schools. COVID-19 incidence in schools conducting in-person instruction was 37% lower than that in the surrounding community. During the study period, 7%–40% of RT-PCR tests from Wood County had positive results (Figure 2).

A total of 2,846 teacher survey responses were collected weekly (response rate = 54%), including 37,575 weekly student masking observations. Observed student masking compliance ranged from 92.1% to 97.4% (Figure 3) and did not vary by student age. During the study period, masking noncompliance increased slightly from 2.6% to 7.9%.

Discussion

This study, involving students and staff members in 17 K–12 schools in five rural Wisconsin districts under district and statewide mask mandates, found high teacher-reported student masking compliance. Among 5,530 students and staff members, 191 COVID-19 cases were reported. Only seven (3.7%) of these cases were associated with in-school transmission, all in students. Despite widespread community transmission, COVID-19 incidence in schools conducting in-person instruction was 37% lower than that in the surrounding community.

Children might be more likely to be asymptomatic carriers of COVID-19 than are adults (*4*). In the present study, the absence of identified child-to-staff member transmission during the 13-week study period suggests in-school spread was uncommon. This apparent lack of transmission is consistent with recent research (*5*), which found an asymptomatic attack rate of only 0.7% within households and a lower rate of transmission from children than from adults. However, this study was unable to rule out asymptomatic transmission within the school setting because surveillance testing was not conducted.

Student masking compliance was reported to exceed 92% throughout the course of the study. Older children were reported to be equally compliant with masking as younger children. High levels of compliance, small cohort sizes (maximum of 20 students), and limited contact between cohorts likely helped mitigate in-school SARS-CoV-2 transmission and could be responsible for the low levels of transmission detected in schools. Investigation of 191 school-related COVID-19 cases in students and staff members suggested that most transmission occurred outside of required school activities. This finding is consistent with recently reported data suggesting limited transmission within schools (*6*).

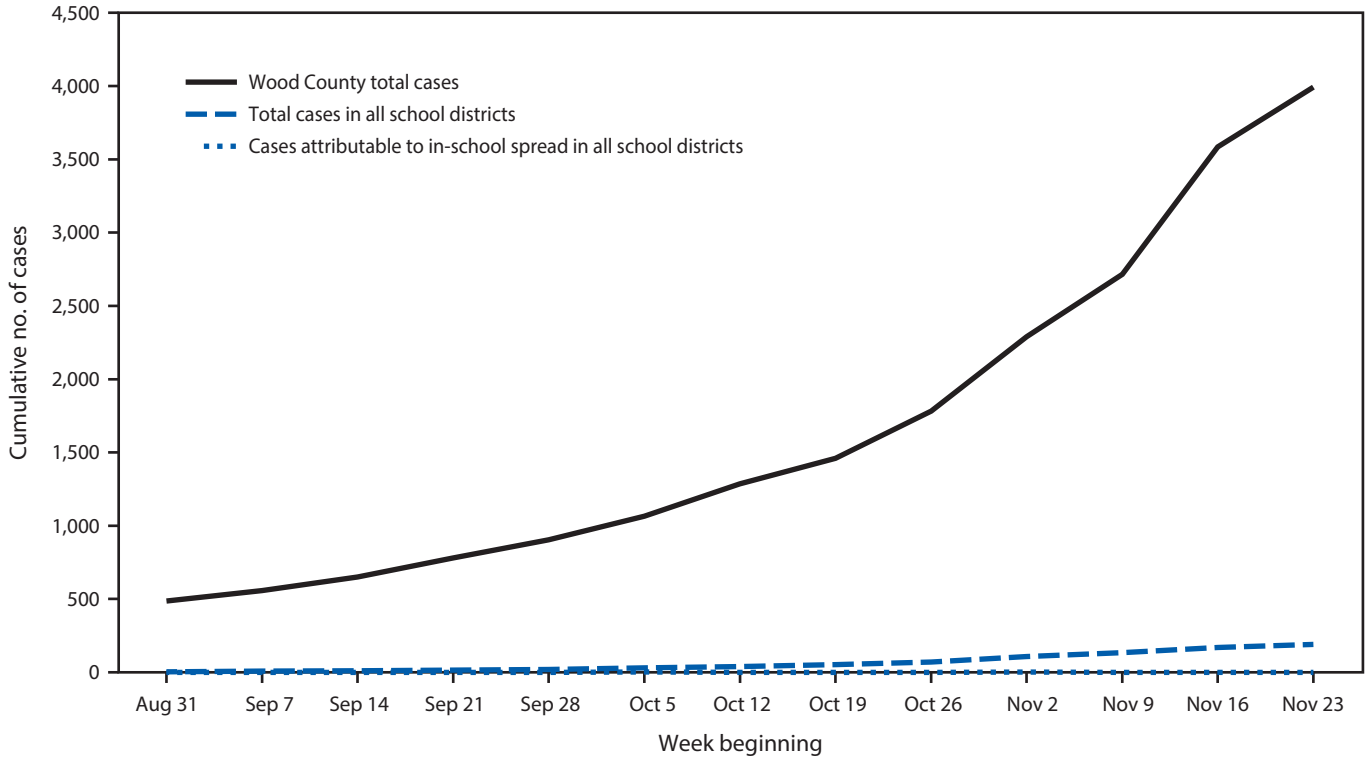
Some school districts throughout the country have set thresholds for reopening based on the percentage of positive test results in the community (e.g., Virginia: 10%, California: 8%) (*7*,*8*). The percentage of positive COVID-19 test results ranged from 7% to 40% in the community, and confirmed COVID-19 cases within schools were few. These findings suggest that attending school where recommended mitigation strategies are implemented might not place children in a higher

[§] CDC has defined "close contact" at the following URL: https://www.cdc.gov/coronavirus/2019-ncov/global-covid-19/operational-considerations-contact-tracing.html#:~:text=Close%20contact%20is%20defined%20by,the%20patient%20is%20isolated

[¶] https://www.census.gov/quickfacts/woodcountywisconsin

[**] https://aspe.hhs.gov/poverty-guidelines

FIGURE 1. Cumulative number of community and school-associated* COVID-19 cases and in-school transmission,† by week — Wood County, Wisconsin, August 31–November 29, 2020



Abbreviation: COVID-19 = coronavirus disease 2019.
* Cases occurring in students or school staff members.
† Cases attributed to virus transmission occurring during students' attendance at schools.

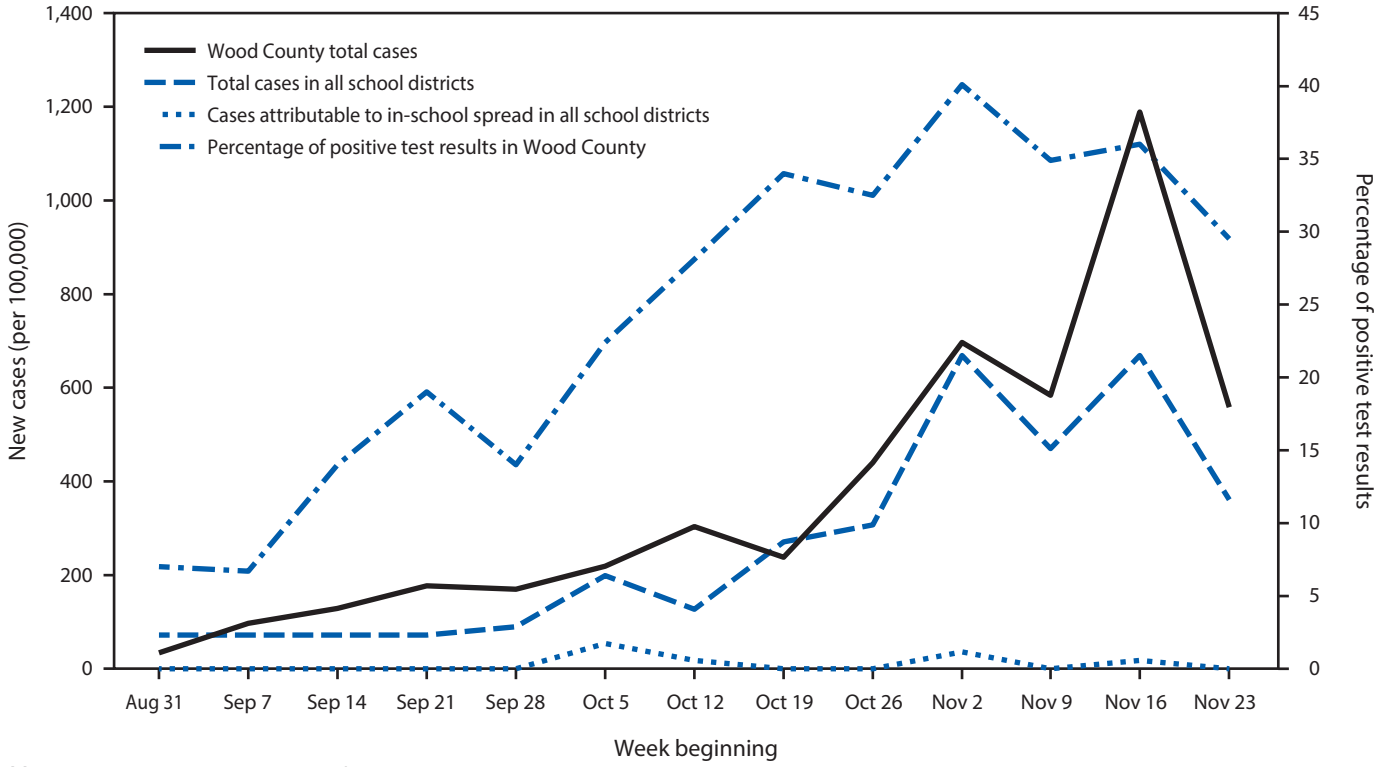
risk environment than exists in the community. Having children in a monitored school setting might increase adherence to mask compliance, and cohorting can help minimize exposures for children and adults. In-person schooling for children has numerous health and societal benefits, especially for children and parents of lower socioeconomic status (*9*).

The findings in this report are subject to at least seven limitations. First, mask use was assessed using a survey that was not validated, dependent on voluntary teacher response and subject to recall and social desirability biases (*10*). The actual mask-wearing rate might have been different because only approximately one half of teachers participated in the study. Teachers with lower masking compliance in their cohort might have been less likely to complete the survey, which limits the reliability of this measure. Second, lack of data about masking compliance among staff members might also lead to a reported masking compliance that differed from actual masking compliance among all persons in the study. Third, it was not possible to determine the specific roles that mask-wearing and other disease mitigation strategies played in the low rate of disease spread, and information on school ventilation systems was not obtained. Fourth, because schools did not perform infection screening of staff members and students, the prevalence of asymptomatic spread could not be determined. However, recent serological survey data from a school setting found asymptomatic spread to be minimal.†† Fifth, sources of infection among identified cases were detected through contact tracing, which is less accurate than is genomic sequencing. Sixth, rural schools might differ in important ways from those in more densely populated areas. For example, the capacity to achieve physical distancing in schools might differ if classroom size and outdoor space in rural schools is different from that in suburban or urban schools. However, all the classes and lunch periods in this study were held indoors, as would be consistent with most urban settings. Finally, the ethnic makeup of this rural population was predominantly non-Hispanic White, and the results of this study might not be generalizable to other rural or nonrural school populations.

In a setting of widespread community SARS-CoV-2 transmission, few instances of in-school transmission were identified among students and staff members, with limited spread among children within their cohorts and no documented transmission

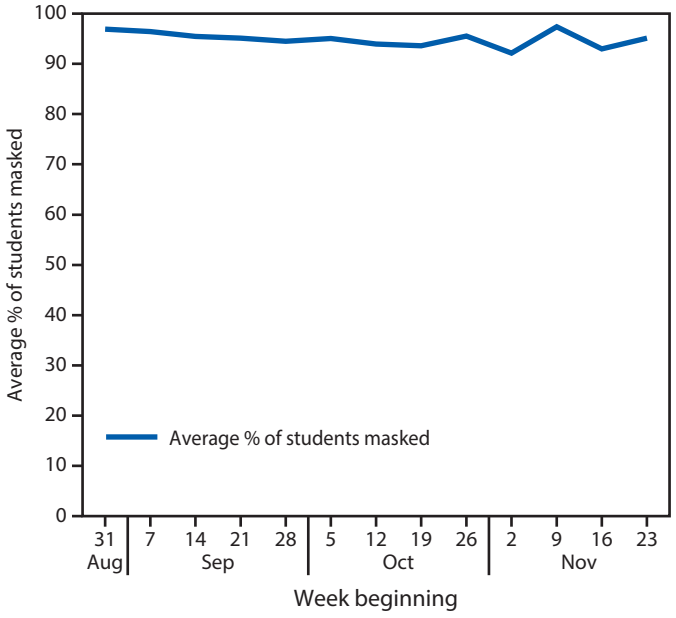
†† https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.26.1.2002011;jsessionid=XJtPf50wnH_YvhDr9woWoYNt.i-0b3d9850f4681504f-ecdclive?fbclid=IwAR2XBDNzXyJfBcZ7aCslsmQAiBhqS57D738ab9gJpAz88_40lnvEE263CT0#html_fulltext

FIGURE 2. Community and school-associated COVID-19 incidence (cases per 100,000) and percentage of positive test results, by week — Wood County, Wisconsin, August 31–November 29, 2020



Abbreviation: COVID-19 = coronavirus disease 2019.

FIGURE 3. Average percentage of students (N = 4,876) in compliance with recommended mask use across all districts — Wood County, Wisconsin, August 31–November 29, 2020



to or from staff members. Only seven of 191 cases (3.7%) were linked to in-school transmission, and all seven were among children. Mask-wearing among students was reported by teachers as high, which likely contributed to low levels of observed disease transmission in these 17 K–12 schools. Although asymptomatic transmission is possible, this study demonstrated that, with precautions in place, in-school transmission of SARS-CoV-2 appeared to be uncommon in this rural Wisconsin community, despite up to a 40% positive SARS-CoV-2 test rate in the surrounding county.

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Summary

What is already known about this topic?

COVID-19 outbreaks related to kindergarten through grade 12 (K–12) classroom settings have been rarely reported; however, in-school transmission risk has not been well described.

What is added by this report?

Among 17 rural Wisconsin schools, reported student mask-wearing was high, and the COVID-19 incidence among students and staff members was lower than in the county overall (3,453 versus 5,466 per 100,000). Among 191 cases identified in students and staff members, only seven (3.7%) cases, all among students, were linked to in-school spread.

What are the implications for public health practice?

With masking requirements and student cohorting, transmission risk within schools appeared low, suggesting that schools might be able to safely open with appropriate mitigation efforts in place.

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SARS-CoV-2 Transmission Associated with High School Wrestling Tournaments — Florida, December 2020–January 2021

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On January 26, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On December 7, 2020, local public health officials in Florida county A were notified of a person with an antigen-positive SARS-CoV-2 test* result who had attended two high school wrestling tournaments held in the county on December 4 and 5. The tournaments included 10 participating high schools from three counties. The host school (school A in county A) participated in the tournaments on both days; five high school teams from two counties participated the first day only; four additional high school teams from the three counties participated the second day. A total of 130 wrestlers, coaches, and referees attended the tournaments (Table). During December 8–9, 13 wrestlers from school A received positive SARS-CoV-2 test results (Figure), including nine who were symptomatic, two who were asymptomatic, and two for whom symptom status at time of specimen collection was unknown. Local public health officials in the three counties initiated an investigation† and tested specimens from an additional 40 attendees from nine of the 10 participating schools. A total of 54 (41.5%) of the 130 tournament attendees received testing, and 38 cases of SARS-CoV-2 infection were identified; the minimum attack rate was 30.2% (38 of 126§), and 70.4% (38 of 54) of tests had a positive result. Among contacts of the 38 COVID-19 patients, 446 were determined by investigators to meet the CDC definition of a close contact,¶ including 62 who were household contacts and 384 who were in-school contacts (classmates, teachers, noncompeting wrestling team members, and other school athletic team members). Among these 446 contacts, five had received a diagnosis of COVID-19 during June–November and were excluded from attack rate calculations. Among 95 (21.3%) contacts who received SARS-CoV-2 testing, 41 (43.2%) received a positive test result (minimum attack rate = 9.3% [41 of 441]); 21 (51.2%) persons with positive test results were symptomatic, eight (19.5%) were asymptomatic, and symptom status for 12 (29.3%) was unknown at the time of specimen collection. Among contacts, attack rates were highest among household members (30.0%) and wrestling team members who did not attend the tournament (20.3%), as were the percentages of positive test results (60.0% among household members and 54.2% among team members). Among all contacts, the odds of receiving a positive test result were highest among household contacts (odds ratio = 2.7; 95% confidence interval = 1.2–6.0). Local health authorities reported the death of one adult contact aged >50 years.

An estimated 1,700 in-person school days were lost as a consequence of isolation and quarantine of patients and contacts during this COVID-19 outbreak.** The number of in-person school days lost would likely have been higher had the outbreak not occurred toward the end of the fall 2020 semester. In addition, this outbreak resulted in the suspension of all winter indoor and outdoor high school athletics in county A, affecting approximately 1,500 students.

The American Academy of Pediatrics interim guidance for return to sports specifically recommends against mask wearing during wrestling because of the choking hazard that face coverings could pose (*1*). In October, local public health and school officials in county A established COVID-19 mitigation guidelines specific to wrestling for practices, matches, and tournaments, including mask wearing and physical distancing (at least 6 feet) when not actively wrestling, symptom screening, and disinfection of space and equipment. However, it is not feasible to maintain physical distancing and universal mask wearing during practice and competition for high-contact sports such as wrestling.

* County A used the Abbott BinaxNOW COVID-19 Ag Card (BinaxNOW) rapid antigen test in testing for symptomatic persons, with follow-up reverse transcription–polymerase chain reaction (RT-PCR) testing if the antigen test was negative, and RT-PCR testing for all asymptomatic persons; results were considered positive if either the BinaxNOW or RT-PCR test result was positive. Wrestling tournament attendees and contacts were encouraged to seek COVID-19 testing services regardless of symptoms, but the decision to be tested was left to each person.

† This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy: 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.

§ Four tournament attendees received positive test results during June–November 2020 and were not included in the attack rate calculation.

¶ https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html

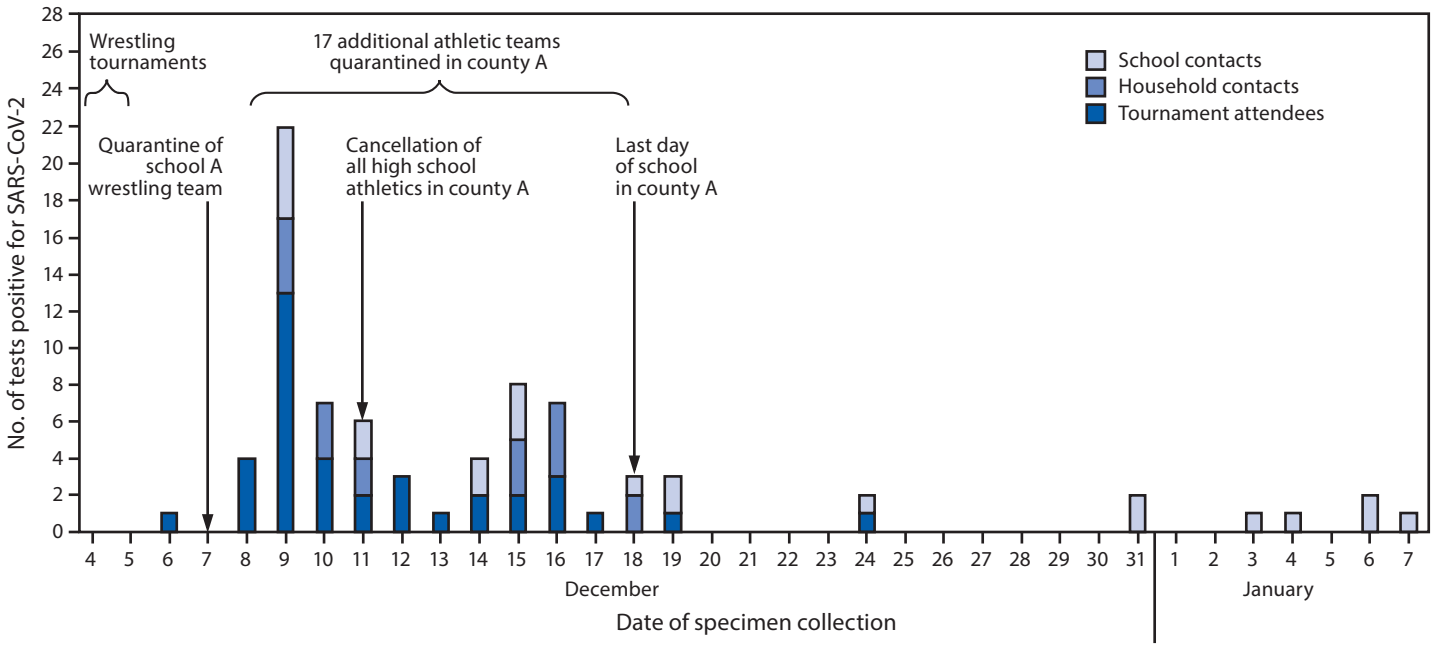
** County A reported that 64% of their high school students were in-person learners. Using the date of specimen collection for cases and exposure date for contacts, the number of missed days of school was calculated, accounting for weekends and the holiday school closure. Patients isolated for 10 days and contacts quarantined for 14 days. The number of missed school days for patients and contacts was summed and multiplied by the percentage of in-person learners (64%) to arrive at the estimated number of lost in-person school days.

TABLE. Characteristics of persons with COVID-19 associated with high school wrestling tournaments — Florida, December 2020–January 2021

Characteristic	No. of persons (%)			Attack rate, % (no. positive/no. susceptible)†
	Total	Received testing	Had positive test results*	
Tournament attendees				
All attendees	**130 (100.0)**	54 (41.5)	38 (70.4)	30.2 (38/126)
Wrestlers	**116 (89.2)**	44 (37.9)	31 (70.5)	27.4 (31/113)
Coaches	**6 (4.6)**	5 (83.3)	3 (60.0)	60.0 (3/5)
Referees	**5 (3.8)**	2 (40.0)	1 (50.0)	20.0 (1/5)
Other§	**3 (2.3)**	3 (100.0)	3 (100.0)	100.0 (3/3)
Contacts				
All contacts	**446 (100.0)**	95 (21.3)	41 (43.2)	9.3 (41/441)
Household	**62 (13.9)**	30 (48.4)	18 (60.0)	30.0 (18/60)
Classmates and teachers¶	**168 (37.7)**	30 (17.9)	10 (33.3)	6.0 (10/166)
Team members not attending tournaments¶	**64 (14.3)**	24 (37.5)	13 (54.2)	20.3 (13/64)
Other school athletic members¶	**152 (34.1)**	11 (7.2)	0 (—)	— (0/151)
Age group of contacts, yrs**				
0–13	**18 (4.0)**	8 (44.4)	5 (62.5)	27.8 (5/18)
14–18	**384 (86.1)**	71 (18.5)	27 (38.0)	7.1 (27/380)
19–24	**8 (1.8)**	2 (25.0)	1 (50.0)	12.5 (1/8)
25–44	**22 (4.9)**	7 (31.8)	3 (42.9)	14.3 (3/21)
45–61	**12 (2.7)**	7 (58.3)	5 (71.4)	41.7 (5/12)

Abbreviation: COVID-19 = coronavirus disease 2019.
* Among those receiving testing.
† Four tournament attendees and five contacts received positive test results during June–November 2020 and were not included in the attack rate calculation.
§ "Other" category includes a nonwrestling high school athletic coach and two students who were not wrestlers.
¶ Within-school contacts.
** Ages of two contacts were unknown.

FIGURE. SARS-CoV-2 tests with positive results among attendees of high school wrestling tournaments and their contacts, by specimen collection date — Florida, December 2020–January 2021



At the time of the tournament, the 14-day cumulative COVID-19 incidence in county A, home to seven of the 10 participating high school teams, was 363 per 100,000 persons; 7.7% of tests for SARS-CoV-2 had positive results (*2*). The incidence in county A placed the community in the highest category for transmission of SARS-CoV-2.†† CDC guidance provides community transmission level thresholds for school

†† https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/indicators.html

decision-makers that should be applied to school athletics and related social gatherings. High-contact school athletic activities for which mask wearing and physical distancing are not possible should be postponed during periods with substantial or high levels of SARS-CoV-2 community transmission (*3*). Outbreaks among athletes participating in high contact sports can impact in-person learning for all students and increase risk for secondary in-school and community transmission with potentially severe outcomes including death (*4*).

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Errata

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In the report "The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine — United States, December 2020," on page 1922, in the third paragraph, the third and fourth sentences should have read **Consistent high efficacy (≥92%) was observed across age, sex, race, and ethnicity categories and among persons with underlying medical conditions. Efficacy was similarly high in a secondary analysis including participants both with or without evidence of previous SARS-CoV-2 infection.** Although numbers of observed hospitalizations and deaths were low, the available data were consistent with reduced risk for these severe outcomes among vaccinated persons compared with that among placebo recipients.

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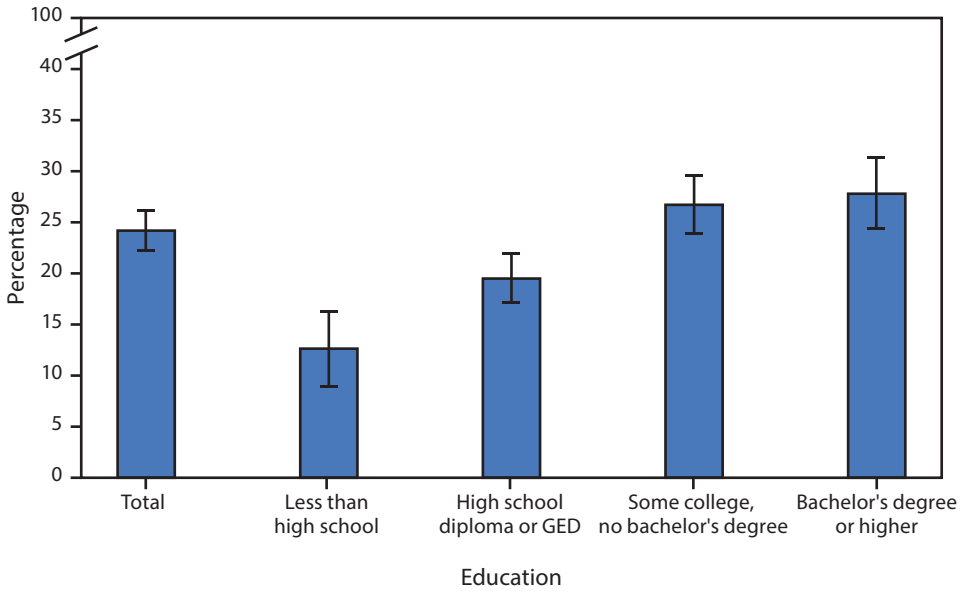
In the report "Evaluation of Abbott BinaxNOW Rapid Antigen Test for SARS-CoV-2 Infection at Two Community-Based Testing Sites — Pima County, Arizona, November 3–17, 2020," on page 103, in Table 2, the positive predictive value (PPV) and 95% confidence interval (95% CI) for the BinaxNOW antigen test performance for asymptomatic participants should have read "**91.7 (80.0–97.7).**" Also on that page, the second sentence of the fourth full paragraph should have read "Community testing strategies focused on preventing transmission using antigen testing should consider serial testing (e.g., in kindergarten through grade 12 schools, institutions of higher education, or congregate housing settings), which might improve test sensitivity in **detecting** infection (*10*)."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Women Who Have Ever Used Emergency Contraception† Among Women Aged 22–49 Years Who Have Ever Had Sexual Intercourse, by Education — National Survey of Family Growth, United States, 2017–2019



Abbreviation: GED = General Educational Development certificate.

* Estimates are based on interviews of the U.S. household population aged 15–49 years and are shown for women aged 22–49 years; 95% confidence intervals are indicated with error bars.

† Use of emergency contraception was based on the following question asked of female respondents who ever had sexual intercourse with a man: "Have you ever used emergency contraception, also known as 'Plan B,' 'Preven,' 'Ella,' 'Next Choice,' or 'Morning after' pills?" Age and education of respondent are at the time of interview.

Among women aged 22–49 years who have ever had sexual intercourse, 24.3% have ever used emergency contraception. The percentage of women who have ever used emergency contraception increased with education level, from 12.6% among women without a high school diploma or GED to 27.9% among women with a bachelor's degree or higher.

Source: National Survey of Family Growth, 2017–2019. https://www.cdc.gov/nchs/nsfg/index.htm

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