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SHORT CONTRIBUTION

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# Crime concentration at micro-places in Latin America

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**Abstract**

Research on crime concentration at micro-places has had a very western-industrialised focus. In this paper we provide results on crime concentration for 42 cities in Latin America. The results suggest that crime is concentrated at higher levels in Latin American cities than in western-industrialised contexts. Reasons for this do not appear to be related to population size, average street length, numbers of crimes or crime rates. The results offer an indication of the crime reduction opportunities that could come from the implementation of programs that are precisely targeted to the micro-places where crime has been observed to highly concentrate, such as hot spot policing.

**Keywords:** Crime concentration, Micro-places, Latin America

## Introduction

Academic study into the geography of crime has increasing been oriented to examining crime at micro-places (Weisburd 2015). To date research on this topic has largely omitted any examination of crime concentration in the important crime research region of Latin America where crime levels are many times greater than those experienced in western-industrialised contexts (UNODC 2018). For example, in a systematic review of more than 45 studies of crime concentration (Lee et al. 2017) no studies from Latin America were included. For crime concentration research to effectively advance, be universally applicable and of wide practical relevance, examining patterns of crime is essential in environments where the settings are often different to the environments where this research topic has emerged.

In this paper we provide a contribution to the spatial crime concentration literature (see Braga et al. 2017 for a detailed review) by examining crime concentration levels in Argentina, Brazil, Colombia, Mexico, Uruguay, and Venezuela. We hypothesise that crime is highly concentrated in Latin American urban contexts.

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## Methods and data

Geocoded crime data at the street segment level for a 1-year period (for 2017 unless otherwise stated) from 37 cities in Latin America were used in the current study. These cities were selected due to ease of access to data, good procedures for recording crime data and their independent assessment (Chainey and Monteiro 2019; Fórum Brasileiro de Segurança Pública 2011). The analysis was performed on homicide, robbery, theft from the person, vehicle theft and other theft. Data on particular crime types for each city were selected based on consistency in definition, and use from in-house analysis to help inform new police interventions. In each case, the geocoding hit rate was above the 85% minimum threshold for reliability suggested by Ratcliffe (2004). Results from five additional cities from two other studies (Jaitman and Ajzenman 2016; Mejía et al. 2015) were included for further completeness.

Weisburd (2015) states that crime concentrates amongst street segments within certain spatial bandwidths: for a cumulative proportion of 25% of crime, the bandwidth for the proportion of micro-places is between 0.4 and 1.6%; and for a cumulative proportion of 50% of crime, the bandwidth for the proportion of micro-places is between 2.1 and 6%. Whilst other methods for measuring crime concentration exist [e.g., Lorenz curves and Gini coefficients (Bernasco and Steenbeek 2017)],

**Table 1 Homicide concentration**

| Country | City and population (in millions) | n crimes (and rate per 100,000) | % of streets accounting for 25% of crime (n streets) | % of streets accounting for 50% of crime (n streets) |
|---|---|---|---|---|
| Brazil | Duque de Caxias (0.3) | 454 (133) | 0.4 (42) | ***1.1*** (***126***) |
| | Nova Iguaçu (0.8) | 431 (55) | ***0.3*** (***42***) | ***0.9*** (***125***) |
| | Rio de Janeiro (6.3) | 1909 (30) | ***0.3*** (***129***) | ***1.1*** (***455***) |
| | São Gonçalo (0.3) | 439 (130) | ***0.2*** (***22***) | ***1.0*** (***102***) |
| Colombia[a] | Barranquilla (1.2) | 523 (43) | ***0.2*** (***na***) | ***0.7*** (***na***) |
| | Bogotá (8.1) | 1834 (23) | ***0.2*** (***na***) | ***0.5*** (***na***) |
| | Cali (2.4) | 2456 (102) | 0.4 (na) | ***1.3*** (***na***) |
| | Medellin (2.5) | 1503 (60) | 0.4 (na) | ***1.2*** (***na***) |
| Venezuela[b] | Sucre (0.3) | 223 (74) | 0.4 (na) | ***1.5*** (***na***) |

[a] Mejía et al. (2015)

[b] Jaitman and Ajzenman (2016)

Numbers in bolditalic indicate values below Weisburd's (2015) bandwidths and numbers in italics indicate values above Weisburd's (2015) bandwidths. All data periods are for 2017 unless stated: Brazil 2016, Colombia 2012–2013, Venezuela 2014

Weisburd's bandwidths of crime concentration are the most used and allow for the best comparison against other results.

For each city, the number of crimes on each street segment was calculated, from which the number of street segments representing the cumulative proportion of 25% of crime and 50% of crime in each city was determined. The average length of street segments across the sample was 139 m,[1] comparable to the average street segment length of 144 m in Weisburd's study (2015). Population statistics were sourced from each contributing agency and crime rates were calculated to allow for further examination of the results.

## Results

Tables 1, 2, 3 and 4 show levels of crime concentration for homicides, robberies, theft from the person, other theft and vehicle theft. Overall, most results were within Weisburd's (2015) crime concentration bandwidths, albeit at the lower end of these bandwidths. Across all crime types and all cities the average proportion of streets accounting for 25% of crime was 0.8% and was 2.5% for the proportion of streets accounting for 50% of crime. The exception to this was homicide where the percentage of street segments containing crime concentrations were consistently below Weisburd's bandwidths, with all examples experiencing 50% of homicides in no more than 1.4% of street segments. In cities in Mexico vehicle theft concentration threshold levels were also reached by a proportion of segments that fell below Weisburd's bandwidths.

On examination of the tables, no apparent pattern was present that related crime concentration levels to population, the number of crimes nor the crime rate.[2]

## Implications and conclusions

This study provides the first detailed crime specific account of crime concentration at micro-places in cities in Latin America. In most cases, threshold concentration levels were achieved towards the lower end of Weisburd's bandwidths, and several were below. The results suggest that crime is concentrated at higher levels in Latin American cities than in the western-industrialised contexts from which Weisburd proposed crime concentration bandwidths. Our results also support previous research (Chainey and Monteiro 2019) that indicates that differences in population, the volume of crime and crime rates do not appear to be related to differences in crime concentration in Latin American settings. Chainey and Monteiro (2019) suggest that crime concentration is more likely to be related to differences in the distribution of favorable conditions, determined by a combination of specific situational, offending site selection, and neighborhood conditions being present at very few places. Determining the extent of the contribution of each of these factors, and the differences between them in a variety of settings (e.g., comparing Latin American cities to cities in the United States) is a topic worthy of further research on why crime concentration levels vary.

Crime concentration levels were highest for homicide. Whilst homicides are typically considered to be a rare

[1] See Appendix for street segment data.

[2] A supporting OLS analysis produced $R^2$ values of less than 0.1 for each relationship examined.

**Table 2 Robbery concentration**

| Country | City and population (in millions) | n crimes (and rate per 100,000) | % of streets accounting for 25% of crime (n streets) | % of streets accounting for 50% of crime (n streets) |
|---|---|---|---|---|
| Argentina | Almirante Brown (0.6) | 1509 (271) | 1.1 (157) | 3.6 (505) |
| | Campana (0.1) | 482 (513) | *1.7* (*57*) | 5.4 (176) |
| | Florencio Varela (0.4) | 837 (197) | 0.8 (92) | 2.7 (300) |
| | General Pueyrredón (0.6) | 2033 (360) | 0.6 (203) | ***1.9* (*626*)** |
| | General Rodriguez (0.1) | 163 (187) | ***0.2* (*23*)** | ***0.6* (*64*)** |
| | La Plata (0.8) | 3837 (502) | 1.2 (298) | 3.4 (861) |
| | Lujan (0.1) | 246 (230) | 0.8 (32) | 2.3 (93) |
| | Merlo (0.5) | 1049 (202) | 0.8 (141) | 2.3 (403) |
| | Moreno (0.1) | 1652 (1116) | 0.8 (146) | 2.6 (494) |
| | Pergamino (0.1) | 1059 (1009) | *2.4* (*95*) | *7.1* (*275*) |
| | Quilmes (0.5) | 2179 (420) | 1.4 (173) | 4.4 (533) |
| Brazil | Belford Roxo (0.5) | 2681 (573) | *1.7* (*58*) | 4.9 (167) |
| | Duque de Caxias (0.3) | 7938 (2328) | 0.5 (60) | 2.4 (271) |
| | Niteroi (0.5) | 4629 (949) | 0.8 (47) | 3.1 (166) |
| | Nova Iguaçu (0.8) | 8310 (1055) | 0.4 (59) | 2.2 (255) |
| | Rio de Janeiro (6.3) | 55,149 (873) | 0.8 (350) | 3.5 (1384) |
| | São Gonçalo (0.3) | 12,357 (3667) | 1.0 (78) | 3.7 (320) |
| | São João de Meriti (0.6) | 5293 (885) | *3.3* (*51*) | *10.5* (*165*) |
| Mexico | Mexico City (8.9) | 8369 (95) | 0.2 (330) | 0.9 (1509) |
| Uruguay | Montevideo (1.4) | 8971 (650) | 0.8 (287) | 2.8 (938) |

Refer Table 1 footnote

**Table 3 Theft (Argentina—other theft; Colombia—theft from the person) concentration**

| Country | City and population (in millions) | n crimes (and rate per 100,000) | % of streets accounting for 25% of crime (n streets) | % of streets accounting for 50% of crime (n streets) |
|---|---|---|---|---|
| Argentina | Bahia Blanca (0.3) | 869 (316) | 0.6 (86) | 2.2 (301) |
| | Olavarria (0.1) | 192 (171) | 0.7 (34) | ***1.7* (*82*)** |
| | San Nicolas (0.1) | 318 (237) | 0.7 (32) | 2.2 (107) |
| | Tandil (0.1) | 305 (261) | 0.9 (45) | 2.4 (121) |
| | Zarate (0.1) | 373 (377) | 0.7 (29) | 2.4 (101) |
| Colombia[a] | Barranquilla (1.2) | 8933 (733) | 1.0 (na) | 3.4 (na) |
| | Bogotá (8.1) | 39,825 (493) | 0.5 (na) | 2.2 (na) |
| | Cali (2.4) | 14,431 (601) | 0.6 (na) | 2.4 (na) |
| | Medellin (2.5) | 5274 (210) | ***0.2* (*na*)** | ***0.9* (*na*)** |

Refer Table 1 footnote

event, in Latin American cities this is less the case. The conditions that give rise to areas becoming high homicide concentration areas may be the same conditions that create crime concentration areas for other crime types, and would be another topic worthy of further study.

To date, most programs to reduce crime in Latin America are applied at macro and meso levels and aim to address the structural determinants associated with crime such as social inequality and poverty (Bergman 2018; Inter-American Development Bank 2016), yet high crime levels persist. The results from the current study provide an indication of the opportunities for implementing programs that are targeted to the micro-place level in Latin American cities. The findings from the current study have already helped to inspire the piloting of hot spot policing and problem oriented policing programs in several of the cities that participated in the study, with initial evaluations reporting

**Table 4 Vehicle theft concentration**

| Country | City and population (in millions) | n crimes (and rate per 100,000) | % of streets accounting for 25% of crime (n streets) | % of streets accounting for 50% of crime (n streets) |
|---|---|---|---|---|
| Argentina | La Matanza (1.8) | 5160 (291) | 0.5 (165) | 2.3 (723) |
| | Lanus (0.5) | 2303 (507) | *2.3* (*186*) | *6.7* (*533*) |
| | Lomas de Zamora (0.6) | 2632 (429) | *1.8* (*202*) | 5.5 (637) |
| | San Martin (0.4) | 1635 (387) | *2.1* (*162*) | 5.9 (467) |
| Colombia[a] | Barranquilla (1.2) | 1406 (115) | 0.6 (na) | ***1.9 (na)*** |
| | Bogota (8.1) | 6573 (81) | 0.4 (na) | ***1.5 (na)*** |
| | Cali (2.4) | 6442 (268) | 0.7 (na) | 2.2 (na) |
| | Medellin (2.5) | 9862 (393) | 0.9 (na) | 3.0 (na) |
| Mexico | Ecatepec (1.7) | 828 (50) | 0.6 (12) | ***1.8 (35)*** |
| | Escobedo (0.4) | 281 (80) | ***0.2 (46)*** | ***0.5 (115)*** |
| | Monterrey (1.1) | 267 (24) | ***0.3 (37)*** | ***0.8 (104)*** |
| | Oaxaca (0.3) | 450 (176) | ***0.03 (5)*** | ***0.1 (12)*** |
| | Tlalnepantla (0.7) | 6216 (952) | 0.8 (145) | 2.1 (383) |
| | Tlaxcala (0.1) | 333 (378) | ***0.2*** (***15***) | ***0.8*** (***50***) |
| | Zacatecas (1.6) | 240 (15) | ***0.03*** (***3***) | ***0.1*** (***7***) |

Refer Table 1 footnote

reductions in crime (Alvarado and Muggah 2018; Chainey et al. 2018).

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**Authors' contributions**
SPC was the main author of the publication and coordinated the supply of the results from each contributing author. GP generated and supplied the results for Argentina. ERV provided the results for Mexico City, and NOGR and JLHR worked with SPC to produce the results for all other cities in Mexico. JM worked with SPC to produce the results for all other cities in Brazil. SPC produced the results for Montevideo and sourced the results for all other cities. All authors read and approved the final manuscript.

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**Availability of data and materials**
The original crime records data used for this research cannot be publicly shared due its restricted content.

**Competing interests**
The authors declare that they have no competing interests.

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## Appendix

See Table 5.

**Table 5 Number of street segments and average street segment lengths**

| Country | City | n of street segments | Average length of street segment (m) |
|---|---|---|---|
| Argentina | Almirante Brown | 14,119 | 105 |
| | Bahia Blanca | 13,915 | 134 |
| | Campana | 3288 | *125* |
| | Florencio Varela | 10,975 | 124 |
| | General Pueyrredón | 32,494 | 126 |
| | General Rodriguez | 10,081 | 158 |
| | La Matanza | 31,583 | 101 |
| | La Plata | 25,235 | 161 |
| | Lanus | 7934 | 106 |
| | Lomas de Zamora | 11,501 | 109 |
| | Lujan | 4070 | 133 |
| | Merlo | 17,750 | 102 |
| | Moreno | 18,925 | 106 |
| | Olavarria | 4778 | 127 |
| | Pergamino | 3880 | 107 |
| | Quilmes | 12,216 | 101 |
| | San Martin | 7849 | 100 |
| | San Nicolas | 4922 | 132 |
| | Tandil | 5084 | 166 |
| | Zarate | 4222 | 189 |
| Brazil | Belford Roxo | 7752 | 143 |
| | Duque de Caxias | 23,953 | 133 |
| | Niteroi | 10,618 | 137 |
| | Nova Iguaçu | 27,468 | 139 |
| | Rio de Janeiro | 83,889 | 152 |
| | São Gonçalo | 19,845 | 127 |
| | São João de Meriti | 3318 | 123 |
| | Belo Horizonte | 18,067 | 200 |
| Colombia | Barranquilla | 21,545 | 154 |
| | Bogotá | 137,117 | 118 |
| | Cali | 49,658 | 124 |
| | Medellin | 37,055 | 125 |
| Mexico | Mexico City | 164,228 | 231 |
| Uruguay | Montevideo | 33,975 | 117 |
| Venezuela | Sucre | 1064 | 152 |

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## Publisher's Note