Circulation: Cardiovascular Quality and Outcomes

AHA SCIENTIFIC STATEMENT

Neighborhoods and Cardiovascular Health: A Scientific Statement From the American Heart Association

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ABSTRACT: The neighborhoods where individuals reside shape environmental exposures, access to resources, and opportunities. The inequitable distribution of resources and opportunities across neighborhoods perpetuates and exacerbates cardiovascular health inequities. Thus, interventions that address the neighborhood environment could reduce the inequitable burden of cardiovascular disease in disenfranchised populations. The objective of this scientific statement is to provide a roadmap illustrating how current knowledge regarding the effects of neighborhoods on cardiovascular disease can be used to develop and implement effective interventions to improve cardiovascular health at the population, health system, community, and individual levels. PubMed/Medline, CINAHL, Cochrane Library reviews, and ClinicalTrials.gov were used to identify observational studies and interventions examining or targeting neighborhood conditions in relation to cardiovascular health. The scientific statement summarizes how neighborhoods have been incorporated into the actions of health care systems, interventions in community settings, and policies and interventions that involve modifying the neighborhood environment. This scientific statement presents promising findings that can be expanded and implemented more broadly and identifies methodological challenges in designing studies to evaluate important neighborhood-related policies and interventions. Last, this scientific statement offers recommendations for areas that merit further research to promote a deeper understanding of the contributions of neighborhoods to cardiovascular health and health inequities and to stimulate the development of more effective interventions.

Key Words: AHA Scientific Statements ■ cardiovascular diseases ■ health inequities ■ neighborhood characteristics ■ residential segregation

The neighborhoods where individuals reside shape environmental exposures, access to resources, and opportunities. In empirical studies, neighborhoods are often evaluated using static measures assessed at a given point in time, but it is important to recognize that neighborhoods are dynamic. The composition of neighborhoods and the resources they provide or deny certain groups are shaped and reconfigured due to a constellation of historical and contemporary structural, cultural, and societal factors, including population decline, urban renewal and gentrification, immigration, and discriminatory or predatory lending practices.

Neighborhood features relevant to cardiovascular health (CVH) include access to high-quality education, stable housing, public transportation, and jobs; proximity to environmental and industrial exposures, health care facilities, healthy foods, and spaces for congregation, exercise, and recreation; and environmental stressors such as safety (Figure 1).[1] Exposure to these factors may affect CVH through multiple pathways, such as the development of poor CVH behaviors and health factors (eg, Life's Essential 8), or through direct physiological processes tied to chronic stress and accelerated aging.[1,2] The inequitable distribution of essential resources for optimal health across neighborhoods exacerbates CVH inequities. Thus, interventions that affect and improve neighborhood environments can potentially reduce the inequitable

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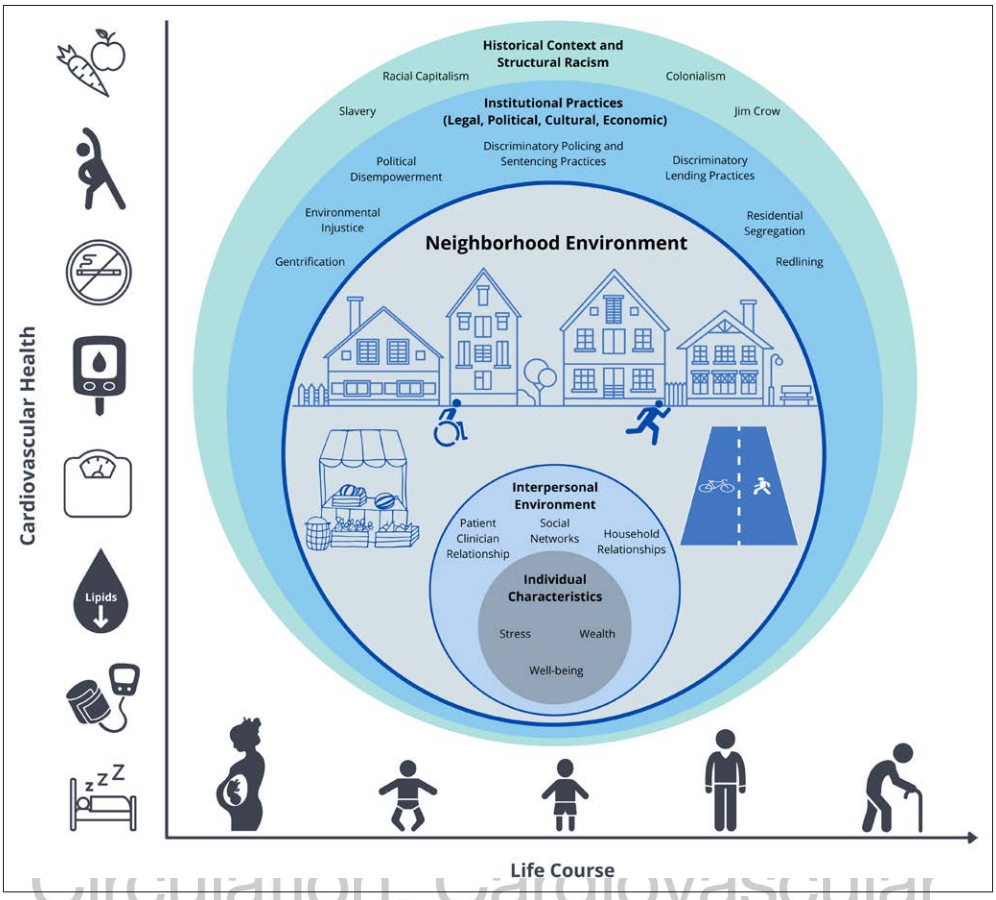

Figure 1. The multilevel and interacting factors that determine and shape the relation of the neighborhood with cardiovascular health and outcomes.
The neighborhood environment is shaped by legacies of historical context and by structural racism, which in turn have perpetuated generational inequities with legal, political, cultural, and economic dimensions. Neighborhoods, as broadly defined by this scientific statement, affect the interpersonal and social environment, as manifested by social determinants of health. The cross-dimensional relations of cardiovascular health metrics across the life course are represented by the intersection of the axes.

burden of cardiovascular disease (CVD) in disenfranchised populations.

This scientific statement highlights key studies identified through literature searches and our collective expertise to broadly summarize the current state of this important area of research. It is not intended to provide an exhaustive review of the vast literature describing neighborhoods and CVH. Rather it is intended to serve as a roadmap illustrating how current knowledge regarding the effects of neighborhoods on CVD can be used to develop and implement effective interventions to improve CVH at the population, health system, community, and individual levels (Figure 2).

CONCEPTUALIZING AND MEASURING NEIGHBORHOODS AND THEIR CHARACTERISTICS

The definition of a neighborhood is context dependent and varies widely across countries, regions within countries, and across the rural-urban continuum. The absence of a uniform definition of a neighborhood presents a challenge for researchers studying neighborhood health effects. Several approaches have been used to obtain an objective measure of a neighborhood. One approach relies on relatively fixed and well-defined geographic boundaries, such as census tracts, to create crude proxies for neighborhoods. These metrics are frequently used because they are convenient and can often be linked to publicly available data that use the same boundaries (eg, poverty levels or home ownership). Another is to define neighborhood boundaries by geospatially (eg, 1-mile buffer surrounding the home), locally (eg, districts established by local governments), or culturally (eg, stakeholder-informed) established boundaries. Objective measures of where people go to access resources or conduct activities (ie, activity spaces) have also been proposed as an alternative to traditional neighborhoods defined by their proximity to a person's home. Subjective approaches have been used to define a neighborhood as well, often with survey-based measures to characterize specific aspects of a study participant's neighborhood

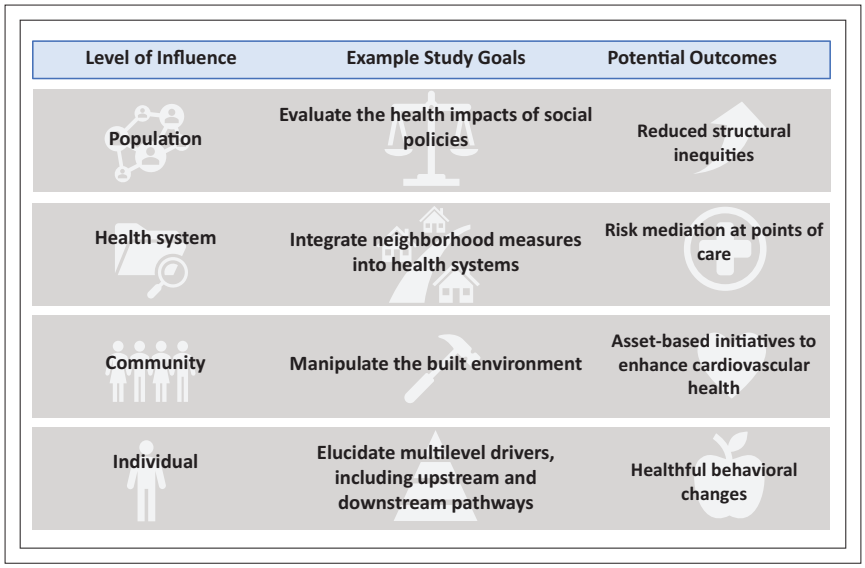

Figure 2. Potential cardiovascular health effect of addressing neighborhood environments. Interventions and strategies addressing neighborhood factors have broad potential to meaningfully affect population, health system, community, and individual outcomes. The figure summarizes potential avenues by which neighborhood-level factors can be incorporated to improve cardiovascular health and promote health equity.

(eg, walkability) either without specifying a frame of reference or by providing one, such as the area within a 20-minute walk from home.

Initial studies focused on neighborhood-level socioeconomic disadvantage as a proxy for a host of specific neighborhood exposures associated with CVD risk.[2] The measures of neighborhood disadvantage used in these studies typically come from administrative data (eg, US Census) and range from single variables like median household income or percent of households living in poverty to multivariable indices constructed using multiple socioeconomic variables. Including survey-based measures of aesthetics, healthy food availability, safety, and social cohesion in large cohort studies has allowed for a better understanding of the association of more specific features of the neighborhood environment on CVH and disease risk. The linkage of business location data, crime data, and data on the location of parks and public recreational spaces to participant address information has also been instrumental in the growth of this area of research because these data can be added to any study with available address information. See Table 1 for commonly used data sources and measures. Many of these measures, and other less commonly used contextual measures, as well, are in the publicly available National Neighborhood Data Archive.[22]

The authors of this scientific statement recognize the complexity of defining the neighborhood and measuring the characteristics believed to affect CVH and health inequities. Therefore, we do not suggest an exclusive definition of the neighborhood. Instead, we suggest that investigators conceptualize the neighborhood

Table 1. Commonly Used Data Sources and Measures for Assessing Neighborhood Conditions

Neighborhood condition	Data sources	Sample measures
Socioeconomic status	Census and American Community Survey	Area Deprivation Index[3]; Neighborhood Socioeconomic Environment[4]
Residential segregation	Census and American Community Survey	G_i^* statistic[5,6]; Index of Concentration at the Extremes[7]
Crime and safety	Crime reports (modeled or actual) Self-report	Police-reported crime rates within a buffer around participants' homes[8,9] MESA neighborhood safety scale[8,10]
Collective efficacy	Self-report	Informal control scale[11]; social cohesion scale[10,11]
Physical disorder	Direct observation Google Street View Self-report	Systematic social observations[12,13] MESA aesthetic quality scale[10]
Food environment	Commercially available business location databases Self-report	Density of or distance to nearest food outlet[14] MESA healthy food availability survey[15,16]
Parks and physical activity resources	Commercially available business and recreation area location databases Self-report	Density of or distance to nearest park[14] Neighborhood amenities scale[17]
Greenspace	Satellite imagery Google Street View	Normalized Difference Vegetation Index[18] Greenspace Exposure[19]
Walkability	Objective indicators like land use mix, street connectivity Self-report	National Walkability Index[20] Neighborhood Environment Walkability Scale[21]

MESA indicates Multi-Ethnic Study of Atherosclerosis.

as appropriate for their research question. Furthermore, the selection of neighborhood measures should align with the conceptual framework guiding the research, the mechanism being studied, the consensus of stakeholders engaged in the research process, the potential limitations and threats to validity, and the feasibility of implementing the type of place-based intervention the research is meant to inform.

OBSERVATIONAL STUDIES EXAMINING THE CONTRIBUTION OF NEIGHBORHOODS TO CVH AND HEALTH INEQUITIES

A large body of observational studies has documented associations between neighborhood conditions and cardiovascular outcomes independent of individual-level socioeconomic indicators and evaluated underlying mechanisms. The varied ways in which neighborhood exposures are measured make summarizing the association of neighborhoods with CVH challenging, but several review articles have offered insights that we highlight below and summarize in Supplemental Table 1. Most studies have been cross-sectional, but a growing number of longitudinal studies have improved our ability to reduce bias and elucidate pathways through which geospatial factors operate. In addition, most studies have examined neighborhood environments at a single point in the life course. A few studies have examined neighborhood exposures across the life course, but more research is needed to understand how life-stage neighborhood environments affect CVH.[23–25]

Neighborhood Physical and Social Environments and CVH

A systematic review and meta-analysis of 36 longitudinal studies examined relations of the built environment (human-made surroundings including buildings and infrastructure) with cardiometabolic outcomes.[26] Walkability was the most frequently measured exposure; it was associated with all 3 health outcomes included in the meta-analysis (obesity, hypertension, and type 2 diabetes). There were an insufficient number of studies to perform meta-analyses for type 2 diabetes or hypertension with any of the other built environment characteristics. Other systematic reviews have found consistent evidence supporting associations of walkability and greenspace with lower weight, type 2 diabetes, stroke, and CVD.[27–29]

In a meta-analysis for obesity, significant associations were found for urban sprawl and population density (the concentration of people and businesses within an area) and recreational facilities, but not route attributes (eg, street connectivity) or destinations (eg, proximity to transit stops).[26] In contrast, another review found that associations of access to facilities for physical and leisure activities were null or inconsistent for coronary heart disease, stroke, and type 2 diabetes.[28] Systematic reviews have found null associations of the food environment with CVD-related outcomes overall, but some evidence linking the fast-food environment to higher weight and CVD.[27–29]

Living in neighborhoods with higher levels of air pollution has been linked to poorer endothelial function and adverse cardiovascular outcomes, including hospitalization and mortality. The most consistent findings are for short- and long-term exposure to ambient air pollution, specifically particulate matter <2.5 μm.[30–32] Other air pollutants such as carbon monoxide, ozone, and particulate matter 10 have also been linked to hospitalization or mortality in patients with heart failure.[32]

Although this area remains understudied compared with the physical environment, a growing number of longitudinal studies have examined aspects of the neighborhood social environment, including socioeconomic position, social cohesion (mutual trust and willingness to help one another), and social hazards (eg, crime) to cardiovascular outcomes.[1,33] The largest subset of these studies has focused on various measures of neighborhood socioeconomic disadvantage and has demonstrated that adverse environments are associated with a higher incidence of CVD risk factors and outcomes. Social cohesion has typically been measured by self-report, and studies have linked it to physical activity, obesity, incident CVD, and the development of coronary artery calcification.[33–36] Neighborhood crime and safety have been examined in relation to several cardiovascular-related outcomes, including physical activity, changes in body mass index and blood pressure, and incident CVD. Findings are somewhat mixed, and there is some evidence that individual perceptions of neighborhood safety are more salient predictors of CVH than objective crime measures.[9,33,36] A few studies have also examined the association of neighborhood physical disorder (eg, litter, graffiti) on cardiovascular-related outcomes.[13,37–39] This has been assessed through self-report, or by objective measures such as systematic observations of the neighborhoods that participants live in, either in person or by using street-level mapping. Findings are primarily cross-sectional but provide some evidence suggesting that higher disorder may be associated with poor health behaviors, obesity, hypertension, and coronary heart disease.

Structural Factors, Neighborhoods, and CVH Inequities

A primary motivation for studying neighborhoods and health is that neighborhood environments create and

perpetuate CVH inequities. Structural factors, including racism, drive the differential distribution of resources across neighborhood environments and are associated with poor CVH.[40] For example, emerging cross-sectional studies have linked area-level historical redlining (measured at the census tract), a discriminatory government-sanctioned lending practice, with poor cardiometabolic outcomes, especially among Black adults.[41,42] Although these historical practices have ended, their residual effect lingers through the continued disinvestment in neighborhoods and the limited economic and social resources available for generations of Americans disproportionally exposed to these environments. Racial and ethnic residential segregation, the systematic separation of racial and ethnic groups into different neighborhoods, is the most well-studied contemporary marker of structural racism. Studies have shown that residential segregation is associated with higher CVD risk factors and incident CVD among Black adults; findings are mixed for Hispanic and Latino adults.[33,43] Other structural factors, such as gentrification, a process in which disinvested neighborhoods receive significant capital investment and revitalization at the expense of original residents who are often displaced, have been understudied, and the limited evidence has focused on self-rated health, maternal, and mental health outcomes.[44]

Evidence directly examining the contribution of adverse neighborhood conditions to CVH inequities remains limited. A series of studies, as part of the Exploring Health Disparities in Integrated Communities Study, documented that, compared with national estimates, there were smaller Black-White differences in CVD risk-factor prevalence among those who reside in areas with similar neighborhood economic profiles in Baltimore, MD.[45] Additional studies have documented modest reductions in racial and ethnic disparities in the prevalence, incidence, and management of CVD risk factors after accounting for measures of neighborhood physical and social environments.[46–48] The literature on neighborhoods and health inequities has primarily focused on racial and ethnic inequities, particularly Black-White differences, but neighborhood conditions may also contribute to inequities seen for other populations. Neighborhood resources may be differentially afforded to people with disabilities, sexual and gender-diverse groups, people living in rural areas, and disaggregated Asian and Latino ethnic groups in ways that could affect CVH.[49–51] Further work is needed to understand whether and how neighborhood conditions affect CVH inequities in these populations.

In summary, although critical knowledge gaps remain (see Table 2), ample evidence from observational studies illustrates that neighborhood context and residence contribute to CVH and health inequities. Building on the foundation set by existing studies linking neighborhood conditions to CVH, the following sections summarize 3 broad contexts in which neighborhoods can improve CVH. The first describes ways neighborhoods have been incorporated into the actions of health care systems. The second section highlights the role of neighborhoods in interventions in community settings, and the third discusses studies that have evaluated policies and interventions that involve modifying the neighborhood environment.

INTEGRATING NEIGHBORHOOD MEASURES INTO THE ACTIONS OF HEALTH CARE SYSTEMS

The strength of evidence describing the contributions of neighborhood-level exposures toward health combined with the feasibility of linking information on neighborhoods to medical records (including the electronic health record [EHR]) has stimulated interest in exploring how this information can be used to target, tailor, or maximize the effect of clinical interventions. This integration could facilitate a more contextualized approach to CVH promotion and disease management, one where systems of care are able to leverage neighborhood-level assets (eg, parks and safe spaces for physical activity [PA]) and are also responsive to potential barriers (eg, limited transportation). We highlight 2 important ways that integrating neighborhood-level measures into health systems may improve health care delivery.

First, it could increase the capacity to identify individuals at increased risk for clinical adversity. Early studies showing the benefits of incorporating neighborhood measures to improve CVD risk prediction stemmed from a recognition that the Framingham risk score underestimated coronary heart disease risk in individuals of low socioeconomic status (SES). Including individual-level indicators of SES improved prediction, but researchers found that area-level indicators could also account for this source of bias.[52,53] This is important given that address information is often more readily available than detailed individual-level SES indicators. There is also some evidence that more granular measures of the neighborhood socioeconomic environment performed better (ie, a census block group rather than a zip code).[53] The findings highlight the need for careful consideration of the most salient geographic area to include in these types of measures. The QRISK score, developed and used in the United Kingdom, is the only calculator to our knowledge that includes a measure of area-level deprivation at the postal code level, and it has been shown to perform better in that population than the Framingham Risk Score.[54,55]

More recent research has explored the utility of incorporating neighborhood measures into machine learning–based risk prediction models. A retrospective study of EHR data from a health system in Durham, NC,

Table 2. Summary of Future Directions for Etiologic, Health System, Intervention, and Policy Research on Neighborhood Characteristics and CVH

Area of focus	Topic	Description
Observational studies	Social determinants	Expand understanding of how neighborhoods act and interact with other social and biological determinants of health to drive the social patterning of CVH.
	Structural racism	Understand how neighborhood conditions may mediate historical effects of structural racism on CVH, including multilevel assessment of historical and contemporary markers of structural racism (eg, redlining, poverty, school quality).
	Health inequities	Assess whether and how neighborhood conditions affect CVH inequities in understudied populations, including people with disabilities, sexual and gender-diverse groups, people living in rural areas, and disaggregated Asian and Latino ethnic groups.
	Neighborhood characteristics	Test and refine our measures of the neighborhood environment to identify the most salient targets for intervention.
		Explore the association of specific neighborhood features (eg, crime, poverty, absence of green spaces) with CVH at different points in the life course.
		Evaluate how changes in neighborhood environments affect CVH over the life course and which groups are most susceptible to these changes.
Health systems and clinical research	Electronic health record integration	Assess the utility of incorporating dashboards into electronic health records to summarize and report neighborhood-level social risk in clinical settings.
	Cardiovascular disease risk prediction	Evaluate contributions of neighborhood and structural factors to cardiovascular risk prediction models independent of individual socioeconomic characteristics and clinical risk factors.
	Addressing unmet social needs	Identify the most effective ways to collect and use neighborhood factors to screen patients for unmet social needs.
		In partnerships with community-based organizations and social services, explore how data on neighborhood assets can be collected and leveraged to address social needs in clinical settings.
Interventions	Behavioral interventions	Explore the potential for neighborhood data to be leveraged to increase the effectiveness of behavioral interventions (eg, by tailoring or supplementing individual-level interventions with neighborhood interventions).
	Neighborhood and multilevel interventions	Develop and evaluate interventions that simultaneously address multiple aspects of the neighborhood's physical and social environment risks to improve CVH.
		Use systems science and other simulation modeling approaches to examine the effectiveness, scalability, and sustainability of multilevel interventions.
	Collaborative interventions	Promote and evaluate partnerships between civic, community, faith-based, and health care organizations to address neighborhood-level characteristics (eg, food access, health screening availability, smoking).
Policy evaluation		Partner with local and federal government agencies in nonhealth sectors to better evaluate the CVH effects of broad policies that affect neighborhoods (eg, neighborhood investments, mixed housing, remediations).
		Adopt more rigorous study designs to better evaluate the effect of targeted neighborhood policies (eg, restrictions on tobacco outlets, neighborhood advertising of unhealthy foods) on CVH and health inequities.

CVH indicates cardiovascular health.

found that neighborhood-level SES did not improve predictive performance for the health outcomes of stroke and myocardial infarction.[56] Researchers attributed the null result to the correlation between neighborhood SES and the demographic characteristics found in EHR data like race, ethnicity, age, and insurance status. This could mean adding neighborhood measures to risk prediction models may be redundant if EHR data already capture mediators or correlates of that exposure. In contrast, a retrospective study of patients in the Get With The Guidelines-Heart Failure registry determined that accounting for various neighborhood-level social determinants of health (eg, median household income, unemployment) significantly improved machine learning–based models predicting in-hospital mortality in Black patients compared with models that included clinical covariates only.[57] There was no significant improvement in risk prediction in patients of other races. Further studies are needed, but these findings indicate that adding neighborhood-level social determinants of health may help predict outcomes in disenfranchised populations.

Neighborhood information is also being used in conjunction with aggregated patient characteristics to identify and provide additional resources to clinicians and health systems serving individuals at increased risk for clinical adversity. For example, the Massachusetts and Arizona Medicaid Agencies each include both an area deprivation index and individual patient characteristics to determine Medicaid payments to managed care organizations.[58] In addition, the Centers for Medicare & Medicaid Services are using dual eligibility status (for Medicare

and Medicaid) and the Area Deprivation Index to allocate higher payments or advance payments, or both, to Affordable Care Organizations serving high-risk populations.[59,60] These funds will enable health care professionals and accountable care organizations to both screen patients for unmet social needs and connect them with resources needed to address them.

The second way integrating neighborhood measures into health systems could improve care delivery is by optimizing strategies for directing and targeting local resources toward those with unmet health-related social needs. For example, the CommunityRx system in Chicago, IL, uses an inventory of local health-promoting resources that were collected by local youth hired and trained through MAPSCorps, a nonprofit organization focused on generating high-quality data on community assets.[61] These resources were then electronically prescribed through the EHR to patients with 37 prevalent social or medical conditions. Embedding these community-based resources into a social dashboard allows for timely screening and referral to services to address unmet social needs. However, there is some evidence to suggest that more than these light-touch referrals may be needed to overcome structural barriers to care.[62] Deeper engagement may be required to successfully connect patients to services. In addition, the closest available support may need to be more conveniently located for patients living in underresourced neighborhoods. Investing in these neighborhoods on a broader level is ultimately essential to promote sustained social, economic, and health equity.

Utilization of social dashboards has occurred predominantly in primary care rather than specialty settings. Successful uptake of a social dashboard in CVD or other specialty management necessitates shifting focus from disease-oriented care toward social dimensions. Obstacles to screening for social determinants of health in the provision of care are multiple and include systemic or physician inertia, privacy concerns, lack of organizational readiness to screen and refer patients to services, and the need for more infrastructure to support time-efficient collection and documentation.[62] The challenge of demonstrating success as determined by financial metrics further obstructs the implementation of the social dashboard in practice settings focused on cardiovascular disease, because such settings are the product of considerable investment in resources for specialty visits and testing. Last, overcoming the inertia of bringing social determinants into specialty care is a task that requires investment, prioritization, and support from health system leadership.

Research initiatives can bypass some of these more complex, system-level challenges. Academic clinicians have worked in concert with community-based partners to identify and uplift the community's health priorities. Informed by implementation science, these partnerships can potentially implement strategic interventions focused on high-risk individuals. Examples include (1) the Community Intervention to Reduce Cardiovascular Disease in Chicago[63] that establishes relationships between community-based churches and health centers to collaboratively adapt a successful health system–based intervention designed to increase blood pressure control and test its effectiveness in underresourced, high-risk communities; (2) mobile units targeting blood pressure control in communities with high chronic disease burden and racially concentrated poverty in Detroit, MI, launched by Wayne State University[64]; and (3) a community health center patient-, clinician-, and staff-informed clinical decision support tool to inform tailored care planning for patients with unmet social needs.[65] Such programs, supported by extramural funding, demonstrate the promise of a partnership between academic health systems and their local communities. Fundamental challenges are the scalability of such initiatives, given their accessibility to a limited number of individuals relative to the general population at risk, and how they can be sustained after the expiration of funding duration. Hence, programs must address these fundamental limitations, particularly when forming community partnerships.

INCORPORATING NEIGHBORHOODS INTO INTERVENTIONS TO IMPROVE CVH

Interventions to promote CVH and improve outcomes have traditionally focused on individual behaviors such as medication adherence, healthy lifestyle, and stress management. The resources afforded to people living in different neighborhoods may affect the effectiveness of these studies, but behavioral interventions are rarely designed, evaluated, or implemented with consideration for neighborhood-level factors that might serve as facilitators or barriers. A few studies have examined neighborhood resources as modifiers of the effect of a behavioral intervention on CVH outcomes like diet or PA, and findings are mixed.[66,67]

Comparing findings across studies is challenging because different environmental measures are included, and the intervention settings and outcomes vary. The ADOPT (Accumulating Data to Optimally Predict Obesity Treatment) Core Measures Project seeks to overcome this challenge by developing a more systematic approach to understanding factors that affect the effectiveness of behavioral interventions to treat obesity. The environmental domain of ADOPT includes 12 neighborhood and social environment constructs and measures such as social norms and features of the food environment.[68] A more thorough examination of which (if any) features of the built and social environment enhance or hinder the success of behavioral interventions, including the use of qualitative and mixed-methods approaches, may inform

better tailored interventions, and help investigators identify the best targets for multilevel interventions.

As defined in socioecological models, multilevel interventions influence health at ≥2 levels.[69] This could be upstream factors like neighborhood conditions or social policies and downstream factors like social relationships or individual knowledge. By targeting structural and place-based barriers, they are believed to have a broader public health impact particularly among disenfranchised populations. However, despite the support from the epidemiological and population health literature, these types of studies remain relatively rare. This section highlights multilevel interventions designed to improve CVH that target a neighborhood-level factor and have been evaluated using randomized trials.

Two studies conducted multilevel interventions in low-income housing communities. One was a cluster randomized controlled trial and focused on mother-daughter dyads living in public housing developments in Boston, MA.[70] Public housing residents randomly assigned to the intervention group were offered optional services, including health screenings, access to affordable fruits and vegetables, walking groups, cooking demonstrations, and resource maps that listed information about the intervention services and local health-related resources (eg, walking parks, places with healthy eating options). Trained lay health advisors provided all services. At 12-month follow-up, researchers found intervention participants experienced significantly increased fruit and vegetable intake (1.6 versus 0.1 more servings) and daily minutes walking (10.7 more versus 0.1 less) than control participants. Intervention participants also significantly reduced sedentary time (30% versus 2% decrease) and fast-food consumption (15% versus 1% decrease). A second study aimed at increasing fruit and vegetable intake in subsidized housing units in Providence County, RI, randomly assigned residents to access to mobile fruit and vegetable markets and nutrition education (intervention sites) or PA and stress interventions (control sites).[71] Participants in the intervention groups increased fruit and vegetable intake by 0.44 cups, whereas intake in the control groups decreased by 0.08 cups at the 12-month follow-up. Increases were even larger for those who went to all (2.1 cups) or most (0.86 cups) of the markets.

A 6-month, multilevel community-randomized trial to promote PA and healthy eating behavior changes in sedentary, overweight women was conducted in 16 rural towns in Montana and New York.[72] The intervention communities received individual-level components (educational sessions, experiential activities, and goal setting and monitoring sessions), interpersonal components (eg, group-based exercises), and environmental components (community audits and asset mapping). Participants in the control communities received reduced educational materials. Researchers found that the intervention group had 0.6 cup equivalents more fruit and vegetable intake per day during follow-up than the control group. There were no significant differences in objectively measured PA, but self-reported minutes walking per week was significantly higher in the intervention group (113.5 metabolic equivalents of task minutes per week more).

These promising findings highlight the need for more multilevel interventions. The high cost of these interventions and their general dependence on federal grant funding raises questions about their sustainability. Addressing sustainability is particularly important for multilevel interventions that may take years to demonstrate positive effects.[73] Systems science approaches like agent-based modeling or systems dynamics modeling have and should continue to be used to model the complex factors that contribute to the success and sustainability of multilevel interventions.[74] Future studies should use community-engaged and asset-based approaches to maximize their potential to reduce longstanding CVH inequities. One promising example is a study that will evaluate the effectiveness of a cluster randomized controlled trial that provides groups of residents in rural towns with nutrition and PA lessons along with built environment change–planning workshops to promote civic engagement.[75]

EVALUATING POLICIES AND INTERVENTIONS AIMED AT IMPROVING NEIGHBORHOOD CONDITIONS

Multiple policies and initiatives have aimed to improve neighborhood conditions that could promote CVH. These include those that give people opportunities to move into neighborhoods with more resources such as housing choice voucher programs, inclusionary zoning policies to require developers to make a portion of new housing units affordable to lower income households, and more government funding allocated toward detecting housing discrimination. Efforts to improve conditions in disinvested, segregated neighborhoods to protect long-term residents from being displaced include the New Markets Tax Credit and the Healthy Food Financing Initiative.[76] In addition, turning vacant lots into community gardens or remediating abandoned houses may improve social cohesion and increase safety,[77–79] both of which are associated with CVD risk.

Although these policies and initiatives are promising in their potential to promote social and economic well-being and stability for many disenfranchised groups, few social or economic policies targeting neighborhood conditions have been evaluated for their effect on CVH outcomes. Moving to Opportunity Study for Fair Housing (1994–1998) was a federal housing experiment that randomly assigned women with children living in high-poverty neighborhoods to receive housing vouchers to move into lower poverty neighborhoods, traditional

vouchers without restrictions, or no vouchers. A study of the long-term (10+ years) effects of this experiment found that those randomly assigned to receive the lower poverty vouchers were significantly less likely to have body mass index ≥35 kg/m^2 and hemoglobin A1c ≥6.5% than those in the control group.[80]

Multiple studies have used a natural experiment design to examine the effect of a 2018 US policy prohibiting smoking in federally subsidized housing on secondhand smoke exposure. Natural experiments facilitate examining the effects of social and economic policies when randomization is difficult or even impossible. A study of 5 public housing agencies in New York found that residents were significantly less likely to report smoking and smell smoke in their development after implementing smoking restrictions.[81] In contrast, studies in New York City and Norfolk, VA, that tracked airborne nicotine levels found no effect on exposure to secondhand smoke before and after policy implementation.[82,83] The divergent findings summarized here may reflect differences in how effectively the policies were implemented across public housing agencies or discrepancies between perceptions and objective assessments of secondhand smoke exposures.

Natural experiments have also been used to evaluate the effectiveness of interventions designed to improve neighborhood conditions (see Supplemental Table 2 for more detailed summaries). The main types of interventions evaluated for cardiovascular-related outcomes added new infrastructure or improved existing ones (eg, parks) to promote PA. A 2018 review of longitudinal studies and natural experiments examining the association of built environment modification with change in PA concluded that introducing new infrastructure was associated with increased PA in 9 of 16 identified studies.[84] Consistent with this, a synthesis of the results of 26 published articles from a "Livable Neighborhoods" planning policy evaluation project in Perth, Australia, determined that 57% of the studies reported that communities incorporating one or more design feature had better self-reported walking outcomes than those that did not incorporate any.[85]

Several studies have also shown that improving existing infrastructure like parks and playgrounds is associated with both increased park visits and PA. The aforementioned 2018 review found that 5 of the 7 natural experiments identified linked upgraded parks and playgrounds to increased PA.[84] More recent research supports this overall finding and identifies nuances that merit further consideration. A study in Melbourne, Australia, found increases in park use, both overall and by individuals engaging in PA, in low socioeconomic areas after refurbishments.[86] These increases narrowed over time, highlighting the importance of identifying strategies to promote sustainable effects of these types of interventions. A study in Cape Town, South Africa, compared visits and PA in a renovated district park with a neighborhood income–matched established district park and found that, although park visits were higher at the renovated park, PA was lower.[87] However, in low-income areas, researchers did find significantly higher levels of PA among visitors of 3 newly developed community parks compared with 3 existing parks.

A growing number of studies have used natural experiments to evaluate the effect of more comprehensive neighborhood improvement or revitalization efforts in low-income communities on cardiovascular-related health outcomes. The comprehensive neighborhood revitalization effort initiated in a low-income, predominantly Black community in Pittsburgh, PA, serves as an example. A stratified random sample of residents from 2 sociodemographically and geographically matched neighborhoods in Pittsburgh were recruited in 2011 and surveyed before and after major investments to the intervention neighborhood, including a full-service supermarket, park and greenspace renovations, and a center devoted to workforce and small business development. Analyses of the results have identified few significant behavioral or physiological improvements between the intervention and control neighborhoods.[88–91] For example, there were no significant differences in PA and body mass index between individuals in intervention neighborhoods compared with those in control neighborhoods.[88]

Overall, the findings highlight the challenges of evaluating policies and interventions targeting neighborhood contexts. The null findings may be due to methodological issues present in many natural experiments.[92] It is also possible that modifying >1 or 2 features of the built environment may be required to promote lasting changes. The Center for Disease Control's Community Preventive Services Task Force recommended combining interventions to the built environment to promote PA, such as improving the safety of active transit with promoting active transit to parks or grocery stores. In addition, interventions may need to be sustained longitudinally, acting over the life course, to exert measurable effects that may only become apparent after long time lags. Such challenges may impede the detection of short-term effects that are the focus of many studies.

CONCLUSIONS

Significant evidence has demonstrated the strong association between neighborhoods, as characterized by their built and social environments, and outcomes across the continuum of CVD risk and outcomes. Research to date has foremost had an observational design, focused on (1) relation of neighborhood physical and social environment features to cardiovascular outcomes in community-based cohort studies; (2) integration of neighborhood-level social risk in relation to health outcomes as ascertained by EHR; and (3) examination of

the effects of changes to built environments on CVH metrics. Limited studies have reported community-centered or multilevel interventions, or on those that promote CVH equity by addressing structural barriers or leveraging neighborhood assets.

As detailed in Table 2, extensive opportunities exist to improve our understanding of the ways in which neighborhoods affect CVH and health inequities. More work is needed to ensure we are measuring the most salient neighborhood-level predictors or indicators of CVH. Integrating neighborhood measures and assessments in routine health in a way that is actionable and does not harm patients is essential to address the critical social and structural determinants that influence and contribute toward CVH outcomes. Collaborating with communities to address neighborhood barriers and leverage assets may improve the effectiveness of behavioral interventions and inform the design of multilevel interventions to address CVH inequities. In addition, more rigorous designs are essential to improve the study of policy effects or neighborhood interventions. Because the neighborhood is a foremost contributor toward health and well-being across the life span, addressing the neighborhood-based environment and its social and structural determinants is fundamental to achieving health equity.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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*Modest.

†Significant.

Reviewer Disclosures

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Tiffany M. Powell-Wiley	NHLBI/NIH	NIH (prior NIH funded grant on neighborhood deprivation and obesity completed in 2021)*; NIH (current research grant on geospatial measures and biologic stress markers)*	None	None	None	None	None	None

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*Modest.

†Significant.

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