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High Prevalence of Hepatitis C Infection Among Adult Patients at Four Urban Emergency Departments — Birmingham, Oakland, Baltimore, and Boston, 2015–2017

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Identifying persons with hepatitis C virus (HCV) infection has become an urgent public health challenge because of increasing HCV-related morbidity and mortality, low rates of awareness among infected persons, and the advent of curative therapies (*1*). Since 2012, CDC has recommended testing of all persons born during 1945–1965 (baby boomers) for identification of chronic HCV infection (*1*); urban emergency departments (EDs) are well positioned venues for detecting HCV infection among these persons. The United States has witnessed an unprecedented opioid overdose epidemic since 2013 that derives primarily from commonly injected illicit opioids (e.g., heroin and fentanyl) (*2*). This injection drug use behavior has led to an increase in HCV infections among persons who inject drugs and heightened concern about increases in human immunodeficiency virus (HIV) and HCV infection within communities disproportionately affected by the opioid crisis (*3*,*4*). However, targeted strategies for identifying HCV infection among persons who inject drugs is challenging (*5*,*6*). During 2015–2016, EDs at the University of Alabama at Birmingham; Highland Hospital, Oakland, California; Johns Hopkins Hospital, Baltimore, Maryland; and Boston University Medical Center, Massachusetts, adopted opt-out (i.e., patients can implicitly accept or explicitly decline testing), universal hepatitis C screening for all adult patients. ED staff members offered HCV antibody (anti-HCV) screening to patients who were unaware of their status.* During similar observation periods at each site, ED staff members tested 14,252 patients and identified an overall 9.2% prevalence of positive results for anti-HCV among the adult patient population. Among the 1945–1965 birth cohort, prevalence of positive results for anti-HCV (13.9%) was significantly higher among non-Hispanic blacks (blacks) (16.0%) than among

* To reduce potential duplicate testing of patients, sites utilized electronic health record mechanisms to identify and cancel HCV antibody orders on persons with prior HCV antibody testing in the last year, as well as any prior positive anti-HCV or RNA result.

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non-Hispanic whites (whites) (12.2%) (p<0.001). Among persons born after 1965, overall prevalence of positive results for anti-HCV was 6.7% and was significantly higher among whites (15.3%) than among blacks (3.2%) (p<0.001). These findings highlight age-associated differences in racial/ethnic prevalences and the potential for ED venues and opt-out, universal testing strategies to improve HCV infection awareness and surveillance for hard-to-reach populations. This opt-out, universal testing approach is supported by new recommendations for hepatitis C screening at least once in a lifetime for all adults aged ≥18 years, except in settings where the prevalence of positive results for HCV infection is <0.1% (*7*).

A retrospective study from four urban academic EDs located in Birmingham, Alabama; Oakland, California; Boston, Massachusetts; and Baltimore, Maryland was conducted with approval from each institution's local Institutional Review Board. Each ED implemented opt-out, universal hepatitis C testing at different times and using differing methodologies among patients who reported no history of HCV infection. The period of observation for this study was 4 months, starting 1 month after initial implementation of opt-out, universal hepatitis C screening. Because of programmatic changes during the observation period at Johns Hopkins ED, only 3 months of observation is reported. All sites used the Abbott Architect anti-HCV assay (Abbott Diagnostics) for testing, with results available during the ED visit, and reflex HCV RNA testing performed on specimens collected during the ED encounter from persons with anti-HCV positive results. Each site used dedicated linkage-to-care coordinators to deliver positive test results and facilitate referral to HCV infection care.

ED sites collected cumulative hepatitis C testing outcomes for the 4-month study period, including cumulative anti-HCV results stratified by birth year, race/ethnicity, sex, and insurance type. Deidentified data were collected for aggregation and analysis at the University of Alabama at Birmingham site. Patient characteristics and prevalence estimates for positive results for anti-HCV were reported with 95% confidence intervals across sites. P-values <0.05 were considered statistically significant. STATA (version 15.1; StataCorp) was used to conduct all statistical analyses.

Using opt-out, universal hepatitis C screening (Table 1), EDs performed a total of 14,252 tests on unique visitors, and 1,315 (9.2%) had positive test results for anti-HCV (Table 2). HCV RNA testing for current infection was performed for 1,118 (85%) visitors with positive test results for anti-HCV, and 693 (62%) of these persons had positive HCV RNA test results, indicating current HCV infection. The prevalence of positive results for anti-HCV was higher among persons in the 1945–1965 birth cohort (13.9%) than among those in the cohort born after 1965 (6.7%); however, the younger cohort accounted for 47.8% (628 of 1,315) of total cases reactive to anti-HCV identified.

Significant differences in positive results for anti-HCV by birth cohort and race/ethnicity were identified (Table 3). Among persons born during 1945–1965, overall positive results for anti-HCV prevalence was significantly higher among

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TABLE 1. Universal hepatitis C testing programs at four urban emergency departments (EDs) — Birmingham, Alabama; Oakland, California; Baltimore, Maryland; and Boston, Massachusetts, 2015–2017

Study site	Study dates	Program overview
University of Alabama at Birmingham Hospital, Birmingham, Alabama	Oct 15, 2015–Feb 15, 2016	Opt-out, nurse-driven intervention using electronic EHR prompts, physician counseling for positive results for anti-HCV during ED visit, or specimens for HCV RNA testing collected during visit for persons with positive results for anti-HCV
Highland Hospital, Oakland, California	Oct 15, 2015–Feb 15, 2016	Opt-out, nurse-driven intervention using EHR prompts at triage, physician counseling for positive results for anti-HCV during ED visit, or specimens for HCV RNA testing collected during visit for persons with positive results for anti-HCV
Johns Hopkins Hospital, Baltimore, Maryland	May 1, 2016–Jul 31, 2016*	Opt-out, triage nurse-driven intervention using EHR prompts, HCV program staff members informing and consulting positive result for anti-HCV at callback after ED visit, or diagnostic HCV RNA testing at callback after the visit for persons with positive results for anti-HCV
Boston University Medical Center, Boston, Massachusetts	Nov 2, 2016–Feb 28, 2017	Opt-out, EHR-driven intervention using an EHR clinical decision support tool for all ED patients undergoing phlebotomy, with reflex HCV RNA testing for persons with positive results for anti-HCV

Abbreviations: anti-HCV = HCV antibody; EHR = electronic health record; HCV = hepatitis C virus.
* Limited to a 3-month testing period because of programmatic changes occurring during the observation period.

TABLE 2. Universal hepatitis C testing results at four urban emergency departments (EDs) — Birmingham, Alabama; Oakland, California; Baltimore, Maryland; and Boston, Massachusetts, 2015–2017

	Study sites and dates				
Client and testing characteristic	University of Alabama at Birmingham Hospital, Birmingham, Alabama Oct 15, 2015–Feb 15, 2016	Highland Hospital, Oakland, California Oct 15, 2015–Feb 15, 2016	Johns Hopkins Hospital, Baltimore, Maryland May 1, 2016–Jul 31, 2016*	Boston University Medical Center, Boston, Massachusetts Nov 2, 2016–Feb 28, 2017	All sites
Unique ED visitors	18,916	18,272	13,069	26,870	77,127
Patients eligible for hepatitis C testing	13,999	9,585	7,639	12,284	43,507†
Anti-HCV tests performed	5,973	2,900	1,638	3,741	14,252§
Total anti-HCV positive tests (%)	459 (7.7)	166 (5.7)	120 (7.3)	570 (15.2)	1,315 (9.2)
Adults born 1945–1965, positive test results for anti-HCV/anti-HCV tests (%)	232/2,205 (10.5)	98/713 (13.7)	69/437 (15.8)	288/1,585 (18.2)	687/4,940 (13.9)
Born after 1965, positive test results for anti-HCV/anti-HCV tests (%)	227/3,768 (6.0)	68/2,187 (3.1)	51/1,201 (4.2%)	282/2,156 (13.1)	628/9,312 (6.7)
Total HCV RNA tests performed (%)	398 (86.9)	125 (75.3)	38 (31.6)	557 (97.7)	1,118 (85)
Total current HCV infections (positive test results for HCV RNA) (%)	252 (63.3)	79 (63.2)	27 (71.1)	335 (60.1)	693 (62.0)
Estimated prevalence of positive results for HCV RNA (%)	4.9	3.6	5.2	9.1	5.7
State and national estimated prevalence of positive results for HCV RNA, %	Alabama, 0.85	California, 1.25	Maryland, 1.00	Massachusetts, 0.85	National, 0.93

Abbreviations: anti-HCV = HCV antibody; EHR = electronic health record; HCV = hepatitis C virus.
* Limited to a 3-month testing period because of programmatic changes occurring during the observation period.
† Born after 1944, aged ≥18 years, medically or surgically stable, and no self-reported history of prior HCV infection.
§ Reasons testing not performed included that the patient declined testing or venipuncture was not performed because no diagnostic tests requiring venipuncture were ordered by the ED provider.

blacks (16.0%) than among whites (12.2%) (p<0.001). In contrast, overall prevalence of positive results for anti-HCV among persons born after 1965 was higher among whites (15.3%) than among blacks (3.2%) (p<0.001). Significant differences in positive results for anti-HCV were identified among ED sites regarding race/ethnicity for both birth cohorts. Positive results for anti-HCV among whites born after 1965 was higher among patients evaluated at the University of Alabama at Birmingham (11.7%), Johns Hopkins (11.8%), and Boston University (30.1%) sites than among those evaluated at Highland Hospital (3.2%).

Among persons born during 1945–1965, and those born after 1965, prevalence of positive results for anti-HCV was significantly higher among men (18.9% and 8.7%, respectively), than among women (8.3% and 5.1%, respectively) (p<0.001). No statistically significant differences were identified in positive results for anti-HCV by sex among ED sites for either birth cohort (Table 3).

Prevalence of positive results for anti-HCV was higher among Medicaid or other public insurance recipients, persons with other or missing insurance information, and Medicare recipients, than among commercially insured persons in both the 1945–1965 birth cohort (17.7%, 14.1%, and 13.6%,

TABLE 3. Prevalence of positive results for hepatitis C virus antibody (anti-HCV) and prevalence differences, by study site and patient characteristics — Birmingham, Alabama; Oakland, California; Baltimore, Maryland; and Boston, Massachusetts, 2015–2017

Characteristic	All sites		University of Alabama at Birmingham Hospital, Birmingham, Alabama		Highland Hospital, Oakland, California		Johns Hopkins Hospital, Baltimore, Maryland		Boston University Medical Center, Boston, Massachusetts	
	Total no. (% positive test results for anti–HCV)	Prevalence difference (95% CI)*	Total no. (% positive test results for anti–HCV)	Prevalence difference (95% CI)*	Total no. (% positive test results for anti–HCV)	Prevalence difference (95% CI)*	Total no. (% positive test results for anti–HCV)	Prevalence difference (95% CI)*	Total no. (% positive test results for anti–HCV)	Prevalence difference (95% CI)*
Born during 1945–1965										
Sex										
Women	2,325 (8.3)	Referent	1,100 (6.2)	Referent	298 (10.1)	Referent	190 (7.9)	Referent	737 (11.0)	Referent
Men	2,615 (18.9)	10.5 (8.6 to 12.4)	1,105 (14.8)	8.7 (6.3 to 11.2)	415 (16.4)	6.3 (1.3 to 11.9)	247 (21.9)	14.0 (8.2 to 20.9)	848 (24.4)	13.4 (9.7 to 16.7)
Race/Ethnicity										
White, NH	1,695 (12.2)	−3.8 (−5.8 to 1.6)	1,058 (9.5)	−2.4 (−5.0 to 0.4)	92 (13.0)	−4.3 (−11.1 to 5.2)	121 (3.3)	−19.2 (−24.8 to 13.6)	424 (21.2)	2.5 (−2.1 to 7.2)
Black, NH	2,534 (16.0)	Referent	1,093 (11.8)	Referent	358 (17.3)	Referent	284 (22.5)	Referent	799 (18.8)	Referent
Other/Missing	711 (10.7)	−5.3 (−7.9 to −2.5)	54 (5.6)	−6.2 (−11.1 to 1.4)	263 (9.1)	−8.2 (−13.3 to −2.4)	32 (3.1)	−19.4 (−26.0 to −10.9)	362 (13.3)	−5.5 (−9.5 to −0.8)
Insurance type										
Commercial	1,138 (8.4)	−9.3 (−11.8 to −7.2)	562 (4.8)	−12.1 (−16.1 to −8.1)	23 (13.0)	0.2 (−11.7 to 19.8)	269 (11.9)	−15.6 (−30.4 to 1.4)	284 (12.0)	−8.7 (−13.5 to −3.8)
Medicare	1,482 (13.6)	−4.1 (−6.7 to −1.8)	844 (9.5)	−7.4 (−11.6 to −3.4)	115 (19.1)	6.3 (−1.8 to 14.1)	79 (19.0)	−8.5 (−26.6 to 6.8)	444 (19.1)	−1.5 (−6.1 to 3.0)
Medicaid/ Publicly funded	1,702 (17.7)	Referent	420 (16.9)	Referent	467 (12.9)	Referent	40 (27.5)	Referent	775 (20.7)	Referent
Other/Missing	618 (14.1)	−3.7 (−6.9 to −0.2)	379 (14.3)	−2.7 (−7.5 to 2.7)	108 (12.0)	−0.8 (−7.6 to 6.5)	49 (22.5)	−5.1 (−23.9 to 13.0)	82 (11.0)	−9.7 (−16.9 to −1.8)
Born after 1965										
Sex										
Women	5,119 (5.1)	Referent	2,149 (4.1)	Referent	1,121 (2.8)	Referent	680 (3.5)	Referent	1,169 (10.2)	Referent
Men	4,193 (8.7)	3.6 (2.5 to 4.7)	1,619 (8.5)	4.4 (2.8 to 6.0)	1,066 (3.5)	0.7 (−0.7 to 2.2)	521 (5.2)	1.7 (−0.6 to 4.0)	987 (16.5)	6.3 (3.6 to 9.5)
Race/Ethnicity										
White, NH	2,623 (15.3)	12.2 (10.6 to 13.6)	1,554 (11.7)	9.7 (8.1 to 11.6)	185 (3.2)	−0.2 (−2.8 to 2.4)	280 (11.8)	9.7 (6.1 to 13.8)	604 (30.1)	23.9 (19.9 to 27.7)
Black, NH	4,711 (3.2)	Referent	2,063 (2.0)	Referent	867 (3.5)	Referent	780 (2.1)	Referent	1,001 (6.2)	Referent
Other/Missing	1,978 (3.9)	0.7 (−0.2 to 1.7)	151 (3.3)	1.3 (−1.0 to 5.0)	1,135 (2.8)	−0.6 (−2.4 to 7.6)	141 (1.4)	−0.6 (−2.3 to 2.2)	551 (6.9)	0.7 (−1.8 to 3.5)
Insurance type										
Commercial	2,370 (3.0)	−5.6 (−6.8 to −4.5)	1,065 (2.2)	−3.0 (−4.7 to −1.3)	94 (3.2)	−0.0 (−3.0 to 4.1)	800 (3.4)	−7.0 (−13.0 to −2.1)	411 (4.4)	−12.1 (−15.2 to −9.5)
Medicare	634 (9.0)	0.4 (−1.8 to 2.8)	359 (6.4)	1.3 (−1.5 to 4.3)	48 (4.2)	0.9 (−3.6 to 8.3)	57 (1.8)	−8.6 (−15.3 to −2.0)	170 (18.2)	1.7 (−3.7 to 8.7)
Medicaid/ Publicly funded	3,944 (8.6)	Referent	935 (5.1)	Referent	1,486 (3.2)	Referent	135 (10.4)	Referent	1,388 (16.5)	Referent
Other/Missing	2,364 (6.8)	−1.8 (−3.1 to −0.4)	1,409 (9.4)	4.3 (2.2 to 6.5)	559 (2.7)	−0.5 (−2.0 to 1.2)	209 (4.3)	−6.1 (−12.4 to −0.9)	187 (2.1)	−14.4 (−16.9 to −11.5)

Abbreviations: CI = confidence interval, NH = non-Hispanic.
* Bias-corrected 95% CIs for prevalence differences calculated by using 1,000 bootstrap replicates.

respectively, versus 8.4%; p<0.001) and persons born after 1965 (8.6%, 6.8%, and 9.0%, respectively, versus 3.0%; p<0.001).

Discussion

Opt-out, universal HCV screening in four geographically diverse, urban EDs identified a high prevalence of previously unrecognized positive results for anti-HCV in approximately one of every 11 (9.2%) adult patients tested. Prevalence of positive results for HCV RNA at the combined ED sites was 5.7%, which was substantially higher than the estimated overall U.S. prevalence of positive results for HCV RNA of 0.95% (*8*). At the state level, ED prevalence of positive results for HCV RNA ranged from three to fivefold higher than the upper-estimated prevalence of positive results for HCV RNA rates in each respective state (*8*). These findings demonstrate the high yield and potential impact of an ED-based opt-out, universal testing strategy.

Considering that the advent of HCV curative therapies, potential exists to eliminate HCV infection from U.S. communities. For this reason, identification of persons unaware of their

Summary

What is already known about this topic?

Targeted testing for hepatitis C virus (HCV) infection in emergency departments (EDs) has been demonstrated to be a high-yield and effective intervention for identifying previously unrecognized infections, especially among persons born during 1945–1965.

What is added by this report?

Opt-out, universal HCV screening in EDs identified that nearly half (47.5%) of infections were among persons born after 1965.

What are the implications for public health practice?

Opt-out, universal screening in EDs can identify a larger number of previously unrecognized HCV infections, especially among persons born after 1965. ED-based opt-out, universal hepatitis C screening can be vital in combating and surveilling the interrelated epidemics of opioid overdose and bloodborne viral infections through harm-reduction interventions and navigation to HCV treatment.

HCV infection has become a public health priority. Because of the increasing incidence of HCV infection among persons who inject drugs, testing and treatment of this population is needed for both infection prevention and for ending the HCV infection epidemic. Although recent studies of ED-based, targeted hepatitis C testing have highlighted the high prevalence of positive results for anti-HCV among the 1945–1965 birth cohort (10.3%–11.6%), ED-based programs have been challenged to systematically identify and test an increasing number of younger persons who inject drugs (*5*,*6*,*9*,*10*).

Although three quarters of HCV infections in the United States are among persons born during 1945–1965, this study demonstrates that nearly half of all persons reactive to anti-HCV identified in EDs were among the cohort born after 1965. This finding is consistent with two recent ED studies, both of which reported that an ED-based 1945–1965 birth cohort strategy alone would fail to identify half of persons with HCV infection (*8*,*9*). Most striking in the current study was the high prevalence of positive results for anti-HCV (6.7%) noted among the younger population, driven by the high prevalence of positive results for anti-HCV among whites (15.3%). Although behavioral risk factors could not be confirmed for this study, this racial/ethnic difference is consistent with the epidemiology of HCV infection and injection drug use behavior (*2*).

By leveraging lessons learned from national HIV testing efforts, opt-out, universal HCV screening might improve rates of hepatitis C testing among populations at high risk by reducing patient and provider stigma associated with identification of hepatitis C behavioral risks as a prerequisite for testing. In addition, the opt-out, universal screening strategy that requires less risk behavior questioning is easier to operationalize in EDs challenged by competing priorities.

Although both targeted and opt-out, universal ED-based hepatitis C testing strategies are effective at identifying previously unrecognized HCV infections, reimbursement for testing and challenging HCV infection care navigation remain crucial barriers. A 2014 decision from the U.S. Department of Health and Human Services and Centers for Medicare & Medicaid Services precluding EDs from reimbursement for hepatitis C testing might be limiting adoption of any systematic hepatitis C testing in the majority of EDs.[†] In addition, the high number of persons with HCV infection identified in the ED setting challenges HCV navigation programs and requires robust support to effectively direct persons who test positive to HCV treatment and other necessary health services, including primary care, social services, and substance use treatment.

The findings in this study are subject to at least three limitations. First, identifying previously unrecognized HCV infection is limited by the patient's recall of their prior HCV infection history and is therefore subject to bias. Second, 29,255 persons identified as being eligible for hepatitis C testing in the study EDs were not tested because a venipuncture was not performed for other diagnostics ordered by the ED provider during the visit, a prior HCV test result was identified in the electronic health record, or the patient declined to be tested. This is consistent with previously reported findings from ED-based targeted hepatitis C testing (*5*,*6*), and bias was not introduced toward testing persons appearing to be at high risk. Finally, study findings are limited to four geographically diverse, urban academic EDs, and might not apply to all U.S. geographic areas or in nonurban or community EDs.

The high prevalence of HCV infection identified among persons born after 1965 as well as those born during 1945–1965 supports continued assessment of ED-based hepatitis C testing, as well as an opt-out, universal screening strategy among similar high-prevalence health care venues. Given the high prevalence of positive results for HCV RNA identified among a younger, predominately white cohort known to be disproportionately affected by the opioid crisis, ED-based opt-out, universal

[†] https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=272.

HCV screening might play an important role in surveillance and combat of interrelated epidemics of opioid overdose and bloodborne viral infections through harm-reduction interventions and navigation to HCV treatment.

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Vital Signs: Postpartum Depressive Symptoms and Provider Discussions About Perinatal Depression — United States, 2018

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Introduction: Perinatal depression is a complication of pregnancy that can result in adverse maternal and infant outcomes. Screening to identify pregnant and postpartum women with depressive symptoms is recommended to provide diagnosis, treatment, and follow-up care to reduce poor outcomes.
Methods: CDC analyzed 2018 data from the Pregnancy Risk Assessment Monitoring System to describe postpartum depressive symptoms (PDS) among women with a recent live birth and to assess whether health care providers asked women about depression during prenatal and postpartum health care visits, by site and maternal and infant characteristics.
Results: Among respondents from 31 sites, the prevalence of PDS was 13.2%, ranging from 9.7% in Illinois to 23.5% in Mississippi. The prevalence of PDS exceeded 20% among women who were aged ≤19 years, were American Indian/Alaska Native, smoked during or after pregnancy, experienced intimate partner violence before or during pregnancy, self-reported depression before or during pregnancy, or whose infant had died since birth. The prevalence of women reporting that a health care provider asked about depression during prenatal care visits was 79.1% overall, ranging from 51.3% in Puerto Rico to 90.7% in Alaska. The prevalence of women reporting that a provider asked about depression during postpartum visits was 87.4% overall, ranging from 50.7% in Puerto Rico to 96.2% in Vermont.
Conclusions and Implications for Public Health Practice: The prevalence of self-reported PDS varied by site and maternal and infant characteristics. Whether providers asked women about perinatal depression was not consistent across sites. Provision of recommended screenings and appropriate referrals for diagnosis, treatment, and follow-up care can ensure early and effective management of depression to reduce adverse maternal and infant outcomes.

Introduction

Mental health conditions are common complications in pregnancy (*1*) and an underlying cause for approximately 9% of pregnancy-related deaths (*2*). Postpartum depression is associated with lower rates of breastfeeding initiation, poorer maternal and infant bonding, and increased likelihood of infants showing developmental delays (*3*). Left untreated, postpartum depression can adversely affect the mother's health and might cause sleeping, eating, and behavioral problems for the infant; when effectively treated and managed, both mother and child benefit (*4*).

Professional and clinical organizations have issued recommendations to address perinatal (i.e., during and after pregnancy) depression. The United States Preventive Services Task Force (USPSTF) recommends that all adults be screened for depression, including pregnant and postpartum women (*5*), and that clinicians provide or refer pregnant and postpartum women who are at increased risk for perinatal depression to counseling interventions (*6*). The American College of Obstetricians and Gynecologists (ACOG) recommends that obstetric care providers screen patients for depression and anxiety symptoms at least once during the perinatal period and also conduct a full assessment of mood and emotional well-being during the comprehensive postpartum visit (*7*). If a patient is screened for depression and anxiety during pregnancy, additional screening should also occur during the comprehensive postpartum visit (*7*). The American Academy of Pediatrics also recommends that routine screening for maternal postpartum depression be integrated into well-child visits (*8*).

USPSTF has noted that identifying women at increased risk for perinatal depression and determining ways to improve the delivery of interventions represent evidence gaps that warrant high-priority efforts (*9*). Women with postpartum depressive symptoms (PDS) are at increased risk for postpartum depression and require further evaluation to determine whether they meet the criteria for having a depressive disorder (*4*). To inform these evidence gaps, CDC used data from the Pregnancy Risk Assessment Monitoring System (PRAMS) to examine the prevalence of self-reported PDS and whether a health care provider inquired about depression during prenatal and postpartum health care visits.

Methods

PRAMS collects site-specific, population-based data on self-reported maternal behaviors and experiences before, during, and shortly after pregnancy. From each of the 50 continuously

participating sites, a stratified, random sample of women with a recent live birth (singleton and multiple births) is selected monthly from birth certificate files, and these women are surveyed 2–6 months postpartum (average = 4 months) using a standardized protocol and questionnaire (*10*). Annually, PRAMS data for each site are weighted for sampling design, nonresponse, and noncoverage to produce data representative of the site's birth population for the year.

Data from 31 PRAMS sites* that had weighted response rates ≥55% in 2018 were included in this analysis. Data were obtained from the infant's birth certificate and survey questions.† Self-reported PDS were ascertained by categorizing five responses ("always," "often," "sometimes," "rarely," and "never") from the following two questions adapted from the Patient Health Questionnaire-2 screening instrument (*11*): 1) "Since your new baby was born, how often have you felt down, depressed, or hopeless?" and 2) "Since your new baby was born, how often have you had little interest or little pleasure in doing things?" Women responding "always" or "often" to either question were classified as experiencing PDS. Women who had prenatal and postpartum health care visits were asked whether health care providers had inquired about depression during these visits. Health care provider inquiry about depression during prenatal care visits was ascertained by the percentage of women responding "yes" to the question "During any of your prenatal care visits, did a doctor, nurse, or health care worker ask you if you were feeling down or depressed." Health care provider inquiry about depression during postpartum visits was assessed by the percentage of women responding "yes" to the question, "During your postpartum checkup, did a doctor, nurse, or other health care worker ask if you were feeling down or depressed."

The weighted prevalence and 95% confidence intervals for self-reported PDS and health care provider inquiry about depression during prenatal and postpartum visits were calculated overall and by site. Chi-squared tests of independence were used to examine the distribution of both PDS and health care provider inquiry about depression by selected maternal characteristics (age, race/ethnicity, education level, marital status, participation in the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC] during pregnancy, health insurance at delivery,§ and number of previous live births) and behaviors and experiences (smoking status during the last 3 months of pregnancy or the postpartum period, experience of intimate partner violence before or during pregnancy, and self-reported depression before or during pregnancy). Chi-squared tests of independence were examined for PDS only for selected maternal characteristics (breastfeeding initiation and duration and having a health care provider ask about depression during prenatal and postpartum visits) and infant characteristics (infant's gestational age at birth and infant vital status at survey completion). Subgroup differences in PDS and health care provider inquiry about depression during prenatal and postpartum visits were ascertained using 95% confidence interval¶ estimates of the weighted prevalence.

CDC tested for linear trends in aggregate estimates of PDS from 2012 to 2018 among 16 continuously reporting sites** and linear trends in health care providers asking about depression during prenatal and postpartum visits from 2016 to 2018 for 22 continuously reporting sites,†† using logistic regression, adjusting for site. All statistical analyses were conducted using a SAS (version 9.4; SAS Institute) complex survey module to account for the PRAMS sampling design.

Results

Among respondents from 31 PRAMS sites, the prevalence of self-reported PDS was 13.2%, ranging from 9.7% (Illinois) and 10.3% (Massachusetts) to 19.4% (West Virginia) and 23.5% (Mississippi) (Table 1). Among 16 continuously reporting sites, a small but statistically significant annual percentage point increase of 0.22% (p-value <0.05) in PDS was observed from 2012 to 2018. PDS prevalence varied by selected demographic and other maternal characteristics (Table 2). Prevalence was

* The 31 sites include Alaska, Colorado, Connecticut, Delaware, Georgia, Illinois, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York City, North Dakota, Pennsylvania, Puerto Rico, Rhode Island, South Dakota, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

† Variables obtained from infant's birth certificate include maternal age, race/ethnicity, education level, marital status, WIC participation during pregnancy, health insurance at delivery, number of previous live births, and infant gestational age at birth. Variables obtained from survey include smoked cigarettes during last 3 months of pregnancy, smoked cigarettes postpartum, any intimate partner violence before or during pregnancy, breastfeeding duration, infant vital status at survey completion, self-reported depression before pregnancy, self-reported depression during pregnancy, health care provider asked about depression during prenatal visits, health care provider asked about depression during postpartum visits, and postpartum depressive symptoms.

§ Health insurance at delivery coded in order of priority: "Private (Private Insurance, Champus/Tricare)"; "Medicaid (Medicaid)"; and "None (Self-Pay, Indian Health Service)." "Other Gov" or "Other" were excluded because these were non-Medicaid, state-specific plans.

¶ To provide general guidance on the statistical differences, 95% confidence intervals (CIs) for the prevalence were compared across groups, with an emphasis on identifying differences (i.e., nonoverlap of CIs) between categories within the selected variables. This typically conservative approach might fail to note differences between estimates more often than formal statistical testing. Overlap between CIs does not necessarily mean that there is no statistical difference between estimates.

** The 16 sites include Alaska, Delaware, Illinois, Maine, Massachusetts, Missouri, New Jersey, New Mexico, New York City, Pennsylvania, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

†† The 22 sites include Alaska, Colorado, Connecticut, Delaware, Illinois, Louisiana, Maine, Massachusetts, Michigan, Missouri, New Jersey, New Mexico, New York City, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

higher among women aged ≤19 and 20–24 years, those who were non-Hispanic black (black), non-Hispanic American Indian/Alaska Native (American Indian/Alaska Native) or non-Hispanic Asian/Pacific Islander (Asian/Pacific Islander), who had completed ≤12 years of education, and were not married (includes living with partner), than among those aged 25–34 and ≥35 years, who were non-Hispanic white (white) or Hispanic, had completed >12 years of education and were married. Prevalence was also higher among women who had participated in WIC during pregnancy, had Medicaid at delivery, smoked cigarettes during the last 3 months of pregnancy or postpartum, breastfed their infants for <8 weeks, had experienced intimate partner violence before or during pregnancy, self-reported depression before or during pregnancy, or whose infant had died since birth, compared with women who had not participated in WIC, had private health insurance, had not smoked during the last trimester or postpartum, breastfed their infants for ≥8 weeks, had not experienced intimate partner violence, had not experienced depression before or during pregnancy, and whose infant was alive at the time of the survey. PDS prevalence exceeded 20% among women aged ≤19 years, American Indians/Alaska Natives, women who smoked during or after pregnancy, experienced intimate partner violence or depression before or during pregnancy, or whose infant had died since birth.

Nearly all women (99.2%) received prenatal care; 79.1% of those who received prenatal care reported being asked by a health care provider about depression during pregnancy. The prevalence of health care provider inquiry about depression during prenatal visits varied by site, ranging from 51.3% (Puerto Rico) and 69.4% (Mississippi) to 90.6% (Minnesota) and 90.7% (Alaska) (Table 3).

The percentage of women who reported that a health care provider asked about depression during prenatal visits was higher among respondents aged ≤19 and 20–24 years than among those aged ≥25 years, and was higher among those who were black, Hispanic, American Indian/Alaska Native, or non-Hispanic other (other) than among respondents who were white or Asian/Pacific Islander. Prevalence was also higher among those who had ≤12 years of education, were not married, had participated in WIC, had Medicaid at delivery, smoked cigarettes during the last trimester of pregnancy, or self-reported depression before or during pregnancy compared with those who had >12 years of education, were married, had not participated in WIC, had private or no health insurance, had not smoked during the last trimester of pregnancy, or had not experienced depression before or during pregnancy (Table 4). Among 22 continuously reporting sites, the prevalence of health care provider inquiry about depression during prenatal visits increased significantly during 2016–2018, from 76.2% to 79.3% (p <0.05), with an average annual percentage point increase of 1.5% (data not shown).

TABLE 1. Prevalence of self-reported postpartum depressive symptoms among women with a recent live birth, 31 sites — Pregnancy Risk Assessment Monitoring System (PRAMS), 2018

Site	No.*	Postpartum depressive symptoms %† (95% CI)
All 31 sites	**32,659**	**13.2 (12.6–13.8)**
Alaska	974	14.8 (12.2–17.3)
Colorado	1,117	11.1 (8.8–13.3)
Connecticut	1,380	11.7 (9.6–13.7)
Delaware	824	13.1 (10.7–15.5)
Georgia	752	13.6 (10.4–16.7)
Illinois	1,298	9.7 (7.9–11.4)
Kansas	958	14.7 (11.6–17.7)
Kentucky	738	14.0 (10.7–17.2)
Louisiana	844	15.9 (13.3–18.6)
Maine	812	10.9 (8.2–13.5)
Massachusetts	1,412	10.3 (8.4–12.2)
Michigan	1,790	16.4 (14.2–18.5)
Minnesota	1,262	10.6 (8.5–12.7)
Mississippi	1,169	23.5 (20.5–26.6)
Missouri	921	13.7 (11.2–16.3)
Nebraska	1,293	12.1 (9.5–14.7)
New Jersey	1,151	11.2 (9.3–13.0)
New Mexico	1,194	15.3 (13.2–17.4)
New York City	1,469	15.5 (13.2–17.7)
North Dakota	865	11.7 (9.1–14.3)
Pennsylvania	934	14.7 (12.0–17.4)
Puerto Rico	943	10.8 (8.3–13.3)
Rhode Island	1,061	12.3 (9.9–14.6)
South Dakota	995	13.0 (10.7–15.3)
Utah	1,222	14.7 (12.3–17.0)
Vermont	848	10.7 (8.5–12.9)
Virginia	1,126	13.5 (10.1–16.8)
Washington	1,100	11.4 (9.2–13.5)
West Virginia	681	19.4 (15.9–22.9)
Wisconsin	988	10.5 (8.0–12.9)
Wyoming	538	15.7 (12.0–19.5)

Abbreviation: CI = confidence interval.
* Unweighted sample size.
† Weighted percentage.

Overall, 90.1% of women attended a postpartum visit, among whom 87.4% reported being asked by a health care provider about depression during the visit. The percentage of women reporting that their health care provider asked about depression during a postpartum visit varied by site, ranging from 50.7% (Puerto Rico) and 73.1% (New York City) to 95.9% (Minnesota) and 96.2% (Vermont) (Table 3). The reported percentage of having a health care provider ask about depression during a postpartum visit was higher among women aged ≤19 years (compared with women aged 20–24, 25–34 or ≥35 years), who were white, American Indian/Alaska Native, or other (compared with those who were Asian/Pacific Islander), and among those who self-reported depression before or during pregnancy (Table 4). Among 22 continuously reporting sites, the prevalence of health care provider inquiry about depression during the postpartum visit increased significantly from

TABLE 2. Prevalence of self-reported postpartum depressive symptoms among women with a recent live birth, by selected characteristics — Pregnancy Risk Assessment Monitoring System (PRAMS), 31 sites,* 2018

Characteristic	Postpartum depressive symptoms (N = 32,659)† %§ (95% CI)
Age group (yrs)¶	
≤19	22.2 (18.8–25.6)
20–24	17.8 (16.3–19.4)
25–34	11.9 (11.2–12.6)
≥35	10.8 (9.7–12.0)
Race/Ethnicity¶	
White, non-Hispanic	11.4 (10.7–12.1)
Black, non-Hispanic	18.2 (16.5–19.9)
Hispanic	12.0 (10.8–13.2)
American Indian/Alaska Native, non-Hispanic	22.0 (17.7–26.3)
Asian/Pacific Islander, non-Hispanic	19.2 (16.6–21.7)
Other, non-Hispanic	16.3 (13.1–19.5)
Education level (yrs)¶	
<12	17.8 (15.8–19.7)
12	16.2 (14.9–17.5)
>12	11.2 (10.6–11.9)
Marital status¶	
Married	11.0 (10.3–11.6)
Not married**	16.9 (15.9–17.9)
WIC participation during pregnancy¶	
Yes	17.0 (15.9–18.0)
No	11.2 (10.6–11.9)
Health insurance at delivery¶	
Private	10.1 (9.5–10.8)
Medicaid	17.2 (16.3–18.2)
None	13.2 (10.0–16.3)
No. of previous live births	
First birth	13.2 (12.3–14.1)
Second or later birth	13.2 (12.5–13.9)
Smoked cigarettes during last 3 mos of pregnancy¶	
Yes	22.3 (19.7–24.8)
No	12.4 (11.9–13.0)
Smoked cigarettes postpartum¶	
Yes	21.5 (19.4–23.6)
No	12.2 (11.6–12.8)
Any intimate partner violence before/during pregnancy¶,††	
Yes	33.1 (28.7–37.4)
No	12.5 (11.9–13.0)
Breastfeeding duration¶	
Breastfed ≥8 wks	11.8 (11.1–12.4)
Breastfed <8 wks	15.6 (14.2–17.0)
Never breastfed	14.0 (12.3–15.6)
Infant gestational age at birth (wks)¶	
Preterm (<37)	17.1 (15.5–18.8)
Term (≥37)	12.8 (12.2–13.4)
Infant vital status at survey completion¶	
Alive	13.0 (12.4–13.5)
Deceased	48.7 (39.3–58.1)
Self-reported depression before pregnancy¶	
Yes	28.7 (26.7–30.7)
No	10.6 (10.1–11.2)
Self-reported depression during pregnancy¶	
Yes	34.3 (32.2–36.5)
No	9.9 (9.4–10.5)
HCP asked about depression during prenatal visit¶	
Yes	12.7 (12.0–13.3)
No	14.5 (13.2–15.8)
HCP asked about depression during postpartum visit¶	
Yes	12.3 (11.6–12.9)
No	14.3 (12.5–16.0)

Abbreviations: CI = confidence interval; HCP = health care provider; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
* Alaska, Colorado, Connecticut, Delaware, Georgia, Illinois, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York City, North Dakota, Pennsylvania, Puerto Rico, Rhode Island, South Dakota, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.
† Unweighted sample size.
§ Weighted percentage.
¶ p<0.05 from chi-squared test of independence.
** Includes single status or living with partner.
†† Includes intimate partner violence from current husband/partner or ex-husband/ex-partner.

84.1% to 88.0% (p<0.05) during 2016–2018, with an average annual percentage point increase of 1.8% (data not shown).

Discussion

In this survey of women with a recent live birth from 31 PRAMS sites, approximately one in eight reported experiencing postpartum depressive symptoms since their infant's birth; PRAMS responses are reported an average of 4 months postpartum, which suggests persistence of these symptoms. The observed variation in PDS by PRAMS sites and selected characteristics is similar to that found in previous reports using PRAMS data (*12*). Differences in the prevalence of PDS by site might reflect differences in the distribution of risk factors, such as low socioeconomic status (*13*). In some subgroups, approximately 20% of women reported PDS, including those aged ≤19 years, who were American Indian/Alaska Native, smoked cigarettes during pregnancy or postpartum, experienced intimate partner violence before or during pregnancy, or self-reported depression before or during pregnancy.

Women with postpartum depression are more likely to have a diagnosis of depression either before or during pregnancy (*14*). In this analysis, the percentage of women with PDS was similarly higher among those who self-reported depression before or during pregnancy; this might reflect the continuum of the condition across the preconception and perinatal period. This study used an adaption of two items from the Patient Health Questionnaire-2, an evidence-based tool used to screen for current depressive symptoms. If the criteria for positive symptomology are met using this tool in clinical practice,

TABLE 3. Prevalence of health care providers asking about depression during prenatal and postpartum visits as reported by women with a recent live birth — Pregnancy Risk Assessment Monitoring System (PRAMS), 31 sites, 2018

Site	Health care providers asked about depression %* (95% CI)	
	Prenatal visit (n = 32,619)†	Postpartum visit (n = 29,187)†
All 31 sites	**79.1 (78.4–79.7)**	**87.4 (86.9–88.0)**
Alaska	90.7 (88.5–92.8)	94.2 (92.4–96.0)
Colorado	82.5 (79.9–85.0)	93.0 (91.2–94.8)
Connecticut	73.5 (70.3–76.6)	89.8 (87.6–92.1)
Delaware	85.1 (82.5–87.6)	88.7 (86.2–91.1)
Georgia	79.1 (75.3–82.9)	85.8 (82.3–89.2)
Illinois	82.2 (79.9–84.5)	91.7 (90.0–93.4)
Kansas	77.9 (74.6–81.2)	85.2 (82.3–88.2)
Kentucky	69.7 (65.3–74.1)	85.4 (81.8–88.9)
Louisiana	70.8 (67.4–74.2)	75.0 (71.7–78.4)
Maine	90.5 (88.1–92.8)	95.5 (93.8–97.3)
Massachusetts	82.7 (80.1–85.3)	93.6 (91.9–95.2)
Michigan	83.4 (81.2–85.6)	88.6 (86.6–90.5)
Minnesota	90.6 (88.7–92.5)	95.9 (94.5–97.3)
Mississippi	69.4 (66.1–72.7)	76.9 (73.8–80.1)
Missouri	77.9 (74.9–81.0)	85.2 (82.4–88.0)
Nebraska	86.3 (83.6–89.0)	89.8 (87.4–92.3)
New Jersey	71.6 (68.8–74.4)	84.8 (82.5–87.1)
New Mexico	89.1 (87.3–90.9)	93.7 (92.2–95.2)
New York City	71.2 (68.4–73.9)	73.1 (70.2–76.0)
North Dakota	89.6 (87.2–92.0)	94.1 (92.1–96.2)
Pennsylvania	81.4 (78.6–84.2)	90.7 (88.4–93.0)
Puerto Rico	51.3 (47.3–55.3)	50.7 (46.1–55.2)
Rhode Island	83.9 (81.4–86.4)	91.8 (89.9–93.7)
South Dakota	87.1 (84.6–89.6)	95.0 (93.4–96.7)
Utah	69.5 (66.3–72.8)	87.3 (84.8–89.7)
Vermont	89.6 (87.6–91.7)	96.2 (94.9–97.6)
Virginia	77.0 (73.0–81.1)	90.3 (87.2–93.3)
Washington	84.8 (82.2–87.4)	91.1 (89.1–93.2)
West Virginia	78.6 (74.8–82.3)	82.4 (78.7–86.1)
Wisconsin	85.8 (82.8–88.9)	90.9 (88.2–93.6)
Wyoming	80.2 (76.1–84.3)	85.9 (82.2–89.7)

Abbreviation: CI = confidence interval.
* Weighted percentage.
† Unweighted sample size.

the patient should receive further assessment to determine whether a diagnosis of major depressive episode is warranted (*4*). Identifying women with PDS should be complemented with adequate systems to ensure needed diagnosis, treatment, and follow-up (*5*). One study from the National Survey of Drug Use and Health indicated that past-year major depressive episodes are common in both pregnant (7.7%) and nonpregnant (11.1%) females of reproductive age (*15*). Furthermore, regardless of pregnancy status, as many as 60% of these persons did not receive a clinical diagnosis and only one half received treatment (*15*). To optimize the health of women and infants, postpartum care should become an ongoing process, with services and support tailored to each woman's individual needs. The comprehensive postpartum visit should include a full assessment of physical, social, and psychological well-being. Women with chronic medical conditions should be

TABLE 4. Prevalence of health care providers asking about depression during prenatal and postpartum visits as reported by women with a recent live birth, by selected characteristics — Pregnancy Risk Assessment Monitoring System (PRAMS), 31 sites,* 2018

Characteristic	Health care providers asked about depression %† (95% CI)	
	Prenatal visits (n = 32,619)§	Postpartum visit (n = 29,187)§
Age group (yrs)¶,**		
≤19	86.9 (84.0–89.7)	91.3 (89.4–93.3)
20–24	83.2 (81.7–84.7)	87.8 (86.4–89.2)
25–34	78.6 (77.7–79.5)	87.4 (86.7–88.2)
≥35	74.9 (73.3–76.6)	86.4 (85.1–87.7)
Race/Ethnicity¶,**		
White, non-Hispanic	76.7 (75.8–77.6)	88.1 (87.3–88.8)
Black, non-Hispanic	85.5 (84.0–87.0)	86.8 (85.2–88.4)
Hispanic	81.8 (80.4–83.2)	86.2 (84.8–87.5)
American Indian/Alaska Native, non-Hispanic	91.5 (88.2–94.8)	92.2 (88.3–96.1)
Asian/Pacific Islander, non-Hispanic	74.6 (71.8–77.5)	83.0 (80.6–85.5)
Other, non-Hispanic	82.8 (79.6–86.1)	91.4 (88.5–94.3)
Education level (yrs)¶		
<12	84.4 (82.6–86.2)	87.7 (85.9–89.6)
12	83.2 (81.9–84.6)	87.1 (85.8–88.4)
>12	76.5 (75.7–77.4)	87.4 (86.8–88.1)
Marital status¶		
Married	75.8 (74.9–76.7)	87.2 (86.5–87.9)
Not married††	84.5 (83.5–85.5)	87.9 (86.9–88.8)
WIC participation during pregnancy¶		
Yes	84.1 (83.0–85.1)	88.2 (87.3–89.1)
No	76.4 (75.6–77.3)	87.1 (86.4–87.8)
Health insurance at delivery¶		
Private	75.2 (74.3–76.2)	87.2 (86.5–88.0)
Medicaid	84.3 (83.3–85.2)	87.9 (87.0–88.8)
None	77.3 (73.2–81.4)	86.9 (83.4–90.4)
No. of previous live births**		
First birth	78.4 (77.3–79.5)	88.4 (87.5–89.2)
Second or later birth	79.5 (78.7–80.3)	86.9 (86.2–87.6)
Smoked cigarettes during last 3 mos of pregnancy¶		
Yes	83.7 (81.4–86.1)	87.7 (85.2–90.1)
No	78.7 (78.0–79.4)	87.5 (86.9–88.0)
Smoked cigarettes postpartum		
Yes	N/A	87.9 (85.9–89.9)
No		87.5 (86.9–88.1)
Any intimate partner violence before/during pregnancy§§		
Yes	80.5 (76.9–84.2)	85.9 (82.4–89.3)
No	79.0 (78.3–79.7)	87.6 (87.0–88.1)
Self-reported depression before pregnancy¶,**		
Yes	86.2 (84.7–87.7)	90.5 (89.0–91.9)
No	77.9 (77.2–78.7)	87.0 (86.4–87.7)
Self-reported depression during pregnancy¶,**		
Yes	85.5 (83.9–87.1)	90.7 (89.3–92.2)
No	78.1 (77.4–78.8)	87.0 (86.4–87.6)

Abbreviations: CI = confidence interval; N/A = not applicable; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
* Alaska, Colorado, Connecticut, Delaware, Georgia, Illinois, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York City, North Dakota, Pennsylvania, Puerto Rico, Rhode Island, South Dakota, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.
† Weighted percentage.
§ Unweighted sample size.
¶ p<0.05 from chi-squared test of independence for the prenatal period.
** p<0.05 from chi-squared test of independence for the postpartum period.
†† Includes single status or living with partner.
§§ Includes intimate partner violence from current husband/partner or ex-husband/ex-partner.

Summary

What is already known about this topic?

Perinatal depression is a complication of pregnancy associated with poor maternal and infant health outcomes. Universal screening of pregnant and postpartum women for depression is recommended.

What is added by this report?

Although 13% of surveyed women with a recent live birth reported depressive symptoms during the postpartum period, one in five did not report a health care provider asking about depression during prenatal visits and one in eight reported they were not asked about depression during postpartum visits.

What are the implications for public health practice?

Health care provider screening of all women in the perinatal period can increase identification of women at risk for depression and provision of care or referral for appropriate diagnosis and treatment.

counseled regarding the importance of timely follow-up with their obstetrician–gynecologist or primary care provider for ongoing coordination of care (*16*).

The prevalence of inquiry about depression by a health care provider was higher during postpartum than prenatal visits, both overall and in 21 (68%) of 31 participating sites. The emphasis in ACOG recommendations for a full assessment of mood and emotional well-being in the postpartum period (*7*) and less evidence of the benefit of screening pregnant versus postpartum women for depression (*5*) might explain some of these differences. Although universal screening for depression is recommended for pregnant and postpartum women (*6*,*7*), variation was seen in the percentage of women who reported being asked about depression by the characteristics assessed. Despite the observed increase in the percentage of health care providers asking women about depression over time, one in eight women with a live birth in 2018 reported not being asked about depression during a postpartum visit, and one in five did not report being asked at a prenatal visit. Health care providers can provide timely perinatal depression education to women and family members or other support persons.[§§] Health systems can implement quality improvement through screening and linkage to care for depression during both the prenatal and postpartum periods (*17*).

Variation in site-based estimates of the percentage of health care providers who asked about depression might be related to differences in state initiatives to increase provider capacity and link women to care. For example, state-based programs such as the Massachusetts Child Psychiatry Access Program for Moms aim to increase the capacity of obstetric providers to address perinatal depression in health care settings (*18*). The Health Resources and Services Administration recently funded seven states to implement programs to support providers, through real-time psychiatric consultation, care coordination, and training in screening, assessing, referring, and treating pregnant and postpartum women for depression and other behavioral health conditions.[¶¶] Additional state-level programmatic initiatives can be leveraged to address perinatal depression through programs such as Healthy Start,[***] home visiting,[†††] and Title V.[§§§]

The findings in this report are subject to at least five limitations. First, results are only representative of women with a recent live birth in the PRAMS sites that are included in the report. Second, postpartum depressive symptoms were self-reported and are not necessarily indicative of a clinical diagnosis of depression. Third, estimates might not capture depressive symptoms that resolved before or began after survey completion, which occurred an average of approximately 4 months after the live birth. Fourth, self-reported PDS and provider discussions about depression are subject to both recall and social desirability biases. Finally, the study assessed health care provider inquiry about depression during prenatal and postpartum visits, but these data cannot provide knowledge of whether recommended screening and referrals were performed or of the content of any care provided outside of the health care setting.

Perinatal depression is a common complication of pregnancy that can be addressed at multiple levels. Screening for perinatal depression should be accompanied by evidence-based systems for diagnosis, counseling, treatment, and referral. Ongoing, site-specific surveillance with PRAMS can be used to monitor estimates of PDS and provider discussions about depression in the perinatal period and identify opportunities for providers, health systems, and states to better support women and their families.

[§§] https://safehealthcareforeverywoman.org/wp-content/uploads/2017/11/Maternal-Mental-Health-Bundle.pdf;.https://www.jognn.org/article/S0884-2175(17)30001-1/fulltext.

[¶¶] https://www.hrsa.gov/about/news/press-releases/hrsa-awards-12-million-maternal-child-mental-health-programs#behavioral.

[***] National Healthy Start Association. Stress and Depression Training Toolkit. http://nationalhealthystart.org/member/training.

[†††] https://www.childwelfare.gov/topics/preventing/prevention-programs/homevisit/maternal-mental-health/.

[§§§] https://mchb.tvisdata.hrsa.gov/PrioritiesAndMeasures/NationalOutcomeMeasures.

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Survival and HIV-Free Survival Among Children Aged ≤3 Years — Eight Sub-Saharan African Countries, 2015–2017

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Although mother-to-child transmission (MTCT) of human immunodeficiency virus (HIV) is preventable through antiretroviral treatment (ART) during pregnancy and postpartum, the Joint United Nations Programme on HIV/AIDS (UNAIDS) estimates that 160,000 new HIV infections occurred among children in 2018 (*1*). Child survival and HIV-free survival rates* are standard measures of progress toward eliminating MTCT† (*2*). Nationally representative Population-based HIV Impact Assessment (PHIA)§ survey data, pooled from eight sub-Saharan African countries¶ were used to calculate survival probability among children aged ≤3 years by maternal HIV status during pregnancy and HIV-free survival probability among children aged ≤3 years born to women with HIV infection, stratified by maternal ART** status during pregnancy. Survival probability was significantly lower among children born to women with HIV infection (94.7%) than among those born to women without HIV infection (97.6%). HIV-free survival probability of children born to women with HIV infection differed significantly by the timing of initiation of maternal ART: 93.0% among children whose mothers received ART before pregnancy, 87.8% among those whose mothers initiated ART during pregnancy, and 53.4% among children whose mothers did not receive ART during pregnancy. Focusing on prevention of HIV acquisition and, among women of reproductive age with HIV infection, on early diagnosis of HIV infection and ART initiation when applicable, especially before pregnancy, can improve child survival and HIV-free survival.

Females aged ≥15 years who provided consent†† to survey participation answered questions about the most recent pregnancy that resulted in a live birth in the 3 years preceding the interview (i.e., births occurring during 2012–2017, depending on the date of the survey). Questions asked whether any antenatal care was received, timing of HIV testing and HIV status (HIV diagnosis before pregnancy; during pregnancy, labor, or delivery; or did not have a diagnosis of HIV infection), and ART use among mothers with HIV infection (initiated ART before pregnancy; initiated ART during pregnancy, labor, or delivery; or did not receive ART). All mothers provided the child's date of birth; whether the child was living or deceased, and if deceased, the date of death or age at death; and HIV status of living children. All mothers and a random subsample of children underwent HIV testing in the household using country-specific HIV rapid testing algorithms. Positive rapid test results were confirmed using Geenius HIV-1/2 confirmatory assay (Bio-Rad) (for children aged ≥18 months).§§ Infants aged <18 months were screened for HIV exposure using rapid tests; a positive rapid test result was confirmed using total nucleic acid polymerase chain reaction. HIV test results were provided to the participants along with referral to HIV treatment services. Survey protocols for each of the eight countries were reviewed by the CDC Institutional Review Board (IRB), the Columbia University Medical Center IRB, and the IRB in each country.

Children were classified according to maternal report of HIV status during pregnancy to determine survival by maternal HIV status. For the HIV-free survival analysis, children born to mothers with HIV infection were classified according to maternal self-reported ART use during pregnancy. Mothers whose response to HIV status during pregnancy was missing but who had positive test results for HIV (0.8%), were classified as having HIV infection during pregnancy. Mothers with HIV infection who were missing information on ART use during pregnancy (5%) were classified as not having received ART during pregnancy.

HIV status of children in this analysis was determined by HIV testing during the survey (74%) or maternal report for nonsampled children (26%). Date of the child's HIV diagnosis was based on the survey test date for sampled children and on mothers' report of first HIV test date with positive results for

* For this analysis, HIV-free survival was defined as the child being alive and HIV-negative at the time of the survey, as determined by either the HIV testing conducted during the survey or the maternal report of the child's HIV status.

† Elimination of new HIV infections among children.

§ https://phia.icap.columbia.edu/.

¶ Eswatini, Lesotho, Malawi, Namibia, Tanzania, Uganda, Zambia, and Zimbabwe (PHIA surveys in these countries were conducted during 2015–2017).

** Information on HIV treatment regimen was not collected in the PHIA questionnaire, and some mothers might not have been on lifelong ART.

†† Method of consent was either oral or written depending on each country's PHIA survey protocol.

§§ In Uganda, Geenius confirmation was not used. All specimens collected by venous blood draw were retested at the central laboratory using the national rapid testing algorithm used in the field.

nonsampled children. Mothers reported the date of death or age at death for children who had died. HIV status of deceased children was not recorded uniformly across surveys and was therefore not included in the analysis. Children without a survey-confirmed HIV status and without mothers' report were excluded.

Kaplan-Meier survival analyses were used to estimate overall survival and HIV-free survival probability (*3*). Interview data about mothers' last pregnancy were used to determine the outcomes of children using the age of the child at the time of events of interest. To estimate survival, children were censored at the age at death or age at time of survey. To estimate HIV-free survival, children of mothers with HIV infection were censored at their age at death, their age at HIV diagnosis, or their age at the time of survey. A sensitivity analysis was conducted to estimate HIV-free survival rates after excluding children currently breastfeeding who were still at risk for HIV infection through breast milk transmission. The analyses were unweighted. Analyses were performed using SAS (version 9.4; SAS Institute) and Stata (version 14.2; StataCorp) statistical software.

Among 36,278 live births, data for the survival analysis were available for 33,863 (93%), including 30,703 (91.0%) children born to mothers without HIV infection, 3,020 (9.0%) born to mothers with HIV infection, and 140 (0.4%) children whose mothers' HIV status was unknown (Table 1). Among children born to mothers with HIV infection, 108 (3.6%) died; 552 (1.8%) mothers without HIV infection and five (3.6%) mothers with unknown HIV status also died. Cumulative probability of survival up to 3 years among children born to mothers with HIV infection was 94.7% and among children born to mothers without HIV infection was 97.6% (p<0.001) (Figure) (Table 2).

Among the 3,020 children born to mothers with HIV infection, 2,373 (78.6%) had complete HIV data (HIV status and diagnosis date) and death data available and were included in the HIV-free survival analysis. Among these 2,373 children, mothers of 1,252 (52.8%) received ART before pregnancy; 842 (35.5%) initiated ART during pregnancy, labor, or delivery; and 276 (11.6%) did not receive ART during pregnancy, labor, or delivery (Table 1). Overall, 127 (5.4%) of these children had HIV infection, 2,138 (90.1%) did not, and 108 (4.6%) had died.

HIV-free survival probability in children born to mothers with HIV infection was 85.3%. HIV-free survival rates among children whose mothers initiated ART before pregnancy, during pregnancy, and who did not receive ART during pregnancy were 93.0%, 87.8%, and 53.4%, respectively (log-rank p-value <0.001) (Figure). Excluding children who were currently breastfeeding did not alter the HIV-free survival estimates.

Discussion

The PHIA surveys provide population-level estimates of child survival and HIV-free survival in eight sub-Saharan African countries among children born during 2012–2017, allowing population-level assessment of progress toward elimination of MTCT. The estimated probability of survival of children born to mothers with HIV infection was lower than that of children born to mothers without HIV infection, as has been previously reported (*4*). Previous studies on child mortality by maternal HIV status were conducted before the widespread scale–up of Option B+ (lifelong ART for all pregnant and breastfeeding mothers living with HIV infection regardless of CD4 cell count or clinical stage)[¶¶] that occurred during 2011–2014 and the 2016 "treat-all" guidance for all persons living with HIV infection (*5*,*6*). Most children included in this analysis were conceived or born before or during the early efforts to scale up adult[***] and pediatric[†††] ART (*6*). The difference in survival probability of children born to mothers with HIV infection and those without HIV infection in the recent birth cohorts[§§§] appears to be narrowing, which could be the early sign of progress in reducing AIDS-specific morbidity and mortality among adults, potentially conferring survival benefits to children (*7*).

The HIV-free survival rate of 85.3% suggests that substantial gaps remain in improving child survival and eliminating MTCT. HIV-free child survival probability was highest when mothers received ART before pregnancy, compared with survival probability of children whose mothers initiated ART during pregnancy or who did not receive ART during pregnancy, as has been reported in another impact assessment of the prevention of mother-to-child transmission (PMTCT) (*8*). Initiation of ART before pregnancy reduces in utero MTCT of HIV and is associated with postpartum ART retention, which, in turn, reduces the risk for HIV transmission through breastfeeding (*8*,*9*). In this analysis, >90% of mothers with HIV infection received ART during pregnancy, but only

[¶¶] Option B+ was first introduced in Malawi in 2011 and expanded globally since 2013. "Treat-all" refers to ART initiation among all adults with HIV regardless of clinical stage and at any CD4 cell count. https://apps.who.int/iris/bitstream/handle/10665/186275/9789241509565_eng.pdf;jsessionid=1461B0D372ABEF56426E1D7CD95CD354?sequence=1.

[***] Births included in this analysis occurred during 2012–2017. National HIV programs scaled up Option B+ in 2011, and adult treat-all approach was initiated in 2016.

[†††] The Accelerated Childen's HIV/AIDS Treatment initiative was a 2-year program to double the number of children receiving ART in sub-Saharan Africa. https://journals.lww.com/jaids/Fulltext/2018/08152/Sustainability_and_Accelerating_Children_s.12.aspx.

[§§§] Corresponding to children who were aged <1 year at the time of the survey.

TABLE 1. Characteristics of children aged ≤3 years at the time of the Population-based HIV Impact Assessment (PHIA) survey, as determined by maternal report of the most recent pregnancy (N = 33,863) — eight sub-Saharan African countries,* 2012–2017

Characteristic	Eswatini	Lesotho	Malawi	Namibia	Tanzania	Uganda	Zambia	Zimbabwe	Total
No. of children eligible†	**1,369**	**1,872**	**4,389**	**2,966**	**7,283**	**6,619**	**4,965**	**4,400**	**33,863**
Child's age at time of survey (yrs), no. (%)									
<1	423 (30.9)	605 (32.3)	1,218 (27.8)	998 (33.6)	2,299 (31.6)	2,249 (34.0)	1,542 (31.1)	1,232 (28.0)	**10,566 (31.2)**
1	391 (28.6)	498 (26.6)	1,232 (28.1)	867 (29.2)	2,178 (29.9)	2,034 (30.7)	1,460 (29.4)	1,202 (27.3)	**9,862 (29.1)**
2	340 (24.8)	416 (22.2)	1,101 (25.1)	674 (22.7)	1,699 (23.3)	1,442 (21.8)	1,141 (23.0)	1,124 (25.5)	**7,937 (23.4)**
3	215 (15.7)	353 (18.9)	838 (19.1)	427 (14.4)	1,107 (15.2)	894 (13.5)	822 (16.6)	842 (19.1)	**5,498 (16.2)**
Sex, no. (%)									
Female§	506 (50.8)	757 (49.2)	2,017 (50.2)	1,117 (50.6)	3,395 (50.6)	2,799 (49.8)	2,259 (50.7)	1,835 (49.2)	**14,685 (50.2)**
Male§	490 (49.2)	781 (50.8)	1,997 (49.8)	1,089 (49.4)	3,314 (49.4)	2,822 (50.2)	2,200 (49.3)	1,893 (50.8)	**14,586 (49. 8)**
Unknown¶	373 (27.2)	334 (17.8)	375 (8.5)	760 (25.6)	574 (7.9)	998 (15.1)	506 (10.2)	672 (15.3)	**4,592 (13.6)**
Place of delivery, no. (%)									
Institution§	1,268 (92.6)	1,607 (85.8)	4,123 (93.9)	2,634 (88.8)	5,484 (75.3)	5,159 (77.9)	4,177 (84.1)	3,771 (85.7)	**28,223 (83.3)**
Home§	89 (6.5)	245 (13.1)	186 (4.2)	299 (10.1)	1,697 (23.3)	1,269 (19.2)	724 (14.6)	543 (12.3)	**5,052 (14.9)**
Other§	12 (0.9)	20 (1.1)	78 (1.8)	31 (1.0)	102 (1.4)	191 (2.9)	63 (1.3)	86 (2.0)	**583 (1.7)**
Unknown¶	0 (0.0)	0 (0.0)	2 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)	**5 (0.0)**
Residence, no. (%)									
Urban	303 (22.1)	798 (42.6)	1,482 (33.8)	1,274 (43.0)	2,212 (30.4)	1,569 (23.7)	1,890 (38.1)	1,285 (29.2)	**10,813 (31.9)**
Rural	1,066 (77.9)	1,074 (57.4)	2,907 (66.2)	1,692 (57.0)	5,071 (69.6)	5,050 (76.3)	3,075 (61.9)	3,115 (70.8)	**23,050 (68.1)**
Ever breastfed, no. (%)									
Yes§	1,248 (92.2)	1,757 (93.9)	4,329 (98.6)	2,876 (97.0)	7,225 (99.2)	6,518 (98.6)	4,887 (98.4)	4,350 (98.9)	**33,190 (98.1)**
No§	105 (7.8)	115 (6.1)	58 (1.3)	90 (3.0)	57 (0.8)	94 (1.4)	78 (1.6)	49 (1.1)	**646 (1.9)**
Unknown¶	16 (1.2)	0 (0.0)	2 (0.0)	0 (0.0)	1 (0.0)	7 (0.1)	0 (0.0)	1 (0.0)	**27 (0.1)**
Currently breastfeeding (among ever breastfed), no. (%)									
Yes§	377 (30.2)	606 (34.5)	2,368 (55.5)	1,086 (37.8)	3,558 (49.2)	3,477 (53.5)	2,476 (51.5)	1,757 (40.9)	**15,705 (47.6)**
No§	871 (69.8)	1,151 (65.5)	1,896 (44.5)	1,790 (62.2)	3,667 (50.8)	3,019 (46.5)	2,334 (48.5)	2,534 (59.1)	**17,262 (52.4)**
Unknown¶	0 (0.0)	0 (0.0)	65 (1.5)	0 (0.0)	0 (0.0)	22 (0.3)	77 (1.6)	59 (1.4)	**223 (0.7)**
Died, no. (%)**	19 (1.4)	52 (2.8)	94 (2.1)	51 (1.7)	146 (2.0)	119 (1.8)	104 (2.1)	80 (1.8)	**665 (2.0)**
Child's HIV status, no. (%)									
HIV-positive§,††	14 (1.8)	12 (1.2)	19 (1.0)	5 (0.4)	17 (0.6)	23 (0.6)	19 (0.9)	23 (1.2)	**132 (0.9)**
HIV-negative§,††	768 (98.2)	984 (98.8)	1,811 (99.0)	1,266 (99.6)	2,613 (99.4)	3,765 (99.4)	2,098 (99.1)	1,933 (98.8)	**15,238 (99.1)**
Unknown¶,§§	587 (42.9)	876 (46.8)	2,559 (58.3)	1,695 (57.1)	4,653 (63.9)	2,831 (42.8)	2,848 (57.4)	2,444 (55.5)	**18,493 (54.6)**
Mother's HIV status, no. (%)									
HIV-positive	441 (32.2)	406 (21.7)	390 (8.9)	398 (13.4)	247 (3.4)	260 (3.9)	388 (7.9)	490 (11.3)	**3,020 (9.0)**
HIV-negative	927 (67.8)	1,463 (78.3)	3,983 (91.1)	2,563 (86.6)	7,028 (96.6)	6,352 (96.1)	4,545 (92.1)	3,842 (88.7)	**30,703 (91.0)**
Not tested	1 (0.1)	3 (0.2)	16 (0.4)	5 (0.2)	8 (0.1)	7 (0.1)	32 (0.6)	68 (1.5)	**140 (0.4)**
ART status during pregnancy among mothers with HIV infection (N = 2,373 included in HIV-free survival analysis), no. (%)									
Treated with ART at first antenatal visit§	173 (56.5)	142 (45.1)	153 (45.9)	211 (75.6)	75 (44.9)	130 (57.5)	154 (49.2)	214 (49.7)	**1,252 (52.8)**
Newly initiated ART during pregnancy or labor§	107 (35.0)	122 (38.7)	152 (45.6)	42 (15.1)	66 (39.5)	65 (28.8)	120 (38.3)	168 (39.0)	**842 (35.5)**
Did not receive ART during pregnancy or labor§	26 (8.5)	51 (16.2)	28 (8.4)	26 (9.3)	26 (15.6)	31 (13.7)	39 (12.5)	49 (11.4)	**276 (11.6)**
Unknown¶	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)	1 (0.3)	1 (0.2)	**3 (0.1)**

Abbreviations: ART = antiretroviral therapy; HIV = human immunodeficiency virus.

* Eswatini, Lesotho, Malawi, Namibia, Tanzania, Uganda, Zambia, and Zimbabwe.

† Eligibility requirements for inclusion in this analysis were that mothers be aged ≥15 years, had a live birth in the most recent delivery within the 3 years preceding the PHIA survey, and had age information on the children.

§ Percentages were calculated using only total of children with reported characteristics as the denominator.

¶ Percentages were calculated using total of all reported children as the denominator.

** Among 665 children's deaths, five (9.8%) children were HIV-infected, 23 (3.5%) were not HIV-infected, and for 637 (97.3%), HIV status was not known.

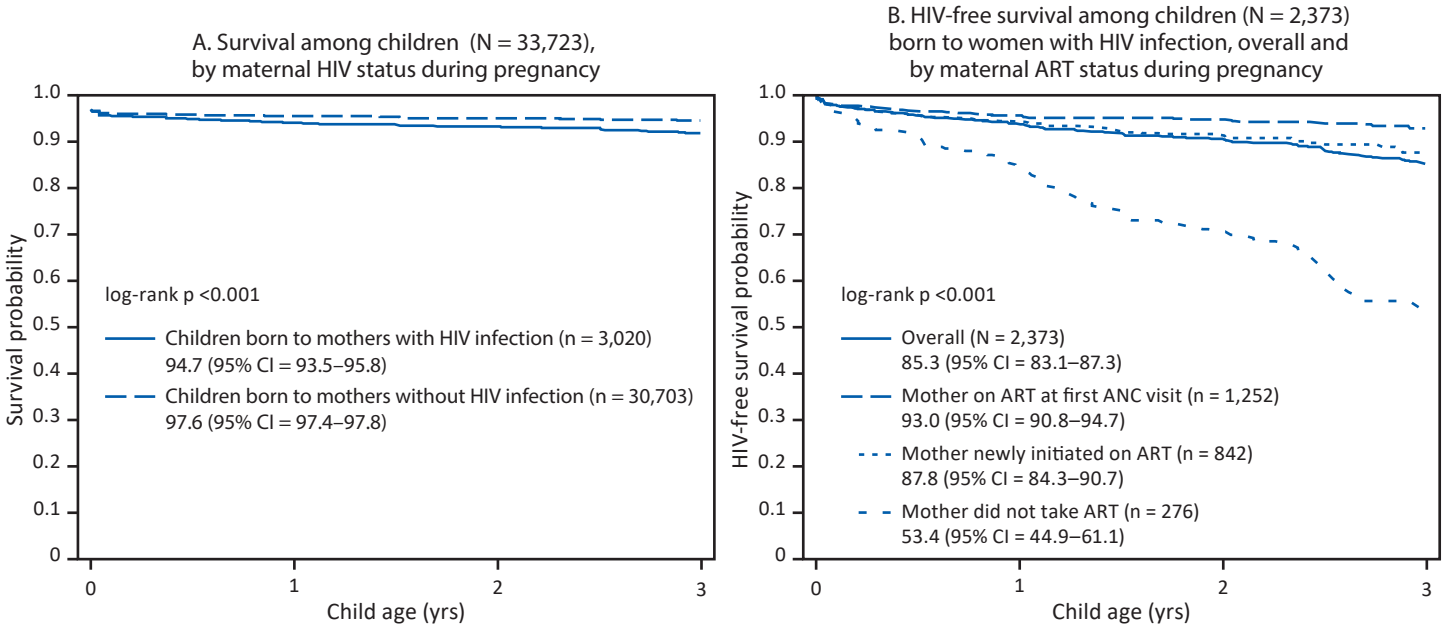
†† As determined by HIV testing conducted during the survey or on mothers' report of child's HIV status if child was not sampled for survey HIV testing.

§§ Child was not tested for HIV during the survey, and mother's report of child's status was missing.

approximately 50% initiated ART before pregnancy. These results suggest that achieving MTCT elimination targets will require earlier diagnosis of HIV infection and earlier initiation of ART among women of reproductive age with HIV infection, along with prevention of HIV acquisition among women, prevention of unintended pregnancies, and safe conception planning for mothers living with HIV infection so that they can receive ART and be virally suppressed before pregnancy.¶¶¶ The difference in HIV-free survival in

¶¶¶ The first two pillars of the World Health Organization's comprehensive approach to PMTCT are preventing HIV infection and preventing unintended pregnancies. https://www.who.int/hiv/pub/mtct/strategic/en/.

FIGURE. Probability of survival (A)*,† and HIV-free survival (B)§ among children aged ≤3 years at the time of the Population-based HIV Impact Assessment (PHIA) survey — eight sub-Saharan African countries,¶ 2015–2017



Abbreviations: ANC = antenatal care; ART = antiretroviral therapy; CI = confidence interval; HIV = human immunodeficiency virus.
* Excludes 140 children out of 33,863 whose mothers had unknown HIV status.
† Excludes 11 deaths among children not exposed to HIV that took place after 3 years.
§ Among 2,373 children born to mothers with HIV infection, three were born to mothers with missing ART use data.
¶ Eswatini, Lesotho, Malawi, Namibia, Tanzania, Uganda, Zambia, and Zimbabwe.

TABLE 2. Country-specific cumulative probability of survival in children aged ≤3 years at the time of the Population-based HIV Impact Assessment (PHIA) survey — eight sub-Saharan African countries,* 2015–2017

		All children aged ≤3 years		Children born to mothers with HIV infection		Children born to mothers without HIV infection	
Country	PHIA survey year	No.	Survival probability (95% CI)	No.	Survival probability (95% CI)	No.	Survival probability (95% CI)
Eswatini	2016–2017	1,369	97.8 (96.3–98.7)	441	98.2 (95.9–99.2)	927	97.5 (95.5–98.7)
Lesotho	2016–2017	1,872	96.8 (95.7–97.6)	406	93.7 (90.0–96.1)	1,463	97.6 (96.6–98.4)
Malawi	2015–2016	4,389	97.2 (96.5–97.8)	390	90.3 (84.6–94.0)	3,983	97.9 (97.3–98.3)
Namibia	2017	2,966	97.3 (96.4–98.0)	398	97.0 (93.3–98.6)	2,563	97.4 (96.4–98.1)
Tanzania	2016–2017	7,283	97.3 (96.7–97.7)	247	92.8 (87.2–96.0)	7,028	97.4 (96.9–97.9)
Uganda	2016–2017	6,619	97.6 (97.1–98.1)	260	96.9 (91.0–99.0)	6,352	97.6 (97.1–98.1)
Zambia	2016	4,965	96.9 (96.1–97.5)	388	91.8 (86.4–95.1)	4,545	97.3 (96.6–97.9)
Zimbabwe	2015–2016	4,400	97.7 (97.1–98.2)	490	96.6 (94.4–98.0)	3,842	98.1 (97.5–98.5)
Overall†	—	**33,863**	**97.3 (97.1–97.6)**	**3,020**	**94.7 (93.5–95.8)**	**30,703**	**97.6 (97.4–97.8)**

Abbreviation: CI = confidence interval.
* Eswatini, Lesotho, Malawi, Namibia, Tanzania, Uganda, Zambia, and Zimbabwe.
† HIV status is unknown for mothers of 140 children, who are excluded from the survival analysis by maternal HIV status.

children determined by maternal ART status during pregnancy was least pronounced in the most recent birth cohort (i.e., children aged ≤1 year at the time of the survey); these children likely benefited most from Option B+ and adult treat-all programs.****

The findings in this report are subject to at least three limitations. First, children in the sample were born during 2012–2017 and received different care depending on HIV treatment standards at the time, which could limit comparability over time. Second, the cross-sectional nature of the data precludes attribution of results to different HIV program effects. Some of the favorable outcomes in children aged ≤1 year could be the consequence of exposure to more effective programs and the shorter duration of observation; however, given that past studies have shown most diagnoses of HIV infection

**** In the pooled data, percentages of children born to mothers who were treated with ART before pregnancy and delivered in the 1, 2 and 3 years preceding the survey were 55.3%, 51.9% and 51.3%, respectively, indicating a modest increase in the proportion of mothers treated with ART before pregnancy over time.

Summary

What is already known about this topic?

Mother-to-child transmission of human immunodeficiency virus (HIV) is preventable through antiretroviral treatment (ART) during pregnancy and postpartum.

What is added by this report?

Among children born to mothers with HIV infection in eight sub-Saharan African countries, HIV-free survival was highest among children whose mothers received ART before pregnancy, compared with those who initiated ART during pregnancy or those who did not receive ART during pregnancy.

What are the implications for public health practice?

In addition to prevention of HIV acquisition, national programs should prioritize early diagnosis of HIV infection and ART initiation among women of reproductive age before pregnancy to reduce mother-to-child transmission of HIV and improve child survival rates.

and HIV-associated deaths occurring in the first year of life (*10*), it is more likely to be related to better programs than to shorter observation periods. Finally, mortality was estimated from the most recent live birth during the preceding 3 years; therefore, these mortality estimates are lower than are those from Demographic and Health Surveys, which estimate infant mortality using all deaths during the preceding 5 years.††††

Despite considerable scale-up of ART and other PMTCT interventions in sub-Saharan Africa, children born to mothers with HIV infection are still at substantial risk for MTCT of HIV and have lower survival rates than do children born to mothers without HIV infection. In addition to prevention of HIV acquisition among women, HIV programs should focus efforts on early diagnosis of HIV infection and initiation of ART among women of reproductive age with HIV infection, especially before pregnancy, to have the greatest impact in reducing MTCT and reaching child survival goals. Ongoing assessments of survival and HIV-free survival will be needed to determine longer-term effects of improving HIV programs on child health outcomes.

†††† Infant mortality rates (deaths in children aged <1 year per 1,000 live births), irrespective of maternal HIV status, from the PHIA surveys and Demographic and Health Surveys (DHS), respectively, in the eight countries are as follows: Eswatini (0.9% and 8.5%), Lesotho (2.6% and 5.9%), Malawi (1.8% and 4.2%), Namibia (1.1% and 3.9%), Tanzania (1.6% and 4.3%), Uganda (1.5% and 6.4%), Zambia (1.7% and 4.5%), and Zimbabwe (1.5% and 5.0%). DHS methods for estimating child mortality are available at https://dhsprogram.com/Data/Guide-to-DHS-Statistics/Early_Childhood_Mortality.htm.

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COVID-19 in Correctional and Detention Facilities — United States, February–April 2020

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An estimated 2.1 million U.S. adults are housed within approximately 5,000 correctional and detention facilities† on any given day (*1*). Many facilities face significant challenges in controlling the spread of highly infectious pathogens such as SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). Such challenges include crowded dormitories, shared lavatories, limited medical and isolation resources, daily entry and exit of staff members and visitors, continual introduction of newly incarcerated or detained persons, and transport of incarcerated or detained persons in multiperson vehicles for court-related, medical, or security reasons (*2*,*3*). During April 22–28, 2020, aggregate data on COVID-19 cases were reported to CDC by 37 of 54 state and territorial health department jurisdictions. Thirty-two (86%) jurisdictions reported at least one laboratory-confirmed case from a total of 420 correctional and detention facilities. Among these facilities, COVID-19 was diagnosed in 4,893 incarcerated or detained persons and 2,778 facility staff members, resulting in 88 deaths in incarcerated or detained persons and 15 deaths among staff members. Prompt identification of COVID-19 cases and consistent application of prevention measures, such as symptom screening and quarantine, are critical to protecting incarcerated and detained persons and staff members.

To estimate the prevalence of COVID-19 in U.S. correctional and detention facilities, CDC requested aggregate surveillance data from 54 state and territorial health department jurisdictions. Data were provided to CDC during April 22–28, 2020 and included laboratory-confirmed cases identified and reported to jurisdictions during January 21–April 21, 2020. Requested data elements included 1) the number of facilities that had reported at least one laboratory-confirmed COVID-19 case; 2) the cumulative number of incarcerated or detained persons and staff members with laboratory-confirmed COVID-19; and 3) the cumulative number of COVID-19–associated hospitalizations and deaths among incarcerated or detained persons and staff members. Jurisdictions were asked to include data for persons in the custody of or working for state and local corrections, U.S. Immigration and Customs Enforcement, U.S. Marshals Service, and Federal Bureau of Prisons. Data on the number tested or persons with negative test results were not requested.

Thirty-seven (69%) jurisdictions provided aggregate surveillance data; 32 (86%) of those reported at least one laboratory-confirmed COVID-19 case among incarcerated or detained persons or staff members. In those 32 jurisdictions, 420 facilities reported 4,893 COVID-19 cases among incarcerated or detained persons and 2,778 cases among staff members (Table). More than half (221; 53%) of the affected facilities reported cases only among staff members. Among COVID-19 cases in incarcerated or detained persons, 491 (10%) COVID-19–associated hospitalizations and 88 (2%) deaths were reported; among staff member cases, 79 (3%) hospitalizations and 15 (1%) deaths were reported. Among the 32 jurisdictions reporting cases, the median number of affected facilities was 10 (range = 1–59), the median number of cases in incarcerated or detained persons was 34 (range = 0–858), and the median number of cases in staff members was 26 (range = 1–756).

Discussion

This analysis provides the first documentation of the number of reported laboratory-confirmed cases of COVID-19 in correctional and detention facilities in the United States, although information on the proportion of incarcerated and detained persons and staff members tested was not available. Approximately one half of facilities with COVID-19 cases reported them among staff members but not among incarcerated persons. Because staff members move between correctional facilities and their communities daily, they might be an important source of virus introduction into facilities. Regular symptom screening can help to reduce introduction of the virus from symptomatic persons, whether through staff members,

* These authors contributed equally.
† Correctional facilities refer to state and federal prisons, which incarcerate persons who have been tried for a crime, convicted, and sentenced for a duration >1 year. Those convicted of federal crimes are incarcerated in federal prisons; those convicted of state crimes are held in state prisons. Detention facilities refer to jails or detention centers, which temporarily detain persons awaiting sentencing or deportation, usually for a duration of <1 year.

Summary

What is already known about this topic?

Correctional and detention facilities face challenges in controlling the spread of infectious diseases because of crowded, shared environments and potential introductions by staff members and new intakes.

What is added by this report?

Among 37 jurisdictions reporting, 32 (86%) reported at least one confirmed COVID-19 case among incarcerated or detained persons or staff members, across 420 correctional and detention facilities. As of April 21, 2020, 4,893 cases and 88 deaths among incarcerated and detained persons and 2,778 cases and 15 deaths among staff members have been reported.

What are the implications for public health practice?

Prompt identification of persons with COVID-19 and consistent application of prevention measures within correctional and detention facilities are critical to protecting incarcerated or detained persons, staff members, and the communities to which they return.

new intakes, or incarcerated or detained persons who attend court-related or medical appointments in the community. Screening all incarcerated or detained persons quarantined as close contacts of a case twice daily and promptly isolating persons with symptoms can help identify persons infected as a result of transmission that occurred within the facility and control spread of disease.

Although symptom screening is important, an investigation of a COVID-19 outbreak in a skilled nursing facility found that approximately one half of cases identified through facility-wide testing were among asymptomatic and presymptomatic persons, who likely contributed to transmission (*4*). These data indicate that symptom screening alone is inadequate to promptly identify and isolate infected persons in congregate settings such as correctional and detention facilities. Additional strategies, including physical distancing, movement restrictions, use of cloth face coverings, intensified cleaning, infection control training for staff members, and disinfection of high-touch surfaces in shared spaces are recommended to prevent and manage spread within correctional and detention facilities (Box). Some jurisdictions have implemented decompression strategies to reduce crowding, such as reducing or eliminating bail and releasing persons to home confinement or community supervision. Testing might become an important strategy to include when it is more widely available and when facilities have developed plans for how the results can be used to inform operational strategies to reduce transmission risk.

The findings in this report are subject to at least six limitations, each of which could result in an underestimation of the number of COVID-19 cases in correctional facilities. First, only 69% of jurisdictions reported data; therefore, these results are not representative of the entire United States. Second, many facilities do not provide testing to staff members, making data completeness dependent on staff members self-reporting their diagnosis to their employer after being tested by their personal health care providers. Third, some jurisdictions received data only from state prisons and were missing data from local jails and federal or privately operated facilities. Fourth, data on the total number of facilities, the total number of incarcerated and detained persons, and the total number staff members were not available; thus, proportions of facilities and persons affected could not be determined. Fifth, one jurisdiction reported only collecting data on facility outbreaks (defined by the jurisdiction as >1 COVID-19 case per facility). Finally, data are not available to determine the extent to which variations in testing availability and testing practices across states influenced the number of COVID-19 cases reported among staff and incarcerated and detained persons.

Prompt identification of COVID-19 cases and consistent application of prevention measures are critical to protecting incarcerated and detained persons, correctional and detention facility staff members, and the communities to which they return (*3*). Additional data on COVID-19 in correctional and detention settings, particularly from facilities that have conducted broad-based testing, is needed to identify differences in disease risk based on demographic characteristics, underlying medical conditions, and type of correctional and detention setting, and to evaluate the effectiveness of mitigation measures. CDC recommends that facility administrators, with the support of local health departments and partners, prepare for potential SARS-CoV-2 transmission, implement prevention measures, and follow guidance for the management of suspected and confirmed COVID-19 cases to prevent further transmission, which is available at https://www.cdc.gov/coronavirus/2019-ncov/community/correction-detention/guidance-correctional-detention.html (*3*).

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TABLE. COVID-19 among incarcerated and detained persons and correctional and detention facility staff members — 32 U.S. state and territorial health department reporting jurisdictions,* January 21–April 21, 2020†

Characteristic	No. (%) of cases among reporting jurisdictions
Facilities reporting at least one confirmed COVID-19 case among incarcerated or detained persons or staff members	420
Facilities reporting COVID-19 cases only among staff members	221 (53)
COVID-19 cases among incarcerated or detained persons	4,893
COVID-19–associated hospitalizations among incarcerated or detained persons	491 (10)
COVID-19–associated deaths among incarcerated or detained persons	88 (2)
COVID-19 cases among facility staff members	2,778
COVID-19–associated hospitalizations among facility staff members	79 (3)
COVID-19–associated deaths among facility staff members	15 (1)

Abbreviation: COVID-19 = coronavirus disease 2019.
* Jurisdictions reporting at least one laboratory-confirmed COVID-19 case among incarcerated or detained persons or staff members.
† Data provided to CDC during April 22–28, 2020.

BOX. COVID-19 guidance for correctional and detention facilities

Prepare for COVID-19

- Update an emergency plan for COVID-19 response
- Coordinate with local public health department and other correctional and detention facilities
- Require that staff members and visitors stay home if ill, and consider suspending in-person visitation
- Ensure access to soap at no cost to encourage frequent handwashing
- Plan for how space will be used to medically isolate and care for ill persons and to quarantine close contacts
- Plan for potential staff member shortages
- Train staff members to safely use personal protective equipment
- Enhance facility cleaning and disinfection

Prevent introduction of COVID-19 into facilities from the community

- Limit nonmedical transfers into and out of the facility
- Screen all new entrants, staff members, and visitors for symptoms before they enter the facility
- Assign staff members to consistent locations to limit movement between facility areas
- Encourage daily use of cloth face coverings by incarcerated or detained persons and staff members
- Use multiple physical distancing strategies (e.g., sleep head to foot, stagger meals and showers, reduce the number of persons allowed in a common area at one time, suspend group gatherings*)
- Regularly communicate with staff members and incarcerated or detained persons about COVID-19 and how they can protect themselves and others

Manage COVID-19 in facilities

- Activate emergency plan and notify public health officials
- Medically isolate ill persons and quarantine close contacts
- Evaluate ill persons for underlying medical conditions that would increase their risk for severe illness from COVID-19,† and provide necessary care on-site or transfer to a health care facility
- Incorporate screening for COVID-19 symptoms into release planning§
- Continue activities from preparation and prevention phases

Abbreviation: COVID-19 = coronavirus disease 2019.
* Other suggestions available in full corrections guidance. https://www.cdc.gov/coronavirus/2019-ncov/community/correction-detention/guidance-correctional-detention.html.
† Asthma, chronic lung disease, diabetes, serious heart conditions, chronic kidney disease being treated with dialysis, severe obesity, age ≥65 years, immunocompromising conditions, and liver disease. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/groups-at-higher-risk.html.
§ Additional guidance on SARS-CoV-2 testing in correctional and detention facilities will be provided as testing becomes more widely available and strategies are developed to assist facilities in using test results to inform their operational efforts to reduce transmission risk.

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Effects of the COVID-19 Pandemic on Routine Pediatric Vaccine Ordering and Administration — United States, 2020

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On March 13, 2020, the president of the United States declared a national emergency in response to the coronavirus disease 2019 (COVID-19) pandemic (*1*). With reports of laboratory-confirmed cases in all 50 states by that time (*2*), disruptions were anticipated in the U.S. health care system's ability to continue providing routine preventive and other nonemergency care. In addition, many states and localities issued shelter-in-place or stay-at-home orders to reduce the spread of COVID-19, limiting movement outside the home to essential activities (*3*). On March 24, CDC posted guidance emphasizing the importance of routine well child care and immunization, particularly for children aged ≤24 months, when many childhood vaccines are recommended.*

Two data sources were examined to assess the impact of the pandemic on pediatric vaccination in the United States: Vaccines for Children Program (VFC) provider order data from CDC's Vaccine Tracking System and Vaccine Safety Datalink (VSD) vaccine administration data. Vaccination coverage is the traditional metric used to assess vaccine usage; however, provider orders and doses administered represent two immediately available proxy measures.

VFC is a national program that provides federally purchased vaccines to approximately 50% of U.S. children aged 0–18 years.† Cumulative doses of VFC-funded vaccines ordered by health care providers at weekly intervals during two periods (January 7, 2019–April 21, 2019 [period 1] and January 6, 2020–April 19, 2020 [period 2]) were tallied, and differences in cumulative weekly vaccine doses ordered between period 2 and period 1 were calculated for all noninfluenza vaccines§ that the Advisory Committee on Immunization Practices (ACIP) recommends for children and, as an example, for measles-containing-vaccines.¶ VSD is a collaborative project between CDC's Immunization Safety Office and eight U.S. health care organizations serving publicly and privately insured patients.** Aggregate counts of measles-containing vaccine doses administered each week at VSD sites during period 2 were compared between two pediatric age groups: children aged ≤24 months and those aged >24 months through 18 years.

Vaccine Tracking System data indicate a notable decrease in orders for VFC-funded, ACIP-recommended noninfluenza childhood vaccines and for measles-containing vaccines during period 2 compared with period 1 (Figure). The decline began the week after the national emergency declaration; similar declines in orders for other vaccines were also observed. VSD data show a corresponding decline in measles-containing vaccine administrations beginning the week of March 16, 2020. The decrease was less prominent among children aged ≤24 months than among older children (Figure). The subsequent increase in vaccine administrations observed in late March was more prominent in younger than older children.

The substantial reduction in VFC-funded pediatric vaccine ordering after the COVID-19 emergency declaration is consistent with changes in vaccine administration among children in the VSD population receiving care through eight large U.S. health care organizations. The smaller decline in measles-containing vaccine administration among children aged ≤24 months suggests that system-level strategies to prioritize well child care and immunization for this age group are being implemented. Increases in vaccine administration to children aged ≤24 months beginning in late March might reflect early success of strategies implemented by VSD health care organizations to promote childhood vaccinations in the context of the pandemic, including outreach to patients overdue for vaccinations and changing office workflows to minimize contact between patients (*4*). Assessment of state and local

* https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html.

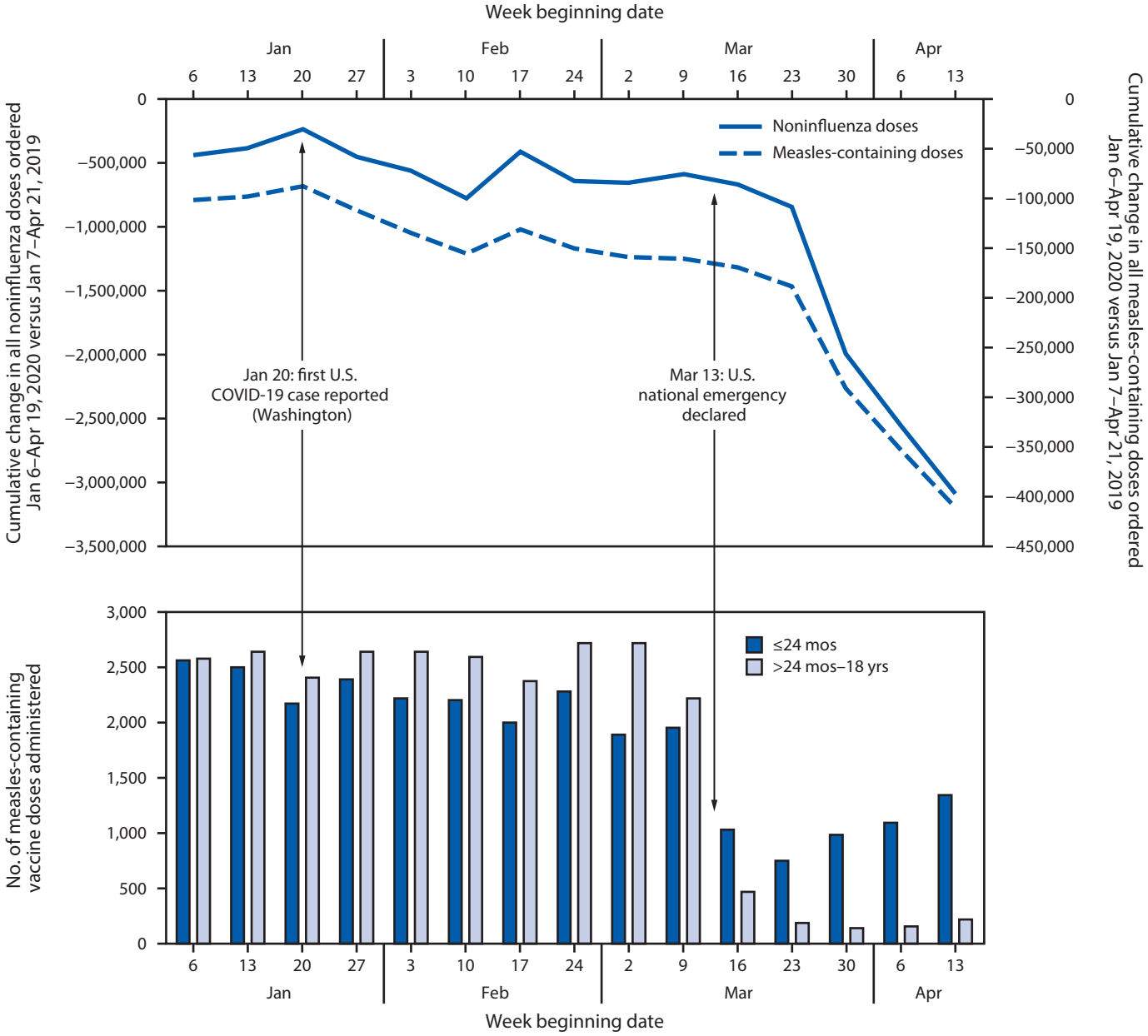
† Children aged ≤18 years are eligible if they are Medicaid-eligible, uninsured, American Indian/Alaska Native, or underinsured and vaccinated at federally qualified health centers, rural health clinics, or provider sites with an approved deputization agreement with the state public health department. https://www.cdc.gov/vaccines/programs/vfc/index.html.

§ https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html.

¶ In the United States, two measles-containing vaccines are licensed for routine use in children: measles-mumps-rubella (MMR) vaccine and a combination MMR and varicella vaccine (MMRV). The Advisory Committee on Immunization Practices recommends that U.S. children receive a 2-dose series of measles-containing vaccines at ages 12–15 months and 4–6 years.

** https://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/vsd/.

FIGURE. Weekly changes in Vaccines for Children Program (VFC) provider orders* and Vaccine Safety Datalink (VSD) doses administered† for routine pediatric vaccines — United States, January 6–April 19, 2020



* VFC data represent the difference in cumulative doses of VFC-funded noninfluenza and measles-containing vaccines ordered by health care providers at weekly intervals between Jan 7–Apr 21, 2019, and Jan 6–Apr 19, 2020.
† VSD data depict weekly measles-containing vaccine doses administered by age group (age ≤24 mos and >24 mos–18 yrs).

vaccination coverage is needed to quantify the impact among U.S. children of all ages and prioritize areas for intervention.

The ongoing COVID-19 pandemic is a reminder of the importance of vaccination. The identified declines in routine pediatric vaccine ordering and doses administered might indicate that U.S. children and their communities face increased risks for outbreaks of vaccine-preventable diseases. Parental concerns about potentially exposing their children to COVID-19 during well child visits might contribute to the declines observed (5). To the extent that this is the case, reminding parents of the vital need to protect their children against serious vaccine-preventable diseases, even as the COVID-19 pandemic continues, is critical. As social distancing requirements are relaxed, children who are not protected by vaccines will be more vulnerable to diseases such as measles. In response, continued coordinated efforts between health care providers

and public health officials at the local, state, and federal levels will be necessary to achieve rapid catch-up vaccination.

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Public Health Response to COVID-19 Cases in Correctional and Detention Facilities — Louisiana, March–April 2020

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Correctional and detention facilities face unique challenges in the control of infectious diseases, including coronavirus disease 2019 (COVID-19) (*1*–*3*). Among >10 million annual admissions to U.S. jails, approximately 55% of detainees are released back into their communities each week (*4*); in addition, staff members at correctional and detention facilities are members of their local communities. Thus, high rates of COVID-19 in correctional and detention facilities also have the potential to influence broader community transmission. In March 2020, the Louisiana Department of Health (LDH) began implementing surveillance for COVID-19 among correctional and detention facilities in Louisiana and identified cases and outbreaks in many facilities. In response, LDH and CDC developed and deployed the COVID-19 Management Assessment and Response (CMAR) tool to guide technical assistance focused on infection prevention and control policies and case management with correctional and detention facilities. This report describes COVID-19 prevalence in correctional and detention facilities detected through surveillance and findings of the CMAR assessment. During March 25–April 22, 489 laboratory-confirmed COVID-19 cases, including 37 (7.6%) hospitalizations and 10 (2.0%) deaths among incarcerated or detained persons, and 253 cases, including 19 (7.5%) hospitalizations and four (1.6%) deaths among staff members were reported. During April 8–22, CMAR telephone-based assessments were conducted with 13 of 31 (42%) facilities with laboratory-confirmed cases and 11 of 113 (10%) facilities without known cases. Administrators had awareness and overall understanding of CDC guidance for prevention of transmission in these facilities but reported challenges in implementation, related to limited space to quarantine close contacts of COVID-19 patients and inability of incarcerated and detained persons to engage in social distancing, particularly in dormitory-style housing. CMAR was a useful tool that helped state and federal public health officials assist multiple correctional and detention facilities to better manage COVID-19 patients and guide control activities to prevent or mitigate transmission.

On March 25, 2020, approximately 2 weeks after the first case of COVID-19 was reported in Louisiana, a case was reported in an incarcerated person. To assess COVID-19–associated morbidity in this population, LDH epidemiologists contacted and enrolled correctional and detention facilities in an active surveillance system, in which a daily email requested a tally of laboratory-confirmed and suspected cases among detained and incarcerated persons and staff members, as well as the daily facility census for incarcerated and detained persons. The total number of facility staff members was not requested. On April 4, 2020, after preliminary analysis of surveillance data, LDH contacted CDC to request onsite technical assistance to describe the scope of the outbreaks, determine the degree of awareness and implementation of CDC COVID-19 guidance, and train regional epidemiologists to provide technical assistance to facilities. A CDC team arrived at LDH on April 6, 2020.

Because multiple outbreaks were identified across the state, LDH and CDC developed a telephone-based assessment tool to facilitate technical assistance to facilities with COVID-19 cases. CDC and LDH modeled the CMAR tool on an infection prevention and control assessment tool for health care facilities previously created by CDC.* CMAR guided telephone conversations with facility health administrators through important components of the CDC interim guidance on COVID-19 management in correctional and detention facilities (*5*). Recommended measures in the CDC guidance include 1) suspension of transfers of incarcerated and detained persons and visitation; 2) access to hand hygiene supplies, including running water, for both incarcerated or detained persons and staff members; 3) symptom screening and 14-day quarantine of incarcerated or detained persons upon intake to the facility before joining the general facility population; 4) symptom screening for staff members at the beginning of each shift; 5) dedication of space for medical isolation and quarantine; 6) symptom screening and coordination with local public health officials before release of incarcerated or detained persons; 7) personal protective equipment (PPE) use by staff members and incarcerated or detained persons who have duties

* https://www.cdc.gov/hai/prevent/infection-control-assessment-tools.html.

that could involve exposure to an incarcerated or detained person with COVID-19; and 8) assignment of staff members to specific housing units. CMAR also provided prompts to facilitate discussion of challenges and lessons learned when implementing CDC guidance.

LDH epidemiologists invited health administrators and facility leadership from all facilities reporting cases among incarcerated or detained persons and a convenience sample of those that had not reported cases among incarcerated or detained persons to participate in technical assistance telephone calls using CMAR. To train LDH epidemiologists to perform technical assistance calls with facilities, a brief description of the recommended management strategy was provided after each question or section in CMAR. Responses to CMAR questions were transcribed during interviews. Facility characteristics, frequency of quantitative responses (e.g., ability to implement recommendations), and captured qualitative information are reported.

During March 25–April 22, 489 laboratory-confirmed COVID-19 cases among incarcerated or detained persons and an additional 253 cases among staff members were reported across 46 (32%) of 144 correctional and detention facilities in Louisiana through active surveillance. There were 37 (7.6%) hospitalizations and 10 (2.0%) deaths related to COVID-19 among incarcerated or detained persons and 19 (7.5%) hospitalizations and four (1.6%) deaths among staff members. Among the 46 facilities with confirmed COVID-19 cases, 17 (37%) reported cases in both incarcerated or detained persons and staff members, 15 (33%) reported cases only in staff members, and 14 (30%) reported cases only in incarcerated or detained persons. Facilities with cases were located in all nine Louisiana health regions and ranged in population size from 12 to >5,000 incarcerated or detained persons, housed juvenile and adult populations, and included 31 local jails, and 11 state, one federal, and three private facilities. Among the 31 facilities with cases in incarcerated or detained persons, the median period prevalence of confirmed COVID-19 cases among the facility population was 3% (range = <0.01%–50%; interquartile range = 1%–11%).

During April 8–22, 2020, CDC and LDH conducted 24 CMAR (Supplementary Material, https://stacks.cdc.gov/view/cdc/87561) telephone-based assessments with health administrators and facility leadership (i.e., the sheriff or warden) including at 13 of 31 (42%) facilities with laboratory-confirmed cases in incarcerated or detained persons and 11 of 113 (10%) facilities without known cases in incarcerated or detained persons. The populations housed in these facilities included men and women, adults and juveniles, and ranged in size from 14 to >1,500 incarcerated and detained persons. Dormitory-style housing was reported in 92% of facilities with cases and 64% of facilities without cases. Nine of 13 facilities reporting cases and six of 11 facilities without cases in incarcerated or detained persons also reported cases among staff members.

All 24 facilities reported implementing CDC recommendations for suspending visitation, providing appropriate hand hygiene supplies, and performing symptom screening of new intakes (Table). All but one facility reported performing symptom checks on staff members at shift change. Facility health administrators and leadership had awareness and overall understanding of the guidance but also reported challenges in implementation, primarily lack of space to individually quarantine close contacts of COVID-19 patients and the inability of incarcerated and detained persons to engage in social distancing, particularly in dormitory-style housing. Among 23 facilities that could implement medical isolation, most (eight of 12 facilities reporting cases and nine of 11 not reporting cases in incarcerated and detained persons) reported that they could medically isolate patients with suspected and confirmed COVID-19 individually, and the remaining facilities medically isolated confirmed COVID-19 patients in cohorts (i.e., in group housing situations instead of individual cells). Among 23 facilities that could implement quarantine, 10 of 12 facilities reporting cases, and six of 11 not reporting cases described limited capacity to individually quarantine asymptomatic close contacts of cases, and instead quarantined close contacts in cohorts.

Among 13 facilities reporting cases, 11 had suspended transfers to and from the facility; fewer (five of 11) facilities not reporting cases had suspended transfers. Among facilities continuing transfers, all reported decreasing their frequency. Symptom screening before release of incarcerated or detained persons was reported by six of 13 facilities reporting cases and two of 11 not reporting cases. The use of face masks or cloth face coverings for all incarcerated or detained persons was reported in nine of 13 facilities reporting cases, but in only three of 11 of those not reporting cases. Facilities often reported that staff members needed to work across multiple units, making it not feasible to assign staff members to a single housing unit; seven of 13 facilities reporting cases and three of 11 facilities not reporting cases had assigned staff members to specific units.

Facilities reported that disincentives to illness reporting by incarcerated or detained persons included an opposition to medical isolation, and that, in some instances, there was a cost attached to medical visits. Two facilities reported that daily symptom screening revealed persons with fever who were unaware of, or had not yet disclosed, their symptoms.

Some facilities implemented additional mitigation strategies, not currently described in CDC guidance, such as

TABLE. Characteristics of facilities participating in the COVID-19 Management Assessment and Response (CMAR) (N = 24), by presence of COVID-19 cases among incarcerated or detained persons — Louisiana, April 2020

Characteristic	No. (%)	
	Facilities that reported COVID-19 cases (n = 13)	Facilities that did not report COVID-19 cases (n = 11)
Population		
Male	13 (100)	10 (91)
Female	6 (46)	8 (73)
Juvenile	3 (23)	3 (27)
Facility description		
Management		
Local jail	8 (62)	10 (91)
State	3 (23)	0 (—)
Federal	1 (8)	0 (—)
Private	1 (8)	1 (9)
Reported cases in staff members	9 (69)	6 (55)
Dormitory-style housing	12 (92)	7 (64)
Interventions		
Suspension of visitation	13 (100)	11 (100)
Access to hand hygiene supplies	13 (100)	11 (100)
Symptom screening of new intakes	13 (100)	11 (100)
Quarantine of new intakes for 14 days	9 (69)	7 (64)
In individual cells	3 (23)	5 (45)
Symptom screening for staff members at entry	13 (100)	10 (91)
Medical isolation of cases		
In individual cells	8 (62)	9 (82)
Cohorting	4 (31)	2 (18)
No separate space available	1 (8)	0 (—)
Quarantine of close contacts		
In individual cells	2 (15)	5 (45)
Cohorting	10 (77)	6 (54)
No separate space available	1 (8)	0 (—)
Suspension of transfers	11 (85)	5 (45)
Symptom screening before release from facility	6 (46)	2 (18)
Universal masking of staff members and inmates	9 (69)	3 (27)
Staff members assigned to single units	7 (54)	3 (27)

Abbreviation: COVID-19 = coronavirus disease 2019.

decompression (i.e., early release and lowering bail to facilitate release), confirmation of a negative real-time reverse transcription–polymerase chain reaction (RT-PCR) test result before discontinuation of quarantine, and transport of COVID-19 patients to other facilities with more space for medical isolation. Facility staff members voiced concerns about asymptomatic transmission and potential for viral shedding after isolation, with implications for decisions regarding whom to test and when persons could be released from isolation or quarantine into general facility housing.

Two facilities reported that RT-PCR testing of asymptomatic close contacts of incarcerated and detained persons with COVID-19 for SARS-CoV-2, the virus that causes COVID-19, at the end of their initial 14-day quarantine period resulted in positive test results for six of 10 contacts in one facility and nine of 19 in the other facility. Two facilities reported patients with COVID-19 who continued to have positive test results for SARS-CoV-2 at what would have been the end of their symptom-based medical isolation periods, and facility staff members voiced concern that patients released from isolation based on absence of symptoms might be infectious. To address this, these facilities described moving persons with positive SARS-CoV-2 test results into group "step-down" units, in which persons who had COVID-19 are cohorted together for an additional 7 days upon completion of their initial symptom-based medical isolation period.[†]

Discussion

Interrupting SARS-CoV-2 transmission in confined, congregate settings creates unique prevention challenges (*6*–*8*). Louisiana has the second highest incarceration rate in the United States, with 144 correctional and detention facilities and an estimated daily correctional census of 45,400.[§] In Louisiana, staff members responding to interviews guided by the CMAR tool revealed awareness and overall understanding of CDC guidance. However, physical, logistical, and security constraints inherent to such settings make it difficult to fully implement the recommendations. The reported inability of some facilities to individually quarantine close contacts of incarcerated or detained persons with COVID-19 could result in spread among persons within the quarantine units.

CDC guidance currently recommends a 14-day quarantine for close contacts of a COVID-19 patient. If symptoms do not develop within those 14 days, movement restrictions can be lifted. However out of an abundance of caution, some facilities decided, in addition, to test quarantined persons before their release back into the general facility population. Some of these asymptomatic persons had positive SARS-CoV-2 test results at the end of quarantine, although it is not known if viable virus was present. Asymptomatic and presymptomatic persons have been shown to contribute to transmission in long-term care facilities (*9*). More research is needed to understand the role of asymptomatic and presymptomatic transmission in other

[†] Symptom-based release strategy refers to release from isolation occurring at least 3 days (72 hours) after recovery, defined as resolution of fever without the use of fever-reducing medications and improvement in respiratory symptoms (e.g., cough, shortness of breath), and at least 7 days since symptoms first appeared. On April 30, 2020, this period was extended to at least 10 days since symptoms first appeared. Test-based release strategy refers to release from isolation when there has been a resolution of fever without the use of fever-reducing medications and improvement in respiratory symptoms and negative test results of a Food and Drug Administration Emergency Use Authorized molecular assay for COVID-19 from at least two consecutive upper respiratory tract swab specimens collected ≥24 hours apart.

[§] https://www.bjs.gov/content/pub/pdf/cpus16.pdf.

congregate settings like correctional and detention facilities. If facilities choose to test asymptomatic persons in quarantine, or use the test-based approach (i.e., two negative test results at least 24 hours apart after resolution of symptoms) for release from isolation, additional medical isolation capacity might need to be secured. Facilities should be aware when using the test-based strategy for release from isolation that positive test results have been reported for longer than 14 days (up to 36 days) after symptom onset, although it is unknown if the persons with these test results are still infectious (*10*).

The findings in this report are subject to at least five limitations. First, the number of COVID-19 cases among staff members was not available for all facilities, so the total number of cases reported among staff members is likely an underestimate. Second, case finding is dependent on the facility's surveillance and testing practices, which might differ among facilities. Third, CMAR participation was voluntary and therefore might not be representative of all facilities in Louisiana. Fourth, the CMAR tool was being tested and revised throughout the investigation; thus, available information might differ slightly by facility. Finally, because CMAR is telephone based, the described interventions could not be directly evaluated by observation.

Correctional and detention facilities face unique challenges to the control of infectious diseases such as COVID-19 (*1*–*3*). Incarcerated and detained persons largely rely on the correctional or detention system for infection control and prevention within the facility. Correctional and detention facilities differ in size, population, facility layout, and operations, and no uniform approach will address the specific needs of all facilities. CMAR provides a systematic, accessible means to facilitate technical assistance by public health officials regarding CDC's interim guidance on management of COVID-19 in correctional and detention facilities and to build local capacity to serve the needs of such facilities within their jurisdictions (*5*). LDH staff members continue to conduct CMARs with facilities in the state. CMAR can be used by local, state, and federal public health agencies to assist correctional and detention facilities to better manage COVID-19 cases and guide control activities to prevent or mitigate SARS CoV-2 transmission. Preventing and mitigating transmission in these facilities not only protects the health of staff members and incarcerated and detained persons, it also protects the health of members of communities where these facilities are located.

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Summary

What is already known about this topic?

COVID-19 can spread rapidly in correctional and detention facilities, where options for social distancing, isolation, and quarantine are limited.

What is added by this report?

In Louisiana, 46 facilities have reported 489 COVID-19 cases among incarcerated or detained persons and 253 cases among staff members. A COVID-19 Management Assessment and Response (CMAR) tool used to assess 24 facilities identified awareness and understanding of guidance. However, limited capacity to individually quarantine exposed persons and inability to engage in social distancing likely contributed to illness spread.

What are the implications for public health practice?

Interrupting COVID-19 transmission in correctional and detention facilities is challenging. The CMAR tool could be used to assess COVID-19 management practices and guide strategies to address gaps.

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Identification and Monitoring of International Travelers During the Initial Phase of an Outbreak of COVID-19 — California, February 3–March 17, 2020

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The threat of introduction of coronavirus disease 2019 (COVID-19) into the United States with the potential for community transmission prompted U.S. federal officials in February 2020 to screen travelers from China, and later Iran, and collect and transmit their demographic and contact information to states for follow-up. During February 5–March 17, 2020, the California Department of Public Health (CDPH) received and transmitted contact information for 11,574 international travelers to 51 of 61 local health jurisdictions at a cost of 1,694 hours of CDPH personnel time. If resources permitted, local health jurisdictions contacted travelers, interviewed them, and oversaw 14 days of quarantine, self-monitoring, or both, based on CDC risk assessment criteria for COVID-19. Challenges encountered during follow-up included errors in the recording of contact information and variation in the availability of resources in local health jurisdictions to address the substantial workload. Among COVID-19 patients reported to CDPH, three matched persons previously reported as travelers to CDPH. Despite intensive effort, the traveler screening system did not effectively prevent introduction of COVID-19 into California. Effectiveness of COVID-19 screening and monitoring in travelers to California was limited by incomplete traveler information received by federal officials and transmitted to states, the number of travelers needing follow-up, and the potential for presymptomatic and asymptomatic transmission. More efficient methods of collecting and transmitting passenger data, including electronic provision of flight manifests by airlines to federal officials and flexible text-messaging tools, would help local health jurisdictions reach out to all at-risk travelers quickly, thereby facilitating timely testing, case identification, and contact investigations. State and local health departments should weigh the resources needed to implement incoming traveler monitoring against community mitigation activities, understanding that the priorities of each might shift during the COVID-19 pandemic.

On December 31, 2019, Chinese authorities reported detection of a novel coronavirus (SARS-CoV-2) among persons with pneumonia in Wuhan City, in Hubei Province; the disease was subsequently named COVID-19 (*1*). The threat of importation of SARS-CoV-2 from China into the United States prompted the executive order limiting travel from China on January 31, 2020, and implemented starting February 3, 2020. U.S. citizens and lawful permanent residents and their families who had been in China in the past 14 days were allowed to enter the United States. To facilitate screening of these persons upon arrival in the United States, the U.S. Department of Homeland Security directed all flights from China to 11 U.S. airports starting on February 3.* Customs and Border Protection agents interviewed travelers arriving from China regarding signs and symptoms compatible with COVID-19† and, working with the Department of Homeland Security and CDC, collected traveler demographic and contact information and provided travelers with instructions for self-monitoring. CDC oversaw secondary screening of symptomatic travelers. Customs and Border Protection transmitted demographic and contact information for all arriving travelers to CDC, regardless of symptom status at the time of arrival, which forwarded this information securely to state public health authorities for follow-up through CDC's Epi-X network.§ Initially, CDC transmitted traveler information to CDPH only for persons arriving on flights from China; however, on March 5, travelers who had been to Iran within the preceding 14 days were added to these notices following CDC's recommendation to avoid nonessential travel to Iran (*2*). State and local public health officials were requested, if resources permitted, to contact travelers, interview them to ascertain signs or symptoms of illness and additional risk exposures, and oversee 14 days of quarantine, self-monitoring, or both, based on CDC risk assessment criteria for COVID-19. This report summarizes CDPH's experience with the traveler monitoring program for COVID-19 among travelers from China and Iran who had traveler contact information sent to CDPH by CDC.

Beginning February 3, CDPH redirected public health medical officers, epidemiologists, and other personnel to the CDPH Return Traveler Monitoring team. From February 5, when CDPH first received CDC traveler notifications, through the decommission of CDPH's traveler monitoring program on March 17, CDPH processed 2,266 Epi-X notifications of arriving travelers, representing 12,061 individual travelers (Figure). CDPH processed a median of 39 notifications per

* Notice of arrival restrictions applicable to flights carrying persons who have recently traveled from or were otherwise present within the People's Republic of China. 19 C.F.R. Chap. 1; 49 C.F.R. Chap. 12 (2020). https://www.dhs.gov/sites/default/files/publications/20_0202_dhs-arrival-restriction-frn-2.pdf.
† Fever, cough, shortness of breath, or who appeared visibly ill.
§ https://emergency.cdc.gov/epix/index.asp.

Summary

What is already known about this topic?

To reduce introductions of COVID-19 into the United States, travelers from selected countries were screened upon entry, and their contact information forwarded to states for monitoring.

What is added by this report?

During February 3–March 17, 2020, California received, corrected, and transmitted information on 11,574 travelers to local health jurisdictions for follow-up. Three travelers were matched to three of the 26,182 patients with COVID-19 reported to California by April 15.

What are the implications for public health practice?

Monitoring travelers was labor-intensive and limited by incomplete information, volume of travelers, and potential for asymptomatic transmission. Health departments need to weigh the resources needed for monitoring against those needed for implementing mitigation activities during the COVID-19 pandemic.

day (range = 1–146), with a median of 23 individual records per notification (range = 1–250), equating to a median of 1,431 travelers per week.

Before sending to local health jurisdictions, CDPH staff members reviewed individual records to identify the destination jurisdiction for each traveler and any possible demographic and contact information errors. Among 1,523 (13%) records with one or more identifiable errors, 1,135 (75%) did not have a correct U.S.-based telephone number, 603 (40%) were duplicate records, and 487 (32%) had insufficient location data or the traveler resided outside of California. Additional suspected errors in reported names and dates of birth were noted, including likely name misspellings and out-of-range dates of birth; flight manifests or other independent records to verify traveler information were unavailable. Following resolution of identifiable and correctable errors, 11,574 (96%) records were assigned and sent to 51 of California's 61 local health jurisdictions. The number of travelers in each affected jurisdiction ranged from one to 4,852. Among the 11,574 California travelers processed by CDPH, three were matched by name and date of birth to three of 26,182 confirmed COVID-19 cases in California reported to CDPH through the California reportable disease system as of April 15. Two of these COVID-19 patients had traveled from Iran and were tested several days after arrival, and their cases were laboratory-confirmed. A third patient had traveled from China but was tested on March 30, approximately 6 weeks after returning to the United States and after the date local health jurisdictions would have ended follow-up.

During the 7-week period of the program, CDPH staff members devoted an estimated 1,694 total person-hours (equivalent to six employees working full-time for 7 weeks) processing traveler Epi-X notices and assigning travelers to local health jurisdictions; 576 (34%) of these person-hours occurred outside regular working hours. The additional personnel time incurred in the 51 affected California local health jurisdictions for follow-up was not available; the capacity for local health jurisdictions to conduct follow-up varied considerably according to resources and traveler volume.

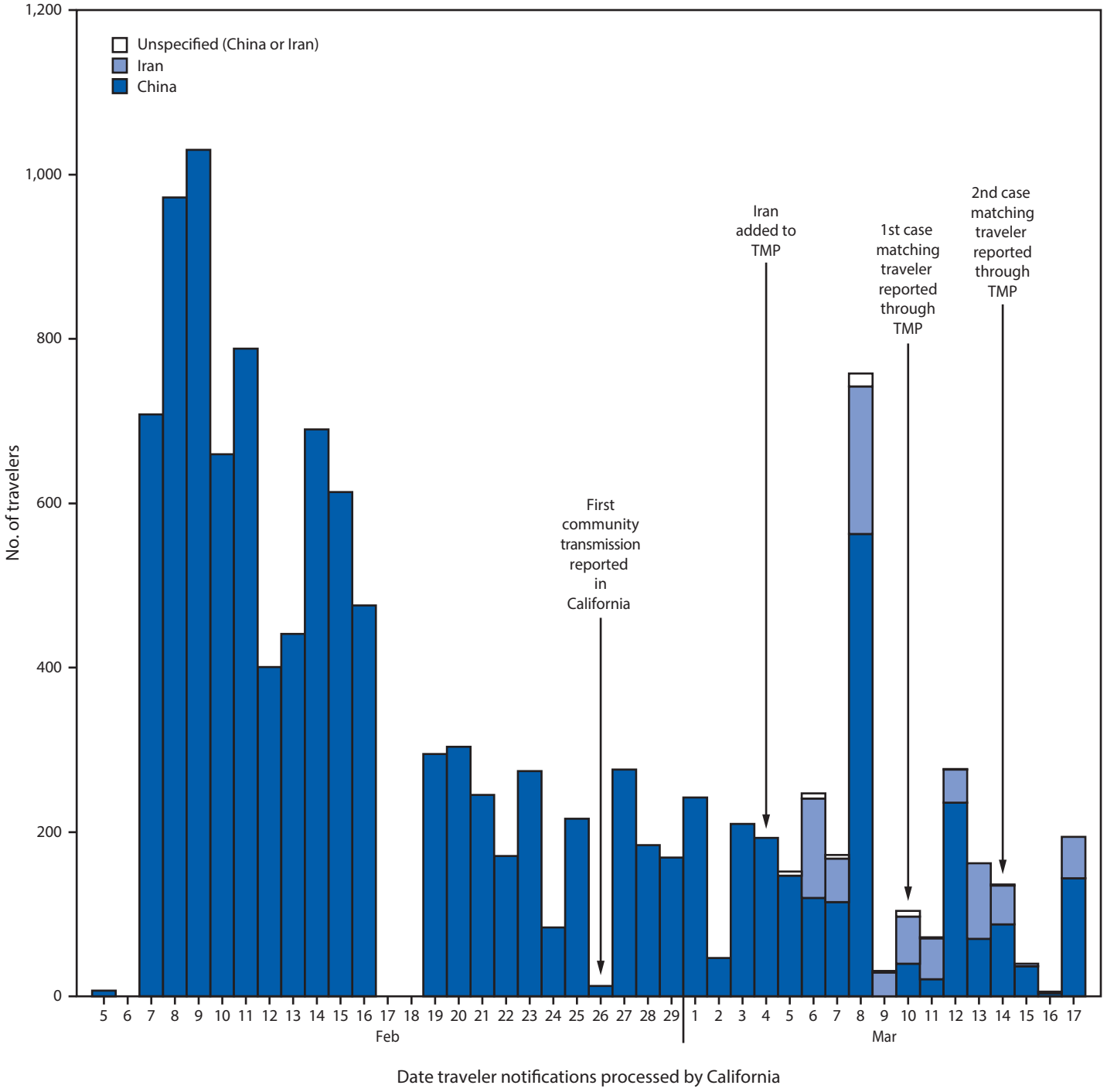
Discussion

Airport entry screening and quarantine and monitoring of travelers can be an effective tool for preventing and slowing importation of some diseases into the United States (*3*). To be effective, it requires accurate contact information for travelers. Substantial time was devoted to addressing incorrect traveler contact information at CDPH, and later at the local jurisdiction level, which compromised timely contact of travelers or completely precluded reaching some travelers. More efficient methods of collecting passenger data, including electronic provision of flight manifests by airlines to federal officials to transmit to states, would help local health jurisdictions quickly reach out to all travelers at risk, thereby facilitating timely testing, case identification, and contact investigations. Flexible electronic messaging platforms, such as text messaging, and additional personnel resources for local health jurisdictions with limited capacity for follow-up of travelers could have further increased the likelihood of case identification.

During previous international disease outbreaks, screening and quarantine or monitoring of travelers was most effective when infected travelers could be readily identified and when they arrived in numbers that could be tracked using available public health resources (*3*). For example, traveler monitoring in California for Ebola virus disease (Ebola) from Africa during 2014–2015 was effective because Ebola has obvious clinical manifestations, is contagious only after symptom onset, and a smaller number of travelers required monitoring. A median of 21 travelers per week from three Ebola-affected countries in Africa were monitored in California over 17 months (CDPH, unpublished data, 2015), compared with the median of 1,431 travelers monitored per week for COVID-19 over 7 weeks.

The benefits of screening for case detection at the airport might be limited for a respiratory disease with the potential for presymptomatic and asymptomatic transmission, such as COVID-19 (*4*). Monitoring travelers after they have cleared screening at the airport can be valuable for certain diseases such as Ebola, but it is labor-intensive for public health officials. Effectiveness of traveler monitoring can vary by pandemic phase (*5*) and is likely more effective during the

FIGURE. Arriving international travelers monitored for COVID-19 (N = 12,061), by country of travel origin and cases identified* — California, February 5–March 17, 2020



Abbreviations: CDPH = California Department of Public Health; COVID-19 = coronavirus disease 2019; TMP = traveler monitoring program.

* The first and second cases identified occurred in travelers arriving from Iran and were laboratory-confirmed; these travelers were reported by CDC to CDPH and matched by traveler's date of birth and name to two confirmed COVID-19 cases reported to CDPH through the California reportable disease system as of April 15, 2020.

initial containment phase, when the focus is on reducing the number of new introductions and delaying the onset of community transmission.

The findings in this report are subject to at least three limitations. First, arriving travelers who were infected but asymptomatic, whether screened upon arrival or monitored after arrival by their destination's local health jurisdiction, would not have been tested and reported as a case to CDPH. Similarly, infected travelers who became symptomatic after screening would have needed to seek care and be tested to be reported as a case to CDPH. Second, errors in names and dates of birth collected from travelers limited CDPH's ability to match travelers to reported COVID-19 cases in California, potentially underestimating the number of travelers that could be matched to a case. Third, as community transmission of COVID-19 became more widespread across California, determining whether travel versus community transmission resulted in infection became less certain. Concurrently, fewer data were collected on individual cases as case numbers increased, making assessment of traveler monitoring effectiveness more difficult. These limitations might have contributed to the similar national findings of 14 confirmed COVID-19 cases identified among the approximately 268,000 travelers screened as of April 21, 2020 (*6*).

Despite intensive effort, the traveler screening system did not effectively prevent introduction of COVID-19 into California. Incomplete traveler information received by federal officials and transmitted to states, the number of travelers requiring follow-up, and the potential for presymptomatic and asymptomatic transmission likely contributed to onset of community transmission and the need to shift to mitigation measures. In California, the first confirmed case of COVID-19 without known exposure to a traveler or a patient with COVID-19 was reported to CDPH on February 26, 2020. Once community transmission was documented in several California counties, local health jurisdictions needed to weigh the effectiveness and costs of continued traveler monitoring for imported disease against implementation of mitigation measures to slow local disease transmission and allow health care systems to prepare for increased caseloads. Multiple California counties declared shelter-in-place orders on March 16; CDPH discontinued the traveler monitoring program on March 17. In later phases of the pandemic, as community transmission decreases following successful mitigation measures, containment strategies such as reconfigured and focused traveler monitoring, with accurate traveler demographic and contact information and increased staffing capacity in public health agencies, might be useful to maintain low disease incidence if there are subsequent disease waves.

Acknowledgments

California's 51 local health jurisdictions that conducted follow-up on arriving travelers.

Traveler Monitoring Team

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Preliminary Estimate of Excess Mortality During the COVID-19 Outbreak — New York City, March 11–May 2, 2020

New York City Department of Health and Mental Hygiene (DOHMH) COVID-19 Response Team

On May 11, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), was first identified in December 2019 in Wuhan, China, and has since spread worldwide. On March 11, 2020, the World Health Organization declared COVID-19 a pandemic (*1*). That same day, the first confirmed COVID-19–associated fatality occurred in New York City (NYC). To identify confirmed COVID-19–associated deaths, defined as those occurring in persons with laboratory-confirmed SARS-CoV-2 infection, on March 13, 2020, the New York City Department of Health and Mental Hygiene (DOHMH) initiated a daily match between all deaths reported to the DOHMH electronic vital registry system (eVital) (*2*) and laboratory-confirmed cases of COVID-19. Deaths for which COVID-19, SARS-CoV-2, or an equivalent term is listed on the death certificate as an immediate, underlying, or contributing cause of death, but that do not have laboratory-confirmation of COVID-19 are classified as probable COVID-19–associated deaths. As of May 2, a total of 13,831 laboratory-confirmed COVID-19–associated deaths, and 5,048 probable COVID-19–associated deaths were recorded in NYC (*3*). Counting only confirmed or probable COVID-19–associated deaths, however, likely underestimates the number of deaths attributable to the pandemic. The counting of confirmed and probable COVID-19–associated deaths might not include deaths among persons with SARS-CoV-2 infection who did not access diagnostic testing, tested falsely negative, or became infected after testing negative, died outside of a health care setting, or for whom COVID-19 was not suspected by a health care provider as a cause of death. The counting of confirmed and probable COVID-19–associated deaths also does not include deaths that are not directly associated with SARS-CoV-2 infection. The objective of this report is to provide an estimate of all-cause excess deaths that have occurred in NYC in the setting of widespread community transmission of SARS-CoV-2. Excess deaths refer to the number of deaths above expected seasonal baseline levels, regardless of the reported cause of death. Estimation of all-cause excess deaths is used as a nonspecific measure of the severity or impact of pandemics (*4*) and public health emergencies (*5*). Reporting of excess deaths might provide a more accurate measure of the impact of the pandemic.

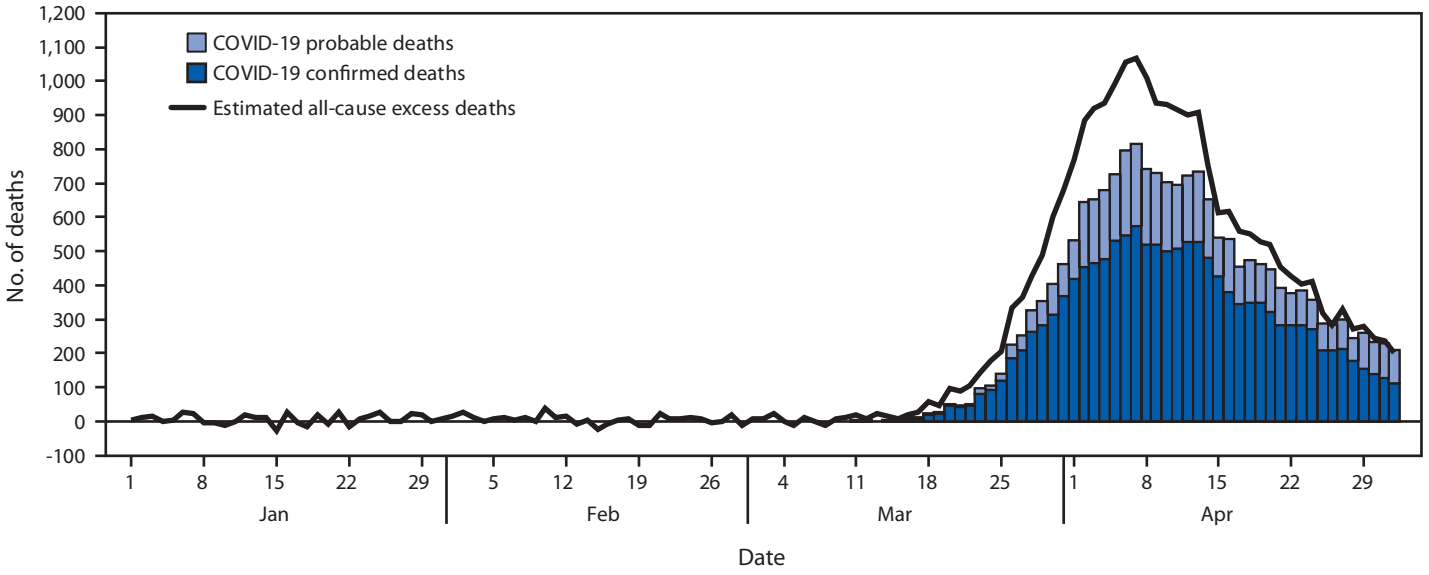
DOHMH has developed an electronic vital statistics reporting system that provides a near complete count of all deaths that occur in NYC (*6*). Rapid reporting of the event of death using this electronic system allows timely surveillance of all deaths in NYC (i.e., all-cause mortality) pending complete recording of demographic and *International Classification of Diseases, Tenth Revision* (ICD-10) coding of cause of death information. To estimate excess deaths in NYC during the COVID-19 pandemic, a seasonal periodic regression model, as is routinely conducted for monitoring the impact of seasonal influenza (*7*), was used. Excess deaths were determined for the period March 11–May 2, 2020, using mortality data from the period January 1, 2015–May 2, 2020 and calculated as the difference between the seasonally expected baseline number and the reported number of all-cause deaths (*7*,*8*). A limitation of this approach is that it does not account for uncertainty in the reporting lag or completeness of these provisional data.

During March 11–May 2, 2020, a total of 32,107 deaths were reported to DOHMH; of these deaths, 24,172 (95% confidence interval = 22,980–25,364) were found to be in excess of the seasonal expected baseline. Included in the 24,172 deaths were 13,831 (57%) laboratory-confirmed COVID-19–associated deaths and 5,048 (21%) probable COVID-19–associated deaths, leaving 5,293 (22%) excess deaths that were not identified as either laboratory-confirmed or probable COVID-19–associated deaths (Figure).

The 5,293 excess deaths not identified as confirmed or probable COVID-19–associated deaths might have been directly or indirectly attributable to the pandemic. The percentages of these excess deaths that occurred in persons infected with SARS-CoV-2 or resulted from indirect impacts of the pandemic are unknown and require further investigation.

COVID-19–associated mortality is higher in persons with underlying chronic health conditions such as heart disease and diabetes (*9*), and deaths in persons with these chronic health conditions might not be recognized as being directly attributable to COVID-19. In addition, social distancing practices, the demand on hospitals and health care providers, and public fear related to COVID-19 might lead to delays in seeking or obtaining lifesaving care. Thus, monitoring of all-cause deaths and estimating excess mortality during the pandemic provides a more sensitive measure of the total number of deaths than

FIGURE. Number of laboratory-confirmed* and probable† COVID-19–associated deaths and total estimated excess deaths§ — New York City, March 11–May 2, 2020



* Death in a person with a positive laboratory test for SARS-CoV-2 RNA.
† Death in a person without a positive test for SARS-CoV-2 RNA but for whom COVID-19, SARS-CoV-2, or a related term was listed as an immediate, underlying, or contributing cause of death on the death certificate.
§ Total excess all-cause deaths were calculated as observed deaths minus expected deaths as determined by a seasonal regression model using mortality data from the period January 1, 2015–May 2, 2020.

would be recorded by counting laboratory-confirmed or probable COVID-19–associated deaths.

This approach can account for factors temporally, but not causally, associated with SARS-CoV-2 that might affect death rates, including other pathogens circulating during the overlapping 2019–20 influenza season. All-cause mortality surveillance based on electronic reporting of the event of death provides a faster and more inclusive measure of the pandemic's impact on mortality than does relying only on national COVID-19 reporting mechanisms (*10*).

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High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington, March 2020

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On March 17, 2020, a member of a Skagit County, Washington, choir informed Skagit County Public Health (SCPH) that several members of the 122-member choir had become ill. Three persons, two from Skagit County and one from another area, had test results positive for SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). Another 25 persons had compatible symptoms. SCPH obtained the choir's member list and began an investigation on March 18. Among 61 persons who attended a March 10 choir practice at which one person was known to be symptomatic, 53 cases were identified, including 33 confirmed and 20 probable cases (secondary attack rates of 53.3% among confirmed cases and 86.7% among all cases). Three of the 53 persons who became ill were hospitalized (5.7%), and two died (3.7%). The 2.5-hour singing practice provided several opportunities for droplet and fomite transmission, including members sitting close to one another, sharing snacks, and stacking chairs at the end of the practice. The act of singing, itself, might have contributed to transmission through emission of aerosols, which is affected by loudness of vocalization (*1*). Certain persons, known as superemitters, who release more aerosol particles during speech than do their peers, might have contributed to this and previously reported COVID-19 superspreading events (*2*–*5*). These data demonstrate the high transmissibility of SARS-CoV-2 and the possibility of superemitters contributing to broad transmission in certain unique activities and circumstances. It is recommended that persons avoid face-to-face contact with others, not gather in groups, avoid crowded places, maintain physical distancing of at least 6 feet to reduce transmission, and wear cloth face coverings in public settings where other social distancing measures are difficult to maintain.

Investigation and Findings

The choir, which included 122 members, met for a 2.5-hour practice every Tuesday evening through March 10. On March 15, the choir director e-mailed the group members to inform them that on March 11 or 12 at least six members had developed fever and that two members had been tested for SARS-CoV-2 and were awaiting results. On March 16, test results for three members were positive for SARS-CoV-2 and were reported to two respective local health jurisdictions, without indication of a common source of exposure. On March 17, the choir director sent a second e-mail stating that 24 members reported that they had developed influenza-like symptoms since March 11, and at least one had received test results positive for SARS-CoV-2. The email emphasized the importance of social distancing and awareness of symptoms suggestive of COVID-19. These two emails led many members to self-isolate or quarantine before a delegated member of the choir notified SCPH on March 17.

All 122 members were interviewed by telephone either during initial investigation of the cluster (March 18–20; 115 members) or a follow-up interview (April 7–10; 117); most persons participated in both interviews. Interviews focused on attendance at practices on March 3 and March 10, as well as attendance at any other events with members during March, other potential exposures, and symptoms of COVID-19. SCPH used Council of State and Territorial Epidemiologists case definitions to classify confirmed and probable cases of COVID-19 (*6*). Persons who did not have symptoms at the initial interview were instructed to quarantine for 14 days from the last practice they had attended. The odds of becoming ill after attending each practice were computed to ascertain the likelihood of a point-source exposure event.

No choir member reported having had symptoms at the March 3 practice. One person at the March 10 practice had cold-like symptoms beginning March 7. This person, who had also attended the March 3 practice, had a positive laboratory result for SARS-CoV-2 by reverse transcription–polymerase chain reaction (RT-PCR) testing.

In total, 78 members attended the March 3 practice, and 61 attended the March 10 practice (Table 1). Overall, 51 (65.4%) of the March 3 practice attendees became ill; all but one of these persons also attended the March 10 practice. Among 60 attendees at the March 10 practice (excluding the patient who became ill March 7, who also attended), 52 (86.7%) choir members subsequently became ill. Some members exclusively attended one practice; among 21 members who only attended March 3, one became ill and was not tested (4.8%), and among three members who only attended March 10, two became ill (66.7%), with one COVID-19 case being laboratory-confirmed.

Summary

What is already known about this topic?

Superspreading events involving SARS-CoV-2, the virus that causes COVID-19, have been reported.

What is added by this report?

Following a 2.5-hour choir practice attended by 61 persons, including a symptomatic index patient, 32 confirmed and 20 probable secondary COVID-19 cases occurred (attack rate = 53.3% to 86.7%); three patients were hospitalized, and two died. Transmission was likely facilitated by close proximity (within 6 feet) during practice and augmented by the act of singing.

What are the implications for public health practice?

The potential for superspreader events underscores the importance of physical distancing, including avoiding gathering in large groups, to control spread of COVID-19. Enhancing community awareness can encourage symptomatic persons and contacts of ill persons to isolate or self-quarantine to prevent ongoing transmission.

Because illness onset for 49 (92.5%) patients began during March 11–15 (Figure), a point-source exposure event seemed likely. The median interval from the March 3 practice to symptom onset was 10 days (range = 4–19 days), and from the March 10 practice to symptom onset was 3 days (range = 1–12 days). The odds of becoming ill after the March 3 practice were 17.0 times higher for practice attendees than for those who did not attend (95% confidence interval [CI] = 5.5–52.8), and after the March 10 practice, the odds were 125.7 times greater (95% CI = 31.7–498.9). The clustering of symptom onsets, odds of becoming ill according to practice attendance, and known presence of a symptomatic contagious case at the March 10 practice strongly suggest that date as the more likely point-source exposure event. Therefore, that practice was the focus of the rest of the investigation. Probable cases were defined as persons who attended the March 10 practice and developed clinically compatible COVID-19 symptoms, as defined by Council of State and Territorial Epidemiologists (*6*). The choir member who was ill beginning March 7 was considered the index patient.

The March 10 choir rehearsal lasted from 6:30 to 9:00 p.m. Several members arrived early to set up chairs in a large multipurpose room. Chairs were arranged in six rows of 20 chairs each, spaced 6–10 inches apart with a center aisle dividing left and right stages. Most choir members sat in their usual rehearsal seats. Sixty-one of the 122 members attended that evening, leaving some members sitting next to empty seats. Attendees practiced together for 40 minutes, then split into two smaller groups for an additional 50-minute practice, with one of the groups moving to a smaller room. At that time, members in the larger room moved to seats next to one another, and members in the smaller room sat next to one another on benches. Attendees then had a 15-minute break, during which cookies and oranges were available at the back of the large room, although many members reported not eating the snacks. The group then reconvened for a final 45-minute session in their original seats. At the end of practice, each member returned their own chair, and in the process congregated around the chair racks. Most attendees left the practice immediately after it concluded. No one reported physical contact between attendees. SCPH assembled a seating chart of the all-choir portion of the March 10 practice (not reported here because of concerns about patient privacy).

Among the 61 choir members who attended the March 10 practice, the median age was 69 years (range = 31–83 years); 84% were women. Median age of those who became ill was 69 years, and 85% of cases occurred in women. Excluding the laboratory-confirmed index patient, 52 (86.7%) of 60 attendees became ill; 32 (61.5%) of these cases were confirmed by RT-PCR testing and 20 (38.5%) persons were considered to have probable infections. These figures correspond to secondary attack rates of 53.3% and 86.7% among confirmed and all cases, respectively. Attendees developed symptoms 1 to 12 days after the practice (median = 3 days). The first SARS-CoV-2 test was performed on March 13. The last person was tested on March 26.

Three of the 53 patients were hospitalized (5.7%), including two who died (3.8%). The mean interval from illness onset to hospitalization was 12 days. The intervals from onset to death were 14 and 15 days for the two patients who died.

SCPH collected information about patient signs and symptoms from patient interviews and hospital records (Table 2). Among persons with confirmed infections, the most common signs and symptoms reported at illness onset and at any time during the course of illness were cough (54.5% and 90.9%, respectively), fever (45.5%, 75.8%), myalgia (27.3%, 75.0%), and headache (21.2%, 60.6%). Several patients later developed gastrointestinal symptoms, including diarrhea (18.8%), nausea (9.4%), and abdominal cramps or pain (6.3%). One person experienced only loss of smell and taste. The most severe complications reported were viral pneumonia (18.2%) and severe hypoxemic respiratory failure (9.1%).

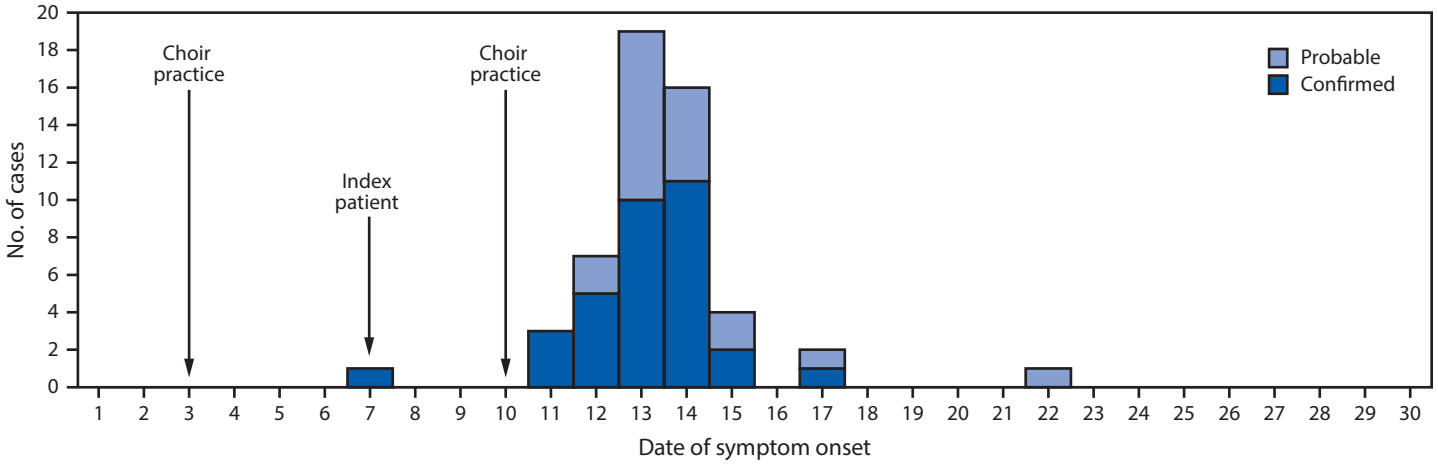
Among the recognized risk factors for severe illness, the most common was age, with 75.5% of patients aged ≥65 years. Most patients (67.9%) did not report any underlying medical conditions, 9.4% had one underlying medical condition, and 22.6% had two or more underlying medical conditions. All three hospitalized patients had two or more underlying medical conditions.

TABLE 1. Number of choir members with and without COVID-19–compatible symptoms (N = 122)* and members' choir practice attendance† — Skagit County, Washington, March 3 and 10, 2020

	No. (row %)					
	March 3 practice			March 10 practice		
Attendance	Total	Symptomatic	Asymptomatic	Total	Symptomatic	Asymptomatic
Attended	78	51 (65.4)	27 (34.6)	61	53§ (86.9)	8 (13.1)
Did not attend	40	4 (10.0)	36 (90.0)	61	3 (4.9)	58 (95.1)
Attendance information missing	4	1 (25.0)	3 (75.0)	0	0 (—)	0 (—)
Attended only one practice	21	1 (4.8)	20 (95.2)	3	2 (66.7)	1 (33.3)

Abbreviation: COVID-19 = coronavirus disease 2019.
* No choir members were symptomatic at the March 3 practice.
† Thirty-seven choir members attended neither practice; two developed symptoms, and 35 remained asymptomatic.
§ Includes index patient; if the index patient excluded, 52 secondary cases occurred among the other 60 attendees (attack rate = 86.7%).

FIGURE. Confirmed* and probable† cases of COVID-19 associated with two choir practices, by date of symptom onset (N = 53) — Skagit County, Washington, March 2020



Abbreviation: COVID-19 = coronavirus disease 2019.
* Positive reverse transcription–polymerase chain reaction test result.
† Attendance at the March 10 practice and clinically compatible symptoms as defined by the Council of State and Territorial Epidemiologists, Interim-20-ID-01: Standardized surveillance case definition and national notification for 2019 novel coronavirus disease (COVID-19). https://cdn.ymaws.com/www.cste.org/resource/resmgr/2020ps/interim-20-id-01_covid-19.pdf.

Public Health Response

SCPH provided March 10 practice attendees with isolation and quarantine instructions by telephone, email, and postal mail. Contacts of patients were traced and notified of isolation and quarantine guidelines. At initial contact, 15 attendees were quarantined, five of whom developed symptoms during quarantine and notified SCPH.

Before detection of this cluster on March 17, Skagit County had reported seven confirmed COVID-19 cases (5.4 cases per 100,000 population). At the time, SCPH informed residents that likely more community transmission had occurred than indicated by the low case counts.* On March 21, SCPH issued a press release to describe the outbreak and raise awareness about community transmission.† The press release emphasized the highly contagious nature of COVID-19 and the importance of following social distancing guidelines to control the spread of the virus.

Discussion

Multiple reports have documented events involving superspreading of COVID-19 (*2*–*5*); however, few have documented a community-based point-source exposure (*5*). This cluster of 52 secondary cases of COVID-19 presents a unique opportunity for understanding SARS-CoV-2 transmission following a likely point-source exposure event. Persons infected with SARS-CoV-2 are most infectious from 2 days before through 7 days after symptom onset (*7*). The index patient developed symptoms on March 7, which could have placed the patient within this infectious period during the March 10 practice. Choir members who developed symptoms on March 11 (three) and March 12 (seven) attended both the March 3

* Skagit County, updated social distancing information. https://skagitcounty.net/departments/home/press/031620.htm.
† Skagit County, public health investigating cluster of related COVID-19 cases. https://skagitcounty.net/departments/home/press/032120.htm.

TABLE 2. Signs and symptoms reported at the onset of COVID-19 illness and during the course of illness among persons infected at a choir practice (N = 53)* — Skagit County, Washington, March 2020

Sign or symptom	No. (%)		no./No. (%)	
	Reported at onset of illness		Reported during course of illness	
	All cases (N = 53)	Confirmed cases (N = 33)	All cases (N = 53)	Confirmed cases (N = 33)
Cough	27 (50.9)	18 (54.5)	47/53 (88.7)	30/33 (90.9)
Fever	28 (52.8)	15 (45.5)	36/53 (67.9)	25/33 (75.8)
Myalgia	13 (24.5)	9 (27.3)	34/52 (65.4)	24/32 (75.0)
Headache	10 (18.9)	7 (21.2)	32/53 (60.4)	20/33 (60.6)
Chills or rigors	7 (13.2)	6 (18.2)	23/51 (45.1)	16/31 (51.6)
Congestion	4 (7.5)	2 (6.1)	25/52 (48.1)	15/32 (46.9)
Pharyngitis	2 (3.8)	2 (6.1)	12/52 (23.1)	8/32 (25.0)
Lethargy	4 (7.5)	2 (6.1)	5/52 (9.6)	3/32 (9.4)
Fatigue	3 (5.7)	1 (3.0)	24/52 (46.2)	15/32 (46.9)
Aguesia (loss of taste)	1 (1.9)	1 (3.0)	11/48 (22.9)	5/28 (17.9)
Anosmia (loss of smell)	1 (1.9)	1 (3.0)	10/48 (20.8)	5/28 (17.9)
Chest congestion or tightness	1 (1.9)	1 (3.0)	5/52 (9.6)	4/32 (12.5)
Weakness	1 (1.9)	1 (3.0)	3/52 (5.8)	2/32 (6.3)
Eye ache	1 (1.9)	1 (3.0)	1/52 (1.9)	1/32 (3.1)
Dyspnea	0 (—)	0 (—)	8/51 (15.7)	8/31 (25.8)
Diarrhea	0 (—)	0 (—)	8/52 (15.4)	6/32 (18.8)
Pneumonia	0 (—)	0 (—)	6/53 (11.3)	6/33 (18.2)
Nausea	0 (—)	0 (—)	3/52 (5.8)	3/32 (9.4)
Acute hypoxemic respiratory failure	0 (—)	0 (—)	3/53 (5.7)	3/33 (9.1)
Abdominal pain or cramps	0 (—)	0 (—)	2/52 (3.8)	2/32 (6.3)
Malaise	1 (1.9)	0 (—)	1/52 (1.9)	0/32 (—)
Anorexia	0 (—)	0 (—)	1/52 (1.9)	0/32 (—)
Vomiting	0 (—)	0 (—)	0/52 (—)	0/32 (—)

Abbreviation: COVID-19 = coronavirus disease 19.
* Including the index patient.

and March 10 practices and thus could have been infected earlier and might have been infectious in the 2 days preceding symptom onset (i.e., as early as March 9). The attack rate in this group (53.3% and 86.7% among confirmed cases and all cases, respectively) was higher than that seen in other clusters, and the March 10 practice could be considered a superspreading event (*3*,*4*). The median incubation period of COVID-19 is estimated to be 5.1 days (*8*). The median interval from exposure during the March 10 practice to onset of illness was 3 days, indicating a more rapid onset.

Choir practice attendees had multiple opportunities for droplet transmission from close contact or fomite transmission (*9*), and the act of singing itself might have contributed to SARS-CoV-2 transmission. Aerosol emission during speech has been correlated with loudness of vocalization, and certain persons, who release an order of magnitude more particles than their peers, have been referred to as superemitters and have been hypothesized to contribute to superspeading events (*1*). Members had an intense and prolonged exposure, singing while sitting 6–10 inches from one another, possibly emitting aerosols.

The findings in this report are subject to at least two limitations. First, the seating chart was not reported because of concerns about patient privacy. However, with attack rates of 53.3% and 86.7% among confirmed and all cases, respectively, and one hour of the practice occurring outside of the seating arrangement, the seating chart does not add substantive additional information. Second, the 19 choir members classified as having probable cases did not seek testing to confirm their illness. One person classified as having probable COVID-19 did seek testing 10 days after symptom onset and received a negative test result. It is possible that persons designated as having probable cases had another illness.

This outbreak of COVID-19 with a high secondary attack rate indicates that SARS-CoV-2 might be highly transmissible in certain settings, including group singing events. This underscores the importance of physical distancing, including maintaining at least 6 feet between persons, avoiding group gatherings and crowded places, and wearing cloth face coverings in public settings where other social distancing measures are difficult to maintain during this pandemic. The choir mitigated further spread by quickly communicating to its members and notifying SCPH of a cluster of cases on March 18. When first contacted by SCPH during March 18–20, nearly all persons who attended the practice reported they were already self-isolating or quarantining. Current CDC recommendations, including maintaining physical distancing of at least 6 feet and wearing cloth face coverings if this is not feasible, washing hands often, covering coughs and sneezes, staying home when ill, and frequently cleaning and disinfecting

high-touch surfaces, remain critical to reducing transmission. Additional information is available at https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html.

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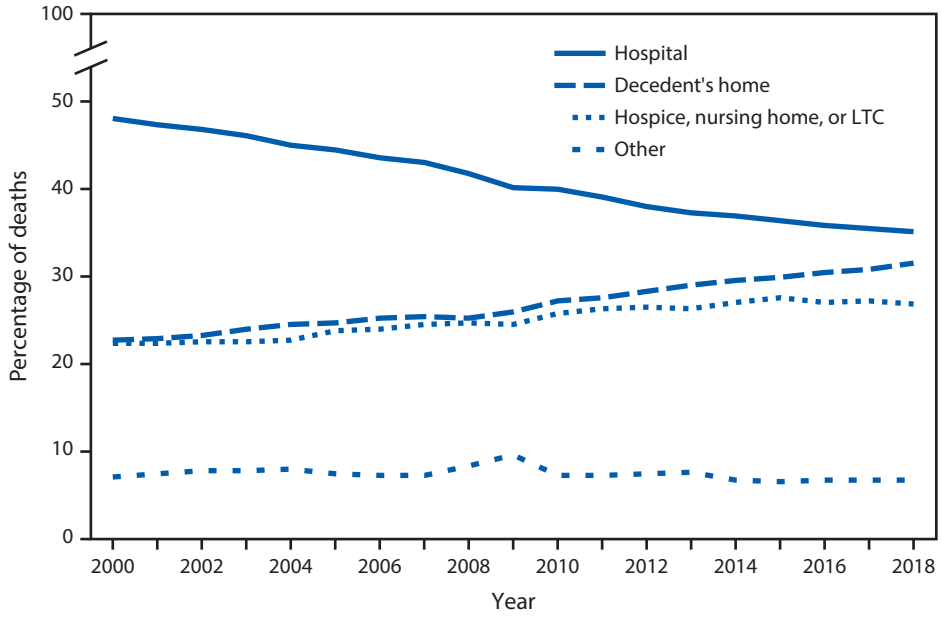
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Deaths,* by Place of Death† — National Vital Statistics System, United States, 2000–2018



Abbreviation: LTC = long-term care.
* Percentage was calculated as the number of deaths occurring in a location divided by all deaths with known location, multiplied by 100.
† Excludes deaths in which decedent was dead on arrival at a hospital, clinic, or medical center and those for which place of death was unknown.

The percentage of deaths from all causes that occurred in a hospital decreased from 48.0% in 2000 to 35.1% in 2018. During that period, the percentage of deaths that occurred in the decedent's home increased from 22.7% to 31.4%, and the percentage that occurred in a long-term care facility (hospice, nursing home, long-term care) increased from 22.9% to 26.8%.

Source: National Vital Statistics System. Underlying cause of death data, 2000–2018. https://wonder.cdc.gov/ucd-icd10.html.

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