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ORIGINAL RESEARCH

Lifestyle Behaviors and Cardiometabolic Diseases by Race and Ethnicity and Social Risk Factors Among US Young Adults, 2011 to 2018

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BACKGROUND: Cardiometabolic health has been worsening among young adults, but the prevalence of lifestyle risk factors and cardiometabolic diseases is unclear.

METHODS AND RESULTS: Adults aged 18 to 44 years were included from the National Health and Nutrition Examination Survey, 2011 to 2018. Age-standardized prevalence of lifestyle risk factors and cardiometabolic diseases was estimated overall and by demographic and social risk factors. A set of multivariable logistic regressions was sequentially performed by adjusting for age, sex, social risk factors, and lifestyle factors to determine whether racial and ethnic disparities in the prevalence of cardiometabolic diseases may be attributable to differences in social risk factors and lifestyle factors. Appropriate weights were used to ensure national representativeness of the estimates. A total of 10 405 participants were analyzed (median age, 30.3 years; 50.8% women; 32.3% non-Hispanic White). The prevalence of lifestyle risk factors ranged from 16.3% for excessive drinking to 49.3% for poor diet quality. The prevalence of cardiometabolic diseases ranged from 4.3% for diabetes to 37.3% for dyslipidemia. The prevalence of having ≥2 lifestyle risk factors was 45.2% and having ≥2 cardiometabolic diseases was 22.0%. Racial and ethnic disparities in many cardiometabolic diseases persisted but were attenuated after adjusting for social risk factors and lifestyle factors.

CONCLUSIONS: The prevalence of lifestyle risk factors and cardiometabolic diseases was high among US young adults and varied by race and ethnicity and social risk factors. Racial and ethnic disparities in the prevalence of cardiometabolic diseases were not fully explained by differences in social risk factors and lifestyle factors.

Key Words: cardiometabolic diseases ■ lifestyle risk factors ■ prevalence ■ racial and ethnic disparities ■ social risk factors

Cardiometabolic health among middle-aged and elderly adults has generally improved over the past 2 decades worldwide, but young adults under the age of 45 years have developed increasingly unhealthy cardiometabolic risk profiles.[1] In the United States, the prevalence of obesity,[2,3] diabetes,[4] and hypertension[5,6] increased substantially among young adults from 1999 to 2018. Also, US young adults do not have ideal health behaviors. For example, diet quality had increased but was still at a very low level in 2017 to 2018.[7] More than half of young adults sat for more than 8 hours a day or were physically inactive in 2015 to 2016.[8] Poor and worsening cardiometabolic health among US young adults calls for immediate public health actions to improve lifestyle behaviors and reduce cardiometabolic disease risk, which are vital for young adults to prevent cardiovascular disease in their later life.[9,10]

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CLINICAL PERSPECTIVE

What Is New?

- US young adults had poor lifestyle and a high burden of cardiometabolic diseases.
- After adjusting for social risk factors and lifestyle factors, racial and ethnic disparities in the prevalence of many cardiometabolic diseases persisted but were attenuated.

What Are the Clinical Implications?

- Given that cardiometabolic diseases are largely preventable and lifestyle behaviors are theoretically modifiable, devising effective and targeted interventions to improve cardiometabolic health in young adults would deliver long-term health benefits.

Nonstandard Abbreviations and Acronyms

HEI-2015	Healthy Eating Index-2015
NAFLD	nonalcoholic fatty liver disease
NHANES	National Health and Nutrition Examination Survey

The prevalence of lifestyle risk factors and cardiometabolic diseases varies substantially by race and ethnicity and social risk factors.[4,11–15] Racial and ethnic disparities in cardiometabolic diseases are substantial and multifactorial and social risk factors are key contributors.[12] Multiple lifestyle risk factors and cardiometabolic diseases tend to cluster.[16] The aforementioned points have been widely studied in general adult populations, diseased populations, and children, but data are sparse for young adults in general. Young adults have unique characteristics of social risk factors and thus may present unique patterns of racial and ethnic disparities due to a wide range of experiences and continuous changes across many domains of life at this stage, which play an important role in determining cardiometabolic health.[17] However, no study has investigated the prevalence of lifestyle risk factors and cardiometabolic diseases, individually and in combination, by race and ethnicity and social risk factors among young adults, which prevents us from identifying high-risk subgroups for early precise prevention of cardiovascular disease. Furthermore, it is unclear to what extent racial and ethnic disparities in cardiometabolic diseases among young adults may be attributable to differences in social risk factors and lifestyle factors.

Using the National Health and Nutrition Examination Survey (NHANES) data from 2011 to 2018, the objectives of this study were to estimate the prevalence of lifestyle risk factors and cardiometabolic diseases overall and by race and ethnicity and social risk factors among US young adults, as well as to determine whether racial and ethnic disparities in the prevalence of cardiometabolic diseases may be attributable to differences in social risk factors and lifestyle factors.

METHODS

Data Source and Study Sample

All data and guidance have been made publicly available by the National Center for Health Statistics and can be accessed at https://www.cdc.gov/nchs/nhanes/index.htm. NHANES was designed by the National Center for Health Statistics to assess health and nutritional status of noninstitutional civilian residents in the United States. NHANES has been a nationally representative serial cross-sectional survey based on a complex multistage sampling design.[18] Four NHANES cycles between 2011 to 2012 and 2017 to 2018 were included. Information was collected during the household interview or in mobile examination centers. Data from NHANES have been released in 2-year cycles since 1999. Personal medical history and medication use were collected by questionnaires. Laboratory data, including fasting plasma glucose, hemoglobin A1c, serum lipids, urine and serum creatinine, and alanine aminotransferase, were assayed according to standard methods. Participants aged 18 to 44 years who were not pregnant were included. Written informed consent was obtained from all participants. This study was approved by the Shanghai Jiao Tong University School of Medicine Public Health and Nursing Research Ethics Review Committee.

Stratification Variables

Stratification variables included demographic and social risk factors. Demographic variables included age, sex, and race and ethnicity self-reported based on fixed-category questions. Social risk factors included education, family income-to-poverty ratio, home ownership, employment status, health insurance status, regular health care access assessed by routine place to go for health care, food security status, and country of birth. Food security levels were measured through the US Household Food Security Survey Module.[19]

Definition of Lifestyle Risk Factors

Self-reported lifestyle risk factors included current smoking, excessive drinking, poor diet quality, inadequate physical activity, and inappropriate sleep

duration (Table S1). Current smokers reported having smoked at least 100 cigarettes during their lifetime and were currently smoking. Excessive drinkers reported having an average of ≥14 drinks per week for men and ≥7 drinks per week for women or at least 4 or 5 drinks in a single day.[20] Diet quality was assessed by the Healthy Eating Index-2015 (HEI-2015), ranging from 0 to 100.[21] There is no established criterion to define poor diet quality. This study defined poor diet quality arbitrarily as having an HEI-2015 score <50 in primary analysis. Total physical activity included work-related activity, leisure-time activity, and transportation activity. Transportation activity was counted as moderate-intensity activity.[22] The total amount of physical activity was calculated as the minutes of moderate-intensity activity plus twice the minutes of vigorous-intensity activity from all 3 domains. Inadequate physical activity was defined as having <150 minutes of moderate to vigorous physical activity per week.[23] Inappropriate sleep duration was defined as <7 hours or >9 hours of sleep per night for young adults.[24] Clustering of lifestyle risk factors was studied, including having 0, 1, and ≥2 of these 5 lifestyle risk factors.

Definition of Cardiometabolic Diseases

Cardiometabolic diseases included obesity, severe obesity, dyslipidemia, hypertension, prediabetes, diabetes, chronic kidney disease (CKD), nonalcoholic fatty liver disease (NAFLD), and metabolic syndrome (Table S1). The 30-year risk of atherosclerotic cardiovascular disease (ASCVD) was calculated based on the Framingham equation with body mass index included.[25] Fasting plasma glucose and triglyceride levels were measured among participants who fasted for at least 8 to <24 hours. Body mass index ≥30 kg/m^2 and ≥40 kg/m^2 defined obesity and severe obesity, respectively. Dyslipidemia was defined as having a total cholesterol level ≥240 mg/dL, self-reported current use of lipid-lowering medications or a high-density lipoprotein cholesterol level <40 mg/dL for men and <50 mg/dL for women.[26] Hypertension was defined as self-reported current use of antihypertensive medications or blood pressure ≥140/90 mm Hg. Having a hemoglobin A1c level of 5.7% to 6.4% or a fasting plasma glucose level of 100 to 125 mg/dL defined prediabetes among participants who did not report a diabetes diagnosis. Diabetes was defined as having a self-reported diabetes diagnosis, hemoglobin A1c level of 6.5% or greater or a fasting plasma glucose level of 126 mg/dL or greater. CKD required having a urine albumin to-creatinine ratio ≥30 mg/g or an estimated glomerular filtration rate <60 mL/min per 1.73 m^2. NAFLD was assumed in the presence of serum alanine aminotransferase >30 IU/L for men and>19 IU/L for women and in the absence of excessive drinking and other identifiable causes of liver disease.[27] Metabolic syndrome required meeting at least 3 of the following 5 criteria: waist circumference >102 cm for men or>88 cm for women, a triglycerides level ≥150 mg/dL, a high-density lipoprotein cholesterol level <40 mg/dL for men or<50 mg/dL for women, blood pressure ≥130/85 mm Hg, and a fasting glucose level ≥100 mg/dL.[28] Clustering of cardiometabolic diseases was studied, including having 0, 1, and ≥2 of dyslipidemia, hypertension, diabetes, CKD, and NAFLD.

Statistical Analysis

Prevalence was defined as the proportion of young adults who had the prespecified lifestyle risk factors and cardiometabolic diseases. The prevalence of lifestyle risk factors and cardiometabolic diseases was estimated in the total sample and subgroups by demographic factors: age (18–24, 25–29, 30–34, 35–39, and 40–44 years), sex (male/female), and race and ethnicity (non-Hispanic Asian, non-Hispanic Black, Hispanic, non-Hispanic White, and other [including other non-Hispanic ethnicities and mixed races]); and by social risk factors: education (<high school, high school graduate, some college, and ≥college graduate), family income-to-poverty ratio (≤100%, >100%–299%, 300%–499%, and ≥500%), home ownership (yes/no), employment status (yes/no), health insurance status (yes/no), regular health care access (yes/no), food security status (secure, marginal, and insecure), and country of birth (United States [born in 50 US states or Washington, DC]/others [born in other countries or US territories]). Results were age-standardized to the 2017 to 2018 NHANES interview population using the following age groups:18 to 29, 30 to 39, and 40 to 44 years. Weights for the interview sample, examination sample, fasting subsample, and dietary subsample were used appropriately to ensure the estimates were representative of the total civilian noninstitutionalized US young adult population.

A set of multivariable logistic regressions was used to examine whether racial and ethnic differences (comparing other racial and ethnic subgroups to non-Hispanic White individuals) in the prevalence of lifestyle risk factors and cardiometabolic diseases may be attributable to demographic factors, social risk factors, and lifestyle factors (for cardiometabolic diseases only). Logistic regression models were sequentially adjusted as follows: model 1 adjusted for age, age squared, and sex; model 2 included variables in model 1 plus all social risk factors mentioned; and for cardiometabolic diseases only, model 3 included variables in model 1 plus lifestyle factors including smoking status (never, former, and current), drinking status (never, former, nonexcessive, and excessive), HEI-2015 score, HEI-2015 score squared, physical activity (minutes),

physical activity squared, sleep hours, and sleep hours squared; and model 4 adjusted for all social risk factors and lifestyle factors simultaneously in addition to demographic factors. A series of logistic regression models with the same adjustments was additionally performed to evaluate racial and ethnic differences in the prevalence of composite outcomes, including having 0, 1, and ≥2 lifestyle risk factors and having 0, 1, and ≥2 of dyslipidemia, hypertension, diabetes, CKD, and NAFLD.

According to the NHANES analytical guidelines, for analyses with 10% or more missing data, weights were adjusted.[29] Participants were classified into 30 subgroups defined by age (18–29, 30–39, and 40–44 years), sex (male/female), and race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, and other). All subgroups had a sample size of at least 30 participants. An adjustment factor was calculated as the sum of the weights for all eligible participants in each subgroup divided by the sum of the weights for those included in the final analyses without missing data. Adjusted weights were calculated through multiplying the original weights by the adjustment factor from each subgroup. Three sensitivity analyses were conducted. First, education attainment was divided into 4 levels to better examine the possible graded relationship between education and the studied outcomes. We assumed that most young adults completed college education before the age of 25 years. Therefore, an additional analysis among adults aged ≥25 years was conducted to assess the robustness of the education-stratified results from primary analysis. Second, family income-to-poverty ratio (9.6% missing data) was removed from multivariable analyses to ensure that missing data did not affect the primary results. Third, due to the absence of an established cutoff to define low diet quality, 2 additional cutoffs, <the 25th percentile of the HEI-2015 score and an HEI-2015 score <60, were used. A 2-sided $P<0.05$ was used to determine statistical significance. All analyses were conducted with SAS for Windows version 9.4 and Stata for Windows version 17.0.

RESULTS

A total of 10 405 participants (weighted sample size: 1 0924 6482 participants) were analyzed but specific sample size for each outcome varied (Figures S1 through S3). The weighted median age was 30.3 years (interquartile range, 13.4 years), and 50.8% were women, 32.3% non-Hispanic White, 22.1% non-Hispanic Black, 26.2% Hispanic, and 14.7% non-Hispanic Asian. Of all the variables, income (9.6%) and excessive drinking (10.5%) had the highest percentage of missing data. All other stratification variables and outcomes had a small percentage of missing data (Table S2).

Prevalence of Lifestyle Risk Factors

The prevalence of lifestyle risk factors among US young adults were as follows: current smoking (22.0% [95% CI, 20.4%–23.5%]), excessive drinking (16.3% [95% CI, 15.1%–17.5%]), poor diet quality (49.3% [95% CI, 46.8%–51.9%]), inadequate physical activity (25.7% [95% CI, 24.5%–27.0%]), and inappropriate sleep duration (35.8% [95% CI, 34.3%–37.3%]) (Figure; Table 1; sample sizes in Table S3). The estimated age-standardized prevalence of lifestyle risk factors varied by demographic and social risk factors. The prevalence of current smoking was significantly higher in non-Hispanic White individuals than Hispanic and non-Hispanic Asian individuals (24.8% [95% CI, 22.3%–27.3%] versus 15.7% [95% CI, 13.7%–17.6%] and 10.5% [95% CI, 8.6%–12.4%]). The prevalence of excessive drinking was also significantly higher in non-Hispanic White individuals than Hispanic and non-Hispanic Asian individuals (18.5% [95% CI, 16.5%–20.5%] versus 13.1% [95% CI, 11.7%–14.5%] and 6.6% [95% CI, 4.9%–8.3%]). Non-Hispanic White individuals had a significantly lower prevalence of poor diet quality (50.4% [95% CI, 46.9%–53.9%] versus 56.0% [95% CI, 52.3%–59.8%]), inadequate physical activity (22.1% [95% CI, 20.7%–23.6%] versus 29.6% [95% CI, 27.1%–32.0%]), and inappropriate sleep duration (33.1% [95% CI, 30.9%–35.2%] versus 49.2% [95% CI, 46.9%–51.5%]) than non-Hispanic Black individuals. Non-Hispanic Asian individuals had the lowest prevalence of all lifestyle risk factors except for inadequate physical activity. Generally, individuals with a more favorable social risk factor profile (eg, higher education, higher income, higher food security level, and with insurance) had a lower age-standardized prevalence of lifestyle risk factors.

Prevalence of Cardiometabolic Diseases

The prevalence of cardiometabolic diseases among US young adults were as follows: obesity (35.7% [95% CI, 33.8%–37.5%]), severe obesity (7.9% [95% CI, 7.0%–8.7%]), dyslipidemia (37.3% [95% CI, 35.6%–39.1%]), hypertension (10.2% [95% CI, 9.3%–11.2%]), prediabetes (25.8% [95% CI, 23.6%–27.9%]), diabetes (4.4% [95% CI, 3.9%–4.9%]), CKD (6.8% [95% CI, 6.2%–7.4%]), NAFLD (31.1% [95% CI, 29.5%–32.8%]), and metabolic syndrome (18.9% [95% CI, 17.0%–20.8%]) (Table 2, sample sizes in Table S4). The estimated age-standardized prevalence of cardiometabolic diseases varied by demographic and social risk factors. The prevalence of obesity (33.4% [95% CI, 30.8%–35.9%] versus 44.1% [95% CI, 41.7%–46.5%] and 41.6% [95% CI, 39.3%–43.9%]), prediabetes (22.2% [95% CI, 19.2%–25.3%] versus 30.3% [95% CI, 27.1%–33.4%]

Figure. Lifestyle behaviors and cardiometabolic diseases by race and ethnicity and social risk factors among US young adults, 2011 to 2018.

This figure summarizes the prevalence of lifestyle risk factors and cardiometabolic diseases as well as racial and ethnic differences in the prevalence of cardiometabolic diseases among young adults, adjusting for age and sex only vs adjusting for age, sex, lifestyle factors, and social risk factors. Definitions for lifestyle risk factors and cardiometabolic diseases are shown in the footnotes of Tables 1 and 2. Sample sizes are shown in Tables S3 and S4. Error bars indicate 95% CIs. NHANES indicates National Health and Nutrition Examination Survey.

and 31.4% [95% CI, 28.5%–34.3%]), diabetes (3.4% [95% CI, 2.8%–4.0%] versus 6.1% [95% CI, 4.7%–7.5%] and 5.4% [95% CI, 4.3%–6.5%]), and CKD (5.9% [95% CI, 5.1%–6.8%] versus 8.7% [95% CI, 7.3%–10.2%] and 8.1% [95% CI, 6.7%–9.4%]) was significantly lower in non-Hispanic White individuals than in non-Hispanic Black and Hispanic individuals. Compared with non-Hispanic White and Hispanic individuals, non-Hispanic Black individuals had a significantly higher prevalence of hypertension (16.9% [95% CI, 15.2%–18.6%] versus 8.9% [95% CI, 7.7%–10.2%] and 8.1% [95% CI, 6.9%–9.3%]), respectively, but a significantly lower prevalence of dyslipidemia (32.0% [95% CI, 29.9%–34.1%] versus 36.2% [95% CI, 33.7%–38.7%] and 42.7% [95% CI, 40.3%–45.0%]) and NAFLD (20.9% [95% CI, 18.5%–23.3%] versus 30.6% [95% CI, 28.1%–33.0%] and 39.4% [95% CI, 36.5%–42.3%]). Hispanic individuals had the highest prevalence of metabolic syndrome among all racial and ethnic subgroups (23.2% [95% CI, 20.7%–25.8%]). Generally, young adults with a more favorable social risk factor profile had a lower prevalence of cardiometabolic diseases.

Table 1. Prevalence of Lifestyle Risk Factors by Demographic Variables and Social Risk Factors*

Characteristics	Prevalence, % (95% CI)†				
	Current smoking‡	Excessive drinking§	Poor diet quality‖	Inadequate physical activity¶	Inappropriate sleep duration#
Total	22.0 (20.4–23.5)	16.3 (15.1–17.5)	49.3 (46.8–51.9)	25.7 (24.5–27.0)	35.8 (34.3–37.3)
Age group, y					
18–24	18.5 (16.3–20.8)	10.2 (8.9–11.5)	58.3 (54.5–62.2)	21.0 (18.7–23.3)	35.9 (33.7–38.1)
25–29	23.4 (20.7–26.2)	17.0 (14.4–19.6)	50.2 (45.9–54.4)	21.1 (18.7–23.6)	33.1 (30.4–35.8)
30–34	23.4 (20.9–25.9)	17.2 (14.6–19.7)	46.2 (41.9–50.6)	24.9 (22.0–27.8)	35.3 (32.6–38.0)
35–39	22.7 (20.4–25.0)	19.7 (17.3–22.1)	44.3 (40.5–48.1)	29.2 (26.5–32.0)	37.7 (34.3–41.1)
40–44	22.9 (20.3–25.5)	20.1 (17.7–22.5)	42.7 (38.0–47.4)	34.7 (31.6–37.7)	37.0 (34.2–39.9)
Sex					
Male	24.8 (22.8–26.9)	20.9 (19.0–22.9)	52.9 (50.3–55.6)	19.6 (18.1–21.2)	37.4 (35.3–39.5)
Female	19.0 (17.3–20.7)	11.4 (10.0–12.8)	45.5 (42.3–48.7)	31.6 (29.8–33.5)	34.2 (32.5–35.8)
Race and ethnicity					
Non-Hispanic Asian	10.5 (8.6–12.4)	6.6 (4.9–8.3)	33.5 (30.0–37.0)	33.1 (30.0–36.3)	28.2 (25.7–30.7)
Non-Hispanic Black	22.7 (20.3–25.2)	15.2 (13.4–17.0)	56.0 (52.3–59.8)	29.6 (27.1–32.0)	49.2 (46.9–51.5)
Hispanic	15.7 (13.7–17.6)	13.1 (11.7–14.5)	46.1 (42.5–49.8)	30.5 (28.4–32.6)	37.0 (34.8–39.2)
Non-Hispanic White	24.8 (22.3–27.3)	18.5 (16.5–20.5)	50.4 (46.9–53.9)	22.1 (20.7–23.6)	33.1 (30.9–35.2)
Other**	30.2 (25.1–35.3)	18.7 (13.6–23.8)	55.9 (47.5–64.3)	21.8 (16.5–27.0)	36.5 (31.4–41.5)
Education level					
Less than high school	32.9 (29.5–36.4)	19.0 (16.8–21.2)	59.0 (55.0–63.0)	32.6 (30.0–35.2)	41.5 (38.9–44.2)
High school graduate	30.0 (27.2–32.9)	19.8 (17.5–22.1)	60.5 (56.9–64.1)	27.2 (25.0–29.5)	39.7 (37.1–42.3)
Some college	23.6 (21.7–25.4)	17.2 (15.2–19.1)	52.5 (48.9–56.1)	24.2 (22.3–26.2)	39.3 (36.8–41.8)
College graduate or higher	9.0 (7.4–10.6)	12.0 (9.7–14.3)	32.4 (28.7–36.2)	21.4 (19.1–23.7)	25.0 (22.7–27.3)
Family income-to-poverty ratio					
≤100%	32.7 (29.1–36.4)	17.7 (15.5–19.8)	57.2 (53.2–61.2)	30.2 (27.5–33.0)	40.7 (38.5–42.9)
>100%–299%	24.5 (22.5–26.5)	17.6 (15.9–19.3)	54.2 (51.3–57.1)	26.5 (25.0–28.1)	38.1 (36.1–40.2)
≥300%–499%	16.0 (13.6–18.3)	14.3 (11.9–16.7)	46.7 (42.2–51.3)	22.9 (20.3–25.4)	33.0 (29.5–36.5)
≥500%	12.0 (9.6–14.4)	14.7 (10.7–18.6)	37.4 (32.9–42.0)	21.5 (18.8–24.2)	28.0 (25.3–30.7)
Food security status††					
Secure	17.0 (15.4–18.6)	14.5 (12.9–16.1)	45.5 (42.7–48.4)	24.4 (22.8–26.0)	32.6 (30.9–34.3)
Marginal	26.7 (23.6–29.7)	16.7 (14.3–19.2)	51.9 (47.4–56.3)	27.6 (24.9–30.3)	38.6 (35.1–42.2)
Insecure	34.6 (31.8–37.5)	21.6 (19.2–24.0)	60.3 (56.4–64.1)	28.3 (26.0–30.7)	44.2 (41.2–47.1)
Employment status					
Employed	20.2 (18.7–21.8)	16.3 (14.8–17.7)	48.1 (45.3–50.9)	23.1 (21.7–24.5)	34.8 (33.0–36.6)
Unemployed	27.4 (24.4–30.5)	16.4 (14.5–18.3)	52.6 (49.0–56.1)	33.0 (30.9–35.1)	38.4 (36.2–40.5)
Home ownership					
Owned home	17.4 (15.8–19.1)	15.2 (13.6–16.8)	49.0 (45.8–52.2)	24.7 (22.9–26.4)	34.3 (32.5–36.1)
Did not own home‡‡	26.5 (24.0–28.9)	17.5 (16.0–19.0)	50.5 (47.5–53.5)	26.4 (24.8–28.1)	37.7 (35.6–39.8)
Insurance status					
Insured	19.1 (17.5–20.7)	14.5 (13.1–15.9)	47.1 (44.4–49.9)	24.4 (23.1–25.6)	34.9 (33.2–36.6)
Uninsured	31.1 (28.0–34.1)	21.8 (19.9–23.8)	56.5 (52.8–60.2)	29.3 (26.8–31.7)	38.7 (36.5–40.9)
Regular health care access					
≥1 Health care facilities	20.8 (19.2–22.4)	15.1 (13.8–16.4)	48.1 (45.3–51.0)	26.2 (24.7–27.7)	35.4 (33.6–37.2)
None	25.8 (23.2–28.3)	19.8 (17.5–22.1)	52.7 (49.4–55.9)	23.9 (21.8–26.0)	37.2 (35.0–39.4)
Country of birth					
United States	24.3 (22.4–26.2)	17.8 (16.4–19.2)	52.5 (49.6–55.3)	23.8 (22.5–25.0)	36.8 (35.1–38.5)

(*Continued*)

Table 1. Continued

Characteristics	Prevalence, % (95% CI)[†]				
	Current smoking[‡]	Excessive drinking[§]	Poor diet quality[‖]	Inadequate physical activity[¶]	Inappropriate sleep duration[#]
Other countries	12.7 (11.4–14.1)	10.7 (9.3–12.1)	36.6 (33.2–39.9)	31.9 (29.8–34.0)	32.1 (29.7–34.4)

*Please refer to Table S3 for sample sizes. Sample sizes were unweighted.

[†]Estimates for overall and by age groups were unadjusted. Other estimates were age-standardized to the 2017–2018 National Health and Nutrition Examination Survey nonpregnant adult population, using the age groups 18 to 29 years, 30 to 39 years, and 40 to 44 years. All estimates were weighted.

[‡]Smoked at least 100 cigarettes during their lifetime and were currently smoking.

[§]Having an average of ≥14 drinks per week for men and ≥7 drinks per week for women or at least 4 or 5 drinks in a single day.

[‖]Having a Healthy Eating Index 2015 score <50 out of 100.

[¶]Having <150 minutes of moderate to vigorous physical activity per week (including work-related activity, leisure-time activity, and transportation activity).

[#]Having <7 hours or >9 hours of sleep per night.

[**]The "other" group included other non-Hispanic ethnicities and mixed races.

[††]Food security level was measured using the US Household Food Security Survey Module in which 10 questions were used to create 4 response levels: full food security, marginal food security, low food security, and very low food security. Low food security and very low food security were combined into the "Insecure" category.

[‡‡]Renting a home or having other arrangements.

Clustering of Lifestyle Risk Factors and Cardiometabolic Diseases and 30-Year ASCVD Risk

The prevalence of having none of the lifestyle risk factors was 20.1% (95% CI, 18.0%–22.1%) and of having ≥2 lifestyle risk factors was 45.2% (95% CI, 43.0%–47.5%) (Table 3, sample sizes in Table S5). The prevalence of having none of the 5 prespecified cardiometabolic diseases (dyslipidemia, hypertension, diabetes, CKD, and NAFLD) was 39.7% (95% CI, 37.3%–42.1%) and of having ≥2 cardiometabolic diseases was 22.0% (95% CI, 20.4%–23.5%). The 30-year ASCVD risk was 14.2% (95% CI, 13.6%–14.8%). Non-Hispanic Black individuals had the highest prevalence of having ≥2 lifestyle risk factors (56.4% [95% CI, 53.1%–59.8%]) among all racial and ethnic subgroups. Compared with non-Hispanic White individuals, Hispanic individuals had a significantly higher prevalence of having ≥2 cardiometabolic diseases (27.1% [95% CI, 24.1%–30.2%] versus 20.1% [95% CI, 17.8%–22.4%]). Non-Hispanic Asian individuals had the lowest 30-year risk of ASCVD among all racial and ethnic subgroups (11.0% [95% CI, 10.4%–11.6%]).

Explaining Racial and Ethnic Disparities Through Adjustment

The differences between non-Hispanic Black or Hispanic individuals and non-Hispanic White individuals in the prevalence of many cardiometabolic diseases were attenuated after adjusting for social risk factors but further adjustment of lifestyle factors did not qualitatively alter the results (Table 4). Based on the fully adjusted models, the prevalence of obesity (difference in prevalence, 7.3% [95% CI, 3.3%–11.3%]), severe obesity (3.1% [95% CI, 1.1%–5.1%]), hypertension (6.7% [95% CI, 4.1%–9.3%]), prediabetes (8.1% [95% CI, 3.5%–12.6%]), and diabetes (2.4% [95% CI, 0.7%–4.1%]) as well as 30-year risk of ASCVD (2.0% [95% CI, 1.3%–2.7%]) remained significantly higher in non-Hispanic Black individuals compared with non-Hispanic White individuals. Compared with non-Hispanic White individuals, Hispanic individuals had a significantly higher prevalence of obesity (13.6% [95% CI, 8.9%–18.2%]), prediabetes (7.6% [95% CI, 1.9%–13.3%]), NAFLD (7.8% [95% CI, 2.7v–12.9%]), and metabolic syndrome (6.9% [95% CI, 3.0%–10.9%]) after adjusting for all factors; however, the difference in the prevalence of dyslipidemia and diabetes was no longer significant. After adjusting for social risk factors, the significant difference in the prevalence of metabolic syndrome and 30-year risk of ASCVD disappeared between non-Hispanic Asian and non-Hispanic White individuals. Compared with non-Hispanic White individuals, non-Hispanic Asian individuals had a significantly higher prevalence of hypertension (6.7% [95% CI, 2.4%–10.9%]) after adjusting for all factors. Racial and ethnic differences in most diseases did not change materially after adjusting for lifestyle factors only.

Results for racial and ethnic differences in the prevalence of lifestyle risk factors after adjusting for social risk factors are shown in Table S6.

Sensitivity Analysis

The estimated age-standardized prevalence of lifestyle risk factors and cardiometabolic diseases according to education level among young adults aged ≥25 years is shown in Table S7. Results were consistent with those of primary analyses. The racial and ethnic differences in the prevalence of cardiometabolic diseases and lifestyle risk factors without adjusting for family income-to-poverty ratio (Tables S8 and S9) were similar to those of primary analyses. The prevalence of poor diet quality was 24.2% (95% CI, 22.1%–26.2%) for <41 (25th percentile of the HEI-2015 score) out of 100 and 74.9% (95% CI, 72.8%–76.9%) for <60 out of 100 (Table S10).

Table 2. Prevalence of Cardiometabolic Diseases by Demographic Variables and Social Risk Factors*

Characteristics	Prevalence, % (95% CI)†								
	Obesity‡	Severe obesity‡	Dyslipidemia§	Hypertension‖	Prediabetes¶	Diabetes¶	CKD#	NAFLD**	Metabolic syndrome††
Total	35.7 (33.8–37.5)	7.9 (7.0–8.7)	37.3 (35.6–39.1)	10.2 (9.3–11.2)	25.8 (23.6–27.9)	4.4 (3.9–4.9)	6.8 (6.2–7.4)	31.1 (29.5–32.8)	18.9 (17.0–20.8)
Age group, y									
18–24	26.4 (23.4–29.4)	5.7 (4.5–7.0)	31.1 (28.1–34.0)	2.5 (1.7–3.2)	17.2 (14.6–19.8)	1.2 (0.5–1.9)	7.5 (6.2–8.7)	24.9 (22.1–27.6)	8.1 (5.7–10.4)
25–29	34.3 (30.4–38.2)	7.3 (5.9–8.7)	34.3 (30.8–37.7)	3.8 (2.7–4.9)	20.2 (16.5–24.0)	2.3 (1.3–3.3)	5.0 (3.4–6.5)	31.8 (28.5–35.2)	13.8 (10.1–17.5)
30–34	38.7 (35.7–41.8)	9.5 (7.6–11.5)	38.8 (36.2–41.4)	10.8 (8.6–13.1)	28.0 (23.2–32.9)	3.3 (2.4–4.2)	6.0 (4.6–7.5)	34.7 (31.8–37.6)	21.4 (18.1–24.8)
35–39	39.7 (36.5–42.8)	8.0 (6.2–9.7)	40.6 (37.6–43.7)	16.6 (14.2–18.9)	31.6 (27.4–35.7)	6.6 (5.2–8.0)	7.6 (6.1–9.1)	33.0 (29.5–36.5)	23.3 (19.0–27.6)
40–44	43.4 (40.2–46.5)	9.8 (7.9–11.7)	44.5 (41.5–47.6)	21.1 (18.2–24.1)	35.4 (30.2–40.5)	9.8 (8.0–11.6)	7.7 (6.3–9.1)	34.7 (31.3–38.1)	32.5 (27.8–37.3)
Sex									
Male	34.8 (32.3–37.3)	5.8 (4.9–6.7)	35.1 (33.2–37.0)	11.9 (10.4–13.3)	31.4 (28.4–34.5)	3.9 (3.1–4.7)	5.2 (4.4–6.0)	32.3 (30.3–34.3)	20.1 (17.7–22.6)
Female	36.4 (34.5–38.2)	9.9 (8.7–11.1)	39.4 (37.3–41.5)	8.1 (7.1–9.1)	19.3 (17.2–21.4)	4.6 (3.8–5.4)	8.4 (7.5–9.4)	30.2 (28.2–32.1)	16.9 (14.8–19.0)
Race and ethnicity									
Non-Hispanic Asian	14.9 (13.0–16.9)	1.1 (0.6–1.6)	33.7 (30.6–36.8)	7.5 (6.1–8.9)	22.8 (19.3–26.3)	4.3 (3.0–5.5)	6.7 (5.1–8.4)	29.6 (27.1–32.1)	13.4 (10.5–16.3)
Non-Hispanic Black	44.1 (41.7–46.5)	12.6 (11.1–14.2)	32.0 (29.9–34.1)	16.9 (15.2–18.6)	30.3 (27.1–33.4)	6.1 (4.7–7.5)	8.7 (7.3–10.2)	20.9 (18.5–23.3)	16.4 (13.5–19.3)
Hispanic	41.6 (39.3–43.9)	7.6 (6.4–8.8)	42.7 (40.3–45.0)	8.1 (6.9–9.3)	31.4 (28.5–34.3)	5.4 (4.3–6.5)	8.1 (6.7–9.4)	39.4 (36.5–42.3)	23.2 (20.7–25.8)
Non-Hispanic White	33.4 (30.8–35.9)	7.4 (6.1–8.7)	36.2 (33.7–38.7)	8.9 (7.7–10.2)	22.2 (19.2–25.3)	3.4 (2.8–4.0)	5.9 (5.1–6.8)	30.6 (28.1–33.0)	17.8 (15.3–20.3)
Other‡‡	41.6 (35.2–48.1)	10.7 (7.2–14.2)	42.7 (37.9–47.6)	11.4 (7.2–15.5)	32.6 (24.1–41.1)	5.8 (3.1–8.4)	6.6 (4.3–8.8)	29.0 (23.3–34.8)	22.3 (14.7–30.0)
Education level									
Less than high school	36.7 (33.7–39.7)	7.7 (6.1–9.4)	44.7 (41.6–47.7)	10.6 (8.9–12.3)	31.6 (27.6–35.5)	5.2 (3.9–6.6)	9.6 (8.0–11.2)	34.8 (32.2–37.4)	24.6 (20.9–28.3)
High school graduate	40.8 (38.5–43.2)	9.1 (7.6–10.6)	39.7 (36.9–42.4)	12.4 (10.5–14.3)	29.8 (25.8–33.7)	5.2 (4.1–6.4)	7.2 (5.8–8.7)	30.8 (27.6–34.0)	20.4 (17.3–23.4)
Some college	39.9 (38.0–41.9)	9.7 (8.3–11.0)	40.4 (37.8–42.9)	11.5 (9.8–13.2)	24.1 (20.9–27.3)	5.2 (4.2–6.2)	6.7 (5.5–7.9)	32.3 (30.1–34.5)	21.6 (18.4–24.8)
College graduate or higher	26.4 (23.1–29.6)	5.3 (3.8–6.8)	27.8 (25.5–30.1)	7.0 (5.6–8.3)	21.5 (17.7–25.4)	2.1 (1.4–2.9)	5.1 (3.9–6.4)	29.4 (26.1–32.7)	11.5 (9.0–13.9)
Family income-to-poverty ratio									
≤100%	37.9 (35.2–40.6)	8.9 (7.6–10.3)	42.7 (39.3–46.1)	11.9 (10.2–13.6)	29.5 (26.3–32.8)	6.0 (4.7–7.3)	9.1 (8.0–10.2)	31.8 (28.7–34.9)	23.0 (18.9–27.2)
>100%–299%	39.6 (37.3–42.0)	9.9 (8.5–11.3)	41.0 (38.6–43.4)	10.4 (9.2–11.5)	26.7 (23.6–29.7)	4.6 (3.6–5.6)	7.6 (6.6–8.7)	33.2 (30.8–35.5)	23.4 (20.6–26.2)
≥300%–499%	33.8 (30.6–36.9)	6.4 (4.9–8.0)	32.9 (29.8–35.9)	9.3 (7.4–11.1)	22.2 (18.5–26.0)	3.8 (2.5–5.1)	4.4 (3.1–5.7)	30.6 (26.7–34.5)	15.1 (11.5–18.6)
≥500%	29.5 (25.1–33.8)	5.3 (3.5–7.1)	29.4 (26.3–32.5)	8.9 (7.1–10.7)	21.8 (16.6–27.1)	2.7 (1.7–3.7)	5.5 (4.0–7.0)	31.5 (27.6–35.3)	10.0 (6.8–13.3)
Food security status§§									
Secure	31.8 (29.5–34.1)	6.4 (5.4–7.4)	33.6 (31.8–35.4)	8.7 (7.7–9.6)	23.3 (20.8–25.7)	3.5 (2.8–4.1)	5.9 (5.2–6.6)	30.1 (28.2–32.0)	14.5 (12.7–16.4)
Marginal	41.0 (37.4–44.6)	8.7 (6.8–10.5)	40.2 (36.7–43.7)	12.4 (10.1–14.8)	29.6 (25.3–33.8)	4.6 (3.3–5.8)	8.4 (6.5–10.3)	33.7 (29.8–37.7)	23.1 (18.5–27.7)

(*Continued*)

Table 2. Continued

Characteristics	Prevalence, % (95% CI)[†]								
	Obesity[‡]	Severe obesity[‡]	Dyslipidemia[§]	Hypertension[‖]	Prediabetes[¶]	Diabetes[¶]	CKD[#]	NAFLD[**]	Metabolic syndrome[††]
Insecure	44.4 (41.6–47.2)	12.0 (10.3–13.8)	47.2 (44.4–49.9)	12.8 (11.1–14.6)	28.9 (25.2–32.7)	6.3 (5.2–7.4)	8.5 (7.0–9.9)	34.4 (31.3–37.5)	27.9 (24.0–31.7)
Employment status									
Employed	35.3 (33.4–37.2)	7.3 (6.4–8.2)	35.1 (33.5–36.8)	9.4 (8.4–10.4)	26.2 (23.9–28.5)	3.8 (3.2–4.4)	6.0 (5.2–6.8)	30.8 (29.1–32.6)	17.6 (15.8–19.4)
Unemployed	36.4 (33.2–39.5)	9.7 (8.1–11.2)	43.6 (40.6–46.6)	12.1 (10.7–13.4)	23.2 (20.0–26.4)	5.6 (4.4–6.7)	9.2 (8.0–10.3)	32.5 (29.6–35.5)	21.5 (18.5–24.5)
Home ownership									
Owned home	33.6 (30.7–36.4)	7.1 (5.8–8.4)	35.5 (33.1–37.8)	9.4 (8.3–10.5)	23.8 (20.8–26.8)	3.7 (2.9–4.4)	6.5 (5.4–7.5)	30.4 (27.8–33.0)	16.5 (14.1–18.9)
Not owned home[‖‖]	38.1 (36.1–40.1)	8.7 (7.5–10.0)	39.4 (37.2–41.5)	10.9 (9.6–12.1)	26.9 (24.3–29.5)	5.0 (4.3–5.7)	7.2 (6.3–8.0)	32.9 (30.9–34.9)	21.1 (18.5–23.6)
Insurance status									
Insured	35.1 (33.0–37.2)	7.6 (6.6–8.5)	35.8 (33.8–37.8)	10.3 (9.2–11.3)	23.5 (21.1–25.9)	4.1 (3.6–4.6)	6.4 (5.7–7.0)	30.5 (28.6–32.4)	17.8 (15.9–19.8)
Uninsured	36.6 (33.7–39.5)	8.6 (7.1–10.2)	41.3 (38.7–44.0)	9.2 (7.6–10.7)	31.6 (27.8–35.5)	4.7 (3.6–5.7)	8.2 (7.0–9.4)	33.6 (31.3–35.9)	20.7 (17.9–23.4)
Regular health care access									
≥1 Health care facilities	36.4 (34.5–38.3)	8.5 (7.5–9.5)	37.9 (36.0–39.8)	10.7 (9.6–11.7)	24.5 (22.1–26.9)	4.5 (4.0–5.1)	6.9 (6.2–7.7)	31.1 (29.2–32.9)	19.0 (17.1–21.0)
None	32.1 (29.3–34.8)	5.6 (4.4–6.7)	34.9 (32.2–37.7)	7.6 (6.4–8.7)	27.6 (24.6–30.7)	3.4 (2.2–4.5)	6.3 (5.2–7.4)	31.2 (28.4–34.1)	16.6 (14.1–19.1)
Country of birth									
United States	37.8 (35.7–39.8)	9.1 (8.0–10.1)	36.4 (34.6–38.3)	11.2 (10.1–12.3)	24.6 (22.1–27.0)	4.1 (3.5–4.7)	6.5 (5.8–7.3)	30.0 (28.1–31.8)	19.0 (17.0–21.0)
Other countries	28.0 (25.7–30.4)	3.6 (2.8–4.4)	39.9 (37.3–42.5)	6.2 (5.2–7.2)	28.9 (25.7–32.0)	4.7 (3.7–5.6)	7.6 (6.4–8.9)	35.9 (32.8–39.0)	16.9 (14.3–19.6)

CKD indicates chronic kidney disease; and NAFLD, nonalcoholic fatty liver disease.

*Please refer to Table S4 for sample sizes. Sample sizes were unweighted.

[†]Estimates for overall and by age groups were unadjusted. Other estimates were age-standardized to the 2017–2018 National Health and Nutrition Examination Survey nonpregnant adult population, using the age groups 18 to 29 years, 30 to 39 years, and 40 to 44 years. All estimates were weighted.

[‡]Obesity was defined as body mass index ≥30 kg/m^2. Severe obesity was defined as body mass index ≥40 kg/m^2.

[§]Having a total cholesterol level ≥240 mg/dL, self-reported current use of lipid-lowering medications, or a high-density lipoprotein cholesterol level <40 mg/dL for men and <50 mg/dL for women.

[‖]Blood pressure ≥140/90 mm Hg or self-reported current use of antihypertensive medications.

[¶]Prediabetes was defined as having a hemoglobin A1c level of 5.7–6.4% or a fasting plasma glucose level of 100–125 mg/dL among participants who did not report a diabetes diagnosis. Diabetes was defined as having a self-reported diabetes diagnosis, a hemoglobin A1c level ≥6.5%, or a fasting plasma glucose level ≥126 mg/dL.

[#]Having a urine albumin-to-creatinine ratio ≥30 mg/g or an estimated glomerular filtration rate<60 mL/min per 1.73 m^2.

[**]Having serum alanine aminotransferase activity >30 IU/L for men and>19 IU/L for women in the absence of excessive drinking and other identifiable causes of liver disease.

[††]Having at least 3 of the following 5 criteria: waist circumference >102 cm for men or >88 cm for women, a triglycerides level ≥150 mg/dL, a high-density lipoprotein cholesterol level <40 mg/dL for men or <50 mg/dL for women, blood pressure ≥130/85 mm Hg, and a fasting glucose level ≥100 mg/dL.

[‡‡]The "other" group included other non-Hispanic ethnicities and mixed races.

[§§]Food security level was measured using the US Household Food Security Survey Module in which 10 questions were used to create 4 response levels: full food security, marginal food security, low food security, and very low food security. Low food security and very low food security were combined into the "Insecure" category.

[‖‖]Renting a home or having other arrangements.

Table 3. Prevalence of Clustering of Lifestyle Risk Factors and Cardiometabolic Diseases by Demographic Variables and Social Risk Factors*

Characteristics	Prevalence, % (95% CI)†						
	Number of unhealthy lifestyle behaviors‡			Number of cardiometabolic diseases§			30-Year risk of atherosclerotic cardiovascular disease‖
	0	1	≥2	0	1	≥2	
Total	20.1 (18.0–22.1)	33.4 (31.8–34.9)	45.2 (43.0–47.5)	39.7 (37.3–42.1)	32.2 (30.6–33.8)	22.0 (20.4–23.5)	14.2 (13.6–14.8)
Age group, y							
18–24	17.8 (14.8–20.9)	35.0 (32.1–37.9)	45.2 (41.3–49.2)	48.8 (44.5–53.1)	33.7 (29.9–37.5)	13.5 (10.7–16.3)	3.9 (3.7–4.1)
25–29	22.3 (18.5–26.2)	33.6 (29.6–37.5)	43.4 (39.3–47.5)	43.0 (37.3–48.8)	33.4 (28.7–38.2)	17.5 (13.9–21.1)	8.2 (7.7–8.6)
30–34	22.0 (18.4–25.6)	31.7 (28.4–34.9)	45.3 (41.1–49.5)	39.1 (35.1–43.2)	30.9 (26.4–35.4)	23.9 (20.9–26.9)	13.5 (12.8–14.2)
35–39	20.8 (16.8–24.8)	31.5 (28.1–35.0)	45.8 (41.5–50.2)	34.2 (29.2–39.2)	31.1 (26.0–36.3)	27.1 (23.2–31.0)	20.4 (19.3–21.4)
40–44	18.3 (14.7–21.9)	34.4 (30.3–38.4)	46.4 (42.0–50.8)	29.4 (25.2–33.6)	31.2 (26.4–36.1)	32.2 (27.7–36.7)	28.6 (27.4–29.9)
Sex							
Male	18.4 (16.0–20.8)	33.5 (31.0–35.9)	47.2 (44.5–50.0)	41.1 (37.9–44.3)	30.7 (28.2–33.2)	21.0 (18.9–23.1)	16.8 (16.2–17.4)
Female	22.0 (19.4–24.5)	33.1 (31.3–34.9)	43.1 (40.1–46.1)	38.8 (35.9–41.7)	33.9 (31.4–36.3)	22.8 (20.7–24.8)	10.4 (10.0–10.9)
Race and ethnicity							
Non-Hispanic Asian	30.7 (25.3–36.1)	35.2 (31.0–39.5)	32.3 (27.6–37.0)	46.1 (41.0–51.1)	28.5 (23.3–33.7)	20.9 (16.9–25.0)	11.0 (10.4–11.6)
Non-Hispanic Black	12.2 (10.0–14.4)	30.1 (27.3–32.9)	56.4 (53.1–59.8)	42.1 (38.2–45.9)	30.8 (27.2–34.3)	21.5 (18.5–24.5)	15.8 (15.2–16.5)
Hispanic	17.8 (15.2–20.3)	37.4 (34.5–40.3)	43.4 (40.1–46.7)	33.6 (30.1–37.1)	34.8 (31.9–37.6)	27.1 (24.1–30.2)	13.6 (13.1–14.1)
Non-Hispanic White	21.7 (18.8–24.5)	32.8 (30.2–35.3)	44.4 (40.9–47.8)	41.5 (37.9–45.0)	31.9 (29.4–34.4)	20.1 (17.8–22.4)	13.5 (12.9–14.1)
Other#	17.6 (11.3–23.9)	29.6 (23.5–35.6)	51.5 (44.7–58.3)	37.9 (28.5–47.3)	32.7 (24.4–41.1)	22.7 (15.3–30.0)	14.7 (13.0–16.4)
Education level							
Less than high school	9.7 (7.7–11.7)	25.8 (22.0–29.6)	62.0 (57.3–66.8)	32.7 (28.4–36.9)	31.2 (27.2–35.3)	29.2 (25.7–32.8)	15.4 (14.6–16.1)
High school graduate	12.2 (9.9–14.5)	27.1 (24.6–29.6)	60.0 (56.8–63.2)	38.1 (34.4–41.8)	32.6 (28.6–36.7)	22.3 (19.3–25.4)	15.8 (15.1–16.6)
Some college	16.5 (13.8–19.2)	34.7 (32.1–37.3)	47.5 (44.4–50.7)	38.1 (34.4–41.8)	31.6 (28.4–34.8)	24.0 (21.0–26.9)	14.2 (13.6–14.8)
College graduate or higher	35.3 (31.8–38.8)	39.3 (36.1–42.6)	24.5 (21.4–27.6)	46.5 (41.3–51.6)	33.5 (29.1–37.8)	16.1 (13.5–18.8)	11.4 (10.9–11.9)
Family income-to-poverty ratio							
≤100%	11.5 (9.0–13.9)	28.6 (25.7–31.5)	58.4 (54.8–62.1)	32.9 (28.4–37.3)	34.1 (30.5–37.8)	26.9 (23.5–30.2)	15.2 (14.3–16.2)
>100%–299%	16.8 (14.3–19.3)	31.6 (29.0–34.1)	50.4 (47.5–53.2)	37.6 (33.7–41.6)	30.4 (27.4–33.3)	25.5 (23.0–28.0)	14.6 (14.1–15.2)
≥300%–499%	23.7 (19.4–27.9)	37.1 (33.5–40.8)	38.4 (34.0–42.8)	45.2 (39.6–50.7)	31.8 (27.1–36.5)	17.4 (14.0–20.9)	13.1 (12.5–13.8)
≥500%	29.9 (26.2–33.6)	37.4 (34.0–40.9)	31.4 (27.2–35.6)	48.4 (40.9–55.9)	31.7 (25.1–38.3)	15.4 (11.7–19.2)	11.6 (11.0–12.2)
Food security status**							
Secure	23.9 (21.2–26.5)	35.4 (33.4–37.4)	39.4 (36.7–42.1)	44.1 (41.1–47.1)	31.9 (29.4–34.3)	18.9 (17.0–20.9)	12.7 (12.3–13.1)
Marginal	15.3 (11.9–18.8)	32.4 (28.4–36.5)	50.7 (45.8–55.7)	34.8 (30.6–39.1)	32.6 (28.2–37.0)	25.4 (20.9–29.9)	14.3 (13.6–15.0)
Insecure	10.6 (8.4–12.8)	26.7 (23.4–30.0)	61.6 (57.3–66.0)	30.7 (26.2–35.3)	31.6 (27.7–35.4)	29.8 (26.2–33.5)	16.3 (15.6–17.1)

(*Continued*)

Table 3. Continued

Characteristics	Prevalence, % (95% CI)[†]						
	Number of unhealthy lifestyle behaviors[‡]			Number of cardiometabolic diseases[§]			30-Year risk of atherosclerotic cardiovascular disease[‖]
	0	1	≥2	0	1	≥2	
Employment status							
Employed	21.7 (19.2–24.1)	34.9 (33.0–36.9)	42.4 (40.1–44.7)	42.8 (40.1–45.5)	32.2 (30.0–34.3)	19.3 (17.8–20.7)	13.7 (13.4–14.1)
Unemployed	15.5 (12.7–18.3)	28.9 (26.0–31.8)	53.5 (49.5–57.6)	31.7 (28.0–35.4)	32.8 (29.5–36.0)	29.3 (26.0–32.6)	13.7 (12.9–14.5)
Home ownership							
Owned home	21.2 (18.7–23.7)	35.4 (33.2–37.7)	42.0 (39.0–45.0)	43.2 (39.6–46.7)	31.1 (28.2–34.0)	20.2 (17.8–22.6)	13.0 (12.5–13.5)
Did not own home[††]	18.2 (15.5–21.0)	31.1 (29.1–33.0)	49.4 (46.2–52.7)	36.7 (33.6–39.8)	32.7 (30.1–35.3)	24.3 (21.8–26.7)	14.5 (13.9–15.1)
Insurance status							
Insured	22.3 (19.9–24.6)	35.0 (33.4–36.7)	41.4 (39.1–43.6)	41.3 (38.5–44.1)	32.5 (30.4–34.7)	20.8 (19.1–22.4)	13.4 (13.0–13.7)
Uninsured	13.2 (10.7–15.7)	27.6 (24.9–30.2)	57.9 (54.6–61.3)	35.8 (32.3–39.3)	31.1 (27.9–34.3)	25.2 (22.3–28.2)	14.8 (14.1–15.4)
Regular health care access							
≥1 Health care facilities	21.2 (19.1–23.4)	32.9 (31.2–34.6)	44.4 (42.0–46.9)	39.5 (36.8–42.1)	32.8 (30.8–34.8)	22.4 (20.9–24.0)	13.6 (13.2–14.0)
None	16.6 (13.7–19.6)	34.3 (31.1–37.5)	48.0 (44.9–51.2)	41.8 (37.2–46.4)	30.7 (26.9–34.5)	19.5 (16.5–22.6)	14.0 (13.3–14.7)
Country of birth							
United States	19.0 (16.8–21.2)	32.4 (30.6–34.2)	47.5 (45.0–49.9)	40.5 (37.9–43.1)	31.8 (29.8–33.8)	21.4 (19.7–23.0)	14.2 (13.7–14.6)
Other countries	24.9 (21.3–28.4)	36.8 (33.4–40.3)	36.1 (32.7–39.5)	38.1 (34.1–42.1)	33.4 (30.0–36.8)	23.8 (20.9–26.8)	12.2 (11.7–12.6)

*Please refer to Table S5 for sample sizes. Sample sizes were unweighted.

[†]Estimates for overall and by age groups were unadjusted. Other estimates were age-standardized to the 2017–2018 National Health and Nutrition Examination Survey nonpregnant adult population, using the age groups 18 to 29 years, 30 to 39 years, and 40 to 44 years. All estimates were weighted.

[‡]Included current smoking, excessive drinking, poor diet quality, inadequate physical activity, and inappropriate sleep duration (definitions are shown in the Table 1 footnote).

[§]Included dyslipidemia, hypertension, diabetes, chronic kidney disease, and nonalcoholic fatty liver disease (definitions are shown in the Table 2 footnote).

[‖]Based on the equation with body mass index included as a covariate from the Framingham Heart Study.

[#]The "other" group included other non-Hispanic ethnicities and mixed races.

**Food security level was measured using the US Household Food Security Survey Module in which 10 questions were used to create 4 response levels: full food security, marginal food security, low food security, and very low food security. Low food security and very low food security were combined into the "Insecure" category.

[††]Renting a home or having other arrangements.

Table 4. Racial and Ethnic Differences in the Prevalence of Cardiometabolic Diseases Adjusting for Demographic Variables, Social Risk Factors, and Lifestyle Factors

Cardiometabolic diseases[‡]	No.[*]	Difference in the prevalence, % (95% CI)[†]			
		Age-, age squared-, and sex-adjusted	Age-, age squared-, sex-, and social risk factors-adjusted[§]	Age-, age squared-, sex-, and lifestyle factors-adjusted[‖]	Age-, age squared-, sex-, social risk factors-, and lifestyle factors-adjusted[§,‖]
Obesity					
Asian—White	6644	−17.9 (−22.1 to −13.8)	−7.9 (−14.4 to −1.5)	−16.1 (−20.5 to −11.7)	−7.6 (−13.9 to −1.2)
Black—White		11.2 (6.6 to 15.7)	8.3 (4.3 to 12.3)	9.6 (5.2 to 14.0)	7.3 (3.3 to 11.3)
Hispanic—White		10.8 (6.7 to 14.9)	13.7 (9.0 to 18.5)	11.0 (6.9 to 15.1)	13.6 (8.9 to 18.2)
Severe obesity					
Asian—White	6644	−6.4 (−8.3 to −4.5)	−4.5 (−7.9 to −1.1)	−6.1 (−8.1 to −4.1)	−4.4 (−7.9 to −1.0)
Black—White		5.2 (2.8 to 7.6)	3.2 (1.2 to 5.2)	4.7 (2.3 to 7.0)	3.1 (1.1 to 5.1)
Hispanic—White		1.7 (−0.8 to 4.2)	2.8 (−0.3 to 5.9)	2.0 (−0.4 to 4.5)	2.9 (−0.2 to 6.0)
Dyslipidemia					
Asian—White	6374	−3.4 (−8.7 to 2.0)	0.3 (−6.6 to 7.3)	−1.2 (−6.4 to 4.1)	−0.2 (−6.8 to 6.4)
Black—White		−3.9 (−7.7 to 0.0)	−7.8 (−11.6 to −3.9)	−5.7 (−9.6 to −1.7)	−8.4 (−12.3 to −4.5)
Hispanic—White		7.3 (3.4 to 11.1)	2.4 (−2.5 to 7.3)	7.6 (3.8 to 11.3)	2.9 (−1.9 to 7.8)
Hypertension					
Asian—White	6573	−0.1 (−2.8 to 2.5)	6.4 (1.9 to 10.8)	1.1 (−1.8 to 4.1)	6.7 (2.4 to 10.9)
Black—White		8.5 (5.5 to 11.5)	6.8 (4.3 to 9.3)	8.1 (5.2 to 11.0)	6.7 (4.1 to 9.3)
Hispanic—White		0.3 (−1.8 to 2.5)	1.6 (−0.8 to 4.0)	0.5 (−1.6 to 2.6)	1.5 (−0.9 to 3.9)
Prediabetes					
Asian—White	3450	0.9 (−3.8 to 5.6)	3.4 (−2.6 to 9.4)	4.4 (−0.3 to 9.2)	4.5 (−1.4 to 10.5)
Black—White		9.5 (5.3 to 13.7)	7.4 (2.9 to 11.8)	9.6 (5.4 to 13.8)	8.1 (3.5 to 12.6)
Hispanic—White		10.0 (5.4 to 14.6)	6.6 (1.2 to 12.1)	11 (6.4 to 15.6)	7.6 (1.9 to 13.3)
Diabetes					
Asian—White	3450	0.4 (−1.1 to 2.0)	1.4 (−0.9 to 3.7)	0.6 (−1.1 to 2.3)	1.3 (−0.9 to 3.6)
Black—White		3.1 (1.5 to 4.7)	2.3 (0.7 to 3.9)	3.3 (1.6 to 4.9)	2.4 (0.7 to 4.1)
Hispanic—White		1.8 (0.3 to 3.4)	1.1 (−0.5 to 2.8)	1.9 (0.4 to 3.4)	1.0 (−0.5 to 2.6)
Chronic kidney disease					
Asian—White	6337	−0.4 (−2.9 to 2.1)	−0.7 (−3.9 to 2.4)	−0.4 (−3.0 to 2.2)	−0.7 (−3.8 to 2.4)
Black—White		2.0 (0.1 to 3.9)	1.3 (−0.7 to 3.3)	1.9 (0.0 to 3.9)	1.2 (−0.9 to 3.2)
Hispanic—White		0.6 (−1.5 to 2.8)	−0.8 (−3 to 1.4)	0.4 (−1.7 to 2.5)	−1.0 (−3.2 to 1.2)
Nonalcoholic fatty liver disease					
Asian—White	5305	−1.4 (−6.7 to 3.8)	−0.9 (−7.7 to 5.8)	−1.7 (−7.0 to 3.6)	−1.0 (−7.8 to 5.7)
Black—White		−10.5 (−15.7 to −5.3)	−11.9 (−17.0 to −6.9)	−11.4 (−16.5 to −6.3)	−12.7 (−17.7 to −7.7)
Hispanic—White		9.5 (4.7 to 14.2)	8.2 (3.2 to 13.2)	8.9 (4.2 to 13.7)	7.8 (2.7 to 12.9)
Metabolic syndrome					
Asian—White	3228	−5.7 (−10.3 to −1.1)	2.5 (−3.6 to 8.5)	−3.7 (−8.9 to 1.4)	2.5 (−3.6 to 8.5)
Black—White		−0.6 (−4.9 to 3.7)	−3.3 (−7.0 to 0.4)	−1.0 (−5.2 to 3.3)	−3.3 (−7.1 to 0.4)
Hispanic—White		5.8 (2.3 to 9.4)	6.6 (2.7 to 10.5)	6.7 (3.1 to 10.4)	6.9 (3.0 to 10.9)
Having 0 cardiometabolic diseases[¶]					
Asian—White	3152	7.1 (−0.3 to 14.4)	4.3 (−4.4 to 12.9)	4.7 (−2.9 to 12.3)	5.5 (−3.6 to 14.6)
Black—White		1.1 (−4.2 to 6.4)	5.9 (0.7 to 11.2)	4.1 (−1.0 to 9.3)	7.6 (2.5 to 12.8)
Hispanic—White		−7.3 (−13.0 to −1.6)	−4.7 (−11.3 to 1.9)	−8.4 (−14.3 to −2.6)	−6.0 (−12.8 to 0.8)
Having only 1 cardiometabolic disease[¶]					
Asian—White	2923	−2.3 (−9.5 to 4.9)	−5.1 (−13.9 to 3.7)	−2.9 (−10.3 to 4.4)	−5.4 (−14.2 to 3.4)
Black—White		−2.1 (−6.4 to 2.1)	−2.5 (−6.6 to 1.6)	−1.9 (−6.1 to 2.4)	−2.5 (−6.6 to 1.6)
Hispanic—White		3.6 (−1.0 to 8.2)	3.4 (−2.5 to 9.3)	3.5 (−1.1 to 8.1)	3.2 (−2.7 to 9.1)

(*Continued*)

Table 4. Continued

Cardiometabolic diseases‡	No.*	Difference in the prevalence, % (95% CI)†			
		Age-, age squared-, and sex-adjusted	Age-, age squared-, sex-, and social risk factors-adjusted§	Age-, age squared-, sex-, and lifestyle factors-adjusted‖	Age-, age squared-, sex-, social risk factors-, and lifestyle factors-adjusted§,‖
Having at least 2 cardiometabolic diseases¶					
Asian—White	3198	−1.6 (−6.4 to 3.2)	2.2 (−3.5 to 7.8)	−1.5 (−6.4 to 3.4)	1.1 (−4.4 to 6.5)
Black—White		2.3 (−2.1 to 6.6)	−0.5 (−4.5 to 3.5)	0.9 (−3.4 to 5.1)	−1.3 (−5.4 to 2.7)
Hispanic—White		6.5 (2.5 to 10.4)	5.1 (0.7 to 9.5)	6.1 (2.4 to 9.9)	4.7 (0.4 to 9.0)
30-year risk of atherosclerotic cardiovascular disease#					
Asian—White	3364	−3.2 (−4.1 to −2.4)	0.0 (−0.9 to 0.9)	−2.0 (−2.8 to −1.3)	−0.2 (−1.0 to 0.6)
Black—White		2.9 (2.0 to 3.7)	1.7 (1.0 to 2.5)	2.4 (1.7 to 3.1)	2.0 (1.3 to 2.7)
Hispanic—White		−0.3 (−1.1 to 0.5)	0.0 (−0.9 to 0.9)	0.5 (−0.2 to 1.1)	1.0 (0.1 to 1.8)

*Unweighted sample size.

†Multivariable weighted logistic regression models were used to assess racial and ethnic differences in the prevalence of cardiometabolic diseases.

‡Definitions for cardiometabolic diseases are shown in the Table 2 footnote.

§Social risk factors included education (<high school, high school graduate, some college, and ≥college graduate), family income-to-poverty ratio (≤100%, >100%–299%, 300%–499%, and ≥500%), home ownership (yes/no), employment status (yes/no), health insurance status (yes/no), regular health care access (yes/no), food security status (secure, marginal, and insecure), and country of birth (United States/others).

‖Lifestyle factors included smoking status (never, former, and current), drinking status (never, former, nonexcessive, and excessive), Healthy Eating Index-2015 score, Healthy Eating Index-2015 score squared, physical activity (minutes), physical activity squared, sleep hours, and sleep hours squared.

¶Included dyslipidemia, hypertension, diabetes, chronic kidney disease, and nonalcoholic fatty liver disease. Definitions for cardiometabolic diseases are shown in the Table 2 footnote.

#Based on the equation with body mass index included as a covariate from the Framingham Heart Study.

Results of subgroup analyses for these 2 definitions were similar to those of primary analyses.

DISCUSSION

Based on this serial cross-sectional analysis of the NHANES data, US young adults aged 18 to 44 years had poor cardiometabolic health. Only 1 in 5 young adults had no lifestyle risk factors and less than half had the absence of cardiometabolic diseases. Approximately 45% and 22% of young adults had at least 2 lifestyle risk factors and at least 2 cardiometabolic diseases, respectively. Significant differences in the prevalence of lifestyle risk factors and cardiometabolic diseases by race and ethnicity as well as social risk factors were identified. Racial and ethnic disparities in many cardiometabolic diseases persisted even after accounting for social risk factors and lifestyle factors.

Poor diet quality and inadequate sleep duration were highly prevalent among young adults, especially in non-Hispanic Black individuals and young adults with an unfavorable social risk factor profile. It is well reported that most US people consumed low-quality diets, although the definitions used for assessing diet quality differed.[7,30] Previous studies reported a trend for increasing diet quality with increasing age[31] and this study also found that emerging adults aged 18 to 24 years had the lowest diet quality. Young adults tended to have inadequate sleep duration because of the technology use.[32] That US young adults had poor lifestyle behaviors was further supported by that the prevalence of current smoking, excessive drinking, and inadequate physical activity was about 20%. Generally, behaviors are established in young adulthood and continue to middle age. Exposure to lifestyle risk factors early is harmful accumulatively to people's health throughout the life course.[33]

Young adults are commonly perceived as healthy. However, this analysis found that one third of young adults had obesity, dyslipidemia, and NAFLD, a quarter had prediabetes, and 1 in 5 had metabolic syndrome. These diseases are known strong risk factors for cardiovascular disease and mortality and pharmaceutical or lifestyle treatments should be used after diagnosis. Furthermore, cardiometabolic diseases occurring in young adulthood also affect work productivity.[34] Therefore, young adults' cardiometabolic health needs more attention, especially that of non-Hispanic Black individuals, Hispanic individuals, and people with an unfavorable social risk factor profile who were at increased risk of cardiometabolic diseases.

Previous studies reported that 2 or more lifestyle risk factors and 2 or more cardiometabolic diseases often clustered together among general adults.[35,36] Results of this study extend this evidence to young adults. The prevalence of having 2 or more lifestyle risk factors was higher than that of having only 1% and 22% of young adults had at least 2 cardiometabolic diseases. Similar to other studies, the clustering phenomenon was more common in non-Hispanic Black

individuals, Hispanic individuals, and adults with an unfavorable social risk factor profile.[37,38] Importantly, the coexistence of multiple lifestyle risk factors may create synergies, resulting in a greater health impact than individual behaviors alone.[39] Multimorbidity has also been associated with a lower life expectancy than a single disease.[40] Accordingly, health promotion activities may consider targeting 2 or more related lifestyle risk factors and cardiometabolic diseases simultaneously.

Racial and ethnic disparities in lifestyle risk factors and cardiometabolic diseases were notable even after adjusting for social risk factors. Non-Hispanic Black and Hispanic individuals generally had poorer cardiometabolic health than non-Hispanic White individuals. Non-Hispanic Asian individuals had relatively healthier behaviors except for physical activity and fewer cardiometabolic diseases than other racial and ethnic subgroups. A recent study by He et al reported that social risk factors contributed to but did not fully explain racial and ethnic disparities in cardiometabolic health.[12] In addition, the current study found, in agreement with a previous study conducted in the general adult population, that lifestyle risk factors made little or only a small contribution to racial and ethnic disparities regardless of whether social risk factors were accounted for.[41] Adjusting for social risk factors reduced but did not eliminate racial and ethnic disparities because apart from social risk factors and lifestyle factors, other factors such as childhood adverse exposures, neighborhood characteristics, social networks, perceived discrimination, genetics, and epigenetics may also contribute.[16,42] Furthermore, this study included selected social risk factors with possibility of measurement error and thus the social risk factor profile was not comprehensively and precisely assessed.

Race categorization in this study was a social construct, not a biological attribute. Structural racism, which is deeply embedded in the economic system as well as in cultural and societal norms, produces widespread unfair treatment of people of color and ultimately leads to racial and ethnic disparities in health.[43] The pathways linking structural racism with biological consequences such as cardiometabolic diseases and related clinical risk factors are complex and multilayered, including but not limited to psychological/physical stress, poor diet and health behaviors, poor community/social support, unhealthy living conditions, as well as differential health care access, diagnosis, treatment, and insurance coverage.[44,45] Social risk factors and lifestyle factors assessed in this study were merely selective, easily measurable manifestations of structural racism, not a complete assessment by design. Therefore, it is within our expectation that social risk factors and lifestyle factors considered in this study did not fully explain racial and ethnic differences in the prevalence of cardiometabolic diseases. Nonetheless, most of these factors are in theory modifiable and thus can serve as actionable intervention targets at the policy, community, and individual level.

To our knowledge, this is the first study to characterize the epidemiological landscape of lifestyle risk factors and cardiometabolic diseases by race and ethnicity and social risk factors among a nationally representative sample of young adults. Findings of this study provide data to quantify the burden of lifestyle risk factors and cardiometabolic diseases among young adults and to identify high-risk subgroups for intervention. Furthermore, racial and ethnic disparities in cardiometabolic diseases were characterized and selected contributors to the disparities were assessed. Young adulthood is a vulnerable period for engagement in health-damaging behaviors and for developing cardiometabolic diseases and risk factors. Given that cardiometabolic diseases are largely preventable and lifestyle risk factors are theoretically modifiable, devising effective and targeted interventions to improve cardiometabolic health in young adults would deliver long-term health benefits and reduce economic costs.

Limitations

This study has several limitations. First, reporting bias was likely for self-reported data. Second, misclassification of disease was possible by using self-reported diagnosis and laboratory test(s) from a single time point. Furthermore, several cardiometabolic diseases (eg, dyslipidemia and NAFLD) had more than 1 definition, although this study selected a most widely used one. Third, many social risk factors are challenging to measure precisely. Fourth, missing data may have caused bias in specific estimates, particularly from those analyses involving more than 10% missing data (eg, excessive drinking). Such analyses were adjusted for missing data. Furthermore, results were robust with excluding the income variable, the covariate with the highest percentage of missing data. Fifth, this study was cross-sectional and observational. Causal inferences cannot be made and reverse causality bias cannot be ruled out. Sixth, due to the descriptive and exploratory study design, adjustment for multiple comparisons was not performed. Thus, some inferences drawn from the results may not be reproducible.

CONCLUSIONS

The prevalence of lifestyle risk factors and cardiometabolic diseases was high among US young adults in 2011 to 2018. Only 1 in 5 young adults had no lifestyle risk factors, and less than half were free of cardiometabolic diseases. The prevalence of both lifestyle risk factors and cardiometabolic diseases varied by race and ethnicity and social risk factors. Racial and ethnic

disparities in cardiometabolic diseases were not fully explained by differences in social risk factors and lifestyle factors.

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Disclosures

None.

Supplemental Material

Tables S1–S10
Figures S1–S3

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