Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

Weekly / Vol. 71 / No. 17 April 29, 2022

Hypertensive Disorders in Pregnancy and Mortality at Delivery Hospitalization — United States, 2017–2019

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Hypertensive disorders in pregnancy (HDPs), defined as prepregnancy (chronic) or pregnancy-associated hypertension, are common pregnancy complications in the United States.* HDPs are strongly associated with severe maternal complications, such as heart attack and stroke (*1*), and are a leading cause of pregnancy-related death in the United States.† CDC analyzed nationally representative data from the National Inpatient Sample to calculate the annual prevalence of HDP among delivery hospitalizations and by maternal characteristics, and the percentage of in-hospital deaths with an HDP diagnosis code documented. During 2017–2019, the prevalence of HDP among delivery hospitalizations increased from 13.3% to 15.9%. The prevalence of pregnancy-associated hypertension increased from 10.8% in 2017 to 13.0% in 2019, while the prevalence of chronic hypertension increased from 2.0% to 2.3%. Prevalence of HDP was highest among delivery hospitalizations of non-Hispanic Black or African American (Black) women, non-Hispanic American Indian and Alaska Native (AI/AN) women, and women aged ≥35 years, residing in zip codes in the lowest median household income quartile, or delivering in hospitals in the South or the Midwest Census regions. Among deaths that occurred during delivery hospitalization, 31.6% had any HDP documented. Clinical guidance for reducing complications from HDP focuses on prompt identification and preventing progression to severe maternal complications through timely treatment (*1*). Recommendations for identifying and monitoring pregnant persons with hypertension include measuring blood pressure throughout pregnancy,§ including self-monitoring. Severe complications and mortality from HDP are preventable with equitable implementation of strategies to identify and monitor persons with HDP (*1*) and quality improvement initiatives to improve prompt treatment and increase awareness of urgent maternal warning signs (*2*).

* https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-complications-data.htm

† https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Freproductivehealth%2Fmaternalinfanthealth%2Fpregnancy-mortality-surveillance-system.htm#causes

§ The U.S. Preventive Services Task Force recommends screening for preeclampsia in pregnant women with blood pressure measurements throughout pregnancy. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/preeclampsia-screening

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Delivery hospitalization data for 2017–2019 were analyzed from the National Inpatient Sample, a nationally representative sample of all U.S. hospital discharges.¶ CDC identified delivery hospitalizations among females aged 12–55 years using *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) diagnosis and procedure codes pertaining to delivery and diagnosis-related group delivery codes.** HDPs were categorized using ICD-10-CM diagnosis codes†† for chronic hypertension,§§ pregnancy-associated hypertension,¶¶ and unspecified maternal hypertension. Deaths were identified based on patient hospital discharge disposition.

Weighted annual prevalence (percentage) and 95% CI for HDP overall and by each type were calculated. Change in annual prevalence of HDP overall and by type was assessed using a linear trend test. Pooling data from this period, CDC calculated the weighted prevalence and 95% CIs for HDP by selected maternal characteristics (i.e., age group, race and ethnicity, and primary payer at delivery hospitalization) and characteristics of the community in which they lived (i.e., county-level rural-urban classification, zip code–level median

¶ https://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp

** Delivery hospitalizations were identified using ICD-10-CM diagnosis codes (Z370, Z371, Z372, Z373, Z374, Z3750, Z3751, Z3752, Z3753, Z3754, Z3759, Z3760, Z3761, Z3762, Z3763, Z3764, Z3769, Z377, Z379, O7582, O80, and O82), procedure codes (10D00Z0, 10D00Z1, 10D00Z2, 10D07Z3, 10D07Z4, 10D07Z5, 10D07Z6, 10D07Z7, 10D07Z8, and 10E0XZZ) and diagnosis-related group codes (765, 766, 767, 768, 774, and 775 through September 2018 and 768, 783, 784, 785, 786, 787, 788, 796, 797, 798, 805, 806, and 807 beginning in October 2018). Ectopic and molar pregnancies and pregnancies with abortive outcomes were excluded. CDC excluded an additional 382 delivery hospitalizations that were missing discharge disposition of the patient.

†† Hypertensive disorders in pregnancy were identified using ICD-10-CM diagnosis codes for chronic hypertension (O100, O101, O102, O103, O109, O104, I10, I11, I12, I13, and I15), pregnancy-associated hypertension (chronic hypertension with superimposed preeclampsia [O11], preeclampsia [O14], eclampsia [O15], gestational hypertension [O13]), and unspecified maternal hypertension (O16).

§§ Chronic hypertension is defined as hypertension diagnosed or present before pregnancy or before 20 weeks of gestation. https://www.acog.org/clinical/clinical-guidance/practice-bulletin/articles/2019/01/chronic-hypertension-in-pregnancy

¶¶ Pregnancy-associated hypertension includes gestational hypertension, preeclampsia, eclampsia, and chronic hypertension with superimposed preeclampsia. Gestational hypertension is defined as hypertension occurring after 20 weeks of gestation in persons with previously normal blood pressure. Preeclampsia is defined as gestational hypertension with new-onset proteinuria. In the absence of proteinuria, preeclampsia might be diagnosed in cases of gestational hypertension with new onset thrombocytopenia, renal insufficiency, impaired liver function, pulmonary edema, visual symptoms, or headache unresponsive to medication and not accounted for by alternative diagnoses. Eclampsia is defined as new-onset tonic-clonic, focal, or multifocal seizures in the absence of other causative conditions. Chronic hypertension with superimposed preeclampsia is defined as preeclampsia in women with a history of hypertension before pregnancy or before 20 weeks of gestation. https://www.acog.org/clinical/clinical-guidance/practice-bulletin/articles/2020/06/gestational-hypertension-and-preeclampsia

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2022;71:[inclusive page numbers].

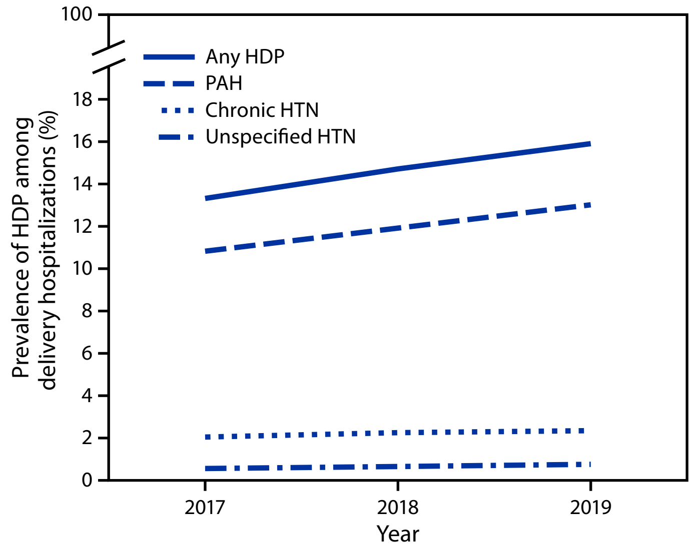
household income, and hospital region).*** Rao-Scott chi-square tests of independence were used to assess whether HDP prevalence differed by characteristics. Percentage of deaths during delivery hospitalization with a documented HDP diagnosis code were calculated. All analyses were conducted using SAS software (version 9.4; SAS Institute); SAS survey procedures and weighting were used to account for complex sampling in the National Inpatient Sample. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.†††

During 2017–2019, the prevalence of HDP among delivery hospitalizations increased from 13.3% to 15.9% (Figure 1), an increase of approximately 1 percentage point annually. Linear trend tests suggested that change in annual prevalence of HDP overall, pregnancy-associated hypertension, and chronic hypertension increased during 2017–2019, while prevalence of unspecified maternal hypertension remained stable. The prevalence of pregnancy-associated hypertension increased from 10.8% to 13.0% and that of chronic hypertension increased from 2.0% to 2.3%.

During 2017–2019 combined, prevalence of HDP overall was 14.6%. Prevalence varied overall and by HDP type for all maternal characteristics evaluated in the study (Table). Prevalence of any HDP was higher among delivery hospitalizations to women aged 35–44 (18.0%) and 45–55 years (31.0%) than to younger women, to Black (20.9%) and AI/AN (16.4%) women than to women of other racial and ethnic groups, to those residing in rural counties (15.5%) and in zip codes in the lowest median household-level income quartile (16.4%) than those residing in metropolitan or micropolitan counties or in zip codes in higher household-level income quartiles, or delivering in hospitals in the South (15.9%) or Midwest (15.0%) U.S. Census regions than in other Census regions. These differences in HDP prevalence were similar across HDP types.

Among maternal deaths that occurred during delivery hospitalization, 31.6% had any HDP documented and 24.3% had

FIGURE 1. Prevalence of hypertensive disorders in pregnancy* among delivery hospitalizations, by year — National Inpatient Sample, United States, 2017–2019



Abbreviations: HDP = hypertensive disorder in pregnancy; HTN = hypertension; PAH = pregnancy-associated hypertension.

* HDPs are defined as chronic hypertension, pregnancy-associated hypertension (i.e., gestational hypertension, preeclampsia, eclampsia, and chronic hypertension with superimposed preeclampsia), and unspecified maternal hypertension.

pregnancy-associated hypertension documented. Chronic or unspecified maternal hypertension was documented in 7.4% of deaths §§§ (Figure 2).

Discussion

During 2017–2019, HDPs affected approximately one in seven delivery hospitalizations; prevalence increases were largely driven by increases in pregnancy-associated hypertension. HDPs were documented in approximately one in five delivery hospitalizations among Black women and one in three among women aged 45–55 years. An HDP diagnosis code was documented in approximately one in three deaths occurring during delivery hospitalization. Timely diagnosis and treatment of HDP are critical to preventing severe complications and mortality (*1*).

Prevalence of risk factors for HDP, such as advanced maternal age, obesity, and diabetes mellitus, have increased in the United States (*1*), and might explain the increase in HDP prevalence. Women with a history of pregnancy-associated hypertension are at increased risk for cardiovascular disease compared with women with normotensive pregnancies.¶¶¶ Addressing risk

*** Patient age in years at hospital admission was calculated from the patient birth date and admission date. The Healthcare Cost and Utilization Project (HCUP) classifies race and ethnicity based on separate race and ethnicity data elements. In HCUP's combined race and ethnicity data element, ethnicity takes precedence over race (i.e., patients with Hispanic ethnicity are classified as Hispanic, and non-Hispanic patients are classified according to their reported race). The HCUP race and ethnicity category Native American is expressed as American Indian and Alaska Native in this report. Payer indicates the expected primary payer and was categorized as private, public (Medicare or Medicaid), or other (self-pay, no charge, or other). Rurality is based on the urban-rural classification of the patient's county, according to the CDC National Center for Health Statistics urban-rural classification for health care research. Rurality was categorized as metropolitan, micropolitan, and rural (nonmetropolitan and nonmicropolitan). HCUP obtains hospital Census region, as defined by the U.S. Census Bureau, from the American Hospital Association's Annual Survey of Hospitals.

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

§§§ Proportions for chronic and unspecified maternal hypertension are combined to conform to the Agency for Healthcare Research and Quality's Data Use Agreement which prohibits reporting estimates based on fewer than 11 unweighted observations.

¶¶¶ https://www.acog.org/clinical/clinical-guidance/practice-bulletin/articles/2019/05/pregnancy-and-heart-disease factors for HDP across the lifespan is important for preventing HDP and improving future health.****

There are substantial racial and ethnic disparities in HDP prevalence. Compared with non-Hispanic White women, non-Hispanic Black women have higher odds of entering pregnancy with chronic hypertension and developing severe preeclampsia (*3*). Factors that contribute to racial and ethnic inequities in chronic and pregnancy-induced hypertension include higher prevalences of HDP risk factors (*4*), as well as differences in access to health care and the quality of health care delivered (*5*). Racial bias within the U.S. health care system can affect HDP care from screening and diagnosis to treatment (*6*). Furthermore, psychosocial stress from experiencing racism is associated with chronic hypertension (*7*). In a study of racial and ethnic disparities in pregnancy-related deaths, those caused by HDP among Black and AI/AN women were found to be substantially higher than those among White women (*8*), highlighting the importance of addressing HDP to reduce inequities in pregnancy-related mortality.

Regional and rural-urban differences in HDP prevalence have been previously reported (*9*). Place-based disparities in HDP prevalence might be due to differences in prevalence of HDP risk factors, including diet, tobacco use, physical activity patterns, poverty, or access to care.†††† Rural counties are at higher risk for pregnancy-related mortality than metropolitan counties (*10*). A strategy to address place-based disparities in HDP and pregnancy-related mortality can include strengthening regional networks of health care facilities providing risk-appropriate maternal care through telemedicine and transferring delivery care of persons with high-risk conditions to facilities that can provide specialty services.§§§§

Clinical guidance for reducing complications from HDP focuses on prompt identification and preventing progression to severe maternal complications. Recommendations for identifying and monitoring pregnant persons with hypertension include measuring blood pressure throughout pregnancy, including self-monitoring.¶¶¶¶ Recommendations for preventing preeclampsia include low-dose aspirin for persons at risk and exercise programs.***** Once a diagnosis of an HDP is received, management strategies include blood pressure–lowering medication,††††† prevention of eclamptic seizures (e.g., administration of magnesium sulfate), and close maternal and fetal monitoring and coordination and continuity of care during the postpartum period.§§§§§

At the systems level, perinatal quality collaboratives (PQCs)¶¶¶¶¶ implement evidence-based quality improvement initiatives in health care facilities, including those to address severe hypertension.****** PQCs use collaborative learning, training, toolkits, and maternal safety bundles (e.g., Alliance for Innovation on Maternal Health Patient Safety Bundles††††††) to improve the quality of care and outcomes statewide. Maternal mortality review committees (MMRCs) provide recommendations for preventing future pregnancy-related deaths, including those attributable to HDP, and often collaborate with PQCs to translate MMRC recommendations into clinical and health systems interventions. Health communication campaigns increase awareness of urgent warning signs of HDP that indicate need for immediate care.§§§§§§ Strategies to address health inequities in HDP include addressing implicit, institutional, and structural racism, disparate access to clinical care, social determinants of health, and engagement of community partners (*2*).

The findings in this report are subject to at least four limitations. First, identification of delivery hospitalizations and HDP is dependent upon accurate ICD-10-CM coding. Less severe cases of HDP might not be coded. In this study, approximately 4% of HDP was documented as unspecified maternal hypertension, which precludes accurate documentation of HDP type. Second, deaths identified using

**** https://www.thecommunityguide.org/content/tffrs-pregnancy-health-exercise-programs-prevent-gestational-hypertension

†††† https://www.hhs.gov/sites/default/files/call-to-action-maternal-health.pdf

§§§§ https://www.acog.org/clinical/clinical-guidance/obstetric-care-consensus/articles/2019/08/levels-of-maternal-care

¶¶¶¶ The American College of Obstetrics and Gynecology identifies self-monitored blood pressure as a strategy for ongoing monitoring of women with chronic hypertension (https://www.acog.org/clinical/clinical-guidance/practice-bulletin/articles/2019/01/chronic-hypertension-in-pregnancy). CDC's Million Hearts also promotes self-monitored blood pressure plus clinical support to help persons with hypertension lower their blood pressure. https://millionhearts.hhs.gov/about-million-hearts/optimizing-care/smbp.html?CDC_AA_refVal=https%3A%2F%2Fmillionhearts.hhs.gov%2Ftools-protocols%2Fsmbp.htm

***** https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/low-dose-aspirin-use-for-the-prevention-of-morbidity-and-mortality-from-preeclampsia-preventive-medication; https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2021/12/low-dose-aspirin-use-for-the-prevention-of-preeclampsia-and-related-morbidity-and-mortality

††††† https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2022/04/clinical-guidance-for-the-integration-of-the-findings-of-the-chronic-hypertension-and-pregnancy-chap-study

§§§§§ https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2018/05/optimizing-postpartum-care

¶¶¶¶¶ https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pqc.htm; https://www.nichq.org/project/national-network-perinatal-quality-collaboratives

****** https://ldh.la.gov/assets/oph/Center-PHCH/Center-PH/maternal/LaPQC/RMMI_Final_Report_LongForm_5-25-2021.pdf; https://gallery.mailchimp.com/244750cf0d942e5d1b1ca3201/files/d82a9758-6b1b-406b-b0bf-7d6cc972783f/ILPQC_HTN_Factsheet_10.17.18.pdf; https://www.michigan.gov/mdhhs/0,5885,7-339--460279--,00.html

†††††† https://safehealthcareforeverywoman.org/council/patient-safety-bundles/maternal-safety-bundles/severe-hypertension-in-pregnancy-aim/

§§§§§§ CDC's Hear Her campaign seeks to raise awareness about potentially life-threatening warning signs during and after pregnancy and improve communications between patients and their providers. https://www.cdc.gov/hearher/about-the-campaign/index.html

TABLE. Prevalence of hypertensive disorders in pregnancy by patient-, hospital- and zip code–level characteristics — National Inpatient Sample, United States, 2017–2019

	Any hypertensive disorder in pregnancy*		Chronic hypertension		Pregnancy-associated hypertension		Unspecified maternal hypertension	
Characteristic	**No.†**	**Row % (95% CI)**	**No.**	**Row % (95% CI)**	**No.**	**Row % (95% CI)**	**No.**	**Row % (95% CI)**
Total no. of cases	**319,913**	—	**47,218**	—	**259,458**	—	**13,237**	—
Maternal age group, yrs								
12–24	73,421	13.9 (13.7–14.1)	5,593	1.1 (1.0–1.1)	65,378	12.4 (12.2–12.5)	2,450	0.5 (0.4–0.5)
25–29	85,358	13.5 (13.3–13.7)	10,984	1.7 (1.7–1.8)	71,010	11.2 (11.1–11.4)	3,364	0.5 (0.5–0.6)
30–34	89,242	14.3 (14.1–14.4)	14,982	2.4 (2.3–2.4)	70,287	11.2 (11.1–11.4)	3,973	0.6 (0.6–0.7)
35–44	70,395	18.0 (17.7–18.2)	15,341	3.9 (3.8–4.0)	51,672	13.2 (13.0–13.4)	3,382	0.9 (0.8–0.9)
45–55	1,497	31.0 (29.7–32.4)	318	6.6 (5.9–7.3)	1,111	23.0 (21.8–24.2)	68	1.4 (1.1–1.7)
Race and ethnicity§								
Asian or Pacific Islander	12,183	9.3 (8.8–9.7)	1,616	1.2 (1.1–1.3)	10,134	7.7 (7.3–8.1)	433	0.3 (0.3–0.4)
Black	66,316	20.9 (20.5–21.2)	13,639	4.3 (4.2–4.4)	49,568	15.6 (15.3–15.9)	3,109	1.0 (0.9–1.0)
Hispanic	54,702	12.5 (12.2–12.8)	6,561	1.5 (1.5–1.5)	46,148	10.6 (10.3–10.8)	1,993	0.5 (0.4–0.5)
American Indian and Alaska Native	2,525	16.4 (15.4–17.5)	318	2.1 (1.8–2.3)	2,103	13.7 (12.7–14.6)	104	0.7 (0.5–0.8)
Another race	11,659	12.0 (11.6–12.3)	1,400	1.4 (1.4–1.5)	9,781	10.1 (9.7–10.4)	478	0.5 (0.4–0.5)
White	162,122	14.7 (14.5–14.9)	22,358	2.0 (2.0–2.1)	133,052	12.1 (11.9–12.2)	6,712	0.6 (0.6–0.6)
Missing	10,406	12.7 (12.2–13.1)	1,326	1.6 (1.5–1.7)	8,672	10.6 (10.2–11.0)	408	0.5 (0.4–0.6)
Payer								
Public¶	139,227	14.8 (14.6–15.0)	21,541	2.3 (2.2–2.3)	111,543	11.8 (11.7–12.0)	6,143	0.7 (0.6–0.7)
Private insurance	166,455	14.8 (14.7–15.0)	23,826	2.1 (2.1–2.2)	136,153	12.1 (12.0–12.3)	6,476	0.6 (0.6–0.6)
Self-pay/Other	13,837	11.9 (11.6–12.2)	1,791	1.5 (1.5–1.6)	11,443	9.8 (9.5–10.1)	603	0.5 (0.5–0.6)
Rurality (county-level)								
Metropolitan	275,342	14.6 (14.4–14.8)	40,136	2.1 (2.1–2.2)	224,232	11.9 (11.7–12.0)	10,974	0.6 (0.6–0.6)
Micropolitan	25,844	14.8 (14.5–15.0)	4,026	2.3 (2.2–2.4)	20,497	11.7 (11.5–11.9)	1,321	0.8 (0.7–0.8)
Rural**	18,139	15.5 (15.1–15.8)	2,980	2.5 (2.4–2.7)	14,241	12.1 (11.9–12.4)	918	0.8 (0.7–0.8)
Median household-level income national quartile for patient zip code††								
Q1	98,661	16.4 (16.1–16.6)	16,218	2.7 (2.6–2.8)	78,022	12.9 (12.7–13.2)	4,421	0.7 (0.7–0.8)
Q2	81,089	14.7 (14.5–14.9)	11,916	2.2 (2.1–2.2)	65,747	11.9 (11.8–12.1)	3,426	0.6 (0.6–0.6)
Q3	77,387	14.4 (14.3–14.6)	10,829	2.0 (2.0–2.1)	63,629	11.9 (11.7–12.0)	2,929	0.5 (0.5–0.6)
Q4	60,014	12.7 (12.5–12.9)	7,830	1.7 (1.6–1.7)	49,857	10.5 (10.3–10.7)	2,327	0.5 (0.5–0.5)
Hospital region§§								
Northeast	48,527	13.9 (13.5–14.4)	6,746	1.9 (1.8–2.0)	40,017	11.5 (11.1–11.9)	1,764	0.5 (0.5–0.5)
Midwest	69,181	15.0 (14.7–15.3)	9,736	2.1 (2.0–2.2)	56,611	12.3 (12.0–12.5)	2,834	0.6 (0.6–0.6)
South	136,435	15.9 (15.7–16.2)	22,355	2.6 (2.5–2.7)	107,940	12.6 (12.4–12.8)	6,140	0.7 (0.7–0.7)
West	65,770	12.7 (12.4–13.0)	8,381	1.6 (1.6–1.7)	54,890	10.6 (10.4–10.9)	2,499	0.5 (0.5–0.5)

Abbreviation: Q = quartile.
* Any hypertensive disorder in pregnancy includes chronic hypertension, pregnancy-associated hypertension, and unspecified maternal hypertension.
† Numbers are unweighted.
§ Patients with Hispanic ethnicity are classified as Hispanic and all non-Hispanic patients are classified according to their reported race. The Healthcare Cost and Utilization Project race and ethnicity category Native American is expressed as American Indian and Alaska Native.
¶ Public insurance includes Medicare and Medicaid.
** Rural defined as nonmetropolitan and nonmicropolitan counties.
†† 2017 (Q1 = $1–$43,999, Q2 = $44,000–$55,999, Q3 = $56,000–73,999, Q4 = ≥$74,000); 2018 (Q1 = $1–$45,999, Q2 = $46,000–$58,999, Q3 = $59,000–$78,999, Q4 = ≥$79,000); 2019: Q1 = $1–$47,999, Q2 = $48,000–$60,999, Q3 = $61,000–$81,999, Q4 = ≥$82,000.
§§ Hospital region is the census region as defined by the U.S. Census Bureau.

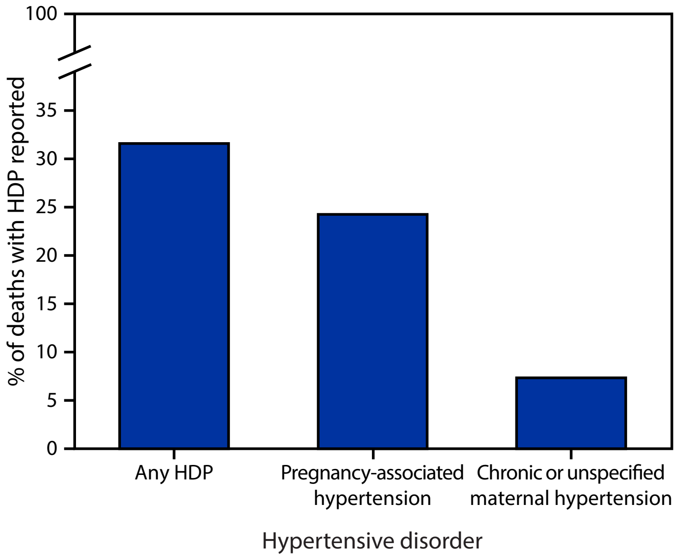
discharge disposition might underestimate deaths during delivery hospitalization.¶¶¶¶¶¶ These data do not represent the universe of pregnancy-related deaths, such as those that occur preceding or after delivery hospitalizations.******* This study did not assign cause of death but instead examined the proportion of in-hospital deaths occurring during delivery hospitalization with an HDP diagnosis code documented. Third, CDC was unable to identify persons who delivered more than once during the study period; the unit of analysis is delivery hospitalization. Finally, small sample sizes did not permit the disaggregation of deaths attributable to less frequent types of HDP and other maternal characteristics.

The prevalence of HDP increased during the 3-year study period with noted racial and ethnic, sociodemographic, and

¶¶¶¶¶¶ During 2008–2017, 23.9% of pregnancy-related deaths occurred during pregnancy, 15.5% on the day of delivery, and 60.6% on days 1–365 postpartum. https://www.cdc.gov/reproductivehealth/maternal-mortality/erase-mm/mmr-data-brief.html

******* Pregnancy-related deaths are deaths of a mother during pregnancy or within 1 year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.

FIGURE 2. Proportion of deaths* occurring during delivery hospitalization with a documented diagnosis code of a hypertensive disorder in pregnancy† — National Inpatient Sample, United States, 2017–2019



Abbreviation: HDP = hypertensive disorder in pregnancy.

* This study did not assign cause of death but instead examined the proportion of in-hospital deaths with an HDP diagnosis code documented among delivery hospitalizations.

† HDPs are defined as chronic hypertension, pregnancy-associated hypertension (i.e., gestational hypertension, preeclampsia, eclampsia, and chronic hypertension with superimposed preeclampsia), and unspecified maternal hypertension. Proportions for chronic and unspecified maternal hypertension are combined to conform to the Agency for Healthcare Research and Quality's data use agreement, which prohibits reporting estimates based on fewer than 11 unweighted observations.

place-based disparities. Severe HDP-associated maternal complications and mortality are preventable with equitable implementation of public health and clinical strategies. These include efforts across the life course for preventing HDP, identifying, monitoring, and appropriately treating those with HDP with continuous and coordinated care, increasing awareness of urgent maternal warning signs, and implementing quality improvement initiatives to address severe hypertension.

Acknowledgments

Lyn Kieltyka, Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; Bureau of Family Health, Louisiana Office of Public Health.

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Summary

What is already known about this topic?

Hypertensive disorders in pregnancy (HDPs) are common pregnancy complications and leading causes of pregnancy-related death in the United States.

What is added by this report?

During 2017–2019, HDP prevalence among delivery hospitalizations increased from 13.3% to 15.9%. The highest prevalence was among women aged 35–44 (18.0%) and 45–55 years (31.0%), and those who were Black women (20.9%) or American Indian and Alaska Native women (16.4%). Among deaths occurring during delivery hospitalization, 31.6% had a diagnosis code for HDP documented.

What are the implications for public health practice?

Severe HDP–associated complications and mortality are preventable with equitable implementation of quality improvement initiatives to recognize and promptly treat HDP and to increase awareness of urgent maternal warning signs.

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

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Public Health Actions to Control Measles Among Afghan Evacuees During Operation Allies Welcome — United States, September–November 2021

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On August 29, 2021, the United States government oversaw the emergent establishment of Operation Allies Welcome (OAW), led by the U.S. Department of Homeland Security (DHS) and implemented by the U.S. Department of Defense (DoD) and U.S. Department of State (DoS), to safely resettle U.S. citizens and Afghan nationals from Afghanistan to the United States. Evacuees were temporarily housed at several overseas locations in Europe and Asia* before being transported via military and charter flights through two U.S. international airports, and onward to eight U.S. military bases,† with hotel A used for isolation and quarantine of persons with or exposed to certain infectious diseases.§ On August 30, CDC issued an Epi-X notice encouraging public health officials to maintain vigilance for measles among Afghan evacuees because of an ongoing measles outbreak in Afghanistan (25,988 clinical cases reported nationwide during January–November 2021) (*1*) and low routine measles vaccination coverage (66% and 43% for the first and second doses, respectively, in 2020) (*2*).

On September 4, CDC was notified of a suspected measles case in an Afghan evacuee at Fort McCoy, Wisconsin. In partnership with state and local health departments, CDC provided technical guidance to DHS, DoD, and DoS to increase measles surveillance, conduct case investigations and contact tracing, and implement a mass measles vaccination campaign at overseas and domestic military bases and hotel A. Among 72,299 evacuees, 47 (0.065%) confirmed measles cases were reported from August 29 (the beginning of OAW) through November 26.¶ Vaccination efforts across domestic and overseas locations that achieved an estimated 96% coverage with measles, mumps, and rubella (MMR) vaccine in this evacuee population were critical in limiting measles importations into the United States and preventing subsequent spread at military bases and into U.S. communities.

Investigation and Results

Measles was first diagnosed in an evacuee aged 17 years who began experiencing prodromal symptoms on September 1 in Germany while awaiting transport to the United States (disclosed on later interview). The patient traveled on military flights from Ramstein Air Base, Germany to Washington Dulles International Airport (IAD) on September 3, and from IAD to Fort McCoy, Wisconsin on September 4. A few hours after completing the intake process, the patient sought care at the on-site acute care clinic with a fever of 107.6°F (42°C) and a maculopapular rash (Box). The patient was transferred to a local emergency department where specimens were collected for measles testing, which was performed by the Wisconsin State Laboratory of Hygiene. Upon return to Fort McCoy on September 5, the patient was isolated at an on-site facility. Measles was confirmed by real-time reverse transcription–polymerase chain reaction (RT-PCR) on September 5; molecular characterization yielded genotype B3, consistent with genotypes recently identified in countries neighboring Afghanistan.**

* Measles was identified in evacuees who transited through Bahrain, Bulgaria, Germany, Italy, Kuwait, Qatar, and Spain.

† Camp Atterbury, Indiana; Fort Bliss, Texas; Fort Lee, Virginia; Fort Pickett, Virginia; Fort McCoy, Wisconsin; Holloman Air Force Base, New Mexico; Joint Base McGuire-Dix-Lakehurst, New Jersey; and Marine Corps Base Quantico, Virginia.

§ Hotel A is located in Virginia and was closed to the public and used only for quarantine and isolation during OAW.

¶ November 26 is 42 days, or two maximum incubation periods, after rash onset in the last case (October 15); a measles outbreak is considered to have ended if there are no additional outbreak-related cases for two or more maximum incubation periods after rash onset in the last case under continued surveillance.

** https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/surveillance/monitoring/provisional-monthly-measles-and-rubella-data

BOX. Time line of events associated with measles cases detected among Afghan evacuees during Operation Allies Welcome — United States and Afghanistan, August 17–October 15, 2021

August 17
Flights with Afghan evacuees began arriving in the United States at IAD.

August 28
Flights with Afghan evacuees began arriving at PHL.

August 24–September 24
MMR and varicella vaccination efforts began, transitioning to rapid scale-up of vaccination on September 6 after the first case was identified and accelerated mass vaccination campaigns after the September 14 directive. Mass vaccination campaigns continued until September 24 across U.S. military bases and hotel A.

August 30
Epi-X notice issued to encourage U.S. health departments and clinicians to maintain vigilance for measles and polio among Afghan evacuees.

September 2
Rash onset in earliest measles case (patient aged 9 months) at hotel A, Virginia (laboratory confirmed September 9).

September 4
Rash onset in first identified measles case (patient aged 17 years) at Fort McCoy, Wisconsin (laboratory confirmed September 5).

September 10
International flights carrying OAW evacuees to the United States temporarily halted.

September 14
CDC directive issued to pause international evacuation flights from overseas locations to the United States and initiate mass MMR and varicella vaccination campaigns and quarantine for 21 days following receipt of MMR vaccine; total of six measles cases confirmed by this date.

September 17
Executive Order issued adding measles to the list of federally quarantinable communicable diseases.

September 20
CDC issued Health Alert Network Update: Guidance for Clinicians Caring for Individuals Recently Evacuated from Afghanistan;* total of 16 measles cases confirmed by this date.

October 5
Flights resumed to United States (PHL).

October 15
Rash onset in last measles case at Marine Corps Base Quantico, Virginia; total of 47 measles cases identified.

Abbreviations: Epi-X = Epidemic Information Exchange; IAD = Dulles International Airport; MMR = measles, mumps, and rubella; OAW = Operation Allies Welcome; PHL = Philadelphia International Airport.
* https://emergency.cdc.gov/han/2021/han00452.asp

A confirmed measles case was defined as an acute febrile rash illness and either detection of measles virus RNA using real-time RT-PCR or measles-specific immunoglobulin M antibody by enzyme immunoassays, or direct epidemiologic linkage to a laboratory-confirmed case (*3*). By September 14, five additional measles cases had been confirmed: four in patients at hotel A and one in a patient at Fort Pickett, Virginia. To identify additional cases, active case finding and tracing of exposed contacts were conducted by DoD and DHS public health surveillance and medical staff members and contractors at domestic military bases, international airports, and hotel A. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[††]

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

A total of 47 confirmed measles cases were reported among Afghan evacuees at six domestic sites in four jurisdictions (22 cases in Virginia, 22 in Wisconsin, two in New Mexico, and one in New Jersey). Rash onset dates ranged from September 2 to October 15.[§§] The median age of patients was 1 year (range = 0–26 years); 16 (34%) patients were aged <12 months, 17 (36%) were aged 1–4 years, 11 (23%) were aged 5–19 years, and three (6%) were aged 20–29 years; 55% were male. All 47 patients were unvaccinated or had unknown vaccination status upon arrival in the United States. Overall, 46 (98%) cases were laboratory-confirmed. Genotyping performed on 43 real-time RT-PCR–positive specimens identified genotype B3 in all. The crude attack rate was 0.065%. Domestic sites also reported 57 varicella cases, 14 mumps cases, and one rubella case.[¶¶]

Public Health Response

After DoD began larger-scale emergency evacuations, administration of routine predeparture vaccinations in Afghanistan was not operationally feasible because of the urgency and scope of the evacuations, and efforts shifted to providing MMR vaccine to evacuees soon after arrival in the United States. Following the detection of measles cases, rapid scale-up of DoD-led vaccination efforts began across domestic military bases housing evacuees on September 6, and evacuation flights from overseas locations to the United States were temporarily halted on September 10. CDC issued a directive on September 14 recommending urgent implementation of measures to limit measles spread; this directive included a pause on evacuation flights from overseas locations and the acceleration of mass MMR and varicella vaccination for all eligible evacuees aged ≥6 months and ≥12 months, respectively, who did not have contraindications (*4*,*5*), at both OAW overseas and domestic locations. Because of the lack of documentation of previous vaccination or disease history of evacuees, more targeted vaccination of susceptible persons was not possible. In addition, all evacuees were presumed to have been exposed to measles and thus were recommended to remain in quarantine (i.e., on bases and in overseas locations) for 21 days following receipt of MMR vaccine (*3*). Efforts were also made to provide immunoglobulin to persons ineligible for MMR vaccine (infants aged <6 months and seronegative pregnant women) at domestic sites.

By September 24, an estimated 91% of eligible evacuees at the domestic military bases had been vaccinated with MMR vaccine, increasing to 96% by November 25. No measles cases were reported in military personnel, volunteers and staff members supporting the OAW response, or in the community (areas surrounding the military bases or hotel A); no measles-related deaths occurred. OAW international flights resumed on October 5, with no measles cases identified among evacuees arriving after the pause.

An additional tool for measles control became available on September 17 with the addition of measles to the list of federally quarantinable diseases via Executive Order 14047.[***] This policy change enabled the use of federal regulatory authority to control measles transmission by allowing the issuance of federal public health orders, if necessary. CDC developed operating procedures and policies to determine situations for which issuing a federal order for isolation of patients and quarantine of exposed contacts might be necessary for the protection of public health. As a result of the high measles vaccination coverage achieved through this response and the adherence with voluntary isolation and quarantine recommendations, no federal public health orders were issued.

Discussion

Measles is an extremely contagious viral illness, with one infectious patient capable of infecting an average of 12–18 persons in a fully susceptible population (*6*). Measles-containing vaccines are highly effective, with 2 doses conferring approximately 97% protection (*4*). Measles elimination[†††] has been maintained in the United States since 2000; however, measles cases reached a 25-year high in 2019, with 1,274 cases reported across 32 U.S. jurisdictions; 85% of these cases occurred among pockets of undervaccinated persons, where the virus spread following international importations (*7*). Reduced global travel, physical distancing, and other COVID-19 pandemic-related mitigation measures likely contributed to only 15 measles cases being reported in the United States from 2020 to 2021 before the start of OAW (*8*). However, the lessons of the 2019 U.S. outbreaks highlight the need for vigilance as well as the importance of prompt interventions to control measles (*8*). In addition, global standards for humanitarian crises[§§§] recommend conducting a mass measles vaccination campaign when estimated measles coverage is ≤90% or is not known. The low measles vaccination coverage among evacuees, coupled with the high potential for multiple importations, increased risk for transmission in congregate settings, and possible spread

[§§] The patient with rash onset on September 2 was identified at hotel A in Virginia, and measles was laboratory-confirmed on September 9 after identification and laboratory confirmation of the first case at Fort McCoy, Wisconsin.

[¶¶] https://ndc.services.cdc.gov/

[***] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/09/17/executive-order-on-adding-measles-to-the-list-of-quarantinable-communicable-diseases/

[†††] The absence of endemic measles virus transmission or a chain of measles transmission that persists for 1 year or more.

[§§§] www.spherestandards.org/handbook

Summary

What is already known about this topic?

Low measles immunization coverage and an ongoing measles outbreak in Afghanistan led to U.S. measles importations among Afghan evacuees who were resettled as part of Operation Allies Welcome.

What is added by this report?

Forty-seven measles cases were reported among 72,299 Afghan evacuees (attack rate = 0.065%) in U.S. military bases and a contracted hotel. A coordinated response and a high-coverage mass vaccination campaign led to rapid containment.

What are the implications for public health practice?

Mass vaccination of an undervaccinated evacuee population can limit measles importations, control measles spread, and prevent transmission into U.S. communities.

into U.S. communities during the OAW response, demanded immediate public health action requiring a whole-of-government approach.

All identified cases occurred among evacuees who arrived during August 17–September 10 before international flights from overseas locations were temporarily halted to permit mass vaccination of all evacuees. The absence of additional cases in evacuees who arrived after flights resumed is evidence of the success of this strategy in preventing new introductions of measles into the United States. This response also highlights the effectiveness of the mass vaccination campaign in minimizing further transmission on military bases (attack rates for measles outbreaks among refugee populations in congregate settings have ranged from 0.9% to 25.5%) (*9*,*10*), as well as preventing transmission into communities with health care systems already strained by the COVID-19 pandemic. Efforts continued to 1) ensure high vaccination coverage among the remainder of incoming evacuees, 2) identify and isolate ill persons among evacuees on military bases, and 3) perform contact tracing to identify and quarantine exposed persons.

The findings in this report are subject to at least two limitations. First, cases might have been missed because of clinical misdiagnoses, limited available staff members to conduct timely and regular wellness checks, and failure of ill persons to seek care at acute care clinics. Second, contact tracing and ascertainment of exposures were difficult because of evacuees mixing at overseas locations, on international and domestic flights, at receiving airports, and at military bases, creating challenges for adequate monitoring among exposed persons.

Rapid implementation of a high-coverage mass measles vaccination campaign by DoD with a 21-day quarantine after receipt of MMR vaccine reduced measles importations and prevented substantial potential spread of measles on military bases and into U.S. communities, and the morbidity and mortality associated with such outbreaks. The robust MMR and varicella vaccination campaign also likely limited the number of varicella, mumps, and rubella cases identified across military bases.

Acknowledgments

Raydel Anderson, Min-hsin Chen, Sara Mercader, Ludmila Perelygina, Kiara Shelby, Sun Sowers, CDC; Susan Coffin, Children's Hospital of Pennsylvania; Jason Collins, Makayla Culbertson, Michelle Grimard, Eric Hawkins, Maria Hasanat, Anna Lay, Lixia Liu, Mackenzie Lovelace, James Miller II, Lauren Milroy, Nicole Pador, Shawn Pence, Pamela Pontones, Brian Pope, Jaxon Pridgen, Andzelika Rzucidlo, Sergey Smulevitch, Alexandria Snively, Marija Stankovich, Stephanie Sweets, Christopher Tarrand, Indiana Department of Health; Lucia Eloisa, Allison O'Rourke, Loyal Source Government Services; Tiffany Giesler, Monroe County Health Department, Wisconsin; Christine Ross, New Mexico Department of Health; Lynnetta Bui, Abraham Chekol, Lisa Dettinger, Hephzibah Tagaram, Pennsylvania Department of Health Bureau of Laboratories; Dana Perella, Philadelphia Department of Public Health; Stephanie Schauer, Wisconsin Department of Health Services.

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

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Provisional Mortality Data — United States, 2021

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On April 22, 2022, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The CDC National Center for Health Statistics' (NCHS) National Vital Statistics System (NVSS) collects and reports annual mortality statistics using U.S. death certificate data. Because of the time needed to investigate certain causes of death and to process and review death data, final annual mortality data for a given year are typically released 11 months after the end of the calendar year. Provisional data, which are based on death certificate data received but not fully reviewed by NCHS, provide an early estimate of deaths before the release of final data. NVSS routinely releases provisional mortality data for all causes of death and for deaths involving COVID-19.* This report presents an overview of provisional U.S. mortality data for 2021, including a comparison of death rates for 2020 and 2021. In 2021, approximately 3,458,697 deaths† occurred in the United States. From 2020 to 2021, the age-adjusted death rate (AADR) increased by 0.7%, from 835.4 to 841.6 per 100,000 standard population. COVID-19 was reported as the underlying cause or a contributing cause in an estimated 460,513 (13.3%) of those deaths (111.4 deaths per 100,000). The highest overall death rates by age occurred among persons aged ≥85 years, and the highest overall AADRs by sex and race and ethnicity occurred among males and non-Hispanic American Indian or Alaska Native (AI/AN) and non-Hispanic Black or African American (Black) populations. COVID-19 death rates were highest among persons aged ≥85 years, non-Hispanic Native Hawaiian or other Pacific Islander (NH/OPI) and AI/AN populations, and males. For a second year, the top three leading causes of death by underlying cause were heart disease, cancer, and COVID-19. Provisional death estimates provide an early indication of shifts in mortality trends and can guide public health policies and interventions aimed at reducing mortality directly or indirectly associated with the pandemic and among persons most affected, including persons who are older, male, or from certain race and ethnic minority groups.

This report analyzed provisional NVSS death certificate data for deaths occurring among U.S. residents in the United States during January–December 2021. NCHS tabulated the number and rates of overall deaths and COVID-19 deaths by age, sex, and race and ethnicity (categorized as Hispanic, non-Hispanic White [White], non-Hispanic Black, non-Hispanic Asian [Asian], non-Hispanic AI/AN, non-Hispanic NH/OPI, non-Hispanic persons of more than one race [multiracial], and unknown). NCHS coded the causes of death according to the *International Classification of Diseases, Tenth Revision*, which details disease classification and the designation of underlying cause of death (*1*,*2*). COVID-19 death counts and rates include deaths for which confirmed or presumed COVID-19 is listed on the death certificate as an underlying or contributing cause of death.§ COVID-19 was the underlying cause for approximately 90% (415,399), and a contributing cause of death for the remaining 10% (45,114) of COVID-19–associated deaths in 2021 (*3*). Leading causes of death were ranked by counts of underlying cause of death (*4*). NVSS data in this report exclude deaths among residents of U.S. territories and foreign countries.¶ Age was unknown for 73 (<0.01%) decedents, and race and ethnicity were unknown for 8,382 (0.24%) decendents. There were no records with unknown sex. To describe the trend in deaths during one year, the number of deaths were calculated for each week from all causes and from COVID-19 as an underlying or contributing cause. AADRs were calculated for deaths by sex and race and ethnicity. Crude death rates were calculated by age. Provisional death counts and rates for 2021 were compared with final 2020 data (*5*). The population data used to estimate death rates presented in this report are July 1, 2021, monthly postcensal population estimates based on the 2010 decennial census (*6*). R statistical software (version 4.0.3; The R Foundation) was used to conduct all analyses. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.**

In 2021, approximately 3,458,697 deaths occurred in the United States (Table). The age-adjusted rate was 841.6 deaths per 100,000 standard population, an increase of 0.7% from 835.4 in 2020. The number of deaths peaked during the week ending January 16, 2021 (87,222) and during the week ending September 11, 2021 (73,466) (Figure 1). In 2021, overall death rates were lowest among persons aged 5–14 years (14.6) and highest among persons aged ≥85 years (13,826.2), similar to patterns in 2020 (Table). Death rates increased for most age

* NVSS provisional mortality data are available at https://wonder.cdc.gov. NVSS COVID-19 surveillance data are available at https://www.cdc.gov/nchs/nvss/deaths.htm.

† Based on death records received and processed as of April 12, 2022, for deaths occurring in the United States among U.S. residents. Data included in this analysis include >99% of deaths occurring in 2021.

§ The underlying cause of death is the disease or injury that initiated the train of morbid events leading directly to death.

¶ At the time of analysis, 0.2% of total NVSS deaths, and 0.2% of COVID-19 deaths, were among foreign residents and residents of U.S. territories.

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

TABLE: Provisional* number and rate of total deaths and COVID-19–related deaths, by demographic characteristics — National Vital Statistics System, United States, 2020–2021

Characteristic	2020 No. (rate†)		2021 No. (rate†)	
	Total deaths	Deaths involving COVID-19§	Total deaths	Deaths involving COVID-19§
Total	**3,383,729 (835.4)**	**384,536 (93.2)**	**3,458,697 (841.6)**	**460,513 (111.4)**
Age group, yrs				
<1	19,582 (524.3)	52 (1.4)	19,724 (528.6)	155 (4.2)
1–4	3,529 (22.7)	25 (0.2)	3,773 (24.7)	63 (0.4)
5–14	5,623 (13.7)	68 (0.2)	5,955 (14.6)	175 (0.4)
15–24	35,816 (84.2)	612 (1.4)	38,234 (90.2)	1,634 (3.9)
25–34	73,486 (159.5)	2,609 (5.7)	82,039 (178.6)	6,971 (15.2)
35–44	10,4490 (248.0)	6,756 (16.0)	124,577 (292.0)	17,304 (40.6)
45–54	191,142 (473.5)	18,250 (45.2)	215,531 (538.5)	39,193 (97.9)
55–64	440,549 (1,038.9)	45,377 (107.0)	477,107 (1,131.8)	78,904 (187.2)
65–74	674,507 (2,072.3)	82,055 (252.1)	723,125 (2,148.2)	111,035 (329.9)
75–84	822,084 (4,997.0)	106,020 (644.4)	828,617 (4,882.6)	110,194 (649.3)
≥85	1,012,805 (15,210.9)	122,707 (1,842.9)	939,942 (13,826.2)	94,884 (1,395.7)
Unknown	116 (—)	5 (—)	73 (—)	1 (—)
Sex				
Female	1,613,845 (695.1)	175,818 (73.9)	1,623,861 (694.6)	202,006 (87.7)
Male	1,769,884 (998.3)	208,718 (117.0)	1,834,836 (1,011.0)	258,507 (140.0)
Race/Ethnicity				
Hispanic	305,708 (723.6)	69,069 (164.8)	315,128 (700.1)	72,685 (157.8)
White, non-Hispanic	2,484,072 (834.7)	232,555 (74.1)	2,545,602 (852.2)	303,595 (100.6)
Black, non-Hispanic	449,213 (1,119.0)	61,401 (154.8)	448,416 (1,081.2)	61,626 (146.8)
Asian, non-Hispanic	91,175 (457.7)	13,523 (67.2)	91,814 (439.6)	13,587 (64.0)
American Indian/Alaska Native, non-Hispanic	24,725 (1,036.2)	4,615 (190.8)	26,850 (1,088.5)	5,027 (198.5)
Native Hawaiian/other Pacific Islander, non-Hispanic	4,439 (821.3)	691 (123.5)	5,225 (916.5)	1,170 (199.8)
Multiracial, non-Hispanic	15,523 (376.9)	1,141 (31.9)	17,280 (399.5)	2,003 (49.8)
Unknown	8,874 (—)	1,541 (—)	8,382 (—)	820 (—)

* National Vital Statistics System provisional data for 2021 are incomplete. Data from December 2021 are less complete because of reporting lags. Data for 2020 are final. These data exclude deaths that occurred in the United States among residents of U.S. territories and foreign countries.
† Deaths per 100,000 standard population. Age-adjusted death rates are provided overall and by sex and race and ethnicity.
§ Deaths with confirmed or presumed COVID-19 as an underlying or contributing cause of death, with *International Classification of Diseases, Tenth Revision* code U07.1.

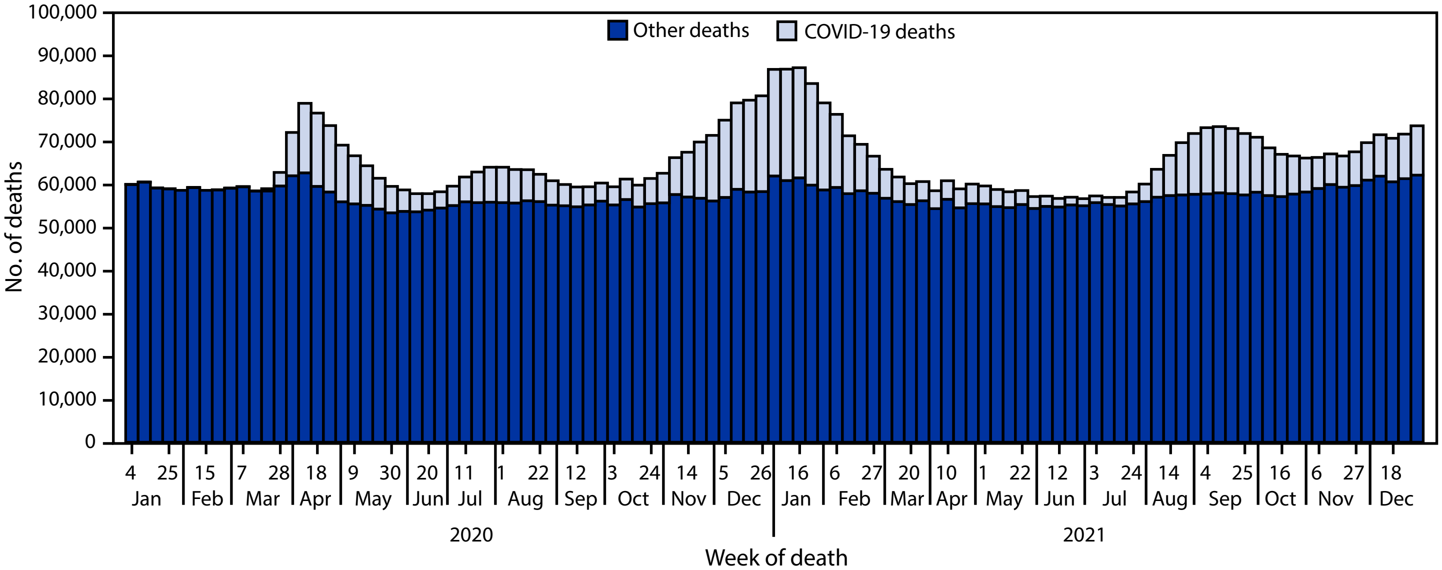
groups from 2020 to 2021, except for persons aged 75–84 and ≥85 years. In 2021, AADRs were higher among males (1,011.0) than among females (694.6), similar to patterns in death rate by sex in 2020.

In 2021, COVID-19 was listed as the underlying or contributing cause of 460,513 deaths (111.4 per 100,000), an increase from 384,536 deaths (93.2) in 2020 (Table). In 2021, COVID-19 death rates were lowest among persons aged 1–4 (0.4) and 5–14 years (0.4) and highest among those aged ≥85 years (1,395.7). COVID-19 death rates increased from 2020 to 2021 for all age groups except for those aged ≥85 years. As with deaths overall, in 2021, the age-adjusted COVID-19–associated death rate among males (140.0) was higher than that among females (87.7).

AADRs differed by race and ethnicity. In 2021, overall AADRs were lowest among multiracial (399.5) and Asian persons (439.6) and highest among AI/AN (1,088.5) and Black persons (1,081.2). Similarly for 2021, COVID-19–associated death rates were lowest for multiracial (49.8) and Asian persons (64.0) and highest among NH/OPI (199.8) and AI/AN persons (198.5). Overall and COVID-19 death rates decreased for Hispanic, Black, and Asian persons from 2020 to 2021.

COVID-19, listed as the underlying cause in 415,399 deaths during 2021, ranked as the third leading underlying cause of death after heart disease (693,021 deaths) and cancer (604,553 deaths) (Figure 2). COVID-19 was the underlying cause for 13.3% of all deaths in 2021, increasing from 10.4% (350,831 deaths) in 2020. Unintentional injuries, the fourth leading cause of death in 2020 and 2021, increased from 200,955 in 2020 to 219,487 in 2021. Other leading causes of death maintained the same ranking from 2020 to 2021, except for chronic liver disease and cirrhosis and influenza and pneumonia. Chronic liver disease and cirrhosis, which was not among the 10 leading causes of death in 2020, was the ninth leading cause in 2021 with 56,408 deaths (51,642 deaths in 2020). Influenza and pneumonia, which was the ninth leading cause of death in 2020 (53,544 deaths), dropped out of the 10 leading causes in 2021 (41,835 deaths).

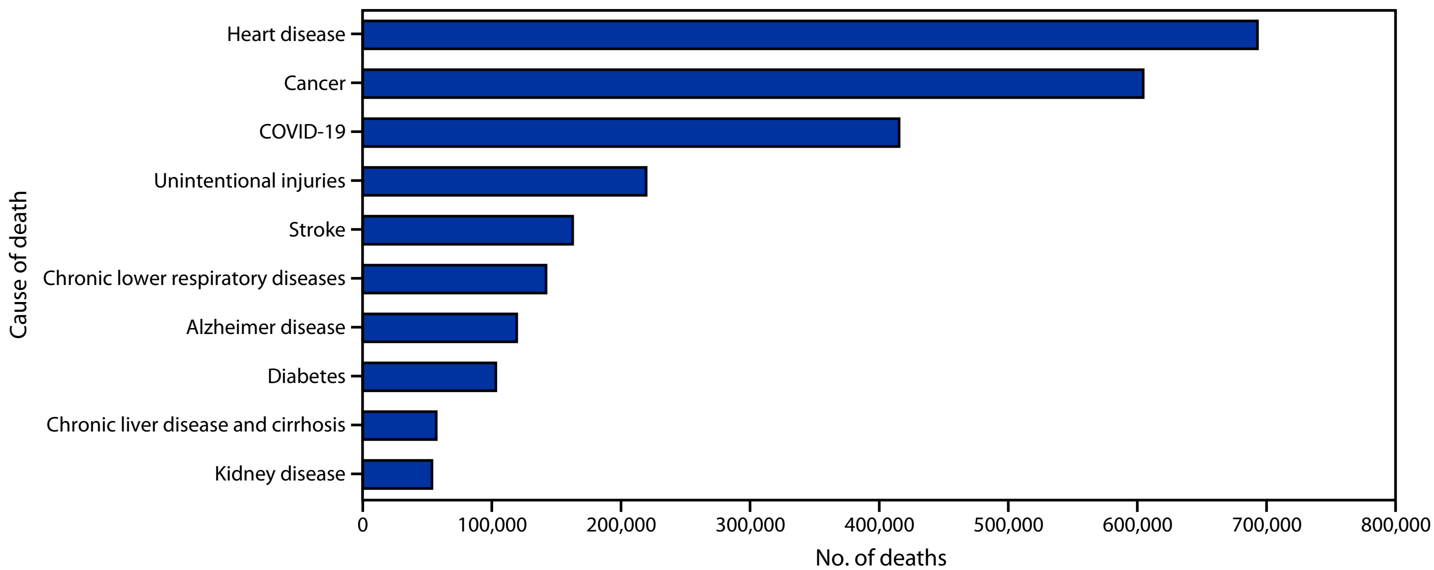
FIGURE 1. Provisional* number of COVID-19 deaths† and other deaths, by week of death — National Vital Statistics System, United States, 2020–2021



* National Vital Statistics System provisional data for 2021 are incomplete. Data from December 2021 are less complete because of reporting lags. Data for 2020 are final. These data exclude deaths that occurred in the United States among residents of U.S. territories and foreign countries.

† Deaths with confirmed or presumed COVID-19, coded to *International Classification of Diseases, Tenth Revision* code U07.1 as an underlying or contributing cause of death.

FIGURE 2. Provisional* number of leading underlying causes of death†— National Vital Statistics System, United States, 2021



* National Vital Statistics System provisional data are incomplete. Data from December are less complete because of reporting lags. Deaths that occurred in the United States among residents of U.S. territories and foreign countries were excluded.

† Deaths for which COVID-19 was a contributing, but not the underlying cause of death are not included.

Discussion

From 2020 to 2021, the age-adjusted U.S. death rate increased by 0.7%, from 835.4 to 841.6 per 100,000 standard population. In 2021, COVID-19 was the underlying or a contributing cause of death for 460,513 deaths (111.4 deaths per 100,000). COVID-19 death rates were highest among males, adults aged ≥85 years, and NH/OPI and AI/AN persons. The highest numbers of overall deaths and COVID-19 deaths occurred during January and September. COVID-19 was the third leading underlying cause of death in 2021, for the second year since the disease emerged (*6*).

Demographic patterns of mortality were similar in 2020 and 2021, but certain populations experienced shifts in death rates. Although the overall and COVID-19 death rate remained higher for persons aged ≥85 years than for all other age groups,

Summary

What is already known about this topic?

COVID-19 was associated with approximately 460,000 deaths in the U.S. during January–December 2021.

What is added by this report?

The overall age-adjusted death rate increased by 0.7% in 2021 from 2020. Overall death rates were highest among non-Hispanic American Indian or Alaskan Native and non-Hispanic Black or African American populations. For a second year, COVID-19 was the third leading cause of death after heart disease and cancer.

What are the implications for public health practice?

Provisional death estimates provide an early signal about shifts in mortality trends. Provisional findings about increases in mortality for certain populations and for certain causes of death can guide public health policies and interventions.

death rates decreased for this age group from 2020 to 2021. Age-adjusted total and COVID-19 death rates remained high for the AI/AN population. Rates decreased for Asian, Hispanic, and Black populations and increased for NH/OPI, White, and AI/AN populations.

The year 2021 saw the highest death rate since 2003, with increases in many leading causes of death, including COVID-19 and unintentional injuries. Although COVID-19 death rates decreased for persons aged ≥85 years, age groups <75 years saw large increases from 2020 to 2021. Unintentional injury deaths were largely driven by drug overdose deaths, and likely contributed to the increased death rate in younger populations. In 2020, drug overdose death rates increased more for persons aged 15–64 years than for persons aged ≥65 years (*7*).

The findings in this report are subject to at least three limitations. First, data are provisional, and numbers and rates might change as additional information is received. Described changes in mortality trends might be underestimates. Second, timeliness of death certificate submission can vary by jurisdiction. As a result, the national distribution of deaths might be affected by the distribution of deaths reported from jurisdictions reporting later, which might differ from those in the United States overall. Finally, there is a higher potential for misclassification of certain categories of race (i.e., AI/AN or Asian) and Hispanic ethnicity reported on death certificates (*8*). Thus, death rates for some groups might be underestimated or overestimated.

Provisional death estimates can give researchers and policymakers an early projection of shifts in mortality trends and provide actionable information sooner than do the final mortality data, which are released approximately 11 months after the end of the data year. These data can guide public health policies and interventions aimed at reducing mortality directly or indirectly associated with the pandemic and among persons most affected, including persons who are older, male, or from certain race and ethnic minority groups.

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

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Provisional COVID-19 Age-Adjusted Death Rates, by Race and Ethnicity — United States, 2020–2021

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On April 22, 2022, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Disparities in COVID-19 death rates by race and ethnicity have been reported in the United States (*1*,*2*). In response to these disparities, preventive, medical care, and social service assistance programs were implemented to lessen disparities in COVID-19 outcomes, including grants to support state, tribal, local, and territorial health department responses (*3*). The potential impact of such efforts on annual changes in racial and ethnic disparities in mortality rates that identify COVID-19 as the underlying cause of death has not been previously reported. This analysis used U.S. provisional mortality data from death certificates collected by CDC's National Vital Statistics System (NVSS) to estimate changes in COVID-19–related age-adjusted death rates (AADRs) by race and ethnicity during 2020–2021. Compared with non-Hispanic multiracial persons (the group with the lowest death rate), significant decreases in AADR ratios occurred during 2020–2021 among non-Hispanic American Indian or Alaska Native (AI/AN) persons (34.0%), non-Hispanic Asian (Asian) persons (37.6%), non-Hispanic Black or African American (Black) persons (40.2%), Hispanic persons (37.1%), and non-Hispanic White (White) persons (14%); a non-statistically significant 7.2% increase in AADR ratio occurred among non-Hispanic Native Hawaiian or other Pacific Islander (NH/OPI) persons. Despite reductions in AADR disparities from 2020 to 2021, large disparities in AADR by race and ethnicity remained in 2021. Providing effective preventive interventions, including vaccination and clinical care, to all communities in proportion to their need for these interventions is necessary to reduce racial and ethnic disparities in COVID-19 deaths.

CDC WONDER* mortality data from 2020 (final) and 2021 (provisional) reported to NVSS as of February 6, 2022, was used to assess annual changes in COVID-19 deaths among U.S. residents of any age during January 2020–December 2021. Cause of death codes from the *International Classification of Diseases, Tenth Revision* (ICD-10) were used to classify diseases as underlying causes of death† (*4*). COVID-19 deaths were defined as deaths for which COVID-19 was listed on the death certificate as a confirmed or presumed underlying cause of death (ICD-10 code U07.1). AADRs and their SEs were downloaded using CDC WONDER Provisional Multiple Cause of Death data file "2018–last month" for numbers of decedents, mid-year resident populations, and crude death rates. The data included COVID-19 deaths by sex (female and male), age group (≤24, 25–44, 45–64, 65–74, and ≥75 years) and race and ethnicity (AI/AN, Asian, Black, Hispanic, NH/OPI, and White persons, and persons who were listed as non-Hispanic more than one race [multiracial]). Deaths that occurred among residents of U.S. territories and foreign countries were excluded.

At the time of this analysis, 2021 U.S. population estimates were unavailable; therefore, midyear U.S. Census Bureau population estimates (as of July 1, 2020) were used to calculate estimated COVID-19-related death rates (deaths per 100,000 population) for 2020 and 2021.§ Crude death rates were calculated by sex, age group, and race and ethnicity, and AADRs were calculated by race and ethnicity. Changes in AADR within each racial and ethnic group from 2020 (*5*) to 2021 with 95% CIs and statistical tests of significance were calculated. Using the non-Hispanic multiracial group (the group with the lowest death rate) as the referent group,¶ changes from 2020 to 2021 in AADR ratios with 95% CIs and statistical tests of significance of differences between each racial and ethnic group and the referent group were calculated. The referent group consisted of persons who identified with two or more races (e.g., White and Asian, Black and AI/AN, or any other combination of races). Pearson's chi-square tests of differences in the distribution of decedents by sex, age group, and race and ethnicity were compared with the estimated midyear U.S. Census Bureau population estimate. Z-tests of statistical significance were used to compare differences in the percent change in each measure of relative disparity. P-values <0.05 were considered statistically significant. Statistical analyses were performed using SAS software (version 9.4; SAS Institute). To detect and correct computational errors, the analyses were replicated by two analysts independently. To assess sensitivity of the results to changing the referent group, separate analyses were conducted with multiracial and non-Hispanic White

* https://wonder.cdc.gov/mcd-icd10-provisional.html
† https://icd.who.int/browse10/2008/en

§ https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.html
¶ https://www.cdc.gov/nchs/healthy_people/hp2020/health-disparities-technical-notes.htm

persons as referent groups. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.**

Total COVID-19 deaths (and crude death rates) increased from 350,831 (106.5 per 100,00 population) in 2020 to 411,465 (124.9) in 2021 (Table 1). The numbers or percentages of decedents in 2020 and 2021 with missing values was small based on sex (the number was 0 for both years), age group (the numbers were 4 and 2, respectively), and race and ethnicity (0.4% and 0.2%, respectively). Persons who were male (54.9%–56.7%), those aged >65 years (68.0%–80.6%), Black persons (13.3%–16.1%), and White persons (59.6%–65.2%) were significantly overrepresented (p<0.001) among decedents compared with the standard population in both 2020 and 2021.

In 2020, AADR was lowest among multiracial persons (29.6 per 100,000 population) (Table 2). In 2020, compared with multiracial persons, the AADR ratio (relative disparity) was 5.9 for AI/AN, 2.1 for Asian, 4.8 for Black, 5.3 for Hispanic, 3.8 for NH/OPI, and 2.3 for White persons. Overall AADR increased by 19.2% from 85.0 in 2020 to 101.3 per 100,000 U.S. residents in 2021, including 3.8% among AI/AN, 57.1% among multiracial, 68.3% among NH/OPI, and 35.1% among White persons; and decreased by 1.9% among Asian, 6.1% among Black, and 1.2% among Hispanic persons. In 2021, the AADR relative disparity decreased by 34.0% for AI/AN, 37.6% for Asian, 40.2% for Black, 37.1% for Hispanic, and 14.0% for White persons. The increase among NH/OPI persons was not statistically significant (7.2%, from 3.8 in 2020 to 4.1 in 2021) (Figure). Using non-Hispanic White persons as the referent group yielded significant decreases in AADR ratios for AI/AN (–23.2%), Asian (–27.4%), Black (–30.5%), and Hispanic persons (–26.9%), but a significant increase for NH/OPI persons (24.6%).

Discussion

Compared with multiracial U.S. residents, who had the lowest COVID-19–related death rate, disparity in COVID-19 AADRs decreased significantly for most racial and ethnic groups from 2020 to 2021. Using multiracial persons as the referent group enabled the presentation of changes in relative disparity for White persons, who accounted for 59.6% of all COVID-19 decedents in 2020 and 65.2% in 2021. Reductions in disparities in AADR for most racial and ethnic groups reflect the widespread impact of effective interventions, including vaccination, deployed since January 2020 to prevent SARS-CoV-2 infection and severe COVID-19 disease and death. Because AADR increased 57.1% among multiracial persons (the referent group for measuring disparity) from 2020 to 2021, percent reductions in AADR ratios for the other racial and ethnic groups were approximately 10% larger than they would have been had non-Hispanic White persons been used as the referent group and larger than they would have been if the AADR for the multiracial group had decreased or remained constant from 2020 to 2021. Low rates of COVID-19 AADR among 33.8 million multiracial persons in 2020 and 2021 are consistent with the lower all-causes mortality experience of components of the multiracial group counted in the 2020 U.S. Census as follows: White persons and another race (57%), White and AI/AN persons (11.8%), White and Asian persons (7.9%), White and Black persons (9.2%), Black persons and another race (3%), and other combinations of race (11%) (*6*). Despite reductions in AADR disparities from 2020 to 2021, large disparities in AADR between each racial/ethnic group remained in 2021 regardless of the referent group chosen.

These findings are consistent with previously published estimates of racial and ethnic disparities in AADR using non-Hispanic White persons as the referent group (*1*,*7*,*8*). This report adds previously unknown changes in relative disparity among White persons, who account for the overwhelming majority of all COVID-19 deaths, emphasizing the critical need for nationwide efforts to reduce AADR among all racial and ethnic groups during 2022 and beyond. These efforts should consider federal, state, tribal, and other local expertise, technical assistance, and resources that deliver preventive interventions, including vaccination and clinical care to all racial and ethnic communities in proportion to their needs rather than their historical demand for or access to services. Through a $2.25 billion national initiative, CDC's Center for State, Tribal, Local, and Territorial Support (CSTLTS) awarded grants to 108 states, counties (urban and rural), cities, territories, and tribal nations (through separate funding agreements) to implement strategies in collaboration with community-based organizations (*3*), including efforts to improve surveillance; isolation; contact tracing; and the delivery of mobile diagnostic testing, vaccination, and outpatient COVID-19 treatment services in nonclinical settings such as homes, churches and other community-gathering places.

The findings in this report are subject to at least five limitations. First, final 2020 and provisional 2021 data were analyzed in February 2022. Provisional numbers and rates might change as additional information is received and 2021 data are finalized. Second, because the timeliness of death certificate submission from states and local jurisdictions to the NVSS varied by jurisdiction and might also vary by race and ethnicity within a jurisdiction during 2020 and 2021, the national distribution of deaths by race and ethnicity might be affected by measurement bias. Third, certain categories of race (e.g., AI/AN, Asian, and multiracial) and Hispanic ethnicity

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

TABLE 1. U.S. resident population and proportional distribution of COVID-19 decedents by sex, age-group, and race/ethnicity, and COVID-19–associated death rates* — United States, 2020–2021

	2020 Population	2020 (final)†			2021 (provisional)†		
		Deaths			Deaths		
Characteristic	No.	No.	Column % or rate§	P-value	No.	Column % or rate	P-value
Sex							
Female	167,227,921	158,319	45.1	<0.001¶	178,028	43.3	<0.001¶
Male	162,256,202	192,512	54.9		233,437	56.7	
Age group, yrs							
≤24	102,849,110	604	0.2	<0.001¶	1,595	0.4	<0.001¶
25–44	88,205,838	8,333	2.4		21,550	5.2	
45–64	82,769,810	59,054	16.8		108,838	26.5	
65–74	32,549,398	76,277	21.7		101,408	24.7	
≥75	23,109,967	206,559	58.9		178,072	43.3	
Not stated	NA	4	0.0		2	0.0	
Race/Ethnicity**							
White	196,773,390	209,138	59.6	<0.001¶	268,121	65.2	<0.001¶
Hispanic	61,312,879	65,237	18.6		67,922	16.5	
Black	41,427,341	56,383	16.1		54,790	13.3	
Asian	19,367,197	12,693	3.6		12,576	3.1	
AI/AN	2,432,338	4,265	1.2		4,518	1.1	
Multiracial††	7,557,471	1,055	0.3		1,793	0.4	
NH/OPI	613,507	633	0.2		1,069	0.3	
Not stated	NA	1,427	0.4		676	0.2	
Total	**329,484,123**	**350,831**	**106.5***	**NA**	**411,465**	**124.9***	**NA**

Abbreviations: AI/AN = American Indian or Alaska Native; NA = not applicable; NH/OPI = Native Hawaiian or other Pacific Islander.
* Deaths per 100,000 population.
† Proportional distribution and rate for 2020 are final and for 2021 are provisional. At the time of this analysis, 2021 U.S. population estimates were unavailable; therefore, midyear U.S. Census Bureau population estimates as of July 1, 2020 were used to calculate estimated COVID-19–associated death rates for 2020 and 2021.
§ This column contains column percent plus the overall total rate in the last row.
¶ P-values <0.05 were considered statistically significant (Pearson's chi-square).
** Hispanic persons could be of any race; AI/AN, Asian, Black, NH/OPI, White, and multiracial persons were non-Hispanic.
†† More than one race reported.

TABLE 2. Changes in age-adjusted death rates* with COVID-19 as underlying cause, by race/ethnicity† — United States, 2020–2021

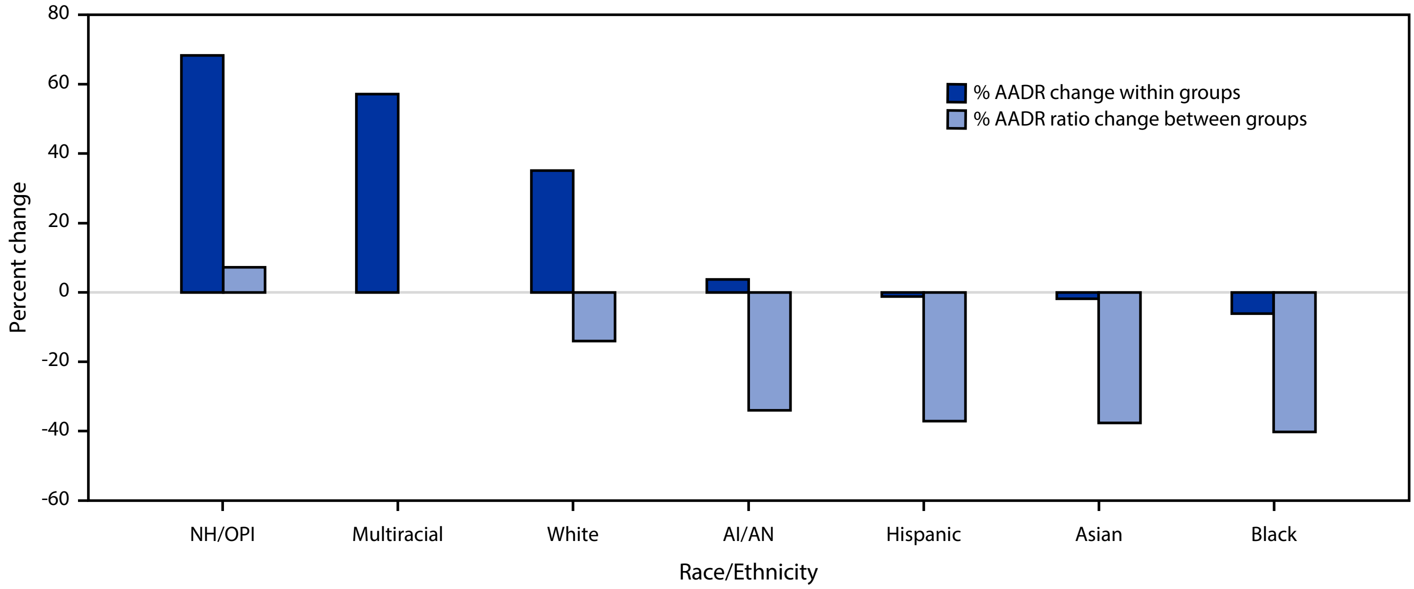
	AADR		% Change in AADR, 2020–2021 (95% CI)	RR (95% CI)		% Change in AADR ratio, 2020–2021(95% CI)§
Race/Ethnicity	2020	2021		2020	2021	
AI/AN	175.9	182.5	3.8 (−0.7 to 8.2)	5.9 (5.5 to 6.3)	3.9 (3.7 to 4.1)	−34.0 (−39.7 to −28.2)
Hispanic	155.5	153.7	−1.2 (−2.2 to −0.1)	5.3 (4.9 to 5.6)	3.3 (3.2 to 3.5)	−37.1 (−41.9 to −32.3)
Black	142.0	133.4	−6.1 (−7.2 to −4.9)	4.8 (4.5 to 5.1)	2.9 (2.7 to 3.0)	−40.2 (−44.8 to −35.6)
NH/OPI	112.4	189.2	68.3 (51.2 to 85.4)	3.8 (3.4 to 4.2)	4.1 (3.8 to 4.4)	7.2 (−6.4 to 20.7)
White	66.6	90.0	35.1 (34.4 to 35.8)	2.3 (2.1 to 2.4)	1.9 (1.8 to 2.0)	−14.0 (−20.5 to −7.5)
Asian	63.1	61.9	−1.9 (−4.5 to 0.7)	2.1 (2.0 to 2.3)	1.3 (1.3 to 1.4)	−37.6 (−42.6 to −32.6)
Multiracial§	29.6	46.5	57.1 (45.2 to 69.0)	Ref.	Ref.	Ref.
Total	**85.0**	**101.3**	**19.2 (18.6 to 19.7)**	**NA**	**NA**	**NA**

Abbreviations: AADR = age-adjusted death rate; AI/AN = American Indian or Alaska Native; NA = not applicable; NH/OPI = Native Hawaiian or other Pacific Islander; Ref. = referent group; RR = rate ratio.
* Deaths per 100,000 standard population.
† Hispanic persons could be of any race; AI/AN, Asian, Black, NH/OPI, White, and multiracial persons were non-Hispanic.
§ More than one race listed.

reported on death certificates might have been misclassified (*9*), possibly resulting in under- or overestimates of death rates for some groups. Fourth, use of the non-Hispanic multiracial category as the referent group, instead of the more precise and statistically stable non-Hispanic White category, might have overestimated the sizes of the relative disparity ratios. Finally, the underlying cause of death for certain persons might have been misclassified because of small differences in availability of diagnostic testing for SARS-CoV-2, the virus that causes COVID-19, by race and ethnicity (*10*). Differential misclassification of the underlying cause of deaths by race and ethnicity might have resulted in an under- or overestimation of COVID-19–associated deaths by race and ethnicity.

During 2020–2021, AADRs decreased for Black (–6.1%), Asian (–1.9%) and Hispanic persons (–1.2%) but increased for NH/OPI (68.3%), multiracial (57.1%), White (35.1%) and

FIGURE. Percent change in COVID-19 age-adjusted death rate and ratio,* by race/ethnicity† — United States, 2020–2021



Abbreviations: AADR = age-adjusted death rate; AI/AN = American Indian or Alaska Native; NH/OPI = Native Hawaiian or other Pacific Islander.
* Referent group was multiracial persons.
† Hispanic persons could be of any race; AI/AN, Asian, Black, NH/OPI, White, and multiracial persons were non-Hispanic.

AI/AN persons (3.8%). Relative disparities in AADR ratios from COVID-19 decreased significantly for most racial and ethnic groups, including non-Hispanic White persons when compared with multiracial persons who had the lowest AADR in 2020 and 2021. Providing effective preventive interventions, including vaccination and clinical care, to all communities in proportion to their needs can help to decrease racial and ethnic disparities in COVID-19 deaths.

Acknowledgments

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

Summary

What is already known about this topic?

In 2020, racial and ethnic disparities in COVID-19 age-adjusted death rates (AADR) were reported among U.S. residents.

What is added by this report?

From 2020 to 2021, disparities in AADR ratios from COVID-19 decreased significantly by 14.0%–40.2% for most racial and ethnic groups, including non-Hispanic White persons, who accounted for 59.6%–65.2% of all decedents; and increased nonsignificantly (7.2%) for non-Hispanic Native Hawaiian and other Pacific Islander persons (0.2%–0.3% of all decedents) compared with non-Hispanic multiracial persons.

What are the implications for public health practice?

Providing effective preventive interventions, including vaccination and clinical care, to all communities in proportion to their need for these interventions is necessary to reduce racial and ethnic disparities in COVID-19 deaths.

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Seroprevalence of Infection-Induced SARS-CoV-2 Antibodies — United States, September 2021–February 2022

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On April 26, 2022, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

In December 2021, the B.1.1.529 (Omicron) variant of SARS-CoV-2, the virus that causes COVID-19, became predominant in the United States. Subsequently, national COVID-19 case rates peaked at their highest recorded levels.* Traditional methods of disease surveillance do not capture all COVID-19 cases because some are asymptomatic, not diagnosed, or not reported; therefore, the proportion of the population with SARS-CoV-2 antibodies (i.e., seroprevalence) can improve understanding of population-level incidence of COVID-19. This report uses data from CDC's national commercial laboratory seroprevalence study and the 2018 American Community Survey to examine U.S. trends in infection-induced SARS-CoV-2 seroprevalence during September 2021–February 2022, by age group.

The national commercial laboratory seroprevalence study is a repeated, cross-sectional, national survey that estimates the proportion of the population in 50 U.S. states, the District of Columbia, and Puerto Rico that has infection-induced antibodies to SARS-CoV-2.† Sera are tested for anti-nucleocapsid (anti-N) antibodies, which are produced in response to infection but are not produced in response to COVID-19 vaccines currently authorized for emergency use or approved by the Food and Drug Administration in the United States.§

During September 2021–February 2022, a convenience sample of blood specimens submitted for clinical testing was analyzed every 4 weeks for anti-N antibodies; in February 2022, the sampling period was <2 weeks in 18 of the 52 jurisdictions, and specimens were unavailable from two jurisdictions. Specimens for which SARS-CoV-2 antibody testing was ordered by the clinician were excluded to reduce selection bias. During September 2021–January 2022, the median sample size per 4-week period was 73,869 (range = 64,969–81,468); the sample size for February 2022 was 45,810. Seroprevalence estimates were assessed by 4-week periods overall and by age group (0–11, 12–17, 18–49, 50–64, and ≥65 years). To produce estimates, investigators weighted jurisdiction-level results to population using raking across age, sex, and metropolitan status dimensions from 2018 American Community Survey data¶ (*1*). CIs were calculated using bootstrap resampling (*2*); statistical differences were assessed by nonoverlapping CIs. All specimens were tested by the Roche Elecsys Anti-SARS-CoV-2 pan-immunoglobulin immunoassay.** All statistical analyses were conducted using R statistical software (version 4.0.3; The R Foundation). This activity was reviewed by CDC, approved by respective institutional review boards, and conducted consistent with applicable federal law and CDC policy.††

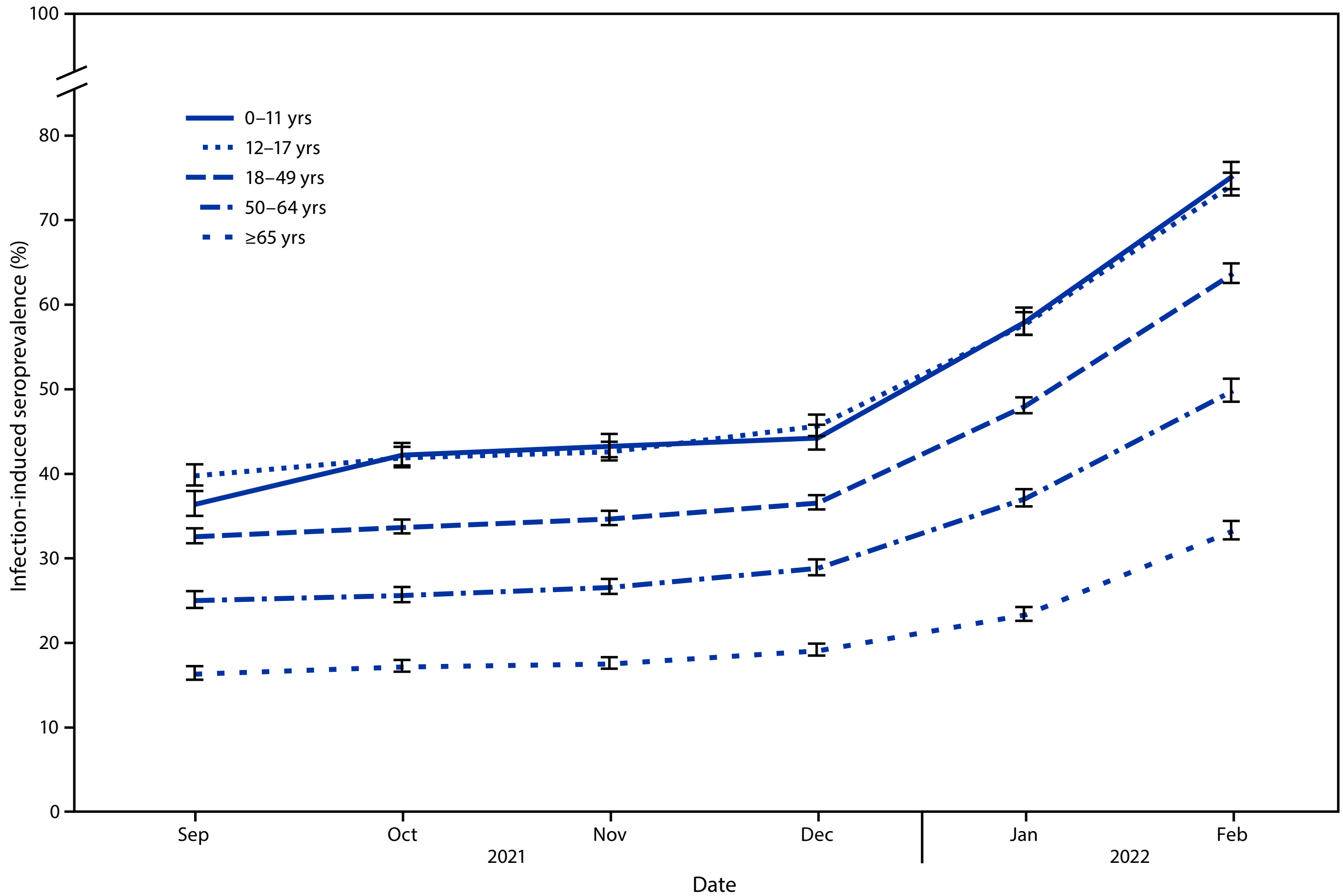
During September–December 2021, overall seroprevalence increased by 0.9–1.9 percentage points per 4-week period. During December 2021–February 2022, overall U.S. seroprevalence increased from 33.5% (95% CI = 33.1–34.0) to 57.7% (95% CI = 57.1–58.3). Over the same period, seroprevalence increased from 44.2% (95% CI = 42.8–45.8) to 75.2% (95% CI = 73.6–76.8) among children aged 0–11 years and from 45.6% (95% CI = 44.4–46.9) to 74.2% (95% CI = 72.8–75.5) among persons aged 12–17 years (Figure). Seroprevalence increased from 36.5% (95% CI = 35.7–37.4) to 63.7% (95% CI = 62.5–64.8) among adults aged 18–49 years, 28.8% (95% CI = 27.9–29.8) to 49.8% (95% CI = 48.5–51.3) among those aged 50–64 years, and from 19.1% (95% CI = 18.4–19.8) to 33.2% (95% CI = 32.2–34.3) among those aged ≥65 years.

The findings in this report are subject to at least four limitations. First, convenience sampling might limit generalizability. Second, lack of race and ethnicity data precluded weighting for these variables. Third, all samples were obtained for clinical testing and might overrepresent persons with greater health care access or who more frequently seek care. Finally, these findings might underestimate the cumulative number of SARS-CoV-2 infections because infections after vaccination might result in lower anti-N titers,§§,¶¶ and anti-N seroprevalence cannot account for reinfections.

As of February 2022, approximately 75% of children and adolescents had serologic evidence of previous infection with SARS-CoV-2, with approximately one third becoming newly

* https://covid.cdc.gov/covid-data-tracker/#trends_dailycases
† https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/commercial-lab-surveys.html
§ https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines
¶ https://www.census.gov/programs-surveys/acs/data.html
** https://www.fda.gov/media/137605/download
†† 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.
§§ https://www.medrxiv.org/content/10.1101/2022.04.18.22271936v1?rss
¶¶ https://www.medrxiv.org/content/10.1101/2021.10.25.21264964v1

FIGURE. Seroprevalence of infection-induced SARS-CoV-2 antibodies,* by age group — United States, September 2021–February 2022



* Error bars represent 95% CIs at each time point.

seropositive since December 2021. The greatest increases in seroprevalence during September 2021–February 2022, occurred in the age groups with the lowest vaccination coverage; the proportion of the U.S. population fully vaccinated by April 2022 increased with age (5–11, 28%; 12–17, 59%; 18–49, 69%; 50–64, 80%; and ≥65 years, 90%).*** Lower seroprevalence among adults aged ≥65 years, who are at greater risk for severe illness from COVID-19, might also be related to the increased use of additional precautions with increasing age (*3*).

These findings illustrate a high infection rate for the Omicron variant, especially among children. Seropositivity for anti-N antibodies should not be interpreted as protection from future infection. Vaccination remains the safest strategy for preventing complications from SARS-CoV-2 infection, including hospitalization among children and adults (*4,5*). COVID-19 vaccination following infection provides additional protection against severe disease and hospitalization (*6*). Staying up to date††† with vaccination is recommended for all eligible persons, including those with previous SARS-CoV-2 infection.

*** https://covid.cdc.gov/covid-data-tracker/#vaccination-demographics-trends (accessed April 17, 2022).

††† https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html

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Notes from the Field

Response to Measles Among Persons Evacuated from Afghanistan — Joint Base McGuire-Dix-Lakehurst, New Jersey, August–October 2021

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On August 29, 2021, the U.S. government initiated Operation Allies Welcome (OAW) to resettle eligible persons from Afghanistan. Evacuees were housed at military bases in the United States while completing immigration resettlement processing. On September 4, 2021, the Fort McCoy, Wisconsin, OAW site reported the first confirmed case of measles in an Afghan evacuee; during the subsequent 10 days, five additional cases were identified across multiple sites (*1*). On September 6, OAW response leadership learned that 16 evacuees at Joint Base McGuire-Dix-Lakehurst (JBMDL) had been exposed to a patient with confirmed measles during a September 3 United States-bound flight. Because of low routine measles vaccination coverage rates in Afghanistan (*2*), risk for measles transmission was high among evacuees at JBMDL, a population that would expand to >10,000 persons living in large tents and multifamily rooms, if any exposed evacuees developed measles. During September 7–9, the JBMDL OAW public health team, with support from local and state health departments and guidance from CDC, provided measles, mumps, and rubella (MMR) vaccine or immunoglobulin to exposed persons. Because of delayed reporting of the exposures and challenges locating evacuees, whose lodgings assignments were not always well documented or might have changed, postexposure prophylaxis was not administered within the recommended time frame.* Exposed persons were asked to quarantine and complied; however, because of space constraints, they were not moved into quarantine until 1 week after the exposure. None of the evacuees exposed to the patient on September 3 experienced measles signs or symptoms† during quarantine. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.§

Although MMR vaccination was already part of the immigration medical exam (*3*), the planned rate of 250 exams per day would have been inadequate to mitigate a potential measles outbreak, in light of the large number of evacuees housed at JBMDL. The public health team, in coordination with OAW leadership, recommended an immediate mass MMR vaccination campaign for all evacuees. The campaign was part of a coordinated effort to vaccinate evacuees at U.S. OAW sites and overseas transit locations after measles cases had been identified. Immigration medical exams were paused, and personnel were reassigned for campaign activities. The campaign ran during September 8–12; a total of 8,849 of 9,503 evacuees (93%) were screened for eligibility and a reliable record of vaccination. Vaccines were administered to eligible persons without documentation of previous vaccination, according to CDC recommendations.¶ Age-specific vaccination rates were calculated by merging vaccination and registration data. By September 12, among the 9,065 eligible evacuees residing at JBMDL, 7,962 (88%) had been vaccinated (Table). After the vaccination campaign, immigration medical exams resumed and were expected to identify any remaining unvaccinated persons. By October 31, among a total of 12,670 eligible evacuees, 12,437 (98%) had received the MMR vaccine.**

The public health team reinforced measles surveillance by briefing OAW medical providers on the measles case definition and reporting procedures. In September, four suspected measles cases were identified at JBMDL; all received negative test results†† from the New Jersey Department of Health. On October 3, a male infant aged 4 months was evaluated at the OAW medical facility with fever, diaper rash, and diarrhea; a fine maculopapular rash was observed on the chest but not the face. The infant was transferred to a local pediatric hospital and received a positive measles test result on October 6. The infant was not a known contact and was not age-eligible for MMR vaccination during the mass vaccination campaign; all other members of his family had been vaccinated on September 10. The infant arrived on September 9 with rash onset on October 3, indicating at least one undetected primary case at JBMDL.

* For postexposure prophylaxis, MMR vaccine should be administered within 72 hours or immunoglobulin within 6 days of initial measles exposure. All 16 exposed persons were placed in a 21-day quarantine based on date of last exposure (i.e., September 3). https://www.cdc.gov/measles/hcp/index.html#prophylaxis; https://www.cdc.gov/vaccines/pubs/surv-manual/chpt07-measles.pdf

† Quarantined persons were monitored for signs and symptoms of measles per the case definition of the Council of State and Territorial Epidemiologists. https://ndc.services.cdc.gov/case-definitions/measles-2013/

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

¶ Infants aged <6 months and pregnant women were not eligible to receive MMR vaccine. Varicella vaccine was offered to all nonpregnant persons aged ≥12 months, and COVID-19 vaccines were offered to all persons aged ≥12 years, consistent with guidance at the time. https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html; https://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html

** Date of arrival was not available for 609 evacuees; they were included in the October 31 data timepoint.

†† Persons with suspected cases received reverse transcription–polymerase chain reaction testing for the presence of measles virus RNA.

TABLE. Selected characteristics and measles, mumps, and rubella vaccination rates among Afghan evacuees — Joint Base McGuire-Dix-Lakehurst, New Jersey, September 12 and October 31, 2021

Characteristic	Total and vaccinated JBMDL evacuee population on specified date*			
	September 12		October 31	
	Total population	Vaccinated† no. (%)	Total population	Vaccinated§ no. (%)
Total eligible¶	**9,065**	**7,962 (88)**	**12,670**	**12,437 (98)**
Age group upon arrival				
6 mos–4 yrs	**1,396**	1,192 (85)	**1,925**	1,907 (99)
5–19 yrs	**3,085**	2,712 (88)	**4,213**	4,175 (99)
20–49 yrs	**4,191**	3,708 (88)	**5,952**	5,813 (92)
≥50 yrs	**389**	348 (89)	**560**	534 (95)
Unknown	**4**	2 (50)	**20**	8 (40)
Sex				
Female	**3,729**	3,275 (88)	**5,152**	5,051 (98)
Male	**5,330**	4,683 (88)	**7,430**	7,315 (98)
Unknown	**6**	4 (67)	**88**	71 (81)

Abbreviations: JBMDL = Joint Base McGuire-Dix-Lakehurst; MMR = measles, mumps, and rubella.
* Cumulative population. Departures from the base have not been subtracted.
† Includes persons who were vaccinated while at JBMDL and 40 persons who provided reliable proof of MMR vaccination.
§ Includes persons who were vaccinated while at JBMDL and 57 persons who provided reliable proof of MMR vaccination.
¶ Persons eligible for MMR vaccination include nonpregnant persons aged ≥6 mos.

Contact tracing identified 56 unvaccinated persons who lived in the same residential tent or were registered at the OAW medical facility on the same days as the infant with measles. Among these persons, 54 (96%) were not vaccine-eligible because of age (18; 32%), pregnancy (35; 63%), or medical contraindication to vaccination (one; 2%) at the time of the campaign. The public health team located and moved 45 (83%) of these persons into quarantine (11 persons could not be located). Among the 45 persons who were located, MMR vaccine was administered to the six eligible persons; immunoglobulin was offered to the 39 who remained ineligible, 36 (92%) of whom received it.[§§] No one developed measles symptoms during quarantine; as of February 1, 2022, no additional cases had been reported.

Early mass vaccination and other response efforts successfully halted the spread of measles; however, inaccurate documentation of evacuee lodging locations led to delays in locating or the inability to locate some exposed persons, and insufficient space resulted in delaying quarantine of exposed persons. Also, reliance on off-site laboratory testing delayed confirmation of suspected cases and prevented serologic testing of pregnant women, which would have eliminated the need to administer immunoglobulin to immune women. Future missions might consider vaccination of persons before arrival, reinforcing disease surveillance, and expanding capabilities for isolation, quarantine, and local testing.

[§§] Eleven of 13 infants, 24 of 25 pregnant women, and one woman who had medical contraindications for MMR vaccine received immunoglobulin. Two additional pregnant women received immunoglobulin but were subsequently unable to be located and moved into quarantine.

Acknowledgments

Members of Task Force Liberty public health team; medically trained evacuee volunteer team; U.S. Department of Defense medical team; International SOS medical team; Korrina Donald, Jerome Ragadio, Task Force Liberty; Maurice Masdeu, Patricia Walker, International SOS; Christine Atherstone, Mushtaq Dualeh, Laura Eloyan, Katherine Franc, Caitlin Green, Maliha Ishaq, Molly Layde, Stephen Miles, Ryan Schweitzer, Erica Sison, CDC Joint Base McGuire-Dix-Lakehurst Team; Paul Gastañaduy, David Sugerman, National Center for Immunization and Respiratory Diseases, CDC.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. Andrea Shahum reports support from International SOS for her work as a public health liaison and infectious diseases physician. No other potential conflicts of interest were disclosed.

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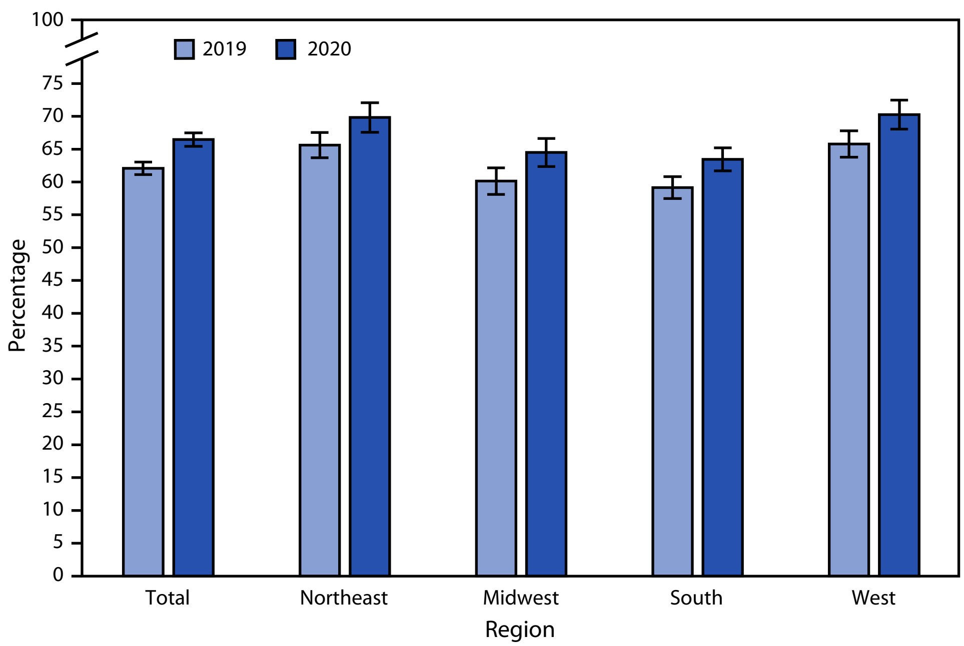
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Currently Employed Adults Aged ≥18 Years Who Had Paid Sick Leave Benefits† at Last Week's Job or Business, by Region — National Health Interview Survey, United States, 2019 and 2020§



* With 95% CIs indicated by error bars.

† Based on responses to the question, "Regarding your job or work last week, is paid sick leave available if you need it?"

§ Estimates were based on household interviews of a sample of adults aged ≥18 years who were working last week, were not working last week because they were temporarily absent, or who performed seasonal or contract work. The number of employed adults declined 5.1% from 2019 to 2020, particularly among workers without access to paid sick leave.

The percentage of currently employed adults who had access to paid sick leave increased from 62.1% in 2019 to 66.5% in 2020. During this period, increases were noted among all regions of the country (Northeast: from 65.6% to 69.8%, Midwest: from 60.1% to 64.5%, South: from 59.1% to 63.5%, and West: from 65.8% to 70.3%). In both years, rates were highest in the Northeast and West and lowest in the Midwest and South.

Source: National Health Interview Survey, 2019–2020 data. https://www.cdc.gov/nchs/nhis.htm

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For more information about this topic, CDC recommends the following link: https://blogs.cdc.gov/niosh-science-blog/2012/07/30/sick-leave/

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ISSN: 0149-2195 (Print)