



Structural racism and geographic access to food retailers in the United States: A scoping review

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ABSTRACT

This scoping review summarized findings and key measures from U.S.-based studies that 1) examined associations between geographic indicators of structural racism (e.g., redlining, racial segregation) and access to food retailers (e.g., supermarkets, convenience stores) or 2) documented disparities in access by neighborhood racial/ethnic composition. In 2022, relevant scientific literature was reviewed using Covidence software. Independent reviewers examined 13,069 citations; 163 citations advanced to the full-text review stage and 70 were selected for inclusion. Twenty-one studies (30%) linked one or more indicator of structural racism to food retailer access while 49 (70%) solely examined differences in access by neighborhood racial/ethnic composition. All studies featuring indicators of structural racism reported significant findings; however, indicators varied across studies making it difficult to make direct comparisons. Key indicators of structural racism in the food access literature included redlining (n = 3), gentrification (n = 3), and racial segregation (n = 4). Many U.S.-based studies have evaluated food retailer access by neighborhood racial/ethnic composition. Moving forward, studies should model indicators of structural racism and determine their influence on geographic access to large and small food retailers.

1. Introduction

In the U.S., most adults and children 1) fail to meet national dietary recommendations for health-promoting foods and beverages and 2) overconsume foods with excessive amounts of saturated fat, sodium, and added sugar (Wilson et al., 2016; Wang et al., 2018). This is particularly concerning since studies continue to report that marginalized racial/ethnic minorities are less likely to meet national dietary recommendations compared to White populations (Thompson et al., 2020; Kirkpatrick et al., 2012). Racial/ethnic disparities in diet quality and risk of diet-related diseases (e.g., obesity, type 2 diabetes, hypertension)

continue to be a major public health concern in the U.S. (Hiza et al., 2013; Thomson et al., 2019; Bell et al., 2018). National survey data indicates that non-Hispanic (NH) Black adults, on average, have lower diet quality scores and consume significantly fewer servings of fruits and vegetables compared to NH White adults (Thompson et al., 2020; Hiza et al., 2013; Thomson et al., 2019; Assari and Lankarani, 2018). Although diet quality scores in the U.S. have improved slightly in the prior decade (Shan et al., 2019), improvement trajectories for NH Black adults have been slower than NH White adults (Zhang et al., 2018). Given this knowledge, and the substantial body of research on racial/ethnic disparities in diet quality, there is a need to synthesize novel

Abbreviations: NH, (non-Hispanic); RFE, (retail food environment); (USDA), U.S. Department of Agriculture.

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evidence on the structural drivers of nutritional inequities in the U.S.

The retail food environment (RFE) is widely considered a structural driver of nutritional inequities (Larson et al., 2009; Hilmers et al., 2012). The RFE encompasses all features of the built environment in which people can purchase food: grocery stores, supermarkets, supercenters, convenience stores, dollar/discount stores, pharmacies, liquor stores, etc. (Larson et al., 2009). For decades, research institutions and federal agencies have monitored the availability, density, and proximity of food retailers to support public health initiatives and policy (Rhône et al., 2019). Terms such as “food desert” and “food swamp” were coined to define geographic areas that, respectively, lack sufficient access to a large retailer that sells healthy foods (e.g., supermarket) and have an overabundance of small retailers that offer few healthy options (e.g., convenience stores) (Yang et al., 2019). Studies have found that residing in a food desert or food swamp can negatively influence dietary behavior and increase risk of adverse outcomes such as obesity (Cooksey Stowers et al., 2017; Hager et al., 2017). Thus, the RFE is an integral factor to consider when developing policy and interventions that aim to reduce nutritional inequities.

Through historical racist and inequitable practices, communities comprising mostly marginalized racial/ethnic minorities are more likely to be labeled a food desert and/or food swamp compared to majority White communities (Larson et al., 2009; Hilmers et al., 2012; Cooksey Stowers et al., 2020). These inequities in food access are indications of structural racism, which Gee and Ford define as “the macrolevel systems, social forces, institutions, ideologies, and processes that interact with one another to generate and reinforce inequities among racial and ethnic groups” (Gee and Ford, 2011). General interest in describing the role of structural racism in perpetuating health and nutritional inequities has grown in recent years (Odoms-Young, 2018; Greene et al., 2023; Singleton et al., 2021). Seminal papers by Bailey and colleagues have described its historical influence on the health of marginalized racial/ethnic minorities in the U.S. (Bailey et al., 2017, 2021). As for food access, many epidemiological and ecological studies have documented disparities in geographic access to food retailers by neighborhood racial/ethnic composition (Bader et al., 2010; Bodor et al., 2010; Hosler et al., 2008; Kavi et al., 2019; Lamichhane et al., 2013, 2015; Morland et al., 2022; Morland and Filomena, 2007; Neckerman et al., 2010; Powell et al., 2007). Newer studies are linking current and historical racist practices (e.g., redlining, racial segregation) to geographic access to food retailers (Shannon et al., 2018; Shaver et al., 2018; Soltero et al., 2019; Towns and Moy, 2020; Ware et al., 2021; Zenk et al., 2006; Anderson, 2017; Bell et al., 2019; Bower et al., 2014; Breyer and Voss-Andreae, 2013; Caruso et al., 2021; Havewala, 2021; Jin and Lu, 2021; Kolak, 2021; Kwate et al., 2013; LaVeist and Wallace, 2000; LeDoux and Vojnovic, 2022; Li and Yuan, 2022; Mui et al., 2017; Richardson et al., 2012; Romley et al., 2007). These novel studies are providing the field a foundation of scientific evidence that underscores the role of structural racism in creating and perpetuating long-standing disparities in the RFE.

Given the breadth of studies that have evaluated disparities in food retailer access based on neighborhood racial/ethnic composition or linked an indicator of structural racism to food retailer access, there is a need to summarize such findings. Furthermore, there is a need to describe the quantitative measures used to operationalize indicators of structural racism in this research space. This scoping review will address these research needs by 1) summarizing peer-reviewed quantitative studies on associations between neighborhood racial/ethnic composition, indicators of structural racism, and food retailer access in the U.S. and 2) describing the quantitative measures used to represent indicators of structural racism among included studies. Findings from this scoping review will be highly informative to health advocates and policy makers working to document and dismantle racist systems and policies that affect nutritional well-being among racial/ethnic minorities. Furthermore, this review will provide researchers better understanding of the measures used to capture indicators structural racism, which will support future research endeavors on this topic.

2. Methods

2.1. Data sources & search strategy

This scoping review was conducted in accordance with PRISMA-ScR guidelines (Tricco et al., 2018). A comprehensive search of the scientific literature was conducted in March 2022 to identify studies that align with the review aims. L.A.W., a health science librarian, developed a search strategy to identify relevant literature available in the following seven databases: PubMed, Embase, CINAHL, PsycINFO, Scopus, SocINDEX, and Business Source Complete. These databases were selected because they feature a wide selection of relevant public health, nutrition, sociology, and economics literature. The original search strategy was created in PubMed and translated to the other databases. C.R.S. wrote the protocol and supplied an initial list of appropriate keywords/search terms, which included the following: *structural racism, systemic racism, institutionalized racism, social segregation, social discrimination, social marginalization, social oppression, redlining, disinvestment, gentrification, food retailers, food environment, food desert, food swamp, supermarket, grocery store, convenience store, corner store, gas station, supercenter, warehouse store, dollar store, pharmacy, drug store, and liquor store*. Where appropriate, database-specific search terms were used (e.g., MeSH, Emtree, and CINAHL Subject Headings). A complete list of search strategies is provided in **Appendix A**, which is available in the supplemental file.

2.2. Inclusion criteria

The inclusion criteria for this review included the following: (1) peer-reviewed research study, (2) U.S.-based study, (3) written/published in English, (4) quantitative study, (5) utilized an observational study design, (6) featured at least one independent variable reflection neighborhood racial/ethnic composition or structural racism, and (7) featured at least one dependent variable reflecting geographic access to an eligible food retailer. All included papers had to present findings from a single quantitative study, so qualitative studies, commentaries, editorials, reviews, and meta-analyses were excluded. Because this review aimed to summarize studies that documented geographic disparities in food retailer access, interventions and experimental studies were excluded.

At least one independent variable had to reflect neighborhood racial/ethnic composition (e.g., % NH Black residents, % Hispanic residents, % non-White residents) or an indicator of structural racism (as described by the manuscript authors). At least one dependent variable in the statistical analyses had to reflect the availability, proximity, or density of at least one type of large or small food retailer of interest: supermarket, grocery store, supercenter (e.g., Wal-Mart, Target), convenience store (which includes corner stores, gas stations, and bodegas), dollar store, pharmacy/drug store, and liquor store. Studies that solely focused on fast food and/or full-service restaurants were excluded since policy mechanisms and strategies to address these settings vary in comparison to food retailers used by consumers to procure groceries. Given wide variety of large and small food retailers of interest to this scoping review, food retailers were labeled as described by the research team that conducted the study. Thus, if the manuscript’s research team described the retailer as a “supermarket” in their paper, the review team labeled the retailer accordingly.

Food access variables that represent retailer availability, proximity, and/or density were of interest. A variable was labeled a measure of availability if it represented a count (total number of retailers in an area) or per capita measure (number of stores per population). Proximity measures reflected distance (e.g., miles, kilometers) to the nearest food retailer while density measures represented the concentration of retailers in an area or the amount of retailers given the size of the geography (number of stores per square mile). Studies with a dependent variable that reflects an index measure of food retailer access were also

included. Index measures, such as the CDC's Modified Retail Food Environment Index (mRFEI), quantify the overall healthfulness of the RFE in a specific area (Centers for Disease Control and Prevention, 2011). Food swamp scores and the U.S. Department of Agriculture's (USDA) low-income/low-access measures were considered index measures (Rhone et al., 2015).

2.3. Citation review process

The PRISMA flow chart describing the citation review process is presented in Fig. 1. The search strategy returned 20,126 citations from the seven selected databases. After removing duplicates, 13,069 citations remained. Three members of the research team participated in the title and abstract review (M.M., I.G.A., and L.A.W.). In order for a citation to move to the full-text review stage, two reviewers had to independently vote "yes" on inclusion. If reviewers disagreed on the status of a citation, a third reviewer (C.R.S.) provided the tie-breaking vote. A total of 163 citations were included in the full-text review stage. PDF files for all remaining citations were gathered and uploaded to the Covidence database. Research team members independently reviewed the full-text files for each study. Sixty-five studies met all the criteria for inclusion. Research team members conducted forward and backward hand searching to identify citations that were not retrieved by the search strategy. An additional 5 studies were located; thus, the final sample includes 70 studies.

2.4. Data extraction & synthesis

Data extraction was performed using Covidence software. C.R.S. developed a standardized data extraction tool in Covidence to extract pertinent information from the 70 included studies. Specifically, data on the following were collected: authors' names, study publication year, data year (secondary analyses) or year of data collection, study design (cross-sectional vs. longitudinal), sample size, unit of analysis (e.g., census tracts, census blocks, counties), a detailed description of independent variables (i.e., neighborhood racial/ethnic composition or indicator of structural racism), a detailed description of the dependent variables (food retailer measures or index measure), and main study

findings. For the independent variables, detail information on variable names, definitions, and data collection tools as described by the manuscript authors were extracted.

Due to the large number of studies included in this review, findings were synthesized using two approaches. First, studies that conducted ecological evaluations of differences in food retailer access by neighborhood racial/ethnic composition were grouped and summarized. Second, all studies that assessed the relationship between an indicator of structural racism and food retailer access were summarized. Studies were grouped and compared if they had a similar indicator of structural racism. However, the variation in measures and definitions challenged the ability to compare studies. Thus, only a description of the study details and findings are presented for the studies that featured an indicator of structural racism.

3. Results

3.1. Description of included studies

Descriptive information on included studies is presented in Table 1 and Fig. 2. Of the 70 included studies, 21 (30.0%) linked an indicator of structural racism to geographic access to food retailers while 49 (70.0%) documented disparities in food retailer access by neighborhood racial/ethnic composition. Most of studies employed a cross-sectional study design (74.3%), evaluated associations at the census tract level (44.3%), and analyzed a measure of food retailer availability (48.6%). The majority of included studies evaluated the availability, proximity, and/or density of supermarkets (68.6%), grocery stores (58.6%), or convenience stores (51.4%). Fewer studies modeled an index measure of the RFE as the dependent variable or evaluated supercenters, dollar stores, pharmacies/drug stores, or liquor stores.

Some key differences in descriptive characteristics were identified between the studies that featured an indicator of structural racism and those that focused on neighborhood racial/ethnic composition. While 30.6% of neighborhood racial/ethnic composition studies utilized a longitudinal study design, only 19.0% of structural racism studies were longitudinal. Approximately 79.6%, 69.4% and 63.3% of neighborhood racial/ethnic composition studies examined supermarkets, grocery

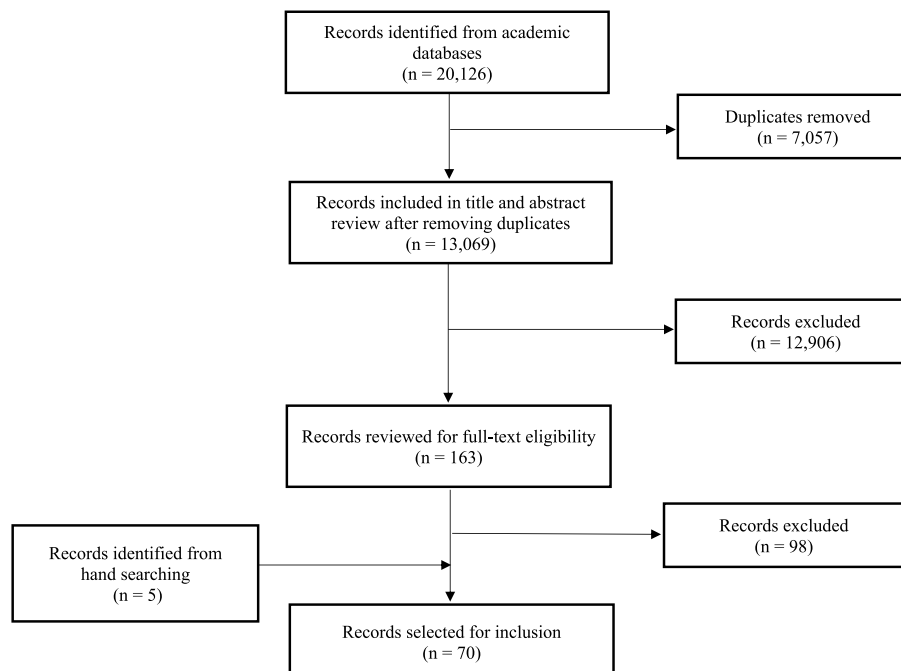


Fig. 1. Prisma flow chart for scoping review.

Table 1
Descriptive characteristics of included studies by study focus, N (%).

Characteristic:	All Studies N = 70	Structural Racism ^a 21 (30.0)	Neighborhood Racial/ Ethnic Composition 49 (70.0)
<i>Study Design</i>			
Cross-Sectional	52 (74.3)	17 (81.0)	34 (69.4)
Longitudinal	18 (25.7)	4 (19.0)	15 (30.6)
<i>Unit of Analysis</i>			
Census Tract	31 (44.3)	9 (42.9)	22 (44.9)
Census Block	17 (24.3)	4 (19.0)	13 (26.5)
Community Area or Neighborhood ^b	4 (5.7)	1 (4.8)	3 (6.1)
Zip Code	5 (7.1)	3 (14.3)	2 (4.1)
Other ^c	13 (18.6)	4 (19.0)	9 (18.4)
<i>Food Access Measure Type</i>			
Availability	34 (48.6)	9 (42.9)	25 (51.0)
Density	7 (10.0)	3 (14.3)	4 (8.2)
Proximity	14 (20.0)	6 (28.6)	8 (16.3)
Multiple	15 (21.4)	3 (14.3)	12 (24.5)
<i>Food Retailer Type(s)</i>			
Supermarkets	48 (68.6)	9 (42.9)	39 (79.6)
Grocery Stores	41 (58.6)	7 (33.3)	34 (69.4)
Supercenters	8 (11.4)	1 (4.8)	7 (14.3)
Convenience Stores	36 (51.4)	5 (23.8)	31 (63.3)
Dollar Stores	15 (21.4)	3 (14.3)	12 (24.5)
Pharmacies/Drug Stores	15 (21.4)	3 (14.3)	12 (24.5)
Liquor Stores	8 (11.4)	2 (9.5)	6 (12.2)
Index Measure ^d	17 (24.3)	11 (52.4)	6 (12.2)

a.) Studies labeled “structural racism” modeled at least one indicator of structural racism as an independent variable in the analysis.

b.) “Community” and “neighborhood” as defined by the authors. The size of this unit varies across studies.

c.) Other units include cities, counties, metropolitan statistical areas (MSA), food retailers, schools, school neighborhoods, and residential parcels.

d.) Index measures quantify food access or the healthfulness of food retailers in the geographic area.

stores, and convenience stores, respectively. Only 42.9%, 33.3%, and 23.8% of structural racism papers focused on supermarkets, grocery stores, and convenience stores, respectively. Approximately 52.4% of structural racism studies modeled an index measure of the RFE as the dependent variable; only 12.2% of the neighborhood racial/ethnic composition studies modeled an index measure.

3.1.1. Findings from structural racism studies

Descriptive characteristics, measures, and key findings from studies that featured indicators of structural racism are provided in Table 2 and Table 3. Of the 21 studies in this category, 10 studies (47.6%) analyzed national data while the other studies focused on specific geographies such as New York, Chicago, Baltimore, and Detroit (Anderson, 2017; Bell et al., 2019; Bower et al., 2014; Breyer and Voss-Andreae, 2013; Caruso et al., 2021; Havewala, 2021; Jin and Lu, 2021; Kolak, 2021; Kwate et al., 2013; LaVeist and Wallace, 2000; LeDoux and Vojnovic,

2022; Li and Yuan, 2022; Mui et al., 2017; Richardson et al., 2012; Romley et al., 2007; Sadler et al., 2021; Shaker et al., 2022; Sharkey and Horel, 2008; Smith et al., 2022; Thibodeaux, 2016; Zenk et al., 2005). A wide variety of indicator variables for structural racism were modeled as the independent variable(s) in these studies. Below are detailed summaries of study findings grouped by indicator of structural racism.

3.1.2. Housing discrimination

Indicators of housing discrimination were explored in 4 studies (19.0%) (LeDoux and Vojnovic, 2022; Li and Yuan, 2022; Sadler et al., 2021; Shaker et al., 2022). Li and Yuan, Sadler and colleagues, and Shaker and colleagues examined associations between *redlining* and food retailer access (Li and Yuan, 2022; Sadler et al., 2021; Shaker et al., 2022). All three studies used data from the University of Richmond’s Mapping Inequality Project, which represents the Home Owners’ Loan Corporation’s (HOLC) historical grades for communities (University of Richmond, 2022). These grades were previously used by mortgage lenders and other financial institutions to exclude racial/ethnic minorities from obtaining housing (University of Richmond, 2022). All three studies modeled an index measure as the dependent variable and reported statistically significant results. Li and Yuan and Sadler and colleagues found that communities with a “B”, “C”, or “D” HOLC grade had unhealthy food environments in comparison to communities with the highest grade of “A” (Li and Yuan, 2022; Sadler et al., 2021). Shaker and colleagues found that communities with a “B”, “C”, or “D” HOLC grade were more likely to be labeled “low-income/low-access” according to the USDA (Shaker et al., 2022).

Another measure of housing discrimination explored was *blockbusting*, which in some cases is termed *white flight*. Blockbusting occurs when mortgage lenders persuade White residents to leave a community out of fear of a non-White racial/ethnic group moving into the community (Chicago and Forest College, 2022). The lenders profit off this fear by convincing White residents to sell their homes below market prices, which drives property values down (Chicago and Forest College, 2022). Sadler and colleagues studied blockbusting by modeling % change in non-Hispanic White residents in Baltimore, MD from 1950 to 1980. They found that blockbusting was negatively associated with healthy food availability in Baltimore, MD (Sadler et al., 2021). LeDoux and colleagues explored the link between white flight in Detroit, MI from 1970 to 2010 and change in supermarket availability; they reported that white flight was significantly associated with supermarket decentralization in inner-city Detroit during that time period (LeDoux and Vojnovic, 2022).

3.1.3. Gentrification

Gentrification emerged as an indicator of structural racism in 3 studies (14.2%) (Breyer and Voss-Andreae, 2013; Caruso et al., 2021; Sadler et al., 2021). Although the term “gentrification” often refers to the physical displacement of lower income and working-class people, sociological research clearly describes the racial and colonial dimensions of gentrification throughout history to demonstrate why it primarily affects Black, Hispanic, and Indigenous populations in the U.S. (Kent-Stroll, 2020). All three of the included studies on gentrification measured it using different analytical approaches. Breyer and Voss-Andreae measured % change in non-Hispanic White residents from 2000 to 2010 in Portland, OR; they linked this measure to shorter distances to grocery stores and the presence of “food mirages” (i.e., geographic areas with grocery stores that have food prices that are unaffordable to nearby residents) (Breyer and Voss-Andreae, 2013). Caruso and colleagues labeled areas of Bronx, NY as “gentrifying” if they were lower income and experienced significant growth in rent rates from 2006 to 2010 (Caruso et al., 2021). They found that gentrifying neighborhoods has increased odds of food retailer instability from 2008 to 2017 (Caruso et al., 2021). Sadler and colleagues measured gentrification by tracking economic change and population displacement. “Gentrified” neighborhoods were those that experienced increases in

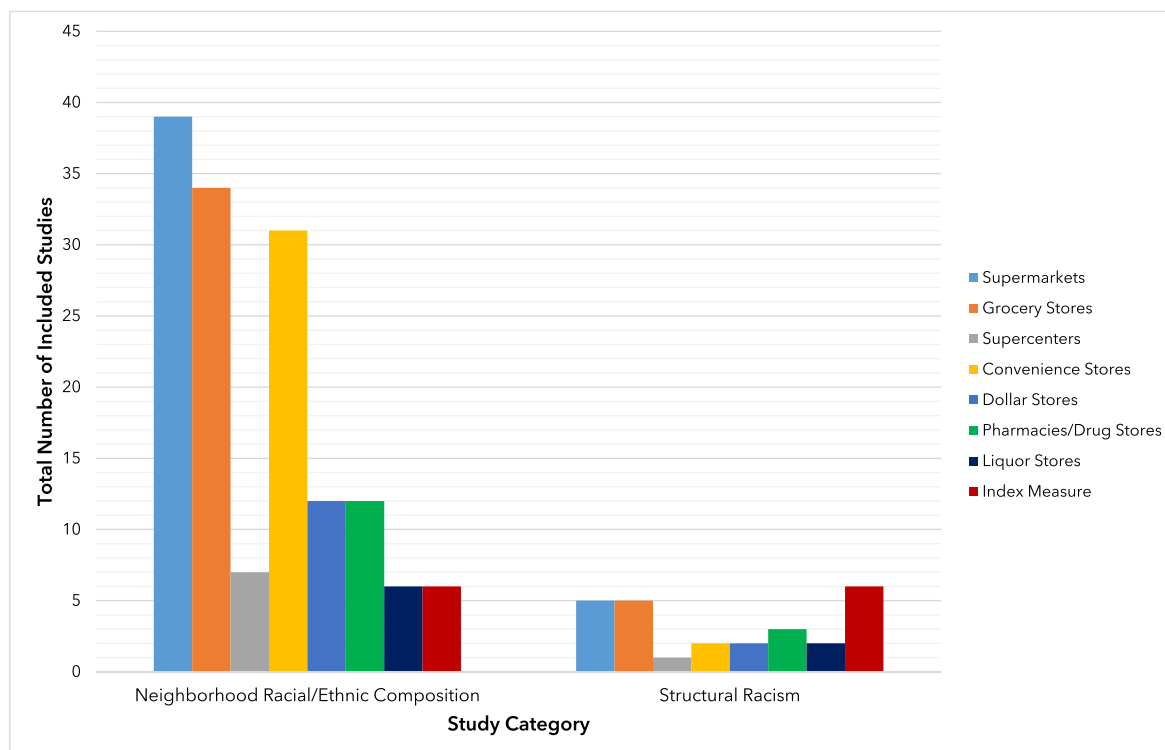


Fig. 2. Number of included studies by study category and food retailer type (N = 70).

median home value, % college-educated people, and median household income (Sadler et al., 2021). The authors reported that gentrified neighborhoods, on average, had significantly healthier food environments than non-gentrified neighborhoods (Sadler et al., 2021).

3.1.4. Racial segregation

Studies by Anderson, Havewala, Li and Yuan, and Smith and colleagues evaluated associations between *racial segregation* and access to food retailers (Anderson, 2017; Havewala, 2021; Li and Yuan, 2022; Smith et al., 2022). Li and Yuan and Smith and colleagues modeled Black-White segregation using the Index of Dissimilarity, a widely used measure of racial segregation (Li and Yuan, 2022; Smith et al., 2022; Forest, 2005). While Li and Yuan did not report a significant association between Black-White segregation and healthy food environments, Smith and colleagues found that schools in areas with more Black-White segregation were more likely to be surrounded by unhealthy food environments (Li and Yuan, 2022; Smith et al., 2022).

Anderson and Havewala used alternative approaches to measure racial segregation (Anderson, 2017; Havewala, 2021). Anderson used a k-2 spatial weight matrix to model residential clustering by race/ethnicity (Anderson, 2017). While the author found no association between the clustering of Black residents and grocery store availability, Black residential clustering was associated with lower availability of pharmacies (Anderson, 2017). Havewala explored five indices of racial segregation designed to represent factors such as clustering, centralization, and concentration (Havewala, 2021). The author reported that racial segregation was negatively associated with healthy food environments and relative proximity to healthy food (Havewala, 2021).

3.1.5. Racial inequity within social class

Nine studies (42.9%) featured an analysis that explored *racial inequity within social class* (Bell et al., 2019; Bower et al., 2014; Kolak, 2021; LaVeist and Wallace, 2000; Mui et al., 2017; Richardson et al., 2012; Romley et al., 2007; Sharkey and Horel, 2008; Zenk et al., 2005). Specifically, these studies aimed to determine if differences in food retailer access existed by neighborhood racial/ethnic composition within a

specific social class. Although social class was modeled using a variety of measures (e.g., neighborhood socioeconomic status, % poverty, median household income, foreclosure risk, etc.), all 9 studies presented some evidence that communities with mostly racial/ethnic minorities have poorer food access compared to mostly White communities despite having similar socioeconomic position.

Bell and colleagues explored racial inequality within 5 key indicators of socioeconomic status: household income, poverty, educational attainment, employment, and homeownership (Bell et al., 2019). They reported that Black-White inequalities in median income, poverty rate, % college graduates, % unemployment, and homeownership were associated with lower grocery store availability among U.S. counties with <9% of Black residents (Bell et al., 2019). Bower and colleagues found that majority Black census tracts in the U.S. had fewer supermarkets than majority White census tracts at all poverty levels (low, medium, and high) (Bower et al., 2014). LaVeist and Wallace reported that lower income census tracts in Baltimore, MD with a high proportion of Black residents had more per capita liquor stores than lower income tracts with a low proportion of Black residents (LaVeist and Wallace, 2000). Similarly, Romley and colleagues found that low-income zip codes that were majority non-White had higher density of liquor stores compared to low-income zip codes that were majority White (Romley et al., 2007). Richardson and colleagues studied food retailer access at the intersection of neighborhood racial/ethnic composition, poverty status, and urbanicity (Richardson et al., 2012). They observed that high poverty/high minority areas had significantly fewer grocery stores, supermarkets and convenience stores compared to low poverty/low minority areas in low-density urban areas (Richardson et al., 2012). Both Sharkey and Horel and Zenk and colleagues explored proximity to supermarkets and grocery stores at the intersection of neighborhood racial/ethnic composition and neighborhood socioeconomic status (Sharkey and Horel, 2008; Zenk et al., 2005). Sharkey and Horel found that distance in miles to the nearest supermarket decreased as minority composition increased in rural Texas (Sharkey and Horel, 2008). However, neighborhoods that were both high minority and high deprivation had the best potential spatial access to the nearest supermarket/grocery

Table 2
Descriptive information for included studies that featured indicators of structural racism (N = 21).

Author (Year)	Study Purpose	Study Location	Study Type	Data Year (s) ^a	Sample Size & Unit (s)	Structural Racism Indicator(s)	Indicator Definition(s)
Anderson (2017)	Evaluate the role of racial residential segregation, specifically racial clustering, on the availability of health-related resources in urban neighborhoods.	National	Cross-Sectional	2010	8644 Zip Codes	Racial Residential Segregation	Three clustering measures were created based on physical adjacency using a “k-2 nearest neighbor spatial weight matrix”. These measures represent spatial clustering of non-Latino Black residents, Latino residents, and Asian residents.
Bell et al. (2019)	Assess associations between racial inequalities in SES and obesogenic environments.	National	Cross-Sectional	2012–2016	26,628 Counties	Racial inequality in 5 SES indicators: income, poverty, educational attainment, employment, and homeownership.	Black-White ratio for median household income, % impoverished households, % residents who completed a four-year degree, % residents unemployed, and % residents who own their home. Ratio measures categorized as “none”, “low”, “medium”, “medium high”, and “high” to reflect the extent of racial inequality.
Bower et al. (2014)	Examine availability of supermarkets, grocery stores, and convenience stores in the U.S. at the intersection of neighborhood racial/ethnic composition, poverty, and urbanicity.	National	Cross-Sectional	2001	65,174 Census Tracts	Neighborhood Racial/Ethnic Composition × Neighborhood Poverty	<i>Neighborhood Racial/Ethnic Composition</i> : Majority non-Hispanic White, Black, and Hispanic neighborhoods (majority defined as ≥60%). All other neighborhoods were labeled “integrated”. <i>Neighborhood Poverty</i> : % residents living below the Federal Poverty Line (categorized as low (10%), medium (10–19.9%), and high poverty (≥20%).
Breyer and Voss-Andreae (2013)	Investigate the role of grocery store prices in structuring food access for low-income households in Portland, Oregon.	Portland, OR	Cross-Sectional	2011	140 Census Tracts	Gentrification	Percent change in non-Hispanic White residents between 2000 and 2010.
Caruso et al. (2021)	Compare food retailer instability among high income, lower income, and gentrifying census tracts in Bronx, NY from 2008 to 2017.	Bronx, NY	Longitudinal	2008 & 2017	330 Census Tracts	Gentrification	Gentrifying census tracts were those that were 1) lower income (median household income in the bottom 40 percent of all census tracts in the Bronx) and 2) experienced rent growth greater than the borough median between 2006 and 2010.
Havewala (2021)	Evaluate underlying pathways by which residential segregation affects the food environment in all large metropolitan areas in the U.S.	National	Cross-Sectional	2010	353 Metropolitan Statistical Areas	Racial Residential Segregation	Indices representing five key dimensions of segregation: <i>evenness</i> , <i>exposure</i> , <i>clustering</i> , <i>centralization</i> , and <i>concentration</i> . For each dimension, measures of segregation were created to compare non-Hispanic Black, Hispanic, and non-Hispanic Asian residents to non-Hispanic White residents.
Jin and Lu (2021)	Examine the spatial dependence in associations between food access and socioeconomic status.	Austin, TX	Cross-Sectional	2016	555 Census Tracts	Sociocultural Deprivation Index	Created by conducting factor analysis using the measures % Hispanic, % without higher education, linguistic isolation, and % renters.
Kolak (2021)	Examine the pre and post effects of the Great Recession (2008) on food access in Chicago, IL.	Chicago, IL	Longitudinal	2007 & 2011	790 Census Tracts	Neighborhood Racial Composition × Foreclosure Risk	<i>Neighborhood Racial Composition</i> : Majority White, Majority Black, and Majority Hispanic. Majority defined as >50% representation. <i>Foreclosure Risk</i> : The 2008 census tract-level estimate of foreclosure rate provided by the U.S. Department of Housing and Urban Development (HUD). Tracts with excessive risk of foreclosure were identified based on relative risk estimates for the city.
Kwate et al. (2013)	Investigate the presence of retail redlining in NYC among retailers that are potentially important to health.	New York, NY	Cross-Sectional	2008	5730 Census Tracts	Retailer Redlining	<i>Retailer Redlining</i> : % Black residents × retail demand <i>Retail Demand</i> : local market demand for goods and services as measured by the Market Potential Index (MPI). A MPI of 100 indicates retailer demand mirrors the US national average. Values above and below 100 indicate retail demand is higher and lower than the national average, respectively.
LaVeist and Wallace (2000)	Determine whether the physical availability of alcohol, through off premises liquor stores is	Baltimore, MD	Cross-Sectional	1990	194 Census Tracts	Neighborhood Racial Composition × Median Income	<i>Neighborhood Racial Composition</i> : % Black <i>Median Income</i> : median annual income among

(continued on next page)

Table 2 (continued)

Author (Year)	Study Purpose	Study Location	Study Type	Data Year (s) ^a	Sample Size & Unit (s)	Structural Racism Indicator(s)	Indicator Definition(s)
	greater in predominantly Black communities relative to other communities.						households categorized as low-income (below the 50th percentile for the city) and high income (\geq 50th percentile for the city).
LeDoux and Vojnovic (2022)	Describe the historical evolution of uneven neighborhood food environments in Tri-County Detroit, Michigan from 1970 to 2010.	Tri-County Detroit, MI	Longitudinal	1970–2010	NP – Census Tracts	White Flight; Supermarket Decentralization	<i>White Flight</i> : change in % Black population from 1970 to 2010 in Tri-County Detroit, MI. <i>Supermarket Decentralization</i> : Change in the availability of supermarkets in Detroit (inner city) and surrounding suburbs from 1970 to 2010.
Li and Yuan (2022)	Assess the how the long term ramifications of racial segregation (including redlining/discriminatory housing practices) are related to unhealthy food environments in urban areas of the U.S.	National	Cross-sectional	2010	11,651 Census Tracts 102 Urban Areas	Redlining; Racial Segregation; Neighborhood Racial Composition	<i>Redlining</i> : The explicit, then-legal mechanism used by mortgage lenders and banks to exclude racial minorities from obtaining housing in certain neighborhoods. Data reflect Home Owners' Loan Corporation historical classifications ("A - best", "B - still desirable", "C - declining", and "D - hazardous"). <i>Racial Segregation</i> : Represents Black-White segregation within the area and was calculated using the Index of Dissimilarity. <i>Neighborhood Racial Composition</i> : White majority, Black majority, Asian majority, Other majority. "Majority" indicates that the racial/ethnic group has the largest representation in the census tract.
Mui et al. (2017)	Examine relationships between vacant homes and food swamps at the intersection of racial and socioeconomic makeup of neighborhoods.	Baltimore, MD	Longitudinal	2001–2012	55 Community Statistical Area	Community Racial Composition \times Vacancy Rate	<i>Community Racial Composition</i> : Predominantly African American neighborhoods ($>62\%$) vs. non-African American neighborhood ($\leq 62\%$). Cutoff based on city average. <i>Vacancy Rate</i> : Number of vacant and abandoned homes divided by the average number of homes per community statistical area over the study period, then multiplied by 100.
Richardson et al. (2012)	Assess differences in the availability of neighborhood food resources by neighborhood-level poverty and racial/ethnic composition.	National	Cross-Sectional	2001–2002	13,995 participants residing in 7588 census blocks	Neighborhood Minority Population \times Neighborhood Poverty Status \times Urbanicity	<i>Neighborhood Minority Population</i> : % minority (i.e., non-White residents) categorized as low, medium, and high based on tertiles. <i>Neighborhood Poverty Status</i> : % poverty categorized as low ($\leq 20\%$) and high ($>20\%$) <i>Urbanicity</i> : non-urban, low-density urban, and high-density urban as indicated by US Census-defined urbanized areas.
Romley et al. (2007)	Characterize differences in the density of liquor stores and bars by race, socioeconomic status, and age among zip codes in the U.S.	National	Cross-Sectional	2001	9361 Zip Codes	Zip Code Race \times Zip Code Socioeconomic Status	<i>Race</i> : White vs. Non-White zip code. <i>Socioeconomic Status</i> : Higher income zip code ($\geq \$42,972$) and lower income zip code ($< \$42,972$).
Sadler et al. (2021)	Link historical characteristics of Baltimore's housing environment throughout the 20th century to a modern and objective measure of the food environment.	Baltimore, MD	Cross-Sectional	2012 & 2016	NP – Residential Parcels	Redlining; Blockbusting; Gentrification	<i>Redlining</i> : Home Owners' Loan Corporation historical zone grades ("A - best", "B - still desirable", "C - declining", and "D - hazardous"). <i>Blockbusting</i> : The % change in the white population between 1950 and 1980 (categorized as "very high", "high", and "some"). <i>Gentrification</i> : Significant economic change and population displacement within a given period of time. The parcel was labeled "Gentrified" if low-income in the 2000 Census and the median home value, percent of college-educated people, and the median household income increased by the next census.

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Table 2 (continued)

Author (Year)	Study Purpose	Study Location	Study Type	Data Year (s) ^a	Sample Size & Unit (s)	Structural Racism Indicator(s)	Indicator Definition(s)
Shaker et al. (2022)	Examine the relationship between Home Owners' Loan Corporation graded mortgage security classification (i.e., redlining) and low food access among U.S. census tracts.	National	Cross-Sectional	2019	10,459 Census Tracts	Redlining	Home Owners' Loan Corporation historical zone grades ("A - best", "B - still desirable", "C - declining", and "D - hazardous").
Sharkey and Horel (2008)	Identify spatial inequalities in spatial access to food stores located in rural areas of Texas.	6 Counties Rural Texas	Cross-Sectional	2006	101 Census Blocks	Neighborhood Minority Composition × Neighborhood Socioeconomic Deprivation	<i>Neighborhood Minority Composition</i> : % minority residents categorized as low (<15%), medium (15–39%) and high (>39%). <i>Neighborhood Socioeconomic Deprivation</i> : Socioeconomic deprivation score computed for every census block using 7 key indicators (unemployment, poverty, low educational attainment, household crowding, public assistance, vehicle availability, and low telephone service). Scores categorized as low, medium, and high. <i>Racial Segregation</i> : Represents Black-White segregation within the area and was calculated using the Index of Dissimilarity. <i>Percent of Racially Marginalized Residents</i> : % non-White residents
Smith et al. (2022)	Compare the food retail environments around private schools to those around public schools, and determine if socio-demographic factors are associated with the food retail environments around schools.	National	Cross-Sectional	2019	94,260 Schools	Racial Segregation; Percent of Racially Marginalized Residents	<i>Percent of Racially Marginalized Residents</i> : % African American at the zip code level and % African American in the surrounding city.
Thibodeaux (2016)	Determine if the relationship between the number of supermarkets and the percentage of African Americans in a zip code depends on the overall racial composition of city.	National	Cross-Sectional	2010	16,705 Zip Codes 366 U.S. Cities	Blalock's Minority Competition Theory	<i>Neighborhood Racial Composition</i> : % African American residents (categorized into tertiles representing low, medium, & high). <i>Neighborhood Poverty</i> : % residents below the poverty line (categorized by tertiles representing low, medium, and high).
Zenk et al. (2005)	Evaluate the spatial accessibility of large chain supermarkets in Detroit, MI in regards to neighborhood racial composition and poverty.	Detroit, MI	Cross-Sectional	2002	869 Census Tracts	Neighborhood Racial Composition × Neighborhood Poverty	

NP – information was not provided by the authors.

Note: An asterisk (*) placed between two variables indicate that study results included stratified analysis at the intersection of those two variables.

^a) Data year(s) reflect the food retailer measures only (dependent variables).

Table 3
Key findings from included studies that featured indicators of structural racism (N = 21).

Author (Year)	Food Retailer Measure Type(s):	Food Retailer Type(s):							Index ^a	Key Findings:
		Super	GS	SC	CS	DS	Pharm	LS		
Anderson (2017)	Availability		X				X		The extent of clustering of Black residents was associated with greater availability of grocery stores, but this association was not significant after adjusting for socioeconomic measures. Black clustering was associated with lower availability of pharmacies after adjusting for covariates. Adjusted models indicated no association between clustering of Latino and Asian residents and availability of grocery stores or pharmacies.	
Bell et al. (2019)	Availability		X					X	In counties with <9% Black residents, racial inequality in median income, poverty rate, % college graduates, % unemployment, and homeownership were associated with fewer grocery stores. In counties that were <9% Black residents, racial inequality in median income and % college graduates were associated with higher ratios of fast food-to-grocery stores (a proxy measure for food swamps). Racial inequality in homeownership was associated with lower fast food-to-grocery store ratios in counties with <9% Black residents.	
Bower et al. (2014)	Availability	X	X		X				As census tract poverty increased, supermarket availability decreased while grocery store and convenience store availability increased, regardless of race/ethnicity. For all poverty levels (low, medium, and high), majority Black census tracts had the fewest supermarkets while majority White census tracts had the most. Majority Hispanic census tracts had the most grocery stores at all levels of poverty.	
Breyer and Voss-Andreae (2013)	Proximity	X	X					X	Extreme food mirages (areas with grocery stores with higher prices) were associated with the highest rates of gentrification (largest increase in non-Hispanic White residents from 2000 to 2010). Gentrification was associated with shorter distances to grocery stores.	
Caruso et al. (2021)	Availability	X	X	X	X	X	X	X	The number of food retailers in all segments (other specialty food stores) increased between 2008 and 2017. The total number of retailers grew by 15.3% in lower income census tracts, 12.8% in gentrifying census tracts, and 8.7% in higher income census tracts. When assessing the unweighted food retailer stability index, lower income and gentrifying census tracts had increased odds of retailer instability. Furthermore, higher income census tracts had decreased odds of retailer instability. When assessing the weighted index, there was no significant relationship between census tract classification and food retail instability.	
Havewala (2021)	Availability & Proximity							X	Metropolitan statistical areas with more residential segregation, particularly Black-White segregation, tend to have lower modified food retail environment index (mRFEL) scores, which suggests fewer healthy food outlets compared to less healthy outlets. Racial residential segregation had a strong relationship with variability in the proximity measure (i.e., relative distance to the closest unhealthy food outlet compared to healthy food outlet).	
Jin and Lu (2021)	Density							X	Sociocultural Deprivation Index was not associated with healthy food access, but significantly and positively associated with unhealthy food access.	
Kolak (2021)	Proximity							X	Census tracts that remained Black-majority in both time periods (before and after Great Recession) had the farthest distance to healthy retailers. Tracts that were Black-majority and had excess risk for foreclosure showed no significant change in distance after the Recession. Tracts that became Black-majority between time periods experienced a worsening of proximity to healthy retailers. Tracts that were Black-minority and not at risk for foreclosure saw a significant improvement in distance to healthy retailers.	
Kwate et al. (2013)	Proximity						X		For all 3 pharmacy chains, increasing retail demand was associated store proximity in New York. After controlling for market potential index (i.e., retailer demand) and other variables, % Black residents was associated greater distance to stores for all three pharmacy chains.	
LaVeist and Wallace (2000)	Availability							X	Census tracts with higher % Black residents had significantly more liquor stores per capita than census tracts with a lower % Black residents (even when controlling for median household income). Interaction effects indicated that the effect of % Black on per capita liquors stores differs by median income of the census tract. Among census tracts with a median income level below the 50th percentile for the city, a higher % Black residents was associated with a greater per capita liquor stores. This association was not significant among tracts with a median income ≥50th percentile.	
LeDoux and Vojnovic (2022)	Availability & Proximity	X							The spatial concentration of Black residents in Detroit increased from 1970 to 2010. During this time, the availability of supermarkets decreased in Detroit significantly while increasing in nearby suburban areas. The % of Black residents in a census tract had a significant positive relationship with distance accessibility measures for supermarkets in every decade. The % of Black residents had a significant negative association with cumulative number of	

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Table 3 (continued)

Author (Year)	Food Retailer Measure Type(s):	Food Retailer Type(s):							Index ^a	Key Findings:
		Super	GS	SC	CS	DS	Pharm	LS		
Li and Yuan (2022)	Availability								X	supermarkets in every decade. Neighborhoods with higher % of Black residents had less cumulative opportunities to access supermarkets. After controlling for key variables, including proportion of vacant houses, racial composition of census tract, and dissimilarity index (i.e., Black-White racial segregation), Home Owner Lending Corporation grades were significantly associated with modified retail food environment index (mRFEI). Census tracts with grades “B”, “C”, and “D” had lower mRFEI scores compared to tracts with grade “A”, which suggests unhealthier food environments. Census tract that were majority Black had lower mRFEI scores. Black-White racial segregation was not associated with mRFEI score.
Mui et al. (2017)	Availability								X	There was no statistically significant relationship between changes in vacant home rate and change in the food swamp index among predominantly AA neighborhoods. Among non-AA neighborhoods, a one-percentage point increase in vacancy rate was associated with a statistically significant decrease in the food swamp index (i.e., a shift towards a healthier food environment). When “predominantly AA” was defined as >93% AA residents, increases in vacancy rates were associated with statistically significant increases in the food swamp index (i.e., a shift towards an unhealthier food environment) when controlling for concurrent change in neighborhood racial diversity, neighborhood SES, and total population size.
Richardson et al. (2012)	Density	X	X		X					In low-density urban areas (i.e., largely suburban areas), high poverty/high minority areas had significantly fewer grocery stores/supermarkets and convenience stores compared to low poverty/low minority areas. In high-density urban areas, high poverty/low minority areas had greater availability of grocery stores/supermarkets and convenience stores compared to low poverty/low minority areas.
Romley et al. (2007)	Availability & Density								X	Majority Black, Hispanic, and Asian/Pacific Islander zip codes had higher density of liquor stores compared to majority White zip codes. Among lower income zip codes, non-White zip codes had higher density of liquor stores compared to White zip codes.
Sadler et al. (2021)	Density								X	Redlining was associated with higher Healthy Food Availability Index (HFAI) scores in both years (2012 & 2016). Blockbusting was negatively associated with HFAI scores in both years. Gentrified neighborhoods, on average, had significantly higher HFAI scores in both years compared to non-gentrified neighborhoods.
Shaker et al. (2022)	Proximity								X	After controlling for socio-demographic factors, census tracts with a Home Owner Lending Corporation grade of “B”, “C”, or “D” had higher odds of being labeled a “low-income/low-access” census tract in comparison to tracts with an “A” grade (the reference group). This suggest that historical redlining designations are associated with food access. This association was significant at ½ mile and 1 mile.
Sharkey and Horel (2008)	Proximity	X	X		X	X				Distance in miles to the nearest supermarket decreased as minority composition increased. Neighborhoods that were both high minority and high deprivation had the best potential spatial access to the nearest supermarket/grocery store, regardless of population density. Neighborhoods that were both high minority and high deprivation had the best potential spatial access to the nearest discount store, regardless of population density.
Smith et al. (2022)	Availability				X	X	X		X	Public and private schools in areas with high % non-White residents are more likely to be in unhealthy food retail environments. Public and private schools in areas with more racial segregation are more likely to be in unhealthy food retail environments.
Thibodeaux (2016)	Availability	X								Percent AA was significantly associated with number of supermarkets among zip codes when controlling for covariates. Findings suggest a lower poverty rate and a higher mean household income in a city is associated with fewer supermarkets in zip codes with more AA residents. These results providence some evidence that supermarkets may avoid predominantly AA zip codes in more affluent and more densely populated cities (i.e., Blalock’s minority competition theory).
Zenk et al. (2005)	Proximity	X								Compared to neighborhood with a low % of AA residents, the nearest supermarket was significantly further away in neighborhoods with a high % AA. Mean distance (in miles) to the nearest supermarket was about the same for all 3 tertiles of % AA among the least impoverished neighborhoods. Among the most impoverished neighborhoods, mean distance to the nearest supermarket was significantly higher among neighborhoods with a high % AA residents compared to neighborhoods with a low % AA residents.

AA: African American; Super: supermarket; GS: grocery store; SC: supercenter; CS: convenience store; Pharm: pharmacy/drug store; LS: liquor store; Index: index measure.

Note: An “X” indicates that the study evaluated access to that food retailer type.

a.) Index measures often represent the overall healthfulness of an area's food retail environment and are calculated from data on multiple food retailers. Key examples include the modified food retail environment index (mRFEI), food swap score, and the U.S. Department of Agriculture's low-income/low-access designation.

store (Sharkey and Horel, 2008). Zenk and colleagues reported that mean distance to the nearest supermarket was significantly higher among impoverished neighborhoods with a high % African American residents compared to impoverished neighborhoods with a low % African Americans residents (Zenk et al., 2005).

Kolak and Mui and colleagues operationalized neighborhood socioeconomic status using other measures (Kolak, 2021; Mui et al., 2017). Kolak studied the influence of foreclosure risk and change in % Black residents on food access in Chicago, IL during the Great Recession (2008) (Kolak, 2021). They found that census tracts that became Black-majority from 2007 to 2011 experienced a worsening of proximity to healthy retailers. Furthermore, only tracts that were Black-minority with low foreclosure risk saw a significant improvement in distance to healthy retailers (Kolak, 2021). Mui and colleagues explored longitudinal associations between change in vacancy rate, an indicator of blight, and the presence of food swamps in Baltimore, MD from 2001 to 2012 (Mui et al., 2017). They found that increases in vacancy rates were associated with significant increases in food swamp index (i.e., a shift towards an unhealthy food environment) in communities with a high percentage of African American residents (i.e., >93%) (Mui et al., 2017).

3.1.6. Other indicators

Other indicators of structural racism explored include *retailer redlining*, *sociocultural deprivation*, and *Blalock's Minority Competition Theory* (Kwate et al., 2013; Jin and Lu, 2021; Thibodeaux, 2016). Kwate and colleagues studied pharmacy redlining in New York, NY by assessing retailer demand at the intersection of neighborhood racial/ethnic composition (Kwate et al., 2013). They found that census tracts with more Black residents had lower proximity to pharmacies even if market demand for a pharmacy retailer was high, which suggests retailer redlining may be occurring in the city (Kwate et al., 2013). Jin and Lu (2021) measured associations between sociocultural deprivation and healthy food environment (Jin and Lu, 2021). They constructed a sociocultural deprivation index via a factor analysis using the measures % Hispanic, % without higher education, linguistic isolation, and % renters. While the index measure was not associated with healthy food access in Austin, TX, it was significantly associated with unhealthy healthy food access (Jin and Lu, 2021). Thibodeaux evaluated Blalock's Minority Competition Theory in the context of supermarket availability (Thibodeaux, 2016). This theory, also known as the Racial Threat Theory, postulates that an increase in racial/ethnic minorities in a community may exacerbate existing disparities (Thibodeaux, 2016; Dollar, 2014). The majority population may view this increase as a threat and respond by increasing discriminatory practices and/or limiting access to vital resources, such as food retailers (Dollar, 2014). Thibodeaux found that supermarket availability is lower in affluent and densely populated U.S. zip codes experiencing increases in African American residents, which aligns with the proposed theory (Thibodeaux, 2016).

3.2. Findings from neighborhood racial/ethnic composition studies

The **Supplemental Table** presents descriptive information and a brief summary of findings from the 49 studies that explored the association between neighborhood racial/ethnic composition and food retailer access (Bader et al., 2010; Baker et al., 2006; Bao et al., 2020; Bastian and Napieralski, 2016; Berg and Murdoch, 2008; Block and Kouba, 2006; Bodor et al., 2010; Chen and Clark, 2016; Chen and Wang, 2014; Filomena et al., 2013; Galvez et al., 2008; Gordon et al., 2011; Hosler, 2019; Hosler et al., 2006, 2008; Jeong and Liu, 2020; Kavi et al., 2019; Kolak et al., 2018; Kwate and Loh, 2016; Lamichhane et al., 2013, 2015; Li and Ashuri, 2018; Lisabeth et al., 2010; Lopez-Class and Hosler, 2010; Lucan et al., 2018; McKenzie, 2014; Mendez et al., 2016; Moore and Diez Roux, 2006; Morland et al., 2022; Morland and Filomena,

2007; Mundorf et al., 2015; Neckerman et al., 2010; O'Connell et al., 2016; Ohri-Vachaspati et al., 2019; Olvera and Sutton, 2021; Peng et al., 2021; Powell et al., 2007; Qato et al., 2014; Raja et al., 2008; Rigby et al., 2012; Rose et al., 2011; Rummo et al., 2017; Satcher, 2022; Shannon et al., 2018; Shaver et al., 2018; Soltero et al., 2019; Towns and Moy, 2020; Ware et al., 2021; Zenk et al., 2006). Unlike the studies that featured an indicator of structural racism, only 2 studies in this category analyzed data that represents all the U.S. The other 47 studies focused on one or more cities or counties. Nevertheless, all four major regions of the U.S. (i.e., South, Midwest, Northeast, and West) were represented among the target geographics for these studies.

The U.S. Census Bureau and American Community Survey were the primary source of data on neighborhood racial/ethnic composition for these studies (United States Census Bureau, 2022). Measures of neighborhood racial/ethnic composition represented the proportion of the geography's residents that self-identify as a specific race/ethnicity. Of the 49 studies in this category, 38 (77.6%) featured an independent variable that represents the proportion of residents that are non-Hispanic Black or African American. Twenty-one (42.9%) had an independent variable that represents the proportion of Hispanic, Latino, or Mexican American residents, and 8 (16.3%) had a variable that represents the proportion of Asian and/or Pacific Islander residents. For studies that targeted a geography with low representation of racial/ethnic minorities, % White residents or % non-White residents were often modeled as the measure of neighborhood racial/ethnic composition.

Regarding food retailers of interest and study findings, 15 studies (30.6%) solely focused on geographic access to large food retailers (i.e., supermarkets, grocery stores, and supercenters) or featured an index measure of healthy food availability. Of these 15 studies, 13 provided evidence that areas with more racial/ethnic minorities were significantly disadvantaged regarding geographic access to large food retailers. Only 3 of 49 studies (0.06%) focused solely on a small food retailer (i.e., convenience stores, dollar stores, pharmacy/drug stores, and liquor stores), with all 3 studies reported evidence that communities with more racial/ethnic minorities were disadvantaged regarding access. For some small retailers (e.g., liquor stores), "disadvantaged" suggests that a community has greater access. The other 31 (63.3%) studies explored access to both large and small retailers. For a complete synopsis of each study, please refer to the supplemental table.

4. Discussion

This scoping review summarized findings from peer-reviewed literature that 1) assessed associations between indicators of structural racism and geographic access to food retailers and 2) examined differences in food retailer access by neighborhood racial/ethnic composition. In addition, this review provided a detailed summary of measures used to quantify important indicators of structural racism in the food access literature, which can be used to grow the scientific literature on this critical topic.

This review includes findings from 70 studies: 21 studies that featured an indicator of structural racism and 49 studies that examined food retailer access by neighborhood racial/ethnic composition. Nine of the structural racism studies (42.9%) were published in 2020 or later (Caruso et al., 2021; Havewala, 2021; Jin and Lu, 2021; Kolak, 2021; LeDoux and Vojnovic, 2022; Li and Yuan, 2022; Sadler et al., 2021; Shaker et al., 2022; Thibodeaux, 2016), which indicates a significant increase in the published literature on this topic in recent years. Interest in the role of structural racism in perpetuating racial/ethnic disparities in the RFE is growing among public health, nutrition, geography, economics, and sociology researchers (Odoms-Young, 2018; Greene et al., 2023; Singleton et al., 2021; Freedman et al., 2022; McLoughlin et al.,

2022; Singleton, 2022). Researchers are now using novel approaches (e.g., systems science, implementation science) to explore how structural racism has historically impacted local food systems in low-resourced communities of color (McLoughlin et al., 2022; Singleton, 2022). They are replacing popular terms that traditionally referred to food access disparities (e.g., food desert, food swamp) with terms such as *food apartheid*, which represents racialized access to healthy foods and racist practices that affect food retail (Sevilla, 2021). Lastly, researchers are exploring the broader socio-environmental context in communities of color to determine how specific social determinants of health (e.g., transportation, crime, blight, etc.) influence food access (Thornton et al., 2016). Overall, these developments underscore the growing interest in documenting and dismantling structural drivers of racial/ethnic disparities in food access. Increasing the literature on this topic will be vital to local and federal endeavors to design equity-centered interventions and policies that address major upstream challenges affecting healthy food access in communities of color.

This review revealed some key gaps in the literature that, if addressed, would make the science significantly more robust. First, most of the studies that featured an indicator of structural racism modeled an index measure of healthy food access as the dependent variable. There is a need to evaluate associations between structural racism and the availability of specific food retailers, separately. This research will determine if differences exist by retailer type regarding the relationship with structural racism. Second, included studies that had similar indicators of structural racism often used different approaches to measure the indicator. For example, all three included studies that focused on gentrification defined and measured the concept using different approaches (Breyer and Voss-Andreae, 2013; Caruso et al., 2021; Sadler et al., 2021). The use of different measures makes comparing findings across studies difficult. For many of these indicators, the science is still growing, so valid and reliable measures are still needed.

Lastly, there are other indicators of structural racism that have yet to be studied in this research space. For example, supermarket redlining and chronic disinvestment are two concepts that have been widely discussed in mainstream media (Move for Hunger, 2020; Eisenhauer, 2001). Supermarket redlining occurs when a supermarket chain permanently closes a store in an underserved community, or relocate it to a more affluent area, for reasons other than financial viability (Eisenhauer, 2001). Studies by LeDoux and Vojnovic and Kwate and colleagues explored supermarket decentralization and pharmacy redlining, which are similar concepts but not equivalent (Kwate et al., 2013; LeDoux and Vojnovic, 2022). Chronic disinvestment refers to communities of color that have endured many years, or decades, without access to a large food retailer (Move for Hunger, 2020). It is an indication of long-term redlining from large chain grocers that renders a community a chronic food desert (Move for Hunger, 2020; Eisenhauer, 2001). Unfortunately, there remains a dearth of quantitative measures that accurately captures these two phenomenon. Thus, there are few quantitative studies that have evaluated their influence on food retailer access. Researchers working in the food access space should continue to develop novel measures that capture relevant indications of structural racism.

Regarding the 49 studies that examined disparities in food retailer access by neighborhood racial/ethnic composition, they represent two decades of research that span a wide range of cities, counties, and regions. This body of evidence indicates that racial/ethnic disparities in food retailer access have been explored by many researchers in the U.S. Moving forward, researchers who are interested in filling gaps in knowledge should 1) focus on understudied food retailers or 2) target geographies that are not already represented in the literature. Only 7 of 49 studies in this category assessed supercenter availability. Supercenters, like Wal-Mart, have become a popular food source in the U.S. (Seenivasan and Talukdar, 2016; Capital Counselor, 2023). Nearly half of the U.S. population (about 140 million people) regularly shop at Wal-Mart in-person or online, which demonstrates the significance of superstores to U.S. consumers (Capital Counselor, 2023). Furthermore,

only 12 of 49 studies in this category considered dollar stores. Dollar stores availability and usage have grown significantly in the past 10 years (McCarthy et al., 2022; Wahba, 2020). Early in the COVID-19 pandemic, dollar stores became a key food source for low-income consumers (Wahba, 2020). The disproportionate growth of dollar stores, particularly in historically low-resourced communities of color in the South and Midwest, has sparked major concern among public health advocates and local policy makers that believe major dollar store chains purposefully target these communities (McCarthy et al., 2022). Thus, there is a need to study the influence of structural racism on the availability of supercenters, dollar stores, and other understudied retailers.

4.1. Strengths & limitations

This research has strengths and limitations. Strengths include the search strategy and selection of databases. The search strategy and databases returned a large and diverse body of scientific literature from a variety of fields including public health nutrition, geography, economics, and sociology. Limitations include the narrowed scope of food retailers considered for inclusion. We did not include studies or results that specifically focused on other food sources such as ethnic food markets, farmers markets, or specialty food stores (e.g., bakeries, butcher shops). Ethnic food markets are a prime source of food in ethnic communities because they provide the best selection of culturally appropriate food items (Joassart-Marcelli et al., 2017). It is likely that ethnic food markets were labeled as grocery stores or convenience stores in the included studies, which hindered the ability to study them separately. Farmers markets have increased in availability exponentially in the U.S., particularly in historically low-resourced communities, due to incentive programming funded by the USDA's Gus Schumacher Nutrition Incentive Program (Leng et al., 2022). Future studies should consider reviewing literature on the availability of these retailers in the context of structural racism. As previously mentioned, all independent and dependent variables were labeled as described by the publishing authors. For example, Breyer et al. (2013) defined gentrification as % change in White residents over time in Portland, OR (Towns and Moy, 2020). This measure was not relabeled to white flight despite being similar to the measures featured in the included studies that examined white flight. Review team members did not conduct a formal assessment of each study's methodological quality due to the variety of research fields and study types represented among the included literature.

It is important to note that this scoping review solely summarized findings from U.S.-based studies. Study findings may not be applicable to other countries or regions of the world. There have been studies that documented disparities in geographic access to food retailers in other countries, particularly Canada, Australia, and the UK (Beaulac et al., 2009; Titis et al., 2021). Although many of these studies have focused on socioeconomic or urban-rural disparities, some recent studies have explored racial/ethnic disparities. For example, a recent review by Titis et al. (2021) summarized studies that evaluated disparities in access to food retailers in the UK; like U.S.-based studies, they found evidence that communities with more ethnic minorities were more likely to have better access to retailers that sell unhealthy foods (Titis et al., 2021). Studying the role of structural racism in perpetuating these disparities in other high-income countries with a majority White population requires considering the historical context of racism in that individual country. The historical consequences of racism in the U.S. are different from other high-income countries because of its history with slavery and civil rights policies (Ball et al., 2022). Thus, studying the connection between structural racism and geographic access to food retailers in other countries may produce different results because the relevant indicators of structural racism are likely different. Scholars in other countries should consider this fact and explore disparities in access to food retailers in relation to the racist systems, policies, and practices that exist in their country.

5. Conclusions

In conclusion, there is a growing body of literature that is linking indicators of structural racism to the availability, proximity, and density of food retailers in the United States. However, additional studies are needed to develop a more robust body of literature on this important topic. These studies should 1) explore additional indicators of structural racism, 2) use consistent definitions and measures to facilitate comparison with other studies, and 3) explore associations by food retailer type individually. Given the large number of studies that solely evaluated disparities by neighborhood racial/ethnic composition, additional studies in this space should only be conducted if the target geography is not represented in the literature or the food retailer of interest is understudied, yet economically essential to consumers, such as supercenters and dollar stores. On another note, several other nutritional factors have been linked to structural racism in the U.S., including unhealthy food marketing, food pricing, and consumer food purchasing (Barnhill et al., 2022; Greene et al., 2023; Singleton et al., 2020). Future studies should consider these findings and expand the research base on these topics. By considering these recommendations, future studies on nutritional inequities will fill crucial gaps in knowledge.

Conflicts of interest

The authors have nothing to disclose.

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Data availability

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Appendix A. Supplementary data

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