



Racialized Housing Discrimination and Population Health: a Scoping Review and Research Agenda

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Accepted: 1 March 2023 / Published online: 14 April 2023
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Abstract Racial residential segregation is considered a fundamental cause of racial health disparities, with housing discrimination as a critical driver of residential segregation. Despite this link, racial discrimination in housing is far less studied than segregation in the population health literature. As a result, we know little about how discrimination in housing is linked to health beyond its connection to segregation. Furthermore, we need to understand how health impacts differ across different types of housing discrimination. This review aims to assess the state of the population health literature on the conceptualization, measurement, and health implications of housing discrimination. We used PRISMA guidelines for scoping reviews and presented the data on 32 articles that met our inclusion criteria

published before January 1, 2022. Nearly half of the articles do not define housing discrimination explicitly. Additionally, there is considerable variation in how housing discrimination is operationalized across studies. Compared to studies using administrative data for housing discrimination exposures, studies using survey data were more likely to report a detrimental association with health outcomes. Synthesizing and comparing the results of these studies helps bridge methodological approaches to this research. Our review helps inform the debate on how racism impacts population health. Given the changing nature of racial discrimination over time and place, we discuss how population health researchers can approach studying various forms of housing discrimination.

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Keywords Housing discrimination · Redlining · Racism · Segregation · Health disparities · Social determinants of health

Introduction

A growing body of population health research recognizes the role of institutional racism in racial health inequities. Early scholarship in this area focused on racial residential segregation. Studying segregation as a form of racism was advantageous because health inequalities often map onto geographic patterns. Census data availability also makes segregation measures readily accessible. This large body of research provides evidence that segregation is a “fundamental cause of racial health disparities” [1, 2], because it influences multiple disease outcomes [3–6], impacts numerous risk factors [7–9], shapes flexible resources, and is reproduced over time [10, 11]. While it is clear that racial residential segregation is associated with multiple health and healthcare inequities, measures of segregation fail to identify specific policies or practices that produce and maintain these inequities.

More recently, population health researchers have highlighted the need to go beyond studying segregation to examining racialized institutional practices and their health implications. Racial residential segregation, the argument goes, is a *consequence* of racism and should not be considered a proxy for racism itself [12, 13]. Furthermore, the hyperfocus on segregation takes our attention away from developing interventions to improve health. The hypothetical solution goes as follows: if the way people are arranged in space (i.e., segregation) causes poor health, we can rearrange space and improve health. This line of reasoning encourages policies that seek to move people around without addressing the underlying factors determining where people live [14]. For example, several social experiments seeking to move public housing residents to “opportunity” did not change why some neighborhoods are “healthier” than others [15–17]. Unequal access to health-promoting resources remained intact even while families move away from places deprived of those resources. Thus, while segregation is an important indicator for understanding place-based racism, public health scholarship would be served by exploring the mechanisms by which segregation—and its underlying geographic inequality—is maintained.

Segregation is maintained by a dynamic system whereby prejudice, wealth inequality, neighborhood knowledge, and racialized housing discrimination interact with and exacerbate one another [10, 11, 18]. Among these factors, housing discrimination deserves attention as a driver of population health inequities because it refers to institutional actions that can be intervened on and that have the power to shape the distribution of harmful exposures and health-promoting resources [19].

Although housing discrimination is a crucial driver of residential segregation, it is far less studied in population health research. For example, a simple PubMed search on December 31, 2021, of “racial residential segregation” returns 149 results, “institutional racism” returns 222 results, while “housing discrimination” yields only 24 results. While this body of evidence is small in the fields of public and population health, the legacy of racialized housing discrimination in the USA is vast, and its connection to health is well documented. In 1899, W.E.B. Du Bois analyzed the relationship between housing discrimination and the health of Black people in Philadelphia [20]. He wrote,

“Negros live in unsanitary dwellings [...] partly on account of the difficulty of securing decent houses by reason of race prejudice [...] In very many cases, landlords refuse to repair and refit for Negro tenants because they know that there are few dwellings which Negroes can hire, and they will not, therefore, be apt to leave a fair house on account of damp walls or poor sewer connections” [20].

Constrained housing markets, discriminatory practices, and unhealthy housing conditions continued to impact the health of Black communities throughout the twentieth century. As a result, housing discrimination was a central focus of the urban rebellions and the Civil Rights Movement of the 1960s [21–23]. Black communities and organizations demanded institutional changes to undo the government-sponsored uneven development in regions across the country. While the Fair Housing Act of 1968 outlawed racial discrimination in housing, it was limited in its enforceability. Therefore, since its passing, several studies have documented that racial discrimination in housing is still prevalent. Studies have also shown an intimate connection between housing discrimination and racial and economic residential segregation [24–28].

Within the context of this history, the study of racialized housing discrimination and health extends the research on segregation and health while also responding to the calls to consider institutional accountability in racism and health research. In fact, there has been an increase in the use of historical (e.g., Home Owner's Loan Corporation [HOLC] security maps) and contemporary (e.g., Home Mortgage Disclosure Act [HMDA]) administrative data to measure racialized housing discrimination. However, there are two concerns regarding this literature.

First, there is no consensus on how this body of work defines and measures housing discrimination. Currently, the Fair Housing Act of 1968 has a broad definition of housing discrimination which includes differential treatment while “renting or buying a home, getting a mortgage, seeking housing assistance, or engaging in other housing-related activities” [29]. The US Department of Housing and Urban Development (HUD) provides a list of activities that fall under this definition ranging from steering to delaying repairs, unjust evictions, and blockbusting [30]. We build on the HUD definition to specify *racialized* housing discrimination as differential treatment at any stage in the housing continuum—from acquisition, to remaining and maintaining, to selling or moving out—based on the race of the individual, family, or residents in a community. At each stage in the housing continuum, people engage with a range of individuals and institutions that can racially discriminate. Table 1 displays a non-exhaustive list of potential discrimination exposures and highlights which exposures public and population health scholars have explored.

Second, there are inconsistencies in the findings regarding how housing discrimination impacts health. For example, some studies of mortgage discrimination using the HMDA database show a protective effect on health; others show a detrimental impact on health, and still others find no association. We address these concerns by answering three questions: (1) How is racialized housing discrimination defined in the population health literature? (2) How is racialized housing discrimination measured? (3) What are the effects of racialized housing discrimination on health outcomes and health disparities? Then, we explain why the evidence is sometimes contradictory to our expectations. Finally, we inform the field of promising methodological and conceptual considerations

that can be used to understand this relationship further.

Methods

Search Strategy

We conducted this scoping review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines [31]. We searched all available literature until December 31, 2021. We searched peer-reviewed and grey literature in databases that publish scholarship on discrimination and health. These include PubMed, CINAHL, PsychINFO, Sociological Abstracts, Social Welfare Abstracts, Academic Search Premier, ERIC, and ProQuest Theses and Dissertations. For grey literature, we searched Grey Literature Report and EMBASE. We also manually searched the reference lists of relevant articles to find additional relevant studies.

We developed a list of exposure terms after reviewing the housing discrimination scholarship. We found that housing discrimination is not always explicitly mentioned, so we included several terms associated with housing discrimination. The terms included mortgage discrimination, redlining, housing discrimination, rental discrimination, subprime lending, reverse redlining, predatory inclusion, and major discrimination. We did not include terms related to housing equity, such as “social housing,” to focus on the impact of housing discrimination as a form of institutional racism.

We were interested in all mental and physical health outcomes and health inequalities. Our outcome search terms included health, mental health, health disparity, depression, disease, cancer, cardiovascular disease, diabetes, obesity, psychological distress, stress, self-rated health, BMI, overweight, chronic illness, pregnancy, birth outcomes, birth weight, pre-term birth, asthma, “health outcomes,” “health disparities,” health effects,” and “health impacts.” In PubMed, we did not use health-related search terms because the database primarily focuses on health, healthcare, and biomedical outcomes. In PubMed, we only searched housing discrimination terms noted above. Due to changes in PubMed's interface, we used the PubMed import function in DistillerSR.

Table 1 Select types of racialized housing discrimination and coverage in public and population health research

Discrimination type	Definition	Individual or institutional actor	Studied in public health
Redlining	Marking an area as risky for investment based on the race of the residents	Mortgage lenders	Y
Mortgage lending bias	Systematic racial bias in the provision and denial of mortgage loans	Mortgage lenders	Y
Rental (denial)	Refusing to rent to a person or family due to race	Landlord, rental management	Y
Reverse redlining	Targeting minoritized individuals or communities with high-cost (i.e., subprime) mortgage loans	Banker, mortgage lenders	Y
Unjust eviction	Evicting a tenant or tenant guest without just cause	Investor, investment company, landlord	Y*
Discrimination in rental conditions	Requiring different qualifications, procedures, standards such as applications, credit analyses, and/or fees for sale or rental approval	Landlord, rental management	N
Steering	Trying to persuade people to seek (or not seek) housing in particular neighborhoods based on race	Real estate agent	N
Rental (availability)	Falsely denying that housing is available due to applicant's race	Landlord	N
Home repair loan bias	Systematically denying access to home repair loans due to applicant's race	Mortgage lenders	N
Blockbusting	Trying to persuade homeowners to sell their homes by suggesting that people of a different racial group are about to move into the neighborhood	Investor, Investment company	N
Reverse blockbusting	Trying to persuade, usually low-income homeowners or homeowners of color to sell their homes for less than what their worth to resell at a higher cost	Investor, Investment company	N
Home insurance discrimination	Refusing to provide or discriminate in the terms or conditions of homeowners insurance	Insurance agent, insurance company	N
Dwelling access discrimination	Assigning a person to a particular building or neighborhood or section of a building or neighborhood	Landlord, rental management	N
Appraisal discrimination	Devaluing property owned by minoritized owners or property located in communities of color	Appraisers	N

*Evictions and foreclosures have been studied in public health research but the extent to which these actions are discriminatory are not explicitly measured

Inclusion and Exclusion Criteria

To be included in the study, articles had to quantitatively assess the relationship between exposure to racialized housing discrimination and health outcomes at the individual or neighborhood levels. To attend to racial health equity, we focus our analysis on

members of minoritized racial groups as the targets of racialized housing discrimination, though we report the findings for all populations. Though racial and ethnic discrimination in housing is a global phenomenon, we limited our study to English language articles in the USA. We acknowledge that global scholarship on housing discrimination might reveal important

associations with health outcomes as well as highlight potential interventions. However, the unique history of racialized housing policies and practices likely shapes processes in the USA differently from other countries. For dissertations and theses that were subsequently peer-reviewed and published, we included the published manuscripts and excluded the dissertation.

In the full-text review, we excluded articles that did not specify the effect of housing discrimination (i.e., if housing discrimination was not separated from other items on a larger discrimination scale). We also excluded articles that focused primarily on health behaviors if they did not explicitly measure at least one health outcome. For example, when deciding whether to include drug use-related outcomes, we excluded those that measured “any” or “lifetime” drug use (which could pathologize recreational drug use) and included those that measured problematic drug use, drug dependence, or drug use disorders [32, 33].

Study Selection and Data Extraction

Once all identified records were compiled and deduplicated, all authors reviewed titles and abstracts to determine eligibility using the criteria listed above. After the title ($n=1710$) and abstract ($n=314$) exclusions, all four authors read a randomly selected sample of full-text articles ($n=71$) to verify the inclusion criteria. At this stage, all four authors extracted relevant data from the articles that met the inclusion criteria. Articles that did not meet the criteria were excluded ($n=42$). At least two authors read each article. RIC performed a quality check on all data extraction responses to ensure accuracy. All conflicts were resolved through discussion. The weighted overall kappa statistic was 0.88.

Reference review, data extraction, and analysis were conducted using DistillerSR web-based software by Evidence Partners Ottawa, Ontario, Canada.,

Results

Deriving the Sample

As shown in Fig. 1, the search retrieved 2094 unique publications. After excluding ineligible ($n=2023$)

studies through title and abstract screening, we reviewed 71 full articles. After a full-text review, 29 publications were included in the preliminary sample. We then manually searched the references of the included articles and found three additional relevant articles, bringing our final sample to 32.

Characteristics of Studies

Table 2 summarizes the key characteristics of the sample overall and by the type of housing discrimination measure (self-report or administrative). Overall, most studies used a cross-sectional design, and the levels of analysis varied. Thirty-six percent of studies used individual-level analysis, while 45% used multi-level analysis where the housing discrimination exposure was at the neighborhood level. The remaining six studies used an ecologic design. Samples were drawn from population-based settings, ranging from 99 to 651,000 individuals.

Regarding sample demographics, most of the studies used adult samples. Only one study had a sample of adolescents [13]. Two studies did not specify the age group of their samples. Concerning gender, 14 of the studies (45.2%) only included women in their samples. The remaining 18 (58.1%) studies included all genders. Over two-thirds (71%) of the studies used multi-racial and multi-ethnic samples, but considerable variability exists. For example, 6 (19.4%) restricted analyses to Black and white participants, and 5 (16.1%) studies used a sample comprising Black, Latinx, and white participants. Two studies had a sample of Black, Latinx, white, and “other” participants. Another 8 (25.8%) did not specify the racial/ethnic categorization of the sample. Among the studies with homogenous racial/ethnic samples, 8 (25.8%) restricted the sample to Black participants, and 1 used a Chinese American sample [34].

Concerning health outcomes examined in the sample studies, 42% of the studies examined a mental health outcome, including psychological distress, general mental health, depressive symptoms, and anxiety. One-third (32.3%) of the studies examined birth outcomes, including preterm birth, low birth weight, small for gestational age, and infant mortality. Another third of the studies (29.0%) focused on cancer, and another third (29.0%) examined general health, such as self-rated health and physical functioning. About one-fifth of the studies (22.6%)

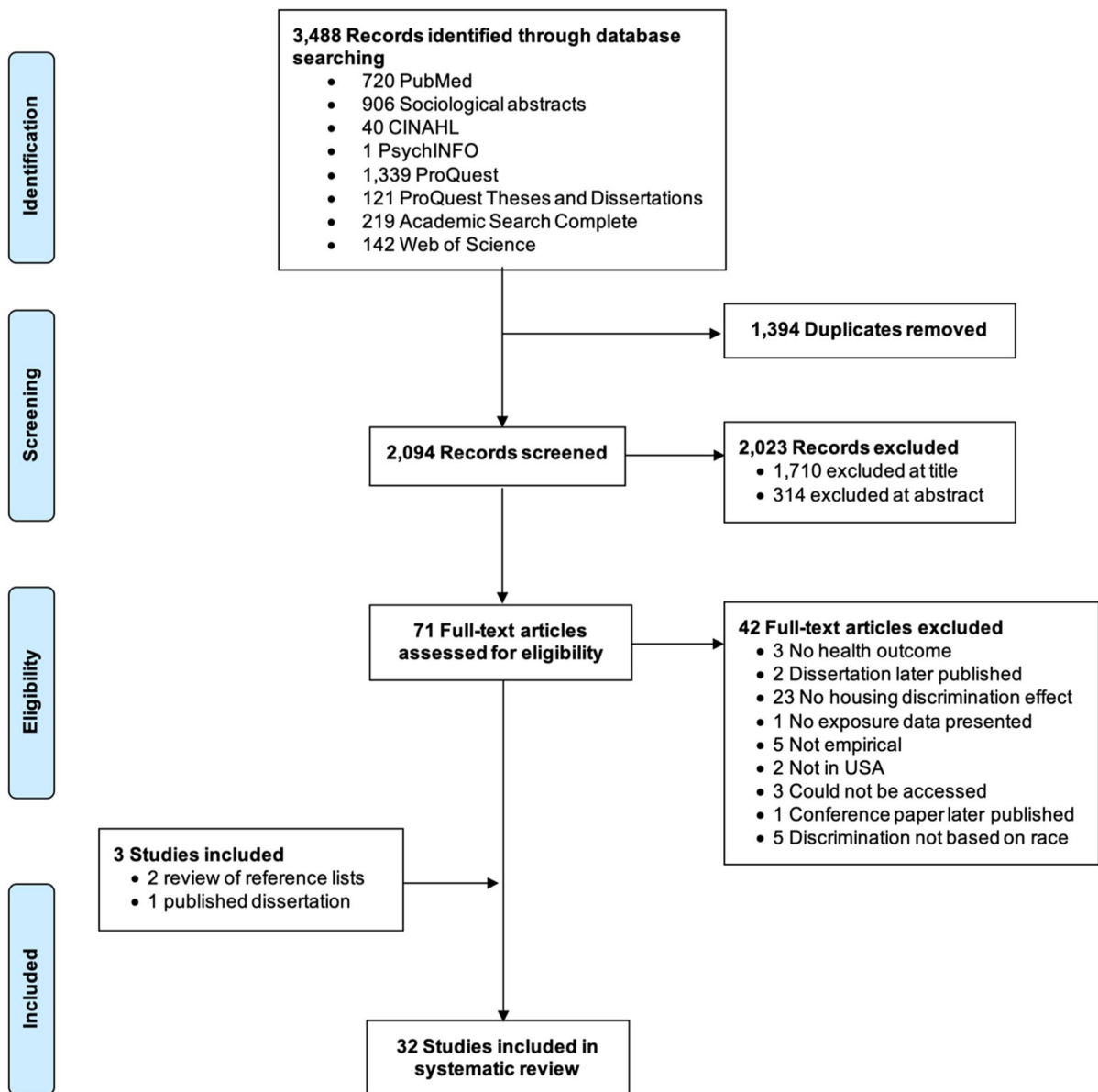


Fig. 1 PRISMA sample derivation flowchart

examined mortality. The remaining studies examined cardiovascular health ($n=2$), lead poisoning ($n=1$), and respiratory illness ($n=1$).

Of the 11 studies using self-reported measures of discrimination, the majority were published before 2020 (90.9%), used a national US-based sample (63.6%), and employed individual level analysis (72.7%). In contrast, of the 21 studies using administrative measures of discrimination, the majority were

published between 2020 and 2021 (52.4%), were set in a specific US state or municipality (85.7%) and applied multilevel analysis (57.1%). The racial/ethnic composition of samples also varied. For example, while 45.5% of studies using self-reported housing discrimination measures were restricted to a Black/African American sample, 42.9% of studies using administrative discrimination measures did not specify the racial/ethnic composition of the sample.

Table 2 Sample characteristics of empirical studies of housing discrimination and health by type of discrimination measure ($N=32$)

	Self-reported measures of discrimination	Administrative measures of discrimination	All studies
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Number of studies	11 (100%)	21 (100%)	32 (100%)
Publication year			
2000–2009	4 (36.4%)	1 (4.8%)	5 (15.6%)
2010–2019	6 (54.5%)	9 (42.9%)	15 (46.9%)
2020–2021	1 (9.1%)	11 (52.4%)	12 (37.5%)
Sample			
Sample size (range)			
Geographic location			
USA (National)	7 (63.6%)	3 (14.3%)	10 (31.3%)
State (CA, MA, TX, WI)	1 (9.1%)	7 (33.3%)	8 (25%)
Multi-county (Finger Lakes, NY)	0 (0%)	1 (4.8%)	1 (3.1%)
County (Milwaukee)	0 (0%)	1 (4.8%)	1 (3.1%)
East Coast City (New York, Philadelphia)	2 (18.2%)	4 (19%)	6 (18.8%)
Mid-West City (Chicago, Detroit, not specified)	1 (9.1%)	3 (14.3%)	4 (12.5%)
Southern City (Atlanta, GA—Metro)	0 (0%)	1 (4.8%)	1 (3.1%)
West Coast City (Los Angeles)	0 (0%)	1 (4.8%)	1 (3.1%)
Demographics			
Age			
Adolescents	0 (0%)	1 (4.8%)	1 (3.1%)
Adults	8 (72.7%)	15 (71.4%)	23 (71.9%)
Not specified	3 (27.3%)	5 (23.8%)	8 (25%)
Gender			
Women only	5 (45.5%)	9 (42.9%)	14 (43.8%)
All genders	6 (54.5%)	12 (57.1%)	18 (56.3%)
Racial/ethnic composition			
Black/African American only	5 (45.5%)	3 (14.3%)	8 (25%)
Chinese American only	0 (0%)	1 (4.8%)	1 (3.1%)
Black, white	2 (18.2%)	3 (14.3%)	5 (15.6%)
Black, Latinx, white	1 (9.1%)	4 (19%)	5 (15.6%)
Black, Latinx, white, other	2 (18.2%)	0 (0%)	2 (6.3%)
Asian-American, Black, Latinx, white, other	1 (9.1%)	1 (4.8%)	2 (6.3%)
Not specified	0 (0%)	9 (42.9%)	9 (28.1%)
Study design			
Cross-sectional	7 (63.6%)	20 (95.2%)	27 (84.4%)
Longitudinal	4 (36.4%)	1 (4.8%)	5 (15.6%)
Level of analysis			
Individual	8 (72.7%)	3 (14.3%)	11 (34.4%)
Ecologic	0 (0%)	6 (28.6%)	6 (18.8%)
Multilevel	3 (27.3%)	12 (57.1%)	15 (46.9%)
Measure of housing discrimination			
Self-report	11 (100%)	–	11 (34.4%)
Administrative			
Mortgage discrimination	–	9 (36.0%)	9 (28.1%)
Contemporary redlining	–	4 (16.0%)	4 (12.5%)

Table 2 (continued)

	Self-reported measures of discrimination	Administrative measures of discrimination	All studies
Historical redlining	–	10 (40.0%)	10 (31.3%)
Rate discrimination	–	1 (4.0%)	1 (3.1%)
Regulatory discrimination	–	1 (4.0%)	1 (3.1%)
Outcome			
Birth outcomes	1 (9.1%)	7 (33.3%)	8 (25%)
Cancer*	1 (9.1%)	6 (28.6%)	7 (21.9%)
COVID-19	0 (0%)	1 (4.8%)	1 (3.1%)
Cardiovascular health	1 (9.1%)	2 (9.5%)	3 (9.4%)
General health	5 (45.5%)	5 (23.8%)	10 (31.3%)
Heat-related disease	0 (0%)	1 (4.8%)	1 (3.1%)
Infant mortality	0 (0%)	2 (9.5%)	2 (6.3%)
Lead poisoning	0 (0%)	1 (4.8%)	1 (3.1%)
Mental health	3 (27.3%)	3 (14.3%)	6 (18.8%)
Mortality* (all-cause and disease-specific)	1 (9.1%)	2 (9.5%)	3 (9.4%)
Respiratory illness	0 (0%)	1 (4.8%)	1 (3.1%)

Percentages may not add up to 100 as studies may include multiple selections under each sub-category *includes one study in which Black-white disparity was a key outcome of interest

Conceptualization

About 69% of the sample studies did not include a specific definition of housing discrimination. There is a notable difference in studies examining housing discrimination at the individual and neighborhood levels. At the individual level (i.e., experiences of housing discrimination), studies overwhelmingly (80%) did not explicitly define housing discrimination. Those that did, defined discrimination broadly as “unfair treatment” in housing markets. Only one study, conducted by Osypuk et al. [35] names “white individuals” as the main perpetrators of housing discrimination.

At the neighborhood level, redlining was the most common conceptualization of housing discrimination. Most of the studies that examined “redlining”—historical and contemporary—explicitly defined the term in the article. However, there is not a universal conceptualization of redlining across the studies. Some defined redlining in terms of aggregated racial bias. For example, Mendez defined redlining as “the illegal practice of banks and financial institutions systematically denying mortgage loans, or providing loans with worse terms, to individuals and groups within an area based on race or socioeconomic status” [36]. While others define redlining as the *area-based*

discrimination. For example, Beyer and colleagues defined redlining as “the process of systematically denying mortgages based on location, where these locations are often defined by a predominant race or socioeconomic group” [37]. Still, others included both area- and group-based mortgage discrimination in their definitions. For example, in a different paper, Mendez defined redlining as the “institutional practice in which banks and other financial institutions deny loans to communities and individuals based on race” [38].

Beyer and colleagues differentiate redlining from racial bias in mortgage lending [37]. According to them, redlining is area-based exclusion regardless of the applicant’s race, and “racial bias in mortgage lending is conceived as the denial of mortgages to Black applicants, regardless of the neighborhood in which they intend, through a mortgage application, to reside” [37].

In another study, Sewell uses different terminology to address redlining and mortgage bias. Sewell conceptualizes both as *access* discrimination which they define as “inequalities in the ability to get an application funded in the primary mortgage market” [13]. Sewell was also the only study to conceptualize *regulation* discrimination which refers to “inclusionary processes [consisting of] inequalities in the federal

Table 3 Housing discrimination concepts and definitions by level of exposure ($n = 32$)

Concepts	Total n (%)	Definition provided?		Definitions
		Yes n (%)	No n (%)	
<i>Individual level</i>				
Unfair treatment	12 (38.7)	2 (16.7)	10 (83.3)	<p>“Discrimination behavior by white individuals in housing transactions excludes minorities from benefiting in housing markets (e.g., housing discrimination).” (Osypuk et al. 2019)</p> <p>“Housing discrimination is the unfair and unequal treatment of individuals or groups who seek housing due to their physical, social, or economic characteristics.” (Martinez 2019, Dissertation)</p>
<i>Neighborhood level</i>				
Redlining	19 (58.1)	15 (78.9)	4 (21.1)	<p>“Redlining contributes to segregation, occurring when lending institutions are biased in regard to their loan dealings with members of racial minorities” (Gee 2002)</p> <p>“Residential redlining, also known as mortgage lending discrimination, is the institutional practice in which banks and other financial institutions deny loans to communities and individuals based on race” (Mendez 2011)</p> <p>“Residential redlining refers to the institutional practice of discrimination in lending” (Mendez 2013)</p> <p>“Residential redlining is a specific institutional practice, and focus of this study, which was the illegal practice of banks and financial institutions systematically denying mortgage loans, or providing loans with worse terms, to individuals and groups within an area based on race or socioeconomic status” (Mendez 2014)</p> <p>“Redlining is the process of systematically denying mortgages based on location, where these locations are often defined by a predominant race or socioeconomic group. Redlining is more specifically about the neighborhood (albeit neighborhoods characterized by particular groups of residents, often defined by race, ethnicity or SES) than it is about the applicant’s race.” (Beyer et al. 2016)</p> <p>“Maps guiding home lending institutions and preventing non-white racial and ethnic groups from establishing residence in some neighborhoods. Neighborhoods designated undesirable for lenders were outlined in red on these maps, and the practice is now known as ‘redlining’” (McClure et al. 2019)</p> <p>“Redlining was a practice initiated in 1934 by the Federal Housing Administration, which marked maps with red lines to delineate neighborhoods where mortgages were denied to racial groups to steer them away from white neighborhoods” (Matoba 2019)</p> <p>“Historical discriminatory policies that shaped neighbourhood development.” (Nardone 2020b)</p> <p>“Redlining now refers to lending (or insurance) discrimination that bases credit decisions on the location of a property to the exclusion of characteristics of the borrower or property.” (Nardone 2020a)</p> <p>“The practice of categorizing perceived neighborhood mortgage investment risk” (Nardone 2020c)</p> <p>“Historical redlining refers to the New Deal-era discriminatory policy of disinvestment in communities with higher minority populations (Li et al. 2021)</p> <p>“One historic vehicle of discrimination and disinvestment was the practice of redlining: a formal practice of the federal government’s Home Owners’ Loan Corporation (HOLC) beginning in the 1930s to delineate areas where mortgages could be insured based on overtly racially discriminatory criteria.” (Hollenbach et al. 2021)</p> <p>“Neighborhoods designated undesirable for lenders were outlined in red and received a grade of ‘D,’ and the practice is now known as ‘redlining’” (Li & Yuan 2021)</p> <p>“The systematic implementation of discriminatory lending practices that denied mortgages in neighborhoods of color while insuring mortgages and reinvestment in predominantly white neighborhoods (Lynch et al. 2021)</p> <p>“Systematic denial of mortgage based on location.” (Collin et al. 2021)</p> <p>“Redlining” refers to the process of color-coding areas red if they included high concentrations of Black, immigrant, and working-class residents, deeming these areas hazardous and excessively risky for investment.” (Mujahid et al. 2021)</p>

Table 3 (continued)

Concepts	Total <i>n</i> (%)	Definition provided?		Definitions
		Yes <i>n</i> (%)	No <i>n</i> (%)	
Racial bias in mortgage lending	5 (12.9)	2 (25)	3 (75)	“Racial bias in mortgage lending is conceived as the denial of mortgages to Black applicants, regardless of the neighborhood in which they intend, through a mortgage application, to reside.” (Beyer et al. 2016) “Exclusionary processes [consist of] inequalities in the ability to get an application funded in the primary mortgage market” (Sewell 2016)
Regulation Discrimination/Credit Privatness	1 (3.2)	1 (100)	0 (0)	“Inclusionary processes [consist of] inequalities in the federal oversight of the applications that are funded in the primary or secondary markets” (Sewell 2016)
Total	37 (100)	20 (54.1)	17 (45.9)	

^aPercentage exceeds 100 due to studies with multiple housing discrimination exposures

oversight of the applications that are funded in the primary or secondary markets” [13].

All studies except for two defined redlining as the discriminatory provision of mortgage loans. In contrast, Nardone defined redlining as “the practice of categorizing perceived neighborhood mortgage investment risk” [39, 40] (Table 3).

Measurement

Of the 11 studies that examined individual-level experiences of housing discrimination, five relied on data from the Black Women’s Health Study (BWHS) [41–45], one uses data from the Survey of the Health of Wisconsin (SHOW) [46] and one used data from Coronary Artery Risk Development in Young Adults (CARDIA). BWHS and SHOW use the Major Experiences of Discrimination Scale [47], and CARDIA uses the Experiences of Discrimination Scale [48] to measure housing discrimination. Each study used a similar approach to isolate housing discrimination. Participants were considered exposed if they responded that they ever experienced discrimination while trying to obtain housing or remain in their neighborhoods. None of these studies analyzed the frequency of housing discrimination experiences. Furthermore, none of these studies indicate when individuals experienced housing discrimination.

The remaining four studies used three other data sources to measure housing discrimination. Yang and colleagues [49, 50] used the Public Health

Management Corporation’s (PHMC) Southeastern Pennsylvania Household Health Survey. This survey asked whether respondents experienced discrimination were “prevented from doing something, or made to feel inferior” in the housing market. Osypuk and colleagues used data from the Moving to Opportunity experiment [35]. This survey used two items to determine if people were exposed to housing discrimination. The first question asked if they were told that they could not rent a particular home. The second asked why they could not rent the home: race, children, source of income, and socioeconomic background. Finally, Rooks et al. [51] used multiple survey items to gauge whether respondents experienced any unfair treatment in housing. However, the authors are not explicit about the number of survey items.

A substantial number of studies examining neighborhood-level housing discrimination used the Home Mortgage Disclosure Act (HMDA) database to develop redlining and mortgage lending discrimination indices [13, 34, 36–38, 52–56]. The HMDA database provides information on applicant race, sex, and income as well as loan amount, location, and loan decision. These data allow scholars to determine where and to what extent there is a systematic bias in mortgage lending decisions. Scholars differed in how they operationalized redlining. Some studies operationalized a neighborhood as “redlined” if the odds of loan denial in a neighborhood were higher for racial minority applicants than white applicants. In comparison, others considered a neighborhood redlined if

the odds of loan denial within the neighborhood were higher relative to other neighborhoods, regardless of the applicant's race.

Beyer et al. and Sewell [13] examine both forms of discrimination (i.e., area-based and applicant-based) using different measures. For area-based discrimination, Beyer and colleagues use areal spatial filters to determine neighborhoods and logistic regression to calculate the odds of loan denial. Using theoretically meaningful neighborhood clusters, Sewell compares the denials rate within each area to the city median. None of the papers operationalizing "redlining" as the area-based likelihood of loan denial differentiate between neighborhoods with different racial compositions. In other words, neighborhoods are considered redlined if they have a relatively high denial rate regardless of whether they are all white or all Black neighborhoods.

Two studies, Sewell [13] and Lynch et al. [56], measured inclusionary forms of discrimination using HMDA data. Sewell calculated two variables to estimate regulation discrimination: area-based and applicant-based. For the area-based variable, they compared the proportion of private loans in each neighborhood cluster to the median proportion of private loans across all clusters. Neighborhood clusters with rates higher than the city median were classified as high, and those with rates lower than the city median were low. For the applicant-based variable, Sewell calculated risk ratios for each neighborhood cluster that compares the risk of obtaining a private loan for minority applicants to the risk of obtaining such a loan for the entire neighborhood cluster. These risk ratios were then compared to the city median risk ratios. Neighborhood clusters above the median were considered to have high "racialized credit privateness."

Lynch and colleagues [56] calculated rate spread to classify census tracts as being targeted for high-cost loans. Rate spread is the difference between the individual loan rate that was charged and the Average Prime Offer Rate (APOR) for that day. Census tracts in which more than 15% (median) of originated loans had rate spreads > 1.5 were classified as having high-cost loans.

Studies that examined *historic redlining* used the digitized Home Owners' Loan Corporation (HOLC) security maps [57]. Historically "redlined" neighborhoods were labeled "Hazardous" or given a D

grade on the HOLC maps. Most studies geocoded the HOLC maps and overlaid them with 2010 census maps. As a result, census tracts (or zip codes) were (1) fully captured within one HOLC designation, (2) partially captured in more than one HOLC designation, or (3) not captured at all by the HOLC maps. One study [56] used weighted scores to account for the neighborhoods with more than one HOLC designation. In this study, neighborhoods covered by redlined or "D" space were given a score of 4, while those with a coverage of 50% D grade and 50% C grade were given a score of 3.5 (Table 4).

Health Effects

Findings by Housing Discrimination Exposures

Experiences of housing discrimination. Among the 11 studies that examined experiences of housing discrimination at the individual level, 54.5% ($n=6$) reported positive (detrimental) associations, 18% ($n=2$) had mixed findings, and 27.3% ($n=3$) reported null results. Three of the six studies that reported statistically significant findings were conditional on a third variable. One study [41] found that for women with less than 12 years of education, experiencing housing discrimination was associated with preterm birth. Another [51] found an interaction between SES and race such that housing discrimination was associated with lower life satisfaction among low-SES Black women compared to middle-SES white women. Another study [58] reported that the relationship between housing discrimination and cardiovascular health (CVH) was conditional on race. White women who reported housing discrimination (compared to those who did not) had diminished CVH.

Other studies found perceived housing discrimination to be directly detrimental to health. Osypuk and colleagues [35] reported that perceived housing discrimination was associated with higher psychological stress and slightly higher major depressive disorder among adult heads of households. Additionally, Yang and Park [49] found that perceived housing discrimination is associated with poor self-reported health (SRH), increased stress, and increased mental illness in a sample of Philadelphia adults. Finally, housing discrimination was associated with increased uterine leiomyomata [42] in a national sample of Black women.

The studies that report mixed findings examined the relationship between experiences of housing discrimination and multiple health outcomes and reported inconsistent associations. For example, Yang [50] found that neighborhood context conditions the relationship between housing discrimination and health and that different neighborhood conditions (e.g., economic conditions vs. racial composition) change the relationship. In neighborhoods with average housing values, residents who perceived discrimination are *more* likely to report poor SRH. In neighborhoods with higher concentrations of Black residents and single-parent households, residents who perceived discrimination are *less* likely to report poor SRH, but only marginally.

Historical Redlining Among the ten studies that examined the relationship between historical redlining and present-day health outcomes, seven found that residence in historically redlined areas was associated with worse health outcomes [56]. Three of the ten used multilevel designs with geocoded birth record data to examine the relationship between current residence in a historically redlined area and adverse birth outcomes. Krieger et al. [59] found that compared to women living in areas graded A or “Best,” women living in those graded B, C, and D, had higher odds of delivering preterm. Hollenbach [61] also examined birth data but compared areas graded A or B to those graded C or D. They found lower grades were associated with higher odds of preterm birth. In the third study examining birth outcomes, Nardone et al. [39] had mixed results. The authors found a different relationship between HOLC grades and birth outcomes in the two California regions under study. In the San Francisco/Oakland metropolitan area, residence in grade C areas was associated with worse birth outcomes than in B-graded areas. However, compared to a residence in a C-graded census tract, living in D-graded census tracts was not associated with adverse birth outcomes. These patterns did not hold in Los Angeles. Surprisingly, residence in D-graded areas (compared to C) was associated with slightly better birth outcomes.

A multilevel analysis [64] of historical redlining and cancer reported mixed results. One study found that residing in a redlined census tract was not associated with breast cancer or cervical cancer risk. The

same study found that living in a historically redlined census tract was associated with a higher risk of being diagnosed with lung cancer at a later stage.

The final multilevel study with historical redlining as the primary exposure, led by Mujahid, found that Black residents in D-rated neighborhoods had lower cardiovascular health (CVH) scores than those in A-rated neighborhoods. This association was not present for other racialized groups [40].

The remaining studies examining historical redlining used ecologic designs and found positive associations with aggregated health outcomes, including prevalence of poor mental health [56], poor physical health [56], infant mortality [56], COVID mortality [62], asthma [60], and heat-related emergency department visits [63], and racial disparities in heart disease, diabetes, and cancer [65].

Contemporary Residential Redlining Overall, the evidence on the health implications of neighborhood-based mortgage exclusion is mixed. Two studies, one examining colorectal cancer mortality [55] and the other [13], lead poisoning and general health, found null results. One study demonstrated that area-based mortgage exclusion was associated with increased all-cause mortality among Black women with breast cancer but a slight *decrease* in breast cancer-specific mortality risk [37]. Another study [52] found redlining was associated with small increases in cancer mortality disparities. This association was positive for men and null for women.

Racial Bias in Mortgage Lending The studies examining the health implications of systematic racial bias in mortgage lending were mixed. Some of these studies [34, 36, 38, 53, 54] use the terminology of “redlining,” but the methodology is consistent with mortgage discrimination studies.

Three studies reported null results. These studies examined various health outcomes, including general health status [13], stress [54], and infant birth weight [38]. Among those with statistically significant findings, the direction of the association was mixed. Three studies [37, 53, 55] reported that living in an area characterized by higher racial bias in mortgage lending is associated with worse health outcomes.

Table 4 housing discrimination data sources and measurement ($n = 32$)

Housing discrimination construct	Data source(s)	Methodology
Experiences of housing discrimination	Black Women's Health Study (BWHS); Survey of the Health of Wisconsin (SHOW); Coronary Artery Risk Development in Young Adults (CARDIA); Public Health Management Corporation's (PHMC) Southeastern Household Survey; Moving to Opportunity (MTO) for Fair Housing Demonstration Project; YES Health study	<p>Rosenberg et al. (2002), Cozier et al. (2006), Taylor et al. (2007), Wise et al. (2007), and Albert et al. (2010) used BWHS data. They dichotomized the responses to the question, "Have you ever been treated unfairly because of your race on the job, in housing, and by the police?" adapted from the Major Experiences of Discrimination Scale [47]. Estimates were calculated for each domain of discrimination separately; Cancel Martinez (2019) used a similar methodology using SHOW data</p> <p>Bey et al. (2020) used CARDIA data for year 7 after baseline. Participants were considered exposed to housing discrimination if they answered yes to experiencing discrimination in housing due to race <i>and</i> gender. CARDIA used the Experiences of Discrimination Scale [48]</p> <p>Yang and Park (2015) and Yang et al. (2016) used PHMC data. To develop the housing discrimination variable, they dichotomized the responses to the question, "Have you ever experienced discrimination, [or] been prevented from doing something or been hassled or made to feel "inferior" due to race/ethnicity or color in the health care system or housing market." Estimates were calculated for each domain of discrimination separately</p> <p>Osypuk et al. (2019) used MTO data and developed a housing discrimination variable using a series of 2 questions: First, "Since [year] have you gone in person to rent a house or apartment you thought was available and been told by a landlord, real estate agent, or manager you could not rent it?" Those that answered yes were asked: "For the most recent time this happened, what was the main reason they gave for not renting the house or apartment to you?" Respondents reporting the following reasons were considered exposed to housing discrimination: "don't rent to Sect. 8," "don't rent to people from public housing," "don't rent to people with children or with too many children," "don't rent to White/Black/Hispanic/Asian people."</p> <p>Rooks et al. (2011) used YES Health Study data. Respondents were asked a series of housing discrimination questions: "if they were ever unfairly prevented from moving into a neighborhood because the landlord or a realtor refused to sell or rent a house or apartment to them, unfairly treated by neighbors who made life difficult for them or their families, or experienced other [unfair treatment] in terms of housing." The authors created two binary housing discrimination variables: lifetime experience and experience in the last year</p>

Table 4 (continued)

Housing discrimination construct	Data source(s)	Methodology
Historical redlining	Home Owners Loan Corporation (HOLC) security maps	<p>Krieger et al. (2020a, 2020b) used the 1938 HOLC security map to overlay the grades (A-D) on the 2010 census map. Census tracts (CT) not entirely in one HOLC area were assigned the grade corresponding to 50% coverage. CTs with less than 50% coverage in one HOLC area were assigned “other.” Li et al. (2021) used zip code tabulated areas (ZCTA) as the unit of analysis and calculated the proportion of land covered by various HOLC grades to assess ZCTAs with partial coverage</p> <p>Nardone et al. (2020a, 2020b) assigned HOLC grades based on geographic centroids at the 2010 CT level. Tracts whose centroids did not fall into a HOLC boundary were excluded; Nardone et al. (2020c) assigned a HOLC grade to each birth by overlaying the HOLC map onto geocoded addresses from birth certificates. Births without a grade were marked “not graded.” Births outside map boundaries were excluded; McClure et al. (2020) overlaid the 1939 HOLC map with Detroit’s Historic Neighborhood Map. They calculated a continuous variable that represented the proportion of the neighborhood that was redlined space</p> <p>Mujahid et al. (2021) overlaid the digitized HOLC maps on 2000 Census tracts in seven MESA cities. Then, they calculated each tract’s proportion of land corresponding to a HOLC grade. Each tract was given a score based on those proportions (A = 1, B = 2, C = 3, D = 4). If a tract had two or more grades, they rounded the score to the nearest grade. A tract with 30% of its land in a B-rated area, and 50% in a C-rated area, would receive a score of 2.62, which would be rounded to 3 or a HOLC grade of C. Lynch et al. (2021) used a similar process using 2010 census tract boundaries</p> <p>Hollenbach et al. (2021) used zip codes as the unit of analysis and made HOLC grade assignments based on “direct visual overlay.” The authors do not specify how they handled zip codes with more than one HOLC grade</p>
Contemporary redlining	Home Mortgage Disclosure Act (HMDA) database	<p>Beyer et al. (2016) and Zhou et al. (2017) used adaptive spatial filters (ASF) as the areal unit of analysis and used logistic regression to compare the odds of loan denial within the filter (neighborhood) to those outside the filter. The authors created two measures, one adjusting for sex and loan amount—the other adjusting for sex, loan amount, and race/ethnicity of the primary applicant. An odds ratio < 1 corresponds with areas less likely to be denied. An odds ratio > 1 corresponds with areas more likely to be denied</p> <p>Sewell (2016) does not use the term “redlining”; instead, they use “neighborhood credit refusal.” They calculated the median “loan denial” rate of all the neighborhoods in the study. Neighborhood clusters with a denial rate higher than the median were considered high, while those below the median were considered low</p> <p>Lynch et al. (2021) measured contemporary redlining by calculating the relative access to homeownership. Census tracts with fewer than 5 originated loans per 1000 households were considered to have low lending</p>

Table 4 (continued)

Housing discrimination construct	Data source(s)	Methodology
Racial bias in mortgage lending	HMDA database	<p>Gee (2002), Mendez et al. (2011, 2012, 2014), and Matoba et al. (2019) calculated mortgage discrimination index using multilevel logistic regression where the outcome was the odds of loan denial of the minoritized group compared to white applicants after adjusting for the loan amount, income, and gender of the applicant. The authors used two specifications: for the dichotomous variable, a CT was considered redlined if there was a 40% or greater (aOR ≥ 1.4) odds of denial for the minoritized group. For the continuous variable, the authors used the odds ratio from the logistic model</p> <p>Beyer et al. (2016) and Zhou et al. (2017) used the same ASF technique mentioned above and logistic regression to derive the odds of a Black applicant being denied a loan versus the White applicant controlling for sex and the loan amount/income ratio. They used a threshold of 5 minimum denials for each racial group to avoid large OR and CIs; Beyer et al. (2019) used logistic regression but measured mortgage bias at the metropolitan statistical area (MSA) level</p> <p>Sewell (2016) does not use the term “racial bias in mortgage lending.” Instead, they use “racialized credit refusal.” They calculated risk ratios for each neighborhood cluster that compares the risk of loan application denials for minority applicants to denial for the entire neighborhood cluster. These risk ratios were then compared to the city median risk ratios. Neighborhood clusters above the median were considered to have high “racialized credit refusal,” and those below the median were considered to have low “racialized credit refusal.”</p>
Mortgage rate discrimination	HMDA database	<p>Lynch et al. (2021) created an indicator for rate spread which the difference between the individual loan rate that was charged and the Average Prime Offer Rate (APOR) for that day. Census tracts in which more than 15% (median) of originated loans had rate spreads > 1.5 were classified as having “high-cost loans.”</p>
Credit privateness	HMDA database	<p>Sewell (2016) developed two variables: neighborhood credit privateness and racialized credit privateness. Private loans are not insured by the government or securitized by a government-sponsored enterprise. Neighborhood credit privateness was calculated by comparing the proportion of private loans in each neighborhood cluster to the median proportion of private loans across all clusters. Neighborhood clusters with rates higher than the city median were classified as high, and those with rates lower than the city median were low</p> <p>To calculate racialized credit privateness, Sewell (2016) calculated risk ratios for each neighborhood cluster that compares the risk of obtaining a private loan for minority applicants to the risk of obtaining such a loan for the entire neighborhood cluster. These risk ratios were then compared to the city median risk ratios. Neighborhood clusters above the median were considered to have high “racialized credit privateness,” and those below the median were considered to have low “racialized credit privateness.”</p>

HMDA Home Mortgage Disclosure Act; *HOLC* Home Owners Loan Corporation; *BWHS* Black Women’s Health Study; *CARDIA* Coronary Artery Risk Development in Young Adults; *MESA* multi-ethnic study of atherosclerosis; *CT* census tract; *CI* confidence interval

Zhou [55] found that racial discrimination in mortgage lending was associated with a greater hazard rate for Black adults with colorectal cancer. There was no association for white adults. Racial bias in mortgage lending was also associated with poorer colorectal cancer survival for Black women compared to the overall sample. In a different study, the same authors [37] found that racial bias in lending increased the hazard rate by 49% as binary categorization. Finally, studying only Black women, Matoba et al. [53] found that residence in an area with racial discrimination in mortgage lending was associated with a slight increase in odds of preterm birth compared to women in areas without systematic bias.

Contrary to expectations, three studies found that living in a neighborhood with racial bias in mortgage lending has a protective effect on health. Gee [34] reported that residence in neighborhoods with higher odds of loan denials for Chinese applicants was associated with better self-reported health and mental health among Chinese adults. Mendez [36] found that residence in an area characterized by mortgage discrimination was associated with decreased risk of preterm birth for Black, Latinx, and white women. Finally, Collin et al. [66] found that residence in census tracts with high lending bias is associated with a 14% decrease in cancer mortality adjusting for age and cancer stage.

Inclusionary Discrimination Only two studies examined inclusionary housing discrimination. Sewell [13] found mixed results. Racialized credit privateness was not associated with general health status or lead poisoning. However, the rate of lead poisoning was substantially higher in neighborhoods with a disproportionately high number of federally regulated loans. Lynch and colleagues [56] combined their measure of inclusionary discrimination (rate spread) with another indicator of discrimination to create a measure of contemporary lending discrimination. Therefore, they did not report the association between rate spread, alone, and health outcomes. However, they found that compared to residents in tracts with no present-day discrimination, those living in tracts with current discrimination (high-cost loans or lack of homeownership) had worse physical and mental health.

Discussion

In this review, we assessed the state of the scholarship examining the relationship between racialized housing discrimination and population health outcomes. First, we determined how this body of work defines housing discrimination. Second, we assessed the methodological tools and strategies used to measure housing discrimination. Finally, we synthesized the findings on the relationship between housing discrimination and health outcomes. Our results reveal limited literature on how racialized housing discrimination impacts health, as only 32 studies across 21 years met the inclusion criteria. While more research is needed, the studies included in the review suggest that this is a promising area of research to better understand and potentially intervene on this form of racism.

Defining Housing Discrimination

About half (47.2%) of the studies did not offer a conceptual definition of housing discrimination. Those that did tend to have housing discrimination as the sole exposure instead of in conjunction with other types of discrimination. The different conceptual definitions across studies have important implications for understanding how this pervasive form of discrimination impacts health and what can be done about it. Epidemiologically, specific conceptual definitions are needed to estimate causal relationships. More importantly, clear definitions are required to develop effective interventions to address discrimination from a public policy standpoint. Population health scholars might benefit from defining the parameters of various forms of housing discrimination to better capture complexity.

Among the studies that defined housing discrimination, there were inconsistencies in the linkage between conceptual and operational definitions. This was especially the case for the studies of contemporary “redlining.” In general, redlining refers to a system of marking neighborhoods as risky—or hazardous—for lenders, mainly based on the race of occupants in the area. The studies in this review raise two concerns related to conceptual and operational definitions. First, most studies define redlining as “neighborhood loan denials” rather than a “labeling of neighborhood risk.” This conceptual definition is problematic because systematic loan denials are only one consequence of the racial marking of

neighborhoods. Thus, scholars operating from this definition will unintentionally ignore other consequences of redlining, such as predatory inclusion [67]. Racialized lending patterns included both disinvestment (i.e., systematic neighborhood loan denials), and exploitative investment [68]. There is historical evidence that the marking of an area as “risky” may result in the practice of economic exploitation [68]. For example, these neighborhoods might be targeted for high-interest (i.e., sub-prime) loans. This complicates how scholars may understand how this type of discrimination is related to health. Only one study reviewed here differentiated—in conceptualization and operationalization—between exclusionary and inclusionary discrimination in the mortgage market and found that each type related to health outcomes differently [13].

This imprecise definition of redlining also leads to the second issue, which centers on the question: which neighborhoods are being redlined? Standard measures of contemporary redlining do not indicate the extent to which racial composition is related to neighborhood loan denials or neighborhood high-cost loans. In other words, we do not know from these studies if neighborhoods with relatively higher mortgage denial rates are predominantly Black or another racialized group. The underlying assumption that neighborhoods with high rates of loan denial are non-white neighborhoods is supported by a recent study showing that neighborhoods with higher proportions of white residents have higher rates of loan approvals [69]. Nevertheless, nuances in the racialized housing market warrant more granular racial disaggregation. Thus, excluding the neighborhood’s racial composition from the measure may obscure relevant associations in these neighborhoods. The lack of racial variation in the redlining indices may explain why the results were null for these measures.

Given these challenges, we argue for a more specific definition of redlining that emphasizes the racial marking of space. Scholars, using this definition, can then explore various consequences of racial marking and their relationship to health.

Methodological Considerations: Limits of Current Measures

All studies in this review likely underestimated housing discrimination. More than a third of the studies

examined self-reported experiences of housing discrimination and used one item of a larger discrimination scale. Though the prevalence of housing discrimination is high, particularly among Black women, it is unclear whether one item is sufficient to capture the complexity of housing discrimination. Research on eviction shows that multiple survey items could capture experiences of displacement better than one question because people often interpret “eviction” in a narrow way [70]. The same argument can be made for the term “housing discrimination.” In a 2002 study examining public knowledge about housing discrimination laws, respondents were asked to identify behavior that qualifies as housing discrimination in a set of eight hypothetical scenarios [71]. Less than 15% of the sample could correctly identify all eight, and those that could were more likely to have higher incomes. This suggests that the public is unaware of all the activities under the umbrella of housing discrimination. Therefore, studies asking about experiences of housing discrimination only using one item may unintentionally ignore a wide range of activities that should be considered.

The studies using administrative data to measure neighborhood-level housing discrimination also suffer from using single measures. This is because there are limitations in the available data sources to measure housing discrimination. About half of these studies used data from the HMDA database. While it is useful for this type of research, one of HMDA’s major limitations includes missing data—which is often missing not at random. In one of the studies reviewed here, Zhou and colleagues note that substantial data was missing in their Wisconsin-based study. They explain, “[o]f a total of 396,032 total applications for the purchase of an owner-occupied home, approximately 40% of applications were missing data on at least one of these variables; 32% of applications were missing approval/denial status” [55]. Thus, the validity of the measures using the HMDA database depends on the extent to which banks and other mortgage providers fully report their lending practices. So, while these data are “unobtrusive” they are not unbiased or objective. Research has shown that HMDA data on applicant race, for example, is disproportionately missing for loan denials in jurisdictions with more households of color; thus, housing discrimination prevalence in these studies may also be underestimated [72].

The remaining neighborhood-level studies in this review used historical “redlining” maps as the primary data source. These studies used slightly different methods to assign HOLC grades to modern-day spatial units of analysis ranging from census tracts to zip codes. However, the extent to which the HOLC grades are valid historical exposures is unclear. Studies suggest that the color-coding of neighborhoods as risky led to discriminatory lending practices, divestment, and the associated urban health sequelae. However, urban scholars have challenged several of these assumptions with detailed historical analysis. First, the assumption that ideas about race were systematically embedded in the map-making process is challenged by Michney’s historical work demonstrating that the on-the-ground fieldwork linking race and mortgage security risk was “idiosyncratic, arbitrary, and variable” [73]. Second, the assumption that HOLC used the maps to deny loans to Black residents is challenged by Fishback [74] who reminds us that HOLC did loan to Black people in relative proportion to their population size. This was because the HOLC program was devised as a refinancing program during the Great Depression. In fact, 97% of these refinance loans were already closed before the HOLC security maps were complete [73]. Taken together, these scholars argue that these maps were, at best, a proxy for *previous* exclusionary practices rather than a guide for future lending [68, 75]. Third, the assumption that neighborhoods with different color-coded grades were treated differently by lending institutions is partially challenged by Hillier [68, 76]. She found that, in the case of Philadelphia, HOLC grades were not linked to disinvestment as commonly thought, but rather to differences in interest rates. Mortgages in redlined areas had higher interest rates suggesting a form of inclusionary discrimination.

At the same time, the categorization or “spatial marking” [77] of neighborhoods was not without consequences. There is a consensus among these scholars that HOLC and the FHA used their lending and insurance products in ways that reinforced segregation [74, 78, 79]. For example, Faber’s extensive historical research shows that while HOLC may not have contributed to large-scale disinvestment as previously thought, the cities that the organization mapped became more segregated than those that were not [77, 78]. As we discussed earlier, deeply entrenched

segregation has health implications. These complexities highlight the limitations of using one data source—HOLC security maps—to explain structural health inequities. To understand the mechanisms by which historical discriminatory practices and policies may impact present-day patterns in health, population health scholars might benefit from historical analyses of additional data sources, as the relationship between the HOLC maps and actual historical lending practices is not straightforward.

Reconciling Unexpected and Contradictory Findings

Does mortgage discrimination improve health? It is widely accepted in the field of population health that housing discrimination is harmful to health, but several studies show a “protective” effect. Three studies [34, 36, 66] found that living in a neighborhood characterized by racialized mortgage discrimination was associated with *better* health outcomes. This finding can be explained by how area-level discrimination is measured. The individuals presumably excluded from neighborhoods where there is mortgage discrimination (i.e., the individuals experiencing discrimination) are not the same individuals currently living in the neighborhoods whose health outcomes are being measured. In other words, the people whose health is “protected” are the people who were not denied a loan. It is important to note that in these studies, minoritized households were systematically—but not totally—excluded from these neighborhoods. Thus, those who avoided that exclusion may have (1) been more likely to have better health to begin with and (2) benefitted from the resources available to other residents. Neighborhoods where minoritized people were *more* likely to get loans, on the other hand, may have fewer health-promoting resources. Suggesting, again, that exclusion is just one form of housing discrimination that should be captured in this body of work. Thus, these findings should not be interpreted as evidence that mortgage discrimination is beneficial for health. Instead, they should push scholars to conceptualize and measure the relational nature of space with attention to the role of power in being able to choose one’s residential location [80]. People excluded from one neighborhood via discrimination must live somewhere. Therefore, our discrimination measures should attempt to capture how processes of inclusion and exclusion and resource hoarding and deprivation are intertwined [81].

Is contemporary redlining inconsequential? While most studies examining historical redlining demonstrate a detrimental association with health, there is little evidence that present-day neighborhood-based mortgage exclusion is associated with health outcomes. On the surface, it may seem that present-day discrimination is less influential for health than historical discrimination. However, several factors may explain the lack of a relationship. First, scholars do not include the racial composition of neighborhoods. As previously mentioned, this oversight may lead to misclassifying neighborhoods as racially marked, potentially obscuring health impacts. Second, wholesale exclusion in the mortgage market is less prevalent than popularly thought. Instead, modern-day discrimination in the mortgage market is more complex and includes reverse-redlining or predatory inclusion as well as racialized reinvestment [67, 82]. Explicit exclusionary discrimination is no longer legal, and exclusion may not be as profitable, so banks may be more likely to include racially marked areas on an exploitative basis. Third, when neighborhood-based exclusion from the mortgage market is a part of a larger system of community divestment, it is only one dimension. Structural neglect is caused by a combination of institutional actors, including municipalities. The studies included here may be proxying disinvestment but to measure multidimensional nature of disinvestment and structural neglect, scholars will have to look beyond mortgage discrimination and examine municipal behavior.

How are past and present housing discrimination related? Many of the studies reviewed here examine either historical or present-day housing discrimination. However, research incorporating both historical and contemporary measures can highlight important nuances between seemingly similar neighborhoods. Only two studies reviewed here attempted such an analysis. McClure and colleagues examined how the foreclosure recovery was slower in formerly redlined neighborhoods [83]. While Lynch et al. [56] estimated trajectories of housing disinvestment in Milwaukee. Both studies suggest a potentially compounding impact on neighborhood health inequalities. However, even in these studies, there is a large gap between the 1930s and today. Several housing and neighborhood processes could explain the associations between historical redlining and health. First, subprime lending. Many formerly

redlined communities of color were targeted for subprime lending (i.e., reverse redlining) and were subsequently hit hard by foreclosures during the Great Recession [84, 85]. Subprime lending is a form of wealth extraction and could plausibly explain the relationships documented between historical redlining and present-day health. Second, gentrification. Other neighborhoods locked out of mortgages in the twentieth century became targets of postwar capital investment, fueling gentrification, changing the housing and demographic landscape. Gentrification continues today in many formerly redlined neighborhoods through tax policies like opportunity zones which reduce capital gains taxes for investors who build or purchase properties eligible neighborhoods [86]. Thus, gentrification could plausibly explain some of the associations documented in the historical redlining studies. For instance, Mujahid and colleagues' analysis found that a higher rated present-day social environment reduced the strength of the association between redlining and health. However, this finding may reflect those who are able to stay in neighborhoods undergoing social transformations. Third, deindustrialization. The abrupt transition away from an industrial economy fueled capital flight and weakened property tax revenue in urban communities contributing to a host of economic and health effects [87–89]. As these three examples demonstrate, understanding how racialized housing discrimination as a form of institutional racism impacts health requires more attention to the intimate connection between the racialization of space, housing markets, and neighborhood processes over time.

A Research Agenda

Based on the findings of this review, we present a research agenda to address some of the gaps in our current knowledge base.

1. *Diversify data sources on housing discrimination.* There are not enough data sources to measure housing discrimination in the population health literature. We suggest four ways these data sources can be improved. First, for individual-level exposures, we suggest more detailed survey data. Surveys are an important tool to link housing experiences with individual-level

health outcomes. However, one item on a survey cannot capture the complexities of housing discrimination. A 2005 Urban Institute and HUD report used 17 items to assess respondents' experiences with housing discrimination [90]. It asked about the type of perceived discrimination, why they think they were discriminated against (e.g., race, source of income, disability), the role or occupation of the discriminator, and included open-ended questions allowing for the respondents to describe the experience in their own words. Future surveys could additionally ask how the perceived discrimination impacted their subsequent living situation. Second, there are no neighborhood-level studies focused on rental market discrimination. Only 40.6% of Black households and 46.6% of Latinx households own their homes compared to 73.1% of white families [91]. To our knowledge, no database tracks rental decisions made in the public or private rental market. Recently, scholars have been using online search engines such as Craigslist to assess housing discrimination. However, like audit studies, online assessments of rental discrimination can tell us how prevalent discrimination is in an area but linking this information to health data might prove challenging. Third, population health scholars interested in racism in the housing market should examine inclusionary discrimination. Predatory inclusion may be a more common form of housing discrimination today than outright exclusion in the early twentieth century [67]. Only one study in this review examines high-cost loans as a type of housing discrimination [56]. HMDA provides data on interest rates that could be used to understand the link between subprime lending and racial health disparities. Another potentially fruitful area of research might be discrimination in the home appraisal process [92, 93]. Fourth, scholars must start going beyond redlining to understand how historical racism in housing impacts present-day health inequities. Due to data availability—notably the digitizing of HOLC maps by Mapping Inequality—there has been almost a fetishization of redlining as a measure of racism in the population health literature. Redlining only represents one component of the racist housing system in the USA, but scholars have increasingly used it

as a proxy for institutional racism at large. However, as Alex Hill astutely argues, when researchers use redlining as a metaphor for structural or institutional racism, they unintentionally ignore the other discriminatory practices and policies that link race and value, which ultimately harms health for some and promotes health for others [94, 95]. These other discriminatory practices, from exclusionary zoning to the financialization of housing markets, continue to shape where people can live and should be studied with as much rigor in the public health literature [96].

2. *Explore displacement and dispossession.* The studies in this review primarily focus on discrimination while accessing new housing. Future studies might consider discrimination across the housing continuum. These studies could examine discrimination related to the ability to remain in a home (e.g., informal evictions) or upkeep a home (e.g., home improvement loans). The literature on the impact of displacement and dispossession on health is largely missing from this review. Our search returned studies on the health implications of eviction [97–101] and foreclosures [102–108]. We found none specifically linked *discriminatory* (i.e., disparate intent or outcome) evictions or foreclosures to health outcomes. This may be an important research agenda as housing costs are increasing in most jurisdictions across the USA while wages remain stagnant. This research may be particularly relevant during the ongoing COVID-19 pandemic as landlords across the country found ways to circumvent the federal eviction moratorium put in place by the US Centers for Disease Control and Prevention (CDC) [109]. To capture discriminatory evictions, scholars might focus their attention on serial evictors that concentrate in Black and Brown neighborhoods [110, 111]. Regarding upkeep, discrimination might be directly associated with health outcomes as homes can literally become unhealthy with sustained structural neglect.
3. *Identify causal pathways.* Studies included in this review mainly examined associations. But finding associations, particularly with historical exposures, should only be a first step. To build on this work, researchers should explore and test causal pathways to explain why some housing discrimination exposures are linked to health outcomes in

specific populations in specific geographies. For example, historical redlining was associated with lung cancer but not breast or colorectal cancer. An exploration of causal pathways might explain why this is the case. Perhaps the association with lung cancer is related to the deliberate concentration of environmental pollutants in certain neighborhoods [112]. Research in this vein can help scholars and policymakers tease out these associations and make more informed decisions about place-based interventions. Several potential mechanisms linking housing discrimination and health exist, including mental health, built environment, and limited access to opportunities over time [113]. Furthermore, qualitative and mixed methods research can both deepen our knowledge about context-specific mechanisms (e.g., precarious wage labor, intersectional stigma and discrimination, government abandonment, and natural disasters) linking racialized housing discrimination and health and unveil new and/or understudied pathways [114–116]. In turn, these methods can reveal limitations in the dominant ways that housing discrimination is measured and interpreted.

Limitations

We did not include a meta-analysis due to the heterogeneity in the racialized housing discrimination exposures, outcomes, and study designs. Additionally, our review may suffer from publication bias as null findings may be less likely to make it into the peer-reviewed process. We also may have missed some published studies that reported the relationship between housing discrimination and health but did not emphasize the findings in the text of the articles. We attempted to limit these omissions by including in our search terms discrimination scales that specifically mention housing discrimination and thoroughly searching both the text and the tables for potential associations. We included all associations regardless of whether they were focal features of the respective articles. Our results are also limited by the specific search terms, databases, and protocols we used. However, our terms were broad, and we used a snowball method to identify additional articles that our search may have missed.

We limited our scope to studies that report at least one health outcome. We exclude drug use and other health behaviors which are important mediators for health. Future reviews could include how racialized housing discrimination shapes social and sexual networks, geographic access to healthcare, nutritious food options, exposure to hazardous toxin sites, and opportunities to engage in physical activity. Additionally, we intentionally avoid cross-national comparisons by limiting the search to publications focused on the USA. However, we acknowledge the global prevalence of racial and ethnic discrimination in housing. Future work should explore the heterogeneous legal landscape regarding racialized housing discrimination to develop and understand global comparisons.

Finally, our results are limited to studies examining racial discrimination in housing. We recognize that individuals and institutions engage in housing discrimination based on disability, gender, sexual orientation, children, age, unsheltered status, felony status, drug use, and other experiences. These identities and experiences intersect with race in important ways [117, 118]. We limited the scope of our search to those directly assessing racialized housing discrimination in order to highlight its impact as a form of institutional racism.

Conclusion

Critical conceptual and methodological gaps exist in the literature exploring racialized housing discrimination and health. This crucial lever in the “race discrimination system” [119] must be better understood to improve population health equity. Our review highlights the merits of housing discrimination measures using survey and administrative data. However, inconsistencies in how various forms of housing discrimination were defined and measured hinder our understanding. Future research should seek to diversify data sources, examine discrimination across the housing continuum, including dispossession and displacement, and explore causal pathways from housing discrimination to health. This research should be grounded in the history and political economy of specific places to improve how we measure housing discrimination, understand its relationship to health, and develop meaningful policy interventions (Table 5).

Table 5 Summary of health effects of housing discrimination ($n = 32$)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
1. Albert et al. (2010)	Black women	48,924	Experiences of housing discrimination	Mortality	Null: Relative to Black women who did not report housing discrimination, those that did report discrimination experienced no statistically significant differences in mortality (HR = 1.0, 95% CI: 0.9–1.2)
2. Bey et al. (2020)	Black and white adults	3758	Experiences of housing discrimination	Change in cardiovascular health	Detrimental/conditional: For white women, self-reported racial discrimination while seeking housing was associated with lower CVH scores ($B = -1.5$, 95% CI: $-2.5, -0.4$); this relationship was null for Black women, Black men, and white men
3. Beyer et al. (2016)	Black women	1010	<ul style="list-style-type: none"> • Residential redlining • Racial bias in mortgage lending 	<ul style="list-style-type: none"> • All-cause mortality • Breast cancer mortality 	Mixed: Areas characterized by racial bias measured as ZCTA (HR = 1.16, 95% CI: 1.04–1.29) or a binary categorization (HR = 1.49, 95% CI: 1.13–1.96) had increased hazard. Areas characterized by residential redlining measured as ZCTA area average had reduced hazard (HR = 0.73, 95% CI: 0.59–0.90)
4. Beyer et al. (2019)	Black and white adults	100 (MSAs)	Racial bias in mortgage lending	Black/white disparities in: <ul style="list-style-type: none"> • Cancer incidence • Cancer mortality 	Detrimental: Adjusting for household SES and segregation variables, mortgage discrimination was associated with slight increases in cancer mortality disparities ($B = 0.05$, $p = .034$). In gender-stratified models, the association was positive for men ($B = 0.05$, $p = .041$) and null for women ($B = 0.04$, $p = .134$)

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
5. Collin et al. (2021)	Black and white women	8523	<ul style="list-style-type: none"> Residential redlining* Lending bias + 	Breast cancer mortality	<p>Mixed: In the overall sample, residing in a redlined neighborhood was associated with an increase in the estimated mortality rate (HR = 1.97; 95% CI, 1.71–2.27), and a one-unit increase in the redlining measure was associated with an increase in mortality rate (HR = 1.19; 95% CI, 1.15–1.24).</p> <p>This relationship held for non-Hispanic white women (1.28; 95% CI, 1.14–1.44) but was null for non-Hispanic Black women (1.03; 95% CI, 0.97–1.08).</p> <p>Each one-unit increase in lending bias measure was associated with a decrease in cancer mortality among the overall sample (HR = 0.93; 95% CI, 0.90–0.97) and non-Hispanic white women (HR = 0.96; 95% CI, 0.90–1.02).</p> <p>The association was null for non-Hispanic Black women</p>
6. Cozier, et al. (2006)	Black women	2316	Experiences of housing discrimination	Hypertension	<p>Null: Among the total sample, housing discrimination was not associated with hypertension incidence rate (IRR: 0.9, 95% CI: 0.8–1.0).</p> <p>Results were similar among women born outside of the US (IRR: 1.0, 95% CI: 0.6–1.7) and women who grew up in predominantly white neighborhoods (IRR: 1.0, 95% CI: 0.7–1.4)</p>
7. Gee (2002)	Chinese American adults	1503	Residential redlining*	<ul style="list-style-type: none"> Self-rated health status Mental health Physical functioning 	<p>Protective: Residence in a “redlined” neighborhood was associated with better SRH ($\beta = 6.99$, SE = 1.79, $p < 0.001$) and better mental health ($\beta = 3.28$, SE = 0.92, $p < 0.001$); the findings were null for physical functioning</p>

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
8. Hollenbach et al. (2021)	Adult women	64,804	Historical redlining	Preterm birth	Detrimental: Compared to women residing in zip codes formerly graded A or B, women living in areas graded D (i.e., redlined) had higher odds of preterm birth (OR: 1.46, CI: 1.08–1.97) adjusting for community-level socioeconomic
9. Krieger (2020)	Adults	Varied	Historical redlining	<ul style="list-style-type: none"> • Breast cancer • Cervical cancer • Colorectal cancer • Lung cancer 	Detrimental: Residing in HOLC areas graded C or D (compared to grades A or B) was associated with a late-stage breast cancer diagnosis for women ($RR_{red} = 1.07$, 95% CI: 0.98–1.17) and lung cancer for men ($RR_{red} = 1.07$, 95% CI: 1.02–1.13) even in for those living in census tracts characterized by present-day economic privilege
10. Krieger et al. (2020)	Adult women	528,096	Historical redlining	Preterm birth	Detrimental: Compared to residing in CTs in HOLC grade A areas, living in grade B (OR: 1.14 95% CI: 1.01–1.28), C (OR: 1.16, 95% CI: 1.03–1.30) and D (OR: 1.14, 95% CI: 1.02–1.28) areas was associated with increased odds of preterm birth adjusting for maternal race, education, age, nativity, and neighborhood poverty
11. Li et al. (2021)	All	n.s	Historical redlining	Heat-related disease and injury	Detrimental: Neighborhoods with a higher proportion of low HOLC-graded area had higher present-day heat-related in-patient rates ($B = 0.0018$, 95% CI: 0.0001–0.0035)
12. Li & Yuan (2021)	All	15,602/165 ZCTAs	Historical redlining	<ul style="list-style-type: none"> • SARS-CoV-2 positivity rate • COVID-19 death rate 	Detrimental: compared to ZCTAs with higher HOLD grades, those with lower grades had a higher positivity rate, a smaller proportion of the population tested, and lower median income

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
13. Lynch et al. (2021)	All	157 census tracts	Historical redlining	<ul style="list-style-type: none"> • Mental health • Physical health Infant mortality	Detrimental (physical and mental health): Higher historic redlining score was associated with increased tract prevalence of poor physical ($\beta = 1.34$, 95% CI: 0.40–2.28) and poor mental health ($\beta = 1.26$, 95% CI: 0.51–2.01), Null (infant mortality rate) ($\beta = -0.48$, 95% CI: -2.12 to 1.15)
14. Cancel Martinez (2019)	Black, white, Latinx, and other	3113		<ul style="list-style-type: none"> • Depression • Anxiety • Stress • Mental health 	Mixed (depression): For white (OR = 1.81, 95% CI: 0.95–3.47) and Black (OR = 3.54, 95% CI: 1.14–11.0) respondents, self-reported housing discrimination was associated with higher odds of depression. These findings were null for Hispanic respondents and those labeled “other.” Mixed (anxiety): For white (OR = 1.92, 95% CI: 1.06–3.48); Black (OR = 5.77, 95% CI: 1.81–18.4) respondents, self-reported housing discrimination was associated with higher odds of anxiety. These findings were null for Hispanic respondents and those labeled “other.” Detrimental (stress): For white (OR = 2.40, 95% CI: 1.25–4.63), self-reported housing discrimination was associated with increased odds of stress. Findings were null for Black and Hispanic respondents and those labeled “other.” Detrimental (any stress anxiety depression): Black (OR = 7.50, 95% CI: 2.60–21.6) self-reported housing discrimination was associated with increased odds of any mental health disorder. The results were null for white and Hispanic respondents and those labeled “other.”

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
15. Matoba et al. (2019)	Black women	33,586	Residential redlining*	Preterm birth	Detrimental: for Black women, residence in a redlined area was associated with a slight increase in odds of preterm birth (OR = 1.12, 95% CI: 1.04–1.20) compared to women in non-redlined areas
16. McClure et al. (2019)	Black adults	1471	Residential redlining*	Self-rated health	Detrimental: Redlining was measured as a percent of each historic neighborhood that was historically redlined. A 10% increase in redlined space was associated with an increase in poor self-rated health at the neighborhood level (0.56, 95% CI: –0.10 to 1.28) and at the individual level ($B=0.23$, 95%CI: –0.06 to 0.57). In the main analysis, adjusting for the percent redlined reduced the effect size of foreclosure rate recovery on SRH
17. Mendez et al. (2011)	Black, Latinx, and white women	4104	Residential redlining*	<ul style="list-style-type: none"> • Bacterial vaginosis • general health status • perceived stress • infant birth weight Stress during pregnancy	Null: In bivariate analyses, redlining was not associated with bacterial vaginosis, general health status, perceived stress, or infant birth weight
18. Mendez et al. (2013)	Black, Latinx, and white women	4652	Residential redlining*	Stress during pregnancy	Null: Redlining was not associated with pregnancy stress ($\beta=0.37$, SE = 0.2, $p=n.s.$)
19. Mendez et al. (2014)	Black, Latinx, and white women	3462	Residential redlining*	Preterm birth	Protective: Redlining was associated with decreased risk of preterm birth for Black (RR = 0.8, 95% CI = 0.6–1.0), Latinx (RR = 0.8, 95% CI = 0.5–1.3), and white (RR = 0.8, 95% CI = 0.6–1.2) women
20. Mujahid et al. (2021)	Black, white, Hispanic, and Chinese adults	4779	Historical redlining	Cardiovascular health	Detrimental: Redlining was associated with lower CVH scores for Black adults only ($\beta=0.82$, 95% CI: – 1.54 to –0.10). Present-day neighborhood advantage weakened the association. Results were null for all other groups

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
21. Nardone (2020a)	All	4061 (CTs)	Historical redlining	Health disparities in: <ul style="list-style-type: none"> • Prevalence of asthma • Cancer • Coronary heart disease • Diabetes • High blood pressure • Poor mental health • Stroke Asthma ED visit rate	Detrimental/conditional: Redlined CTs were more likely to have worse health outcomes and higher rates of unhealthy behaviors in particular cities, including Cleveland, Los Angeles, Miami, New York, and San Francisco/Oakland. Overall, the associations were weak to moderate
22. Nardone et al. (2020b)	All	1431	Historical redlining	Asthma ED visit rate	Detrimental: Compared to grade A census tracts, those in historically redlined areas have increased (RR = 1.39, 95% CI: 1.21–1.57) relative risk for asthma ED visits. Other categorized neighborhoods also have increased risk: Grade C RR = 1.18 (95% CI: 1.03–1.33); Grade B RR = 1.14 (95% CI: 1.00–1.28)
23. Nardone (2020c)	Adult women, infants	651,260	Historical redlining	<ul style="list-style-type: none"> • Preterm birth • Small for gestational age • Low birth weight • Infant mortality 	Mixed: Compared to residence in HOLC C-graded areas, living in redlined (or D-graded) areas was associated with decreased odds of preterm birth (OR = 0.94, 95% CI: 0.91–0.97) for LA births. For SF/OAK births, residence in a C-graded census tract was associated with increased odds of PTB relative to b-graded tracts (OR = 0.94; 95% CI: 0.91–0.97). The authors do not compare D-graded areas to A-graded areas
24. Osypuk et al. (2019)	Black, Latinx, and white adults	3526	Experiences of housing discrimination	<ul style="list-style-type: none"> • Psychological distress • Major depressive disorder 	Detrimental: Perceived housing discrimination was associated with higher psychological stress ($\beta = 1.58$, CI: 0.83–3.99) and slightly higher major depressive disorder ($\beta = 0.57$, CI: 0.43–1.56). Without adjusting for neighborhood poverty, the association between housing discrimination and mental health outcomes changed signs

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
25. Rooks et al. (2011)	Black and white adults	99	Experiences of housing discrimination	Life satisfaction	Detrimental/conditional: Among the overall sample, housing discrimination was not associated with life satisfaction ($\beta = -0.057$, $SE = 0.166$); Among low SES Black (compared to middle SES white), housing discrimination was negatively associated with life satisfaction ($\beta = -0.282^*$, $SE = 0.253$) Detrimental/conditional: For women with less than 12 years of education, experiencing housing discrimination was associated with preterm birth (OR: 2.4, 95% CI: 1.2–4.6). The association was not present for women with 13–15 years of education (OR: 0.9, 95% CI: 0.6–1.3) or greater than 16 years of education (OR: 1.0, 95% CI: 0.7–1.3)
26. Rosenberg, et al. (2002)	Black women	4966	Experiences of housing discrimination	Preterm birth	
27. Sewell (2016)	Black, white, Latinx adolescents	3333	<ul style="list-style-type: none"> • Neighborhood credit refusal⁺ • Racialized credit refusal* • Neighborhood credit privateness • Racialized neighborhood privateness 	<ul style="list-style-type: none"> • General health • Lead poisoning 	Detrimental: The prevalence of lead poisoning is lower (OR: 0.44; $z = -3.640$) in neighborhoods with less-regulated loans. The findings for the other exposures were null
28. Taylor et al. (2007)	Black women	49,161	Experiences of housing discrimination	Breast cancer	Null: In the overall sample, housing discrimination was not associated with incident breast cancer (IRR = 1.00, 95% CI: 0.84–1.18); similar results were found when the sample was stratified by age. Discrimination in housing coupled with workplace and police discrimination was associated with higher breast cancer incidence (IRR = 1.31, 95% CI: 1.00–1.18)

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction ^s and estimate
29. Wise et al. (2007)	Black women	22,002	Experiences of housing discrimination	Uterine leiomyomata (fibroids, myomas)	Detrimental: Housing discrimination was associated with an increase in uterine leiomyomata (IRR = 1.13, 95% CI: 1.05–1.21)
30. Yang & Park (2015)	Asian, Black, Latinx, white, and other	9042	Experiences of housing discrimination	<ul style="list-style-type: none"> • Self-rated health (binary) • Stress (continuous) • Mental illness (binary) 	<p>Detrimental: Perceived housing discrimination is associated with poor SRH ($\beta=0.433$, $p < 0.001$, SE = 0.132) (logit scale) increased stress: ($\beta=0.903$, $p < 0.001$, SE = 0.132) and increased mental illness ($\beta=0.424$, $p < 0.01$, SE = 0.140).</p> <p>Sleep quality mediates the relationship between perceived housing discrimination and each outcome. Sleep duration also mediates the relationship between perceived housing discrimination and stress</p>
31. Yang et al. (2016)	Black, Latinx, white, and other	9842	Experiences of housing discrimination	Self-reported health	<p>Mixed/conditional: The association between perceived housing discrimination and SRH is conditional on neighborhood features. Without including neighborhood context, the relationship is null. In neighborhoods with average housing values, residents who perceived discrimination are <i>more</i> likely to report poor SRH (OR = 1.515, 95% CI: 1.047–2.190).</p> <p>In neighborhoods with higher concentrations of Black residents (OR = 0.988, 95% CI: 0.979–0.996) and single parent households (OR = 0.970, 95% CI: 0.944–0.996), residents who perceived discrimination are <i>less</i> likely to report poor SRH</p>

Table 5 (continued)

Author/year	Population	Sample Size	Exposure	Outcome	Effect direction [§] and estimate
Zhou et al. (2017)	Black and white adults	5381	<ul style="list-style-type: none"> • Residential redlining • Racial bias in mortgage lending 	<ul style="list-style-type: none"> • All-cause mortality • Colorectal cancer mortality 	<p>Detrimental/null: Racial bias in mortgage lending was associated with a greater hazard rate for Black adults with colorectal cancer (HR = 1.37; 95% CI: 1.06–1.76). There was no association for white adults. Racial bias in mortgage lending was associated with worse colorectal cancer survival for Black women (HR = 1.53; 95% CI: 1.06–2.21) compared to the overall sample. The redlining index was not associated with colorectal cancer mortality or all-cause mortality</p>

[§]To avoid confusion about the direction of health effects, we use “protective” and “detrimental” rather than “positive” and “negative”

*Exposure is consistent with “systematic bias in mortgage lending based on race”

+Exposure is consistent with “systematic loan denial based on neighborhood”

Acknowledgements The authors thank the reviewers for generous and generative feedback and Rafik Wahbi for helpful comments on an earlier draft. Cross, Huynh, and Francis received support from the Robert Wood Johnson Foundation Health Policy Research Scholars Program. Cross additionally received support from the UCLA Ziman Center for Real Estate.

Author contributions RIC: conceptualized study, project management, data screening, data extraction, wrote first full draft, edited 2nd draft; JH: data screening, data extraction, edited 1st draft, edited 3rd draft; NJB: data screening, data extraction, edited 3rd draft; BF: data screening, data extraction, edited 3rd draft.

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