

Towards a New Studio Pedagogy: Improving Social Determinants of Health through Community-based Participatory Research and Design

Pravin Bhiwapurkar

University of Cincinnati, Cincinnati, OH, USA

ABSTRACT: The social determinants of health (SDOH) are cited as a common reason for disparities in public health and social medicine literature. However, the interlinkage between SDOH, such as neighborhood and built environments with healthcare access and quality, education access and quality, economic stability, and social and community context, is less explored and is handled independently. Therefore, this research asks what role design-based interventions play in improving SDOH. The method includes a combination of quantitative and qualitative approaches completed by the author with multiple collaborators and built upon their previous works before the multi-year senior-level studio investigation began. Using the prompts from these works, the studio integrated the community-based participatory research (CBPR) model and Jamie Learner's urban acupuncture approach to examine the role of design-based interventions for low-income black communities in Cincinnati, OH. The main contribution of this work is repurposing existing vacant lots and buildings to improve spatial, social, and service environments by integrating them with the existing community fabric via proposing programmatic gaps and improving the connection between SDOH. Over thirty individual design interventions are proposed, ranging from short (1-year), mid (1-3 years), and long-term projects (over 3 years), including fixing existing structures, green infrastructure, and community gardens, and new building projects hosting various community functions, such as a community clinic, pharmacy, zero-energy homes, co-op grocery store, education, and training center for renewables. Integrating individual interventions with the existing community's physical, social, and economic structure provides opportunities to mitigate the impact of extreme weather events and improve SDOH while making it actionable research. Currently, community partners are pursuing these projects with the help of academic, civic, and industry partners by seeking external funding (such as the EPA EJ grant) and availing the existing state-funded programs. Progress is slow but steady, and financial challenges remain a primary barrier.

KEYWORDS: Social determinants of health, design-based interventions, community-based participatory research, urban acupuncture, low-income communities

INTRODUCTION

Economically deprived communities face the burden of health disparities in urban areas (CDC). The quality of social determinants of health (SDOH) – neighborhood and the built environment, health and health care, social and community context, education, and economic stability – in a given area are commonly described in public health and social medicine literature as a cause of these disparities (CDC). Environmental conditions caused by degrading physical environments have a significant influence on physical and mental health (North et al. 2004, Brokamp et al. 2017); and lack of social and service environments (like access to health care) further increases negative health impacts (Diez Roux and Mair 2010, Duncan and Kawachi 2018). Infants and children, older populations, pregnant women, individuals with chronic medical conditions, and outdoor workers are most vulnerable (Bei et al. 2013, CDC). Demographic factors like race, gender, age, and income are frequently cited denominators for negative health (Claudio, Stingone, and Godbold 2006, O'Neill 2005). In addition, changing climatic impacts — the increasing frequency of extreme weather events (EWE), particularly heat waves and flash flooding — worsen environmental exposure in low socioeconomic status (SES) communities (Ahdoot 2015, D'Amato et al. 2015, NIEHS 2014), further increasing health disparities. Importantly, climate change-related deaths and illnesses are preventable (CDC). Although community responses to health outcomes are not consistent (Beck et al. 2014) and vary per geographic location, the community-specific context plays an important role.

SDOH are commonly studied in both social medicine and public health, but the inflections this concept receives in each disciplinary context are different. John Ryle suggests that social medicine differs from public health in three distinct ways (Horton 2013). First, it fundamentally concerns itself with people and endeavors to study them in relation to their environment, whereas public health primarily focuses on the environment. Second, social medicine has a broader reach, which, unlike public health, includes non-communicable diseases, mental health, and injuries. Third, social medicine takes into account the organization of after-care and the readjustment of the lives of individuals and families disrupted or broken by illness. Within the dichotomy of social medicine and public health, this paper presents design as a preventive medicine tool that can shape the physical, social, and service environment in order to create livable, healthy, and resilient communities and minimize health disparities.

In the context of an urban design studio engaging in this work, pedagogical questions about the role of architecture (specifically, design interventions in the existing context) in improving physical and mental health in low SES communities are paramount. The importance of Jane Jacobs's work on how the built environment influences people and how they navigate their neighborhood is a point of departure for this approach (Jacobs 1961). Jacobs notes that urban design and planning should encourage a diversity of destinations that would attract visitors throughout the day and night, and she foregrounds the importance of creating or enhancing often-used gathering spaces that engage residents of all ages, providing welcome opportunities for daily physical activity and social interaction (Duncan and Kawachi 2018). Recently emerging healthy design guidelines, like *Building Healthy Places Toolkit: Strategies for Enhancing Health in the Built Environment* (ULI 2015) and *Healthy Community Design Checklist Toolkit* (CDC) reflect these principles.

1.0 METHOD

Adopting the CBPR model, this studio co-designed interventions with residents, a community-based non-profit organization, and the community council as project partners since the inception of the studio. It prioritizes community-based health issues intensified by extreme weather events and research and design questions emerging from such partnerships, contrasting with imposed agendas by status quo top-down approaches. A combination of qualitative and quantitative research methods provided a deeper understanding of how extreme weather intensifies physical and mental health impacts. A health survey completed by the collaborators provided residents' perceptions of their indoor and outdoor environment and its health effects as a part of their daily lifestyle (Cincinnati, 2016). Analysis of the physical environment identifies several microenvironments in the community that residents overlap (Bhiwapurkar, 2017). A field study conducted for this purpose confirms hazardous environmental exposure via recording environmental stressors along the path commonly traveled by residents. The urban acupuncture approach, grounded in a deeper understanding of problems, people, and place, further informed current gaps in physical, social, and service environments affecting SDOH. To revive the community's spatial, social, and service environment, the studio proposed design interventions to fill in community programmatic gaps, improve urban landscape and outdoor spaces, and build community pride via art and culture-based activities. The integration of design-based interventions with existing community fabric on strategically selected vacant lots and buildings using the urban acupuncture approach, as a part of the studio pedagogy, engages diverse groups, interests, stakeholders, organizations, and agencies to work simultaneously on an overarching goal of creating healthy, equitable, and sustainable solutions.

1.1 The community context

The selection of a representative of the low SES community was an essential first step in this process. The selected community, South Cumminsville (SC), is the smallest of the 52 neighborhoods that constitute the City of Cincinnati—located in the Lower Mill Creek Valley, SC (Tract 77, BG 2 and Tract 78, BG 3) within a heavily industrialized corridor packed with water management, transportation infrastructure, and a large public housing community. Historically, it was a working-class neighborhood within walking distance of manufacturing jobs and community amenities. Still, its recent fate is familiar to many industrial urban centers across the Midwest region. SC was significantly impacted by the construction of the I-74 highway, which effectively divided the Cumminsville neighborhood into North and South segments, precipitating racial segregation. While the North segment experienced pronounced development since the partition, SC has struggled with poverty for more than 40 years, and the declining economic and environmental conditions have taken their toll on the community and its residents. Per the 2010 census, the population of 3,319 residents is 92% African American or multi-racial. The community has a 25.5% unemployment rate, compared with Hamilton County's unemployment of 6.1% (2010 US Census). Life expectancy in SC is 72.1 years compared to 87.8 years in Cincinnati's more affluent neighborhoods. The average median annual household income is \$17,185, about 1/3 of the county's \$50,990 median. Women head 62.7% of the 1,431 households, compared to 20.8% of county households.

As of 2010, more than one-quarter (26.1%) of the neighborhood's homes were vacant (US Census 2010). Many were bank-owned Real Estate Owned (REOs) or held by out-of-state investors. Many of these houses have been demolished in the past couple of years, and vacant lots have grown. However, public dollars available for rehabilitation and new construction remain limited. The land use is distributed between residential and industrial functions, with minimal buffering. Many factories are now shuttered, resulting in a high percentage of brownfield sites. Additionally, the community currently lacks access to basic functions within walking distance, experiences a food desert situation, and remains isolated from the north segment.

SC was selected as a test case because it represents other city communities experiencing decades-old development policies (such as redlining, segregation by freeways, industrial land use, and more). The community also expressed interest in the new ideas to be proposed by the studio and was eager to integrate design-based interventions as a part of the community development process. While the neighborhood faces many challenges, residents actively engage with the SC Community Council (SCCC) and the resident-led SC Action Team (SCAT). A community-based non-profit organization, Working In Neighborhoods (WIN), partners with the SCCC & SCAT has a mission "to empower people to make informed choices for themselves and their neighborhoods through Community Building, Home Ownership, and Economic Learning." WIN has built partnerships with community actors like the Ethan Taylor Elementary school, the neighboring Millvale Rec Center, First Baptist Church of Cumminsville and other churches, and a small but dedicated core of local businesses. They also work with the City of Cincinnati, such as the Environment & Sustainability, Recreation, Transportation, Planning, and Community & Economic Development departments. SCCC & WIN sponsor youth summer and afterschool programs, a community garden, and regular community-building events. They are key partners on this project.

This partnership between WIN, SCCC, and SCAT has led to several achievements: several pedestrian safety improvements; changes to the City's Land Development Code that reflect community priorities; a HUD designation as a Neighborhood Revitalization Strategy Area; bringing job training resources through the City's "Hand-Up" Initiative; securing major upgrades for the recreation area and the community garden; construction of a Greenway Trail along the Mill Creek; and expanding fresh food access through the Healthy Corner Store initiative & a weekly "Harvest Day" to sell locally grown organic produce. There existed an opportunity to integrate these ongoing independent interventions in addition to the programmatic needs that are meaningful to the community.

1.2 Establishing a connection

A community is a complex system composed of individuals, interests, experiences, and sectors requiring preparation and guidance as a precursor for successful engagement. Following the protocol suggested in NIH's community-engaged research model (Michener et al. 2012), the faculty instructor attended several community meetings and events and worked with a team of city officials and health researchers involved in the community in order to become familiar with the context and gain the trust of residents and community partners. WIN and SCCC members were welcoming and became primary contacts for the project. Interacting with the community context, residents, and working groups to understand community concerns and ongoing projects is crucial for community-engaged research (Michener et al. 2012; Ebi and Semenza 2008). Understanding the complex community context allowed the faculty instructor to effectively frame the health-focused studio problem, pursue research needed to build on ongoing efforts, and identify ways to shape the studio projects to make them meaningful for the community.

1.3 Community-based participatory research

A combined qualitative and quantitative research method provided a good understanding of the role of the physical, social, and service environment in shaping community health, particularly during extreme weather events (Bhiwapurkar et al. 2018).

1.3.1 Qualitative research

A health survey (n=118) was conducted via Project Cool It (awarded to the City of Cincinnati), funded by the EPA's Agency for Toxic Substances and Disease Registration, in 2014-15 in Mill Creek Valley communities, including SC, to establish a baseline for community health. Demographic information about race/ethnicity, age, and gender were collected, and respondents were also asked to report their occupancy status (rent/own). The average length of residency was 18.8 years; moreover, 52.2% (n=64) owned their own homes, 48.8% (n=52) rented, and the remaining data (from two residents) were missing. This trend is consistent with the 2010 Census data. The survey results are similar to other published work (Khan et al. 2019). In addition, respondents were asked about their perceptions of their indoor and outdoor environments so that researchers could investigate how self-perception of the environment might affect reported health outcomes. Given the lack of perceived mental health data, this line of investigation was an important prerequisite in assessing the role of future interventions. 61.5% (n=72) reported feeling irritable in the summer due to the heat, and 41.9% (n=56) and 42.1% (n=48) of the residents cited summer heat as the cause of changes to their mood and general health, respectively. Approximately 30.8% reported having asthma or another lung disease, and while 75.4% (n=89) described owning an air conditioner, only 69.5% (n=82) indicated that they used their air conditioner in the summer months. Four residents cited the cost of electricity as their reason for non-use. The majority, 60.3% (n=70), reported spending less than nine hours a day indoors during the summer months. Importantly, parking lots and vacant lots were used as playgrounds by, respectively, 42.7% (n=50) and 35.7% (n=41) of the children. The majority of residents reported living within a one-block radius of a vacant building or lot and/or spilled chemicals. There was a greater level of variability in the respondents' self-perception of the outdoor environment; in particular, 56.8% (n=67) reported that greenspace was available to them, and 87.1% felt safe walking in their neighborhood during daylight hours.

1.3.2 Quantitative research

A geo-medicine-based study conducted by Cincinnati Children's Hospital and Medical Center (CCHMC) researchers shows that not only low SES communities carry the burden of health disparities, but also there is variation among those communities (Beck et al. 2014)). Asthma-related emergency department (ED) visits are very high; low SES communities, including those selected for this study, have a higher concentration of ED visits than more affluent communities. The selected community also reported higher heat-related health problems in the health survey. The faculty instructor then carried out a field study during an extreme heat event in 2016 using a traverse method in which residents' environmental exposure, heat stress index (HSI), and ultrafine particulate (UFP) matter along the commonly used paths and spaces are recorded as shown in Figure 1 (Bhiwapurkar 2017). This study's unique feature includes identifying 24 microenvironments (like street intersections, community spaces, parking lots, etc.) within the community that residents frequently use.

Environmental stressors—heat stress index (HSI) and air pollution—varied across space and time. Among 24 microenvironments in the community, 54% had HSI values in the danger zone (104°F–124°F), while 46% were in the extreme caution zone (91°F–103°F), per the National Weather Service (NWS 2017). High HSI values were accompanied by ultrafine particulate (UFP) exposure, especially near industrial zones, intersections, and parking lots. Based on an average five-minute walk, residents were in the danger zone 70% of the time and in the extreme caution zone 30% during extreme heat events. UFP exposure ranged from 7,633 to 34,751 particles/cm³ between high- and low-canopy streets with higher traffic exposure. Land use and land cover analysis showed that industrial buildings, large parking lots, and vacant parcels with demolished structures increased impervious surfaces. Streets leading to residential areas lacked tree canopy, heightening environmental exposure, while brownfields added

complexity to the site. These elements intensified heat stress (Bhiwapurkar 2017) and contributed to surface runoff, flash flooding, and sewer overflow during rain events—leading to increased respiratory illnesses (Brokamp et al. 2017).

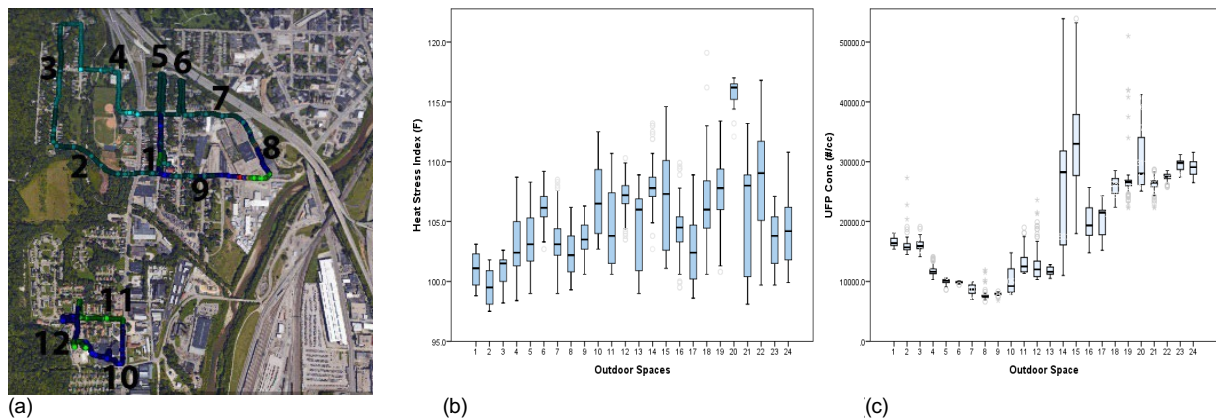


Figure 1: (a) Microenvironments (b) HSI spatial distribution and (c) UFP spatial distribution. Source: (Bhiwapurkar 2017)

Outdoor spaces commonly used for social gatherings and children's play, such as parking lots of housing complexes and areas near street intersections, had high HSI values and health-damaging conditions. Indoor spaces didn't offer refuge either; tenants without air-conditioning (or unable to use it due to cost) often spent time outdoors, exposing themselves to heat, air pollution, and allergens. The evidence in this study offers insight into how and why reported heat-related physical and mental health issues—such as irritation, mood swings, and negative health perceptions—are prevalent in the health survey

2.0 DESIGN INTERVENTIONS

The community development history, resident narratives, and research provided critical insights to frame the health-focused studio prompt. Initial analysis of the community's physical, social, and service patterns was crucial to understanding how, where, and why residents get exposed to heat and air pollution in space and time (Figure 2), complementing the above research. Further, the community charrettes proved vital in understanding immediate questions, like how a lack of community function is affecting their daily lives and how design interventions could be integrated into the socio-cultural life of the community, along with more wide-ranging issues, like how the residents perceive the future of their neighborhood and the unique identity they wish to establish for the community. This led to a studio strategy of multiple design interventions at multiple scales spread over short (1 year), mid (1-3 years), and long-term (over 3 years) projects. The dispersed vacant lots and buildings emerged as opportunities to keep them within walking distance.

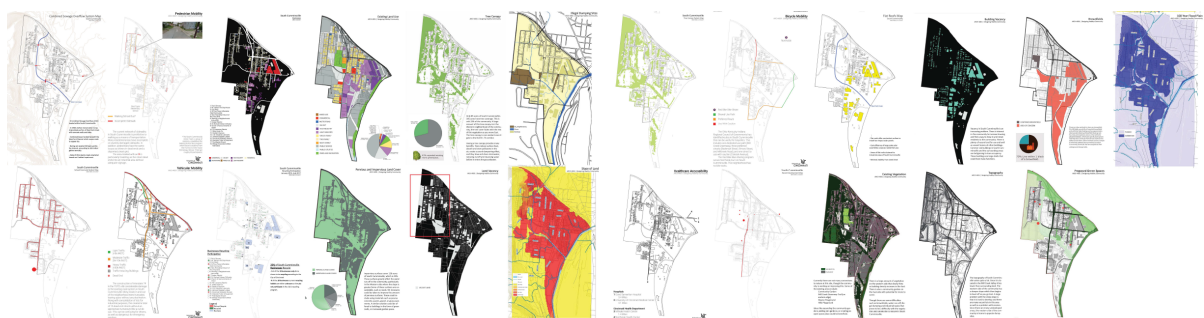


Figure 2: Physical, social, and service patterns within the community context completed during the Fall of 2016. Source: (Bhiwapurkar 2016)

The urban acupuncture concept, grounded in a deeper understanding of problems, people, and places, provided a strategy for integrating design-based interventions. First introduced by Learner (Lerner 2014) and further developed by Sol-Morales (Solà-Morales i Rubió, Frampton, and Ibelings 2008) and Casagrande (Casagrande 2015), this is the first study to apply the concept to improving SDOH. The interventions, representing “needles” shown in Figure 3, were driven by health criteria supported by function and access. New community functions—primary healthcare facilities, mixed-use development, locally owned businesses, diverse housing, healthy homes, and a community center supporting jobs and amenities—were co-designed with community partners. These are integrated into the existing fabric and located within walking distance of each other and public transit. Additionally, Green Parklets (Figure 4) were introduced to address heat, air pollution, and runoff at gathering spaces. The green infrastructure network—community garden, recreation area, and parks—creates a safe, walkable neighborhood usable by all ages throughout the day. These ecologically sensitive design principles complement ULI's Building Healthy Places guidelines (ULI 2015). Pride-building activities, like painting murals on walls and streets, were also included.



Figure 3: Urban acupuncture showing select design-based interventions from studios completed in 2016 and 2017. Source: (Bhiwapurkar 2017)

This studio developed over thirty design-based interventions for improving SDOH that are integrated into the community fabric (Figure 3 shows select projects). While the detailed descriptions of individual design processes are beyond the scope of this paper, a Green Parklet design (short-term) provides an excellent example of improving social spaces while providing shade, increasing native vegetation to arrest air and noise pollution, and decreasing surface runoff by collecting water. Such structures could be located along the walkways in the community (see Figure 4) and used by children and adults alike. For example, the locally owned Mr. Gene's hot-dog place at the intersection of Beekman St. and Dreman St. is a major social hub. At the same time, public housing a couple of blocks further north is popular for children, parents, and grandparents. Similarly, tiny, affordable, healthy homes (mid-term) are proposed to improve homeownership with WIN's support and guidance. The modular designs of these structures simplify the building process for residents and take ownership of the interventions.

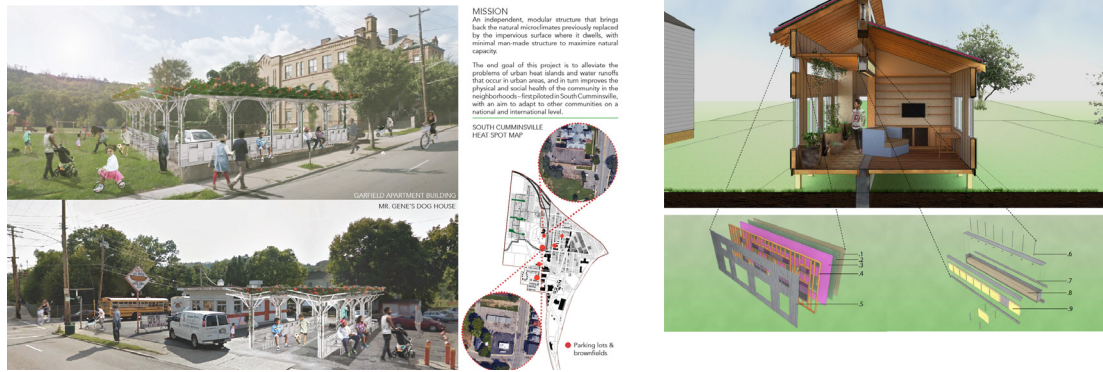


Figure 4: Green Parklet by Trang Le (left) and Healthy Home by Josiah Ibert (right), Fall 2016. Source: (Bhiwapurkar 2016)

A complete, safe, and walkable *neighborhood and built environment* allow residents to meet their needs in the community. It has a significant influence on the *social and community context* by energizing public and block-level spaces, like gathering places and community gardens, and improves social interaction among all ages while strengthening social capital and esteem. Reinforced social ties allow residents to live in a close-knit community and ameliorate health concerns (Diez Roux and Mair 2010). Residents feel that they can age in their community without having to move away (several families migrated to other locations when social and service environments deteriorated). A proposed primary health center is vital to improving *health and healthcare access*.

The studio team provided *education and training* on the impact of extreme weather events on physical and mental health. Such training included firsthand experience in recording outdoor and indoor HSI. Residents were provided with a National Weather Service (NWS) Heat Index map to associate empirical data with their perceived health. They were also provided with explanations of how using parking areas as play lots increases HSI. In addition, WIN emphasized the need for health- and energy-efficient homes, along with possible financial training and support. The first net-zero energy housing project is already significantly impacting residents' attitudes toward the environment. The proposed green technology training and education center will also create job opportunities in renewable energy and urban agriculture. There is a possibility of introducing this knowledge at K-8 levels.

Economic stability is the most challenging part of improving SDOH. Job creation and economic development are well beyond this paper's scope as they depend on external sources. However, engaging stakeholders from the community and external funding agencies is key to improving potential investment opportunities in meaningful locations for the residents. For example, mixed-use development and locally owned and operated businesses provide opportunities for investment from within the community. The residents are concerned about gentrification associated with economic development (Checker 2011), as other city neighborhoods, like Over the Rhine, experienced similar fates. The recreation and community centers are expected to provide job training and employment for youth and unemployed residents. A green technology center for renewable energy, urban agriculture, reuse, and recycling is a relatable example in the city for creating a workforce where residents can train and educate members of the community and beyond.

Although addressing SDOH is a transdisciplinary, multi-organizational, and multi-year effort, this studio approach provides a workable blueprint and strategic collaborations. This is important because several independent efforts exist in SC but are not coordinated, diminishing their effectiveness for their intended communities. Therefore, a comprehensive resident-centric, resident-led development plan focusing on improving SDOH via design-based interventions at multiple scales makes this approach unique and applicable to other communities, particularly those with a shared history of economic decline with SC.

3.0 OUTCOME

A community-based participatory research and design pedagogy provides new directions for addressing SDOH using design-based interventions within the myriad of public and social medicine approaches. This pedagogy applies to communities experiencing health disparities and degraded physical, social, and service environments in regional, national, and international contexts. Furthermore, this paper sheds light on several epistemological questions for architectural studio pedagogy on the role of architecture in improving physical and mental health in low SES communities and how design-based interventions can help improve degraded urban systems and damaged ecological conditions. The paper also shares insights on the community-based participatory research and design process to understand health gaps and introduce interventions to improve SDOH. Significantly, this studio pedagogy provides a service-learning model while discovering the potential of design as a tool for addressing social and environmental injustice.

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