Using the Big Cities Health Inventory to Examine Obesity and City Environment in Select U.S. Cities

Supplement File, Online

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DISCLAIMER

The Big Cities Health Inventory data platform is primarily funded by the U.S. Centers for Disease Control and Prevention through a cooperative agreement with the National Association of County and City Health Officials. The views expressed in the Brief and supplement files do not necessarily reflect the official policies or opinions of the funders or their partners. Additionally, mention of data sources does not imply endorsement by the institutions that sourced the data.

Obesity measurement

Adult obesity

Adult obesity was reported as received from the Centers for Disease Control and Prevention's (CDC) Population Level Analysis and Community Estimates (PLACES, see Supplement Table 1). The source data for these estimates is primarily the Behavioral Risk Factor Surveillance System (BRFSS). In the BRFSS, weight and height are self-reported by the respondent and used to derive body mass index (kg/m^2, BMI). Adult obesity is the percentage of the city population ≥18 years who had a BMI ≥ 30 kg/m^2. The CDC excludes respondents from the obesity measure who reported being pregnant, reported extreme height or weight (height <3ft, height ≥8 ft, weight <50 lbs, weight ≥650 lbs), or if height or weight were missing.

The BRFSS is designed to provide state-level estimates. In order to obtain stable city-level estimates, the CDC used a small-area-estimation modeling approach that incorporated into the estimation procedure individual-level attributes from the BRFSS survey respondent and city-level census socio-demographic data. CDC utilized the respondent's age, gender, and race during the estimation procedure; thus, did not provide adult obesity prevalence separately by those factors.

Teen obesity

Teen obesity was reported as received from the Youth Risk Behavior Surveillance System (YRBS see Supplement Table 1). In the YRBS, weight and height are self-reported and used to derive body mass index (kg/m^2, BMI). The YRBS defined teen obesity as BMI at or above the 95th percentile of children of the same age or gender.

Teen dataset

In our data platform, teen obesity is only available for cities that have data in the CDC's Youth Risk Behavior Surveillance System data portal (see Supplement Table 1 for the weblink to the data source). Nineteen of the BCHC member areas had data in the CDC's portal.

Alignment of BCHI metric data with data from other sources

Metric values in this report may be different from what the reader sees in other reports / websites. Differences are often due to differences in data sources and standardization methods. For example, some of the BCHC cities may locally collect obesity data and report obesity estimates by demographic subgroups (race, gender, etc.).

Obesity prevalence estimates generally are lower when body mass index is derived from self-reports vs. when body mass index is derived from measured weight and height. For example, CDC-NCHS National Health and Nutrition Examination Survey used measured weight and height and reported that the age-adjusted prevalence of adult obesity in the U.S. was approximately 42% in the period 2017-2018; whereas, the BRFSS used self-reports and estimated it to be approximately 31% in 2019.

Methods for combining metrics into city environment composite scores

Our data platform includes many metrics that are relevant risk factors for obesity. In order to enhance interpretability of data in the Brief, we decided to combine metrics according to two city environment domains and one behavioral domain.

- Natural and built environment
- Poverty and uninsured
- Physical inactivity and lower quality diet

We selected metrics *a priori* (see conceptual Figure 1 in the Brief) and took the following simple steps:

Step 1. In order to determine which variables should be retained, within each domain we examined simple bivariate correlation statistics and removed variables that were not moderately/highly correlated with each other (Spearman rank correlation <0.4).
Step 2. Within each domain, we standardized the directionality of each item so that a positive direction would correspond to an environment with higher risk for obesity. The following metrics were inverted: green space access, city park system, bikeability, walkability.
Step 3. In order to combine the items into a score per domain, we normalized each item by calculating a z-score for each item (difference between a city's value and the mean across cities / divided by the standard deviation).
Step 4. Within each domain, we summed the z-scores. For discussion of these methods, see references below.[1]

The composite metric for *natural and built environment* used these metrics from our data platform.

- Lower Green Space Access
- Lower City Park Score® (effective park system based on park acreage, investment, amenities, and access)
- Lower Walkability (amenities available by walking, as calculated by Walk Score®)
- Lower Bikeability
- Percent of residents that are low income and do not live close (within 0.5 miles) to a supermarket, supercenter, or large grocery store

The composite metric for *poverty and uninsured* used these metrics from our data platform.

- Percent of all ages uninsured
- Percent of people who are poor or "near poor" (<200% of the federal poverty level)

The composite metric for *teen physical inactivity and lower dietary quality* used these metrics from our data platform.

- Percent of high school students played video or computer games or used a computer three or more hours per day on an average school day[2]
- Percent of high school students watched television three or more hours per day on an average school day[2]
- Percent of high school students not physically active on at least 5 days[3]
- Percent of high school students not physically active (zero days of physical activity per week)[3]
- Percent of high school students drank soda one or more times per day in the past 7 days
- Percent of high school students did not eat breakfast in the past 7 days

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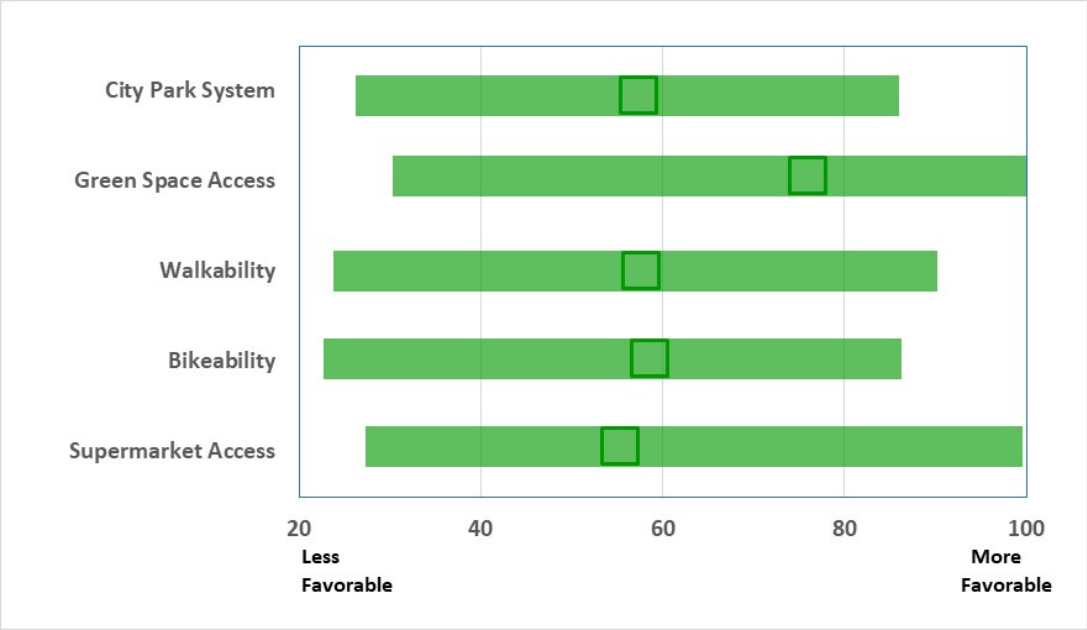
[1] References: 1) Evans, L.D., 1996. A two-score composite program for combining standard scores. Behavior Research Methods, Instruments, & Computers 28:209-13. URL: link.springer.com/content/pdf/10.3758/BF03204767.pdf 2) Tofallis, C., 2014. Add or Multiply? A Tutorial on Ranking and Choosing with Multiple Criteria. INFORMS Transactions on Education 13:109-19. URL: doi.org/10.1287/ited.2013.0124.

[2] Because video/computer time and television time had similar range/distribution, we first derived a "screen time" composite by calculating the mean value for video/computer time and television time. Subsequently, a z-score was created for screen time and added to the z scores for the remaining 4 metrics: two physical activity metrics, soda, and breakfast.

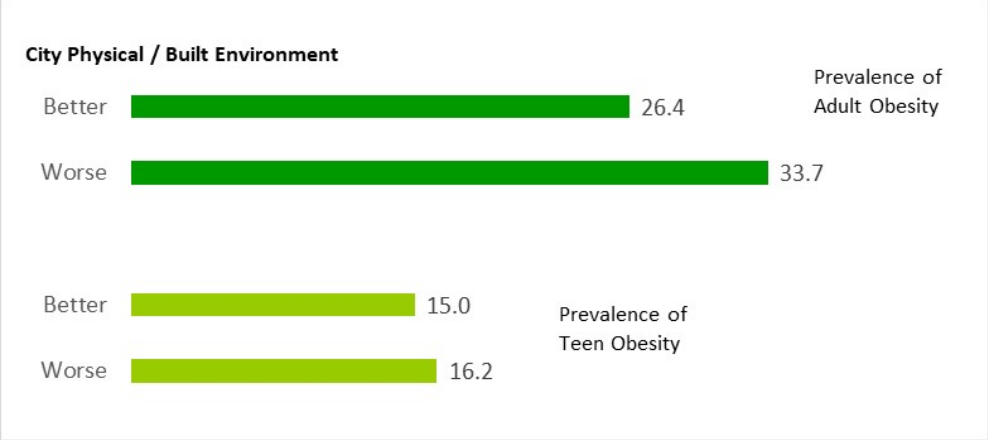
[3] Adolescent physical activity is defined by the CDC: ≥60 minutes moderate-to-vigorous intensity physical activity on a single day. CDC's guidelines state adolescents should have at least that amount each day.
URL: cdc.gov/physicalactivity/basics/children/index.htm Last accessed 12/20/2021

Supplemental Figures for City Natural and Built Environment

Supplement Figure 1. City natural and built environment, minimum to maximum across BCHC cities (mean is noted by middle box)

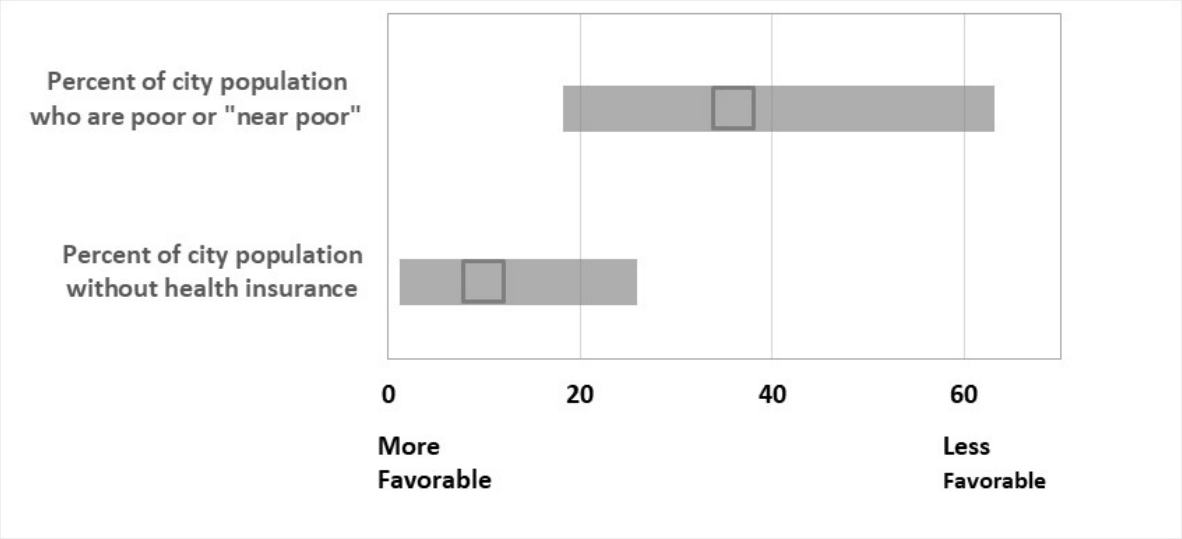


Supplement Figure 2. Prevalence of adult and teen obesity by city natural and built environment

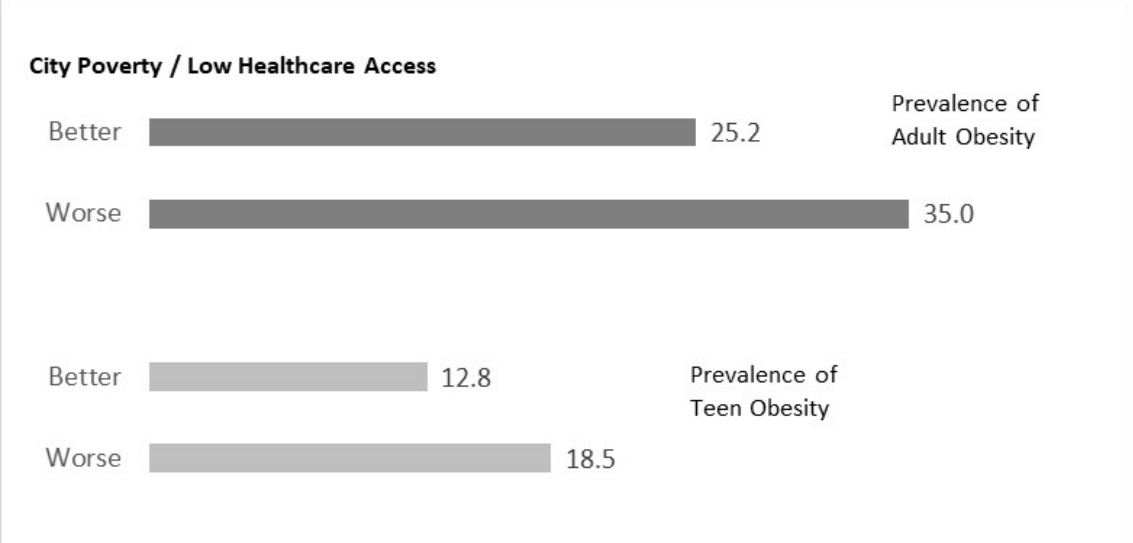


Supplemental Figures for City Poverty and Uninsured

Supplement Figure 3. City poverty and uninsured, minimum to maximum across BCHC cities (mean is noted by middle box)

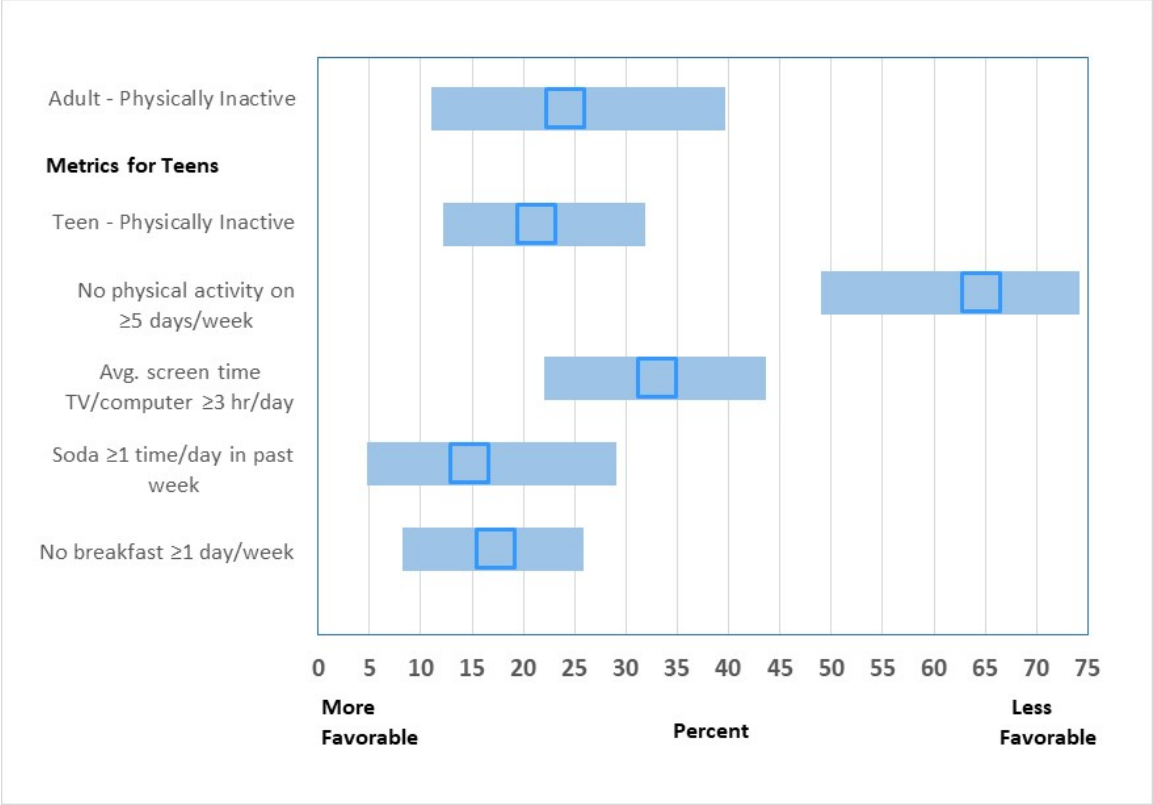


Supplement Figure 4. Prevalence of adult and teen obesity by city poverty (poor and "near poor") and uninsured

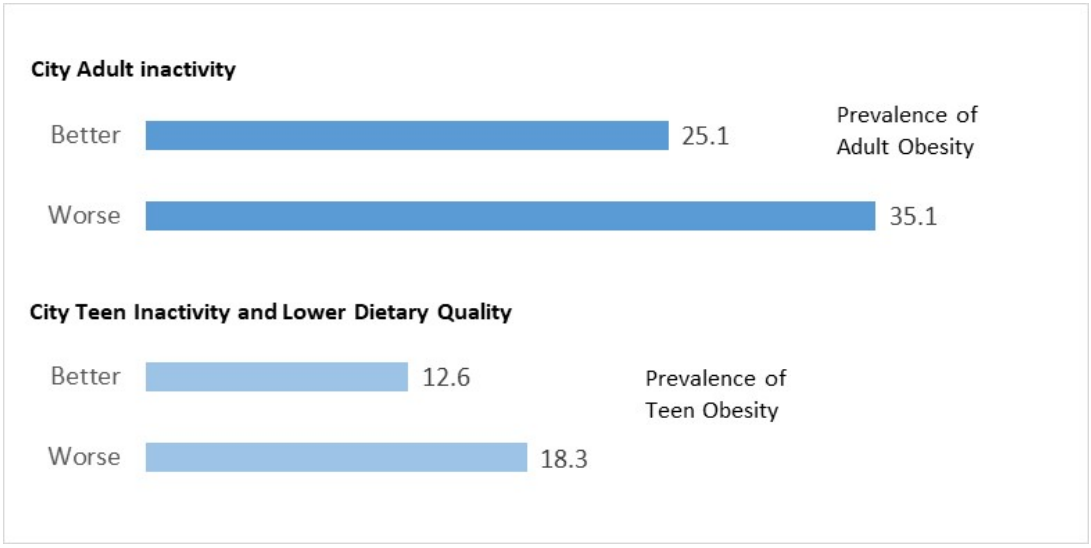


Supplemental Figures for City Physical Inactivity and Lower Quality Diet

Supplement Figure 5. City physical inactivity and lower quality diet, minimum to maximum across BCHC cities (mean is noted by middle box)



Supplement Figure 6. Prevalence of adult and teen obesity by city prevalence of physical inactivity and lower quality diet



Data platform metrics and source data

Supplement Table 1. Metrics included in the Brief: category, description, source of data, geography and year

Domain/ Broad Category	Sub-category	Metric	Metric Description	Data Source	Source file geography	Source data year
Chronic Health Conditions	Obesity	Adult Obesity	Percent of adults aged 18+ who are obese	Population Level Analysis and Community Estimates (PLACES), Centers for Disease Control and Prevention https://www.cdc.gov/places/index.html	County	2018
		Teen Obesity	Percent of high school students who are obese	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019
Physical and Built Environment	Park Access	City Park System	City has an effective park system, based on park acreage, investment, amenities, and access (scale from 0 - 100)	ParkScore®, The Trust for Public Land https://www.tpl.org/parkscore/about	City	2019
		Green Space Access	Percent of residents living within a 10-minute walk of green space	ParkScore®, The Trust for Public Land https://www.tpl.org/parkscore/about	City	2019
	Active Transportation	Walkability	Amenities available by walking as calculated by Walk Score® (scale from 0 - 100)	Walk Score®, Redfin Corporation www.walkscore.com	City	2020
		Bikeability	City is good for biking as calculated by Bike Score® (scale from 0 - 100)	Bike Score®, Redfin Corporation https://www.tpl.org/parkscore/about	City	2020
	Food Access	Limited Supermarket Access	Percent of residents that are low income and do not live close to a supermarket, supercenter, or large grocery store	Economic Research Service, U.S. Department of Agriculture https://www.ers.usda.gov/data-products/food-access-research-atlas/	County	2019
Chronic Health Conditions	Physical Activity	Adult Physical Inactivity	Percent of adults aged 18+ did not participate in any leisure-time physical activity	Population Level Analysis and Community Estimates (PLACES), Centers for Disease Control and Prevention https://www.cdc.gov/places/index.html	City	2018
		Teen Physical Activity Levels	Percent of high school students not physically active on at least 5 days during the past 7 days	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019
		Teen Physical Inactivity	Percent of high school students not physically active	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019
		Teen Computer Time	Percent of high school students played video or computer games or used a computer three or more hours per day on an average school day	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019
		Teen TV Time	Percent of high school students watched television three or more hours per day on an average school day	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019
	Dietary Quality	Teen Soda	Percent of high school students drank soda one or more times per day in the past 7 days	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019
		Teen Breakfast	Percent of high school students did not eat breakfast in the past 7 days	Youth Risk Behavior Surveillance System, Centers for Disease Control and Prevention https://chronicdata.cdc.gov/Youth-Risk-Behaviors/DASH-Youth-Risk-Behavior-Surveillance-System-YRBSS/svam-8dhg	City	2019

Domain/ Broad Category	Sub-category	Metric	Metric Description	Data Source	Source file geography	Source data year
Social and Economic Factors	Poverty	Poverty and Near Poverty in All Ages	Percent of people who are poor or "near poor" (<200% of the federal poverty level)	American Community Survey, U.S. Census Bureau https://www.census.gov/programs-surveys/acs	City	2015-2019
Access to Health Services	Insurance	Uninsured, All Ages	Percent of the population without health insurance	American Community Survey, U.S. Census Bureau https://www.census.gov/programs-surveys/acs	City	2015-2019