Body mass index (BMI, kg/m^2): A public health perspective

Cynthia L. Ogden, PhD, MRP

NHANES Analysis Branch Chief

NASEM Roundtable on Obesity Solutions

April 4, 2023

Cynthia Ogden

- No conflicts of interest

Strengths and limitations of BMI

- Simple
- Inexpensive
- At high levels correlated with fat
- Trends and distributions over time

- Not a direct measure of body fat
- Does not capture fat distribution
- Does not distinguish between fat and lean mass
- Associations vary by ethnic group:
  - BMI & adiposity
  - BMI & diabetes

CUT POINTS AND LABELS

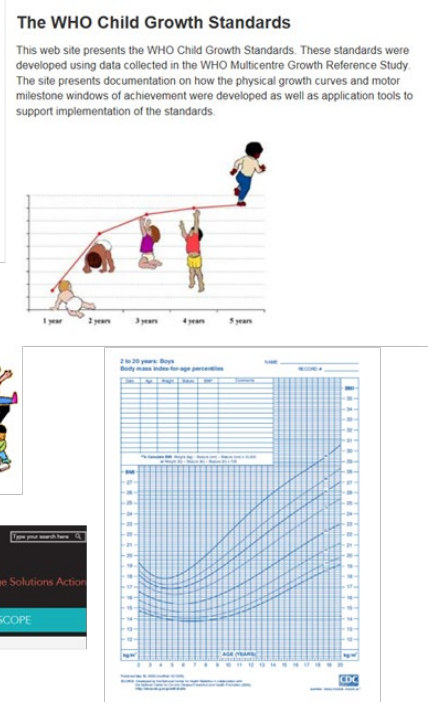
Adult obesity cut points vary

- WHO, BMI ≥ 30 (severe obesity ≥ 40)
- China, BMI ≥ 28

1. Obesity and overweight (who.int)
2. Chen et al. Criteria of Weight for Adults. National Health Commission of the People's Republic of China. Beijing, China 2013. p. 1-4.

Variations in definitions among youth

- BMI varies by age and sex
- Statistical definition based on a reference population
  - sex specific BMI-for-age
- Many different reference populations
  - Country-specific charts
  - WHO growth standards birth-5 y
  - WHO growth reference 5-18 y
  - IOTF cut offs and population 2-18 y
  - CDC growth charts 2-20 y

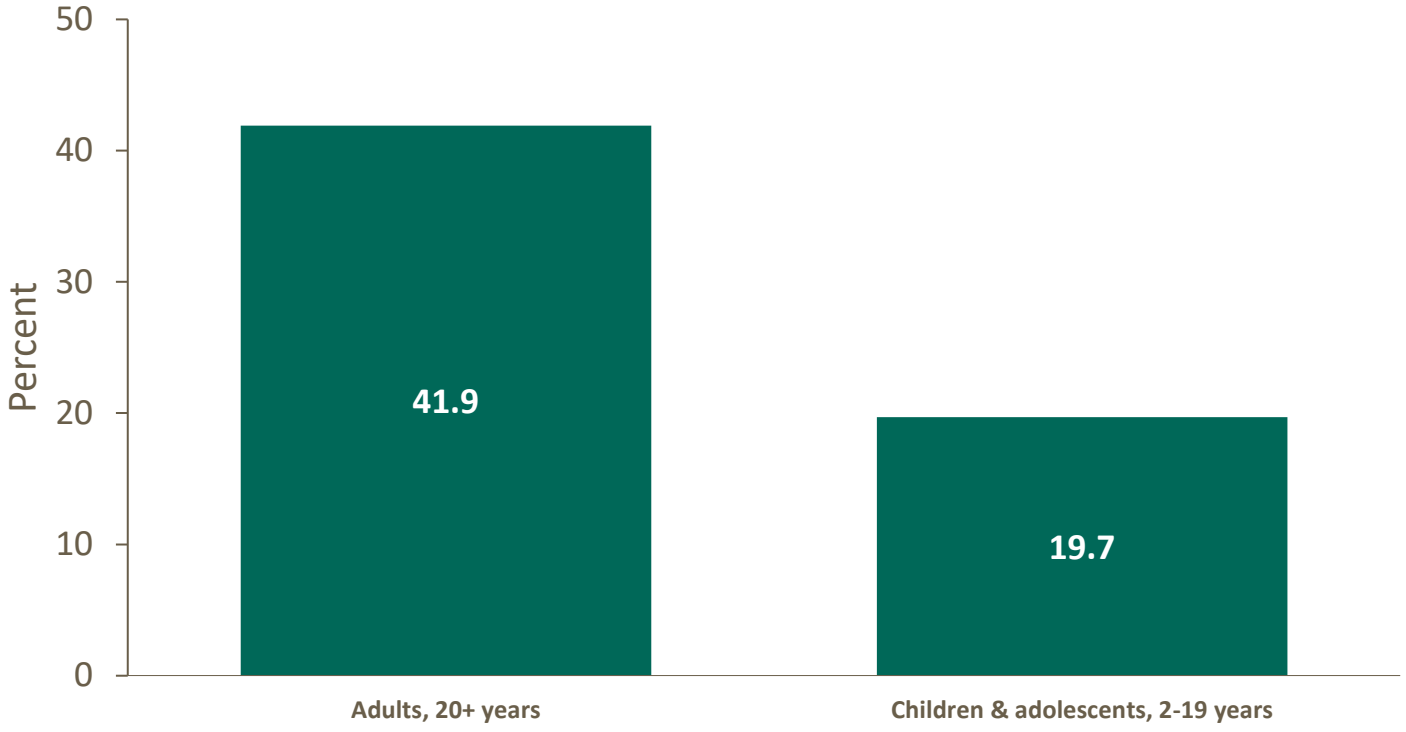


Cut-offs for obesity among children and adolescents

WHO	IOTF	CDC
>2 z-score (97.7th percentile)	Corresponds to BMI of 30 at 18 y	>=95th percentile (1.645 z-score)

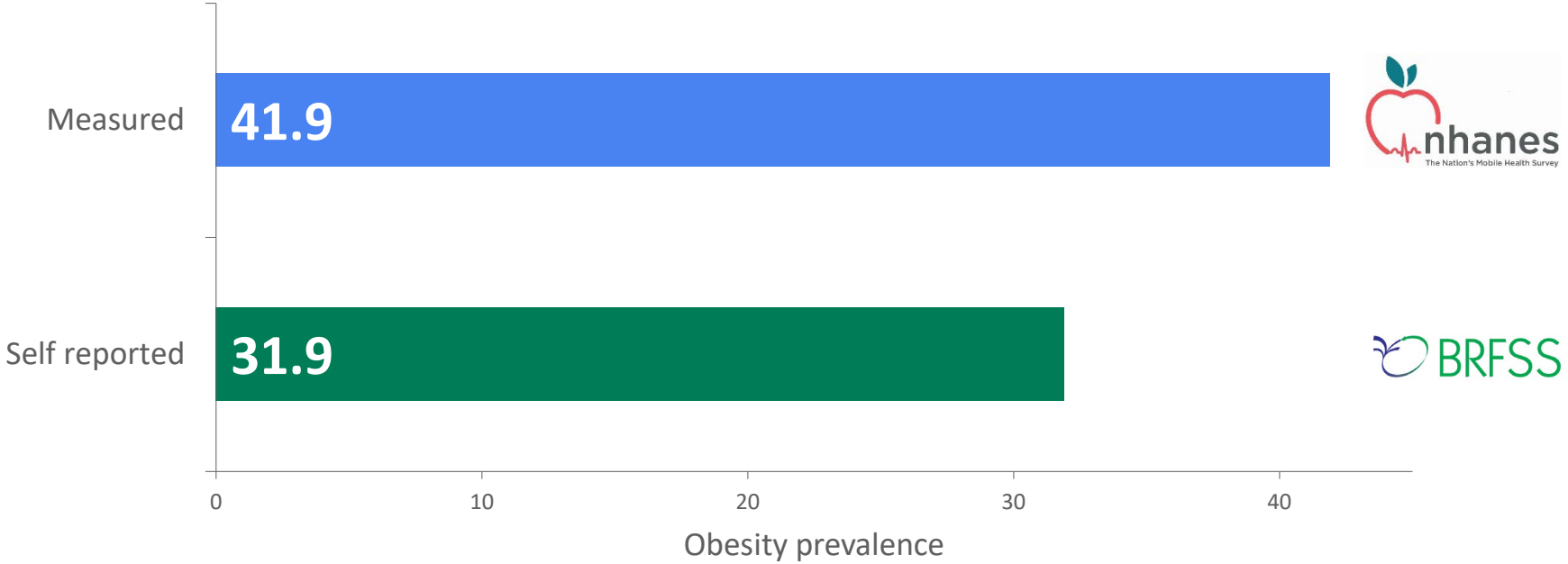
US National data

Over 2 in 5 adults and 1 in 5 youth have obesity



Source: NHANES 2017-March 2020; Stierman et al. NHSR 2021

Prevalence of adult obesity measured vs self-reported

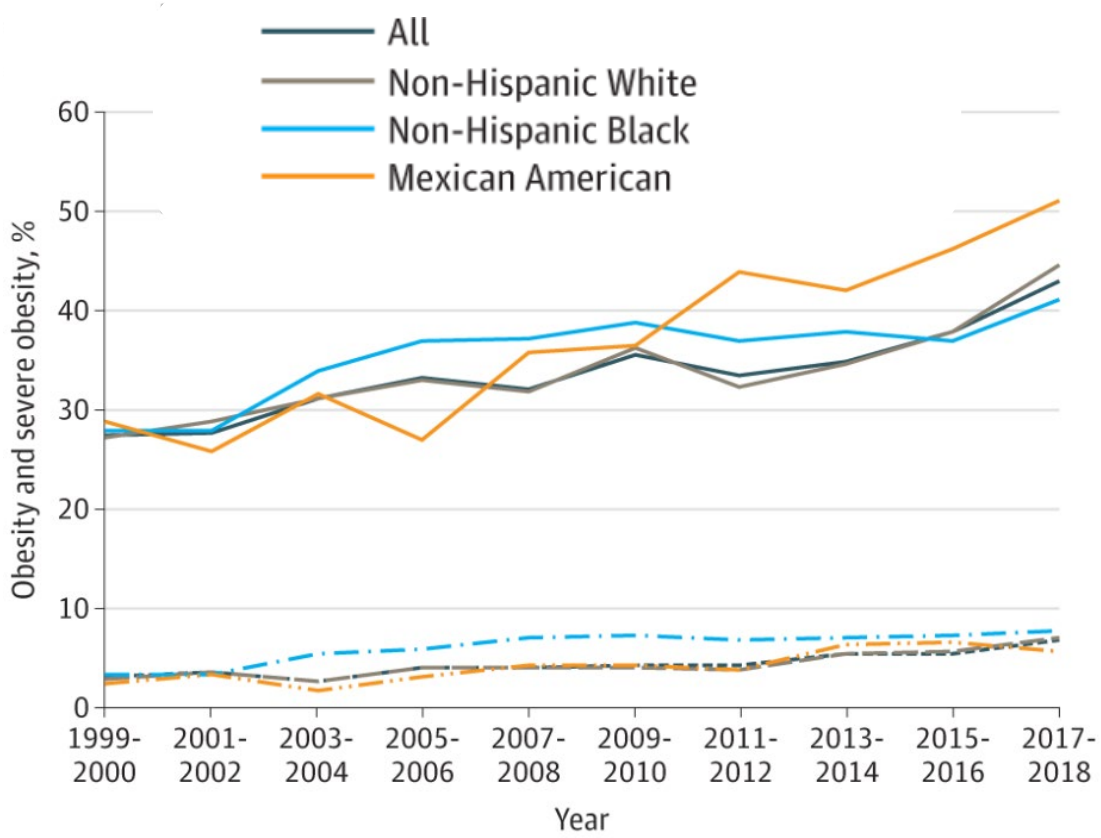


Self reported: BRFSS 2020, crude, BRFSS Prevalence & Trends Data: Explore by Topic | DPH | CDC

Measured: NHANES 2017-Mar 2020, age adjusted, Stierman et al 2021 National Health Statistics Reports, Number 158, June 14, 2021 (cdc.gov)

TRENDS

Trends show widening disparity: Largest increase in Mexican American men

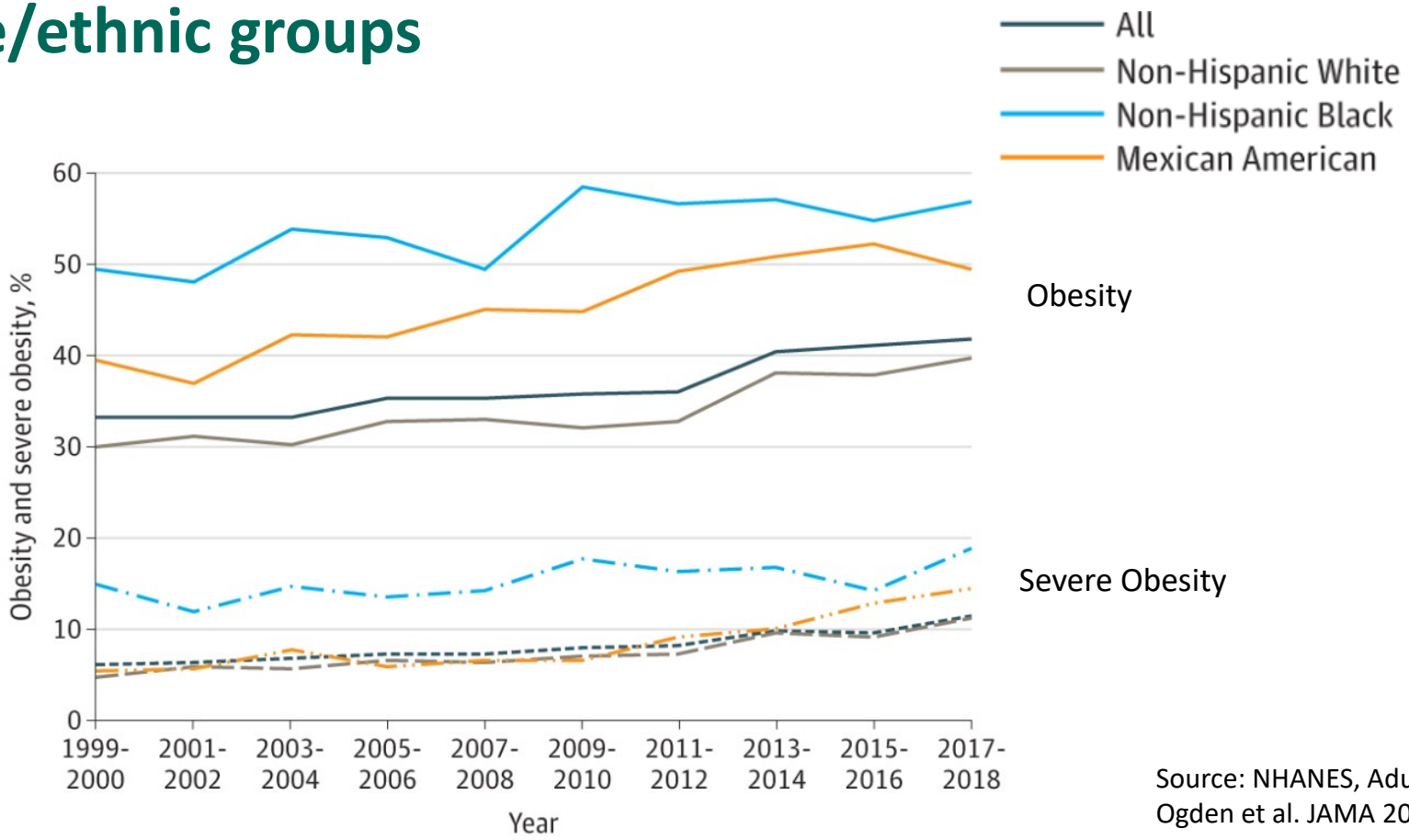


Obesity

Severe Obesity

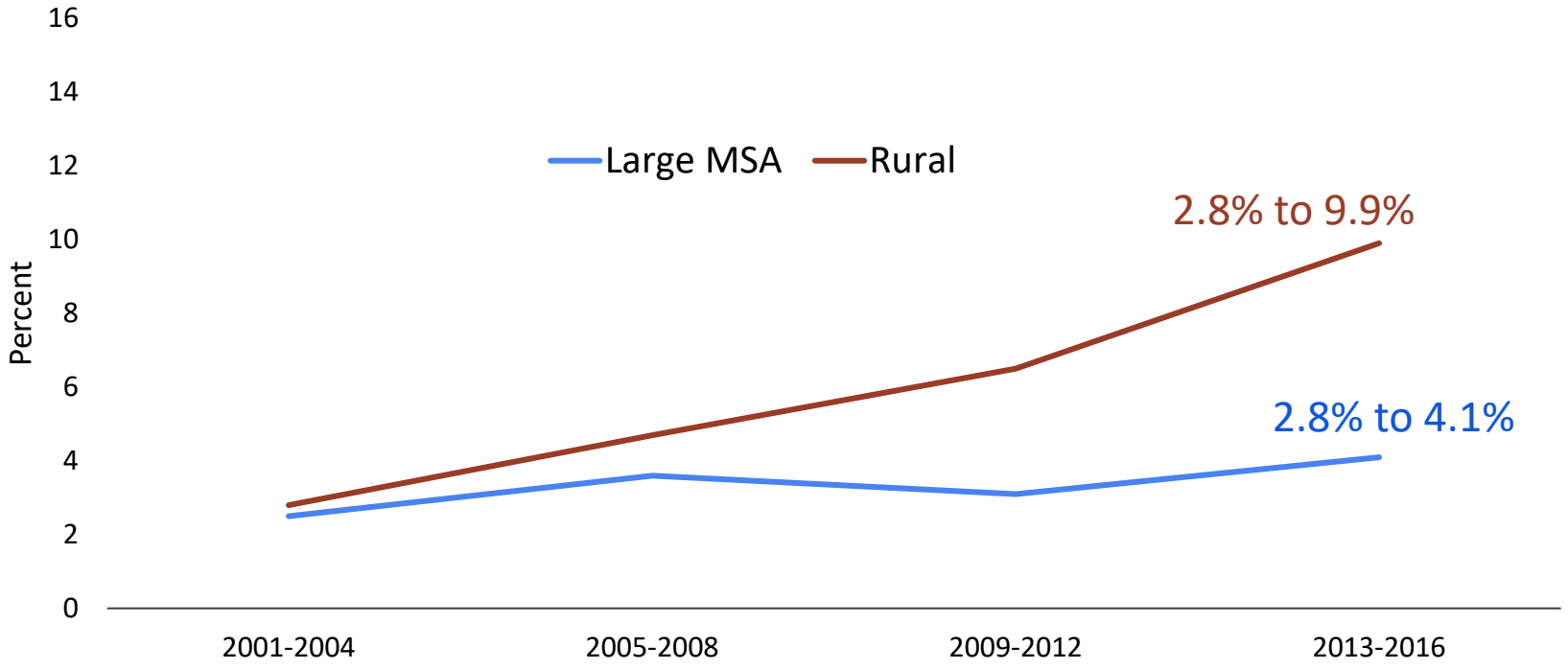
Source: NHANES, Adults; Ogden et al. JAMA 2020

Trends in women show increases in all race/ethnic groups



Source: NHANES, Adults
Ogden et al. JAMA 2020

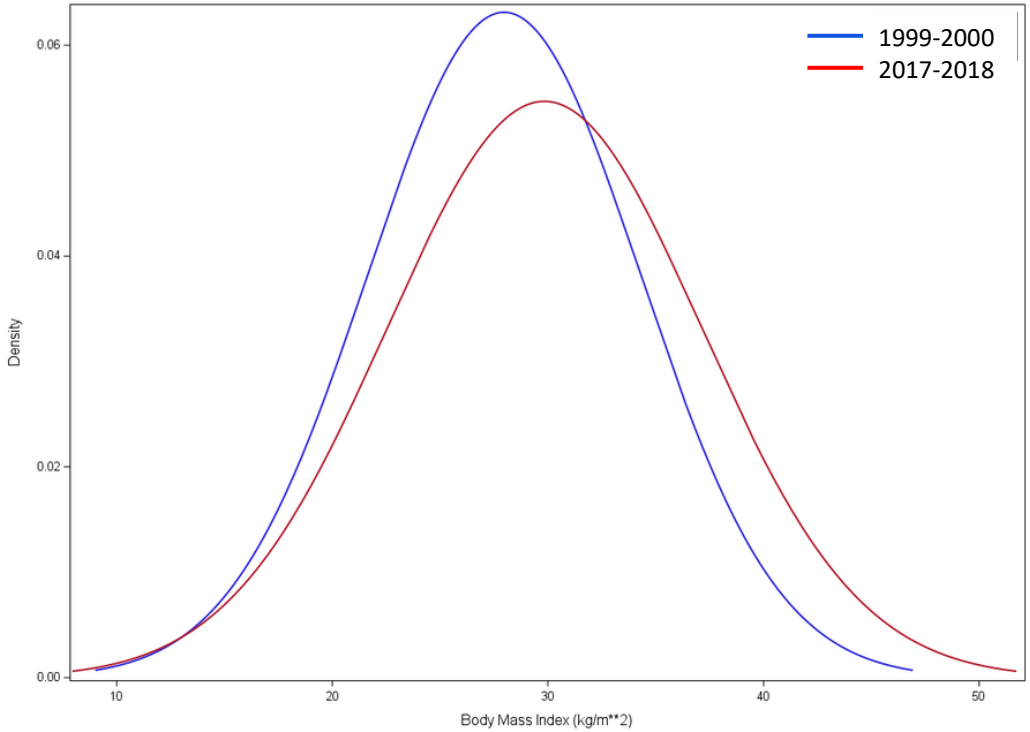
Trends show widening disparities between urban and rural areas in severe obesity in men



Source: NHANES 2013-2016, Hales et al JAMA 2018; Significant trends after adjustment for race/Hispanic origin

DISTRIBUTIONS

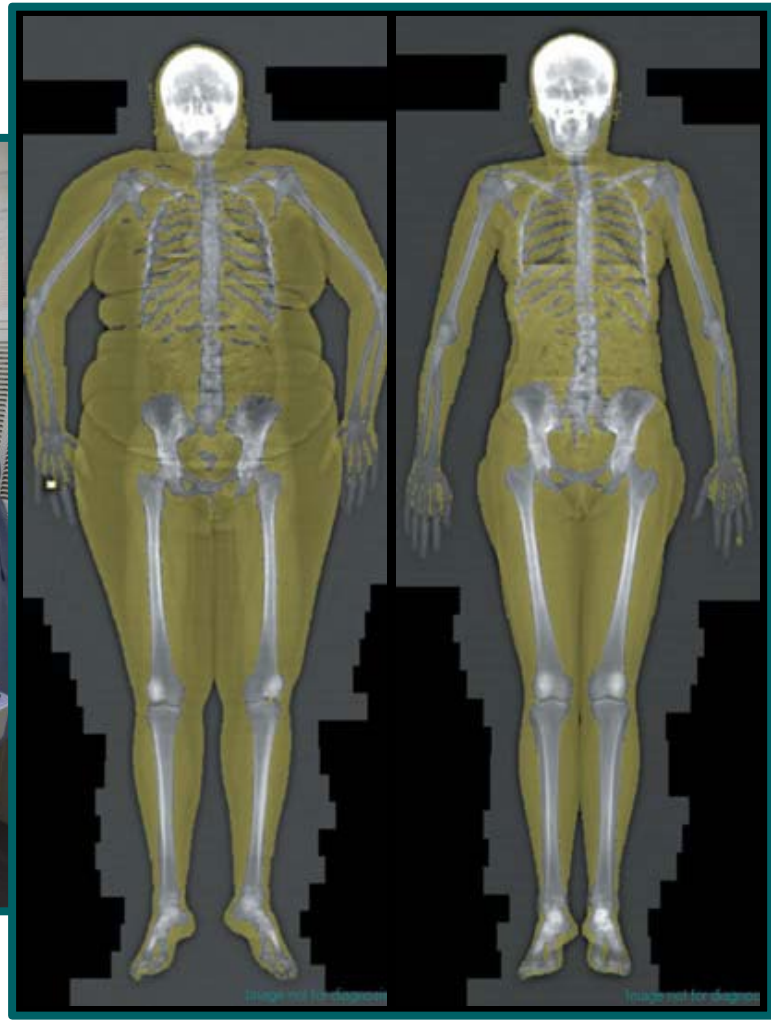
Adult BMI distributions show population change, 1999-2000 to 2017-2018



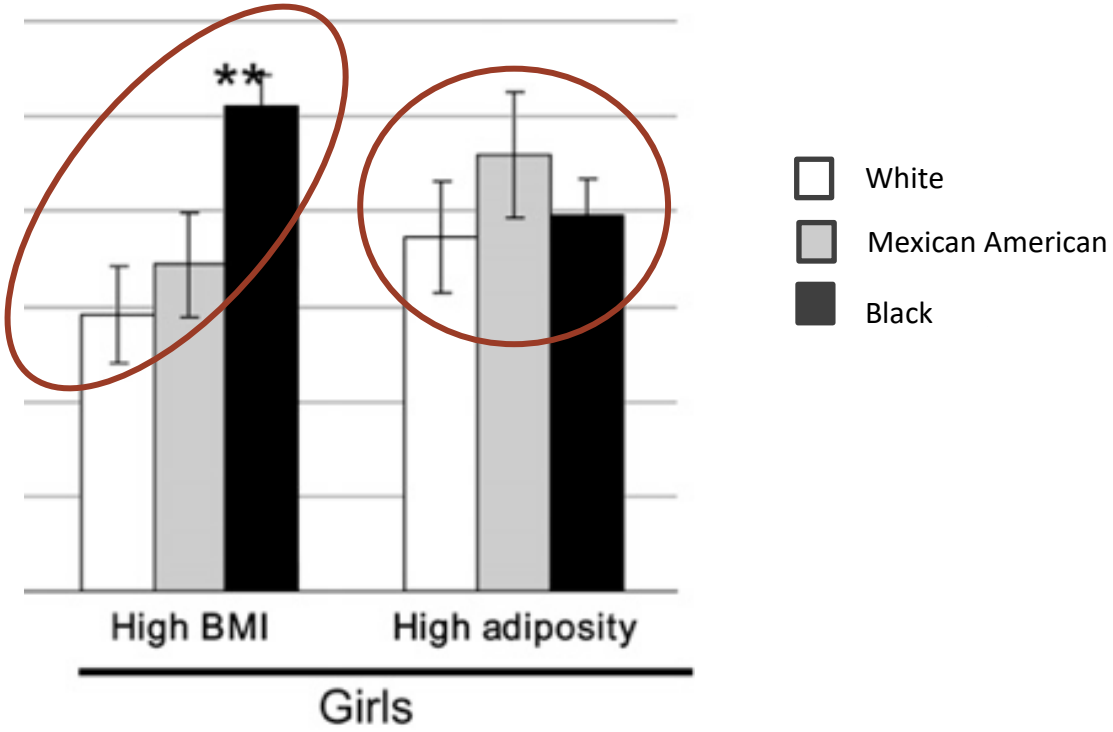
Source: NHANES 1999-2000, 2017-2018, adults 20+ years, T. Chen unpublished analyses

BMI AND ADIPOSITY


PLEASE DO NOT LEAN
ON THE C-ARM

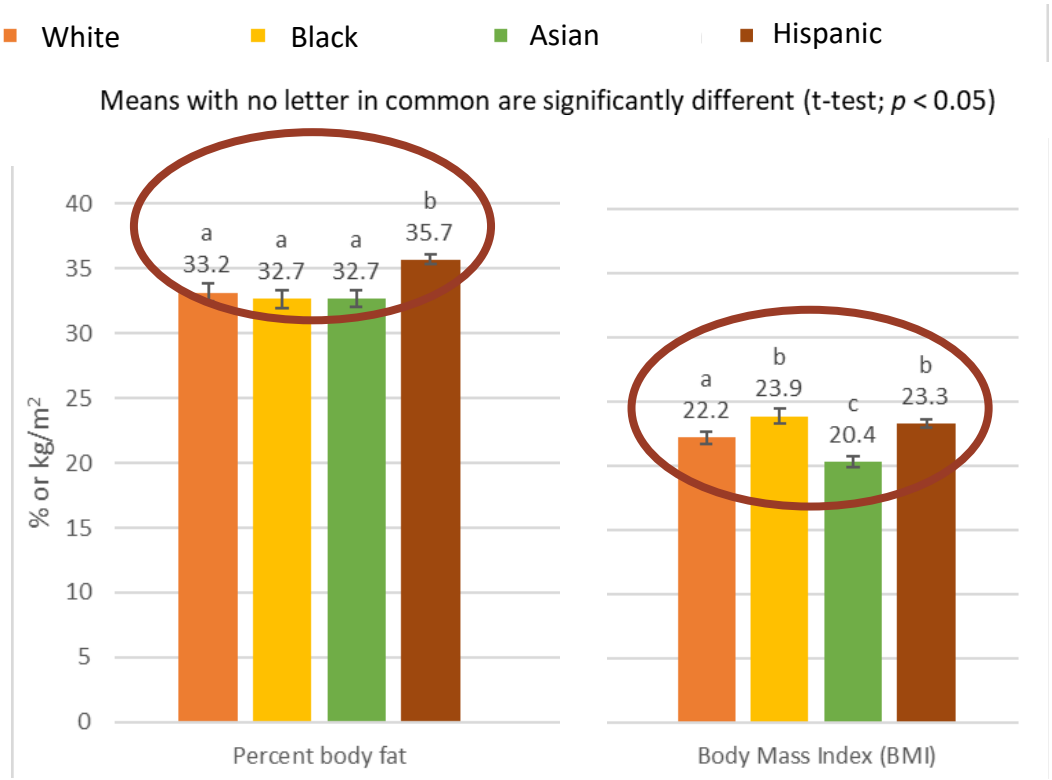


Adiposity disparities are mischaracterized by BMI



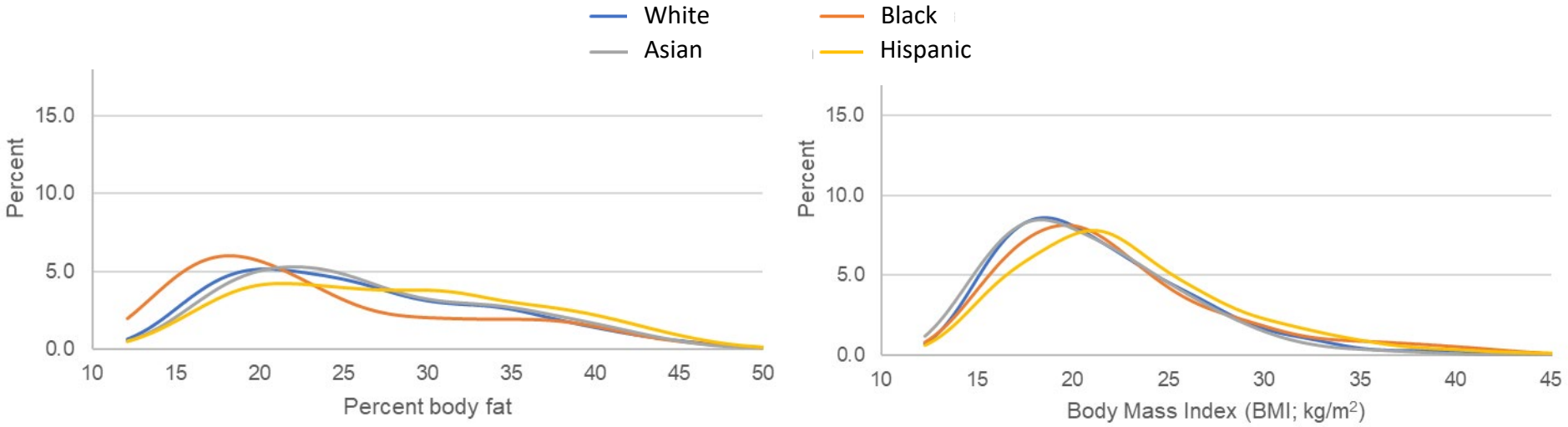
Source: CDC/NCHS, National Health and Nutrition Examination Surveys 1999-2004; girls 8-19 years, Flegal et al AJCN 2010

More recent (2011-18) data on females also show body fat and BMI differences not consistent



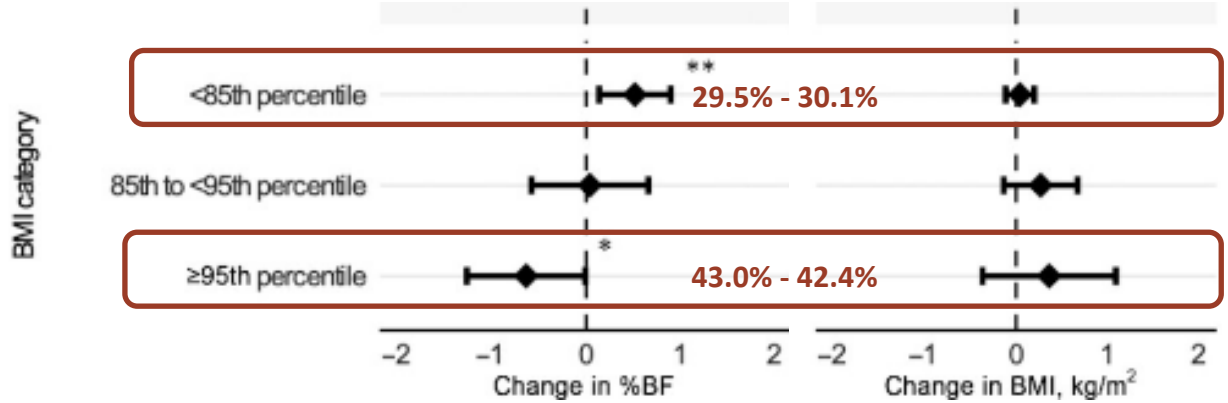
NHANES 2011-2018; **females 8-19 years**; data age-standardized; Martin et al. Pediatric Obesity, 2022

Race/ethnic differences in distributions of Body fat and BMI not always consistent



NHANES 2011-2018; **males 8-19 years**; data age-standardized; Martin et al. Pediatric Obesity, 2022

Between 1999-06 to 2011-18, changes in percent body fat were not always consistent with changes in BMI

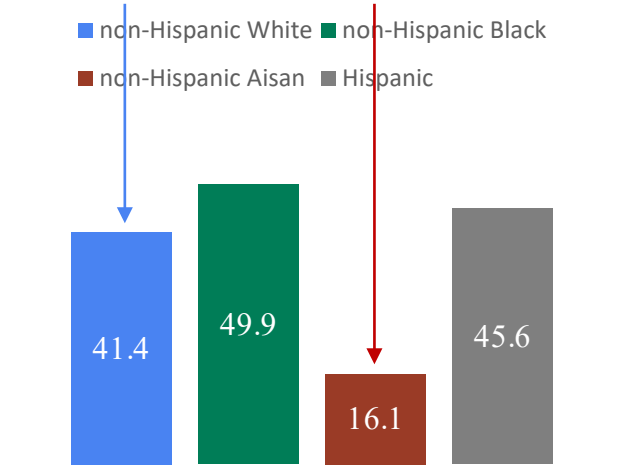


NHANES; **Females 8-19 years**; Data for 1999–2006 (2001–06 in females) are standardized to the sex-specific, race and Hispanic origin–specific, and 6-m age–specific distributions of 2011–18 to allow for comparison across time. Stierman et al. AJCN, 2021

BMI AND DIABETES

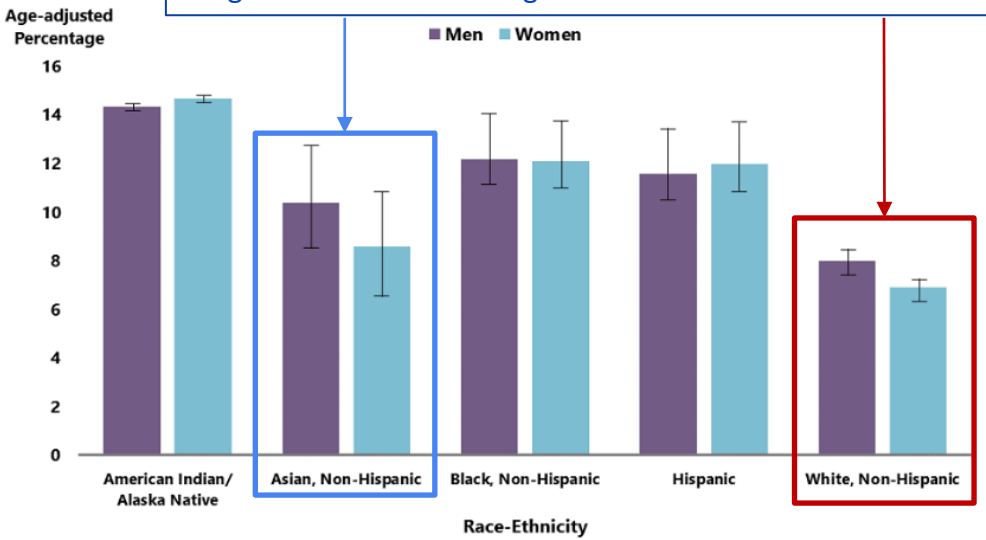
Disparities based on BMI may not translate to disparities in diagnosed diabetes

Obesity higher in White than Asian adults



National Health Statistics Reports, Number 158, June 14, 2021 (cdc.gov)

Diagnosed diabetes not higher in White than Asian adults



Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data sources: 2018–2019 National Health Interview Survey; 2019 Indian Health Service National Data Warehouse (for American Indian/Alaska Native group only).

Prevalence of Diagnosed Diabetes | Diabetes | CDC

BMI AND PUBLIC HEALTH: KEY POINTS

1. Various BMI cut points, reference populations (pediatrics)
2. BMI important especially for monitoring trends
3. Self-reported weight and height underestimate BMI
4. Relationship of BMI with body fat, diabetes varies by race/ethnicity

Cynthia L Ogden, PhD
cogden@cdc.gov

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.