PEAK Urban

Towards a better understanding of what makes a healthy urban built environment in Colombia.

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This brief presents recent evidence about the relationships between features of the built-environment and cardiovascular disease and diabetes in Medellín, Colombia. A better understanding of these relationships in the context of cities in low-and middle-income countries can lead to improvements to urban planning guidelines and contribute to minimizing the burden of non-communicable diseases in these urban areas.

Considerable attention has been given to understanding the detrimental and long-lasting effects of urban development patterns that contribute to sedentary lifestyles and unhealthy diets (Ding & Gebel, 2012; Feng et al., 2010; Kirk et al, 2010). Previous studies show that certain built environment features can improve population health by increasing opportunities for physical activity and social interaction (Frank et al., 2004; Cohen et al., 2008), while reducing psychological stress and depression (Gong et al., 2016).

However, there is a limited understanding of the relationship between the built environment and non-communicable diseases in cities of low-and middle-income countries (LMICs), with most of the empirical evidence concentrated in high income countries. The findings from those countries may not be transferable due to variations and the complexity of social, political and environmental contexts (Miranda et al., 2019). To our knowledge, there have been few studies examining the relationship between the built environment and cardiovascular disease and diabetes in Latin America, one noteworthy study is the SALURBAL project, presently underway in 11 Latin American countries (Quistberg et al., 2019).

Like other municipalities in Latin America, Medellin recognizes it has a critical role to play in improving the health of residents. The Medellín ciudad saludable (Medellín healthy city) initiative (Restrepo-Zea et al., 2017), currently forms part of the city's Master Plan 2014-2027 and aims to improve pedestrian infrastructure, build more bike lanes, reduce pollution from public transport, increase public open spaces, and foster mixed land-use, among others (Consejo de Medellín, 2014). The Development Plan 2020 – 2023 sets out guidelines to achieve the aim and expects to invest more than £275 million GBP on relevant programs. **Our research provides evidence about specific features of the built environment associated with positive health outcomes that can aid the municipality to achieve intended aims.**

Key findings

It is important to address the mobility and physical activity challenges of residents of cities in LMICs. Urban interventions could be designed to address both challenges rather than one over the other. For urban interventions to be effective in increasing walkability, 'usability' must be a chief aim, given that the terrain slope and safety concerns from crime could deter physical activity. **Neighbourhoods with very high intersection densities —short blocks, tend to have lower mortality rates from cardiovascular disease and diabetes. When coupled with gentle slopes, a very high intersection density can foster physical activity and active transport —walking or biking.**

More green space in close proximity to people's home results in better health. Studies from different countries worldwide have reported lower risk of cardiovascular disease for people living close to green space (Donovan et al., 2013; James et al., 2016; Lane et al., 2017; Pereira et al., 2012; Tamosiunas et al., 2014; Twohig-Bennet and Jones, 2018; Wang et al., 2019; WHO Regional Office for Europe, 2016; Yang et al., 2019; Yitshak-Sade et al., 2017). **Planners could use open satellite imagery to identify the residential areas that lack green space in their surroundings to allocate investment via innovative interventions, particularly where areas are already built-up.**

High urban population density should be pursued with caution. In Medellín, high population density to a certain degree was associated with low mortality rates, but extremely high population density was associated with increased mortality rates from diabetes and cardiovascular diseases. In the context of Latin American cities, very high density is often associated with overcrowding and deprivation, and previous works have found that extremely high densities can be associated with less walking (Christiansen et al., 2016). **In Medellín 60,000 people / km2 constitutes a healthy limit for neighbourhood's population density.**

Are dense urban layouts better for public health outcomes?

The distinct socioeconomic groups and built-environment features of Medellin's neighbourhoods are useful for understanding the implications of these differences on health.

Most research about the relationship between the urban built-environment and health has been done in high income countries. In low-and middle-income countries, we have a limited understanding, particularly of the relationship between the built environment and cardiovascular risk, and the findings from high income countries may not be easily transferable due to complex social, political, and environmental contexts (Miranda et al., 2019).

Medellín is the second largest city in Colombia, with a population close to 2.5 million. The city is located in a valley crossed by a river from south

to north, with flat areas close to the river and steep slopes towards the mountains. The city of Medellín is a useful location for studying the differences between neighbourhoods as it has experienced accelerated growth since the second half of 20th century. The rapid growth led to the co-existence of neighbourhoods with significantly different socioeconomic and their built-environment characteristics (Duque et al., 2013).

In an ongoing study Patino et al. (2021) use data from Medellín to interrogate the associations between built-environment features and mortality rates from cardiovascular diseases and diabetes in urban neighbourhoods. To date, Patino et al. (2021) have extracted built-environment metrics from open geospatial datasets and satellite imagery and coupled those metrics with adjusted mortality rates from cardiovascular diseases and diabetes. The adjusted mortality rates were calculated for different disease groups: the general group of diseases of the circulatory system, and the specific groups for ischemic heart disease, cerebrovascular disease, and diabetes mellitus (Figure 1). These mortality rates were calculated using official records from the Colombian statistical office (DANE). Patino et al. (2021) investigated the relationships between the adjusted mortality rates of each group and the built-environment metrics while controlling for socioeconomic status.

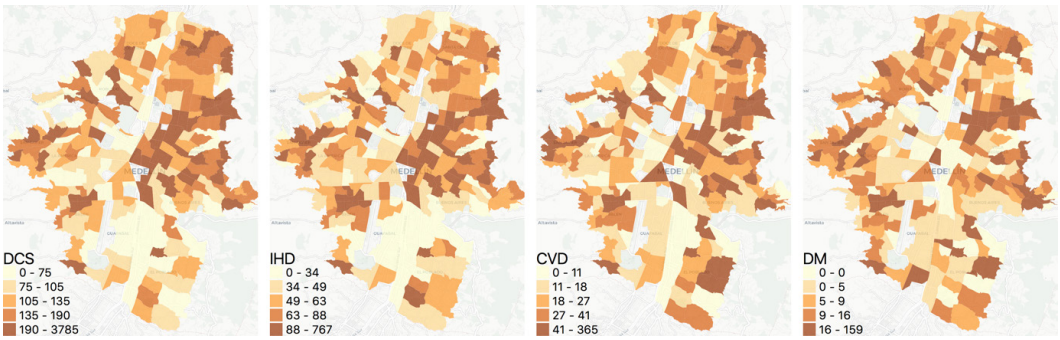

Figure 1. Spatial distribution of adjusted mortality rates for the analysed disease groups (units: number of deaths / 100,000 people). DCS: diseases of the circulatory system; IHD: ischemic heart disease; CVD: cerebrovascular disease; DM: diabetes mellitus.

The aspects of the built-environment that were analysed are related to four dimensions of the urban layout: design, diversity, destination, and density (Ewing and Cervero, 2010).

1 - The design dimension accounts for the urban layout in terms of the intersection density —the size of the blocks and street connectivity, the terrain slope and neighbourhood greenness.

2 - The diversity dimension includes the land use mix, the area share of industrial use within the neighbourhood, and the average of that share at the surrounding neighbourhoods.

3 - The destination dimension includes the density of amenities within the neighbourhood; and

4 - The density dimension was measured as the residential population density using population counts at neighbourhood level and the area of each neighbourhood.

A more walkable urban layout can foster

The findings from Patino et al. (2021) indicate that high intersection density, that translates on the ground to shorter blocks and higher connectivity, is associated with lower mortality rates from cerebrovascular

disease and diabetes. They also found that Medellín neighbourhoods with steeper terrain are associated with higher mortality rates. This was the case even when comparing areas with residents of similar socioeconomic backgrounds. This is likely due to the significant difficulty posed by the terrain slope to walking and biking. Urban design guidelines for new developments should aim for a high intersection density (short blocks) and, if they are on hilly terrain, they should include walking and biking pathways with gentle slopes or other urban features that foster physical activity like readily accessible playgrounds and workout stations.

mortality rates, from that point mortality rates start to increase again with higher population densities. In Medellín and in many other cities of low-and middle-income countries, extremely high population densities are often related to overcrowding, with many people sharing the same dwellings and also suffering from several forms of deprivation, such as limited access to health and education, inadequate housing, and food insecurity, that also have a negative impact on health. Moreover, due to the recent COVID-19 pandemic, we have to re-think carefully how to plan neighbourhoods with the right degree of population density to maximize health benefits while minimizing risk.

High population density is good, but only up to a certain point.

Density has been associated with more physical activity, including walking and biking, in cities of the Global North and China (Cervero and Kockelman, 1997; Leal and Chaix, 2011; Malambo et al., 2018). In Medellín, Patino et al. (2021) found that population density of up to 60,000 people/km2 is associated with lower

Are urban green spaces important for people's health and wellbeing?

Urban green spaces provide a series of benefits to residents.

Green spaces are good for health even if they are not accessible to people, as they give environmental services like reducing air pollution, noise, and surface temperature (Meerow and Newell, 2017).

When accessible, green spaces provide pleasant views and additional opportunities to exercise and to engage with other people, which help to reduce psychological stress and depression and to increase social cohesion (James et al., 2016).

Availability of neighbourhood greenness is strongly associated with better health but creativity, which can come in the form of repurposing residual spaces or vertical gardens, is necessary to increase greenness in places lacking it.

The findings for Medellín are similar to those of previous work conducted worldwide that have reported lower risk of cardiovascular disease for people living close to green spaces (Donovan et al., 2013; James et al., 2016; Lane et al., 2017; Pereira et al., 2012; Tamosiunas et al., 2014; Twohig-Bennet and Jones, 2018; Wang et al., 2019; WHO Regional Office for Europe, 2016; Yang et al., 2019; Yitshak-Sade et al., 2017). More greenness in Medellín's neighbourhoods was associated with lower mortality rates from the heart diseases analysed and from diabetes. In Medellín, as in many other cities of low-and middle-income countries, residential neighbourhoods that lack green space in their surroundings often have a very high built-up density and lack open space. The challenge is how to make space for green areas, and how to increase neighbourhood greenness using space-efficient strategies in these settings. Vertical gardens and the repurposing of small residual spaces to grow gardens and trees can help to achieve this goal.

Conclusion

It is important to strike a balance between economic development and population health and well-being in Latin American cities. Many Latin American cities have experienced rapid population growth, excessive urban densification and increasing pressures in maintaining adequate levels of health and quality of life. Knowledge accumulated in high income countries provides useful insights for implementing urban development strategies that equate health with economic growth, justifying commensurate investments in preserving health-promotive urban features, such as open and green spaces. However, many questions regarding the health impacts of the built environment remain unanswered. Further research in Latin American cities would be required to understand the impacts associated with neighbourhood differences in morbidity and mortality risk.

This brief was authored by Jorge E. Patiño, Andy Hong, Juan C. Duque, Kazem Rahimi, Silvana Zapata, Verónica Lopera. It draws on key findings from:

Patino, J., Hong, A., Duque, J.C., Rahimi, K., Zapata, S., (2021) Built environment and mortality risk from cardiovscular disasese and diabetes in Medellin, Colombia: An ecological study. Landscape and Urban Planning. Volume 213, 2021, 104126, ISSN 0169-2046, **https://doi.org/10.1016/j.landurbplan.2021.104126**

Further reading

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About us

The PEAK Urban programme aims to aid decision-making on urban futures by:

1. Generating new research grounded in the logic of urban complexity;

2. Fostering the next generation of leaders that draw on different perspectives and backgrounds to address the greatest urban challenges of the 21st century;

3. Growing the capacity of cities to understand and plan their own futures;

In PEAK Urban, cities are recognized as complex, evolving systems that are characterised by their propensity for innovation and change. Big data and mathematical models will be combined with insights from the social sciences and humanities to analyze three key arenas of metropolitan intervention: city morphologies (built forms and infrastructures) & resilience; city flux (mobility and dynamics) and technological change; as well as health and wellbeing.

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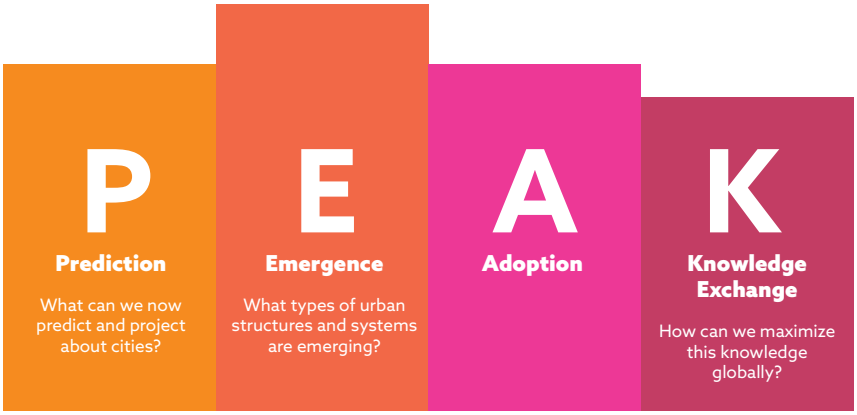
Our framework



The PEAK Urban programme uses a framework with four inter-related components to guide its work.

First, the sciences of **Prediction** are employed to understand how cities evolve using data from often unconventional sources.

Second, **Emergence** captures the essence of the outcome from the confluence of dynamics, peoples, interests, and tools that characterize cities, which lead to change.

Third, **Adoption** signals to the choices made by states, citizens and companies, given the specificities of their places, its resources and the interplay of urban dynamics resulting in changing local power and influence dynamics.

Finally, the **Knowledge** component accounts for the way in which knowledge is exchanged or shared and how it shapes the future of the city.

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