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Prevalence of Cardiometabolic Diseases Among Racial and Ethnic Subgroups in Adults — Behavioral Risk Factor Surveillance System, United States, 2013–2021

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Abstract

Although diabetes and cardiovascular disease account for substantial disease prevalence among adults in the United States, their prevalence among racial and ethnic subgroups is inadequately characterized. To fill this gap, CDC described the prevalence of diagnosed cardiometabolic diseases among U.S. adults, by disaggregated racial and ethnic subgroups, among 3,970,904 respondents to the Behavioral Risk Factor Surveillance System during 2013–2021. Prevalence of each disease (diabetes, myocardial infarction, angina or coronary heart disease, and stroke), stratified by race and ethnicity, was based on self-reported diagnosis by a health care professional, adjusting for age, sex, and survey year. Overall, mean respondent age was 47.5 years, and 51.4% of respondents were women. Prevalence of cardiometabolic diseases among disaggregated race and ethnicity subgroups varied considerably. For example, diabetes prevalence within the aggregated non-Hispanic Asian category (11.5%) ranged from 6.3% in the Vietnamese subgroup to 15.2% in the Filipino subgroup. Prevalence of angina or coronary heart disease for the aggregated Hispanic or Latino category (3.8%) ranged from 3.1% in the Cuban subgroup to 6.3% in the Puerto Rican subgroup. Disaggregation of cardiometabolic disease prevalence data by race and ethnicity identified health disparities among subgroups that can be used to better help guide prevention programs and develop culturally relevant interventions.

Introduction

Cardiometabolic diseases affect a substantial proportion of adults in the United States, including approximately 11% who have diagnosed diabetes,* and 10% who have diagnosed cardiovascular disease (coronary heart disease, heart failure, or stroke) (*1*). Few recent studies have provided estimates of the prevalence of cardiometabolic diseases in disaggregated racial and ethnic subgroups in large nationwide samples (*2*,*3*). Documentation of racial and ethnic disparities in cardiometabolic diseases is typically aggregated because sample sizes are insufficient or because racial and ethnic subgroup data were not collected. These limitations can obscure differences in disease prevalence among disaggregated subgroups that might result from differences in social determinants of health and other drivers of health inequities.

Although racial and ethnic disparities in cardiometabolic disease prevalence have been documented,†,§,¶ a disaggregated analysis of racial and ethnic groups might better characterize

* https://www.cdc.gov/diabetes/data/statistics-report/index.html#anchor_40084

† https://www.cdc.gov/diabetes/data/statistics-report/appendix.html#tabs-1-1
§ https://www.cdc.gov/heartdisease/facts.htm
¶ https://www.cdc.gov/nchs/data/hus/2018/013.pdf

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unique patterns of disease prevalence that can more effectively guide prevention and treatment strategies in disaggregated racial and ethnic subgroups at higher risk. To address this gap, CDC evaluated the prevalence of cardiometabolic diseases among selected racial and ethnic subgroups among approximately 4 million adult respondents to the Behavioral Risk Factor Surveillance System (BRFSS) during 2013–2021.

Methods

Study Population

BRFSS is an annual random-digit–dialed landline and cellular telephone-based survey representative of noninstitutionalized adults aged ≥18 years from all 50 states, the District of Columbia, and three U.S. territories.** BRFSS includes questions on health-related behavioral risk factors, health care access, and chronic conditions. The study period included 2013, the first year that BRFSS collected disaggregated data on selected race and ethnicity subgroups, through 2021. Among the 4,030,567 total respondents, the analysis excluded 58,743 (1.5%) who were missing data on age, sex, or race and ethnicity, and 1,525 (0.4%) who did not include data on any cardiometabolic diseases. The analysis included the remaining 3,970,904 (98.5%) respondents. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.††

Measurements

Demographic information included age and sex. Respondents who reported Hispanic or Latino (Hispanic) ethnicity were categorized as Hispanic regardless of race. Non-Hispanic respondents were categorized by race. Race and ethnicity choices and corresponding disaggregated subgroups on the questionnaire included Hispanic (Cuban, Mexican, Puerto Rican, or Other Hispanic), non-Hispanic American Indian or Alaska Native (AI/AN), non-Hispanic Asian (Asian [Chinese, Filipino, Indian, Japanese, Korean, Vietnamese, or Other Asian]), non-Hispanic Black or African American (Black), non-Hispanic Pacific Islander (Pacific Islander [Guamanian or Chamorro, Native Hawaiian, Samoan, or other Pacific Islander]), non-Hispanic White (White), non-Hispanic Multiracial, and non-Hispanic Other. Other variables included weight status (underweight, normal, overweight, or obesity as determined by body mass index [BMI] in kg/m2 using World Health Organization criteria for Asian and non-Asian populations) (*4*), physical activity (defined as leisure-time physical activity at least one time in the last month), and smoking status (current, former, or never). Prevalence of cardiometabolic diseases

** https://www.cdc.gov/brfss/about/index.htm

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

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(diabetes [excluding gestational diabetes], myocardial infarction [MI], angina or coronary heart disease [CHD], or stroke) was based on self-reported diagnosis by a physician or other health care professional.

Statistical Analysis

Prevalence of each cardiometabolic disease was estimated from multivariable logistic models adjusted for age, sex, and survey year. Sample weights and design variables were used to account for the complex survey design. Two-sided p-values <0.05 were considered statistically significant. Analyses were conducted using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0.1; Research Triangle Institute).

Results

Among a total of 3,970,904 adults, the mean respondent age was 47.5 years, and 51.4% were women (Table 1). Among both aggregated groups and disaggregated subgroups, the proportion of adults reporting less than a high school education varied from 2.7% among Korean adults to 41.5% among Mexican adults. The proportion of adults with obesity ranged from 12.0% among Chinese adults to 51.2% among Samoan adults.

Diabetes

The overall prevalence of diabetes was 10.9% (Table 2); the range among aggregated race and ethnicity groups was from 9.1% among White adults to 16%–17% among AI/AN, Black, and Pacific Islander adults. Prevalence was 11.5% for the aggregated Asian category; among disaggregated Asian subgroups, prevalence ranged from 6.3% for Vietnamese adults to 15.2% for Filipino adults. Diabetes prevalence among all subgroups was highest among Samoan adults (20.3%).

Angina, Coronary Heart Disease, Myocardial Infarction, and Stroke

The overall prevalence of angina or CHD was 4.1%; the range among aggregated race and ethnicity groups was from 2.8% among Asian adults to 6.1% among AI/AN adults. Among subgroups, prevalence ranged from 1.1% among Korean adults to 7.2% among Guamanian or Chamorro adults. The prevalence for the aggregated Hispanic category was 3.8% and ranged from 3.1% among Cuban adults to 6.3% among Puerto Rican adults. Overall prevalence of MI was 4.3%; the pattern of variation among aggregated race and ethnicity groups was similar to that of angina or CHD. Prevalence of stroke was 3.2% overall, ranging from 1.8% among Asian adults to 6.2% among AI/AN adults.

Discussion

Findings from this study illustrate pronounced differences in cardiometabolic disease prevalence among racial and ethnic subgroups, with the largest variation occurring in diabetes prevalence. Among Hispanic subgroups, diabetes prevalence was highest for Mexican and Puerto Rican adults and lowest for Cuban adults. Among Asian subgroups, diabetes prevalence was highest for Filipino and Indian adults and lowest for Chinese, Korean, and Vietnamese adults.

Hispanic Subgroups

In the current study, although the prevalence of diabetes was the same among both Puerto Rican and Mexican adults, prevalence of angina or CHD was approximately twice as high among Puerto Rican adults. In a cohort study during 2008–2011, elevated prevalence of cardiometabolic diseases in the Puerto Rican subgroup was associated with a higher prevalence of cardiovascular risk factors such as smoking (*5*). Increased acculturation was also associated with a higher prevalence of cardiovascular disease risk factors (*5*). Prevalence of current smoking was higher in the Puerto Rican group than in the Mexican group, both in the current study and during 2008–2011. The prevalence of physical activity during the past month was lower in the Puerto Rican group in the current study; Puerto Rican adults had higher educational attainment and a slightly lower prevalence of overweight and obesity. It is unclear how this overall combination of risk factors might explain the observed pattern of cardiometabolic diseases in the current study.

Asian and Pacific Islander Subgroups

A higher prevalence of most cardiometabolic diseases among Filipino and Indian adults compared with other Asian subgroups might be partly attributed to differences in the prevalences of hypertension, hyperlipidemia, and overweight or obesity (*2*,*6*). In the current study, prevalence of overweight or obesity was higher among Filipino and Indian adults than among other Asian subgroups, as has been reported previously (*2*,*6*). Because of small sample sizes, high variability in prevalence estimates makes subgroup disparities difficult to infer among Pacific Islander adults. In the current study, educational attainment and prevalence of physical activity in the past month were higher among Native Hawaiian adults compared with other Pacific Islander subgroups, although variability of prevalence estimates overall was high. Similarly, a previous study of 561 patients hospitalized with ischemic stroke suggested that Native Hawaiian adults might have a more favorable cardiovascular profile than do other Pacific Islander adults (*7*).

TABLE 1. Characteristics of adults aged ≥18 years, by race and ethnicity — Behavioral Risk Factor Surveillance System, United States, 2013–2021

Group (no. of persons; %)*	Mean age, yrs (95% CI)	% (95% CI)							
		Women	Less than high school education	Weight status† Overweight	Weight status† Obese	Physical activity in past month¶	Smoking status§ Never	Smoking status§ Former	Smoking status§ Current
Total (3,970,904)	**47.5 (47.5–47.6)**	**51.4 (51.3–51.5)**	**13.6 (13.5–13.7)**	**35.7 (35.6–35.8)**	**30.8 (30.7–30.9)**	**74.9 (74.8–75.0)**	**59.8 (59.7–60.0)**	**24.2 (24.1–24.3)**	**15.9 (15.9–16.0)**
American Indian or Alaska Native, NH (66,022; 1.0%)	**46.3 (46.0–46.6)**	**49.8 (48.9–50.6)**	**20.3 (19.6–21.1)**	**33.6 (32.8–34.4)**	**37.1 (36.2–37.9)**	**71.6 (70.8–72.4)**	**46.3 (45.5–47.2)**	**24.7 (24.0–25.5)**	**28.9 (28.1–29.7)**
Asian, NH (90,298; 5.3%)	**40.9 (40.7–41.2)**	**50.1 (49.4–50.8)**	**4.7 (4.4–5.1)**	**41.5 (40.7–42.2)**	**20.5 (19.9–21.0)**	**79.9 (79.4–80.5)**	**80.2 (79.6–80.8)**	**12.2 (11.7–12.6)**	**7.6 (7.3–8.0)**
Chinese (14,035; 1.0%)	39.5 (38.9–40.0)	52.6 (51.0–54.1)	3.1 (2.5–3.9)	38.1 (36.5–39.8)	12.0 (10.9–13.2)	81.6 (80.2–82.8)	85.3 (84.1–86.5)	8.6 (7.7–9.6)	6.1 (5.4–6.9)
Filipino (17,063; 0.7%)	45.7 (44.9–46.5)	59.9 (57.9–61.8)	6.1 (5.1–7.2)	43.0 (41.0–45.2)	27.4 (25.6–29.3)	77.8 (76.1–79.5)	75.2 (73.4–77.0)	15.7 (14.3–17.2)	9.0 (7.9–10.3)
Indian (17,851; 1.2%)	40.4 (40.0–40.8)	43.0 (41.7–44.4)	3.7 (3.2–4.3)	46.6 (45.2–48.0)	22.5 (21.3–23.7)	80.4 (79.3–81.5)	84.9 (84.0–85.8)	9.5 (8.8–10.2)	5.6 (5.1–6.2)
Japanese (12,663; 0.3%)	55.4 (54.4–56.4)	57.6 (54.8–60.4)	3.8 (2.7–5.3)	36.8 (34.0–39.6)	25.8 (23.1–28.7)	80.7 (78.3–82.9)	61.9 (58.9–64.8)	28.7 (26.0–31.5)	9.4 (7.7–11.5)
Korean (4,355; 0.3%)	37.4 (36.4–38.3)	50.6 (47.6–53.6)	2.7 (2.0–3.7)	40.1 (37.0–43.3)	16.1 (14.0–18.4)	81.6 (78.9–84.0)	68.5 (65.7–71.1)	18.0 (15.9–20.4)	13.5 (11.7–15.5)
Vietnamese (3,142; 0.3%)	36.8 (35.7–37.8)	46.9 (43.5–50.2)	7.0 (4.8–10.2)	37.6 (34.4–40.9)	13.5 (11.6–15.6)	78.3 (75.6–80.7)	81.3 (78.7–83.6)	9.7 (8.0–11.8)	9.0 (7.4–10.9)
Other Asian (21,189; 1.5%)	39.1 (38.6–39.6)	49.0 (47.6–50.4)	6.0 (5.3–6.8)	40.8 (39.4–42.2)	22.5 (21.3–23.7)	79.2 (78.1–80.3)	80.4 (79.3–81.5)	11.5 (10.6–12.4)	8.1 (7.4–8.7)
Black or African American, NH (315,725; 11.8%)	**45.7 (45.6–45.8)**	**54.2 (53.8–54.5)**	**14.4 (14.1–14.6)**	**33.5 (33.2–33.8)**	**39.6 (39.2–39.9)**	**70.1 (69.8–70.4)**	**65.9 (65.5–66.2)**	**16.0 (15.8–16.2)**	**18.1 (17.9–18.4)**
Pacific Islander, NH (16,421; 0.2%)	**40.6 (40.1–41.2)**	**49.1 (47.3–50.8)**	**11.8 (10.7–13.0)**	**32.6 (30.9–34.4)**	**35.5 (33.8–37.3)**	**76.7 (75.2–78.2)**	**62.3 (60.5–64.0)**	**18.8 (17.4–20.2)**	**19.0 (17.6–20.4)**
Guamanian or Chamorro (5,163; 0.02%)	42.0 (40.7–43.3)	50.6 (46.6–54.6)	18.9 (16.3–21.9)	36.8 (32.4–41.4)	40.6 (36.8–44.5)	72.5 (69.1–75.6)	53.6 (49.7–57.5)	18.1 (15.6–20.9)	28.3 (25.0–31.7)
Native Hawaiian (3,411; 0.04%)	43.6 (42.4–44.8)	51.1 (47.6–54.6)	8.3 (6.6–10.3)	32.7 (29.5–36.1)	38.1 (34.9–41.5)	79.3 (76.3–82.1)	55.2 (51.7–58.8)	24.7 (21.8–27.8)	20.1 (17.3–23.2)
Samoan (938; 0.02%)	37.6 (36.2–39.0)	42.8 (36.9–49.0)	10.5 (7.5–14.4)	29.2 (23.4–35.7)	51.2 (44.5–57.8)	75.5 (70.0–80.3)	56.5 (49.9–62.8)	17.7 (12.6–24.3)	25.8 (21.0–31.3)
Other Pacific Islander (6,909; 0.1%)	40.0 (39.3–40.8)	49.1 (46.6–51.5)	11.6 (10.0–13.3)	32.3 (30.0–34.7)	31.7 (29.4–34.1)	77.0 (74.8–79.0)	66.6 (64.1–68.9)	17.5 (15.7–19.4)	16.0 (14.2–17.9)
White, NH (3,041,848; 62.8%)	**50.3 (50.2–50.3)**	**51.4 (51.3–51.5)**	**8.3 (8.2–8.4)**	**35.3 (35.2–35.5)**	**29.3 (29.2–29.4)**	**77.0 (76.9–77.1)**	**54.6 (54.5–54.7)**	**28.6 (28.5–28.7)**	**16.7 (16.7–16.8)**
Hispanic or Latino (333,673; 17.0%)	**41.3 (41.2–41.4)**	**50.3 (50.0–50.7)**	**35.5 (35.2–35.8)**	**37.3 (36.9–37.6)**	**33.6 (33.3–34.0)**	**68.4 (68.1–68.7)**	**70.7 (70.3–71.0)**	**16.9 (16.6–17.1)**	**12.5 (12.2–12.7)**
Cuban (7,566; 0.5%)	47.9 (47.0–48.8)	49.2 (46.9–51.5)	18.9 (17.0–21.0)	37.8 (35.4–40.2)	30.7 (28.5–33.1)	65.6 (63.2–67.9)	62.6 (60.2–64.9)	20.0 (18.1–21.9)	17.4 (15.6–19.5)
Mexican (149,206; 9.2%)	40.4 (40.2–40.5)	49.8 (49.3–50.3)	41.5 (41.0–42.0)	37.5 (37.0–38.1)	36.2 (35.7–36.7)	69.6 (69.1–70.1)	71.5 (71.1–72.0)	16.3 (16.0–16.7)	12.2 (11.8–12.5)
Puerto Rican (75,871; 2.4%)	44.8 (44.6–45.0)	52.9 (52.3–53.5)	22.9 (22.4–23.5)	35.5 (34.9–36.2)	33.1 (32.5–33.7)	61.1 (60.5–61.7)	65.4 (64.8–66.0)	19.0 (18.5–19.5)	15.6 (15.1–16.1)
Other Hispanic or Latino (101,030; 4.9%)	40.7 (40.5–40.9)	50.2 (49.6–50.8)	32.4 (31.8–33.0)	37.6 (37.0–38.2)	29.4 (28.8–30.0)	70.2 (69.6–70.7)	72.7 (72.1–73.2)	16.5 (16.1–17.0)	10.8 (10.4–11.2)
Multiracial, NH (80,117; 1.4%)	**42.3 (42.0–42.6)**	**51.3 (50.6–52.1)**	**11.2 (10.7–11.8)**	**32.2 (31.5–32.9)**	**31.8 (31.1–32.5)**	**78.2 (77.6–78.8)**	**53.6 (52.8–54.3)**	**23.2 (22.5–23.8)**	**23.3 (22.6–23.9)**
Other, NH (26,800; 0.5%)	**47.8 (47.4–48.3)**	**46.3 (45.1–47.5)**	**12.7 (11.8–13.6)**	**35.8 (34.6–37.0)**	**27.5 (26.3–28.6)**	**75.0 (74.0–76.0)**	**59.2 (58.0–60.4)**	**23.0 (22.0–24.1)**	**17.8 (16.8–18.7)**

Abbreviation: NH = non-Hispanic.

* Row percentages are weighted and represent the proportion of the total population for each group or disaggregated subgroup.

† Categories are based on World Health Organization thresholds of body mass index (kg/m^2) (non-Asian: <18.5 [underweight], 18.5–24.9 [normal], 25.0–29.9 [overweight], ≥30 [obese]; Asian: <18.5 [underweight], 18.5–22.9 [normal], 23.0–27.4 [overweight], or ≥27.5 [obese]).

§ Current smokers are defined as respondents who reported having smoked at least 100 cigarettes in their lifetime and now smoke every day or some days. Former smokers are those who reported having smoked at least 100 cigarettes in their lifetime and currently do not smoke. Never smokers are those who reported they had not smoked at least 100 cigarettes in their lifetime.

¶ Defined as self-reported leisure-time physical activity at least once in the past month.

TABLE 2. Adjusted prevalence of cardiometabolic diseases among adults aged ≥18 years, by race and ethnicity — Behavioral Risk Factor Surveillance System, United States, 2013–2021

Group (no. of persons)	% (95% CI)*			
	Diabetes	Angina or coronary heart disease	Myocardial infarction	Stroke
Total (3,970,904)	**10.9 (10.8–11.0)**	**4.1 (4.1–4.2)**	**4.3 (4.3–4.3)**	**3.2 (3.1–3.2)**
American Indian or Alaska Native, NH (66,022)	**16.8 (16.2–17.4)**	**6.1 (5.7–6.4)**	**7.9 (7.5–8.3)**	**6.2 (5.9–6.6)**
Asian, NH (90,298)	**11.5 (11.0–12.0)**	**2.8 (2.5–3.1)**	**2.6 (2.4–2.9)**	**1.8 (1.6–2.1)**
Chinese (14,035)	7.0 (6.1–8.1)	1.7 (1.3–2.4)	1.7 (1.3–2.3)	1.3 (1.0–1.8)
Filipino (17,063)	15.2 (13.8–16.8)	3.6 (2.9–4.6)	3.1 (2.3–4.1)	2.4 (1.8–3.2)
Indian (17,851)	14.7 (13.7–15.7)	3.5 (2.9–4.1)	3.3 (2.8–4.0)	1.4 (1.1–1.8)
Japanese (12,663)	9.6 (8.1–11.4)	2.2 (1.6–3.1)	1.9 (1.3–2.8)	2.1 (1.5–2.9)
Korean (4,355)	7.2 (5.8–9.0)	1.1 (0.7–1.8)	1.7 (1.1–2.5)	3.0 (1.5–5.8)†
Vietnamese (3,142)	6.3 (4.7–8.4)	1.7 (0.9–3.1)	2.3 (1.3–3.9)	2.0 (1.1–3.5)
Other Asian (21,189)	11.8 (10.8–13.0)	3.0 (2.4–3.6)	2.9 (2.4–3.4)	1.8 (1.4–2.3)
Black or African American, NH (315,725)	**16.2 (16.0–16.4)**	**4.1 (3.9–4.2)**	**4.6 (4.4–4.7)**	**5.0 (4.9–5.1)**
Pacific Islander, NH (16,421)	**16.6 (15.2–18.0)**	**5.1 (4.1–6.3)**	**5.4 (4.5–6.4)**	**4.3 (3.6–5.3)**
Guamanian or Chamorro (5,163)	19.9 (17.1–23.1)	7.2 (4.8–10.7)	6.1 (4.7–8.0)	5.8 (3.9–8.6)
Native Hawaiian (3,411)	14.6 (12.1–17.4)	5.6 (3.7–8.4)	7.6 (5.5–10.4)	6.1 (4.2–8.9)
Samoan (938)	20.3 (14.8–27.1)	5.1 (2.8–9.2)†	5.6 (3.5–8.8)	4.3 (2.6–7.1)
Other Pacific Islander (6,909)	16.0 (14.2–18.0)	4.5 (3.2–6.2)	4.5 (3.3–6.0)	3.4 (2.5–4.6)
White, NH (3,041,848)	**9.1 (9.0–9.1)**	**4.2 (4.2–4.3)**	**4.2 (4.2–4.3)**	**2.9 (2.9–3.0)**
Hispanic or Latino (333,673)	**15.3 (15.1–15.6)**	**3.8 (3.7–4.0)**	**4.4 (4.3–4.6)**	**2.9 (2.8–3.0)**
Cuban (7,566)	11.0 (9.7–12.4)	3.1 (2.3–4.0)	4.5 (3.6–5.5)	2.4 (1.8–3.1)
Mexican (149,206)	16.7 (16.3–17.1)	3.2 (2.9–3.4)	4.1 (3.9–4.3)	2.8 (2.6–3.0)
Puerto Rican (75,871)	16.7 (16.2–17.1)	6.3 (6.0–6.6)	5.3 (5.0–5.6)	3.2 (2.9–3.5)
Other Hispanic or Latino (101,030)	12.6 (12.2–13.1)	3.5 (3.3–3.8)	4.4 (4.2–4.7)	3.0 (2.8–3.2)
Multiracial, NH (80,117)	**12.8 (12.3–13.3)**	**5.6 (5.3–6.0)**	**6.5 (6.1–6.9)**	**5.4 (5.1–5.8)**
Other, NH (26,800)	11.3 (10.6–12.0)	4.4 (4.0–4.8)	4.6 (4.2–5.0)	3.9 (3.5–4.4)

Abbreviation: NH = non-Hispanic.
* Prevalence is adjusted for age, sex, and survey year. Each cardiometabolic disease (diabetes, myocardial infarction, angina or coronary heart disease, or stroke) is based on self-reported diagnosis by a health care professional.
† Estimate has a relative SE ≥0.30 and is therefore considered statistically unreliable.

Cardiometabolic Disease and BMI

Evidence suggests that a specific distribution of ectopic fat as a measure of adiposity might be a stronger marker of cardiometabolic diseases than BMI (*8*). The generally low BMI but high diabetes risk among Asian populations (*9*) might provide unique opportunities to better understand diabetes etiology and shed light on the paradoxical continuing increase in obesity rates[§§] concurrent with recent declining diabetes incidence in the United States.[¶¶]

Limitations

The findings in this report are subject to at least three limitations. First, self-reported information might be subject to bias, including underreporting of disease prevalence. Underreporting, such as that associated with undiagnosed disease, might affect prevalence estimates to different degrees in different groups. Second, because the survey questionnaire did not collect disaggregated data for AI/AN (e.g., by tribal affiliation or tribal enrollment status), Black, and White adults, potential subgroup disparities could not be assessed among these groups. Finally, information was not available on other relevant factors related to disaggregated race and ethnicity, such as country of birth or English language proficiency.

Implications for Public Health Practice

Continued collection and analysis of disaggregated data could enable more accurate characterization of racial and ethnic disparities in cardiometabolic diseases among U.S. adults. Collection of clinical data with comparable definitions of race and ethnicity might allow comparison of prevalence estimates with self-reported data. Further, as availability of disaggregated data increases, increased use of such data might allow implementation of better tailored disease prevention and management programs. A greater body of evidence might allow an evaluation of how best to implement and financially sustain these programs, train staff members in cultural competency, and maximize the effectiveness in reducing health disparities.

§§ https://www.cdc.gov/nchs/data/hus/2019/026-508.pdf
¶¶ https://www.cdc.gov/diabetes/data/statistics-report/index.html#anchor_63700

Summary

What is already known about this topic?

Diabetes and cardiovascular disease account for substantial disease prevalence among U.S. adults.

What is added by this report?

In this survey of nearly 4 million U.S. adults, prevalence of diagnosed cardiometabolic diseases varied up to twofold among disaggregated racial and ethnic subgroups. Diabetes prevalence among U.S. Asian subgroups ranged from 6.3% among Vietnamese adults to 15.2% among Filipino adults. Among U.S. Hispanic or Latino subgroups, prevalence of angina or coronary heart disease ranged from 3.1% among Cuban adults to 6.3% among Puerto Rican adults.

What are the implications for public health practice?

Disaggregated categories of race and ethnicity are crucial in accurately identifying and addressing disparities in cardiometabolic diseases and can be used to help guide prevention programs and development of culturally relevant interventions among U.S. adults.

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Underuse of Antiviral Drugs to Prevent Progression to Severe COVID-19 — Veterans Health Administration, March–September 2022

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Abstract

Antiviral drugs reduce the rate of progression to severe COVID-19 when given to patients with mild-to-moderate disease within 5 days of symptom onset. Despite being recommended for patients at high risk for progression to severe COVID-19 because of age or chronic conditions, reported antiviral use among the general adult population has been ≤35%. To ascertain reasons for underuse of antiviral medications to prevent severe COVID-19 and propose interventions accordingly, a detailed review was conducted of 110 Veterans Health Administration patients with mild-to-moderate infection at high risk for progression because of underlying conditions (organ transplantation or hematologic malignancies) who did not receive an antiviral drug. Among these 110 patients, all of whom had received COVID-19 vaccine, 22 (20.0%) were offered treatment but declined, and 88 (80.0%) were not offered treatment. Among the 88 patients not offered treatment, provider reasons included symptom duration of >5 days (22.7%), concern about possible drug interactions (5.7%), or absence of symptoms (22.7%); however, among nearly one half (43 of 88; 48.9%) of these patients, no reason other than mild symptoms was given. Among 24 (55.8%) of those 43 patients, follow-up was limited to telephone calls to report test results and inquire about symptom evolution, with no documentation of treatment being offered. These findings suggest that education of patients, providers, and medical personnel tasked with follow-up calls, combined with advance planning in the event of a positive test result, might improve the rate of recommended antiviral medication use to prevent severe COVID-19–associated illness, including death.

Introduction

Use of the antiviral drugs nirmatrelvir/ritonavir (Paxlovid) and remdesivir (Veklury) is approved by the Food and Drug Administration (FDA); molnupiravir (Lagevrio) is authorized for emergency use.* These antiviral medications reduce the risk of hospitalization and death and are recommended for patients with mild-to-moderate COVID-19 who are at high risk for progression to severe COVID-19 because of age or medical conditions (*1*). All three of these drugs have retained activity against different circulating SARS-CoV-2 variants. In contrast, by late 2022, monoclonal antibodies had lost activity against prevalent variants (*2*).

Despite demonstrated effectiveness and guideline endorsement (*3*,*4*), use of antiviral medications appears to be considerably lower than expected, based on the prevalence of risk factors for severe COVID-19. A recent study of patients in the Veterans Health Administration (VA) reported use of outpatient antiviral medications among 24% of all documented SARS-CoV-2 infections in 2022, remaining at that level through early 2023 (*5*). Description of the untreated comparison group clearly showed that many patients would have met treatment criteria. Similar overall rates of use (maximum = 34%) were observed in a large cohort from health care systems participating in the National Patient-Centered Clinical Research Network (PCORnet) (*6*).

To identify barriers to antiviral use that might be addressed through novel implementation strategies, a sample of VA patients with COVID-19 was reviewed to ascertain the reasons for the nontreatment of patients with mild-to-moderate disease at the time of initial evaluation and testing. These patients had all received COVID-19 vaccination and had one of three relatively common conditions associated with severe immunocompromise, placing them at risk for progression to severe COVID-19 despite vaccination (solid organ transplantation, chronic lymphocytic leukemia [CLL], or plasma cell malignancies).

Methods

Study Cohort and Patient Characteristics

Data on vaccination and SARS-CoV-2 infection and demographic and clinical data were obtained from the VA COVID-19 Shared Data Resource (*7*) and from electronic medical records (EMRs) and vital status in the Corporate Data Warehouse, respectively. The VA Joint Legacy Viewer interface, a web application that provides an integrated read-only view of EMR data from the VA, Department of Defense, and community partners[†,§] was used for chart review.

* https://www.fda.gov/media/155055/download

† https://www.va.gov/vdl/documents/Clinical/Joint_Longitudinal_Viewer_(JLV)/jlv_2_9_ug.pdf

§ Care at a non-VA facility is not always documented in patients' records. Although some patients might have received care at a non-VA facility, all 110 patients included in the analysis had sufficient VA data to be classified. Patients whose records suggested that they might have received an antiviral elsewhere were excluded from the analysis.

The first date of a documented positive SARS-CoV-2 test result was used to define infection after vaccination. Data were limited to infections documented from March 1, 2022 (when effective oral antivirals became widely available to treat outpatients with mild-to-moderate COVID-19) (*5*), through September 30, 2022. Patients with a diagnosis of solid organ transplantation, CLL, or plasma cell malignancies were initially identified by single use of *International Classification of Diseases, Tenth Revision* (ICD-10) codes during January 1, 2021–September 30, 2022. Use of immunosuppressive or antineoplastic drugs was ascertained 3–12 months before the date of infection (depending on the drug). Nonuse of oral (by outpatient pharmacy dispensing records) or intravenous antiviral drugs (by orders placed) was preliminarily ascertained from 5 days before (to identify treatment based on a non-VA test) to 28 days after the VA test. The electronic search for prescription of an antiviral was limited to nirmatrelvir/ritonavir, molnupiravir, and monoclonal antibodies, because pharmacy records preclude distinguishing between remdesivir use to treat versus prevent severe COVID-19 (*5*). Severe COVID-19 was defined as 1) death within 28 days after the positive test result, or 2) hospitalization with either use of dexamethasone or evidence of at least mild hypoxemia (minimum oxygen saturation <94% or any use of supplemental oxygen) (*8*).

Comorbidities were defined using ICD-10 codes per the Chronic Conditions Warehouse¶ during the 12 months preceding initial vaccination.** Presence of comorbidities was summarized as a count (0–6) of six chronic conditions that have been associated with severe COVID-19 after vaccination (*8*,*9*). To improve representativeness of the high-risk VA population and to reduce the prevalence of missing data, the study was limited to patients who had documentation of either 2 doses of an mRNA COVID-19 vaccine or 1 dose of an adenoviral COVID-19 vaccine.

Sampling and Inclusion Criteria

The full cohort comprised 1,196 VA patients who received a vaccination for COVID-19; had an ICD-10 code indicating solid organ transplantation, CLL, or plasma cell malignancy; and had received a positive SARS-CoV-2 test result during March 1–September 30, 2022. A random sample of patients without EMR evidence of prescription of antiviral medication was then selected for detailed chart review. To obtain a random sample, a random number was assigned to each case, and cases were reviewed in sequential order beginning with the lowest assigned number until the target number of cases meeting criteria for inclusion was obtained.

After chart review, patients were included in the analysis of reasons for nonreceipt of antiviral medication if the patients met the following criteria: 1) confirmation of a diagnosis of solid organ transplantation, CLL, or plasma cell malignancy; 2) confirmation of no evidence of antiviral use at either a VA or non-VA facility; and 3) initial medical evaluation of mild-to-moderate COVID-19. Review proceeded until 110 cases meeting inclusion criteria were classified. A target of 100 cases was chosen to allow reasonable precision in estimating the frequency of a common event (for example, an outcome of 28% would have a 95% CI of 20%–36%) for a time-intensive process. The aim was to include similar numbers of cases of solid organ transplantation and hematologic malignancies (including numbers of patient with CLL or plasma cell malignancies).

Data Analysis

A member of the study team conducted chart review and classified each case using the following criteria: 1) antiviral was offered, and the patient declined treatment; or antiviral was not offered because of 2) symptom duration >5 days; 3) concern about drug interactions expressed by the provider; 4) administrative barriers or delays; or 5) not determined to be indicated because of mild or asymptomatic disease, with the option for antiviral treatment either rejected by the provider or not mentioned. Reference to a patient's or provider's concern for Paxlovid rebound (a phenomenon of temporary recurrence of symptoms shortly after completing a standard 5-day Paxlovid treatment) was also recorded.

Among cases that were reviewed but did not meet inclusion criteria for analysis, the proportion for which an antiviral was received for mild-to-moderate COVID-19 but was not discernible from the initial electronic screen of EMR (e.g., remdesivir given for 3 days, or an oral antiviral given in the emergency department or through a non-VA pharmacy) was determined, to better estimate under usage of antivirals. This activity was determined to be exempt from Institutional Review Board (IRB) oversight or a requirement for informed consent by the IRB of the VA Boston Healthcare System.††

Results

Patient Characteristics

Among all 1,196 patients, 96% were male, nearly two thirds (64%) were non-Hispanic White, and 84% had received a COVID-19 vaccine booster dose (Table 1). Those with solid organ transplantation (317) were younger (mean age = 64.6 years) than were the 472 patients with CLL

¶ https://www2.ccwdata.org/web/guest/home/

** Comorbidities included Alzheimer disease and other forms of dementia, chronic kidney disease, chronic obstructive pulmonary disease or bronchiectasis, diabetes, heart failure, and peripheral vascular disease.

†† 38 C.F.R 16.104d(4)iii.

TABLE 1. Demographic and clinical characteristics of COVID-19–vaccinated veterans with selected immunosuppressive conditions and mild-to-moderate or asymptomatic COVID-19* — Veterans Health Administration, United States, March–September 2022

Characteristic	No. (%)							
	Total		Solid organ transplantation		Chronic lymphocytic leukemia		Plasma cell malignancy	
	All cases N = 1,196	Reviewed† n = 110	All cases N = 317	Reviewed† n = 50	All cases N = 472	Reviewed† n = 30	All cases N = 407	Reviewed† n = 30
Age, yrs, mean (SD)	**71.6 (10.9)**	**70.5 (11.0)**	64.6 (10.5)	65.1 (10.9)	75.3 (9.7)	78.3 (9.2)	72.7 (9.9)	71.8 (7.2)
Male sex	**1,146 (95.8)**	**101 (91.8)**	294 (92.7)	45 (90.0)	457 (96.8)	26 (86.7)	395 (97.1)	30 (100)
Race and ethnicity§								
Asian	**7 (0.6)**	**1 (0.9)**	5 (1.6)	1 (2.0)	1 (0.2)	0 (—)	1 (0.2)	0 (—)
Black or African American	**333 (27.8)**	**43 (39.1)**	109 (34.4)	19 (38.0)	69 (14.6)	9 (30.0)	155 (38.1)	15 (50.0)
Native American or Hawaiian	**15 (1.3)**	**1 (0.9)**	3 (0.9)	0 (—)	3 (0.6)	1 (3.3)	9 (2.2)	0 (—)
White	**766 (64.0)**	**61 (55.5)**	170 (53.6)	28 (56.0)	373 (79.0)	19 (63.3)	223 (54.8)	14 (46.7)
Hispanic or Latino	**91 (7.6)**	**11 (10.0)**	29 (9.1)	8 (16.0)	27 (5.7)	3 (10.0)	35 (8.6)	0 (—)
Unknown	**75 (6.3)**	**4 (3.6)**	30 (2.5)	2 (4.0)	26 (5.5)	1 (3.3)	19 (4.7)	1 (3.3)
U.S. region where primary vaccination series was completed¶								
Continental	**179 (15.0)**	**12 (10.9)**	44 (13.9)	5 (20.0)	69 (14.6)	2 (6.7)	66 (16.2)	5 (16.7)
Midwest	**202 (16.9)**	**16 (14.5)**	47 (14.8)	3 (6.0)	97 (20.6)	6 (20.0)	58 (14.3)	7 (23.3)
North Atlantic	**294 (24.6)**	**28 (25.5)**	86 (27.1)	13 (26.0)	110 (23.3)	10 (33.3)	98 (24.1)	5 (16.7)
Pacific	**228 (19.0)**	**21 (19.1)**	69 (21.8)	8 (16.0)	92 (19.5)	7 (23.3)	67 (16.5)	6 (20.0)
Southeast	**287 (24.0)**	**33 (30.0)**	70 (22.1)	21 (42.0)	103 (21.8)	5 (16.7)	114 (28.0)	7 (23.3)
Unknown	**6 (0.5)**	**0 (—)**	1 (0.3)	0 (—)	1 (0.2)	0 (—)	4 (1.0)	0 (—)
Vaccine booster**	**1,003 (83.9)**	**90 (81.8)**	272 (85.8)	40 (80.0)	384 (81.4)	22 (73.3)	347 (85.3)	28 (93.3)
Comorbidity score (0–6),†† mean (SD)	**1.3 (1.2)**	**1.2 (1.0)**	1.7 (1.0)	1.7 (0.7)	1.1 (1.2)	0.8 (1.0)	1.2 (1.2)	0.9 (1.0)
Antiviral drug received§§	**335 (28.0)**	**0 (—)**	94 (29.7)	0 (—)	148 (31.4)	0 (—)	93 (22.9)	0 (—)
Severe COVID-19¶¶	**207 (17.3)**	**12 (10.9)**	42 (13.2)	4 (8.0)	94 (19.9)	5 (16.7)	71 (17.4)	3 (10.0)
Death***	**30 (2.5)**	**2 (1.8)**	8 (2.5)	0 (—)	11 (2.3)	2 (6.7)	11 (2.7)	0 (—)

Abbreviation: VA = Veterans Health Administration.
* First documented SARS-CoV-2 infection after vaccination.
† All patients in the reviewed subcohorts had mild-to-moderate COVID-19 or asymptomatic infection at the time of initial evaluation and were not given antiviral drugs.
§ VA patients self-report Hispanic or Latino (Hispanic) ethnicity separately from race; therefore, Hispanic patients are also included in the race categories. Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.
¶ *Continental:* Arkansas, Colorado, Louisiana, Mississippi, Montana, Oklahoma, Texas, Utah, and Wyoming; *Midwest*: Illinois, Indiana, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *North Atlantic*: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia; *Pacific:* Alaska, Arizona, California, Hawaii, Idaho, Nevada, New Mexico, Oregon, and Washington; and *Southeast*: Alabama, Florida, Georgia, Kentucky, Puerto Rico, South Carolina, and Tennessee.
** Receipt of ≥1 additional vaccine dose after completion of the initial vaccination series; no attempt was made to determine the number of additional doses.
†† Based on number of persons with the following six comorbidities: Alzheimer disease or other dementias, chronic kidney disease, chronic obstructive pulmonary disease, diabetes, heart failure, and peripheral vascular disease.
§§ Using VA pharmacy records, which do not detect prescriptions sent to non-VA pharmacies nor some medications given in the emergency department.
¶¶ Within 28 days of the positive results of SARS-CoV-2 test performed at the VA.
*** Defined as either death within 28 days of the positive results of SARS-CoV-2 test performed at the VA, or hospitalization with either administration of dexamethasone or evidence of hypoxemia (minimum pulse oximetry <94% or any use of supplemental oxygen).

(75.3 years) or the 407 patients with plasma cell malignancies (72.7 years). All patients with solid organ transplantation and most patients with CLL (67.4%) or plasma cell malignancies (81.8%) were currently receiving immunosuppressive or antineoplastic medications (Supplementary Table; https://stacks.cdc.gov/view/cdc/141955). Overall, 861 (72.0%) patients were initially classified in EMR as not having received antiviral drugs, including 223 (70.3%) with solid organ transplantation, 324 (68.6%) with CLL, and 314 (77.1%) with plasma cell malignancies. Among the 207 (17.3%) patients who met criteria for severe COVID-19 (including 42 [13.2%] with solid organ transplantation, 94 [19.9%] with CLL, and 71 [17.4%] with plasma cell malignancies), it was not possible to determine whether disease was severe at initial evaluation or whether mild-to-moderate disease later progressed to severe disease. Thirty (2.5%) patients died within 28 days of the positive SARS-CoV-2 test result.

Reasons for Not Administering Antiviral Medications

Among 110 patients with mild-to-moderate COVID-19 at initial evaluation who did not receive antiviral drugs, 22 (20.0%) were offered treatment but declined (Table 2). Among the 88 who were not offered antiviral treatment, 20 (22.7% [18.2% of all 110 who did not receive antiviral drugs]) were not offered treatment because symptoms had been present for >5 days, and five (5.7% [4.5%]) were not offered treatment

TABLE 2. Reasons for nonreceipt of antiviral medication among COVID-19–vaccinated veterans with mild-to-moderate or asymptomatic COVID-19 and immunosuppressive conditions — Veterans Health Administration, United States, March–September 2022

Reason for nonreceipt of antiviral drug	Diagnosis, no. (%)			
	All N = 110	Solid organ transplantation n = 50	Plasma cell malignancy n = 30	CLL n = 30
Antiviral offered (22)				
Patient declined	**22 (20.0)**	13 (26.0)	7 (23.3)	2 (6.7)
Antiviral not offered (88)				
Symptom duration of >5 days	**20 (18.2)**	7 (14.0)	3 (10.0)	10 (33.3)
Concern about drug interaction*	**5 (4.5)**	3 (6.0)	0 (—)	2 (6.7)
Concern about Paxlovid rebound†	**0 (—)**	0 (—)	0 (—)	0 (—)
Patient asymptomatic§	**20 (18.2)**	10 (20.0)	6 (20.0)	4 (13.3)
Mild-to-moderate disease or reason not mentioned	**43 (39.1)**	17 (34.0)	14 (46.7)	12 (40.0)
Telephone follow-up only§	**24 (21.8)**	11 (22.0)	5 (16.7)	8 (26.7)

Abbreviation: CLL = chronic lymphocytic leukemia.

* The drug interactions noted were of ritonavir with tacrolimus for all three patients with solid organ transplantation. Among the patients with CLL, the interaction was ritonavir with a statin in one patient and not specified in the other patient.

† A phenomenon in which symptoms recur after having resolved during a standard 5-day treatment with Paxlovid.

§ Description as asymptomatic or with the only follow-up of a positive SARS-CoV-2 test result by telephone are not mutually exclusive; among other cases, test results were obtained while the patient was present, either in the hospital, emergency department, or urgent care.

because of concern about possible drug interactions (in three cases, tacrolimus and ritonavir). In 63 cases (71.6% [57.3%]), no treatment was offered because the patient was considered asymptomatic (20 cases) or had mild disease (43 cases). In no cases was concern about Paxlovid rebound mentioned as a reason for patient or provider deciding against treatment. Sixteen of the asymptomatic infections were detected by hospital, emergency department, or transplant clinic screening procedures, or before elective procedures; 24 patients with mild illness received follow-up from clinical staff members only by telephone, with no documented reference to possible antiviral treatment.

The study required review of 233 cases to obtain 110 that met inclusion criteria for analysis. The 123 excluded cases included 38 (16.3% of all 233 cases reviewed) in which chart review determined that an antiviral drug was given during mild-to-moderate COVID-19, although this had not been detected in the initial EMR screen. The undetected treatments included an outpatient regimen of remdesivir (23 patients), delivery of a monoclonal antibody at a VA (4 patients) or non-VA facility (1 patient), or delivery of an oral antiviral at a VA facility (4 patients) or non-VA pharmacy (6 patients).

Discussion

During March–September 2022, among 110 patients in the VA system with solid organ transplantation, CLL, or plasma cell malignancies who had previously received a COVID-19 vaccine but who did not receive antiviral treatment after receiving positive SARS-CoV-2 test results during a mild-to-moderate or asymptomatic infection, 20% were offered treatment and declined. The remainder were not offered treatment because symptoms were present for >5 days (22.7% of those not offered treatment), concern about possible drug interactions (5.7%), or asymptomatic infection (22.7%), with no reason other than mild symptoms given for 43 of 88 (48.9%) cases.

Limited information is available on reasons for failure to prescribe antivirals to eligible patients with COVID-19. Algorithms to determine these reasons using EMR review would have to be based entirely on text data; therefore, measures to develop them would likely be prone to bias. VA EMR data also underestimate antiviral use, because chart review identified evidence of antiviral therapy in 16.3% of reviewed cases in which antiviral therapy was not detected through the initial EMR-based algorithm. Thus, reported use among 23.9% of the general VA population (*5*) and 28.0% seen in this study are both underestimates, but the proportion of eligible patients who are not offered an antiviral is still substantial.

Limitations

The findings in this report are subject to at least six limitations. First, the study was conducted among a population of patients who were at particularly high risk for severe disease; drivers of limited antiviral use might be different among populations at lower, but still substantial, risk. Second, these results might not be applicable to non-VA health care systems. For example, results could differ in systems that do not routinely test all patients at hospital admission, that rely on offsite private pharmacies for prescriptions, that do not adhere to recommended timelines for antiviral treatment, or that have no standardized mechanisms for communicating with patients after positive test results. Rates of prescription of antiviral medications could be higher in other health care systems, but available data suggest prescription rates were similar in the VA and U.S. systems participating in PCORnet through mid-2022 (*5*,*6*). Third, results might not be generalizable to women or to persons of Hispanic, Asian, or Native American

Summary

What is already known about this topic?

Antiviral drugs reduce progression to severe COVID-19 among high-risk patients with nonsevere disease; however, reported use is low.

What is added by this report?

Review of 110 immunosuppressed patients with nonsevere COVID-19 at risk for progression who did not receive an antiviral drug found that 80% were not offered such treatment. For nearly one half of these, the only reason given for not offering antiviral treatment was mild symptoms. Other reasons included symptom duration >5 days (22.7%), lack of symptoms (22.7%), and concern about drug interactions (5.7%). One fifth of the 110 patients were offered treatment but declined.

What are the implications for public health practice?

Education of providers, patients, and staff members tasked with follow-up calls might increase use of antiviral medications for mild-to-moderate COVID-19, especially if combined with advance planning for possible antiviral treatment at the time of testing or earlier.

ethnicity and race, and who were underrepresented or not represented in this study. Fourth, EMRs underestimated antiviral use and have other limitations. However, focus on chart review ensured that all patients 1) had solid organ transplants, CLL, or plasma cell malignancies; 2) had SARS-CoV-2 infection; 3) were evaluated during mild-to-moderate COVID-19; and 4) did not receive an antiviral. Fifth, chart review, when it focuses on information not available through electronic searches, involves subjective judgment and limits the numbers of cases that can be assessed. Accordingly, a research question that could be answered with a small sample and would not require complicated analysis was selected. Finally, case review had to focus on clinical notes, which might not accurately reflect the conversations that occurred.

Implications for Public Health Practice

Interventions that might improve prescription of antiviral medications for patients for whom they are indicated include 1) educating patients to inform health care providers soon after developing symptoms, especially if they have had previous discussions about antivirals and have decided they would be interested in receiving treatment; 2) educating providers, especially those tasked with making routine follow-up calls to patients to monitor their progress after a positive test result, about the indications for antiviral treatment to reduce risk for severe infection; and 3) ensuring that patients whose test results will return after they have left the facility have reliable contact information and a plan in place regarding antiviral treatment.

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Deaths of U.S. Citizens Undergoing Cosmetic Surgery — Dominican Republic, 2009–2022

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Abstract

Although infections resulting from cosmetic surgery performed outside the United States have been regularly reported, deaths have rarely been identified. During 2009–2022, 93 U.S. citizens died after receiving cosmetic surgery in the Dominican Republic. The number of deaths increased from a mean of 4.1 per year during 2009–2018 to a mean of 13.0 during 2019–2022 with a peak in of 17 in 2020. A subset of post-cosmetic surgery deaths occurring during peak years was investigated, and most deaths were found to be the result of embolic events (fat emboli or venous thromboembolism) for which a high proportion of the patients who died had risk factors, including obesity and having multiple procedures performed during the same operation. These risk factors might have been mitigated or prevented with improved surgical protocols and postoperative medical care, including prophylactic measures against venous thromboembolism. U.S. citizens interested in receiving elective cosmetic surgery outside the United States should consult with their health care professionals regarding their risk for adverse outcomes. Public health authorities can support provider education on the importance of preoperative patient evaluation and the potential danger of performing multiple cosmetic procedures in one operation.

Introduction

Traveling to another country to receive medical care (medical tourism), including travel related to cosmetic surgery, is increasingly common among U.S. residents because the cost is lower and wait times for procedures are shorter than in the United States (*1*). The Dominican Republic is popular for medical tourism because it is close to the United States, has an existing tourism infrastructure, and some doctors from the Dominican Republic advertise in the United States. Since 2003, CDC has documented adverse events occurring in U.S. citizens after cosmetic surgery in the Dominican Republic (*2*). Most reports of adverse events after medical tourism for cosmetic surgery have cited infections; deaths have rarely been reported (*1*).

Since 2009, the Consular Section of the U.S. Embassy in the Dominican Republic has recorded cosmetic surgery–associated deaths among U.S. citizens. Notices of deaths are obtained from a variety of sources including families, funeral homes, and the Instituto Nacional de Ciencias Forenses (National Institute of Forensic Sciences), which conducts autopsies on all foreign citizens who die within the Dominican Republic. During 2009–2018, a mean of 4.1 deaths in U.S. citizens who had received cosmetic surgery in the Dominican Republic occurred each year (range = 1–8 deaths); however, the number of cosmetic surgery–associated deaths increased to 12 in 2019 and 17 in 2020. Because of this increase, the U.S. Embassy contacted CDC. In collaboration with the Dominican Republic Ministry of Health (MOH), CDC launched an investigation to identify the etiology and epidemiology of and preventable risk factors for death among U.S. citizens who underwent cosmetic surgery in the Dominican Republic.

Methods

A case was defined as a death occurring in a U.S. citizen who had received cosmetic surgery in the Dominican Republic within the preceding 3 weeks and who died in the Dominican Republic during 2009–2022.[†] Cosmetic surgical procedures were defined as all procedures falling under the American Society of Plastic Surgeons' designations as cosmetic surgery, such as breast procedures, abdominoplasty, liposuction, and gluteal augmentation (*3*). CDC analyzed the number of deaths collected by the Consular Section at the U.S. Embassy, conducted a review of available medical and autopsy reports provided by the MOH during 2019–2020, and extracted information on known risk factors for perioperative death. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[§]

Results

A total of 93 cosmetic surgery–related deaths of U.S. citizens in the Dominican Republic occurred during 2009–2022; all but one occurred in women. The mean decedent age was

* These senior authors contributed equally to this report.

† The Dominican Republic MOH is aware of 70–80 clinics that provide plastic surgery; however, how many of these clinics provide plastic surgery to medical tourists, including to those who are U.S. citizens, is unknown. In addition, the number of private cosmetic surgeons who might operate outside of a clinic setting is unknown.

§ 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.

40 years (range = 19–69 years). The number of deaths varied from one to 17 per year, with the peak in 2020 (Figure).

Patient Characteristics

Medical records were available for 24 (83%) of the 29 deaths that occurred during 2019–2020, including 10 in 2019 and 14 in 2020 (Table). All 24 deaths occurred in women; the mean age was 41 years (range = 26–61 years), and the mean body mass index (BMI) was 32 kg/m^2 (range = 24–44 kg/m^2); in 22 (92%) cases, comorbid conditions associated with increased risk for venous thromboembolism were reported. Among 23 decedents with information on BMI available, 22 (96%) had overweight or obesity,[¶] two of 24 (8%) reported diabetes mellitus, three (13%) reported current tobacco use, and two (8%) reported current use of oral contraceptives. No other patient-specific risk factors for venous thromboembolism were identified. A preoperative evaluation by a cardiologist was documented for 18 (75%) of the 24 decedents and by a pulmonologist for 11 (46%).

Procedures

Liposuction was performed in all 24 fatal cases (100%), gluteal fat transfer in 22 (92%), abdominoplasty in 14 (58%), and breast augmentation in 11 (46%). A mean of three procedures (range = two to four) were performed for each decedent during surgery. In 14 (58%) cases, death occurred within 24 hours of surgery; the mean interval from procedure to death was 2.8 days (range = 0–18 days). Nine surgical clinics were linked to the deaths; two clinics were linked to two or more deaths.

Cause of Death

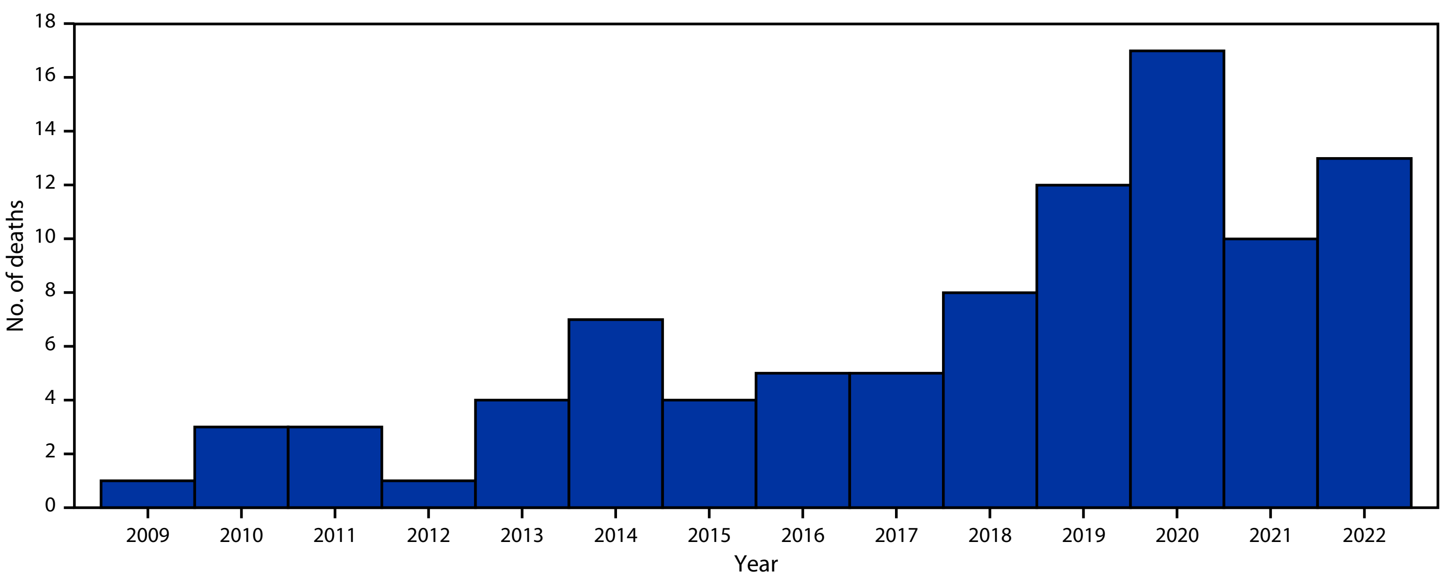
Autopsy reports were available for 20 (83%) cases with medical records; all autopsy-confirmed deaths were attributed to intraoperative and postoperative complications. Fat embolism was the cause of death in 11 (55%) of 20 cases and pulmonary venous thromboembolism in seven (35%).

Discussion

A total of 93 U.S. citizens were reported to have died in the Dominican Republic during 2009–2022 soon after receiving cosmetic surgery. Medical records were available for 24 of 29 decedents during 2019–2020, most of whom were young to middle-aged women. Among the 20 fatalities during 2019–2020 with an autopsy report available for review, 18 (90%) deaths were attributed to embolic phenomena. A large proportion of decedents had personal (92%) or procedural (100%) risk factors for perioperative embolism. Among deaths due to fat emboli, all patients had undergone liposuction and gluteal fat transfer. Fat embolism is a recognized risk associated with fat injections, particularly as used in gluteal augmentation, a procedure in which fat is harvested from the patient and then injected into the buttocks to augment the body silhouette (*4*). Recommendations to avoid injecting the fat into the deep muscular layers of the buttocks to reduce the possibility of fat embolism have been previously published (*4,5*). Risk factors

[¶] Overweight is defined as a BMI = 25.0–29.9 kg/m^2; obesity is defined as a BMI ≥30 kg/m^2. https://www.cdc.gov/obesity/basics/adult-defining.html

FIGURE. Perioperative cosmetic surgery–related deaths*,† among U.S. citizens, by year (N = 93) — Dominican Republic, 2009–2022



* Data provided by the U.S. Embassy Consular Section, Santo Domingo, Dominican Republic.
† Deaths occurring among U.S. citizens, in the Dominican Republic, within 3 weeks of the cosmetic surgical procedure.

TABLE. Characteristics of perioperative deaths associated with cosmetic surgery procedures performed among U.S. citizens* (N = 24) — Dominican Republic, 2019–2020

Characteristic	No. (%)		
	Total	2019	2020
Total no. of decedents	**24 (100)**	**10 (40)**	**14 (60)**
Female sex	**24 (100)**	10 (100)	14 (100)
Mean BMI† (range)	**32 (24–44)**	31 (25–38)	32 (24–44)
Mean age (range)	**41 (26–61)**	40 (26–61)	41 (29–55)
Risk factor for venous thromboembolism			
BMI ≥25 kg/m^2,† no./No.	**22/23 (96)**	10/10 (100)	12/13 (92)
Aged ≥40 years	**12 (50)**	4 (40)	8 (57)
Diabetes mellitus	**2 (8)**	1 (10)	1 (7)
Current tobacco use	**3 (13)**	1 (10)	2 (14)
Current oral contraceptive use	**2 (8)**	0 (—)	2 (14)
Body (trunk) procedure§	**24 (100)**	10 (100)	14 (100)
≥2 procedures	**24 (100)**	10 (100)	14 (100)
≥3 procedures	**18 (75)**	5 (50)	13 (93)
Preoperative evaluation documented			
Cardiologist	**18 (75)**	8 (80)	10 (71)
Pulmonologist	**11 (46)**	4 (40)	7 (50)
Procedure			
Liposuction	**24 (100)**	10 (100)	14 (100)
Gluteal fat transfer	**22 (92)**	9 (90)	13 (93)
Abdominoplasty	**14 (58)**	4 (40)	10 (71)
Breast augmentation or reduction	**11 (46)**	3 (30)	8 (57)
No. of procedures performed, mean (range) per decedent	**3.0 (2–4)**	2.6 (2–4)	3.2 (2–4)
Timing of death			
Death within 24 hours	**14 (58)**	4 (40)	10 (71)
Interval from procedure to death, days, mean (range)	**2.8 (0–18)**	3.3 (0–12)	2.4 (0–18)
Cause of death available from autopsy report	**20 (83)**	8 (80)	12 (86)
Fat embolism	**11 (55)**	5 (63)	6 (50)
Pulmonary venous thromboembolism	**7 (35)**	2 (25)	5 (42)
Hemorrhagic shock	**1 (5)**	0 (—)	1 (8)
Sepsis¶	**1 (5)**	1 (13)	0 (—)

Abbreviation: BMI = body mass index.
* Information was available for 24 of 29 deaths that occurred in 2019 and 2020.
† BMI missing for one record from 2020.
§ Body (trunk) procedures included abdominoplasty, liposuction, gluteal fat transfer, and breast augmentation or reduction.
¶ Due to intestinal perforation.

for venous thromboembolism in this report included BMI ≥25 kg/m^2 (96% of patients), aged ≥40 years (50%), having undergone procedures on the trunk of the body (100%), or having undergone two or more procedures during the same operation (100%) (*6*–*8*). Preoperative ascertainment of patient risk for venous thromboembolism should be considered an expected standard of care during the preoperative evaluation and can be accomplished using validated risk-assessment models (e.g., Caprini score)** to help guide and incorporate the appropriate use of mechanical methods (e.g., early ambulation or compression devices) and chemoprophylaxis (e.g., anticoagulant and antithrombotic agents) to protect against periprocedural venous thromboembolism†† (*9*). The findings in this report highlight the importance of considering patient and operative risk factors when determining whether to proceed with elective cosmetic surgery.

Limitations

The findings in this report are subject to at least three limitations. First, no reliable statistics on the number of U.S. citizens who receive cosmetic surgery in the Dominican Republic each year are available, precluding calculation of the risk for perioperative death. Second, this report might be an underestimate of the number of deaths among U.S. citizens receiving cosmetic surgery in the Dominican Republic because it only included deaths that were reported to the U.S. Embassy. Other investigators have documented adverse outcomes from cosmetic surgeries performed in the Dominican Republic that were only recognized after the patient had returned to the United States (*1*,*2*). Finally, perioperative deaths are rare complications of cosmetic surgery, and this report does not address other well-documented adverse events such as postsurgical infections that can result in substantial morbidity (*1*,*2*).

Implications for Public Health Practice

Public health departments can make recommendations to improve medical care within their jurisdictions, and surveillance can identify new or ongoing health concerns. In 2019, the Dominican Republic MOH issued safety and quality recommendations to cosmetic surgeons, including training and licensure requirements, specific recommendations for patients to have cardiac and pulmonary evaluations before surgery, and that no more than two major procedures should be scheduled during one operation (*5*). After CDC shared preliminary results of the investigation of cosmetic surgery–associated deaths, the MOH distributed the safety and quality guidelines (*5*) to cosmetic surgeons in the country, made monitoring visits to 77 facilities that offered cosmetic surgery, and certified infection control committees for high volume cosmetic surgery centers. The MOH created a multilateral commission, including representatives from the Dominican Society of Plastic Surgery, to review perioperative adverse events, including deaths, and recommend disciplinary or administrative sanctions when warranted. Results of ongoing passive surveillance by the Dominican Republic government are provided to the U.S. Embassy regarding deaths of U.S. citizens after medical care.

As a result of this investigation, the U.S. State Department updated the Medical Tourism and Elective Surgery advisory on the website of the U.S. Embassy in the Dominican Republic§§

** https://capriniriskscore.org/

†† https://pubmed.ncbi.nlm.nih.gov/37882602/; https://doi.org/10.1002/aorn.14019

§§ https://do.usembassy.gov/services/medical-assistance

Summary

What is already known about this topic?

Infections regularly occur after cosmetic surgery performed outside the United States, but deaths are rarely reported.

What is added by this report?

The number of deaths after cosmetic surgery among U.S. citizens in the Dominican Republic increased from a mean of 4.1 per year during 2009–2018 to a mean of 13.0 during 2019–2022 with a peak in of 17 in 2020. A review of the 29 deaths during 2019–2020 revealed that the deaths were associated with fat or venous thromboembolism. A high proportion of patients who died had risk factors for embolism, including obesity and having multiple procedures performed during the same operation.

What are the implications for public health practice?

Persons interested in cosmetic surgery should discuss the risks with their regular medical professional. Public health authorities can support provider education on the importance of preoperative patient evaluation and the potential danger of performing multiple cosmetic procedures in one operation.

to provide a list of steps to take to reduce the risk for adverse outcomes, including a recommendation to obtain international travel insurance to cover medical evacuation back to the United States.

U.S. citizens considering cosmetic surgery abroad should consult with their primary health professionals about their inherent risk for adverse events after surgery and preventive measures they can take to reduce the risk. They should consult with a travel medicine specialist ≥1 month before travel, and, as air travel and surgery independently increase the risk for blood clots, patients should allow adequate time between flying to and from a destination for surgery to reduce the risk for complications (*10*).

Acknowledgment

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Notes from the Field

Nontuberculous Mycobacteria Infections After Cosmetic Surgery Procedures in Florida — Nine States, 2022–2023

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Introduction

Mycobacterium abscessus is a species of intrinsically multidrug–resistant, rapidly growing nontuberculous mycobacteria (NTM) known to cause health care–associated infections (*1*) and implicated in skin and soft tissue infections after cosmetic surgical procedures (*2*,*3*). On February 7, 2023, CDC notified the Florida Department of Health (FDOH) of a non-Florida resident with NTM infection after a cosmetic procedure at a surgery clinic (clinic A) in south Florida. FDOH and CDC issued national Epidemic Information Exchange (Epi-X) notices in March 2023 (http://www.cdc.gov/epix) to identify additional infections. During the ensuing investigation in March 2023, FDOH identified a total of 15 NTM infections in patients who underwent surgical procedures by a plastic surgeon in solo practice at clinic A, an alternative practice location that was used during renovation of the permanent facility (clinic B).

Investigation and Outcomes

Case Definition

A case was defined as the isolation of *M. abscessus* from a wound culture obtained from a patient who underwent a cosmetic procedure at clinic A during August–December 2022. Among 19 reported infections, a total of 15 patients (including the index patient) from nine U.S. states met the case definition (Table). The other four patients experienced signs and symptoms of postsurgical infection but lacked confirmatory laboratory results and were not included in the analysis. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.*

Characteristics of Cases

All patients were women, and the median age was 33 years (range = 24–51 years). The median interval from the procedure to symptom onset was 69 days (range = 33–119 days). Patients reported swelling, purulent drainage, redness, or pain at surgical sites. Pharmaceutical treatments for *M. abscessus* included oral and intravenous antibiotics with prolonged courses up to 2–6 months. In addition to prescribing medication, health care providers performed incision, drainage, and debridement. (Table). Seven patients' wound isolates were available for

* 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.

TABLE. Demographic and epidemiologic characteristics of patients with nontuberculous mycobacteria infections after receiving cosmetic surgery at clinic A (N = 15) — Florida, 2022–2023

Characteristic	No. (%)
Sex	
Male	0 (—)
Female	15 (100)
Race or ethnicity	
Black or African American, non-Hispanic	3 (20)
White, non-Hispanic	1 (7)
White, Hispanic or Latino	2 (13)
Hispanic or Latino	1 (7)
Unknown	8 (53)
Age group, yrs	
18–29	4 (27)
30–39	8 (53)
40–49	2 (13)
50–59	1 (7)
State of residence	
California	4 (27)
Florida	4 (27)
Illinois	1 (7)
Kansas	1 (7)
Massachusetts	1 (7)
Missouri	1 (7)
Texas	1 (7)
Washington	1 (7)
Wisconsin	1 (7)
Wound site	
Buttocks	10 (67)
Abdomen	3 (20)
Hip	1 (7)
Breast	1 (7)
Procedure performed*	
Liposuction	15 (100)
Gluteal augmentation with autologous fat transfer	12 (80)
Abdominoplasty	2 (13)
Breast reduction or lift	1 (7)
More than one procedure	14 (93)
Outcome	
Required intravenous antibiotics	6 (40)
Required additional interventions†	4 (27)
Inpatient hospitalization§	1 (7)
Death	0 (—)

* Patients might have had multiple procedures at the time of surgery; therefore, the total number of procedures exceeds the total number of patients.
† Including computerized tomography–guided percutaneous abscess drainage, needle aspiration, incision and drainage, wound debridement, and surgical skin excision with drainage.
§ Data obtained from available records.

analysis by the Florida Bureau of Public Health Laboratories. Whole genome sequencing determined that four isolates were closely related[†] (*4*). Clinic A was closed after identification of the cluster; the closure precluded environmental sampling during the investigation.

On-site Assessment

On March 3, 2023, FDOH conducted an on-site infection control assessment at clinic B, which operated with the same surgeon, staff members, and protocols as did clinic A. The assessment detected gaps in environmental cleaning practices, use of proper personal protective equipment, and disinfection during surgical device reprocessing.

Preliminary Conclusions and Actions

This cluster was challenging to identify because patients were located throughout the United States and because NTM infections are not nationally notifiable. Collaboration among health jurisdictions and CDC was crucial in identifying the initial extrapulmonary NTM infection. Subsequent case finding required active surveillance to encourage reporting by providers as well as outreach to patients using nontraditional approaches, such as social media and online reviews of businesses (e.g., Facebook or Yelp), because patients reported symptoms on these sites.

Implications for Public Health Practice

Health care providers should have a high index of suspicion for extrapulmonary NTM when evaluating patients for postsurgical infection after cosmetic procedures and should be aware of the existing threshold for notifying public health officials, realizing NTM infections could develop months after surgery. Standard case definitions and thresholds for reporting to improve surveillance have been published.[§,¶] Although the specific source associated with clinic A's cluster has not yet been identified, FDOH found gaps in infection control, including cleaning practices, use of personal protective equipment, and surgical device disinfection, that can contribute to NTM transmission. FDOH will use these findings to develop additional training for cosmetic surgery clinic staff members statewide to help prevent future outbreaks in this setting (*5*).

[†] Among the seven isolates available for genetic sequencing, all were identified as *Mycobacteroides abscessus*, with six identified as sequence-type 80, and one as sequence-type 422. Four isolates were similar with average nucleotide identity values of 100% and a coding single nucleotide polymorphisms (SNP) difference of 0–3. Florida Bureau of Public Health Laboratories used a 20 SNP cutoff to identify relatedness based on established literature.

[§] https://cdn.ymaws.com/www.cste.org/resource/resmgr/publications/Extrapulmonary-NTM-PS_Op-Gui.pdf_

[¶] https://www.corha.org/wp-content/uploads/2019/09/CORHA-Proposed-NTM-Thresholds-and-Definition-08-19.pdf_

Summary

What is already known about this topic?

Nontuberculous mycobacteria (NTM) have been reported as a cause of health care–associated infections.

What is added by this report?

Investigation of a case of NTM infection in a patient who received a cosmetic surgical procedure in Florida identified a total of 15 cases in nine states in patients who received cosmetic surgical procedures at the same facility in Florida. Multiple lapses in infection control and prevention were found at an outpatient cosmetic surgery clinic operating with the same staff members.

What are the implications for public health practice?

Health care providers should have a high index of suspicion for extrapulmonary NTM when evaluating patients for postsurgical infection after cosmetic procedures and should be aware of the threshold for notifying public health officials of these cases.

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Florida Department of Health Care-Associated Infection Prevention Program; Florida Bureau of Public Health Laboratories; California Department of Public Health; Michigan Department of Health & Human Services; Ohio Department of Health; Kansas Department of Health and Environment; Texas Department of State Health Services; Illinois Department of Public Health; Wisconsin Department of Health Services; Massachusetts Department of Public Health; Minnesota Department of Health; Rhode Island Department of Health; Washington State Department of Health; Missouri Department of Health and Senior Services.

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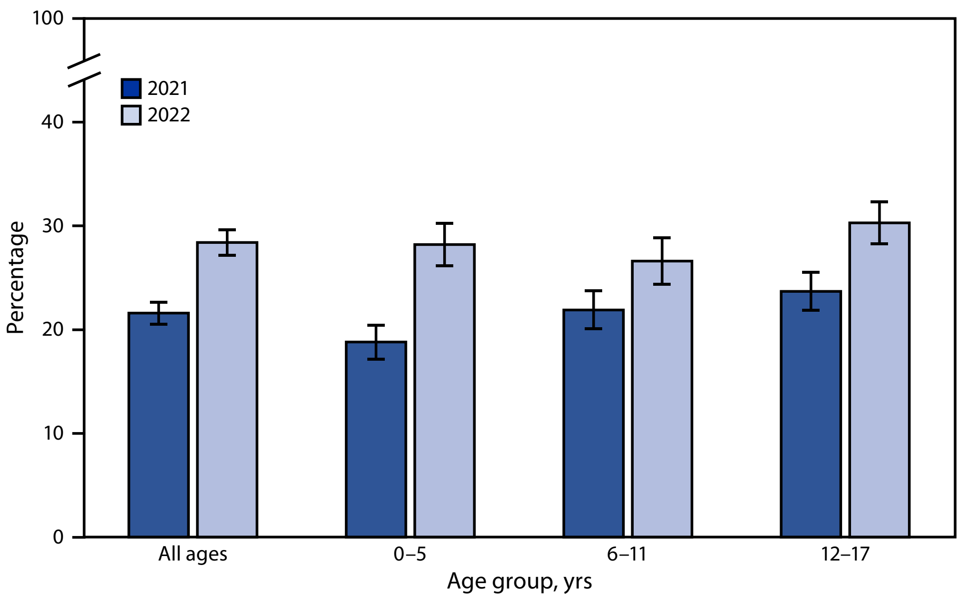
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Children and Adolescents Aged ≤17 Years Who Visited an Urgent Care Center or a Clinic in a Drug Store or Grocery Store in the Past 12 Months,† by Age Group and Year — National Health Interview Survey,§ United States, 2021–2022



* With 95% CIs indicated by error bars.

† Based on responses to the survey question, "During the past 12 months, how many times has (child's name) gone to an urgent care center or clinic in a drug store or grocery store about his/her/their health?"

§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey Sample Child component.

The percentage of children and adolescents aged ≤17 years who had at least one visit to an urgent care center or a clinic in a drug store or grocery store in the past 12 months increased from 21.6% in 2021 to 28.4% in 2022. This increase was noted for all age groups during 2021–2022. In 2021, urgent care or retail health clinic visits were lower among children aged 0–5 years than those aged 6–11 years and 12–17 years. In 2022, visits for those aged 12–17 years (30.3%) were higher than for those aged 6–11 years (26.6%). Other observed differences among age groups were not significant.

Source: National Center for Health Statistics, National Health Interview Survey, 2021–2022 data. https://www.cdc.gov/nchs/nhis/index.htm

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