Neighborhood and the Built Environment

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Key Points

- Access to healthcare resources, including acute care services, is not distributed equally among communities, and this structure shapes how communities interact with the healthcare system.
- Exposure to neighborhood risks such as violence, trauma, pollution, or alcohol sales increases both acute illness and exacerbations of chronic illnesses that can lead to emergency department visits.
- Emergency providers can glean important clinical clues by probing relevant historical details pertaining to a patient's built environment. The context provided in such a history can lead to improved acute care management and may reduce the need for emergency care.
- Observations and research on the built environment for patients served in the emergency department can lead to community-based interventions or policy recommendations that can improve population health.

Foundations

Background

The physical realities of where we live, work, and spend our time matter deeply for our health and need for emergency care. At least as far back as John Snow's investigation of the role of the Broad Street water pump during the cholera outbreak

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in 1850s London, investigators in medicine and public health have sought to understand how differences in the conditions of neighborhoods and local environments reflect and generate differences in our health. In more modern times, research on the role the physical environment plays in health has led to the identification by the Healthy People 2020 initiative of the neighborhood and built environment as one of the five key social determinants of health [1]. While most of the work on the role of the built environment within medicine has taken place in the realms of general medicine and pediatrics, emergency medicine providers are increasingly taking notice of the physical reality patients face outside the walls of the emergency department (ED), and of the role emergency physicians (EPs) can and should play in addressing this reality [2, 3].

This chapter focuses on understanding the built environment as a driver of emergency care, and how individual EPs and healthcare systems can work to explore and address structural issues affecting patients and their communities. We will consider several different potential emergencies related to the built environment with a particular focus on respiratory diseases like asthma and chronic obstructive pulmonary disease (COPD), where the links to the built environment have a strong evidence base and are conceptually straightforward.

The Centers for Disease Control and Prevention (CDC) defines the built environment as the "physical makeup of where we live, learn, work, and play—our homes, schools, businesses, streets and sidewalks, open spaces, and transportation options." [4] In this sense, the built environment is the nonhuman components of our surroundings: things like the quality of housing stock and roads; the availability of food, medicine, and healthcare; access to schools and outdoor spaces for exercise; and exposures to potential risks like violence, drugs, or toxic chemicals. Implicit in this idea is the concept that the built environment can vary by increments in both time and space and across multiple physical scales: the presence of mold in an entire apartment building might influence all its residents' probability of having an asthma attack, whereas insulation problems in a specific unit might additionally influence the probability of the inhabitants of that particular unit having breathing problems during the winter months.

Defining a "neighborhood" is somewhat more complicated and no universal definition exists. Generally speaking, neighborhoods are both spatial and cultural entities, combining the ideas of a particular geographic area and the repeated social interactions of people and communities in that geographic area [5]. For the purposes of research, neighborhoods are often defined imperfectly using proxies like zip codes or US census tracts or their divisions. While neighborhoods are often thought of as unified areas, some research has shown the need for emergency care can differ within a neighborhood. For example, in the Charlestown neighborhood within Boston, MA, there are the existence of geospatial differences at the census tract level in opioid-related ED visits [6]. For the purposes of this chapter, we focus on the geographic and sociodemographic rather than the interpersonal aspects of a neighborhood; we define a neighborhood as the local geographic area within which we will consider potential effects of the built environment on emergency health needs [5].

In evaluating the effects of neighborhoods and the built environment on emergency medicine, it is useful to consider the so-called first law of geography, described by Waldo Tobler: "Everything is related to everything else, but near things are more related than distant things." [7] In other words, the more we can understand where things are in space, the better understand how they may be related. Geospatial analysis, the use of geographic data and mapping tools to quantify and analyze the spatial relationships between things, is an increasingly important tool used in many of the studies cited in this chapter. A review of geospatial analysis is beyond this chapter's scope, but EPs interested in learning more about geospatial analysis and developing expertise might start by exploring QGIS, which is a free and open-source spatial software for geospatial analysis and mapping [8].

Evidence Basis

Neighborhoods differ substantially in their resources related to emergency care, and the built environment influences access to care at a variety of points. While the Emergency Medical Treatment and Labor Act of 1986 (EMTALA) guarantees all people in the US medical treatment during an emergency, access to this medical treatment is not distributed equitably. In some cases, simply getting to an ED involves overcoming significant structural barriers like distance or difficult terrain. In other cases, access to trained EPs may not be feasible. For example, recent work highlights inequities in access to emergency-trained providers in rural communities, and an even more striking disparity for American Indian/Alaskan Native communities [9–11]. In conditions like traumatic injury or stroke, where specialty resources like trauma surgery, anesthesia, neurology, and neurosurgery may be required, differences in access to high-level emergency care have also been observed in both rural and in more urban environments [12, 13].

Outside of an ED, differences in neighborhood-level access to other health care services such as pharmacies can influence the ability of certain communities to stay healthy and follow through with emergency discharge plans [14, 15]. The built environment also affects access to potentially lifesaving devices such as automated external defibrillators (AEDs) and opioid overdose reversal kits, which require rational, community-centric design to ensure access where and when they are most needed [16, 17]. One example of this modeled the effectiveness of placing AEDs inside 7-Eleven ® convenience stores, and found that placing AEDs inside these stores, which were designed to be open and accessible to passersby, could considerably improve public AED access [18]. Finally, the built environment where a patient lives can affect their ability to utilize certain medications, such as oxygen, as access to electricity and other essentials are not universal, especially in shelters and temporary housing [19].

Exposure to Risk

Neighborhoods also vary substantially in the levels of various types of risks their inhabitants face related to the built environment. Within the home, exposure to allergens like mold or cockroaches has been shown to increase asthma symptoms,

and exposure to substandard housing conditions has been linked to increased asthma-related pediatric emergency department visits [20, 21]. Exposure to secondhand smoke has similarly been linked to increased asthma-related pediatric emergency department visits [22], and there is a strong socioeconomic gradient to childhood exposure to passive smoke, with children at or below the federal poverty level (FPL) exposed at more than four times the rate of children at or above 400% of the FPL [23]. Deficiencies in the structural characteristics of the built environment of the home are associated with heavy alcohol consumption [24].

Neighborhoods also determine an individual's risk of exposure to toxic chemicals, such as lead, that disproportionately affect poor communities and communities of color [25]. Contaminated drinking water, specifically lead contamination, is related to older housing and contaminated soil. In 2014, Flint, Michigan changed its water supply for a portion of the city that is comprised of a majority of Black people, and where 40% of residents live under the FPL. For several years afterward, residents complained of poor water quality, which was due to corroded pipelines that supplied homes in this community, arising from the change [26]. This lead-contaminated water crisis received national attention when lead levels in children under 6 years in this community were found to be substantially elevated—at levels that have been associated with cognitive, behavioral, and long-term cardiovascular complications including all-cause mortality [25, 27, 28].

A person's access to alcohol and healthy food is also determined largely by their neighborhood which has implications for chronic disease burden (e.g. obesity, metabolic syndrome, and cardiovascular disease) and can also impact individuals' safety [29]. In one study, Baylor Scott & White Health System in Texas tested a comprehensive program that provided healthy food options, as well as other services, for patients living in food deserts. Patients enrolled in the group that provided access to low-cost, healthy food options saw a decrease in ED visits over the subsequent year [30]. The presence of alcohol sales in a neighborhood has been linked to increased risk of cyclist or pedestrian injury [31]. The density of alcohol outlets in a neighborhood has also been shown to be related to excessive drinking behavior [32]. Several studies have noted a higher level of intimate partner violence, crimes, and adverse alcohol-related health outcomes associated with increased alcohol outlet density [33, 34]. In addition to access to food and nutrition, the air we breathe is tightly bound to where we live. Air pollutants and cold temperatures due to poor insulation have been linked to increased asthma symptoms, as has exposure to dust and smoke in the work environment [20].

Considering the role of the built environment in either access to care or exposure to risk can seem daunting, since the realities of a particular built environment might have existed long before an EP begans her practice and might be designed to last long after she retires. That said, organizations such as BuildHealthyPlaces.org are specifically dedicated to connecting public health experts, clinicians, community leaders, and businesses, to find creative solutions to develop communities in a way that promotes equity, justice, and improved health outcomes [35]. With training and multidisciplinary supportive systems, EPs can improve the built environment their patients inhabit and, in doing so, do better for their patients and the communities they serve.

Emergency Department and Beyond

Bedside

During the initial acute phase of an emergency evaluation, the EP should focus on caring for the patient, not on the patient's built environment outside the ED – with certain specific exceptions, such as the need to assess for toxins such as carbon monoxide, cyanide, or heavy metals exposures. An acute asthma exacerbation requires inhaled beta agonists, consideration of systemic steroids, and close monitoring, regardless of whether it was precipitated by a virus, difficulty reaching a pharmacy to obtain controller medication, or irritants like mold or second-hand smoke. That said, the details of the trigger need consideration when planning for a safe discharged and for how future exacerbations can be mitigated. A patient whose exacerbation was triggered by lack of access to a pharmacy could be helped by medication delivery services, or in the short term by simply discharge with an inhaler in hand. A patient whose exacerbation was related to housing issues like mold, however, might benefit from the help of an ED social worker, or a referral to a medical–legal partnership, which can help patients address dangerous housing conditions with legal action [36, 37].

Whatever the emergency, it is advisable that when taking a full history, EPs ask patients the details of the built environments to which they will return to when leaving the ED in order to create a rational discharge plan. For example, a patient with bilateral ankle fractures who temporarily requires a wheelchair before an interval operation cannot be discharged to a home that requires climbing three flights of stairs. In all cases, the discharge plan from the ED must make sense in the patient's environmental context. This requirement is set out in the Knowledge, Skills, and Abilities profiles from the American Board of Emergency Medicine, which states that EPs should be able to "[e]stablish and implement a comprehensive disposition plan that uses appropriate consultation resources; patient education regarding diagnosis; treatment plan; medications; and time- and location-specific disposition instructions" [38].

Hospital/Healthcare System

Hospitals can support neighborhoods and improve the built environment in a number of ways using interventions that are based in the ED, or in the larger hospital and health care system. Where specific resources already exist to address a particular need in the built environment, hospitals can use the ED as a referral source to such resources. For example, the Breathe Easy at Home Program, which operates primarily in Boston, allows EPs and other health professionals to identify patients with asthma whose housing conditions affect their asthma care; referral to the program triggers a home visit by the Boston Inspectional Services Department, which can work with property owners to address housing deficiencies [39]. In some cases, these types of referrals to specific resources can happen as part of a more general referral to an organization equipped to identify and address a patient's social

needs, such as the national Health Leads program, the Health Advocates program in Alameda County, or the Kaiser Thrive Local Initiative [40–42]. For these types of referrals to succeed, however, hospital systems need to educate their EPs and ED staff about the communities their patients live and work in, and about what resources are available, both within and outside the hospital. Such training could take the form of meetings with community members, or engagement with community groups that provide services to improve neighborhood conditions.

Additionally, hospitals in some cases can directly fill gaps in the built environment their patients inhabit. In an area with minimal access to fresh produce or other healthy foods, hospitals can commit to host farmers markets and food banks, as does the Lindau Lab at the University of Chicago Medical Center. Feed1st, an initiative developed by Dr. Stacy Lindau, hosts a food pantry at the medical center, and at the same time connects patients with social services, job training, and other resource. The program has fed more than 20,000 individuals and 7000 households since opening in 2010 [43]. Other hospitals have started to grow food on their roofs in order to create health food pantries for patients [44]. If access to exercise facilities is an issue, hospitals could build on-campus walking trails or house exercise classes accessible to the community. Issues related to housing stock are often more complex due to greater capital requirements [45]; nevertheless, several hospital systems have started to address these issues directly by actively developing high-quality affordable housing and medical respite facilities [46].

Societal Level

Emergency physicians can marry their knowledge of emergency presentations to their links to the built environment to function as advocates for social change. Examples abound, but this change is likely to require multidisciplinary efforts involving not only doctors but also lawyers, urban planners, politicians, and most importantly, members of the involved community. One such example is the expanding evidence base surrounding blight mitigation in urban communities. EPs see the consequences of gun violence on a daily basis, particularly in urban communities, and an interesting strategy to reduce violence may lie in reshaping the built environment through blight mitigation. Several large cities, including Philadelphia, Detroit, and Los Angeles, have embarked on converting blighted and abandoned lots and parks into green spaces, with the express purpose of decreasing violence in vulnerable communities.

In a landmark paper, Branas et al. reported a randomized controlled trial in Philadelphia that examined the impact of converting blighted lots into urban green spaces [47]. The transformation they describe was specifically designed to be scalable, affordable, and meant to create community rather than disperse it through gentrification. The quantitative and ethnographic findings from the Branas study showed a significantly reduced incidence of gun violence and other police-related problems, as well as greater perceived safety among community members. Several of the beneficial effects from this intervention were most pronounced in some of

Philadelphia's most vulnerable neighborhoods. This study represents a clear and striking link between the built environment at a societal level and its interaction with the acute care system.

Recommendations for Emergency Medicine Practice

Basic

- EPs, as part of every discharge, should ensure that the patient goes into a built environment where they are capable of executing the discharge plan. If unsafe conditions are identified in a person's neighborhood or environment, EPs can connect patients with social services and specific resources or Help Desks in their community, and actively partner with social services in their ED.
- When an emergency presentation seems likely related to a particular factor in the patient's built environment, EPs can refer patients to extant resources in the hospital or ED to address these factors. These might include specific resources that require a provider referral, such as medical–legal partnerships or case management services.

Intermediate

- EPs can learn about the built environment their patients live and work in and can work with hospital administration to develop solutions for modifiable factors. For example, knowing that a pharmacy desert exists outside your hospital might lead toward developing a take-home prescription program from the ED [48].
- EPs interested in medical advocacy can work with social emergency medicine teams within ACEP, SAEM, and AAEM to focus efforts on advocating for neighborhood health issues like housing code reform or safe streets initiatives (redesigning streets for pedestrians and bicyclists).
- Hospitals and EDs can develop training programs to help their EPs learn more about the unique strengths and vulnerabilities of the communities and geographic areas their ED is likely to serve. This training should be part of orientation for permanent and intermittent staff [49].

Advanced

- Outside the ED, an individual EP might consider working with medical–legal partnerships to effect regulatory changes to the local built environment, such as through zoning or building codes, or potentially becoming involved in politics at local or larger scales [30, 39]
- At the hospital level, EPs can champion a project within their hospital that responds to potential limitations in the local built environment, such as

collaborating with a farmers' market to supply food for patients after ED discharge, or creating an on-campus walking trail.
- EPs interested in studying a particular aspect of the built environment and its role in emergency care can learn more about geospatial analysis and work with research teams to investigate specific connections to health.

Teaching Case

Clinical Case

Mr. W is a 60-year-old male who presents to your ED during an overnight shift via ALS ambulance with a chief complaint of "difficulty breathing." As you enter the room, Mr. W appears in moderate respiratory distress—he is tripoding and pulling at the EKG leads and oxygen saturation monitors your nursing team is trying to place on him. Report from the paramedics indicate he has a history of chronic obstructive pulmonary disease (COPD), hypertension, and diabetes, and he was picked up from his apartment, where the patient had called 911 for his breathing troubles. His initial vitals include a temperature of 37.0 °C, heart rate 105 bpm, blood pressure 180/90 mmHg, respiratory rate 30/minute, and oxygen saturation 88% on room air. An initial finger-stick blood glucose was 180.

Mr. W's initial exam, in addition to his obvious respiratory distress, is notable for decreased breath movement throughout all lung fields and significant use of accessory muscles for inspiration. There is no lower extremity edema, and your point of care ultrasound shows lung sliding bilaterally with no evident B-lines. Your leading diagnosis is a COPD exacerbation, and you start Mr. W on noninvasive positive pressure ventilation and administer inhaled beta agonists and anticholinergics, as well as systemic steroids.

As he starts to improve, you note in your EMR that he was recently discharged from the inpatient medical service after a similar ED visit, and has had five ED visits for similar exacerbations in the last 6 months. When he's able to talk, you ask him what happened since that last visit, and he tells you that he lives immediately adjacent to a highway which is a thoroughfare for long-haul trucks. The city has identified his neighborhood's unsafe levels of air pollution, but he has been unable to find other low-income housing options in his community. As you admit Mr. W to a telemetry bed with the inpatient medical team, you contact your hospital's medical–legal help desk and ask them to see the patient while in the hospital. The help desk is able to identify housing stipends that are available to him through the city, and he is paired with a case manager to help him to find alternative housing.

Teaching Points

1. Early recognition of risks in Mr. W's built environment can lead to early engagement of social work and the mobilization of resources to improve discharge planning for the admitting team.
2. Asking patients about specific barriers can help uncover issues in their built environment that can be modified by leveraging ED and hospital-based resources.

Discussion Questions

1. What resources would you engage in your emergency department for this patient?
2. What tools would help you care for this patient if his respiratory status was such that he could potentially be managed as an outpatient?
3. Are there steps that the hospital could take to improve care for this patient and decrease future unscheduled visits for his COPD exacerbations?
4. How could EPs translate this common clinical scenario into specific policy recommendations in their community?

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