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Trends in Cardiometabolic Risk Prevalence among US Young Adults, NHANES 1999-2014

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Abstract

Trends in Cardiometabolic Risk Prevalence among US Young Adults, NHANES 1999-2014

By Julia Certa

Objectives. This study aimed to characterize the cardiometabolic risk profile for the United States (US) young adult population over the 1999-2014 period, assess trends in prevalence over four survey periods, and identify the subgroups experiencing the biggest increases in cardiometabolic risk in this population.

Methods. We analyzed data for 21,655 young adults, aged 18-44 years, from the National Health and Nutrition Examination Survey (NHANES). We estimated prevalence of diabetes, prediabetes, hypertension, prehypertension, high non-HDL cholesterol, current smoking, obesity, overweight, central obesity, and central adiposity. We used multivariate logistic regression to compute prevalence estimates (predictive margins) adjusted for sex, race/ethnicity, educational attainment, marital status, and insurance coverage. We calculated absolute percentage changes in prevalence (and 95% confidence intervals [CI]) across sociodemographic subgroups from 1999-2002 to 2011-2014 and compared them using *t*-tests.

Results. Among US young adults, diabetes prevalence increased from 2.65% (95% CI: 2.15-3.28) in 1999-2002 to 4.03% (3.50-4.64) in 2011-2014, while prediabetes more than doubled from 4.69% (3.72-5.89) to 11.11% (10.00-12.34). Prevalence of obesity (26.41% [24.74-28.16] to 33.98% [31.94-36.09]) and central obesity (11.90% [10.52-13.44] to 19.27% [17.42-21.20]) also increased. In contrast, prehypertension declined from 27.15% (25.52-28.84) to 22.55% (21.02-24.15), as did smoking (39.90% [36.56-43.34] to 32.19% [29.9-34.56]). There were no changes in hypertension or high non-HDL cholesterol. Diabetes prevalence significantly increased among women, Mexican Americans, high school graduates, married young adults, and PIR group <1.0. Prediabetes increased across all subgroups, especially among non-Hispanic blacks, Mexican Americans, those with less than high school education, married, and uninsured young adults. Increases in obesity were greatest among sociodemographic subgroups similar to diabetes and prediabetes.

Conclusions. US young adults had significant increases in prevalence of diabetes, prediabetes, obesity, and central obesity from 1999 to 2014, with simultaneous decreases in prehypertension and smoking. Public health efforts should be targeted towards women, non-Hispanic black and Mexican American young adults, those with a high school education or less, low- and middle-income young adults, married, and uninsured young adults, as these individuals experienced the largest increases in risk prevalence over time putting them at high-risk for CVD.

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INTRODUCTION

Cardiovascular disease (CVD) is currently the number one cause of death in the US (1). There are several known modifiable risk factors for CVD, both biological and behavioral, including hyperglycemia, hypertension, and hypercholesterolemia, as well as smoking and obesity (2-5). Trend analyses among US adults from 1980 to 2013 reveal increases in many of these risk factors: diabetes, prediabetes, obesity, hypertension, and hypercholesterolemia among US adults (aged 18 years and older), as well as decreases in the percentage of adults who smoke cigarettes (1, 6, 7).

While cardiometabolic risk factors have been extensively studied in adults and adolescents (2, 8-13), their prevalence in young adults is less well understood. Young adults are of particular interest nationally as this age represents one's prime economically-productive years of life and sets the precedent for middle and later life health (14-16). Some studies that have investigated cardiometabolic risk in US adults, broken down by age groupings, provide limited estimates on young adults (6-8, 17). These studies, however, focus on individual risk factors among broader populations (e.g. US adults, aged 20 years or older) and do not explore the young adult population in any further detail. To our knowledge, no other studies have estimated the prevalence of multiple cardiometabolic risk factors specifically among the young adult population, as well as within sociodemographic subgroups of this population, over an extensive period of time.

Here, using nationally representative data, we aim to expand upon the current knowledge regarding cardiometabolic risk among individuals aged 18-44 years (hereafter referred to as young adults) in the US by: (1) estimating national prevalence of cardiometabolic risk indicators in the 1999-2002, 2003-2006, 2007-2010, and 2011-2014 periods, (2) assessing whether significant changes in prevalence of these risk indicators have occurred over the four survey

periods, (3) evaluating whether and to what extent any changes over time have varied by demographic characteristics, and (4) comparing prevalence of risk factors between demographic subgroups within the most recent survey period. Results from this study will provide important information on cardiometabolic risk in young adults that can be used to better understand why some groups may have higher risk for CVD and other cardiometabolic conditions. By identifying high-risk subgroups within the US young adult population, this study may inform the development and implementation of future targeted public health interventions that aim to prevent cardiovascular disease among those at highest risk.

METHODS

Data Source and Study Design

We used data from the National Health and Nutrition Examination Surveys (NHANES) from 1999 to 2014. NHANES conducts serial cross-sectional, nationally representative surveys of the non-institutionalized, civilian U.S. population and has done so continuously since 1999-2000. Data are collected in two-year cycles utilizing a stratified, multi-stage probability sampling design to ensure the population recruited is nationally-representative. Our study combined NHANES cycles to create the following four-year survey periods: 1999-2002, 2003-2006, 2007-2010, and 2011-2014. Detailed descriptions of NHANES sampling methods are provided elsewhere (18). Sampled participant response rates for NHANES cycles between 1999 and 2014 ranged from 68.5 to 80%.

Study Sample

We restricted our sample to individuals aged 18 to 44 years, resulting in an analytic sample of 21,655 individuals. Sample sizes per four-year period ranged from 5,369 in 1999-2002 to 5,472 in 2007-2010. The proportions of study participants with missing data for study variables (item non-response) ranged from 0.10% (highest grade or year of school completed) to 16.8% (smoking

status; see Supplemental Table 1). Implausible values for diastolic blood pressure (DBP < 10 mmHg) were recoded as missing and removed from the analysis. Twenty-one participants had at least one DBP < 10 mmHg; however, only three participants were completely removed from analysis due to missing DBP measurements (i.e. DBP measurements < 10 mmHg).

Covariates: Demographic Characteristics

Respondents self-reported demographic characteristics, including age, sex, race/ethnicity, educational attainment, marital status, and insurance coverage. We categorized race/ethnicity into four groups: non-Hispanic white, non-Hispanic black, Mexican American, and other. We classified educational attainment as less than high school graduate, high school graduate, GED or equivalent, and some college or more. We dichotomized marital status into married or not married, and insurance coverage into insured and uninsured.

We also included poverty-income ratio (PIR), a measure of poverty based on self-reported income and household size. Specifically, PIR was calculated by dividing family (or individual) income by poverty guidelines issued by the US Department of Health and Human Services, specific to family size, geographic location, and survey year. We categorized PIR as < 1.0, 1.0 - 3.0, and > 3.0, with < 1.0 indicating an income below the federal poverty line and > 3.0 indicating 300% or more above the poverty line.

Outcomes: Cardiometabolic Risk Measures

We used six variables to characterize cardiometabolic profiles of young adults: glycated hemoglobin (HbA1c), blood pressure, non-HDL cholesterol, smoking, body mass index (BMI, kg/m^2), and waist -to-height ratio (WHtR), an indicator of central adiposity.

We categorized each variable into categories using cut-points defined by the following expert guidelines. We categorized glycemia into three groups using American Diabetes Association-defined (19) HbA1c cut-points: diabetes (physician-diagnosed diabetes or HbA1c $\geq$ 6.5%), prediabetes (no physician-diagnosed diabetes and HbA1c 5.7% - < 6.5%), or normal glycemia (no physician-diagnosed diabetes and HbA1c < 5.7%).

Using World Health Organization (WHO) cut-points (20), we categorized BMI into: underweight (< 18.5 kg/m^2), normal (18.5 to < 25.0 kg/m^2), overweight (25.0 to < 30.0 kg/m^2), and obese ($\geq$ 30.0 kg/m^2). We also calculated WHtR as an alternative measure of obesity and cardiometabolic risk to BMI. We categorized WHtR as normal (< 0.5), while WHtR $\geq$ 0.5 and < 0.65 indicated central adiposity and WHtR $\geq$ 0.65 indicated central obesity (11, 21).

We categorized blood pressure into three groups based on cut-points reinforced by the Eighth Joint National Committee (22): hypertension (physician-diagnosed hypertension [HTN], self-reported use of prescribed medication for HTN, systolic blood pressure [SBP] $\geq$ 140 mmHg, or diastolic blood pressure [DBP] $\geq$ 90 mmHg); prehypertension (no self-reported physician-diagnosis and SBP 120 – < 140 mmHg or DBP 80 – < 90 mmHg); and normal (no physician-diagnosis, SBP < 120 mmHg, and DBP < 80 mmHg).

We dichotomized cholesterol according to American Medical Association (3) cut-points: high (non-HDL $\geq$ 160 mg/dL or physician-diagnosed high cholesterol) and optimal (non-HDL < 160 mg/dL and no physician diagnosis).

We defined smoking status using cotinine cut-points recommended by the Centers for Disease Control and Prevention (CDC) and respondents' self-reported current smoking status (23). A respondent was considered to be a smoker if they reported currently smoking or their serum

cotinine values were > 10 ng/mL. Alternatively, non-smokers had cotinine levels ≤ 10 ng/mL and were self-reported non-smokers.

Statistical Analysis

We used Statistical Analysis Software (SAS), version 9.4 (SAS Institute) and SUDAAN software, version 11.0.1 (RTI International). All analyses were conducted using SAS-callable SUDAAN, adjusting for strata and primary sampling units as well as appropriate weights in order to account for the NHANES complex survey design, oversampling, and nonresponse. Because the two-year survey cycle structure was altered, four-year weights were created and applied to all analyses.

We performed descriptive analyses to examine the distribution of demographic characteristics among young adults within each four-year survey cycle. We assessed changes in demographic distributions over time using Wald F tests. Within each four-year survey period, we created frequency tables and reported weighted proportions for each demographic category (described above) as well as for each cardiometabolic risk indicator. We assessed significant differences in risk indicator prevalence between the first and last survey periods using 95% confidence intervals and *t* tests.

Using multivariable logistic regression models, we estimated adjusted prevalence (predictive margins) for each cardiometabolic risk measure, controlling for the following sociodemographic characteristics: sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage. The predictive margins method was used as a form of direct standardization in order to control for the demographic distribution within each survey cycle when observing the independent relationships between each sociodemographic characteristic and cardiometabolic risk prevalence. Sex, race/ethnicity, education, and poverty-income ratio were included in final

models as they are all considered major risk factors for our outcomes of interest and have been adjusted for in previous literature (2, 7, 9, 24-26). Additionally, marital status and insurance coverage were included in our final models. Marital status was included due to a significant change in the distribution in young adults over time and insurance coverage was maintained as a covariate of interest to the authors due to the potential influence of the Patient Protection and Affordable Care Act of 2010 on the health of young adults. Models also included first-order interactions of survey period (as a discrete variable) with each sociodemographic variable to account for changes in demographic characteristics over time. Significant changes in prevalence within subgroups over time were assessed using 95% CI and p-values.

To understand the magnitude of prevalence differences between sociodemographic subgroups within the young adult population, we computed prevalence ratios in the most recent survey period (2011-2014). Calculations of prevalence ratios were restricted to the 2011-2014 survey period in order to identify subgroups that are currently high-risk, according to the latest prevalence estimates available.

RESULTS

Changes in US Young Adult Characteristics Over Time

Selected population characteristics are presented in Table 1. The distributions of sex (approximately 50% males) and insurance coverage (just under three-quarters insured) did not change significantly from 1999-2002 (T1) to 2011-2014 (T4). The proportion of Non-Hispanic white young adults decreased slightly from 65.5% (SE, 1.7) in T1 to 57.4% (SE, 2.8) in T4, while the proportion of Mexican Americans increased from 10.1% (SE, 1.0) in T1 to 12.4% (SE, 1.5). Levels of educational attainment increased during the time period under study, with 52.7% (SE, 1.6) completing college or above in T1 compared to 62.7% (SE, 2.0) in T4. At the same time, the proportion with a high school education or less declined from 47.4% in T1 to 37.3% in T4, while

the proportion of young adults living below the federal poverty line (measured by PIR) increased from 17.76% (SE, 1.1) in T1 to 22.56% (SE, 1.9) in T4.

Changes in Cardiometabolic Risk Prevalence

Table 2 and Figure 1 show adjusted prevalence of cardiometabolic risk measures among young adults across T1 to T4. Models adjusted for sex, race/ethnicity, level of educational attainment, marital status, poverty-income ratio (PIR), and insurance coverage. Adjusted models resulted in similar trends as in the unadjusted analysis, and so only adjusted prevalence estimates are reported.

During the study period, diabetes prevalence increased from 2.65% (95% CI: 2.15-3.28) in T1 to 4.03% (3.50-4.64; p<0.001) in T4, while prediabetes more than doubled from 4.69% (3.72-5.89) in T1 to 11.11% (10.00-12.34) in T4 (p<0.001). We also noted significant increases in prevalence of obesity (26.41% [24.74-28.16] to 33.98% [31.94-36.09], p<0.001) and central obesity (11.90% [10.52-13.44] to 19.27% [17.42-21.20], p<0.001).

In contrast, prevalence of prehypertension declined significantly from 27.15% (25.52-28.84) in T1 to 22.55% (21.02-24.15) in T4 (p<0.001). Similarly, smoking prevalence declined significantly (39.90% [36.56-43.34] to 32.19% [29.9-34.56]); p<0.001). There was no change in prevalence of hypertension or high non-HDL cholesterol from T1 to T4.

Changes in Risk Prevalence across Sociodemographic Groups

When we examined whether prevalence of these cardiometabolic risks changed over time across sociodemographic subgroups (Table 3), we found that diabetes prevalence increased among women, Mexican Americans, high school graduates, married young adults, PIR groups < 1.0 and > 3.0, and regardless of insurance coverage. The increase in diabetes prevalence in these

subgroups ranged from 1.14 percentage points (ppts) in the insured to 2.45 ppts in Mexican Americans. Prediabetes increased across all subgroups. Hypertension prevalence only increased among PIR group 1.0 – 3.0, from 17.35% (15.46-19.42) to 21.03% (18.51-23.79; p=0.03). Using BMI and WHtR as measures of obesity, we found increases for both measures in each subgroup, except for those classified as other race/ethnicity. Increases in obesity prevalence were greatest among Mexican Americans, young adults with a high school education or less, married young adults, those in the middle PIR group, and the uninsured (Table 3).

Prehypertension declined in men, non-Hispanic whites, Mexican Americans, those with some college or above, PIR groups 1.0 – 3.0 and > 3.0, the insured, and at the same rate in married and non-married persons (Table 3). Hypercholesterolemia declined only among high school graduates (37.33 to 31.34%; p=0.04) and PIR group 1.0 – 3.0 (36.58 to 32.26%; p=0.02). Smoking prevalence declined for all sociodemographic subgroups, except for non-Hispanic blacks and those in the highest PIR group (Table 3).

Table 4 looks within the most recent survey period (T4) to identify high-risk sociodemographic subgroups for each of the six cardiometabolic risk measures. We found that females were less likely to have cardiometabolic risk factors, though females were more likely to be obese according to both BMI and WHtR (PR: 1.09, 95% CI: 1.01-1.17 and 1.61, 1.42-1.82, respectively). As compared to non-Hispanic whites, non-Hispanic blacks were more than twice as likely to have diabetes (PR: 2.11, 1.28-3.49) and more than three times as likely to have prediabetes (PR: 3.30, 2.55-4.28). In addition, they were more likely to have hypertension (PR: 1.49, 1.29-1.73) and obesity (PR: 1.45, 1.27-1.65).

Individuals with a high school education or less were consistently more likely to have cardiometabolic risk factors, other than high cholesterol and central adiposity/overweight, when

compared to those with at least some college education (Table 4). As compared to those in PIR group > 3.0, young adults living below the poverty line (PIR < 1.0) were more likely to be current smokers (PR: 1.55, 1.33-1.80) and to have both obesity (PR: 1.25, 1.09-1.43) and central obesity (PR: 1.61, 1.23-2.11). Not being married appeared to have a protective effect against prediabetes, hypertension, high cholesterol, overweight and obesity, while unmarried young adults were more likely to be current smokers. Prevalence estimates did not differ by insurance coverage, except for smoking status, in which uninsured young adults were more likely to be current smokers than the insured (PR: 1.29, 1.14-1.45).

DISCUSSION

Young adults in the US had significant improvements in prevalence of prehypertension and smoking during the study period, 1999 to 2014. However, we observed increases in unadjusted (crude) and adjusted prevalence of diabetes, prediabetes, obesity, and central obesity. When taking into account changes in the sociodemographic predisposition of this population, the changes in prevalence appeared to be driven by certain subgroups, particularly among females, non-Hispanic blacks and Mexican Americans, less well-educated and lower income individuals, and those who were married and uninsured.

The results of the present study corroborate other similar studies on cardiometabolic risk factors in the US. In their study of trends in diagnosed diabetes prevalence in US adults, aged 20-79 years, Geiss et al. observed an increased prevalence among adults aged 20-44 years from 1984 and 2012 (6). Bullard et al. also found that the prevalence of prediabetes in US adults aged 18 to 44 years increased from 1999-2002 to 2007-2010, after controlling for age, sex, race/ethnicity, PIR, and BMI (7). However, the higher prediabetes prevalence estimates for young adults in their study may be due to the inclusion of fasting plasma glucose (FPG) levels into their definitions of dysglycemia, potentially identifying more individuals with prediabetes than in the present study.

Finally, the CDC's US Health Report 2014 (1), which provides cardiometabolic risk factor prevalence estimates for the entire US population, indicated comparable declines in smoking between 2000 and 2013, increases in obesity between 1999 and 2012, and no significant changes in hypertension prevalence in US adults aged 20 years and older during the same time period, as did our study. There is less consensus, however, on the trends in hypercholesterolemia prevalence, as some reports show increases in the US adult population aged 20 years and older(1), while others found declining trends over similar periods of time (8). Our study found that, within the young adult population specifically, there was no change in prevalence of high cholesterol.

Previous studies suggest that these prevalence increases among US adults may be attributed to the aging of the US population, the growth of minority populations at increased risk, and simultaneous increases in risk factors such as obesity and sedentary lifestyle (6). In addition, changes in diagnostic criteria (e.g. the lowering of fasting plasma glucose levels in 1997) may inflate prevalence estimates and impact certain subgroups of the population more than others (6, 7). Traditional population characteristics that are linked to cardiometabolic risk factors, such as sex, race/ethnicity, and income level, were controlled for in the present study as they have been in previous literature, as these factors may explain prevalence trends (2, 7, 9, 24-26). In addition to traditional factors, our study included marital status and health insurance coverage as potential driving forces behind prevalence changes among young adults. Inclusion of these factors revealed a significant increase in diabetes prevalence among married young adults, as well as substantially larger increases in prevalence of prediabetes and both measures of obesity among married and uninsured young adults when compared to their unmarried and insured counterparts. Our analysis contributes to our understanding of how sociodemographic characteristics influence susceptibility to cardiometabolic risk factors.

In light of the potentially adverse long-term health consequences of poor cardiometabolic health in young adulthood (11, 16, 26, 27), these findings are particularly striking. The results of this study suggest that public health interventions should be directed more aggressively towards young adults, specifically regarding metabolic health. The increases in prevalence of diabetes, prediabetes, obesity, and central obesity that we observed have strong implications for the health outcomes of young adults as they age. The association between obesity and diabetes has been well-established (28-32) and most older adults with diabetes also have other major diseases (33). Not only are the increasingly sedentary lifestyles of the working-age population, particularly in young adults, detrimental to health (34), the presence of these risk factors during adolescence has also been associated with increased risk of cardiovascular outcomes, including death (26).

We identified high-risk sociodemographic subgroups, including women; non-Hispanic blacks, Mexican Americans, and those who identified as other races/ethnicities; those with a high school education or less; those who are living below or just above the federal poverty line; married young adults; and the uninsured. These high-risk groups should be of special concern for prevention and intervention programs. For example, high obesity prevalence among those with a high school education (37.0%) or less (38.3%) in the present study emphasizes the importance of educational programs that focus on healthy lifestyle and behavioral choices (e.g. nutrition programs, physical education) throughout adolescence, which translates to actions throughout adulthood.

Several decades worth of research support the association between lifestyle and behavioral characteristics, such as smoking, physical inactivity, and poor diet, and development of cardiovascular disease (35). Randomized trials, such as the Diabetes Prevention Program (DPP) and the Look AHEAD Study, have proven the effectiveness of lifestyle interventions in the prevention of cardiometabolic diseases across different population subgroups (36-38).

Haskell et al. argue, however, that in order to achieve and maintain the beneficial effects of lifestyle interventions, individuals must receive sustained support from a healthcare system (35). This is problematic specifically to young adults, as approximately a quarter of the US young adult population (aged 18 to 44 years) reported having no health insurance coverage – even after the implementation of the Patient Protection and Affordable Care Act of 2010 (1). Without access to healthcare, the tremendous benefits of lifestyle interventions on overall and cardiometabolic health may be lost in this portion of young adults. The results of this study support this hypothesis, as we saw greater increases in the prevalence of diabetes, prediabetes, and obesity in uninsured young adults when compared to those reporting insurance coverage from 1999-2002 to 2011-2014.

While the DPP and Look AHEAD studies served as the impetus for the recent coverage of preventive services (i.e. intensive behavioral counseling for obesity) under Medicare (39), the results from the present study should similarly motivate public health officials to consider financing options for preventive services aimed at young adults, especially high-risk subgroups. Public prevention programs offered to young adults could slow the observed increases in cardiometabolic risk prevalence, therefore thwarting the development of CVD and other diseases.

There are some limitations to this analysis. First, cross-sectional data does not allow for the establishment of temporality, thus causal inferences cannot be made. In addition, NHANES cross-sectional design allows for single clinical measurements, essentially taking a “snapshot” of health and so failing to capture any intra-individual variability, resulting in potential misclassification of participants among our risk factor categories. Finally, the present study did not include behavioral characteristics, such as physical activity levels or dietary patterns, as potential factors for change in prevalence estimates. Future research focusing on developing the

cardiometabolic risk profile in young adults should include these covariates in analyses for a more detailed understanding of prevalence trends.

The study also has several important strengths. We used nationally representative samples of the US non-institutionalized population, allowing for generalizable estimates to be calculated. With these data, we were able to estimate the prevalence of multiple cardiometabolic risk factors for a variety of sociodemographic subgroups within a specified age population. In addition, we were able to conduct trend analyses by using NHANES data spanning sixteen years, including the most recent data available. Another strength of this study was the inclusion of laboratory measurements in the definition of cardiometabolic risk factor categories, such that this study did not rely on self-report data alone and we were able to capture both diagnosed and undiagnosed cases of diabetes, hypertension, etc. Similarly, the inclusion of medication use into our definitions for hypertension and hypercholesterolemia accounted for the mediating effect that a prescribed medication may have on clinical measurements.

In summary, this study described the cardiometabolic risk profile for US young adults, aged 18 to 44, over four survey periods ranging from 1999 to 2014. While we found decreased prevalence of prehypertension and smoking in young adults over time, increased prevalence of diabetes, prediabetes, and obesity as defined by both BMI and WHtR measures raise cause for concern for this population. Public health efforts should be targeted towards women, non-Hispanic black young adults, Mexican Americans, those with a high school education or less, low- and middle-income young adults, married young adults, and uninsured young adults, as these individuals have all experienced increases in risk prevalence over time and are considered at high-risk for development of CVD. Fortunately, as research has shown, these risk factors are modifiable through lifestyle interventions such as dietary changes and increased physical activity (35, 36, 38, 40). However, identification of at-risk populations is difficult when dealing with “silent”

cardiometabolic diseases, especially in relatively healthy populations such as young adults. The results of this study support more targeted screening for cardiometabolic risk factors among young adults, with particular emphasis on the aforementioned “high-risk” subgroups. Future research should add to these findings by developing systems to deliver lifestyle interventions to the young adult population in a practical way.

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TABLES AND FIGURES

Table 1. Characteristics of US young adults, aged 18-44, in NHANES 1999-2014*

Demographic Characteristic	NHANES 1999-2002 % (SE)		NHANES 2003-2006 % (SE)		NHANES 2007-2010 % (SE)		NHANES 2011-2014 % (SE)		*p*
Total	5,369		5,440		5,472		5,374		
Sex									0.95
Male	49.78	0.75	49.28	0.77	49.51	0.80	49.76	0.63	
Female	50.22	0.75	50.72	0.77	50.49	0.80	50.24	0.63	
Race/Ethnicity									0.02
Non-Hispanic White	65.50	1.74	65.51	2.30	61.61	2.81	57.40	2.80	
Non-Hispanic Black	12.36	1.28	12.99	1.47	12.69	1.12	12.88	1.58	
Mexican American	10.08	1.04	11.33	1.26	11.94	1.61	12.36	1.54	
Other^	12.06	1.74	10.17	1.06	13.77	1.45	17.35	1.22	
Education									0.00
Less than High School Graduate	20.80	0.93	18.18	1.04	19.26	0.88	16.22	1.20	
High School Grad/GED or Equivalent	26.55	1.25	25.24	0.97	24.17	1.09	21.08	1.22	
Some College or Above	52.65	1.63	56.58	1.42	56.58	1.51	62.70	1.99	
Marital Status									0.01
Married	55.54	1.44	57.96	1.35	55.21	1.18	50.19	1.98	
Not Married	44.46	1.44	42.04	1.35	44.79	1.18	49.81	1.98	
Poverty Income Ratio (PIR)									0.02
< 1	17.76	1.00	16.61	1.02	19.89	1.13	22.56	1.89	
1 - 3	38.78	1.35	37.02	1.21	36.86	1.24	36.79	1.22	
> 3	43.46	1.71	46.36	1.52	43.25	1.53	40.65	2.17	
Health Insurance Coverage									0.30
Insured	74.08	1.10	74.04	1.19	70.92	1.00	73.29	1.26	
Uninsured	25.92	1.10	25.96	1.19	29.08	1.00	26.71	1.26	

Data presented are weighted percentages (SE).

*Total sample size 1999-2014 = 21,655

Missing values were identified and removed from analysis for the following variables: Marital Status (556 total missing values); Education (18 total missing values); Poverty-Income Ratio (1,659 total missing values); and Insurance Coverage (152 total missing values). Missing values resulted in reduced sample sizes for the following variables: Marital Status (n=21,099); Education (n=21,637); PIR (n=19,996); and Insurance Coverage (n=21,503).

^Other race/ethnicity include: Other Non-Hispanic, Other Hispanic, and Non-Hispanic Asian.

P-values for equal proportions were calculated from an F-test (Wald F).

Table 2. Adjusted Prevalence of Cardiometabolic Risk Factors in US young adults, aged 18-44, in NHANES 1999-2014

Cardiometabolic Indicator	**NHANES 1999-2002** **Prevalence (95% CI)**		**NHANES 2003-2006** **Prevalence (95% CI)**		**NHANES 2007-2010** **Prevalence (95% CI)**		**NHANES 2011-2014** **Prevalence (95% CI)**		**% Change** (T4-T1)
Glycemia									
Diabetes	2.65	(2.15, 3.28)	3.10	(2.56, 3.74)	3.07	(2.55, 3.68)	4.03	(3.50, 4.64)	**1.38*** **
Prediabetes	4.69	(3.72, 5.89)	5.12	(4.50, 5.83)	10.54	(9.60, 11.56)	11.11	(10.00, 12.34)	**6.43*** **
Normal	92.68	(91.32, 93.83)	91.61	(90.43, 92.66)	82.48	(85.20, 87.66)	85.02	(83.66, 86.29)	**-7.65*** **
Blood Pressure									
Hypertension	16.39	(14.78, 18.15)	17.50	(15.41, 19.81)	15.87	(14.93, 16.85)	18.76	(17.15, 20.48)	2.37
Prehypertension	27.15	(25.52, 28.84)	25.01	(22.99, 27.15)	23.62	(22.18, 25.12)	22.55	(21.02, 24.15)	**-4.60*** **
Normal	56.47	(54.43, 58.48)	57.35	(54.34, 60.30)	60.55	(58.76, 62.32)	58.82	(56.27, 61.33)	2.36
Non-HDL Cholesterol									
High	34.13	(32.08, 36.25)	33.93	(31.96, 35.96)	33.34	(31.66, 35.06)	32.57	(30.84, 34.36)	-1.56
Optimal	65.38	(63.72, 67.87)	66.12	(64.12, 68.06)	66.66	(64.93, 68.34)	67.42	(65.63, 69.16)	1.59
Smoking Status									
Smoker	39.90	(36.56, 43.34)	42.64	(40.18, 45.14)	38.84	(36.57, 41.16)	32.19	(29.90, 34.56)	**-7.72*** **
Non-Smoker	59.67	(56.20, 63.05)	57.54	(54.98, 60.05)	61.25	(58.77, 63.67)	67.95	(65.66, 70.15)	**8.28*** **
Body Mass Index (BMI, kg/m^2)									
Obese	26.41	(24.74, 28.16)	30.32	(27.93, 32.82)	31.48	(29.24, 33.81)	33.98	(31.94, 36.09)	**7.57*** **
Overweight	31.18	(29.02, 33.44)	29.39	(27.46, 31.40)	31.41	(29.95, 32.92)	30.27	(28.32, 32.29)	-0.92
Normal	39.69	(37.56, 41.86)	37.45	(35.26, 39.68)	35.13	(33.00, 37.33)	33.86	(31.18, 36.65)	**-5.83*** **
Underweight	2.82	(2.29, 3.45)	2.55	(2.04, 3.20)	2.01	(1.58, 2.56)	2.13	(1.66, 2.72)	-0.69
Waist-to-Height Ratio (WHtR)									
Central Obesity	11.90	(10.52, 13.44)	14.84	(13.22, 16.62)	15.85	(14.40, 17.41)	19.24	(17.42, 21.20)	**7.34*** **
Central Adiposity	52.24	(50.39, 54.09)	53.50	(50.97, 56.01)	52.45	(50.00, 54.90)	52.31	(49.89, 54.71)	0.06
Normal	35.98	(33.78, 38.24)	31.48	(29.14, 33.92)	31.73	(29.18, 34.39)	28.64	(25.98, 31.47)	**-7.33*** **

P-values were calculated from a t-test. ***p < 0.05, **p < 0.01, ***p < 0.001.**

GLYCEMIA categories are defined as follows: **Diabetes** (physician-diagnosed diabetes or HbA1c ≥6.5%); **Prediabetes** (no physician-diagnosed diabetes and HbA1c 5.7% - <6.5%); or **Normal** (no physician-diagnosed diabetes and HbA1c <5.7%).

BLOOD PRESSURE categories are defined as: **Hypertension** (physician-diagnosed hypertension [HTN], self-reported use of prescribed medication for HTN, average systolic blood pressure [SBP] ≥140 mmHg, or average diastolic blood pressure [DBP] ≥90 mmHg); **Prehypertension** (no self-reported physician-diagnosis and SBP 120 – <140 mmHg, or DBP 80 – <90 mmHg); or **Normal** (no physician-diagnosis, SBP <120 mmHg, and DBP <80 mmHg). Individual DBP measurements < 10 mmHg were recoded as missing and removed from analysis, as to not skew average DBP/SBP values.

NON-HDL CHOLESTEROL categories are defined as: **High** (non-HDL ≥ 160 mg/dL or physician-diagnosed high cholesterol) or **Optimal** (non-HDL < 160 mg/dL and no physician diagnosis).

SMOKING STATUS categories are defined as: **Smoker** (serum cotinine > 10 ng/mL or self-reported current smoker) or **Non-smoker** (cotinine level ≤ 10 ng/mL and self-reported non-smoker).

BODY MASS INDEX categories are defined as: **Underweight** (<18.5 kg/m^2); **Normal** (18.5 – <25.0 kg/m^2); **Overweight** (25.0 – <30.0 kg/m^2); or **Obese** (≥30.0 kg/m^2).

WAIST-TO-HEIGHT RATIO categories are defined as: **Central obesity** (≥0.65); **Central adiposity** (0.5 – <0.65); or **Normal** (<0.5).

Table 3. Adjusted Prevalence^ of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle

Demographic Characteristics	Diabetes					Prediabetes				
	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change
Overall Young Adult Population	2.65	(2.15, 3.28)	4.03	(3.50, 4.64)	**1.38*** **	4.69	(3.72, 5.89)	11.11	(10.00, 12.34)	**6.43*** **
Sex										
Male	3.00	(2.26, 3.96)	3.83	(3.10, 4.73)	0.83	5.19	(3.89, 6.89)	12.12	(10.68, 13.73)	**6.94*** **
Female	2.33	(1.72, 3.14)	4.22	(3.51, 5.07)	**1.89*** **	4.21	(3.13, 5.63)	10.14	(8.84, 11.61)	**5.93*** **
Race/Ethnicity										
Non-Hispanic White	2.12	(1.54, 2.91)	2.99	(2.28, 3.90)	0.87	3.70	(2.53, 5.38)	7.84	(6.32, 9.69)	**4.14*** **
Non-Hispanic Black	4.21	(0.30, 5.92)	6.32	(4.16, 9.49)	2.10	11.40	(9.47, 13.66)	25.90	(23.20, 28.80)	**14.50*** **
Mexican American	2.55	(1.76, 3.69)	5.00	(3.42, 7.25)	**2.45***	3.41	(2.33, 4.97)	14.18	(12.11, 16.54)	**10.77*** **
Other	3.78	(2.35, 6.01)	5.70	(3.93, 8.20)	1.92	4.36	(1.89, 9.76)	11.02	(9.17, 13.18)	**6.65** **
Education										
Less than High School	3.80	(2.67, 5.37)	5.61	(4.07, 7.69)	1.82	5.03	(3.50, 7.18)	13.74	(10.81, 17.31)	**8.71*** **
High School Graduate/GED or Equivalent	2.16	(1.46, 3.19)	4.20	(2.92, 6.01)	**2.04***	5.61	(3.77, 8.27)	11.59	(9.65, 13.86)	**5.98*** **
Some College or Above	2.45	(1.75, 3.43)	3.45	(2.76, 4.32)	1.00	4.16	(3.16, 5.44)	9.97	(8.66, 11.44)	**5.81*** **
Marital Status										
Married	3.07	(2.24, 4.21)	4.81	(3.82, 6.05)	**1.74***	6.26	(4.76, 8.20)	13.75	(12.08, 15.61)	**7.49*** **
Not Married	2.18	(1.62, 2.92)	3.18	(2.42, 4.16)	1.00	3.00	(2.20, 4.09)	8.28	(7.18, 9.54)	**5.28*** **
Poverty Income Ratio (PIR)										
< 1	2.91	(1.91, 4.41)	4.99	(3.71, 6.68)	**2.08***	5.39	(3.59, 8.02)	11.71	(9.81, 13.91)	**6.32*** **
1 - 3	3.50	(2.56, 4.77)	4.21	(3.26, 5.43)	0.71	4.80	(3.61, 6.34)	11.34	(9.98, 12.86)	**6.54*** **
> 3	1.73	(1.09, 2.72)	3.38	(2.49, 4.57)	**1.66***	4.19	(3.01, 5.79)	10.57	(8.81, 12.62)	**6.38*** **
Health Insurance Coverage										
Insured	2.98	(2.30, 3.86)	4.12	(3.41, 4.97)	**1.14***	4.56	(3.38, 6.11)	10.50	(9.15, 12.02)	**5.94*** **
Uninsured	1.95	(1.29, 2.93)	3.84	(2.79, 5.26)	**1.89***	4.99	(5.59, 6.91)	12.55	(10.59, 14.82)	**7.56*** **

^Predictive margins were calculated using logistic regression models, controlling for sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage. Baseline data (T1) from NHANES 1999–2002. Absolute change in risk factor indicators from NHANES 1999–2002 (T1) to 2011–2014 (T4). P-values were calculated from a t-test. ***p < 0.05, **p < 0.01, ***p < 0.001**

Table 3. Adjusted Prevalence^ of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle (cont.)

Demographic Characteristics	Hypertension					Prehypertension				
	T1 (%)	**(95% CI)**	**T4 (%)**	**(95% CI)**	**Absolute % Change**	**T1 (%)**	**(95% CI)**	**T4 (%)**	**(95% CI)**	**Absolute % Change**
Overall Young Adult Population	16.39	(14.75, 18.15)	18.76	(17.15, 20.48)	2.37	27.15	(25.52, 28.84)	22.55	(21.02, 24.15)	**-4.60*** **
Sex										
Male	18.55	(15.99, 21.42)	21.31	(18.67, 24.22)	2.76	38.50	(35.81, 41.27)	32.08	(29.58, 34.69)	**-6.42****
Female	14.31	(12.31, 16.57)	16.32	(14.53, 18.28)	2.01	15.95	(14.00, 18.10)	13.12	(11.31, 15.17)	-2.83
Race/Ethnicity										
Non-Hispanic White	15.52	(13.51, 17.75)	18.33	(15.97, 20.95)	2.81	27.43	(25.50, 29.44)	22.32	(20.18, 24.63)	**-5.10*** **
Non-Hispanic Black	26.56	(24.08, 29.20)	27.32	(24.65, 30.16)	0.76	29.48	(26.17, 33.01)	25.96	(22.68, 29.53)	-3.52
Mexican American	12.91	(10.91, 15.21)	16.77	(13.68, 20.40)	3.86	23.72	(20.72, 27.00)	19.78	(17.47, 22.32)	**-3.94***
Other	14.78	(11.12, 19.38)	14.66	(12.82, 16.72)	-0.12	26.32	(19.61, 34.34)	22.41	(19.47, 25.65)	-3.91
Education										
Less than High School	18.08	(14.80, 21.89)	20.81	(17.82, 24.15)	2.73	28.37	(24.77, 32.26)	26.09	(23.06, 29.37)	-2.28
High School Graduate/GED or Equivalent	17.90	(14.85, 21.43)	21.65	(18.65, 24.99)	3.75	25.99	(22.90, 29.34)	21.42	(18.11, 25.15)	-4.57
Some College or Above	15.20	(13.35, 17.25)	17.22	(15.31, 19.31)	2.02	27.34	(24.92, 29.90)	22.06	(20.11, 24.15)	**-5.28****
Marital Status										
Married	17.58	(15.31, 20.11)	20.35	(18.02, 22.90)	2.77	27.49	(25.11, 30.01)	22.77	(21.12, 24.51)	**-4.72****
Not Married	15.02	(13.17, 17.08)	16.75	(14.76, 18.93)	1.72	26.73	(24.80, 28.76)	22.24	(19.93, 24.73)	**-4.50****
Poverty Income Ratio (PIR)										
< 1	19.91	(16.15, 24.29)	19.73	(16.59, 23.29)	-0.18	26.13	(22.02, 30.70)	22.16	(19.98, 24.51)	-3.97
1 - 3	17.35	(15.46, 19.42)	21.03	(18.51, 23.79)	**3.68***	25.95	(23.35, 28.72)	22.20	(20.28, 24.24)	**-3.75***
> 3	14.27	(12.01, 16.86)	16.52	(14.40, 18.88)	2.25	28.63	(26.64, 30.71)	22.92	(20.13, 25.98)	**-5.71****
Health Insurance Coverage										
Insured	17.22	(15.15, 19.50)	19.54	(17.81, 21.40)	2.32	27.18	(25.25, 29.19)	21.86	(20.06, 23.77)	**-5.31****
Uninsured	14.12	(11.91, 16.66)	16.61	(14.09, 19.47)	2.49	27.02	(23.43, 30.94)	24.42	(22.24, 26.73)	-2.60

^Predictive margins were calculated using logistic regression models, controlling for sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage. Baseline data (T1) from NHANES 1999–2002. Absolute change in risk factor indicators from NHANES 1999–2002 (T1) to 2011–2014 (T4). P-values were calculated from a t-test. ***p < 0.05, **p < 0.01, ***p < 0.001**

Table 3. Adjusted Prevalence^ of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle (cont.)

Demographic Characteristics	High Cholesterol					Current Smokers				
	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change
Overall Young Adult Population	34.13	(32.08, 36.25)	32.57	(30.84, 34.36)	-1.56	39.90	(36.56, 43.34)	32.19	(29.90, 34.56)	**-7.72*** **
Sex										
Male	40.04	(37.29, 42.85)	38.38	(35.72, 41.11)	-1.65	45.79	(42.08, 49.54)	36.95	(34.08, 39.92)	**-8.83*** **
Female	28.38	(26.06, 30.82)	26.91	(24.33, 29.66)	-1.46	34.12	(30.32, 38.13)	27.46	(25.05, 30.02)	**-6.65** **
Race/Ethnicity										
Non-Hispanic White	35.27	(32.83, 37.80)	33.32	(30.95, 35.79)	-1.95	46.06	(42.82, 50.36)	38.84	(35.43, 42.37)	**-7.22** **
Non-Hispanic Black	32.15	(28.61, 35.90)	29.44	(26.65, 32.39)	-2.71	33.73	(29.85, 37.85)	30.21	(26.05, 34.71)	-3.53
Mexican American	31.00	(28.42, 33.71)	33.40	(28.66, 38.50)	2.39	20.99	(17.48, 24.99)	13.75	(10.47, 17.86)	**-7.24** **
Other	32.36	(26.95, 38.29)	31.16	(28.63, 33.82)	-1.20	36.42	(29.07, 44.46)	23.41	(19.79, 27.48)	**-13.01** **
Education										
Less than High School	32.11	(28.37, 36.10)	33.96	(30.17, 37.96)	1.84	56.11	(52.95, 59.21)	46.01	(41.54, 50.55)	**-10.09*** **
High School Graduate/GED or Equivalent	37.33	(33.22, 41.64)	31.34	(27.88, 35.02)	**-5.99***	50.45	(46.85, 54.04)	39.67	(35.03, 44.51)	**-10.78*** **
Some College or Above	33.40	(30.63, 36.29)	32.51	(30.10, 35.02)	-0.89	30.25	(26.14, 34.71)	24.45	(21.59, 27.55)	**-5.81***
Marital Status										
Married	39.10	(37.03, 41.20)	37.62	(35.63, 39.66)	-1.48	36.38	(32.83, 40.08)	29.47	(26.46, 32.68)	**-6.91** **
Not Married	27.79	(24.82, 30.96)	26.07	(23.15, 29.22)	-1.72	44.06	(39.51, 48.71)	35.13	(32.03, 38.36)	**-8.93** **
Poverty Income Ratio (PIR)										
< 1	30.00	(25.74, 34.64)	32.21	(29.24, 35.32)	2.21	49.64	(43.12, 56.17)	40.23	(35.14, 45.55)	**-9.41***
1 - 3	36.58	(33.53, 39.73)	32.26	(30.15, 34.45)	**-4.31***	44.66	(39.15, 50.30)	34.48	(30.50, 38.69)	**-10.18** **
> 3	33.58	(30.56, 36.74)	32.98	(29.76, 36.37)	-0.60	30.95	(27.09, 35.10)	26.03	(23.01, 29.30)	-4.92
Health Insurance Coverage										
Insured	34.64	(32.46, 36.88)	32.38	(30.27, 34.56)	-2.26	35.96	(32.63, 39.43)	29.79	(26.93, 32.82)	**-6.17** **
Uninsured	32.72	(29.35, 36.28)	33.14	(30.18, 36.24)	0.42	50.51	(45.50, 55.51)	38.29	(35.43, 41.24)	**-12.22*** **

^Predictive margins were calculated using logistic regression models, controlling for sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage. Baseline data (T1) from NHANES 1999–2002. Absolute change in risk factor indicators from NHANES 1999–2002 (T1) to 2011–2014 (T4). P-values were calculated from a t-test. ***p < 0.05, **p < 0.01, ***p < 0.001**

Table 3. Adjusted Prevalence^ of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle (cont.)

Demographic Characteristics	BMI: Obese					BMI: Overweight				
	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change
Overall Young Adult Population	26.41	(24.74, 28.16)	33.98	(31.94, 36.09)	**7.57*** **	31.18	(29.02, 33.44)	30.27	28.32, 32.29	-0.92
Sex										
Male	24.29	(22.39, 26.30)	32.53	(29.96, 35.21)	**8.24*** **	36.07	(32.91, 39.36)	34.64	32.49, 36.86	-1.43
Female	28.47	(26.19, 30.86)	35.39	(33.25, 37.60)	**6.93*** **	26.38	(23.71, 29.23)	25.98	23.69, 28.40	-0.40
Race/Ethnicity										
Non-Hispanic White	25.38	(23.47, 27.40)	31.23	(28.38, 34.24)	**5.85** **	29.52	(26.76, 32.44)	30.94	28.26, 33.76	1.42
Non-Hispanic Black	34.79	(31.50, 38.23)	45.34	(41.36, 49.37)	**10.54*** **	30.89	(27.72, 34.26)	28.65	25.01, 32.60	-2.24
Mexican American	26.63	(23.55, 29.97)	42.77	(38.77, 46.86)	**16.13*** **	36.27	(33.49, 39.14)	33.59	30.73, 36.58	-2.67
Other	22.79	(18.62, 27.59)	28.19	(24.18, 32.57)	5.39	36.06	(31.18, 41.23)	27.62	24.76, 30.67	**-8.44*** **
Education										
Less than High School	26.25	(22.54, 30.33)	36.97	(32.43, 41.76)	**10.73*** **	31.33	(27.58, 35.34)	30.12	25.73, 34.90	-1.21
High School Graduate/GED or Equivalent	27.91	(24.89, 31.14)	38.25	(35.09, 41.52)	**10.35*** **	31.50	(28.00, 35.22)	28.61	25.48, 31.96	-2.89
Some College or Above	25.98	(23.35, 28.80)	31.65	(29.08, 34.34)	**5.67** **	30.94	(27.96, 34.08)	60.85	27.51, 34.40	-0.09
Marital Status										
Married	28.33	(25.74, 31.06)	37.08	(34.45, 39.78)	**8.75*** **	33.45	(30.61, 36.41)	33.06	30.54, 35.69	-0.39
Not Married	24.13	(21.51, 26.94)	30.29	(27.70, 33.01)	**6.16** **	28.34	(25.39, 31.50)	26.86	24.58, 29.28	-1.48
Poverty Income Ratio (PIR)										
< 1	30.35	(26.90, 34.03)	36.44	(32.91, 40.13)	**6.10***	28.09	(23.83, 32.78)	27.32	24.48, 30.36	0.76
1 - 3	29.38	(27.01, 31.86)	38.32	(35.34, 41.40)	**8.95*** **	30.77	(27.98, 33.70)	29.84	27.03, 32.81	-0.93
> 3	22.20	(19.70, 24.92)	29.18	(26.14, 32.42)	**6.98** **	32.82	(30.46, 35.27)	31.91	28.68, 35.33	-0.91
Health Insurance Coverage										
Insured	27.57	(25.16, 30.12)	33.87	(31.33, 36.51)	**6.30*** **	31.64	(28.89, 34.52)	29.81	27.66, 32.05	-1.83
Uninsured	23.38	(20.90, 26.04)	34.26	(31.03, 37.65)	**10.89*** **	29.87	(26.38, 33.62)	31.52	28.86, 34.31	1.65

^Predictive margins were calculated using logistic regression models, controlling for sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage. Baseline data (T1) from NHANES 1999–2002. Absolute change in risk factor indicators from NHANES 1999–2002 (T1) to 2011–2014 (T4). P-values were calculated from a t-test. ***p < 0.05, **p < 0.01, ***p < 0.001**

Table 3. Adjusted Prevalence^ of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle (cont.)

Demographic Characteristics	WHtR: Central Obesity					WHtR: Central Adiposity				
	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change	T1 (%)	(95% CI)	T4 (%)	(95% CI)	Absolute % Change
Overall Young Adult Population	11.90	(10.52, 13.44)	19.27	(17.42, 21.20)	**7.34*** **	52.24	(20.39, 54.09)	52.31	(49.89, 54.71)	0.06
Sex										
Male	8.85	(7.36, 10.60)	14.71	(12.78, 16.86)	**5.86*** **	55.48	(52.72, 58.21)	54.07	(51.07, 57.04)	-1.41
Female	14.85	(12.65, 17.37)	23.63	(21.37, 26.05)	**8.77*** **	49.04	(46.14, 51.94)	50.61	(47.59, 53.63)	1.57
Race/Ethnicity										
Non-Hispanic White	10.48	(8.78, 12.47)	18.76	(16.32, 21.47)	**8.28*** **	51.34	(49.10, 53.58)	50.77	(47.22, 54.31)	-0.57
Non-Hispanic Black	15.87	(13.88, 18.10)	23.53	(20.63, 26.71)	**7.66*** **	47.84	(44.65, 51.04)	50.34	(47.12, 53.57)	2.51
Mexican American	13.51	(11.54, 15.76)	24.24	(20.68, 28.21)	**10.73*** **	62.41	(58.80, 65.89)	59.08	(55.01, 63.02)	-3.33
Other	13.72	(9.45, 18.51)	13.58	(11.13, 16.47)	-0.14	51.76	(44.56, 58.88)	55.71	(51.87, 59.48)	3.95
Education										
Less than High School	12.55	(9.92, 15.76)	20.91	(17.42, 24.88)	**8.35*** **	54.66	(50.90, 58.36)	52.49	(47.62, 57.31)	-2.17
High School Graduate/GED or Equivalent	12.44	(9.85, 15.61)	24.29	(21.74, 27.04)	**11.85*** **	54.50	(50.45, 58.49)	50.00	(45.92, 54.08)	-4.50
Some College or Above	11.67	(9.75, 13.90)	16.76	(14.63, 19.14)	**5.09** **	50.24	(47.70, 52.78)	52.95	(49.47, 56.41)	2.71
Marital Status										
Married	12.98	(11.10, 15.13)	20.57	(17.90, 23.54)	**7.59*** **	56.93	(54.67, 59.16)	57.81	(54.45, 61.10)	0.88
Not Married	10.63	(8.99, 12.54)	17.60	(15.01, 20.53)	**6.97*** **	46.38	(43.67, 49.10)	45.44	(42.56, 48.34)	-0.94
Poverty Income Ratio (PIR)										
< 1	16.26	(13.31, 19.72)	23.62	(20.35, 27.23)	**7.35** **	48.86	(43.23, 54.51)	46.88	(42.84, 50.96)	-1.98
1 - 3	13.54	(11.25, 16.21)	22.25	(19.83, 24.89)	**8.72*** **	53.95	(50.97, 56.90)	53.00	(50.01, 55.98)	-0.95
> 3	8.45	(6.75, 10.53)	14.65	(11.88, 17.94)	**6.20*** **	52.21	(49.16, 55.24)	54.17	(50.20, 58.09)	1.96
Health Insurance Coverage										
Insured	12.73	(10.88, 14.83)	19.35	(17.35, 21.53)	**6.63*** **	52.19	(49.94, 54.44)	51.54	(48.61, 54.46)	-0.65
Uninsured	9.94	(7.96, 12.33)	18.91	(16.49, 21.60)	**8.97*** **	52.36	(47.78, 56.89)	54.44	(51.27, 57.58)	2.09

^Predictive margins were calculated using logistic regression models, controlling for sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage. Baseline data (T1) from NHANES 1999–2002. Absolute change in risk factor indicators from NHANES 1999–2002 (T1) to 2011–2014 (T4). P-values were calculated from a t-test. ***p < 0.05, **p < 0.01, ***p < 0.001**

Table 4. Adjusted Prevalence Ratios^ (PR) of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle

Demographic Characteristics	Diabetes		Prediabetes		Hypertension		Prehypertension		High Cholesterol	
	T4 PR	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**
Sex										
Male	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Female	1.10	(0.84, 1.45)	**0.84**	**0.72, 0.98**	**0.77**	**(0.64, 0.91)**	**0.41**	**(0.35, 0.48)**	**0.70**	**(0.62, 0.80)**
Race/Ethnicity										
Non-Hispanic White	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Non-Hispanic Black	**2.11**	**(1.28, 3.49)**	**3.30**	**2.55, 4.28**	**1.49**	**(1.29, 1.73)**	1.16	(0.98, 1.38)	0.88	(0.78, 1.00)
Mexican American	**1.67**	**(1.01, 2.78)**	**1.81**	**1.40, 2.33**	0.92	(0.71, 1.18)	0.89	(0.76, 1.03)	1.00	(0.84, 1.19)
Other	**1.91**	**(1.19, 3.05)**	**1.41**	**1.12, 1.76**	**0.80**	**(0.67, 0.96)**	1.00	(0.85, 1.19)	0.94	(0.85, 1.03)
Education										
Less than High School	**1.63**	**(1.12, 2.36)**	**1.38**	**1.05, 1.80**	**1.21**	**(1.03, 1.42)**	**1.18**	**(1.02, 1.37)**	1.04	(0.91, 1.20)
High School Graduate/GED or Equivalent	1.22	(0.76, 1.96)	1.16	0.92, 1.46	**1.26**	**(1.05, 1.51)**	0.97	(0.80, 1.18)	0.96	(0.84, 1.11)
Some College or Above	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Marital Status										
Married	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Not Married	0.66	(0.44, 1.00)	**0.60**	**0.50, 0.72**	**0.82**	**(0.70, 0.97)**	0.98	(0.87, 1.10)	**0.69**	**(0.61, 0.79)**
Poverty Income Ratio (PIR)										
< 1	1.48	(0.92, 2.37)	1.11	0.90, 1.37	1.19	(0.95, 1.50)	0.97	(0.81, 1.15)	0.98	(0.86, 1.11)
1 - 3	1.25	(0.84, 1.85)	1.07	0.88, 1.31	**1.27**	**(1.08, 1.50)**	0.97	(0.83, 1.13)	0.98	(0.86, 1.11)
> 3	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Health Insurance Coverage										
Insured	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Uninsured	0.93	(0.62, 1.40	1.20	0.96, 1.49	0.85	(0.72, 1.00)	1.12	(1.00, 1.25)	1.02	(0.91, 1.15)

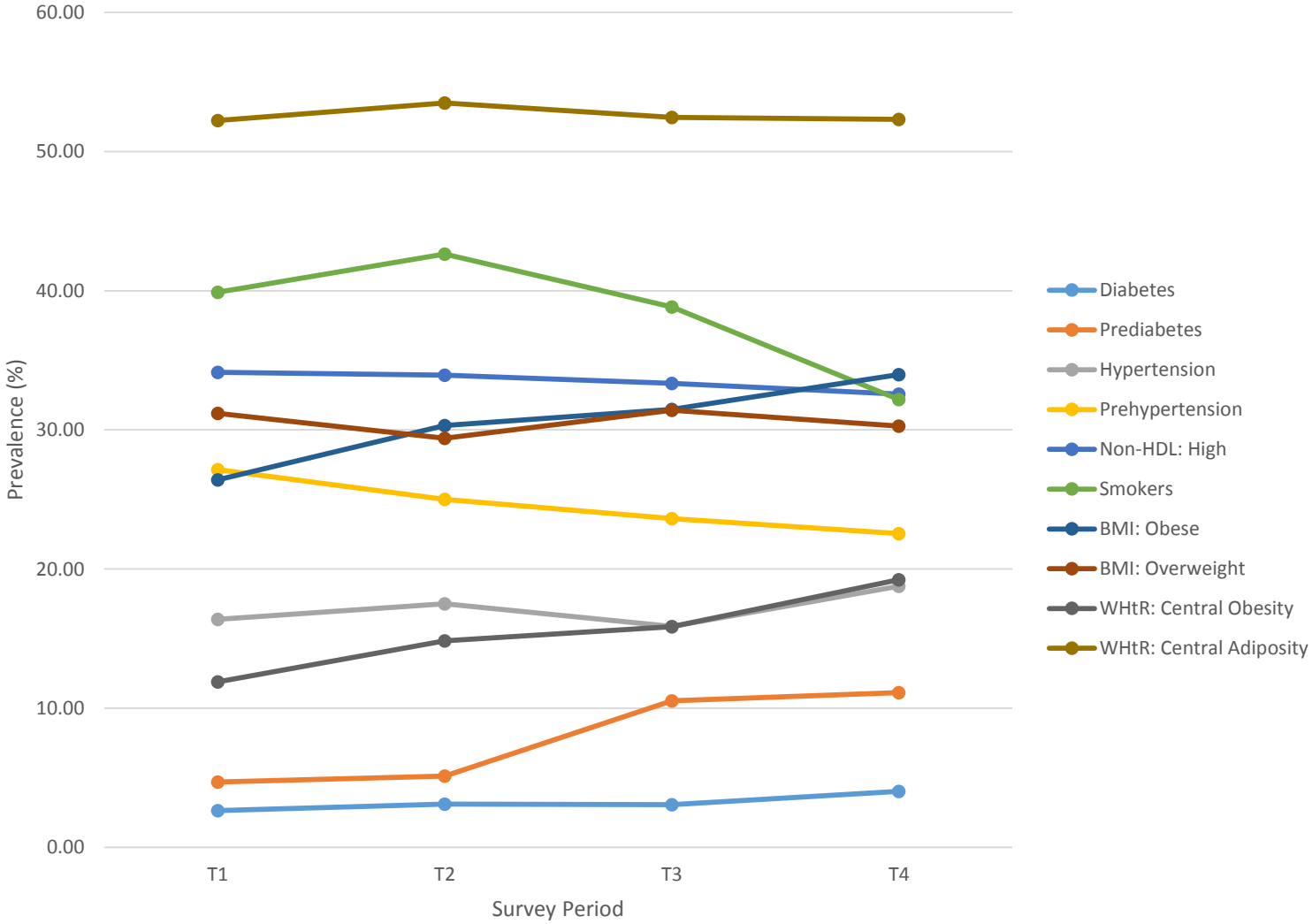
^Adjusted prevalence ratios were calculated using multivariate logistic regression models (predictive margins), adjusting for confounders (sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage). PRs were reported for NHANES 1999–2002 (T1) and 2011–2014 (T4).
Bold values represent statistical significance.

Table 4. Adjusted Prevalence Ratios^ (PR) of Cardiometabolic Risk Factors among US young adults, by Demographic Characteristics and Survey Cycle (cont.)

Demographic Characteristics	Current Smokers		Obesity		Overweight		Central Obesity		Central Adiposity	
	T4 PR	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**	**T4 PR**	**(*95% CI*)**
Sex										
Male	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Female	**0.74**	**(0.68, 0.81)**	**1.09**	**(1.01, 1.17)**	**0.75**	**(0.69, 0.81)**	**1.61**	**(1.42, 1.82)**	0.94	(0.87, 1.00)
Race/Ethnicity										
Non-Hispanic White	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Non-Hispanic Black	**0.78**	**(0.66, 0.91)**	**1.45**	**(1.27, 1.65)**	0.93	(0.80, 1.08)	**1.25**	**(1.05, 1.50)**	0.99	(0.90, 1.10)
Mexican American	**0.35**	**(0.27, 0.46)**	**1.37**	**(1.19, 1.57)**	1.09	(0.96, 1.23)	**1.29**	**(1.06, 1.57)**	**1.16**	**(1.05, 1.29)**
Other	**0.60**	**(0.50, 0.72)**	0.90	(0.75, 1.08)	0.89	(0.79, 1.01)	**0.72**	**(0.58, 0.91)**	**1.10**	**(1.02, 1.19)**
Education										
Less than High School	**1.88**	**(1.60, 2.21)**	1.17	(1.00, 1.36)	0.98	(0.77, 1.25)	**1.25**	**(1.03, 1.51)**	0.99	(0.87, 1.13)
High School Graduate/GED or Equivalent	**1.62**	**(1.36, 1.94)**	**1.21**	**(1.08, 1.35)**	0.93	(0.80, 1.07)	**1.45**	**(1.23, 1.70)**	0.94	(0.86, 1.04)
Some College or Above	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Marital Status										
Married	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Not Married	**1.19**	**(1.05, 1.36)**	**0.82**	**(0.74, 0.91)**	**0.81**	(0.73, 0.90)	0.86	(0.69, 1.06)	**0.79**	**(0.73, 0.85)**
Poverty Income Ratio (PIR)										
< 1	**1.55**	**(1.33, 1.80)**	**1.25**	**(1.09, 1.43)**	**0.86**	(0.74, 0.99)	**1.61**	**(1.23, 2.11)**	**0.87**	**(0.78, 0.96)**
1 - 3	**1.32**	**(1.11, 1.58)**	**1.31**	**(1.16, 1.49)**	0.94	(0.81, 1.08)	**1.52**	**(1.23, 1.88)**	0.98	(0.89, 1.07)
> 3	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Health Insurance Coverage										
Insured	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
Uninsured	**1.29**	**(1.14, 1.45)**	1.01	(0.89, 1.15)	1.06	(0.96, 1.16)	0.98	(0.85, 1.12)	1.06	(0.98, 1.14)

^Adjusted prevalence ratios were calculated using multivariate logistic regression models (predictive margins), adjusting for confounders (sex, race/ethnicity, education, marital status, poverty-income ratio, and insurance coverage). PRs were reported for NHANES 1999–2002 (T1) and 2011–2014 (T4).
Bold values represent statistical significance.

Figure 1. Multivariate-Adjusted Changes in Prevalence of Cardiometabolic Risk Factors Among US Young Adults, 1999-2014



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Supplemental Table 1. Extent of Missingness for all Sociodemographic and Cardiometabolic Risk Factor Variables among US Young Adults, NHANES 1999-2014

Variable	N Missing	%
Sex	0	0.00
Race/Ethnicity	0	0.00
Marital Status	556	2.32
Education	18	0.10
Poverty-Income Ratio (PIR)	1,659	6.46
Insurance	152	0.62
Glycemia	1,256	5.20
Blood Pressure	1,158	4.56
Non-HDL Cholesterol	1,345	5.49
Smoking Status	3,731	16.77
Body Mass Index (BMI)	325	1.40
Waist-to-Height Ratio (WHtR)	924	3.96

Percent column corresponds to percentage of total young adult population from all survey cycles with missing values for each respective variable.