

Variation and predictors of youth and young adult homicides in cities of Latin America: the SALURBAL study

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Background

- **Interpersonal violence is a major public health problem (~2.5% of total mortality in the world)¹**
- **It is also spatially dependent¹, and has been associated with accelerated urbanization^{2,3}**
- **Latin America and the Caribbean (LAC)**
 - ~80% pop. living in cities⁴
 - 28.5/100k homicide rate in LAC vs. 6.7/100k worldwide¹

¹WHO (2014), ²Patton et al. (2009), ³Galea et al. (2005), ⁴Chioda (2017)

Background

- Men are usually more affected by homicides (~82% of victims worldwide) than women¹
- Homicides are particularly frequent in youth (15-24 yo) and young adults (25-39 yo), accounting for ~1/3 of all violent deaths in this age group¹
- Contextual city factors such as size⁵, density⁵, connectivity⁶, and inequality^{7,8} might also be important to explain homicide rates in youth

¹WHO (2014), ⁵Bilal et al. (2021), ⁶Briceño-León et al. (2008), ⁷Kennedy et al. (1996), ⁸Viana et al. (2011)

Scope and objective

- This study is set within the SALURBAL⁹ project, comprising contiguous urban areas¹⁰ w/ >100k pop. in 11 LAC countries
 - We define “cities” as these contiguous urban areas
 - Cities are aggregates of “subcities”, which are country-specific administrative units (e.g. *municipio* or *comuna*)
- Our aims are
 1. assess the variability in homicide rates in young adults and youth across subcities, cities and countries
 2. investigate the associations between contextual social and built environment factors and these homicide rates

⁹Diez-Roux et al. (2019), ¹⁰Quistberg et al. (2019)

Methods

- **Sample**

- 1,205 subcities nested within 315 in 8 countries (Argentina, Brasil, Chile, Colombia, El Salvador, Mexico, Panama and Peru)

- **Outcome**

- Homicide rates by age range (young adults, 15-24 yo and youth, 25-39 yo), subcity and sex

- **Exposures**

- Subcity and city-level social environment (SE) and built environment (BE) indicators

Methods: outcome variable

- Homicides are defined as Global Health Estimates (GHE) codes 1580 + 1600:

GHE code	ICD-10 codes	GHE category name
1570	X60-X849, Y870	Self-inflicted injuries
1580	X85-Y099, Y871	Violence
1590	Y36-Y369	War
1600	Y35-Y359	Other intentional injuries

- Death counts were conditionally redistributed according to age and sex using GHE¹¹
 - They were also corrected for undercounting at the city-level using an ensemble of death distribution methods⁵
- We pooled rates over the years 2010-2015 for AR, BR, CL, CO, MX and PE, 2010-2014 for PA and 2012-2016 for SV

⁵Bilal et al. (2021), ¹¹WHO (2017)

Methods: exposures

Variable (SE)	Interpretation (higher values)	Level
Educational attainment score ¹²	Higher educational attainment in the population	Subcity
Gross Domestic Product (GDP)	Higher overall income	City
Income-based Gini index	More income-based inequality	City

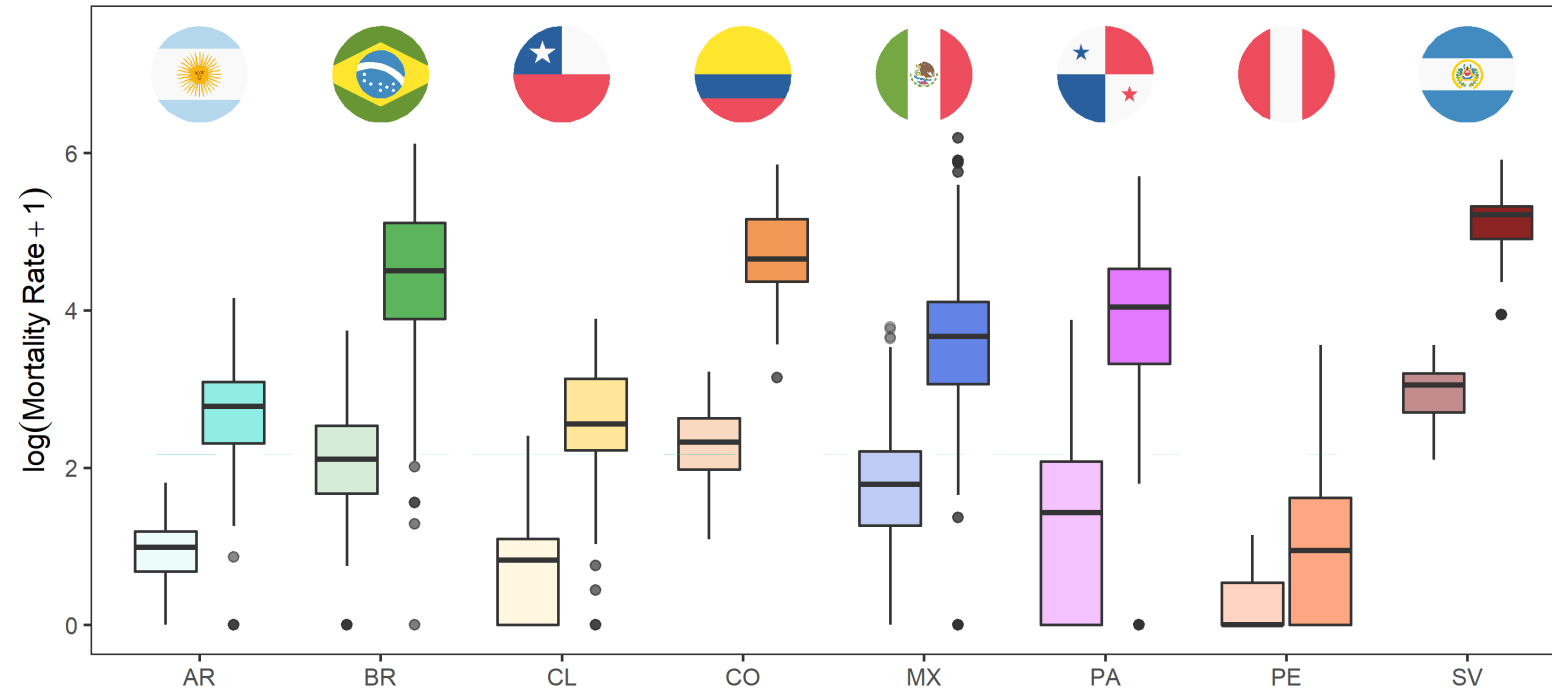
Variable (BE)	Interpretation (higher values)	Level
Area-weighted mean nearest-neighbor distance	More isolated urban patches	City
Population density	Denser urban development	City
City size	Higher overall population	City
Population growth	Higher population growth	City

¹²Ortigoza et al. (2021)

Methods: statistical analysis

- **Descriptive analyses of homicide rates across both sexes, age ranges and areas**
- **Mixed linear regression to assess clustering (subcities within cities within countries) variability of homicide rates**
- **Negative Binomial mixed model to estimate associations between homicide rates and exposures**

Results: boxplots of homicide rates by country and sex*



*pooled across all years and log-transformed

*prior to log-transforming, we added 1 to the homicide rates so that the log-rate equals 0 if the aggregated rates are also 0

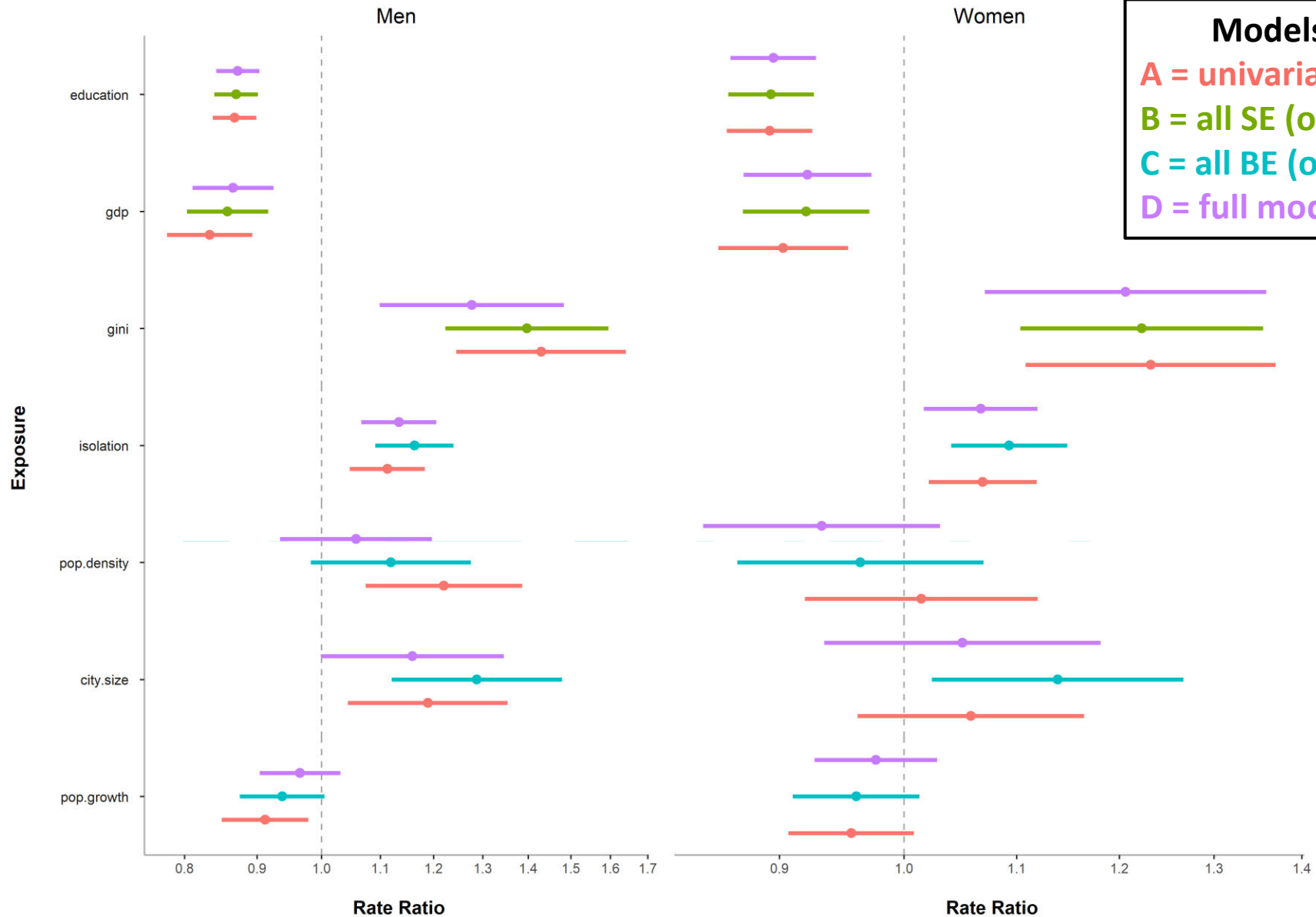
*estimates for women are on the left (softer shades) and estimates for men are on the right (darker shades)

Results: clustering variability analyses*

Level	Proportion of total variance (%)	
	<i>Men</i>	<i>Women</i>
Subcity	24.34%	41.02%
City	19.95%	10.72%
Country	55.71%	48.26%

*Linear mixed regressions stratified by sex with log of homicide rates (aggregated by age ranges) as the outcome and with random intercepts at the city and country levels

**Results:
associations
between
homicide rates
and exposures***



*Neg. Bin. mixed model adjusted by age and country fixed effects, and subcity and city-level random intercepts

*Dots are rate ratios (RRs) and horizontal lines are 95% confidence intervals

*RR axis is in a log10 scale

Discussion

- **Education and lower homicides rates**
 - improved living conditions^{1,6,13,14}
- **GDP and lower homicides rates**
 - higher overall income allows for better job opportunities and improved living conditions^{15,16}
- **Gini and higher homicides rates**
 - violent deaths are usually more frequent in areas with higher income inequality¹⁷⁻¹⁹

¹WHO (2014), ⁶Briceño-León et al. (2008), ¹³Krug et al. (2002), ¹⁴Wanzinack et al. (2018), ¹⁵Romero et al. (2001), ¹⁶Murray et al. (2013), ¹⁷WHO (2013), ¹⁸Yapp et al. (2019), ¹⁹Butchart et al. (2002)

Discussion

- **Isolation and higher homicide rates**
 - isolated areas may be socially and economically disadvantaged^{20, 21}
- **City size and higher homicide rates**
 - larger cities usually have higher homicide rates^{1,5,6}
 - only significant independent of social environment factors
- **Population growth and population density**
 - associations show signs of confounding

²⁰Graif et al. (2017), ²¹Inostroza et al. (2013), ¹WHO (2014), ⁵Bilal et al. (2021), ⁶Briceño-León et al. (2008)

Strengths and limitations

- **Strengths**

- harmonized data across cities w/ >100k pop. in 8 LAC countries¹⁰
- accounted for incomplete coverage of mortality using demographic methods⁵
- redistributed ill-defined injuries by sex, age, city and year using GHE¹¹

- **Limitations**

- ecological study
- secondary data
- inherent longitudinal nature of the data was ignored

¹⁰Quistberg et al. (2019), ⁵Bilal et al. (2021), ¹¹WHO (2017)

Concluding remarks

- Even after accounting for country effects, there was significant variability in homicide rates across cities and subcities
- Cities with higher education levels, higher GDP, lower income inequality and less isolated landscapes had lower homicide rates
 - associations remained significant even after adjusting for each other and unobserved city and country factors
- Our findings suggest that urban policies aiming to improve education, income inequality and urban planning might play an important role in reducing homicide rates in LAC cities

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THANK YOU!

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