Urban landscape and street design factors associated with road traffic mortality in Latin American cities

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There are on average 95,000 road traffic deaths in Latin America annually and are the leading cause of death of 5-14-year old's in the Americas and 2nd leading cause of 15-44-year old's

https://www.childinthecity.org/2019/01/17/why-we-need-a-summit-on-youth-urban-road-safety/
They also result in a major economic impact of **annual 4.4% Gross Domestic Product (GDP) loss** in the region due to impacts on young lives, trauma care costs, employment, and other impacts.

Paulozzi, 2007, Acc An Prev
CITY-LEVEL FACTORS

More traffic fatalities

NEIGHBORHOOD-LEVEL FACTORS

Less urban sprawl

Ewing, 2003 AJPH

AAP Committee on Environmental Health, 2009, Pediatrics
STREET-LEVEL FACTORS
ROAD TRAFFIC SAFETY POLICIES

TRADITIONAL APPROACH
- Traffic deaths are INEVITABLE
- PERFECT human behavior
- Prevent COLLISIONS
- INDIVIDUAL responsibility
- Saving lives is EXPENSIVE

VISION ZERO
- Traffic deaths are PREVENTABLE
- Integrate HUMAN FAILING in approach
- Prevent FATAL and SEVERE CRASHES
- SYSTEMS approach
- Saving lives is NOT EXPENSIVE
RESEARCH OBJECTIVES

• Assess quality of road traffic death data
• Examine city-level epidemiology of road traffic deaths across cities in Latin America
• Evaluate the association between city-level built and social environment factors with road traffic mortality
METHODS

- 366 cities ≥100,000 population from 10 countries
- Deaths 2010-2016 from city-level vital registry data
- Examined 5-year age groups by sex
- Assessed factors like population density, urban fragmentation, intersection density, GDP in regression analyses
There are substantial differences in the distribution of road users by country in terms of fatal victims.
Pedestrians were from older age groups, while other groups tended to be younger.
Pedestrians and bicyclists tended to be older, motorcyclists and car passenger occupants were younger.
Substantial variation between and within countries in terms of city-level road traffic death rates.
BY SEX AND 5-YEAR AGE GROUPS

Men

Women

The road traffic mortality rate for one of the Central American cities goes up to 544.

The road traffic mortality rate for one of the Central American cities goes up to 232.
WHICH CHARACTERISTICS OF THE URBAN ENVIRONMENT ARE LINKED TO Road Traffic MORTALITY IN CITIES?

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density</td>
<td>2010 Population per 2010 built-up area in square kilometers</td>
</tr>
<tr>
<td>Population Growth</td>
<td>Annual average change in population 2010-2016</td>
</tr>
<tr>
<td>Annual GDP</td>
<td>Annual gross domestic product in 2010</td>
</tr>
<tr>
<td>Social Environment Index</td>
<td>% population age 25+ ≥ primary school level</td>
</tr>
<tr>
<td></td>
<td>% Households overcrowding (&gt;3 people/bedroom)</td>
</tr>
<tr>
<td></td>
<td>% Households piped water access</td>
</tr>
<tr>
<td></td>
<td>% Households sewage network connection</td>
</tr>
<tr>
<td>Urban Development Isolation</td>
<td>Average distance between urban developments in city boundaries</td>
</tr>
<tr>
<td>Intersection Density</td>
<td>Number of intersections per square kilometer</td>
</tr>
<tr>
<td>Street Length Average</td>
<td>Average length of street segments</td>
</tr>
<tr>
<td>Streets per Intersection</td>
<td>Average number of streets emanating from intersections</td>
</tr>
<tr>
<td>Mass Transit System</td>
<td>Presence or absence of a bus rapid transit system or subway system</td>
</tr>
<tr>
<td>Urban Travel Delay Index</td>
<td>Average minutes delay</td>
</tr>
</tbody>
</table>
### WHICH CHARACTERISTICS OF THE URBAN ENVIRONMENT ARE LINKED TO Road Traffic MORTALITY IN CITIES?

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Association</th>
<th>Risk Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density</td>
<td>6% Lower</td>
<td>0.94 (0.90, 0.98)</td>
</tr>
<tr>
<td>Population Growth</td>
<td>5% Higher</td>
<td>1.03 (1.00, 1.06)</td>
</tr>
<tr>
<td>Social Environment Index</td>
<td>4% Lower</td>
<td>0.96 (0.91, 1.02)</td>
</tr>
<tr>
<td>Annual GDP</td>
<td>4% Lower</td>
<td>0.96 (0.94, 0.98)</td>
</tr>
<tr>
<td>Urban Development Isolation</td>
<td>5% Higher</td>
<td>1.05 (1.02, 1.09)</td>
</tr>
<tr>
<td>Intersection Density</td>
<td>8% Lower</td>
<td>0.92 (0.89, 0.95)</td>
</tr>
<tr>
<td>Street Length Average</td>
<td>4% Lower</td>
<td>0.96 (0.92, 1.00)</td>
</tr>
<tr>
<td>Streets per Intersection</td>
<td>2% Higher</td>
<td>1.02 (0.99, 1.05)</td>
</tr>
<tr>
<td>Mass Transit System</td>
<td>8% Lower</td>
<td>0.92 (0.86, 0.99)</td>
</tr>
<tr>
<td>Urban Travel Delay Index</td>
<td>No Association</td>
<td>0.98 (0.94, 1.02)</td>
</tr>
</tbody>
</table>

Association is per 1 standard deviation, bolded values were statistically significant at P<0.05.
CONCLUSIONS

• Urban planners and traffic engineers can consider ways to increase street connectivity and reduce fragmented urban development

• Cities can consider mass transit systems, such as BRT and subways, which also can provide other health benefits (e.g., less air pollution)

• Future work should examine other road safety outcomes (e.g., police reports), subgroups (e.g., pedestrians) and smaller geographic areas within cities

• Given heterogeneity, it is important to look beyond only the largest capital cities and see what smaller and middle-sized cities are doing successfully
THANK YOU!

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  • Philipp Hessell, Universidad de los Andes, Colombia
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