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among adults in the United States: 2011-2018**

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Trends in obesity and adiposity measures by race/ethnicity among adults in the United States: 2011-2018

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Summary boxes

What is already known on this topic

Previous studies reporting trends in obesity usually assessed obesity by body mass index (BMI) and waist circumference, which is useful but cannot directly assess body fat or adiposity.

Population data assessing the trends in imaging-assessed adiposity, expressed as body composition, among US population remain lacking.

What this study adds

In this nationally representative cross-sectional study, non-Hispanic blacks showed a leveling off in all adiposity measures (i.e., BMI, waist circumference, body fat percentage, general obesity, and abdominal obesity) but a decrease in lean mass from 2011-2012 to 2017-2018. Non-Hispanic Asians had increases in all measures, while Hispanics and non-Hispanic whites increased in BMI and waist circumferences and remained stable in body fat percentage and lean masses. This study not only updated the recent trends in obesity by race/ethnicity, but also provided the first estimates about national trends in body composition among US adults.

ABSTRACT

Objective: Given the global obesity epidemic and its racial/ethnic disparities, it is imperative to understand the trends in obesity by race/ethnicity. Moreover, while previous studies reported trends in obesity defined by body mass index (BMI) and waist circumference, trends in imaging-assessed adiposity, expressed as body composition, remain unknown. To examine the trends in obesity and adiposity measures, including BMI, waist circumference, body fat percentage, and lean mass, by race/ethnicity among US adults from 2011-2018.

Design: Nationwide, population-based, cross-sectional study.

Setting: National Health and Nutrition Examination Survey, 2011-2018.

Participants: A nationally representative sample of U.S. adults aged 20 years or older.

Main outcomes and Measures: Weight, height, and waist circumference among adults aged 20 years or older were measured by trained technicians using standardized protocols. Obesity was defined as BMI ≥ 30 kg/m² for non-Asians and ≥ 27.5 kg/m² for Asians. Abdominal obesity was defined as waist circumference ≥ 102 cm for men and ≥ 88 for women. Body fat percentage and lean mass was measured among adults aged 20-59 years old using dual-energy x-ray absorptiometry.

Results: This study included 21,399 participants, with BMI measured among 21,093 adults, waist circumference among 20,080 adults, and body fat percentage among 10,864 adults. From 2011-2012 to 2017-2018, there was a significant increase in age-adjusted BMIs and waist circumferences and age-adjusted prevalence of obesity and abdominal obesity among Hispanics, non-Hispanic whites, and non-Hispanic Asians, but not among non-Hispanic blacks. For body fat percentage, there was a significant increase among non-Hispanic Asians, from 30.6% (29.8%-31.4%) in 2011-2012 to 32.7% (32.0%-33.4%) in 2017-2018 (P for trend 0.001), but not among

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3 other racial/ethnic groups. The age-adjusted mean lean mass decreased in non-Hispanic blacks (P
4 for trend 0.04), increased in non-Hispanic Asians (P for trend 0.01), and remained stable in other
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6 racial/ethnic groups (P values > 0.05).
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10 **Conclusions:** In this nationally representative sample of US adults, racial/ethnic disparities exist
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12 in trends in obesity and adiposity measures, including BMI, waist circumference, body fat
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14 percentage, lean mass, general obesity, and abdominal obesity from 2011-2012 to 2017-2018.
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INTRODUCTION

Obesity, recognized as a common, complex, serious, and costly disease, continues to be a major focus of public health efforts in the world. Obesity has broad effects on human health. It is not only associated with increased risk of physical diseases (e.g., diabetes, hypertension, and cardiovascular disease)¹ and mental illnesses (e.g., depression, substance abuse, and schizophrenia),² but also results in increased mortality.^{3 4} Obesity has caused sizable burdens to individuals, communities, and society.⁵ Therefore, it is crucial to track the prevalence of obesity to provide evidence to inform policy efforts and prevention programs.

In the United States, the National Health and Nutrition Examination Survey (NHANES) has been the leading source to track the trends in obesity among US adults since the 1980s.⁶⁻¹³ However, previous studies reporting trends in obesity usually assessed obesity by BMI⁶⁻¹² and waist circumference,¹³⁻¹⁵ which is useful but cannot directly assess body fat or adiposity. Data on recent national trends in adiposity measured by body fat percentage in the United States are lacking. Since the 2011-2012 cycle, NHANES administered whole-body dual-energy X-ray absorptiometry (DXA) scans to provide data on body composition, which provided a unique opportunity to address the trends in not only obesity but also adiposity and lean mass measures among US general population.

In addition, from 2011-2012 to 2017-2018, NHANES oversampled non-Hispanic Asians in addition to traditionally oversampled groups, including Hispanics and non-Hispanic Blacks.¹⁶ Before the 2011-2012 NHANES cycle, non-Hispanic Asians were not differentiated in the released data and included as a whole in the “other” racial/ethnic category. In the United States, there were 18.3 million Asian Americans in 2017, accounting for 5.7% of the nation’s population, and it is projected to grow to 36.8 million (9.1%) in 2060.¹⁷ Given the continuous

growth of the Asian Americans, there is an urgent need to understand health conditions and risk factors among Asian Americans. Asians are known to have different body composition compared with other racial/ethnic groups. The World Health Organization¹⁸ and the American Diabetes Association¹⁹ recommended Asian-specific cut-off points for BMI (i.e., ≥ 27.5 kg/m²) to define obesity among Asians, which are lower than the BMI cut-off points for general population (i.e., ≥ 30 kg/m²). Moreover, the Asian-specific BMI cutoff points have been recommended to define and classify obesity among Asian Americans in the Standards of Medical Care in Diabetes by the American Diabetes Association since 2016.²⁰ This is because at a given BMI, Asians tend to have higher risks of certain diseases, such as diabetes, than people of other races/ethnicities.^{18 19} It is imperative to address the critical data gap about the national prevalence and trends in obesity among Asian Americans, in comparison with other racial/ethnic groups.

In the present study, using data from NHANES 2011-2018, we examined national trends in BMI, waist circumference, body fat percentage, and lean mass, by race/ethnicity among US adults.

METHODS

NHANES is a nationally representative survey conducted by the National Center for Health Statistics, a unit of the Centers for Disease Control and Prevention. To represent the civilian non-institutionalized U.S. population, NHANES applied a complex, multistage probability sampling design and recruited approximately 10,000 participants in each 2-year cycle.²¹ NHANES data collected a combination of in-person interviews and physical examinations, comprising general health, disease history, health behavior, physiological measure, and diet and nutritional status.²¹ Starting in 2011, NHANES restarted performing whole-body DXA scans to provide data on body composition, and performed an oversample of non-Hispanic Asians to increase measurement precision.²² In recent years, the response rate of national survey gradually decreases, ranging from 66% in 2011-2012 to 47.7% in 2017-2018. However, the CDC has further evaluated the data and conducted enhanced weighting adjustment to minimize potential nonresponse bias.²³ Detailed descriptions of NHANES methods and data access are publicly available on the NHANES website.²⁴ NHANES procedures were approved by the National Center for Health Statistics Ethics Review Board.²⁵ Written informed consent was obtained from all participants.

In this study, we used data from NHANES 2011-2012 to 2017-2018. There were 21,646 adults aged 20 years or older. Pregnant women were excluded from all analyses (n=247). Additionally, adiposity measurement data were missing for BMI (n=306) and waist circumference (n=1,319). DXA was only conducted among adults aged 20-59 years old (n=14,100), among which 3,236 had missing data on body composition due to various reasons, showing in **eFigure 1**. Ultimately, there were available data on BMI among 21,093 adults, waist

circumference among 20,080 adults, and body composition among 10,864 adults aged 20-59 years. A flow chart of participants were provided (appendix Figure 1).

Body measures

Weight, height, and waist circumference were measured among all adults aged 20 years or older by trained staff using standardized techniques.²⁶ In the mobile examination center (MEC), participants wearing only underclothing and an MEC examination gown were weighed in kilograms using a digital scale. Standing height was measured using a stadiometer with a fixed vertical backboard and an adjustable head piece. Waist circumference was measured just above the iliac crest using a steel measuring tape. Detailed descriptions of the measurement protocol, equipment, and quality control are provided in the NHANES Anthropometry Procedures Manual.²⁶ BMI was calculated as weight in kilograms divided by squared height in meters. General obesity was defined as BMI ≥ 27.5 kg/m² for Asians and ≥ 30 kg/m² for non-Asians, including Hispanics, non-Hispanic whites, non-Hispanic blacks, and individuals with other race/ethnicity categories. Abdominal obesity was defined as a waist circumference ≥ 102 cm for men and ≥ 88 for women.

Body composition, including body fat percentage and lean mass (excluding bone mass), were measured among adults 20-59 years old using dual-energy x-ray absorptiometry (DXA) by trained and certified radiology technologists following a standard protocol.²⁷ Whole body scans, with an extremely low radiation exposure (< 20 uSv), were performed on the Hologic QDR 4500A fan-beam bone Densitometers and the data acquired were analyzed with Hologic APEX version 4.0 software with the NHANES BCA option.

Other variables

Information about age, sex, and race/ethnicity was collected using standardized questionnaires. Race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, Hispanic (Mexican and non-Mexican Hispanic), non-Hispanic Asian, and other race/ethnicity.

Data analysis

According to the NHANES Analytic Guidelines, we accounted for examination sample weights to obtain variance estimates in the data, using a stratified multistage probability design.²² Because the prevalence of obesity varies across ages and to be comparable with previous CDC reports,⁸ age-adjusted estimates were calculated using the 2000 Census data, based on recommendations from NHANES.²⁹ In 2000, the proportion of adults aged 20 to 39 years, 40 to 59 years, and ≥ 60 years was 0.3966, 0.3718, and 0.2316, respectively.³⁰ A different proportion (0.5161 for 20-39 years and 0.4839 for 40-59 years) was used for the analyses of body fat percentage and lean mass, since these were only determined in adults 20-59 years.

Age-adjusted mean BMIs, mean waist circumferences, mean body fat percentages, and mean lean mass, as well as age-adjusted prevalences of general obesity and abdominal obesity, overall and stratified by race/ethnicity and sex, in each cycle from 2011-2012 to 2017-2018 were calculated, respectively. To investigate linear trends over time, we performed multivariable linear regressions (for BMI, waist circumference, body fat percentage, and lean mass) or logistic regressions (obesity and abdominal obesity) with survey cycles as a continuous independent variable in models. Age, race/ethnicity, and sex were adjusted except when used as a stratified variable. To be comparable with previous reports on obesity defined by BMI, we also conducted a sensitivity analysis using the cut-off point for general population (i.e., $\text{BMI} \geq 30 \text{ kg/m}^2$) to define obesity in non-Hispanic Asians. In addition, to be comparable with the study population for body fat percentage and lean mass, we provided results for age-adjusted mean BMIs and

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3 waist circumferences, as well as age-adjusted prevalences of obesity and abdominal obesity
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5 among adults aged 20-59 years as well.
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8 All statistical analyses were conducted using survey modules of SAS software version
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10 9.4 (SAS Institute, Cary, NC). Two-sided P-values < 0.05 were considered statistically
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12 significant.
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RESULTS

In this study, we have different sample sizes for various measures, which is 21,093 for BMI, 20,080 for waist circumference, 10,864 for body fat percentage and lean mass. In the maximal study sample, the weighted mean (SE) age was 47.9 (0.3) years; 10,794 participants were women (weighted proportion 51.4%); 7,757 participants (weighted proportion 64.8%) were of non-Hispanic white ancestry, 5,037 (14.9%) of Hispanic ancestry, 4,809 (11.3%) of non-Hispanic black ancestry, and 2,732 (5.6%) of non-Hispanic Asian ancestry. Sample sizes and population characteristics varied slightly across survey cycles (appendix Table 1). Unweighted sample sizes for adults 20 years and older by sex, age, and race/ethnicity in NHANES 2017-2018 are shown in appendix Table 2.

BMI

The overall population age-adjusted mean BMI increased significantly from 28.7 kg/m² (28.2-29.1 kg/m²) in 2011-2012 to 29.8 kg/m² (29.2-30.4 kg/m²) in 2017-2018 (P for trend 0.001). Significant increases were observed among Hispanics, non-Hispanic whites, and non-Hispanic Asians (P values for trend < 0.05, **Table 1**). The increase in Hispanics and non-Hispanic whites was mainly present in males, while for non-Hispanic Asian, the increase was observed in both sexes. The age-adjusted mean BMI did not change significantly among non-Hispanic blacks (P for trend 0.33), although they continue to have the largest BMIs (**Table 1**). The age-adjusted body weight and standing height are provided in supplemental materials (appendix Table 3, 4).

Waist Circumference

The overall population age-adjusted mean waist circumference increased from 98.4cm (97.4-99.5 cm) in 2011-2012 to 100.5cm (98.9-102.1 cm) in 2017-2018 (P for trend 0.01).

Significant increases were observed among Hispanics, non-Hispanic whites, and non-Hispanic Asians (P values for trend < 0.05, **Table 2**). When stratified by sex, increases occurred only in males (**Table 2**). The age-adjusted mean waist circumference did not change significantly among non-Hispanic blacks (P for trend 0.50).

Body fat percentage

The overall population age-adjusted body fat percentage did not change significantly, which was 32.6% (95%CI 32.0%-33.2%) in 2011-2012 and 33.0% (95%CI 32.4%-33.7%) in 2017-2018 (P for trend 0.93). Body fat percentages remained stable among most racial/ethnic groups except for non-Hispanic Asians, among which the age-adjusted body fat percentage increased from 30.6% (29.8%-31.4%) in 2011-2012 to 32.7% (32.0%-33.4%) in 2017-2018 (P=0.001, **Table 3**). Moreover, the increase was mainly present in Asian males, where the age-adjusted body fat percentage increased from 25.5% (24.7%-26.4%) in 2011-2012 to 28.2% (27.7%-28.7%) in 2017-2018 (P for trend < 0.0001). Among non-Hispanic Asian females, the body fat percentage was relatively stable at around 37% (P for trend 0.32).

We also calculated distributions for total body fat overall and by race/ethnicity from 2011-2018 (appendix Table 5). In addition, we also calculated the age-adjusted mean BMI, waist circumference, as well as age-adjusted prevalence of obesity and abdominal obesity among adults aged 20-59 years (appendix Table 6). Further, we provided the estimates of body weight and standing height among these adults as well (appendix Table 7, 8).

Lean body mass

The overall population age-adjusted mean lean remained stable at 52.7 kg (52.0-53.4 kg) in 2011-2012 and 52.1 kg (51.3-52.9 kg) in 2017-2018 (P for trend 0.98). However, significant decreases were observed among non-Hispanic blacks from 56.1kg (55.2-57.0 kg) in 2011-2012

to 55.2kg (54.4-56.0 kg) in 2017-2018 (P for trend 0.04), and the decrease was mainly present in females (P for trend 0.03). Among non-Hispanic Asians, the mean lean mass increased from 44.6kg (43.7-45.4 kg) to 45.5kg (44.3-46.8 kg) in 2017-2018, and the increase was mainly present in males (P for trend 0.01). The age-adjusted mean lean mass remained stable in Hispanics and non-Hispanic whites (**Table 4**).

General obesity

The overall age-adjusted prevalence of general obesity increased significantly regardless cut-off points that were used for non-Hispanic Asians (**Table 5**). The age-adjusted prevalence of obesity, defined with Asian specific cut-off points, increased from 20.8% (17.2%-24.4%) in 2011-2012 to 34.2% (29.8%-38.6%) in 2017-2018 among Asians (P for trend < 0.0001), which is much higher than that defined using the cut-off points for general population (appendix Table 9). Significant increases were also seen in Hispanics and non-Hispanic whites (P values for trend < 0.05). The prevalence of general obesity has levelled off in non-Hispanic blacks (P for trend= 0.52), although still highest (**Table 5**).

Abdominal obesity

The overall age-adjusted abdominal obesity increased from 54.5% (51.2%-57.8%) in 2011-2012 to 59.1% (55.6%-62.7%) in 2017-2018 (P for trend 0.02). However, significant increases were only observed among non-Hispanic white males (P for trend 0.02) and non-Hispanic Asian males (P for trend 0.01) and females (P for trend 0.03, **Table 5**).

DISCUSSION

This study, based on a multi-racial/ethnic representative population, reported most recent national estimates of obesity, abdominal obesity, and body composition and their racial/ethnic disparities among US adults from 2011-2012 to 2017-2018. Overall, we found that obesity remained high and was increasing in the USA, although with variation among racial/ethnic groups. The age-adjusted mean BMIs and waist circumferences as well as obesity and abdominal obesity increased significantly from 2011-2012 through 2017-2018. The age-adjusted body fat percentage and lean body mass, only available among adults 29-59 years old, did not change significantly during this period. The trends differed significantly across race/ethnicity groups. Non-Hispanic blacks were plateauing at a high level for all measures, but showed a decrease in lean mass. Non-Hispanic Asians were the only group that had significant increases in every adiposity measures and lean mass. Hispanics and non-Hispanic whites showed significant increase in BMI and waist circumference but not in body fat percentage and lean mass. Of note, in every racial/ethnic group, the prevalence of general obesity in 2017-2018 was higher than the goal of 30.5% in healthy people 2020.

To the best of our knowledge, this study for the first time investigated national estimates of body composition among US adults in recent years. This provides important information about adiposity directly measured by DXA, whereas previous studies usually reported obesity defined by BMI as a proxy of adiposity. Overall, age-adjusted body fat percentages and lean masses were stable among US adults 20-59 years during 2011-2018 with considerable race/ethnicity disparities. Non-Hispanic Asians showed a significant increase in body fat percentage, while all other racial /ethnic groups remained relatively stable. Compared with reports from 1999-2004 (mean body fat percentage, 28.2%; total body fat, 25.4 kg), body fat

percentage and total body fat in the current study were much higher overall and in each racial /ethnic group.³¹ For lean mass, it is interesting to find that non-Hispanic Asians also showed a significant increase, while non-Hispanic blacks showed a significant decrease, especially among females.

Most previous studies reporting national prevalence of obesity focused on BMI-defined general obesity.⁶⁻¹² Our findings about BMI and general obesity defined by the BMI cut-off points for general population were consistent with previous reports.^{6 8 13} Of note, we also reported the prevalence of obesity in non-Hispanic Asians using the Asian specific cut-off point, showing that 20.8% of Asians in 2011-2012 and 34.2% of Asians in 2017-2018 were obese. Using the Asian specific cut-off point, additional approximately 3 million non-Hispanic Asians in 2017-2018 would be classified as obese. Moreover, our findings provide the most recent national estimate of waist circumference and abdominal obesity. During 2011-2018, significant increases in waist circumference occurred in Hispanics, non-Hispanic whites, and non-Hispanic Asians, but not in non-Hispanic blacks. In addition, we found that the overall prevalence of abdominal obesity increased from 54.5% in 2011-2012 to 59.1% in 2017-2018, an increase mostly attributed to non-Hispanic Asians (increased by 29.1%). Previous reports showed that waist circumference increased from 95.5 cm in 1999-2000 to 98.5 cm in 2011-2012.¹⁴ Meanwhile, the overall prevalence of abdominal obesity increased significantly from 46.4% in 1999-2000 to 54.2% in 2011-2012.¹⁴ These previous reports combined with our findings suggested that waist circumference and abdominal obesity have increased steadily in the USA in the past two decades, with significant variations across race/ethnicity.

Several factors, such as increased sedentary behavior,^{32 33} insufficient sleep,^{34 35} environmental endocrine disruptor exposure,³⁶⁻³⁸ and continued suboptimal diet quality,³⁹ may

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3 serve as potential explanations for the increase in obesity prevalence in the United States and
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5 worldwide. Moreover, in contrast to the increased BMI and waist circumference, body fat
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7 percentages and lean mass remained relatively stable during these years. The underlying reasons
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9 are unclear and warrant further exploration, although BMI and waist circumference do not
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11 necessarily correspond to body fat percentage.
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15 Significant race/ethnicity disparities have been observed in all the obesity and adiposity
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17 measures. In this study, non-Hispanic blacks have stopped increasing in all the obesity and
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19 adiposity measures, although they are still high. This might be attributable to improvements in
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21 lifestyle factors, such as the improved diet quality,³⁹ increased rate of adhering to the Physical
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23 Activity Guidelines for Americans for aerobic activity.³² However, it is also worth noting that the
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25 mean lean masses decreased significantly among non-Hispanic blacks from 2011-2018, which
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27 prompts multiple negative health implications. For non-Hispanic Asians, we observed much
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29 smaller BMIs, waist circumferences, and lean masses than other racial/ethnic groups. However,
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31 the body fat percentage in non-Hispanic Asians was comparable to non-Hispanic whites and
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33 non-Hispanic blacks. This is consistent with previous findings showing that Asians have higher
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35 adiposity than non-Hispanic whites and non-Hispanic blacks at a given BMI,⁴⁰ and could explain
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37 why increased health risks, such as insulin resistance, high triglycerides, and high cholesterol,
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39 begins at a lower BMI among Asians than among white adults.^{41 42} Moreover, it is worth noting
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41 that non-Hispanic Asian is the only group that had increases in all the obesity and adiposity
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43 measures, suggesting a potential higher medical and financial burden in the future. However,
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45 most previous studies, such as those related to physical activity and diet, have classified non-
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47 Hispanic Asian into other race/ethnic group.^{32 39} Therefore, we cannot speculate on the potential
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49 explanations for the increase of adiposity measures in Asians. Continued increases in some, but
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not all, adiposity measures, were also observed among Hispanics and non-Hispanic whites. More effort is needed to develop more effective obesity control programs and to further ameliorate health problems caused by the obesity epidemic.

Strength and Limitation

The main strength of this study is the use of data from NHANES, which provides an opportunity to estimate the national trends in a comprehensive set of obesity and adiposity measures, including objectively measured body weight, height, waist circumference as well as body composition. Moreover, we have enough sample size to separately identify non-Hispanic Asians from “other races/ethnicities”, which allows us to find the distinct but neglected pattern of obesity epidemic among Asian Americans. This study has several limitations. First, although NHANES remains the leading national survey with high response rates, like many other national face-to face surveys,⁴³ there was a decline in response rates over time, which may be subject to selection bias. However, the NCHS has evaluated the NHANES data and conducted enhanced weighting adjustment to minimize the potential nonresponse bias, and we have incorporated the sampling weights in analyses according to NHANES analytic guidelines.^{23 28} Of note, NHANES data remain the best resource to estimate obesity prevalence among US adults and continue to be used in CDC’s reports.⁸ Second, in NHANES 2011-2018, body composition (body fat, lean mass) was measured among adults aged 20-59 years old, but not those aged 60 years or older. Therefore, we could not estimate the distribution in the older population. In addition, some NHANES participants were not eligible for DXA scan due to excessive weight or height. However, the number of these participants was small (0.1% of the participants).

Conclusions

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3 This nationally representative survey provided an important picture of trends in various
4 obesity and adiposity measures in US adults in the United States. Significant variations across
5 race/ethnicity were observed for trends in the obesity and adiposity measures, including BMI,
6 waist circumference, body fat percentage, lean mass, general obesity and abdominal obesity,
7 from 2011-2012 through 2017-2018. Non-Hispanic blacks showed a leveling off, although still
8 high, in most measures but a decrease in lean mass. In addition, increases in all measures were
9 consistently observed only among non-Hispanic Asians, which warrants further attention.
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Author Contributions: WB has full access to all of the data in this study and has final responsibility for the decision to submit for publication. WB and BL contributed to the conception and design of the study. BL performed the statistical analyses and drafted the manuscript. All authors contributed to the acquisition, analysis, or interpretation of the data, and critically revised the manuscript for important intellectual content. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Competing interests: All the authors declared no conflict of interest.

Ethical approval: NHANES has been approved by the National Center for Health Statistics Ethics Review Board.

Data sharing: No additional data available.’

Transparency: The manuscript’s guarantor (JOS) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained. This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) license, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <http://creativecommons.org/licenses/by/4.0/>.

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Table 1. Trends in Age-Adjusted Mean BMI by Race/Ethnicity: United State, 2011-2018 (N=21,093)

Variables	Mean of age-adjusted mean BMI, kg/m ² , mean (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^a	28.7 (28.2-29.1)	29.1 (28.7-29.5)	29.4 (28.8-29.9)	29.8 (29.2-30.4)	0.001
All participants ^b					
Hispanic	29.6 (29.1-30.1)	29.8 (29.2-30.4)	30.6 (29.9-31.3)	30.3 (29.8-30.8)	0.01
Non-Hispanic white	28.4 (27.8-28.9)	29.0 (28.5-29.5)	29.1 (28.5-29.7)	29.7 (28.8-30.5)	0.006
Non-Hispanic black	30.8 (30.2-31.4)	30.9 (30.2-31.5)	30.6 (29.9-31.3)	31.3 (30.7-31.9)	0.33
Non-Hispanic Asian	24.5 (24.1-25.0)	24.8 (24.4-25.2)	24.9 (24.6-25.2)	26.2 (25.9-26.5)	< 0.0001
Other	29.4 (27.4-31.5)	29.2 (27.7-30.6)	30.6 (29.5-31.6)	30.6 (29.3-31.8)	0.20
Male ^c					
Hispanic	29.2 (28.7-29.7)	29.3 (28.5-30.1)	30.0 (29.3-30.7)	30.3 (29.7-31.0)	0.01
Non-Hispanic white	28.4 (27.9-28.9)	28.9 (28.4-29.3)	29.1 (28.4-29.8)	29.8 (29.0-30.6)	0.002
Non-Hispanic black	29.0 (28.4-29.5)	28.9 (28.2-29.5)	29.0 (28.2-29.8)	29.4 (28.8-30.0)	0.22
Non-Hispanic Asian	24.9 (24.4-25.4)	25.4 (24.9-25.9)	25.3 (24.9-25.6)	26.9 (26.4-27.4)	< 0.0001
Other	30.5 (26.9-34.1)	28.6 (26.5-30.7)	30.1 (28.2-32.0)	30.2 (28.5-32.0)	0.93
Female ^c					
Hispanic	30.0 (29.4-30.6)	30.3 (29.5-31.1)	31.2 (30.4-31.9)	30.3 (29.6-31.0)	0.18
Non-Hispanic white	28.3 (27.6-29.1)	29.1 (28.5-29.7)	29.1 (28.4-29.8)	29.6 (28.4-30.8)	0.07
Non-Hispanic black	32.4 (31.7-33.1)	32.5 (31.8-33.3)	31.9 (30.9-32.8)	32.8 (31.9-33.8)	0.62
Non-Hispanic Asian	24.2 (23.6-24.8)	24.3 (23.6-24.9)	24.6 (24.1-25.1)	25.6 (25.0-26.1)	0.0004
Other	28.4 (26.3-30.4)	29.8 (27.8-31.7)	30.9 (29.4-32.3)	31.2 (29.6-32.8)	0.01

^a P for trend adjusted for age, sex, and race/ethnicity.

^b P for trend adjusted for age and sex.

^c P for trend adjusted for age.

Table 2. Trends in Age-Adjusted Mean Waist Circumference by Race/Ethnicity: United State, 2011-2018 (N=20,080)

Variables	Mean of age-adjusted mean waist circumference, cm, mean (95%CI)				<i>P</i> for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^a	98.4 (97.4-99.5)	99.3 (98.6-100.1)	100.0 (98.6-101.5)	100.5 (98.9-102.1)	0.01
All participants ^b					
Hispanic	99.2 (97.9-100.4)	100.0 (98.1-101.9)	101.3 (100.1-102.5)	100.9 (99.8-102.1)	0.04
Non-Hispanic white	98.6 (97.3-99.8)	99.7 (98.6-100.7)	100.4 (98.8-101.9)	100.9 (98.7-103.0)	0.03
Non-Hispanic black	100.7 (99.5-101.9)	100.8 (99.4-102.1)	100.7 (98.6-102.8)	101.3 (99.8-102.8)	0.50
Non-Hispanic Asian	87.4 (86.2-88.5)	88.3 (87.2-89.3)	88.5 (87.6-89.4)	90.6 (89.8-91.5)	<0.0001
Other	100.3 (95.1-105.4)	99.3 (95.2-103.4)	102.8 (100.4-105.2)	103.2 (100.3-106.2)	0.21
Male ^c					
Hispanic	101.1 (99.6-102.7)	101.7 (99.3-104.1)	102.5 (101.0-103.9)	103.6 (102.2-105.1)	0.048
Non-Hispanic white	101.6 (100.2-102.9)	102.7 (101.4-104.1)	103.2 (101.2-105.1)	104.0 (101.9-106.2)	0.042
Non-Hispanic black	99.3 (98.0-100.7)	98.5 (96.5-100.5)	99.2 (96.9-101.6)	99.9 (97.9-101.8)	0.52
Non-Hispanic Asian	90.1 (88.8-91.4)	91.1 (90.0-92.3)	91.5 (90.2-92.9)	95.0 (94.0-96.0)	<0.0001
Other	105.5 (97.3-113.8)	100.9 (95.3-106.6)	104.4 (100.0-108.7)	105.0 (100.1-109.8)	0.88
Female ^c					
Hispanic	97.2 (95.6-98.8)	98.3 (96.0-100.6)	100.0 (98.8-101.3)	98.2 (96.6-99.8)	0.19
Non-Hispanic white	95.66 (94.1-97.2)	96.7 (95.4-98.0)	97.6 (95.9-99.3)	97.9 (95.0-100.8)	0.09
Non-Hispanic black	102.0 (100.6-103.3)	102.8 (101.4-104.2)	102.0 (99.4-104.6)	102.7 (100.9-104.4)	0.66
Non-Hispanic Asian	84.9 (83.4-86.3)	87.8 (84.1-87.4)	85.6 (84.3-87.0)	86.6 (85.3-87.9)	0.08
Other	94.6 (91.0-98.1)	97.5 (92.0-103.1)	101.0 (98.3-103.8)	101.0 (97.9-104.1)	0.01

^a *P* for trend adjusted for age, sex, and race/ethnicity.^b *P* for trend adjusted for age and sex.^c *P* for trend adjusted for age.

Table 3. Trends in Age-Adjusted Body Fat Percentage by Race/Ethnicity: United State, 2011-2018 (N=10,864)^a

Variables	Mean of age-adjusted body fat percentage, mean (95%CI)				<i>P</i> for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^b	32.6 (32.0-33.2)	33.1 (32.5-33.6)	32.9 (32.2-33.5)	33.0 (32.4-33.7)	0.93
All participants ^c					
Hispanic	33.7 (32.8-34.6)	33.8 (32.9-34.8)	34.0 (33.2-34.8)	34.1 (33.3-35.0)	0.53
Non-Hispanic white	32.5 (31.8-33.2)	33.1 (32.3-33.9)	32.8 (32.0-33.5)	32.9 (32.1-33.7)	0.42
Non-Hispanic black	32.6 (31.9-33.2)	32.5 (31.7-33.4)	31.9 (30.7-33.2)	32.0 (30.6-33.4)	0.69
Non-Hispanic Asian	30.6 (29.8-31.4)	31.7 (31.1-32.2)	31.4 (30.8-32.0)	32.7 (32.0-33.4)	0.001
Other	31.9 (29.9-33.8)	31.9 (29.8-34.1)	33.1 (30.3-35.9)	33.9 (32.0-35.9)	0.06
Male ^d					
Hispanic	27.8 (27.1-28.5)	28.0 (27.0-28.9)	28.4 (27.6-29.2)	28.6 (27.5-29.6)	0.31
Non-Hispanic white	27.1 (26.5-27.7)	27.9 (27.0-28.9)	26.8 (26.1-27.6)	27.2 (26.5-27.9)	0.44
Non-Hispanic black	25.0 (24.5-25.5)	25.0 (24.2-25.8)	24.9 (23.8-26.1)	25.5 (24.3-26.6)	0.67
Non-Hispanic Asian	25.5 (24.7-26.4)	26.7 (25.9-27.5)	26.8 (26.2-27.4)	28.2 (27.7-28.7)	< 0.0001
Other	28.1 (25.8-30.4)	26.4 (24.2-28.6)	27.1 (23.8-30.4)	28.3 (26.1-30.6)	0.62
Female ^d					
Hispanic	40.3 (39.5-41.1)	40.0 (39.3-40.7)	40.2 (39.6-40.9)	40.0 (39.3-40.8)	0.82
Non-Hispanic white	38.3 (37.6-39.0)	38.5 (37.9-39.0)	38.3 (37.3-39.2)	38.0 (36.6-39.5)	0.65
Non-Hispanic black	39.7 (38.7-40.6)	39.7 (39.1-40.4)	38.9 (38.3-39.5)	39.2 (37.8-40.6)	0.32
Non-Hispanic Asian	36.2 (34.9-37.4)	36.5 (36.0-37.1)	36.4 (35.2-37.6)	37.1 (35.7-38.4)	0.32
Other	36.4 (34.2-38.6)	38.2 (36.5-39.9)	38.4 (36.2-40.5)	39.9 (38.0-41.8)	0.01

^a percent body fat was available among adults aged 20-59 years.

^b *P* for trend adjusted for age, sex, and race/ethnicity.

^c *P* for trend adjusted for age and sex.

^d *P* for trend adjusted for age.

Table 4. Trends in Age-Adjusted Lean Mass by Race/Ethnicity: United State, 2011-2018 (N=10,864)^a

Variables	Mean of age-adjusted lean mass, kg, mean (95%CI)				<i>P</i> for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^b	52.7 (52.0-53.4)	52.6 (51.7-53.6)	52.8 (51.9-53.6)	52.1 (51.3-52.9)	0.98
All participants ^c					
Hispanic	50.9 (50.1-51.7)	51.8 (50.4-53.2)	51.6 (50.9-52.3)	51.4 (50.5-52.3)	0.27
Non-Hispanic white	53.1 (52.1-54.1)	53.1 (51.8-54.4)	53.3 (52.3-54.3)	52.4 (51.2-53.5)	0.66
Non-Hispanic black	56.1 (55.2-57.0)	55.3 (53.8-56.8)	56.2 (55.4-56.9)	55.2 (54.4-56.0)	0.04
Non-Hispanic Asian	44.6 (43.7-45.4)	43.9 (43.0-44.8)	44.7 (44.2-45.3)	45.5 (44.3-46.8)	0.01
Other	53.5 (49.1-58.0)	54.5 (50.3-58.7)	53.4 (48.5-58.2)	54.2 (52.2-56.1)	0.76
Male ^d					
Hispanic	58.8 (57.5-60.1)	59.9 (58.3-61.5)	58.9 (57.8-60.0)	60.3 (59.0-61.5)	0.26
Non-Hispanic white	61.6 (60.6-62.7)	61.7 (60.1-63.2)	62.0 (60.4-63.6)	61.2 (59.7-62.8)	0.83
Non-Hispanic black	63.2 (62.2-64.1)	62.8 (61.2-64.4)	63.9 (62.4-65.5)	62.7 (61.2-64.2)	0.81
Non-Hispanic Asian	52.2 (51.0-53.3)	52.2 (51.2-53.2)	52.3 (51.2-53.3)	54.8 (53.2-56.4)	0.01
Other	64.4 (59.3-69.4)	61.9 (57.2-66.5)	62.5 (57.9-67.1)	62.7 (58.3-67.0)	0.53
Female ^d					
Hispanic	41.9 (41.2-42.6)	43.1 (41.8-44.5)	43.4 (42.7-44.1)	42.1 (41.5-42.7)	0.65
Non-Hispanic white	44.0 (43.2-44.8)	44.2 (43.0-45.4)	45.3 (44.3-46.2)	44.4 (43.2-45.6)	0.28
Non-Hispanic black	49.5 (48.6-50.4)	48.2 (46.8-49.6)	48.5 (47.3-49.6)	47.1 (45.2-49.0)	0.03
Non-Hispanic Asian	36.2 (35.5-37.0)	35.8 (34.9-36.8)	36.5 (35.4-37.7)	36.6 (36.0-37.2)	0.23
Other	40.9 (37.9-43.9)	46.2 (42.4-49.9)	45.3 (43.5-47.0)	45.4 (43.9-46.9)	0.07

^a percent body fat was available among adults aged 20-59 years.^b *P* for trend adjusted for age, sex, and race/ethnicity.^c *P* for trend adjusted for age and sex.^d *P* for trend adjusted for age.

Table 5. Trends in Prevalence of Age-Adjusted Obesity by Race/Ethnicity: United State, 2011-2018

Variables	Age Adjusted Prevalence, % (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
General Obesity defined by BMI (N=21,093)					
Overall (Asian specific cut off points for Asians)	35.4 (32.5-38.3)	38.3 (36.4-40.2)	40.3 (37.0-42.7)	43.4 (39.8-47.0)	0.0003 ^a
Overall (cut off points for general population)	34.9 (32.0-37.8)	37.7 (35.8-39.7)	39.6 (36.0-43.1)	42.4 (38.6-46.3)	0.0007 ^a
All participants					
Hispanic	42.5 (39.0-46.0)	42.6 (38.1-47.0)	47.0 (42.5-51.5)	44.8 (51.4-48.1)	0.004 ^b
Non-Hispanic white	32.6 (28.9-36.4)	36.4 (34.0-38.8)	37.9 (34.0-41.8)	42.2 (36.8-47.6)	0.002 ^b
Non-Hispanic black	47.8 (44.4-51.3)	48.4 (44.1-52.7)	46.8 (41.9-51.7)	49.6 (46.5-52.8)	0.52 ^b
Non-Hispanic Asian ^d	20.8 (17.2-24.4)	23.5 (20.0-27.0)	25.5 (20.0-31.1)	34.2 (29.8-38.6)	< 0.0001 ^b
Other	35.2 (22.3-48.0)	38.0 (28.8-47.2)	51.9 (44.2-59.5)	46.3 (35.6-57.1)	0.098 ^b
Male					
Hispanic	40.1 (35.7-44.5)	37.9 (31.9-43.8)	43.1 (37.0-49.2)	45.7 (41.9-49.6)	0.04 ^c
Non-Hispanic white	32.4 (29.6-35.3)	34.7 (31.3-38.1)	37.9 (32.0-43.7)	44.7 (36.8-52.6)	0.002 ^c
Non-Hispanic black	37.1 (33.0-41.2)	38.0 (32.6-43.3)	36.9 (31.5-42.2)	41.1 (36.3-45.9)	0.26 ^c
Non-Hispanic Asian ^d	21.9 (17.3-26.5)	25.1 (18.8-31.4)	25.6 (20.4-30.9)	37.2 (30.4-43.9)	0.0004 ^c
Other	40.6 (19.0-62.3)	41.0 (24.8-57.1)	53.0 (40.4-65.7)	42.1 (29.4-54.9)	0.87 ^c
Female ^c					
Hispanic	44.4 (40.0-48.8)	46.9 (41.2-52.6)	50.6 (46.2-55.0)	43.7 (39.3-48.0)	0.78
Non-Hispanic white	32.8 (27.1-38.6)	38.2 (34.7-41.7)	38.0 (33.9-42.0)	39.8 (33.7-46.0)	0.09
Non-Hispanic black	56.6 (52.3-61.0)	57.2 (53.6-60.7)	54.8 (49.9-59.8)	56.9 (52.8-61.0)	0.91
Non-Hispanic Asian ^d	19.8 (15.2-24.3)	21.8 (16.9-26.7)	25.0 (18.1-32.0)	31.5 (26.4-36.7)	0.001

Other	28.7 (16.8-40.7)	36.1 (24.5-47.6)	50.0 (38.5-61.5)	54.3 (42.1-66.5)	0.002
Abdominal obesity defined by waist circumference (N=20,080)					
Overall ^a	54.5 (51.2-57.8)	56.3 (54.8-57.7)	58.4 (53.9-62.9)	59.1 (55.6-62.7)	0.02
All participants ^b					
Hispanic	57.8 (54.7-60.9)	60.4 (55.9-64.8)	62.4 (59.1-65.8)	60.6 (57.6-63.7)	0.24
Non-Hispanic white	54.4 (50.1-58.8)	56.2 (54.0-58.4)	59.5 (54.4-64.6)	59.9 (55.0-64.8)	0.052
Non-Hispanic black	60.8 (57.9-63.7)	62.1 (58.5-65.7)	59.0 (54.1-63.8)	62.3 (58.8-65.9)	0.75
Non-Hispanic Asian	24.7 (21.5-27.9)	25.8 (21.7-29.9)	26.8 (22.8-30.8)	31.9 (29.1-34.7)	0.001
Other	55.3 (40.9-69.8)	53.2 (41.8-64.5)	65.0 (55.3-74.7)	68.4 (60.1-76.7)	0.04
Male ^c					
Hispanic	43.9 (38.6-49.2)	45.8 (41.0-50.6)	47.5 (42.6-52.4)	49.5 (46.1-52.8)	0.20
Non-Hispanic white	45.2 (41.6-48.7)	48.2 (44.8-51.6)	51.2 (44.3-58.1)	54.0 (46.9-61.0)	0.02
Non-Hispanic black	41.2 (37.4-45.0)	40.5 (35.7-45.4)	40.3 (34.5-46.1)	44.0 (39.9-48.1)	0.36
Non-Hispanic Asian	14.0 (10.2-17.8)	13.6 (8.0-19.2)	15.6 (11.5-19.7)	21.3 (17.7-24.8)	0.01
Other	47.4 (26.9-67.9)	41.4 (24.0-58.8)	50.6 (39.8-61.4)	58.5 (43.8-73.2)	0.30
Female ^c					
Hispanic	71.1 (67.4-74.8)	74.7 (68.4-81.0)	77.2 (74.0-80.5)	71.8 (67.7-75.8)	0.73
Non-Hispanic white	63.9 (58.4-69.5)	64.2 (61.1-67.3)	67.7 (62.9-72.4)	65.8 (59.8-71.8)	0.41
Non-Hispanic black	77.2 (73.3-81.0)	81.1 (78.5-83.6)	74.8 (70.4-79.3)	78.0 (73.7-82.4)	0.68
Non-Hispanic Asian	33.9 (29.7-38.2)	36.0 (30.1-41.9)	36.7 (32.5-41.0)	41.0 (36.4-45.6)	0.03
Other	64.3 (53.8-74.7)	66.9 (55.6-78.3)	79.1 (69.9-88.4)	80.9 (74.2-87.7)	0.004

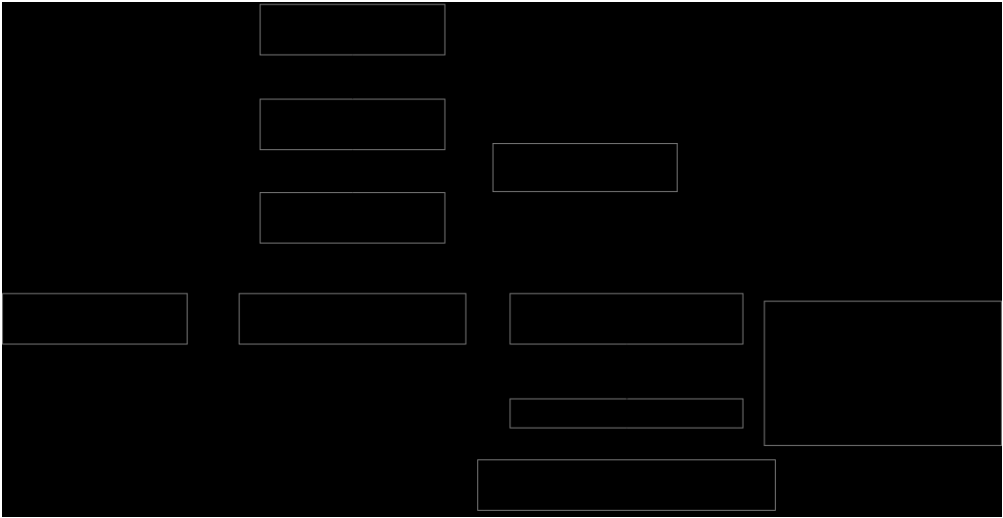
^a P for trend adjusted for age, sex, and race/ethnicity.

^b P for trend adjusted for age and sex.

^c P for trend adjusted for age.

^d obesity was defined using Asian specific cut-off point (BMI ≥ 27.5 kg/m²) for Asians

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Supplementary Online Content

Appendix Figure 1. Flow chart of participants

Appendix Table 1. Population Characteristics for Adults 20 Years or Older: NHANES, 2011-2018

Appendix Table 2. Unweighted Sample Sizes for Adults 20 Years and Older by Sex, Age Group, and Race/Ethnicity: NHANES 2017-2018

Appendix Table 3. Trends in Age-Adjusted Body Weight by Race/Ethnicity: United State, 2011-2018 (N=21,093)

Appendix Table 4. Trends in Age-Adjusted Standing Height by Race/Ethnicity: United State, 2011-2018 (N=21,093)

Appendix Table 5. Trends in Age-Adjusted Total Body Fat by Race/Ethnicity among Adults aged 20-59 years: United State, 2011-2018 (N=10,864)

Appendix Table 6. Trends in Age-Adjusted Adiposity Measures among Adults 20-59 years old: United State, 2011-2018

Appendix Table 7. Trends in Age-Adjusted Body Weight by Race/Ethnicity among Adults aged 20-59 years: United State, 2011-2018 (N=10,864)

Appendix Table 8. Trends in Age-Adjusted Standing Height by Race/Ethnicity among Adults aged 20-59 years: United State, 2011-2018 (N=10,864)

Appendix Table 9. Trends in Prevalence of Age-Adjusted General Obesity (BMI ≥ 30 kg/m²) among non-Hispanic Asians: United State, 2011-2018

Appendix Table 1. Population Characteristics for Adults 20 Years or Older: NHANES, 2011-2018

Variables	2011-2012		2013-2014		2015-2016		2017-2018	
	Unweighted No. of participants	Weighted percentage (95%CI)	Unweighted No. of participants	Weighted percentage (95%CI)	Unweighted No. of participants	Weighted percentage (95%CI)	Unweighted No. of participants	Weighted percentage (95%CI)
Overall	5181	/	5455	/	5337	/	5120	/
Age, years								
20-39	1808	35.8 (30.9-40.6)	1810	35.7 (33.6-37.9)	1780	35.5 (32.7-38.2)	1523	35.7 (33.1-38.3)
40-59	1727	38.4 (35.6-41.2)	1896	37.4 (35.6-39.2)	1785	36.4 (34.0-38.7)	1634	35.2 (32.5-37.9)
≥ 60	1646	25.9 (23.3-28.4)	1749	26.9 (25.0-28.8)	1772	28.2 (25.2-31.2)	1963	29.1 (25.9-32.4)
Sex								
Men	2585	48.6 (47.0-50.3)	2638	48.6 (47.4-49.9)	2583	48.5 (47.4-49.6)	2493	48.6 (46.9-50.4)
Women	2596	51.4 (49.7-53.0)	2817	51.4 (50.1-52.6)	2754	51.5 (50.4-52.6)	2627	51.4 (49.6-53.1)
Race/ethnicity								
Hispanic	1037	14.2 (9.3-19.2)	1214	14.7 (9.9-19.4)	1633	15.2 (10.0-20.5)	1153	15.6 (11.7-19.4)
Non-Hispanic white	1899	66.6 (58.9-74.3)	2343	66.0 (59.5-72.5)	1751	64.0 (56.3-71.7)	1764	62.5 (57.4-67.7)
Non-Hispanic black	1364	11.4 (6.9-15.8)	1115	11.3 (8.1-14.5)	1126	11.3 (7.0-15.6)	1204	11.3 (8.1-14.5)
Non-Hispanic Asian	733	5.2 (3.4-7.0)	623	5.3 (4.1-6.6)	637	5.8 (3.3-8.4)	739	5.8 (3.9-7.8)
Other	148	2.6 (1.8-3.4)	160	2.7 (1.8-3.6)	190	3.6 (2.9-4.4)	260	4.7 (3.5-5.9)
BMI								
General obese	1927	35.7 (33.0-38.4)	2129	38.5 (36.8-40.2)	2244	40.5 (37.5-43.5)	2266	56.5 (53.1-59.9)
Non obese	3254	64.3 (61.6-67.0)	3326	61.5 (59.8-63.2)	3093	59.5 (56.5-62.5)	2854	43.5 (40.1-46.9)
Waist circumference								

Abdominal obese	2609	55.0 (51.3-58.8)	2919	56.8 (55.6-58.1)	2940	58.9 (54.5-63.3)	2926	60.0 (56.8-63.2)
Non obese	2297	45.0 (41.2-48.7)	2277	43.2 (41.9-44.4)	2104	41.1 (36.7-45.5)	1958	40.0 (36.8-43.2)

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Appendix Table 2. Unweighted Sample Sizes for Adults 20 Years and Older by Sex, Age Group, and Race/Ethnicity: NHANES 2017-2018

	No. of Participants by Race/Ethnicity					
Age groups, year	Overall	Hispanic	Non-Hispanic white	Non-Hispanic black	Non-Hispanic Asian	Other race/ethnicity
All participants						
20-39	1523	382	478	340	235	88
40-59	1634	387	475	381	292	99
≥60	1963	384	811	483	212	73
Men						
20-39	729	190	226	158	109	46
40-59	770	169	234	173	137	57
≥60	994	190	419	245	98	42
Women						
20-39	794	192	252	182	126	42
40-59	864	218	241	208	155	42
≥60	969	194	392	238	114	31

Appendix Table 3. Trends in Age-Adjusted Body Weight by Race/Ethnicity: United State, 2011-2018 (N=21,093)

Variables	Mean of age-adjusted body weight, kg, mean (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^a	81.8 (80.7-82.9)	83.1 (82.1-84.1)	83.4 (81.8-85.1)	84.6 (82.8-86.3)	0.005
All participants ^b					
Hispanic	79.3 (78.1-80.5)	80.7 (78.8-82.7)	81.5 (80.0-83.1)	82.1 (80.9-83.3)	0.005
Non-Hispanic white	82.4 (80.9-83.9)	83.9 (82.4-85.4)	84.5 (82.6-86.5)	85.3 (82.9-87.8)	0.02
Non-Hispanic black	87.9 (86.0-89.7)	88.1 (86.4-89.8)	86.8 (84.9-88.6)	89.1 (87.4-90.7)	0.56
Non-Hispanic Asian	65.7 (64.4-67.0)	65.9 (64.6-67.1)	66.3 (65.6-67.0)	70.1 (69.2-70.9)	< 0.0001
Other	83.4 (77.8-89.3)	84.5 (79.0-90.0)	87.9 (84.3-91.5)	88.9 (84.0-93.9)	0.13
Male ^c					
Hispanic	85.0 (83.2-86.7)	86.0 (83.0-89.0)	86.4 (84.6-88.3)	88.6 (86.9-90.3)	0.02
Non-Hispanic white	89.2 (87.5-90.9)	90.8 (88.9-92.8)	91.7 (89.4-94.0)	93.0 (90.4-95.7)	0.009
Non-Hispanic black	90.0 (88.0-92.1)	90.4 (88.0-92.7)	89.6 (87.1-92.2)	91.9 (89.6-94.1)	0.31
Non-Hispanic Asian	72.2 (70.7-73.7)	73.4 (72.1-74.7)	73.1 (71.9-74.3)	78.8 (76.9-80.6)	< 0.0001
Other	93.3 (83.1-103.5)	89.8 (82.3-97.3)	94.1 (89.1-99.1)	95.7 (88.2-103.1)	0.57
Female ^c					
Hispanic	73.7 (72.4-74.9)	75.4 (73.4-77.5)	76.7 (75.1-78.2)	75.5 (73.7-77.3)	0.054
Non-Hispanic white	75.8 (74.1-77.6)	77.3 (75.6-79.0)	77.6 (75.5-79.6)	78.0 (74.9-81.2)	0.18
Non-Hispanic black	86.2 (84.0-88.3)	86.2 (84.4-88.1)	84.4 (82.1-86.7)	86.7 (84.4-89.0)	0.99
Non-Hispanic Asian	59.8 (58.2-61.4)	59.4 (57.7-61.1)	60.0 (59.0-61.1)	62.4 (61.3-63.6)	0.004
Other	73.3 (67.7-78.9)	78.6 (72.9-84.2)	81.2 (77.4-84.9)	81.4 (78.0-84.8)	0.009

^a P for trend adjusted for age, sex, and race/ethnicity.^b P for trend adjusted for age and sex.^c P for trend adjusted for age.

Appendix Table 4. Trends in Age-Adjusted Standing Height by Race/Ethnicity: United State, 2011-2018 (N=21,093)

Variables	Mean of age-adjusted body weight, cm, mean (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^a	168.8 (168.2-169.3)	168.6 (168.0-169.3)	168.4 (167.8-168.9)	168.1 (167.6-168.6)	0.06
All participants ^b					
Hispanic	163.5 (162.8-164.1)	164.2 (163.6-164.9)	163.0 (162.3-163.8)	164.3 (163.3-165.2)	0.79
Non-Hispanic white	170.3 (169.7-170.9)	170.0 (169.4-170.5)	170.2 (169.7-170.7)	169.3 (168.6-170.1)	0.08
Non-Hispanic black	168.9 (168.4-169.4)	169.1 (168.0-170.1)	168.4 (167.7-169.1)	168.8 (168.1-169.5)	0.39
Non-Hispanic Asian	163.3 (162.7-163.8)	162.7 (161.4-163.9)	162.6 (161.7-163.4)	163.0 (162.0-164.0)	0.76
Other	168.3 (166.4-170.2)	169.8 (166.9-172.7)	169.4 (167.6-171.1)	170.2 (168.1-172.4)	0.19
Male ^c					
Hispanic	170.4 (169.7-171.2)	171.1 (170.2-171.9)	169.5 (168.5-170.5)	170.7 (169.8-171.7)	0.60
Non-Hispanic white	177.3 (176.5-178.0)	177.2 (176.4-178.1)	177.4 (176.7-178.0)	176.5 (175.8-177.3)	0.20
Non-Hispanic black	176.0 (175.3-176.8)	176.5 (175.6-177.4)	175.5 (174.9-176.1)	176.4 (175.6-177.3)	0.99
Non-Hispanic Asian	170.1 (169.6-170.5)	169.9 (168.5-171.3)	169.7 (168.9-170.5)	170.8 (170.0-171.5)	0.18
Other	175.3 (173.5-177.1)	176.6 (174.3-178.9)	176.6 (174.4-178.8)	177.5 (175.0-180.0)	0.18
Female ^c					
Hispanic	156.7 (156.1-157.4)	157.5 (156.9-158.2)	156.7 (156.0-157.3)	157.7 (157.0-158.5)	0.23
Non-Hispanic white	163.6 (162.8-164.5)	163.0 (162.5-163.6)	163.3 (162.7-163.9)	162.5 (161.8-163.2)	0.06
Non-Hispanic black	163.1 (162.3-163.8)	162.7 (161.9-163.6)	162.6 (161.9-163.3)	162.4 (161.9-162.9)	0.14
Non-Hispanic Asian	157.2 (156.5-157.9)	156.5 (155.4-157.7)	156.2 (155.2-157.2)	156.4 (155.5-157.2)	0.13
Other	161.0 (159.2-162.9)	162.3 (160.0-164.5)	162.1 (160.5-163.7)	161.4 (159.9-163.0)	0.99

^a P for trend adjusted for age, sex, and race/ethnicity.

^b P for trend adjusted for age and sex.

^c P for trend adjusted for age.

Appendix Table 5. Trends in Age-Adjusted Total Body Fat by Race/Ethnicity among Adults aged 20-59 years: United State, 2011-2018 (N=10,864)^a

Variables	Mean of age-adjusted total body fat, kg, mean (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^b	27.3 (26.5-28.1)	28.0 (27.1-28.8)	27.9 (26.9-28.8)	27.7 (26.5-28.9)	0.70
All participants ^c					
Hispanic	27.4 (26.3-28.6)	28.2 (26.5-29.8)	28.5 (27.5-29.5)	28.2 (26.8-29.5)	0.38
Non-Hispanic white	27.3 (26.3-28.2)	28.3 (27.0-29.6)	28.1 (26.9-29.3)	27.7 (26.2-29.3)	0.87
Non-Hispanic black	29.8 (28.8-30.9)	29.2 (28.0-30.4)	28.9 (27.4-30.4)	28.8 (27.0-30.5)	0.34
Non-Hispanic Asian	20.7 (19.7-21.7)	21.3 (20.8-21.8)	21.5 (20.8-22.2)	23.2 (22.6-23.7)	< 0.0001
Other	26.7 (22.9-30.5)	27.4 (23.6-31.3)	28.4 (25.1-31.7)	29.9 (27.2-32.6)	0.14
Male ^d					
Hispanic	24.6 (23.3-25.9)	25.2 (23.3-27.2)	25.4 (24.1-26.7)	25.8 (24.1-27.6)	0.34
Non-Hispanic white	24.9 (23.7-26.0)	26.1 (24.4-27.9)	24.9 (23.5-26.3)	25.0 (23.8-26.3)	0.75
Non-Hispanic black	23.6 (22.7-24.5)	23.3 (22.0-24.6)	23.7 (21.8-25.6)	24.3 (22.6-26.0)	0.58
Non-Hispanic Asian	19.2 (18.2-20.2)	20.3 (19.4-21.3)	20.4 (19.8-21.1)	23.0 (22.0-23.9)	< 0.0001
Other	27.6 (22.8-32.4)	24.2 (20.1-28.2)	25.7 (20.6-30.9)	26.8 (22.8-30.8)	0.98
Female ^d					
Hispanic	30.6 (29.4-31.8)	31.3 (29.6-33.0)	31.9 (31.0-32.9)	30.7 (29.4-31.9)	0.70
Non-Hispanic white	29.9 (28.8-31.0)	30.6 (29.2-33.0)	31.0 (29.4-32.6)	30.2 (27.6-32.8)	0.67
Non-Hispanic black	35.7 (34.2-37.2)	34.9 (33.2-36.6)	33.9 (32.8-35.1)	33.7 (31.2-36.2)	0.10
Non-Hispanic Asian	22.3 (20.9-23.8)	22.3 (21.6-23.1)	22.7 (21.4-23.9)	23.4 (22.2-24.6)	0.18
Other	25.7 (22.5-29.0)	31.1 (27.0-35.2)	30.6 (27.5-33.7)	33.2 (29.8-36.5)	0.005

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^a percent body fat was available among adults aged 20-59 years.
^b P for trend adjusted for age, sex, and race/ethnicity.
^c P for trend adjusted for age and sex.
^d P for trend adjusted for age.

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Appendix Table 6. Trends in Age-Adjusted Adiposity Measures among Adults 20-59 years old: United State, 2011-2018

Variables	2011-2012	2013-2014	2015-2016	2017-2018	P for trend ^a
BMI, kg/m ² , mean (95%CI)	28.7 (28.2-29.1)	29.1 (28.6-29.7)	29.3 (28.6-30.0)	29.9 (29.2-30.5)	0.002
Hispanic	29.6 (29.1-30.1)	29.9 (29.2-30.6)	30.6 (30.0-31.3)	30.4 (29.7-31.0)	0.02
Non-Hispanic white	28.3 (27.7-28.9)	28.9 (28.2-29.6)	29.0 (28.2-29.7)	29.6 (28.7-30.6)	0.02
Non-Hispanic black	30.9 (30.3-31.5)	31.0 (30.3-31.7)	30.8 (29.9-31.6)	31.5 (30.8-32.3)	0.25
Non-Hispanic Asian	24.5 (24.0-25.0)	24.8 (24.5-25.1)	25.0 (24.7-25.4)	26.3 (26.0-26.7)	< 0.0001
Other	29.0 (26.8-31.3)	29.9 (28.4-31.5)	30.7 (29.1-32.2)	31.0 (29.5-32.5)	0.10
Waist circumference, cm, mean (95%CI)	97.4 (96.3-98.5)	98.3 (97.2-99.5)	98.9 (97.2-100.6)	99.5 (97.7-101.3)	0.006
Hispanic	98.4 (96.8-99.9)	99.3 (97.2-101.5)	100.4 (99.2-101.7)	100.2 (98.6-101.7)	0.04
Non-Hispanic white	97.5 (96.1-99.0)	98.5 (96.9-100.2)	99.1 (97.1-101.0)	99.7 (97.3-102.2)	0.03
Non-Hispanic black	100.1 (98.8-101.5)	99.8 (98.2-101.5)	100.1 (97.6-102.6)	100.9 (99.1-102.6)	0.50
Non-Hispanic Asian	86.5 (85.1-87.9)	87.6 (86.9-88.4)	88.1 (87.0-89.2)	90.0 (89.1-90.9)	< 0.0001
Other	97.3 (91.5-103.0)	99.3 (94.3-104.4)	101.8 (98.2-105.4)	102.9 (99.3-106.4)	0.21
Obesity, % (95%CI)	35.3 (32.3-38.2)	38.1 (35.3-40.8)	39.9 (35.7-44.1)	43.3 (39.8-47.0)	0.001
Hispanic	42.4 (38.6-46.2)	43.7 (39.2-48.2)	47.0 (42.3-51.7)	45.2 (40.7-49.6)	0.18
Non-Hispanic white	32.2 (28.2-36.3)	35.6 (32.1-39.1)	37.0 (31.9-42.1)	41.5 (35.9-47.0)	0.008
Non-Hispanic black	47.6 (43.6-51.7)	48.5 (43.8-53.2)	47.2 (41.4-53.1)	50.6 (47.1-54.2)	0.30
Non-Hispanic Asian	21.2 (16.9-25.5)	23.8 (20.5-27.2)	25.9 (19.7-32.2)	36.1 (31.5-40.7)	< 0.0001
Other	30.7 (18.2-43.1)	38.8 (26.8-50.8)	52.0 (40.1-63.9)	51.6 (38.4-64.8)	0.02
Abdominal obesity, % (95%CI)	50.5 (46.7-54.2)	52.0 (49.5-54.5)	59.4 (49.7-59.4)	55.1 (51.3-59.0)	0.007
Hispanic	55.7 (51.7-59.7)	58.0 (53.2-62.8)	58.4 (54.3-62.4)	56.7 (52.5-60.8)	0.67

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Non-Hispanic white	49.8 (44.8-54.9)	51.3 (47.7-54.9)	55.5 (49.8-61.1)	55.5 (49.9-61.2)	0.07
Non-Hispanic black	58.3 (55.0-61.6)	59.4 (54.6-64.2)	56.0 (50.0-62.1)	59.8 (55.9-63.6)	0.84
Non-Hispanic Asian	22.1 (18.4-25.8)	23.3 (19.7-26.8)	24.6 (19.8-29.4)	29.3 (26.7-31.9)	0.002
Other	49.3 (34.4-64.3)	50.4 (37.0-63.9)	62.0 (51.1-72.8)	65.3 (55.4-75.2)	0.03

^a P for trend adjusted for age, sex, and race/ethnicity.

Appendix Table 7. Trends in Age-Adjusted Body Weight by Race/Ethnicity among Adults aged 20-59 years: United State, 2011-2018 (N=10,864)^a

Variables	Mean of age-adjusted body weight, kg, mean (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^b	82.0 (80.8-83.2)	82.6 (81.0-84.2)	82.6 (81.0-84.3)	81.8 (79.8-83.7)	0.87
All participants ^c					
Hispanic	80.3 (78.8-81.7)	81.7 (79.1-84.4)	82.0 (81.7-83.3)	81.4 (79.4-83.4)	0.31
Non-Hispanic white	82.4 (80.7-84.1)	83.4 (80.9-85.8)	83.4 (81.4-85.5)	82.1 (79.6-84.6)	0.77
Non-Hispanic black	88.3 (85.6-90.0)	86.7 (84.4-88.9)	87.3 (85.5-89.0)	86.1 (84.0-88.3)	0.11
Non-Hispanic Asian	67.0 (65.3-68.8)	66.9 (65.7-68.0)	67.9 (66.8-68.9)	70.5 (69.0-72.0)	0.0001
Other	82.4 (74.2-90.5)	84.0 (76.3-91.6)	83.8 (76.9-90.8)	86.1 (82.2-90.0)	0.36
Male ^d					
Hispanic	85.4 (83.0-87.9)	87.0 (83.5-90.5)	86.3 (84.2-88.4)	88.1 (85.5-90.8)	0.25
Non-Hispanic white	88.7 (86.6-90.9)	89.9 (86.7-93.2)	89.1 (86.2-92.1)	88.5 (85.9-91.1)	0.78
Non-Hispanic black	89.1 (87.4-90.8)	88.3 (85.6-91.0)	90.0 (86.7-93.3)	89.3 (86.4-92.2)	0.84
Non-Hispanic Asian	73.2 (71.3-75.1)	74.4 (72.6-76.1)	74.5 (73.0-76.0)	79.8 (77.3-82.2)	0.0001
Other	94.5 (85.1-104)	88.3 (79.6-97.0)	90.4 (81.0-99.9)	91.7 (83.9-99.4)	0.68
Female ^d					
Hispanic	74.3 (72.5-76.1)	76.1 (73.1-79.1)	77.1 (75.7-78.5)	74.3 (72.6-76.0)	0.73
Non-Hispanic white	75.7 (73.9-77.5)	76.5 (74.0-79.0)	78.1 (75.8-80.5)	76.4 (72.7-80.1)	0.50
Non-Hispanic black	87.4 (85.3-89.6)	85.1 (82.1-88.1)	84.5 (82.5-86.6)	82.8 (78.6-87.1)	0.04
Non-Hispanic Asian	60.2 (58.3-62.2)	59.6 (58.0-61.3)	60.7 (58.6-62.8)	61.6 (60.2-62.9)	0.12
Other	68.3 (62.4-74.3)	79.1 (71.2-87.0)	77.8 (73.1-82.4)	80.5 (75.8-85.2)	0.01

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^a percent body fat was available among adults aged 20-59 years.
^b P for trend adjusted for age, sex, and race/ethnicity.
^c P for trend adjusted for age and sex.
^d P for trend adjusted for age.

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Appendix Table 8. Trends in Age-Adjusted Standing Height by Race/Ethnicity among Adults aged 20-59 years: United State, 2011-2018 (N=10,864)^a

Variables	Mean of age-adjusted body weight, kg, mean (95%CI)				P for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
Overall ^b	169.7 (169.1-170.3)	169.5 (168.7-170.2)	168.6 (168.0-169.2)	168.0 (167.4-168.7)	0.001
All participants ^c					
Hispanic	164.8 (164.0-165.6)	165.5 (164.8-166.2)	163.8 (163.1-164.6)	164.6 (163.9-165.3)	0.11
Non-Hispanic white	171.3 (170.6-171.9)	170.9 (170.3-171.6)	170.4 (169.9-170.9)	169.3 (168.5-170.1)	0.007
Non-Hispanic black	169.9 (169.1-170.7)	169.8 (168.4-171.1)	169.3 (168.4-170.2)	169.2 (168.3-170.1)	0.02
Non-Hispanic Asian	165.2 (164.8-165.7)	164.0 (162.5-165.4)	164.2 (163.6-164.8)	164.0 (163.0-164.9)	0.17
Other	168.8 (166.2-171.4)	170.4 (166.8-173.9)	168.5 (165.3-171.7)	169.9 (168.3-171.5)	0.47
Male ^d					
Hispanic	171.1 (169.9-172.3)	172.0 (171.2-172.8)	169.7 (168.8-170.6)	170.6 (169.6-171.6)	0.06
Non-Hispanic white	177.2 (176.6-177.7)	177.4 (176.5-178.4)	177.2 (176.4-178.0)	175.6 (174.7-176.5)	0.005
Non-Hispanic black	176.3 (175.2-177.4)	176.3 (175.1-177.5)	175.6 (174.8-176.3)	175.3 (174.2-176.5)	0.09
Non-Hispanic Asian	171.6 (170.8-172.5)	170.8 (169.3-172.4)	170.5 (169.6-171.4)	171.5 (170.3-172.6)	0.80
Other	175.5 (173.9-177.2)	176.8 (173.8-179.9)	176.2 (173.9-178.5)	176.4 (174.7-178.0)	0.68
Female ^d					
Hispanic	157.6 (156.7-158.5)	158.6 (157.6-159.5)	157.3 (156.4-158.3)	158.2 (157.4-159.0)	0.96
Non-Hispanic white	164.9 (163.9-165.9)	164.1 (163.5-164.8)	164.1 (163.5-164.7)	163.6 (162.8-164.5)	0.06
Non-Hispanic black	163.8 (162.9-164.8)	163.4 (162.3-164.6)	163.0 (162.2-163.9)	162.5 (161.5-163.6)	0.04
Non-Hispanic Asian	158.2 (157.3-159.1)	157.3 (155.9-158.7)	157.4 (156.1-158.8)	156.8 (155.9-157.7)	0.048
Other	160.9 (158.4-163.5)	163.0 (160.7-165.3)	161.9 (159.6-164.1)	162.8 (160.4-165.1)	0.63

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^a percent body fat was available among adults aged 20-59 years.
^b P for trend adjusted for age, sex, and race/ethnicity.
^c P for trend adjusted for age and sex.
^d P for trend adjusted for age.

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Appendix Table 9. Trends in Prevalence of Age-Adjusted General Obesity (BMI ≥ 30 kg/m²) among non-Hispanic Asians: United State, 2011-2018

Non-Hispanic Asians	Prevalence of age adjusted obesity defined by BMI, % (95% CI)				<i>P</i> for trend
	2011-2012	2013-2014	2015-2016	2017-2018	
All Asians	10.8 (7.8-13.8)	12.6 (9.8-15.4)	12.7 (10.2-15.1)	17.4 (14.7-20.2)	0.002 ^a
Male	10.0 (6.6-13.4)	12.6 (8.8-16.4)	10.1 (7.3-12.8)	17.5 (12.9-22.0)	0.02 ^b
Female	11.4 (6.8-16.1)	12.4 (7.9-16.8)	14.8 (11.9-17.6)	17.2 (14.3-20.0)	0.03 ^b

^a *P* for trend adjusted for age and sex.

^b *P* for trend adjusted for age.