Office of Health Equity
Healthy Communities Data and Indicators Project

Short Title: Retail food environment.
Full Title: Modified retail food environment index.
Dashboard: An interactive **dashboard of the Modified Retail Food Environment Index** by County, Census Designated Place, and Census Tract can be found on **ArcGIS**.

1. **Healthy Community Framework.**
   Meets the basic needs of all.

2. **What is our aspirational goal?**
   Affordable, accessible, and nutritious foods.

3. **Key factors as they relate to health and mental health disparities and inequities (California Health and Safety Code Section 131019.5):**
   Food security and nutrition such as food stamp eligibility and enrollment, assessments of food access, and rates of access to unhealthy food and beverages.

4. **Why is this important to health?**

   a. **Description of significance and health connection.**

   An adequate, nutritious diet is a necessity for good health at all stages of life. Pregnant women and their developing babies, children, adolescents, adults, and older adults depend on adequate nutrition for optimum development and maintenance of good health (1). Inadequate diets in children can impair intellectual performance and have been linked to frequent school absences and poorer educational achievement (2). Nutrition also plays a significant role in contributing to or preventing illnesses including cardiovascular disease, cancer, obesity, type-2 diabetes, and anemia (3). Weight-associated illnesses are not restricted to adults as the prevalence of obesity has risen significantly in children with recent increases nationally from 17.7% (95% CI, 16.4%-19.0%) in a 2011-2012 study to 21.5% (95% CI, 20.3%-22.6%) in a 2017- 2020 study (4). Obesity among US children and youth is intimately linked with cardiometabolic comorbidities throughout life and remains a major public health concern (4).

   Lower-income families are less likely to have a nutritious diet than those with higher incomes (5). People's food choices and their likelihood of being overweight or obese are also influenced by their food environment: the foods available in their neighborhoods including in stores, restaurants, schools, and worksites (6, 7, 8,9). In California, adults living in environments with greater availability of fast-food restaurants and convenience stores relative to grocery stores and produce vendors near their homes—are more likely to be obese and to have diabetes than those who live in environments with lower proportions of

fast-food restaurants and convenience stores (6). These findings hold even after accounting for individual and community characteristics including income. There is a strong association between the consumption of calorie-dense foods and low nutritional value and being overweight or obese when one or more calorie-dense meals are consumed per week (10, 11). Common perceptions of available high-fat and high-sugar foods at most elementary and middle schools exist side by side with dietary specifications established by the US Department of Agriculture (USDA) for operators of the National School Lunch Program (NSLP) in the development of school meal menus (12). In the past several decades, the proportion of daily calories from fast food eaten away from home has risen with significant increases in fast food restaurants. From 1986 to 2016, the combined number of entrées, sides, and desserts for all fast food restaurants rose by 226% (13). Fast food portion sizes of entrées increased by 13 grams per decade and that of desserts by 24 grams per decade (13). The growth of these restaurants has moderated somewhat, decreasing to 0.9% per year during the COVID-inclusive years of 2018 to 2023 (14).

b. **Summary of evidence.**

Measures of the food environment include distance to food retailers, food cost, and density of food outlets (15). Related to the density of outlets are the concepts of food deserts and food swamps. The former refers to geographies with limited access to healthy food (16, 17), while the latter describes environments marked by the preponderance of high-calorie fast food outlets and junk food relative to healthier food options (17). Due to the lack of standardization of food environment metrics and differences among populations studied, it is difficult to generalize the evidence on the relationship between the food environment and health. Nevertheless, various cross-sectional and longitudinal studies show a positive association between the density of fast-food restaurants and convenience stores with obesity and overweight rates in communities and a negative association with fruit and vegetable intake (18). The strength of these relationships can vary by race and ethnicity (19).

5. **What is the indicator?**

a. **Detailed Definition.**

Modified retail food environment index (mRFEI) =
No. of healthy food retailers ÷ (No. of healthy + No. of less healthy food retailers) *100

The Centers for Disease Control (CDC) has details about the interpretation of mRFEI (20). A mRFEI score of zero generally corresponds with the concept of a food desert.

Healthy food retailers included supermarkets and larger grocery stores (North American Industry Classification System, NAICS code 445110), fruit and vegetable markets (NAICS 445230), and warehouse clubs (NAICS 452910). Less healthy food retailers included fast food restaurants (NAICS 722513), and convenience stores (NAICS 445120). The retailers in NAICS 445110 were identified as healthy if they had ten or more employees, or a sales volume higher than one million dollars (20). We used the sales volume criterion.

b. Data Description.

i. <u>Data sources</u>: ESRI Business Analyst database.
ii. Years available: 2022.
iii. Updated: Annual.
iv. Geographies available: census tracts, cities/towns, county subdivisions, counties, regions, and state.

ESRI's 2022 Business Analyst license and database were used. The database contains locational data for all businesses in California as well as demographic data at various levels of geography including, county, city, ZIP code, and census tract. A distinction needs to be made between the original retail food environment indicator (RFEI) and the modified RFEI (mRFEI). Developed by the California Center for Public Health Advocacy, RFEI is a ratio of the combined count of fast-food restaurants and convenience stores (numerator) to the total number of supermarkets and produce vendors (denominator) (6). The modified mRFEI methodology developed by the Centers for Disease Control puts healthy food outlets such as grocery stores in the numerator and all food outlets in the denominator (20). The number of food retailers within various geographies was obtained by intersecting in ArcGIS Pro the Business Analyst locational data on food outlets with shapefiles of counties, county subdivisions, cities or census-designated places (CDP), and census tracts. As the last step, counties were aggregated into regions,[1] and statewide values were calculated.

6. Limitations.

Travel distances to food retailers are not considered in this indicator. The approach used here to identify healthy and less healthy grocery stores has important limitations as small ethnic markets can be classified as less healthy due to their small number of employees or low sales volume. This methodology also leaves out meat and fish markets and other stores that might offer healthy foods. Additionally, the use of different data sources can potentially yield different results. For instance, the number of healthy retailers extracted from the 2022 ESRI's Business Analyst database was 6,774 and the total number of retailers was 32,405, for a statewide mRFEI of 20.9%. The numerator and denominator at the last (2017) update of this indicator were larger at 9,530 and 53,275 respectively, for a statewide mRFE index of 17.9%. The data source for the 2017 report was Dun & Bradstreet. It is not clear whether the reductions in the numerator and in the overall number of stores are due to the use of a different data source or due to real reductions in the number of stores owing, for instance, to the inability to recover from COVID-19-related closures.

---

[1] Regions were based on counties of <u>metropolitan planning organizations (MPO) regions</u> as reported in the 2021 California Regional Progress Report.

7. Projects using this indicator.

1. Centers for Disease Control and Prevention. CDC's LEAN Works: A Workplace Obesity Prevention Program. Centers for Disease Control and Prevention; 2021. https://www.cdc.gov/obesity/
2. San Francisco Department of Public Health. Sustainable Communities Index. San Francisco, CA: San Francisco Department of Public Health; 2013. https://sustainablesf.org/webpages/view/39
3. Connect SoCal, Healthy Cities Toolbox. https://scag.ca.gov/sites/main/files/file-attachments/toolbox_healthycities_final.pdf

8. Similar Measures.

- ***The Food Environment Index****:* The County Health Rankings and Roadmap (CHR&) - a program of the University of Wisconsin Population Health Institute - has the Food Environment Index based on proximity to healthy foods and their affordability (21). The index has values ranging from 0 (worst) to 10 (best).

- ***The Food Environment Atlas:*** The USDA's Food Environment Atlas (22) assembles available data on food environment indicators to stimulate research on diet quality and the determinants of food choices, as well as provides a spatial overview of the communities' abilities and success in accessing healthy foods.

- ***Food Access:*** The United States Department of Agriculture's (USDA) Economic Research Service (ERS) has a measure that it simply calls Food Access (23). It is based on the number of places and people facing barriers to accessing healthy and affordable foods. The measure uses percentages of populations residing within different distance bands (less than half a mile, between one-half to 1 mile, and more than 1 mile) relative to at least one supermarket, by income levels at census tract levels.

- ***The Healthy Eating Index:*** The Healthy Eating Index (HEI) is a measure developed in 1995 and updated three times post-2005 (24) as a collaboration between USDA's Food and Nutrition Services (FNS), the Center for Nutrition Policy and Promotion, Health and Human Services (HHS), and the National Cancer Institute. It is a tool designed to evaluate the extent to which the public follows key recommendations and dietary guidelines published in the Dietary Guidelines for Americans. HEI ranges from 0 to 100 with a score of 100 representing sets of foods aligning perfectly with published dietary recommendations and patterns.

- ***Measuring Access to Healthful, Affordable Food in American Indian and Alaska Native Tribal Areas:*** The United States Department of Agriculture (USDA) Economic Research Service (ERS) uses the same formula to measure access to healthy foods in American Indian and Alaska Native Areas (AIAN) and the rest of the country (25). The goal is to find

out the difference in accessibility to healthy foods in AIAN areas and the nation by distance thresholds and income. The measure involves walking and driving distances to healthy food outlets and distance measures for the 20th, 50th (median), and 80th percentile population distributions. Examples of results from the formula are as follows:

- Whereas 58.8 percent of U.S populations were 1 mile or less from a supermarket (defined as walking distance), only 25.6 percent of all tribal area populations were within such distance
- The median distance to the nearest supermarket was 3.3 miles for all tribal area individuals; it was only 0.8 miles for all Americans
- Nationwide, 63.6 percent of individuals below the federal poverty level (FPL) lived within walking distance of a supermarket; only 27.8 percent in tribal areas

References:

1. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans. 7th ed, Washington, DC: U.S. Government Printing Office; 2010.
2. Michael SL, Merlo CL, Basch CE, Wentzel KR, Wechsler H. Critical connections: health and academics. J Sch Health. 2015 Nov;85(11):740-58. doi: 10.1111/josh.12309. PMID: 26440816; PMCID: PMC4606776.
3. Gropper SS. The Role of Nutrition in Chronic Disease. Nutrients. 2023 Jan 28;15(3):664. doi: 10.3390/nu15030664. PMID: 36771368; PMCID: PMC9921002.
4. Hu K, Staiano AE. Trends in Obesity Prevalence Among Children and Adolescents Aged 2 to 19 Years in the US From 2011 to 2020. JAMA Pediatr. 2022;176(10):1037–1039. doi:10.1001/jamapediatrics.2022.2052
5. Drewnowski A, Eichelsdoerfer P. Can Low-Income Americans Afford a Healthy Diet? Nutr Today. 2010 Nov;44(6):246-249. doi: 10.1097/NT.0b013e3181c29f79. PMID: 20368762; PMCID: PMC2847733.
6. California Center for Public Health Advocacy, PolicyLink, UCLA Center for Health Policy Research. Designed for Disease: The Link Between Local Food Environment and Obesity and Diabetes. https://healthpolicy.ucla.edu/our-work/publications/designed-disease-link-between-local-food-environments-and-obesity-and-diabetes.
7. Papas M A, Alberg, AJ, Ewing R, Helzlsouer KJ, Gary TL, Kalssen AC. The built environment and obesity. Epidemiol Rev. 2007; 29(1):129-143.
8. Gibson DM. The neighborhood food environment and adult weight status: estimates from longitudinal data. Am J Public Health. 2011; 101(1): 71-78.
9. Zenk SN, Lachance LL, Schulz AJ, Mentz G, Srimathi K, Ridella W. Neighborhood retail food environment and fruit and vegetable intake in a multiethnic urban population. Am J Health Promot. 2009; 23(4): 255-264
10. Stelmach-Mardas, M.; Rodacki, T.; Dobrowolska-Iwanek, J.; Brzozowska, A.; Walkowiak, J.; Wojtanowska-Krosniak, A.; Zagrodzki, P.; Bechthold, A.; Mardas, M.; Boeing, H. Link between Food Energy Density and Body Weight Changes in Obese Adults. Nutrients 2016, 8, 229. https://doi.org/10.3390/nu8040229
11. Gibson DM. The neighborhood food environment and adult weight status: Estimates From

Longitudinal Data. Am J Public Health. 2011; 101(1): 71-78

12. California Department of Education, Lunch Meal Pattern (Grades K-12), https://www.cde.ca.gov/ls/nu/he/newfbmplunch.asp

13. Megan A. McCrory, Allen G. Harbaugh, Sarah Appeadu, and Susan B. Roberts, Fast-Food Offerings in the United States in 1986, 1991, and 2016 Show Large Increases in Food Variety, Portion Size, Dietary Energy, and Selected Micronutrients, VOLUME 119, ISSUE 6, P923-933, JUNE 2019, February 27, 2019 DOI: https://doi.org/10.1016/j.jand.2018.12.004

14. Fast Food Restaurants in the US - Number of Businesses 2005–2029, https://www.ibisworld.com/industry-statistics/number-of-businesses/fast-food-restaurants-united-states/

15. Mahendra A, Polsky JY, Robitaille É, Lefebvre M, McBrien T, Minaker LM. Status report - Geographic retail food environment measures for use in public health. Health Promot Chronic Dis Prev Can. 2017 Oct;37(10):357-362. doi: 10.24095/hpcdp.37.10.06. PMID: 29043763; PMCID: PMC5674767

16. National Collaborative Center for Environmental Health, Food Deserts, and Food Swamps: A Premiere, https://www.ncceh.ca/sites/default/files/Food_Deserts_Food_Swamps_Primer_Oct_2017.pdf

17. Cooksey-Stowers K, Schwartz MB, Brownell KD. Food Swamps Predict Obesity Rates Better Than Food Deserts in the United States. Int J Environ Res Public Health. 2017 Nov 14;14(11):1366. doi: 10.3390/ijerph14111366. PMID: 29135909; PMCID: PMC5708005

18. Renfei Yan, Nathaniel D. Bastian, Paul M. Griffin, Association of food environment and food retailers with obesity in US adults, Health & Place, Volume 33, 2015, Pages 19-24, ISSN 1353-8292, https://doi.org/10.1016/j.healthplace.2015.02.004

19. Odoms-Young, A.M., Zenk, S.N., Karpyn, A. et al. Obesity and the Food Environment Among Minority Groups. Curr Obes Rep 1, 141–151 (2012). https://doi.org/10.1007/s13679-012-0023-x

20. Centers for Disease Control, Census Tract Level State Maps of the Modified Retail Food Environment Index (mRFEI), https://www.cdc.gov/obesity/downloads/census-tract-level-state-maps-mrfei_TAG508.pdf

21. County Health Rankings and Roadmaps, Building a Culture of Health, County by County. https://www.countyhealthrankings.org/explore-health-rankings/county-health-rankings-model/health-factors/health-behaviors/diet-and-exercise/food-environment-index?year=2023

22. USDA, Food Environment Atlas, https://www.ers.usda.gov/data-products/food-environment-atlas/

23. United States Department of Agriculture (USDA), Economic Research Service (ERS) Food Access, https://www.ers.usda.gov/topics/food-choices-health/food-access/

24. United States Department of Agriculture, Food and Nutrition Services, Healthy Eating Index, HEI Scores for Americans, https://www.fns.usda.gov/cnpp/hei-scores-americans

25. Kaufman, Phillip, Chris Dicken, and Ryan Williams. Measuring Access to Healthful, Affordable Food in American Indian and Alaska Native Tribal Areas, EIB-131, U.S. Department of Agriculture, Economic Research Service, December 2014.

11/08/2023