Improving Healthcare Resilience Through an Equity Focused Framework

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Keywords: Health Equity, Resiliency, Salutogenisis, Healthcare Design & Social Determinents of Health

Resilience is an equity issue. It is directly linked to the resources one has to cope with environmental stressors. These resources occur at multiple scales and involve social, physical, and economic components. Resilience can be considered at the scale of the individual human, the building, or municipal infrastructure. Because resilience issues are also health issues, we are studying how it is approached within the healthcare industry in the United States. This industry is currently experiencing a paradigm shift from providing episodic care, focused on the treatment of disease, to a holistic focus on maintaining health.

This article shares research on the factors that contribute to resilience and a framework we developed to measure effectiveness of applying these factors at each scale. This framework and the methodology for applying it helps architects and our clients make better decisions about design. We believe this multifactor approach centers equity in developing resilient approaches to energy, air quality, and water use.

At the macro scale, climate change has wrought havoc on infrastructure. This impacts us all, but vulnerable populations bear the brunt of the health burden. Within the United States, adverse weather events linked to climate change such as flooding, heat waves, extreme cold and violent storms often occur in areas with poor air, water, and soil quality exacerbating challenges.

Health facilities are also under new stressors. Weather events impact aging structures, challenging their ability to operate in an emergency. Structural integrity, access to power, and indoor air quality are among the life safety issues that may arise. As we build new hospitals, it is important to consider these impacts and potential future impacts on what we design. As we renovate existing structures, we need to consider how to build resilience within the existing systems so that future problems don't occur.

The impacts of the pandemic have magnified the need to consider individual resilience. Stress undermines a person's short-term ability to function and make decisions. Chronic stress has been shown to create inflammation in the body. This inflammation contributes to physical and mental disease. Personal resilience is tied to the ability to return to homeostasis after experiencing an adverse event. Our research in salutogenic (health generating) design shows environmental resources can help activate the parasympathetic nervous system and turn off the stress response. Additionally, there are beneficial effects even with temporary exposure to a salutogenic space.

Our framework will demonstrate how each of the resilience factors operates at all three scales. We will show the research supporting each factor and how it impacts the individuals and communities. Through this metric, we aim to make resilience a more visible and quantifiable concept. Looking at social determinants to health in conjunction with the exposome (environmental factors) at all three scales, we can begin to think more comprehensively about resilience. We can create an equitable built world that contributes to everyone's well-being.

INTRODUCTION

This study looked at what factors impact health and the role that the built environment can play in providing additional resources to cope. Our study sought to define terms that are often discussed in this arena and consider health through a resilience framework. At a time when the healthcare industry and the Architecture/Engineering/Construction industry are recognizing this as a priority, it is important to have a standard way to understand and measure health equity.

According to definitions developed by the American Hospital Association Institute for Diversity and Health Equity (IFDHE), health equity is defined as, "everyone has a fair and just opportunity to achieve optimal health. This requires removing obstacles to health such as poverty, discrimination, and their consequences, including powerlessness and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care." [1] The IFDHE further acknowledges that obstacles to health are often systemic and tied to social inequities. This means that the issue of social justice, or the just distribution of wealth, opportunities, and privileges within a society must also be considered.

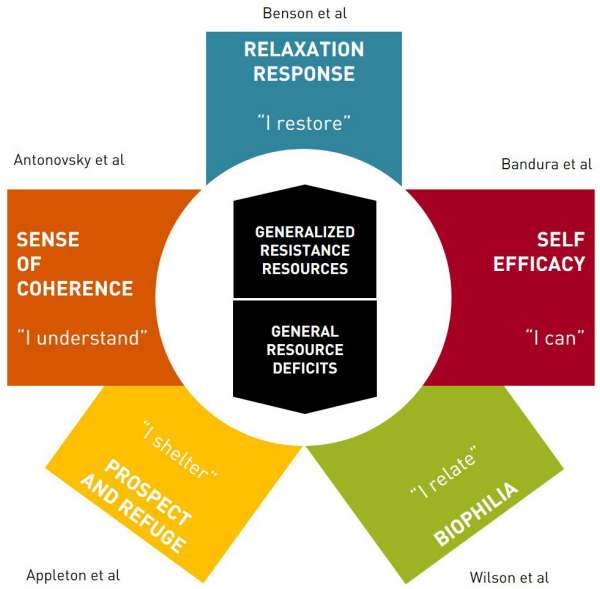

Figure 1. 5 parts to a solutogenic approach.[4]

Resilience, or the capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance[2], becomes an important part of understanding how to restore health equity. Work by Angela Mazzi, which builds on Aaron Antonovsky's study of salutogenesis,[3] shows that coping resources can be economic, social, and environmental. When one has fewer resources, one is more likely to experience stress and trauma, which has been shown to diminish physical and mental health. Stress and trauma also impact cognitive abilities. Because of this, health equity is a social justice issue and is directly tied to an individual's resilience.[4]

Inequities occur from environmental and socioeconomic factors. Together, these comprise the exposome. Wild's research[5] on the exposome identifies three categories: internal bodily processes, external environmental conditions, and external socioeconomic conditions. The exposome ranges across environmental domains such as air and water quality, exposure to toxins, noise and light pollution, access to quality green space, and climate impacts. It also includes strength of social network, education level, stability of finances and housing, as well as access to reliable transportation and healthy food.[5] Stress and trauma caused by these internal factors impact body systems and, over time, genetics. The exposome can be directly linked to health outcomes and by measuring them, it becomes clear certain communities are adversely impacted solely because they live in an exposome that places them at risk. This study hypothesizes that the available resources to cope within an exposome will impact the resilience of people, and ultimately their health outcomes.

METHODOLOGY

This study was based on a literature review on the definition of health equity, as well as semi-structured interviews with a panel of experts about how to promote health equity through the lenses of community resilience and sustainability. Four experts formed the interview panel, including (1) an academic professor and researcher of urban health and population science at the Lewis Katz School of Medicine, Temple University (Expert A), (2) an architect, consultant, and public health researcher at Harvard T. H. Chan School of Public Health (Expert B), (3) a doctor, pediatric surgeon, and director of trauma services at a top-ranked children's hospital (Expert C), and (4) an administrator of medical campus and facilities at a major public hospital in a metropolitan area (Expert D).

We interviewed the experts following a pre-determined set of questions and extended the discussion around the responses. The questions included:

- How do you define health equity and community resilience? How is resilience related to equity?
- What makes a community healthy or sick? What caused social and health inequity among some communities?
- What are the vulnerabilities currently existing in our urban and rural communities, particularly among minority and low-income communities?
- What social, physical, and economic resources could help those communities promote health equity and resilience?
- Aside from the healthcare delivery system, is there anything in non-healthcare or at a behavioral intervention level that could provide services to our communities?
- What measures are you taking to track the effectiveness of health intervention programs at the community level?

Interviews were conducted in October 2022; a total of four investigators transcribed and interpreted the interview data following the content analysis strategies. Gaps we found relate to the multiple ways in which health equity and community resilience can be defined and how each of those ways can be linked to health outcomes. A preliminary framework focusing on health equity through community resilience was proposed as a reference for future practices in environmental planning and design.

LITERATURE REVIEW

Research on social determinants of health and environmental conditions having an adverse impact on health have both indicated that there is inequity in health outcomes. This inequity can be traced to a very granular level such as a zip code.[6] The concept of health equity is twofold, with one focusing on the definition and another on measuring and monitoring "how well efforts to improve health equity are working." [7]

As early as the 1980s, Margaret Whitehead, representing the Programme on Health Policies and Planning of the World

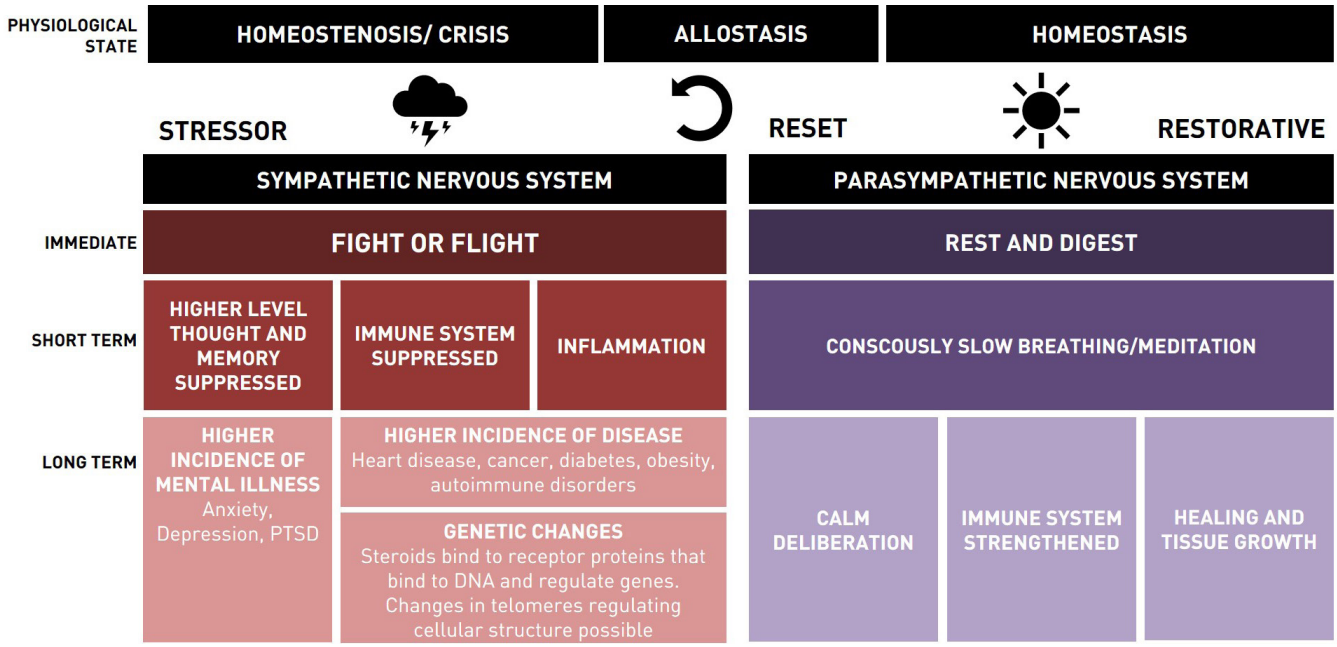

Figure 2. Autonomic Nervous System and Stress.[4]

Health Organization Regional Office for Europe, articulated the concept of health equity: "Equity in health implies that ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that no one should be disadvantaged from achieving this potential, if it can be avoided (p.7). She further defined equity in health care "as equal access to available care for equal need, equal utilization for equal need, equal quality of care for all" (p.8).[8] Widely discussed factors that contribute to health inequity included social class (as measured by income, wealth, and/or formal education), geographic/spatial distribution, and ethnicity. [9]

Social determinants, such as racism or systemic bias, are root causes of many factors that adversely affect health outcomes among excluded or marginalized populations. [10] The practical aspects of health equity aim at "reducing and ultimately eliminating disparities in health and in the determinants of health that adversely affect excluded or marginalized groups." (p.2) [7] Paula Braveman and colleagues[11] have clearly defined the key steps, together with guiding principles and case studies, that promote health equity in a project founded by the Robert Wood Johnson Foundation, among which transforming built environments of disadvantaged communities plays important roles in advancing health equity.

People who experience health inequity usually are more likely to live in underserved neighborhoods that are surrounded with high levels of stressors.[12] Multiple studies on stress and trauma show that experiencing a stress response and the corresponding impact on the autonomic nervous system suppresses higher level thought, the immune system, and increases inflammation.[13] Over time, this can lead to a higher incidence of mental illness, physical disease such as heart disease, diabetes, obesity, and autoimmune disorders as well as genetic changes.[14]

The built environments in which vulnerable populations live correlate with intensified environmental stressors due to climate change over the past decade.[15] The urban environments and climate have been changing as the result of of greenhouse gas emissions from human activities, (such as transportation systems and infrastructure), building construction and operation, and the altered land use in forestry and agriculture.[15] Research relating climate stressors to health impacts have shown that indoor heat health can be a serious risk to mortality. Lower socioeconomic and ethnic minority groups are more likely to live in neighborhoods with warmer microclimates yet lack capability and resources to deal with excessive heat stress.[16] The increased flooding hazard will "disproportionately" impact black and low-income populations.[17] Inequitable distribution

of safe and quality open spaces in those neighborhoods become significant contributors to physical inactivity and obesity among all age group populations.[18]

INTERVIEW RESULTS

Interview data were interpreted to four themes as below, and the high-level summary of expert panelists' responses have been highlighted in Table 1.

1. Revisiting Definitions and Social Determinants of Health Equity and Community Resilience

Health equity and community resilience means community having access to the information and resources to respond to all existing and new challenges in the aspects of economic, social, and health domains. The community needs to have the ability to acquire knowledge and overcome some major barriers. There are so many factors that make a community healthy or sick, and culturally competent healthcare providers are what they need. Poverty is the number one killer as annotated by all expert panelists. Healthcare ranks very low on the priority list for lower income populations, who live paycheck to paycheck. Many first generation, minority population groups face language barriers to access healthcare resources. Urban environments and public transportation, particularly in lower income neighborhoods, are heavily polluted and unsafe, which discourages people from going outside and seeking healthcare. Neighborhoods with high density of people of color are more likely to have a higher exposure to environmental toxins and trash, and a lack of clean and safe playgrounds or sidewalks. Some public health studies have started looking at neighborhood level factors and the physical environments that correlate with health behaviors, such as the cancer screening uptake.

> "Chronic stress is linked to early onset of disease in children. More severe cases of cardiovascular disease have been noted among African Americans, just because of the neighborhood contexts they lie in and the color of their skin." - Expert C

2. Advancing Health Equity and Community Resilience at Human Scale

There is a need to look beyond healthcare to a broader understanding of health from individuals to the entire society. Expert C observed impacts of generational trauma related to the history of minority populations. He has considered structural racism and violence and what it takes for a population to develop resiliency in the face of that. "It's one thing to experience a shooting but experiencing shootings again and again and again over a child's lifespan have a protracted impact (Expert C)." "Resilience is the ability for the body to have homeostasis. That homeostasis or equilibrium is disrupted depending not only on the dose of stress but the chronicity of the stress (Expert C)." Resilience happens first at the human level and how a group chooses to perceive a threat or aggression. It happens at a personal level beginning with the relationships someone has and the stress they are experiencing, which creates a biologic response in the body. Resilience breaks down when someone feels that they cannot control what they are experiencing. Studies by the National Health Service have shown that mortality rates are higher in lower income populations and that these populations also express the feeling that they cannot control their destiny.

> "To make a community resilient, addressing the bottom of the health impact pyramid is the most important. Architects tend to focus on the built environment and not specifically what the community really needs, while public health officials prioritize the bottom of the health pyramid and not how we can help." - Expert B

Neighborhood concentrated disadvantages affect not only the physiology but cognitive ability particularly among the younger population. All children can succeed when they do not experience toxic stress as determined by neighborhood disadvantage, which could negatively impact the structure and function of human brain, and the size of the hippocampus which impacts verbal ability and executive function. These changes clearly impact classroom performances and educational outcomes among children. These effects permeate every area of life. Environmental toxins affect personal health, such as lead and air pollution, eventually leading to school absenteeism and poor education outcomes.

3. Advancing Health Equity and Community Resilience at Building Scale

Public hospitals service people who aren't typically serviced by private or for-profit hospitals would typically serve. This includes the disenfranchised, uninsured, under-insured, and beyond. "Public hospitals are charter driven. Their charters have always required them to address folks that were not able to get health care anywhere else…by definition, they have to be almost the most equitable institutions, health care institutions (Expert D)."

Large healthcare facilities can be challenging to access and navigate by lower income people or those who have a language barrier. Studies have shown that having a patient navigator could significantly reduce the no-show rate. In terms of the spatial design in healthcare facilities, it's important to provide consulting rooms or stress-free conversation spaces for patients, families, and medical teams to talk through treatment options. Respite and recovery are an important part of occupant empowerment. Family and staff lounges should be offered at the end of each wing on every floor along with wellness rooms on each floor to provide unprogrammed respite spaces for care givers and family. Respite and recovery are further supported by centralized community spaces throughout a hospital, including a family resource center, cafeteria, and public floor lobbies. All these building spaces also help address

Panelists	Interview Date	Expertise	Barriers to Health Equity	Barriers to Community Resilience
Expert A	Oct. 4, 2022	Cancer health disparities, multilevel behavioral intervention, cardiometabolic conditions, and social determinants of health	- Culturally competent healthcare providers - Healthcare as a low priority given other living expenses - Language barriers - Fear of spending time outdoors - Access to digital resources to use telehealth	- Unsafe neighborhoods that are polluted - Environmental toxins and trash (including drug paraphernalia)
Expert B	Oct. 5, 2022	Green building, public health, and climate change	- Addressing needs of the most vulnerable - Physical access to healthcare	- Adaptation strategies to change the environment are lacking - Lack of redundancy in resources and systems in rural areas
Expert C	Oct. 10, 2022	Pediatrics medicine, links between child health/well-being with family, community, and neighborhood, and impacts of chronic stress	- Generational trauma and chronic stress due to socioeconomic instability - Access to healthy food - Cognitive ability impacted by lead poisoning (increased violent behavior) - Asthma prevalent due to air pollution	- Violence a frequent occurrence - Structural racism or segregation - Poor education outcomes - Air pollution and lead contamination - Lack of ability to control destiny - Lack of quality green space
Expert D	Oct. 25, 2022	Public hospitals as sources of health equity	- Understanding and addressing social barriers to health including transportation and health literacy	- Providing respite and recovery spaces within facility and in public green space on campus - Commitment to a diverse workforce - Hiring within the community

Table 1. Highlights of expert panelists' interviews

	HUMAN	BUILDING	INFRUSTRUCTURE
WHAT	Mental and physical wellbeing of the individual	Buildings and physical spaces for one individual to a community	Connecting transportation, utilities, and public commodities
HOW	Providing for respite and recovery	Flexibility to adapt to potential future stressors	Minimizing impact of future use and growth
	Equitable access to healthcare and resources	Using equitable design to increase accessibility	Providing equitable access to resources for all communities
	Optimizing for safety and security from stressors	Minimizing exposure to external stressors	Maintaining systems for optimal operation

DESIGN IMPLICATIONS

OPERATIONAL: HEALTHCARE BEYOND BUILDINGS
- Push instead of pull

24 HOUR BUILDINGS
- What else can it be?

SALUTOGENESIS
- Well-being
- Stress reduction

SUSTAINABILITY AND RESILIENCE
- Non Toxic environments
- Active Design

SAFETY AND SECURITY
- Crime prevention through environmental design (CPTED)

DAYLIGHT
- Equitable access
- Use to orient occupants

VENTILATION
- Reduce exposure to toxins

ACCESSIBLE DESIGN
- Bariatric patient accommodations
- Accessible routes

PUBLIC ACCESS
- Access to public transportation
- Bike accessible

MAINTAINANCE
- Building upkeep and system upgrades
- Optimization of systems

RESPITE/ SOLITUDE
- Space for seclusion and reflection

ENERGY EFFICIENCY
- Reducing energy consumption
- Minimize reliance on central grid

Image 3. Framework Scales and Example Design Implications.

some of the social determinants of health that their communities need at the human level.

4. Advancing Health Equity and Community Resilience at Infrastructure Scale

Public hospitals should engage local communities from an equity standpoint to build resilient sources for positive social determinants of health. As a major employer in the community, public hospitals should commit to diversity standards from their in-house staff to their expectations from contractors. Beyond healthcare services, some hospitals have integrated educational programs as part of their structure allowing high school students to be paired with hospital staff who provide mentorship in multiple professions. They have also looked to provide more stable housing through the integration of affordable housing on their campus along with public parks that are accessible to the entire community. Public transit should also be provided to maintain access for the hospital to the local community. All these programs can provide a local source of positive change to the communities' infrastructure and resources.

> "Public hospitals are charter driven. Their charters have always required them to address folks that were not able to get health care anywhere else…by definition, they have to be almost the most equitable institutions, health care institutions." - Expert D

To promote health, equity, and resilience for vulnerable communities through partnerships with the academic-community, what is in need is empowering community and capacity building – giving education workshops and helping them build their own research skills, "helping the community patients and leaders gain a skill to gather accurate health information and conduct a need assessment in their own community (Expert A)." Telemedicine may play a role in cracking accessibility issues for some minority populations, but any kind of new technology, unless it's designed with careful consideration for equity, disproportionately benefits those with a higher socioeconomic status.

> "Community capacity building is important; what they need is a robust and sustainable model in the community so that they can better handle future epidemics or any kind of barrier." - Expert A

THE FRAMEWORK

Community resilience is key to an individual having the resources to cope with the exposome. This resiliency must be cultivated at multiple scales to provide a more holistic protection. The built environment has a significant impact on how well a community can cope with stressors but in order for it to be affective, it must be considered at the three scales of resilience – (1) the human scale, (2) the scale of buildings, and (3) the scale of infrastructure. Each scale provides a vital building block for a community's ability to cope with their exposome:

- Human – Physical, mental, and emotional interventions at the human scale that improve the mental and physical wellbeing of the individual in the moment
- Building – Physically built spaces and buildings that improve the social and economic stability of multiple occupants and the surrounding community directly or indirectly
- Infrastructure – Long term systemic changes to the community's-built environment and networks that improve the socio-economic wellbeing of the community and their social determinants of health.

Human Scale

This scale is focused on the impacts to individuals through smaller interventions. These interventions are meant to make a meaningful immediate impact to an individual's well-being and resources for coping. These smaller interventions should provide immediate respite and recovery, equitable access, or optimizing safety and security. Environmental changes under this category include equitable access to employment, small private spaces for respite and recovery, or even access to nutritious food via a prescription from a healthcare provider. All these interventions have an immediate impact on the individual's bank of resources and provide immediate resources for the individual to build resilience.

Building Scale

The building scale refers to more lasting interventions that impact a larger quantity of individuals. While the human scale provides more immediate relief, the building scale has an impact that is not always visible and may take more time. At this scale, interventions are meant to provide access to all individuals, minimize the impact of stressors such as climate change, and should be adaptable to future stressors. Environmental changes that fit in the building scale include sustainable and energy reducing designs to mitigate the impact to climate change, community spaces for gathering and enriching society, equitable and safe spaces to ensure comfort and respite of occupants.

Infrastructure Scale

The final scale, infrastructure, references larger systemic and intercommunity adaptations to the environment that will impact multiple communities' access to resources. At this level, the quantity of people experience change should span communities and will be long lasting impacts. Examples of interventions at this scale include public transportation access, sustainable community or campus power sources and distribution, and equitable access to healthcare needs through democratized healthcare systems. These broader strokes of systemic change should have the widest spread impact and will create a much longer lasting change for the communities.

Framework Synopsis

Each scale has its benefits and downsides that make each of them integral to every approach. Human scale impacts the individual in a large way but tends to only provide more immediate impacts. On the other end, infrastructure scales impact multiple individuals and communities but may not be as large of an impact for the individual. Each scale helps build a more equitable, safe, and sustainable society overall and the more you can bring to each project, the greater the impact. We have categorized multiple interventions into a checklist that can be reviewed with each project to potentially bring new ideas and verify that each step we take will lead to a more resilient community. While this framework begins to identify the impact of these many interventions, it doesn't consider the overall cost of each design idea or the eventual benefits to fully be able to quantify its value. This does give a starting point for assessing designs and their resiliency with regards to equity.

CONCLUSION

Architecture and urban planning provide a constant medium by which to influence people's behavior and therefore health. Salutogenic design of buildings is an opportunity to enhance well-being but the design of our spaces and places alone will not have as much impact as health generating design in combination with addressing systemic issues of social injustice, specifically health equity. With careful design and strategic collaborations between public health officials, health care providers, and architects, we can expect to positively impact portions of the exposome – air and water quality, exposure to toxins, noise and light pollution, access to quality green space, climate impacts, access to healthy food and reliable transportation. Implementing our framework can help reduce trauma and even stress, positively impacting one's ability to cope and improving resilience and health outcomes individually and within the community.

By implementing a framework for community resilience at the scale of the human, building, and infrastructure, a more holistic and long-lasting improvement to resilience occurs across the community. This is a result of the impact of specific interventions over time, some immediate and acute, while others are subtle but daily. Each scale of intervention impacts a different number of people and demonstrates various gestation periods and lifespan of effectiveness, again supporting a multi-pronged approach to improving community resilience equitably. It is only through an equitable built environment that we can expect to provide a resilient future for everyone to enjoy and prosper.

ACKNOWLEDGEMENT

We sincerely thank the following experts who agreed to take the interviews. They are:

- Lin Zhu, PhD. Assistant Professor of Urban Health and Population Science and Assistant Professor at the Center for Asian Health, Lewis Katz School of Medicine, Temple University.
- Adele Houghton, AIA; MPH; LEED AP BD+C, O+M, ND DrPH '23 | Harvard T. H. Chan School of Public Health, President, Biositu, LLC
- Dr. Victor Garcia MD, FACS, FAAP Founding director of trauma services at Cincinnati Children's Hospital Medical Center
- Walter Jones, AIA, LEED AP, EDAC Senior Vice President of Campus Transformation at Metro Health

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