



IMPACT CASE STUDY

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# Evolving Towards Sustainability: the challenge for existing cities

Latin America and the Caribbean (LAC) is the second most urbanised region in the world, with 80% of its population living in urban areas.<sup>1</sup>

But urban population growth in the region is now declining and is expected to grow below the world average over the next decades. Many existing cities are characterised by informal settlements, fragile, disaster-prone locations, and poorly planned development. How then can LAC cities become more sustainable?

Research and analysis by EAFIT University's Research in Spatial Economics (RISE) group explores a range of evidence and interventions that could improve life for citizens and protect the environment in existing cities.

The 'Urban Sustainability' project is supported by the PEAK Urban programme and informed by a research framework which seeks to predict, plan, and adopt new approaches to address current and future urban challenges, drawing on knowledge and expertise from across the disciplines and engaging with policy makers and practitioners at every stage.<sup>2,3</sup>

The research covers many aspects of urban life, from productivity and economic development to transport, health, recreation, and well-being. It also considers environmental fragility and the resilience of the built environment as well as effective management of city crime and accidents.

Above all the hope of the project is to achieve scientific research with impact – developing a network of practitioners, policymakers, and academics discussing the synergies between findings on public health, built environment, green space, and climate emergency – which can help to evolve existing cities to meet current and future sustainability challenges. This experience from Latin America could also offer important lessons for other parts of the world as urban redevelopment, improvement, and renovation become the most significant ways that cities change.

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1. <https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf> (Accessed Jan 2022)

2. PEAK Urban website <https://www.peak-urban.org/>

3. Keith M, O'Clery N, Parnell S, Revi A. The future of the future city? The new urban sciences and a PEAK Urban interdisciplinary disposition. *Cities*. 2020;105(May):102820. Doi:10.1016/j.cities.2020.102820



# 1. Urban form and health

**SDG 11.7: Provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.**

**Jorge Patiño and colleagues in the RISE group investigated the links between green space and health and shared their findings with health policy makers and urban planners in Medellín and beyond.**

## The problem

**How do we best support health and well-being in urban environments?**

Research literature and the lived experience of residents all point to the health and environmental advantages of well-planned city layout and adequate green space in urban areas. But many questions remain, particularly for planners trying to maximise benefits for low-income city dwellers in the global south. What benefits do green spaces afford to physical and mental health and well-being? How much does social economic status affect proximity and access to green spaces? Which city layouts best promote good health? And what is the situation in Latin America?

## Research and findings

**Dense cities are more walkable and therefore better for health - but with caveats.**

There is currently little research on the impact of urban layout on health in low- and middle-income countries so Patiño and colleagues wanted to explore this issue.

They investigated the link between urban layout and deaths from cardio-vascular disease and diabetes (both significant drivers of mortality) in Medellín, Colombia's second largest city, with a population of 2.5 million. Medellín is a particularly interesting research site because of its socio-economic diversity and varied geography, with the centre located in a valley and

largely informal settlements climbing steep slopes at the periphery.

The researchers used open geospatial datasets and satellite imagery to map city layout against four factors: design, diversity, destination, and density. **Design** included layout such as the size of the blocks and street connectivity, the terrain slope and neighbourhood greenness. **Diversity** reflected the mix of industrial and residential land-use. The destination dimension looked at distance to local amenities, while the **density** dimension looked at density and spread of population across the city.

The team also worked with the Medellín Health Office to collect neighbourhood-level mortality statistics from 250 administrative areas. "This was really important," explains Patiño.<sup>4</sup> "The Health Office normally collects data from its 16 communes, which is not enough for a quantitative study. Collecting data at the neighbourhood level gave us objective data on health outcomes rather than the self-reported health risk factors typically used in Latin American studies.

"The findings broadly showed that a more walkable city is a healthier city. Shorter blocks and more intersections were associated with lower mortality rates from cardiovascular disease and diabetes.<sup>5</sup> Conversely, areas with steep terrain were associated with higher mortality rates because of the difficulty of walking and biking in such areas."

The research also confirmed the finding that dense cities are better for health, up to a point. Researchers found that population density of up to 60,000 people per Km<sup>2</sup> was associated with lower mortality rates, but that higher densities had a negative impact on mortality, probably due to overcrowding and poor living conditions.

## Impact on policy and practice

**Findings were shared with the Medellín Health Office.**

The Medellín Health Office were involved in the research from the design phase and have been very receptive to the findings, which were shared with them and disseminated more widely at a workshop in October 2021. The Health Office's *Medellín Ciudad*

4. Evaluation meeting conducted by Zoom on 15 October 2021

5. Patiño, J. E., Hong, A., Duque, J. C., Rahimi, K., Zapata, S., & Lopera, V. M. (2021). Built environment and mortality risk from cardiovascular disease and diabetes in Medellín, Colombia: An ecological study. *Landscape and Urban Planning*, 213, 104126.



*Saludable* (Medellín healthy city) plan provides a framework for potential improvements and the office continues to engage with EAFIT around possible interventions.

### Further research: green space and well-being

**Green space is good for health and well-being. Sharing research findings with policy makers has led to greater awareness of its importance.**

As a result of this initial research finding, the group then decided to investigate the health and environmental benefits of green space. They found that people benefit from services such as temperature, noise, and air pollution control, and some degree of amenity value, whether they can access green spaces directly or can only see them from a window. Where people have access, however, there are measurable additional benefits in terms of decreasing stress and depression and increasing the opportunity to exercise or enjoy the outdoors.

Looking at urban inhabitants' access to green space in Medellín and other Colombian cities, the group found that middle-class neighbourhoods in Medellín had the least greenery around them, whilst in other cities such as Cali, as might be expected, the highest socio-economic groups had the most surrounding greenery. In coastal Cartagena and Riohacha, poorer communities were found to have more green space around them and in Neiva, middle-class neighbourhoods have most green space.

A policy briefing from this work was shared with the Medellín Health Office and disseminated to other municipalities in the province. As result, a network of practitioners, decision-makers and researchers are now aware of an issue which had hitherto been ignored and are able to discuss the importance of green space in a more nuanced and informed way with public and policy audiences.

#### Further information

- Patino, J. E., Hong, A., Duque, J. C., Rahimi, K., Zapata, S., & Lopera, V. M. (2021). Built environment and mortality risk from cardiovascular disease and diabetes in Medellín, Colombia: An ecological study. *Landscape and Urban Planning*, 213, 104126. <https://doi.org/10.1016/j.landurbplan.2021.104126>
- Patino, J. E. (2020). Analyzing long-term availability of urban green space by socioeconomic status in Medellín, Colombia, using open data and tools. In *2020 IEEE Latin American GRSS & ISPRS Remote Sensing Conference (LAGIRS)* (pp. 87-92). Santiago, Chile: IEEE. <https://doi.org/10.1109/LAGIRS48042.2020.9165672>
- Hong, A., Martinez, L., Patino, J. E., Duque, J. C., & Rahimi, K. (2021). Neighbourhood green space and health disparities in the global South: Evidence from Cali, Colombia. *Health and Place*, 72, 102690. <https://doi.org/10.1016/j.healthplace.2021.102690>

#### Policy briefs:

- Patino, J. E., Hong, A., Duque, J. C., Rahimi, K., Zapata, S., & Lopera, V. M. (2021). Towards a better understanding of what makes a healthy urban built environment in Colombia. *PEAK Urban Brief* (F. Obando ,Ed). <https://www.peak-urban.org/publications/towards-better-understanding-what-makes-healthy-urban-built-environment-colombia>
- Patino, J. E., Hong, A., Duque, J. C., Rahimi, K., Zapata, S., & Lopera, V. M. (2021). ¿Qué es lo que hace que el entorno urbano sea saludable en Colombia. *PEAK Urban Brief* (F. Obando ,Ed). [https://www.peak-urban.org/sites/default/files/2021-06/peak\\_brief\\_healthy\\_urban\\_environment\\_colombia-spanish.pdf](https://www.peak-urban.org/sites/default/files/2021-06/peak_brief_healthy_urban_environment_colombia-spanish.pdf)

## 2. Investigating cycling patterns in Medellín

**SDG 11.2: Provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety.**

**SDG 13.2: Integrate climate change measures into national policies, strategies, and planning.**

**Juan Pablo Ospina and colleagues in the RISE group have investigated the factors that will persuade more people to cycle in Medellín and have influenced the city council's plans for new cycle routes.**

### The problem

**Cycling is great for health. How do we get more people out of cars and onto bikes?**

Cycling is a great way to get round cities. Encouraging more people to cycle can help tackle congestion, reduce air pollution, and bring health benefits for individuals. But anecdotal evidence from Canada and elsewhere has shown that significant investment in cycling infrastructure does not necessarily get people onto bikes.

Keen cyclist, Juan Pablo Ospina, wanted to find out what factors would persuade more people to cycle in Medellín, a diverse, hilly urban area where 50% of car journeys are less than 4k. In particular, he wanted to investigate how scarce resources could be allocated most cost effectively to get best return on investment.

### Research and findings

**Cyclists in Medellín value 'connectivity' and 'directness'.**

A survey targeted at bicycle commuters and the public was developed with input from local cycling organisations, local authorities, and universities, and distributed online, by telephone, and on the street. The survey found that despite the mountainous terrain, cycling was already a popular mode of transport.

Findings revealed that:

- people were willing to climb slopes of up to 9%
- socio-economic status did not affect people's willingness to cycle
- having dedicated cycling infrastructure along the whole route is important to people
- the maximum distance most people are prepared to travel is around 4k.

The two elements that mattered most to cyclists, however, were 'connectivity' along the route and 'directness' to their destination. "Even though experienced cyclists are used to mixing with traffic, we found that people wanted dedicated cycle lanes or corridors for the whole length of their journey and not to be forced onto the road for some of the time," Ospina explains. <sup>6</sup> "They also wanted to be able to get to their destination in the most direct way."



### Impact on policy and practice

**The findings have influenced Medellin city council's plans for cycling infrastructure.**

Ospina shared the findings with the Mobility Office of Medellin City Council, who were keen to boost cycling and walking as modes of transport. The RISE team also developed specific, cost-effective proposals for new cycle paths - bearing in mind cyclists' behaviour and the council's limited resources - using optimisation approaches to make trade-offs between possible cycling networks.

Virtual meetings held during the COVID pandemic allowed council representatives to understand the research and engage with the proposals. The group also engaged the cycling community through discussions and workshops at the Explora LAB (<https://www.parqueexplora.org/exploratorio>).

The Mobility Department's working scheme for enhanced cycle paths across Medellin, presented in March 2021 and due for implementation before the end of the Council's term in office in 2023, reflects elements of the research but in fact goes further. The proposal includes investing a higher budget in more direct routes and new corridors towards the peripheral areas of the city, a significant investment in non-motorised transportation. As of January 2022, parts of the cycle infrastructure network have started to be built.

6. Evaluation meeting held by Zoom on 21 October 2021

The research also has implications for other cities in Latin America and beyond and will be shared in VELO-CITY (<https://www.velo-city2022.com/en/>) and with the National Ministry of Transport from Colombia. Ospina and colleagues are also participating in the formulation of the **Colombian National Strategy for Active Mobility** which will provide an opportunity to influence national level policy.

"For the project to expand the cycling network, we have taken into account different inputs; among them, the results derived from the articles *Understanding cycling travel distance: the case of Medellin city (Colombia)* and *A database to analyse cycling routes in Medellin, Colombia...* This input was added to others that have been fundamental for the design and construction of the scheme... For us as Human Mobility Management of the city of Medellin, it is very valuable to have this type of work, since it helps us make objective decisions based on research evidence."

*Wilson Enrique Lopez Bedoya, Head of Mobility, Medellin City Council.*

#### Further information

- Ospina, J. P., Botero-Fernández, V., Duque, J. C., Brussel, M., & Grigolon, A. (2020). Understanding cycling travel distance: The case of Medellin city (Colombia). *Transportation Research Part D: Transport and Environment*, 86, 1-15, 102423. <https://doi.org/10.1016/j.trd.2020.102423>
- Ospina-Zapata, J. P., López-Ríos, V. I., Botero-Fernández, V., & Duque, J. C. (2020). A database to analyze cycling routes in Medellin, Colombia. *Data in Brief*, 32, 106162.

## 3. Disaster risk management: assessing seismic risk

**SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.**  
**SDG 11.5: Reducing the impact of disasters, with a focus on protecting the poor and people in vulnerable situations.**

**Ana Acevedo from EAFIT University has worked with Juan Carlos Duque and the RISE team to develop**

**new methods to assess seismic risk, which could enable authorities to undertake more frequent risk assessments and develop more effective disaster preparedness policies.**

### The problem

**Assessing the exposure of buildings to seismic risk can be expensive and time consuming. So how can policy makers undertake effective disaster risk planning?**

Colombia, like many countries in Latin America, is prone to earthquakes. But whilst the hazard posed by quakes in Japan for instance is higher, the impact in Colombia is often greater due to the vulnerability of its infrastructure.

“In Japan buildings are made to withstand earthquakes,” explains Dr Ana Acevedo, Professor of Engineering at EAFIT University.<sup>7</sup> “In Colombia, we have had a code requiring buildings to be earthquake resistant since 1984 but obviously many of our buildings were constructed before this. The movement of displaced people into the city in recent decades has also resulted in many low-income, informal settlements which don’t meet the code’s standards.”



**Using machine learning to analyse publicly available images can help make seismic risk assessment quicker and cheaper.**

Seismic risk is calculated by looking at three factors; **hazard** – the severity and frequency of quakes; **exposure** – the nature of the building stock (materials, design, etc) as well as population location and density; and **vulnerability** – the ability of buildings to sustain the impact of earthquakes.

Initial work by Acevedo and students, looked at quantifying the exposure of buildings in Medellin by individually assessing more than 10,000 open access images from Google Street View. Later, collaborating with Duque and the RISE team, the group used convolutional neural networks to automatically classify buildings in the images. The model proved around 95% accurate in identifying the ‘nonductile’ buildings most likely to be damaged in an earthquake. “When we were looking at images ‘by hand’ it was painstaking and slow work,” explains Acevedo. “Using

7. Evaluation meeting by Zoom on 22 October 2021

8. Evaluation meeting by Zoom on 14 October 2021

artificial intelligence makes it fast and easy. The fact that we had already classified the images meant that the neural networks could learn from experts – but do it quicker. Having learnt how to classify buildings, the process can then be used in other contexts.”

### Impact on policy and practice

**The RISE group is encouraging public authorities to use machine learning to undertake more frequent seismic risk assessments.**

The model has already been shared with policy and practice stakeholders, including the World Bank and UN Habitat. The Sustainable Development Department at the World Bank have identified the model as useful in helping to track neighbourhood improvements (eg increased resilience), and are keen to have further discussions with the team. The RISE group is also developing a proposal for public risk management bodies, looking at how the model could support their ongoing risk assessment and resilience work.

Duque comments:<sup>8</sup> “To the best of our knowledge, this was the first approach to evaluate the ‘exposure’ element of seismic risk assessment by analysing publicly available data with machine learning. We are keen to share it with decision makers and hope it will help guide emergency preparedness and inform decisions on resilience and mitigation planning in future.”

#### Further information

- Gonzalez, D., Rueda-Plata, D., Acevedo, A. B., Duque, J. C., Ramos-Pollan, R., Betancourt, A., & Garcia, S. (2020). Automatic detection of building typology using deep learning methods on street level images. *Building and Environment*, 177, 106805. <https://doi.org/10.1016/j.buildenv.2020.106805>
- Rueda-Plata, D., González, D., Acevedo, A. B., Duque, J. C., & Ramos-Pollán, R. (2021). Use of deep learning models in street-level images to classify one-story unreinforced masonry buildings based on roof diaphragms. *Building and Environment*, 189, 107517. <https://doi.org/10.1016/j.buildenv.2020.107517>

## 4. Urban form and productivity

**SDG 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.**

**Juan Carlos Duque and the RISE group have collaborated with researchers from the World Bank to look at how Urban Form affects productivity at city level, identifying interventions which can help boost economic development.**



## The problem

### How do we boost the productivity of urban areas?

With more than 80% of global GDP generated in cities, well managed urbanisation can contribute to sustainable growth by allowing innovation and increasing productivity.<sup>9</sup> But GDP per capita in Latin American countries is below what we would expect from the level of urbanisation, so cities may not be realising their potential.<sup>10</sup>

The importance of urban form has already been explored in urban economics, where 'dense' cities are usually thought to be more productive. Density facilitates knowledge sharing, lowers commuting costs, increases the availability of workers, and reduces time to retail and amenity destinations. Limited evidence exists however for low- and middle-income cities, and the focus on density may miss other characteristics of city form relating to productivity. Crucially, what can planners do to boost productivity when cities are not dense?

## Research and findings

### Dense cities tend to be more productive. But cities that are not dense can boost their productivity through specific interventions.

RISE first started to look at the issue of urban form and productivity after a request by the World Bank in 2018. "We wanted to understand more about the factors that promote productivity at the city level, in order to open up a conversation with governments and local authorities in Latin America about how they can create jobs and foster economic development," explains Nancy Lozano-Gracia<sup>11</sup> from the World Bank's Urban Disaster Risk Management, Resilience and Land Global Practice Team. "Our partnership with the multidisciplinary RISE group has been a great way to explore a question that spans economics, planning and geography, and required a high level of data analysis."

Wanting to go deeper than the traditional density dimension of urban form used by economists, the World Bank/EAFIT team developed a set of indicators adapted from the planning literature. These look at three dimensions of urban form: **shape of the border** (whether the city is elongated, rounded or irregular); **urban texture** (road layout and connectedness, which indicates whether it is planned or organic); and **land use patterns** (which indicate land use, and sprawl versus density).

The team then used OpenStreetMap to access data on street networks, and information from the NOAA National Centers for Environmental Information open access night-time light imagery, to analyse the form of nearly one thousand cities in Latin American and the Caribbean.

"The amount of light emitted by a city at night (radiance) indicates the concentration of productive activities," explains Duque.<sup>12</sup> "Previous literature suggested that it is possible to use this radiance

to estimate Gross Domestic Product (GDP) and city-level productivity. This premise allowed us to use a standardised measure of productivity for Latin American cities, based on publicly available information."

### Research findings:

The findings were analysed in different ways and resulted in three academic papers (see below). Key findings include:

**Historical survey:** Looking at 919 Latin American and Caribbean cities in 1996, 2000 and 2010 the researchers noted the tendency of certain cities to grow on steeper slopes, urban growth occurring in protected areas, and a trend towards sprawl in some cities. The team also noted that the cities had not changed much over the period.

**Productivity:** The research showed that compact, dense, and well-connected cities are likely to be highly productive, as previously thought. However, by going further to consider shape, texture and land-use, the research suggests that a non-compact city can reach high levels of productivity using specific interventions, such as safe and efficient public transport and appropriate land-use planning.

**Local government structures:** The researchers also looked at the impact of local government on productivity. They found that administration by multiple local authorities at *district level* in large cities reduced productivity as might be expected, and that *higher-level metropolitan authorities* (operating over many districts), did *not* provide effective coordination to mitigate the impact of fragmented district-level governance, as we might hope. This indicates that metropolitan authorities are not currently effective governance bodies in LAC and should be strengthened to help increase productivity, among other goals.



## Impact on policy and practice

### Research findings are influencing the World Bank's ongoing policy dialogue with governments and local authorities in LAC.

The research is now being used in World Bank discussions with national governments and local authorities in Latin America. Nancy Lozano-Gracia

9. <https://www.worldbank.org/en/topic/urbandevelopment/overview#1> (Accessed Jan 2022)

10. Ferreyra M M, Roberts M. Ferreyra MM, Roberts M, editors. *Raising the bar for productive cities in Latin America and the Caribbean*, Washington, DC: World Bank Publications.; 2018.

11. Evaluation meeting held by Zoom on 29 October 2021

12. Evaluation meeting held by Zoom on 14 October 2021

comments: “The research has been a fruitful collaboration between EAFIT and World Bank researchers and has deepened our understanding of productivity at city level. The findings on productivity, governance, and development over time have been captured and disseminated in academic papers and in a World Bank Report and are already informing our ongoing policy dialogue with governments and local authorities in Latin America. This is a very good example of how solid analytics can inform urban policy and practice and help shape future cities.”

**Further information**

- Duque, J. C., Lozano-Gracia, N., Patino, J. E., & Restrepo, P. (2019). Urban form and productivity: What shapes are Latin-American cities?. *Environment and Planning B: Urban Analytics and City Science*, 0(0), 1–20. 2399808321999309.
- Duque, J. C., Lozano-Gracia, N., Patino, J. E., Restrepo, P., & Velasquez, W. A. (2019). Spatiotemporal dynamics of urban growth in Latin American cities: An analysis using nighttime light imagery. *Landscape and Urban Planning*, 191, 103640.
- Duque, J. C., Lozano Gracia, N., Patino, J., & Restrepo, P. (2019). Institutional fragmentation and metropolitan coordination in latin american cities: What consequences for productivity and growth? *World Bank Policy Research Working Paper* (8696). DOI: 10.1111/rsp3.12314
- Ferreyra, M. M., & Roberts, M. (Eds.). (2018). Raising the bar for productive cities in Latin America and the Caribbean. *The World Bank Open Knowledge Repository*. <http://hdl.handle.net/10986/29279>

## 5. Investigating patterns of crime and crashes

**SDG 3.6: By 2030, halve the number of global deaths and injuries from road traffic accidents.**

**SDG 16.1: Significantly reduce all forms of violence and related death rates everywhere.**

**Rafael Prieto Curiel and colleagues in the RISE group and at UCL, have mapped the patterns of crimes and traffic accidents in Mexico City throughout the week, providing useful information on how to best target scarce public resources.**

**The problem**

**Can we identify when crimes and crashes are most likely to occur in cities?**

Reducing crime and road deaths are both targets of the SDGs<sup>13</sup> and important to ensuring safe, inclusive, sustainable cities. In Latin America, crime has been

identified as the most important issue for citizens, and costs country economies at least 3% of GDP; and cars kill three times more people than crime and violence combined, with most casualties being working aged young adults. Understanding the conditions which increase the likelihood of a crime or crash could help policy makers better understand and tackle the problems.<sup>14</sup>

Rafael Prieto Curiel worked for the Mexico City police force as a mathematician before doing his PhD, and the research project emerged from this experience. “We used to sit in the police bunker watching cameras tracking activity in different parts of the city,” he explains.<sup>15</sup> “We had an intuition that more crimes and accidents happened at certain spots across the city, and at certain times of the week, but we didn’t have the evidence and thought that modelling the data might help.”

**The research**

**Crime and crashes in Mexico City follow predictable weekly patterns - peaking on Friday night (8.00pm) and dipping to their lowest level on Tuesday morning (3.00am).**

Crime research has tended to focus on hotspot locations, but there had been little investigation of the time of the week that a crime is more likely to occur. “Weeks are the most relevant temporal unit to analyse social events as these have regular patterns of human activity across them,” explains Prieto Curiel.

Prieto Curiel and colleagues analysed open access data from Mexico City giving the time and location of crashes detected by the Emergency Attention Centre from January 2016 to March 2020; and an Open Access dataset containing all crimes reported to the Police, including their location and time.

The researchers then modelled the weekly trace or ‘heartbeat’ of events, capturing the time and location of more than 200,000 violent crimes and nearly one million crashes in Mexico City.

The researchers found that crime and crashes follow a similar pattern with both reaching their ‘peak’ on Friday night (8.00pm) and ‘valley’ on Tuesday morning (3.00am). The level of crime was found to be 7.5 times higher at peak times than its lowest level, whilst crashes were 12.3 times higher at peak than the lowest point. By analysing the data at neighbourhood level, they also found that nearby barrios have similar patterns, and that their distinct patterns are based on local amenities and economic activities (such as services, education, leisure, offices, manufacture, and health) in that area.

**Impact on policy and practice**

**Understanding the pattern of crimes and crashes across the week can help policy makers allocate scarce public resources.**

13. SDG 3.6: By 2030, halve the number of global deaths and injuries from road traffic accidents; 16.1 Significantly reduce all forms of violence and related death rates everywhere

14. Prieto Curiel, R., Patino, J.E., Duque, J.C., & O’Clery, N. (2021). The heartbeat of the city. *PLoS ONE*, 16(2): e0246714. <https://doi.org/10.1371/>

15. Evaluation meeting held by Zoom on 29 October 2021

“The findings have clear implications for the allocation of resources,” comments Prieto Curiel. “Friday nights will see a big pull on both police and emergency response resources as any crime or accident will require both services. Throughout the week, fewer or greater numbers of police may be needed at different times, depending on the pattern. It’s easy to see how this information could support the effective allocation of scarce public resources, ultimately keeping people safe.”

Prieto Curiel has delivered three workshops (last, Sept 2021) to support police colleagues and security experts to understand the findings and explore their implications for resourcing and organisation. Feedback indicates that the police feel the evidence offers new ways of looking at crime and accidents, and that they are considering how to take this forward. Security experts have also expressed interest in the methodology, which can be applied to other cities. As a result, some of the research outputs oriented to crime analysts will include a graphic ‘heartbeat’ of city crimes to help visualise the temporal pattern of crimes.

#### Further information

- Prieto Curiel, R. (2021). Weekly Crime Concentration. *Journal of Quantitative Criminology*, 1-28. 10.1007/s10940-021-09533-6.
- Prieto Curiel, R., Patino, J.E., Duque, J.C., & O’Clery, N. (2021). The heartbeat of the city. *PLoS ONE*, 16(2): e0246714. <https://doi.org/10.1371/>



## Value for money

PEAK research on Urban Sustainability offers excellent value for money as it has produced a body of evidence around interventions to evolve existing cities covering a wide range of issues, including health, transport, economic productivity, disaster risk assessment, and crimes and accidents.

### Economy test

- Evolving existing cities through evidence-based interventions is a cost-effective way to improve sustainability, in contrast to building expensive new urban areas and developments.
- Evidence-based interventions will avoid the problem of costly policy mistakes and ensure taxpayers and public bodies get value for money from public funding and resources.
- The insights equip governments to prevent losses to life and infrastructure from natural disasters, ill-health, crime, and accidents – all of which have a significant economic cost – and the application of them will therefore be cost-effective.

### Efficiency test

- All the research and policy recommendations relating to existing cities were developed in collaboration with stakeholders and have been shared with policy makers and practitioners. This ensures that the research is grounded in the real needs and experience of urban dwellers and the findings are practical, appropriate, and have real-world use.
- We can already report examples of impact at local and national level – and evidence of influencing international agencies and global conversations around existing cities.

### Equity test

- All interventions to evolve and improve existing cities have potential to enhance the health and well-being, and leisure and economic opportunities, of urban residents – particularly those on low incomes in the global south.
- Many of the interventions proposed use low-cost, publicly available data collection and analysis techniques, making them replicable and scalable by public authorities in resource constrained contexts.
- Proposed interventions will make cities more sustainable, reducing their climate impact and better protecting fragile environments.

## So what?

Medellin, in common with many cities in Colombia and indeed Latin America, has grown organically over the last decades, with the population swelled by people seeking opportunity or fleeing poverty and conflict, and much new building happening unplanned and informally.

Whilst population growth and urban expansion are now slowing, it may seem that policy makers have few options in terms of planning the sustainable, resilient cities envisioned by the SDGs. How then do they maximise the potential of existing cities to promote the health, well-being, and economic prosperity of citizens, particularly those on low incomes, living in marginalised areas?

The Urban Sustainability research shows that a variety of interventions can help all cities become more sustainable, even where resources are scarce. Attention to urban layout can foster green spaces and boost health and well-being. Well-planned cycle routes can encourage city dwellers to move from motorised transport onto bikes. Better predicting the impact of natural disasters, can allow appropriate investment in mitigation and preparedness. Understanding what makes urban areas productive, can inform interventions to foster economic growth. And understanding patterns such as crime and accidents, can ensure effective allocation of scarce public resources.

Evolving urban form through appropriate interventions shows that working with what is there, and making evidence-based, precisely targeted interventions, can help to transform cities. Over the next year, the RISE group will be sharing research findings with stakeholders in Latin America and elsewhere and developing detailed proposals on how public bodies and private entities can continue to take forward these interventions in their contexts.

### Support from the RISE group

Planners and policy makers interested in support with any of the issues in this case-study should contact Juan Carlos Duque, Director of the RISE group, EAFIT University. Contact: [jduque1@eafit.edu.co](mailto:jduque1@eafit.edu.co)

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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 recognised 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 analyse three key arenas of metropolitan intervention: city morphologies (built forms and infrastructures) and resilience; city flux (mobility and dynamics) and technological change; as well as health and wellbeing.

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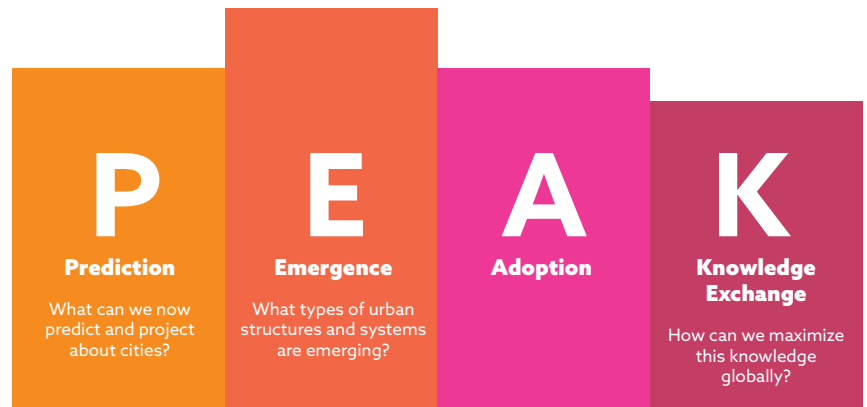
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## Our framework



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 characterise cities, which lead to change.

Third, **Adoption** signals to the choices made by states, citizens and companies, given the specificities of their places, their resources and the interplay of urban dynamics, resulting in changing local power and influencing 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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PEAK Urban is a partnership between:

