How the analysis of crime data can help us to reduce crime in Rio de Janeiro

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Introduction

- Crime and violence are of major concern in Latin America
  - It hosts 9 percent of the world's population and 33 percent of the world's homicides.
  - Levels of violence not only continue to be high, but where violence has actually been intensifying since 2005 (Jaitman and Guerrero, 2015).
  - One in four citizens in the region states that insecurity is the main problem in their lives, even worse than unemployment or the state of the economy (Jaitman and Ajzenman, 2016).

- Crime and violence has been understudied in the region
  - Deficient information system
  - Politicians prefer a *mano dura* rather than an evidence-based approach

- Since the 1980s, numerous studies have found that crime significantly concentrates at small geographic scales.

- New trend in criminology research to study "where" crime occurs rather than only analyzing the criminological profile of "who" commits the crimes.

Introduction

- Law of crime concentration at place (Weisburd, 2015)
  - **25%** of crime is concentrated in a bandwidth between **0.4 and 1.6%** of "street segments"
  - **50%** of crime is concentrated in a bandwidth between **2.1 and 6%** of "street segments"

- Most of studies analyze cities in developed countres: Mineapolis (Sherman, Gartin, and Buerger, 1989); Boston (Pierce, Spaar, and Briggs,1988); Baltimore (Eck, Gersh, and Taylor, 2000) ; Seatle (Weisburd et al., 2004); Vancouver (Curman, Andresen, and Brantingham, 2015)

- Robbery is typically 5–10 times greater in most Latin American cities than in cities in North America and Europe (UNODC 2017)
  - Only two peer reviewed studies have examined crime concentration in Latin America (de Melo et al. 2015; Pereira et al. 2016)

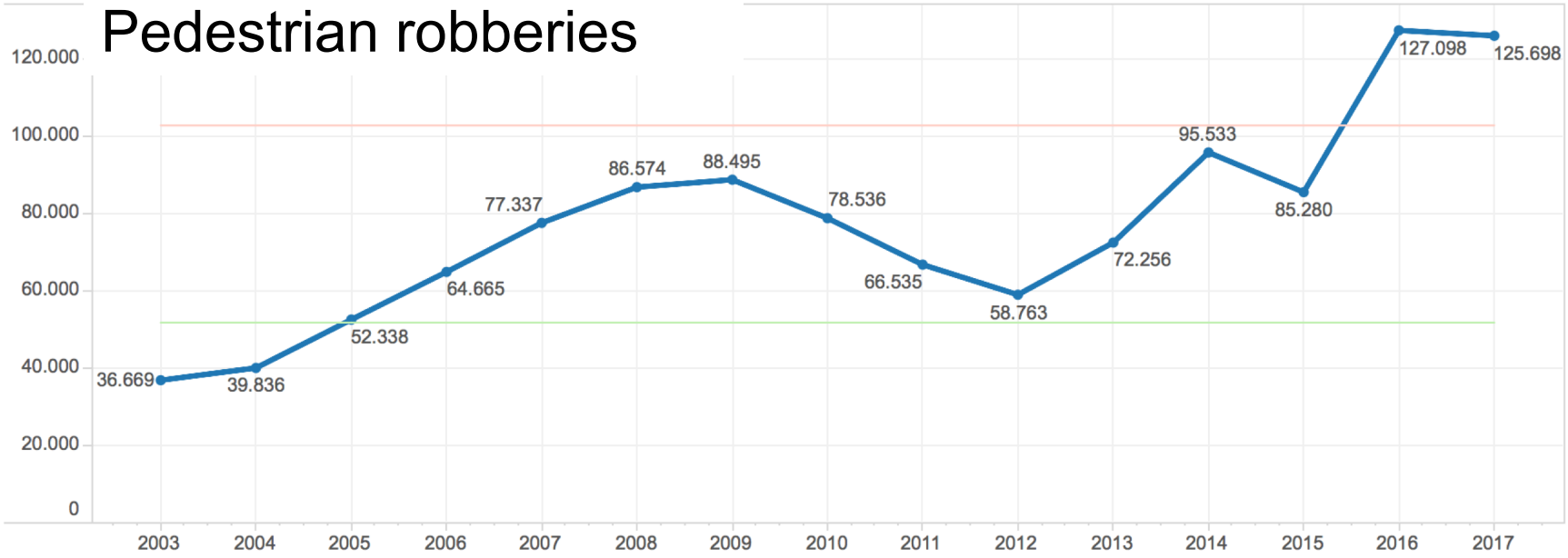
Agenda

Spencer & Monteiro: *The dispersion of crime concentration during a period of crime increase*

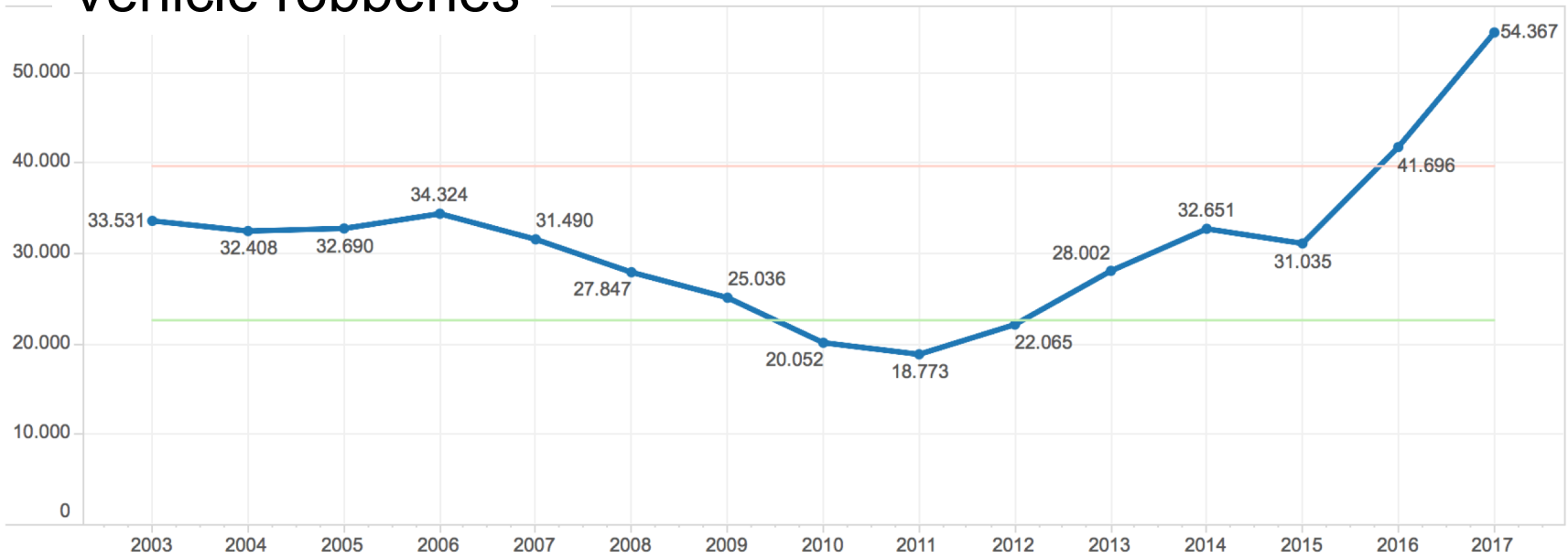
- An examination of the concentration of robbery for seven cities in the state of Rio de Janeiro, Brazil

- Examine the stability of crime concentration at the micro-place level during a period of crime increase
  - We introduce a crime concentration dispersion measure to determine if hot spots have just become hotter, or if other areas are responsible for the crime increase

Pedestrian robberies



Vehicle robberies



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Case study

- Discuss a pilot initiative to incentivize the use of evidence by Rio de Janeiro military police

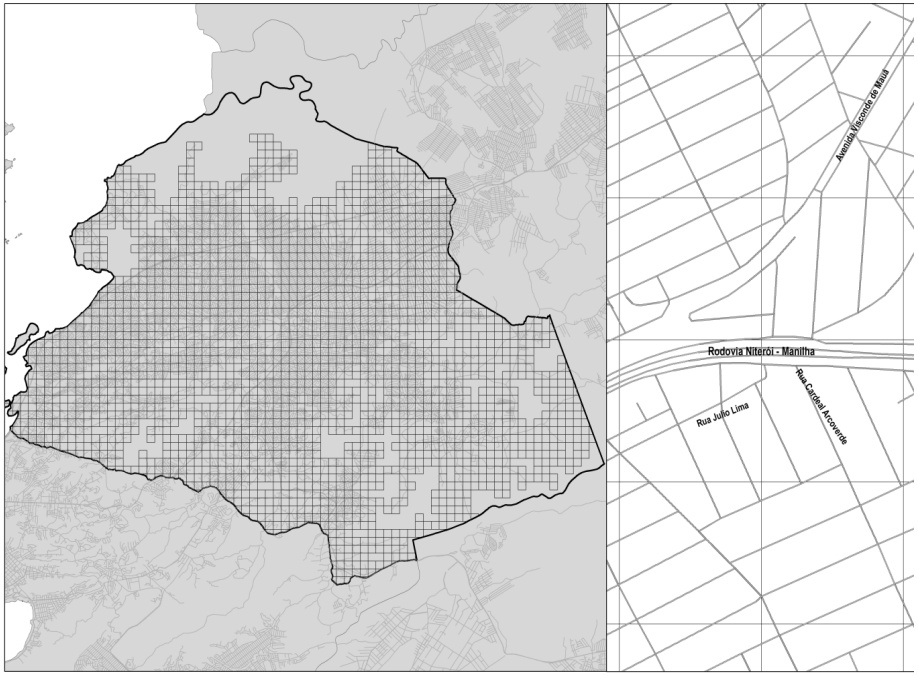
Cities under analysis

Descriptive statistics

Table 1 Population, population density, robbery levels, and change in robbery

City	Population	Population density (pop per km^2)	*n* Robbery 2016	Robbery rate 2016 (per 100,000 pop)	Change 2015/16 (%)
Rio de Janeiro	6,498,837	5306	55,149	849	+25
Duque de Caxias	1,044,058	2248	7938	760	+63
São Gonçalo	886,917	3575	12,357	1393	+82
Nova Iguaçu	797,435	1521	8310	1042	+69
Niteroi	497,883	3845	4629	930	+37
São João de Meriti	460,541	13,219	5293	1149	+77
Belford Roxo	434,474	5441	2681	617	+72

Unit of analysis



- We use 150 m×150 m grid cells
- Only cover built up areas, usable public space and the street network

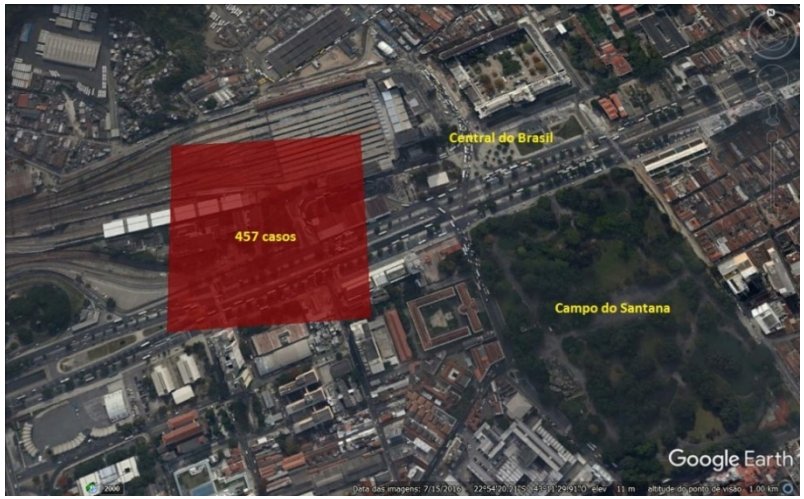
Advantages

- Units of the same size
- Requires less precision in geocoding data
  - Many crime records are geocoded to a street junction or to a reference point

Concentration patterns in 2016

City	Percentage of cells within which **25** per cent of robberies occurred	Percentage of cells within which **50** per cent of robberies occurred
Rio de Janeiro	0.8%	3.5%
São Gonçalo	1.0%	3.7%
Duque de Caxias	0.5%	2.4%
Nova Iguaçu	0.4%	2.2%
Niteroi	0.8%	3.1%
São João de Meriti	3.3%	10.5%
Belford Roxo	1.7%	4.9%

Top four cells in 2016 – Rio de Janeiro



Definitions

- Andresen's *S* Index (Andresen 2009) is a spatial point pattern test that applies a nonparametric Monte Carlo approach for measuring the degree of similarity between two observations.
  - Varies between 0 and 1.
  - Equal or greater than 0.8 indicates stable spatial pattern

- Offence Dispersion Index (ODI, ranging from 0 to 1)
  - determines the proportion of areas that alone have contributed to a study area-wide equivalent increase in crime (Emerging Problem Areas)

- The Non-Contributory Dispersion Index (NCDI, ranging from 0 to 1)
  - indicates the proportion of other areas that also contributed to crime increase

Results

City	S Index	ODI	NCDI
Rio de Janeiro	0.80	0.034	0.134
São Gonçalo	0.82	0.084	0.092
Duque de Caxias	0.86	0.048	0.082
Nova Iguaçu	0.90	0.048	0.064
Niteroi	0.84	0.037	0.106
São João de Meriti	0.54	0.233	0.206
Belford Roxo	0.82	0.084	0.106

Crime Concentration Dispersion Index

- Measure for determining if areas of high crime concentration are responsible for the crime increase

$$\text{Crime Concentration Dispersion Index (CCDI)} = \frac{\text{Crime increase between } t1 \text{ and } t2 \text{ per non-CC EPA}}{\text{Crime increase between } t1 \text{ and } t2 \text{ per CCA}}$$

Example for Nova Iguaçu

Number of cells			
	non-EPA	EPA	Total
non-CCA	4993	457	5450
CCA	2	46	48
Total	4995	503	5498

Crime variation per group			
	non-EPA	EPA	Total
non-CCA	15	1438	1453
CCA	-13	623	610
Total	2	2061	2063

Average variation per group			
	non-EPA	EPA	Total
non-CCA	0,0	**3,1**	0,3
CCA	0,0	13,5	**12,7**
Total	0,0	4,1	0,4

CCDI= 3.1 /12.7 = 0.25

Results

City	S Index	ODI	NCDI	CCDI
Rio de Janeiro	0.80	0.034	0.134	0.702
São Gonçalo	0.82	0.084	0.092	0.390
Duque de Caxias	0.86	0.048	0.082	0.281
Nova Iguaçu	0.90	0.048	0.064	0.247
Niteroi	0.84	0.037	0.106	0.425
São João de Meriti	0.54	0.233	0.206	0.382
Belford Roxo	0.82	0.084	0.106	0.489

Results

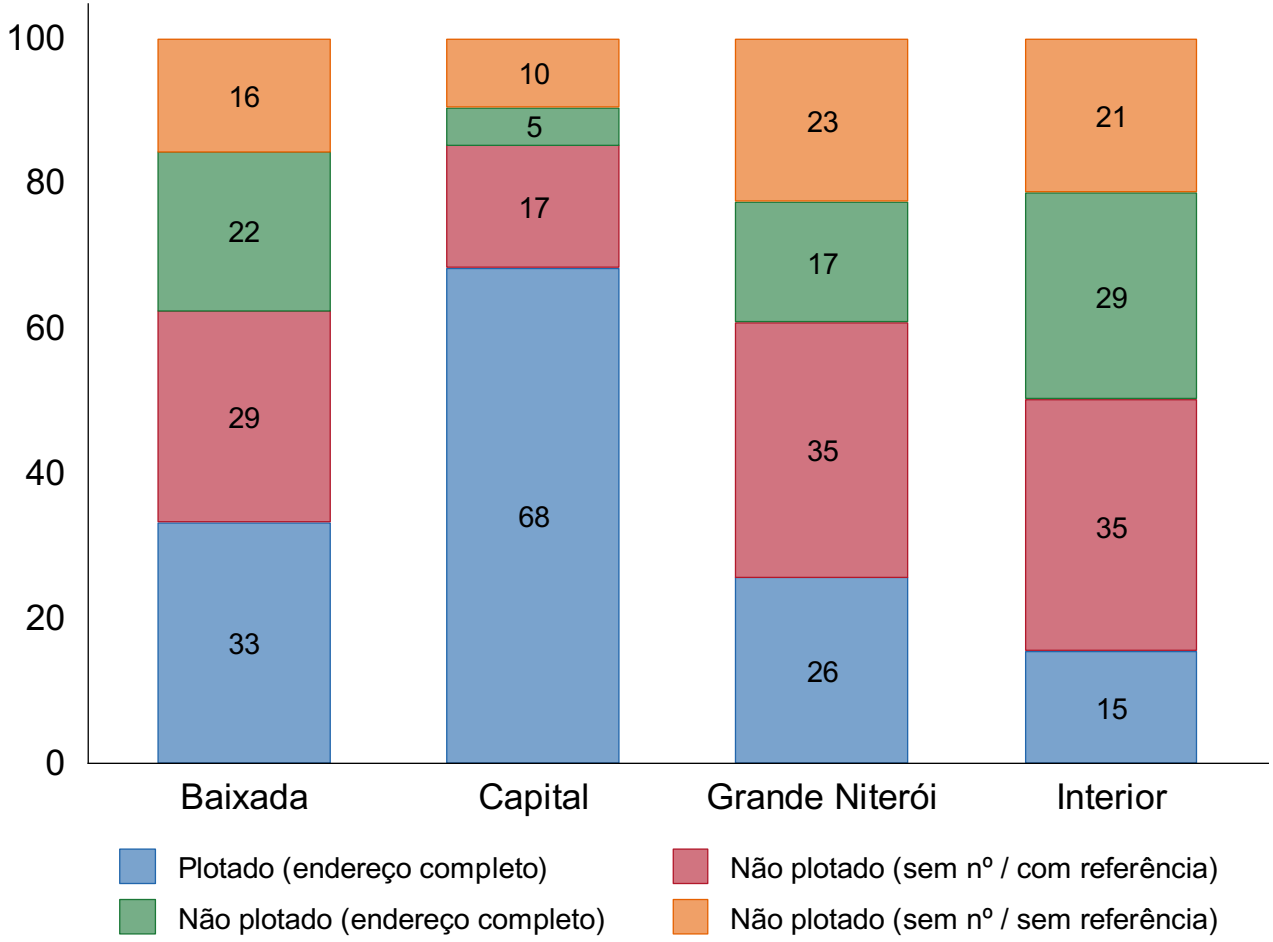
City	S Index:		Dispersion Calculator:		High crime concentration:	
	Cells with statistically significant increase: n (proportion of all cells)	Average increase in robbery per cell with statistically significant	EPAs: n (proportion of all cells)	Average increase in robbery per EPA	HCC areas: n (proportion of all cells	Average increase in crime per CCA
Rio de Janeiro	2425 (5.8%)	5	1427 (3.4%)	7	350 (0.8%)	8
São Gonçalo	581 (5.9%)	4	833 (8.4%)	4	78 (0.8%)	8
Duque de Caxias	442 (3.7%)	4	577 (4.8%)	4	60 (0.5%)	11
Nova Iguaçu	415 (3.0%)	4	663 (4.8%)	4	59 (0.4%)	11
Niteroi	220 (4.1%)	5	195 (3.7%)	6	47 (0.9%)	10
São João de Meriti	258 (15.6%)	5	387 (23.3%)	5	51 (3.1%)	10
Belford Roxo	202 (5.2%)	4	327 (8.4%)	3	58 (1.5%)	5

FOSTERING THE USE OF EVIDENCE AT POLICE UNITS

1 – Clean and geocode data

datc	dscr	circ	locf	fnum	fcom	fref	fbai
						INTERIOR DA ESTAÇÃO	
14-FEB-201	Lesão corporal (outros)	4	RUA PRESIDENTE VARGAS	00		FERROVIÁRIA DO BRASIL	CENTRO
14-FEB-201	Lesão corporal (outros)	4	RUA BUENOS AIRES	00			CENTRO
14-FEB-201	Lesão corporal provocada p	4	AVENIDA PRESIDENTE VARGAS	1733		CENTRAL DO BRASIL	CENTRO
						HOSPITAL MUNICIPAL SOUZA	
17-FEB-201	Homicidio prov. por paulada	4	PRAÇA DA REPÚBLICA	111		AGUIAR	CENTRO
18-FEB-201	Lesão corporal (outros)	4	RUA ACRE	56			CENTRO
19-FEB-201	Lesão corporal (outros)	1	AVENIDA ERASMO BRAGA	115			
19-FEB-201	Lesão corporal (outros)	4	OUTROS COELHO E CASTRO	60			CENTRO
22-FEB-201	Lesão corporal (outros)	4	RUA SACADURA CABRAL	137		BOITE THE WEEK	CENTRO
22-FEB-201	Lesão corporal provocada p	1	AVENIDA PRESIDENTE VARGAS	750			CENTRO
22-FEB-201	Lesão corporal provocada p	1	AVENIDA PRESIDENTE VARGAS	750			CENTRO
22-FEB-201	Lesão corporal (outros)	4	RUA URUGUAIANA	1			CENTRO
24-FEB-201	Lesão corporal (outros)	4	AVENIDA PRESIDENTE VARGAS	1700		ESTAÇÃO DE TREM	CENTRO
25-FEB-201	Lesão corporal provocada p	4	RUA BARÃO DE SÃO FÉLIX	0			CENTRO
25-FEB-201	Lesão corporal provocada p	4	AVENIDA PRESIDENTE VARGAS	00		CANDELÁRIA	CENTRO
26-FEB-201	Furto de veículo - moto	1	PRAÇA PIO X	00		EM FRENTA A NUMÉRICA 60	CENTRO
27-FEB-201	Lesão corporal (outros)	4	AVENIDA PRESIDENTE VARGAS	1700			CENTRO
01-FEB-201	Lesão corporal provocada p	5	AVENIDA MEM DE SÁ	00		EM FRENTE AO POSTO SHELL	CENTRO
01-FEB-201	Lesão corporal (outros)	5	AVENIDA MEM DE SÁ	69	BAR DA BOA.		CENTRO
						ESQUINA COM A RUA DO	
02-FEB-201	Lesão corporal provocada p	5	AVENIDA GOMES FREIRE	24		REZENDE	CENTRO

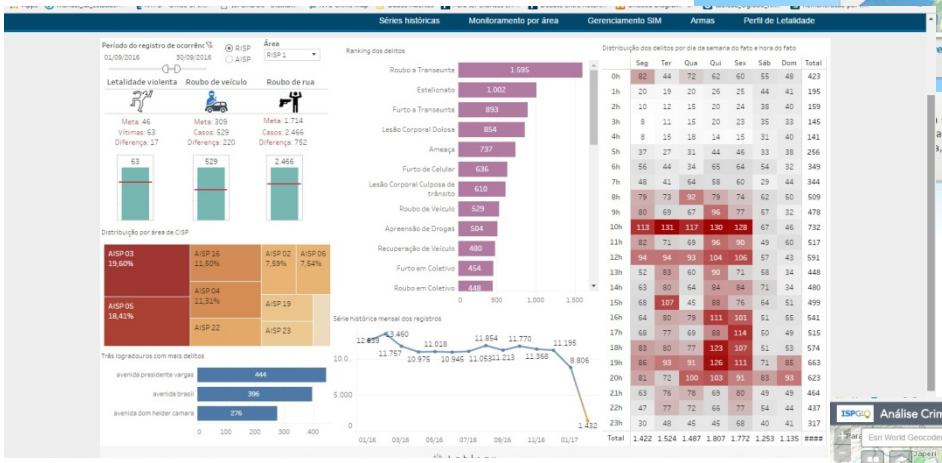
1 – Clean and geocode data

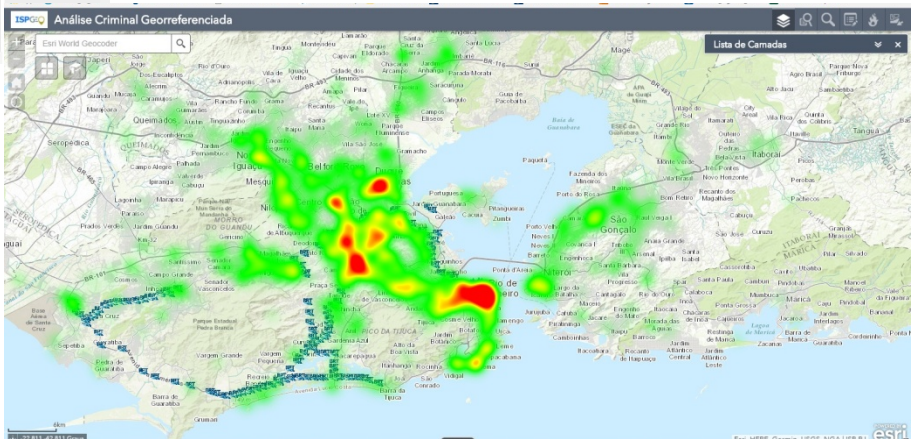


Maio – 2015

2 - Make data easily available to the police

Portal ISPGEO





Pedestrian robberies

Distribuição dos delitos por dia da semana do fato e hora do fato

	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Total
0h	233	181	181	255	227	287	284	1.648
1h	178	112	133	159	161	240	240	1.223
2h	130	64	91	146	124	220	215	990
3h	137	100	110	90	117	187	190	931
4h	424	327	285	308	322	341	278	2.285
5h	789	688	722	699	687	606	410	4.601
6h	710	572	643	601	605	546	414	4.091
7h	484	396	402	385	389	321	275	2.652
8h	356	320	366	303	266	251	207	2.069
9h	265	282	239	225	252	180	197	1.640
10h	305	286	313	250	285	224	205	1.868
11h	312	276	272	272	253	206	194	1.785
12h	327	322	333	295	314	213	154	1.958
13h	305	312	323	296	310	230	202	1.978
14h	346	331	298	290	283	253	185	1.986
15h	305	320	322	270	288	224	283	2.012
16h	291	295	324	269	322	268	278	2.047
17h	325	327	347	348	364	276	345	2.332
18h	568	568	526	535	524	382	461	3.564
19h	756	773	760	709	773	568	528	4.867
20h	866	986	901	820	845	646	741	5.805
21h	790	795	868	778	786	615	772	5.404
22h	654	731	672	677	692	583	638	4.647
23h	485	456	478	453	521	522	549	3.464
Total	10.341	9.820	9.909	9.433	9.710	8.389	8.245	65.847

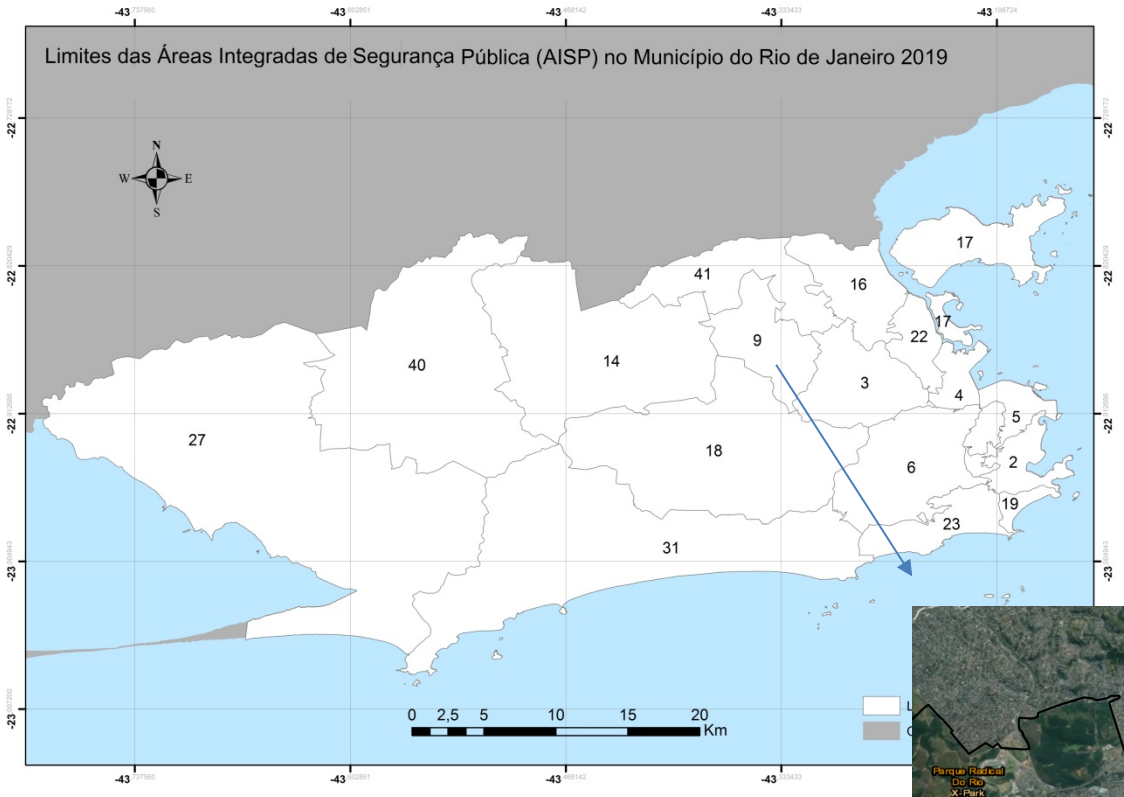
Vehicle robberies

Distribuição dos delitos por dia da semana do fato e hora do fato

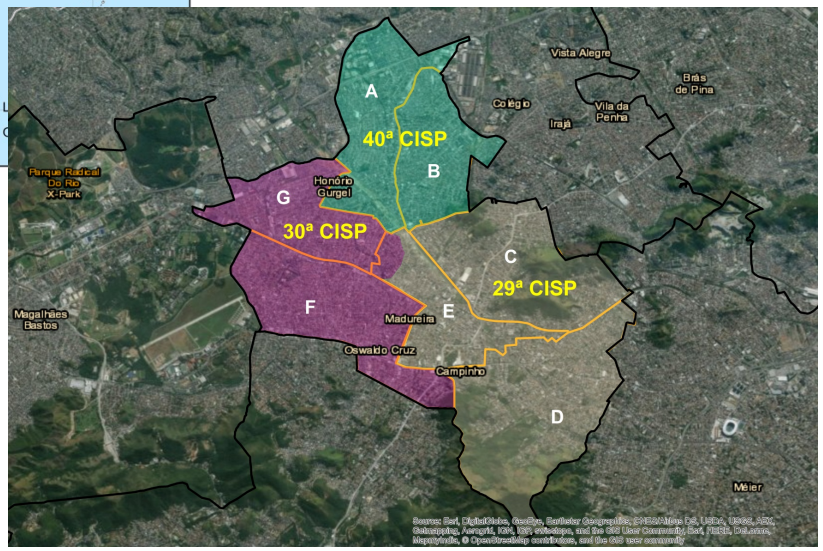
	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Total
0h	57	43	62	54	58	61	57	392
1h	48	33	46	46	30	55	47	305
2h	31	18	23	25	39	47	23	206
3h	20	16	13	22	28	33	19	151
4h	33	24	26	23	35	27	17	185
5h	50	64	72	55	79	48	34	402
6h	48	52	52	48	59	64	61	384
7h	25	26	41	29	26	48	42	237
8h	15	27	24	15	25	27	33	166
9h	11	28	29	18	30	23	31	170
10h	18	23	31	32	18	23	23	168
11h	21	24	24	21	25	16	24	155
12h	27	33	25	29	40	30	29	213
13h	24	40	38	35	31	26	29	223
14h	20	27	33	31	34	41	46	232
15h	25	34	30	41	47	46	42	265
16h	30	37	39	35	40	33	46	260
17h	38	40	63	57	54	52	60	364
18h	56	60	72	54	79	47	81	449
19h	57	63	75	67	90	83	68	503
20h	93	117	90	101	127	85	98	711
21h	107	124	166	149	142	124	106	918
22h	111	144	140	147	129	116	129	916
23h	77	113	103	101	109	105	97	705
Total	1.042	1.210	1.317	1.235	1.374	1.260	1.242	8.680

3 – Incentivize the use of data

4 – Create examples of success



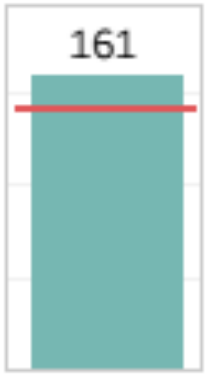
- 9 Área Integrada de Segurança Pública
- 40% of state vehicle robberies
- 33% of state pedrestian robberies

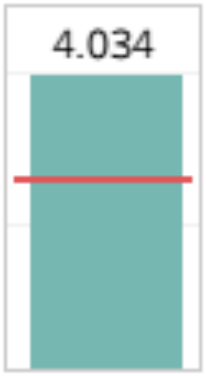


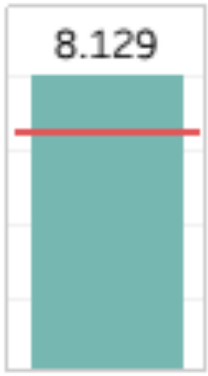
9 AISP crime records in 2017

Janeiro a Outubro de 2017

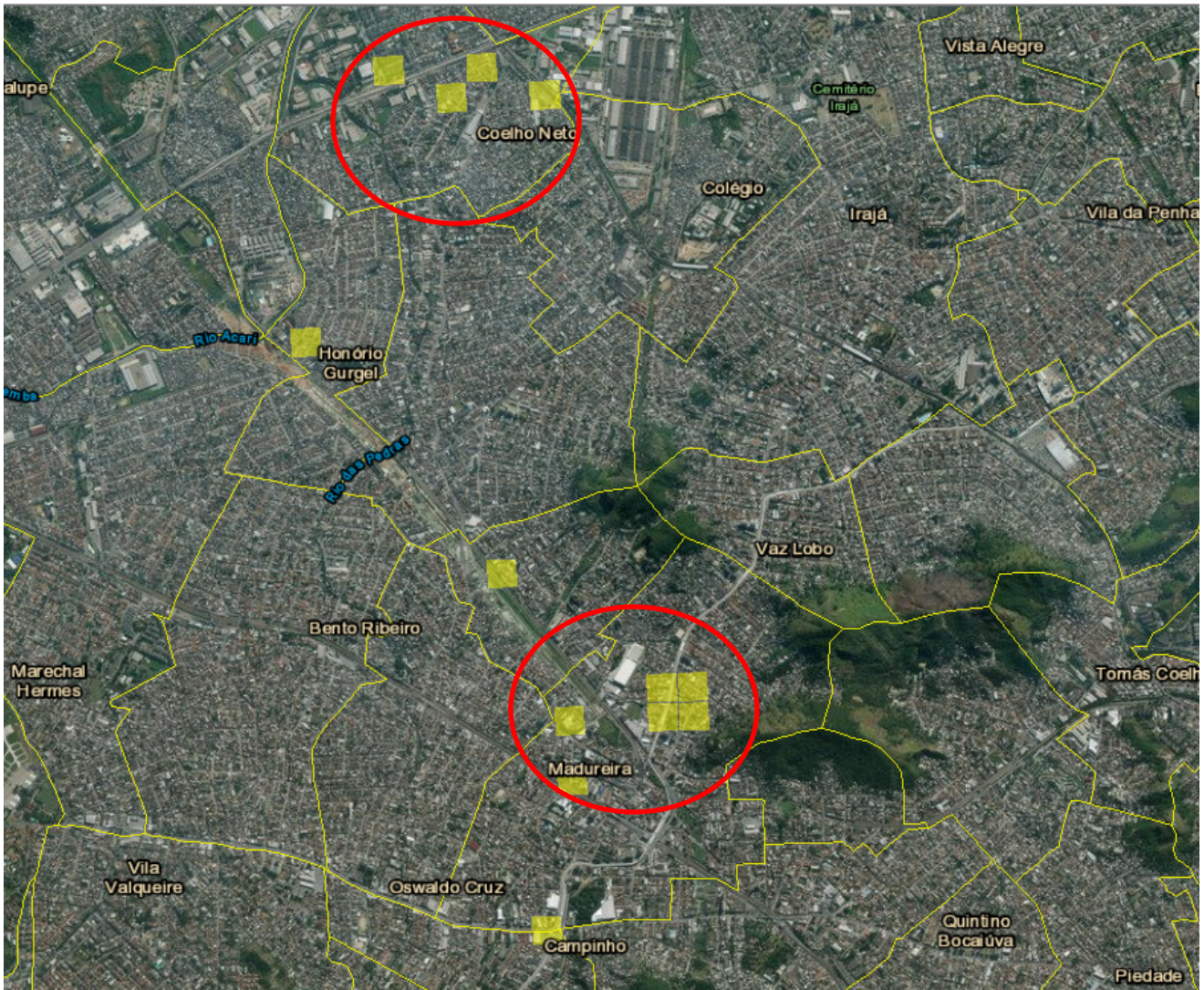
Letalidade violenta	Roubo de veículo	Roubo de rua
Meta: 144	Meta: 2.648	Meta :6.569
Vítimas: 161	Casos: 4.034	Casos: 8.129
Diferença: 17	Diferença: 1.386	Diferença: 1.560



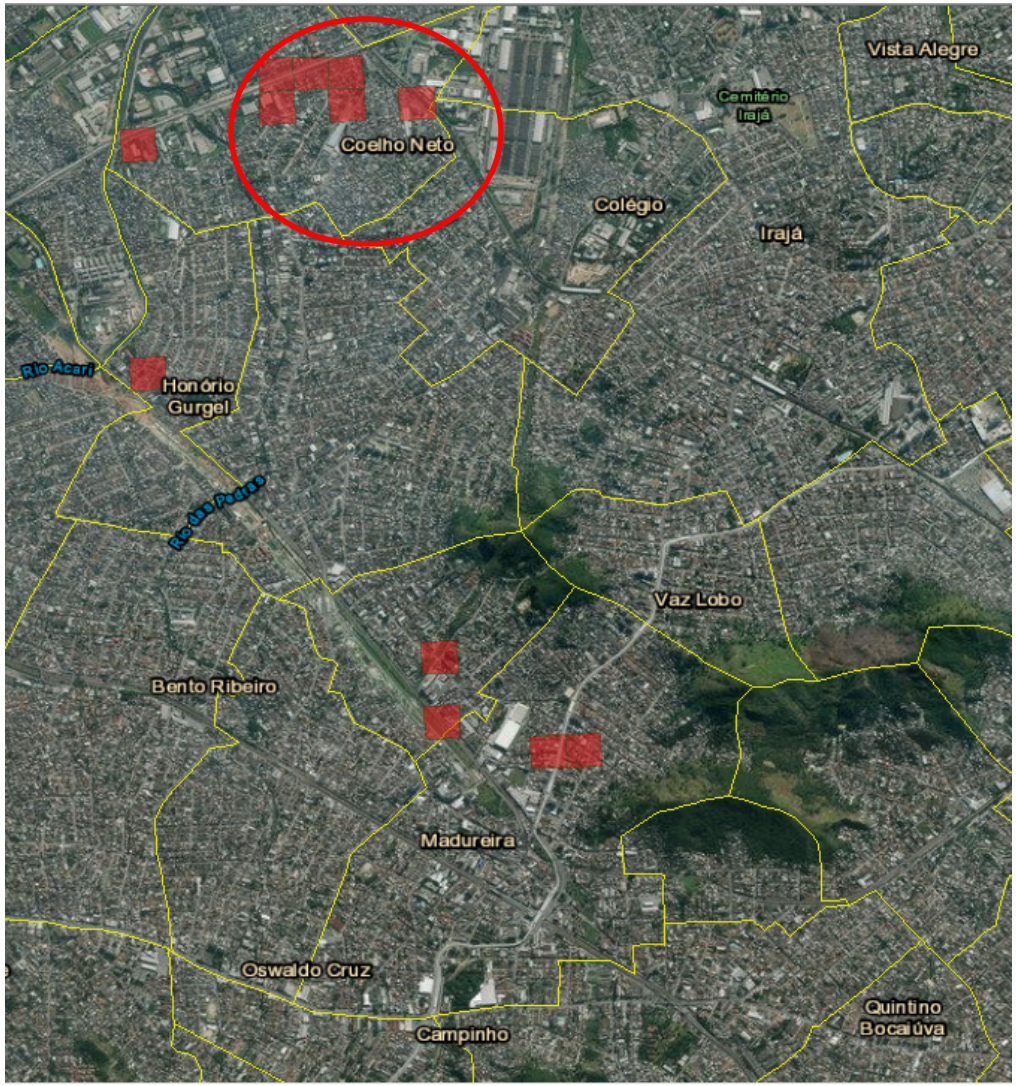




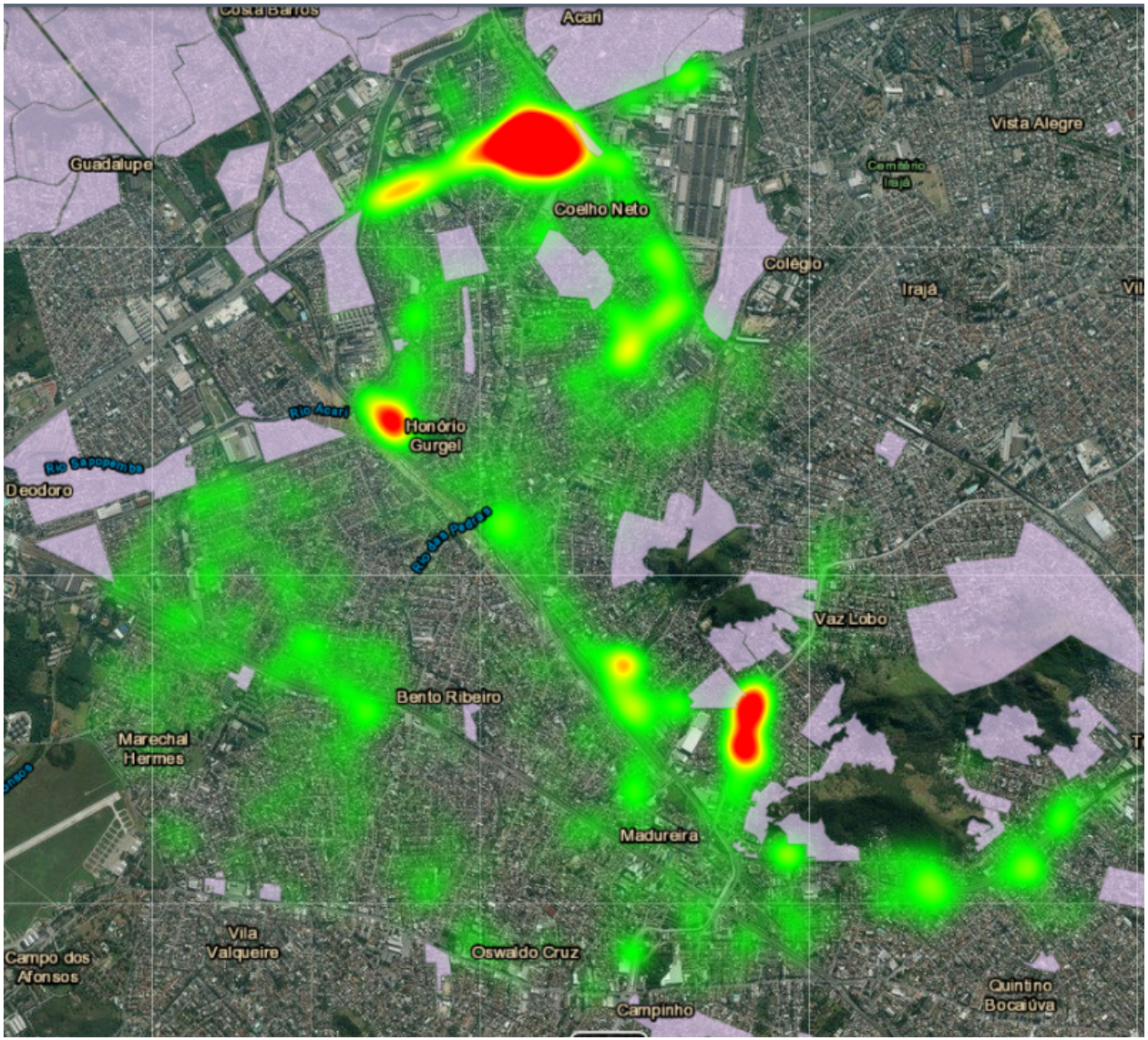
Only 13 cells are responsible for 11 percent of pedestrian robberies at the area – 2017/2



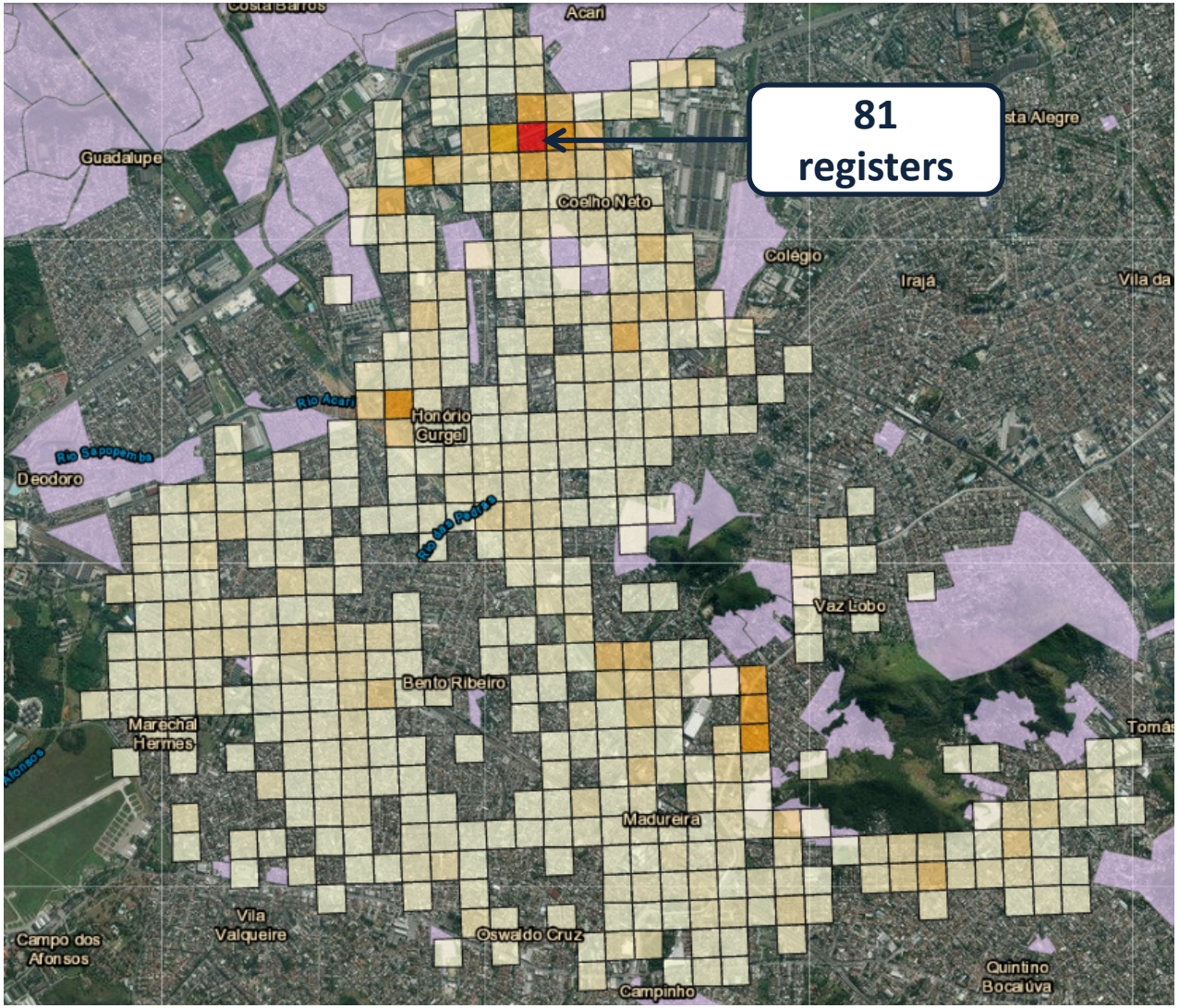
Only 12 cells are responsible for 18 percent of vehicles robberies at the area – 2017/2



Vehicles robberies hotspot map– 2017/2

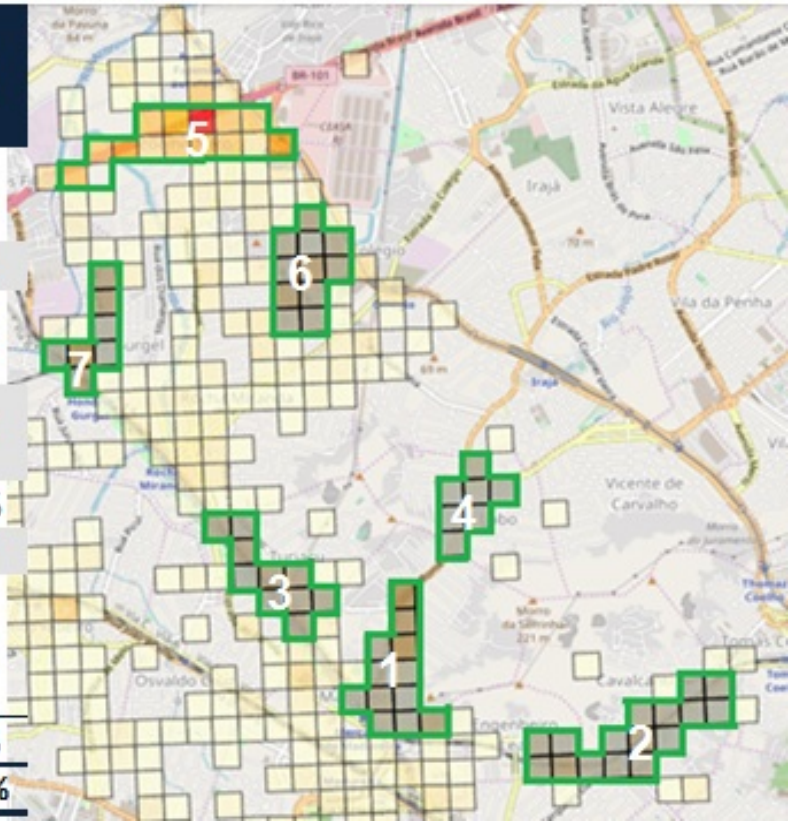


Vehicles robberies grid cell map– 2017/2

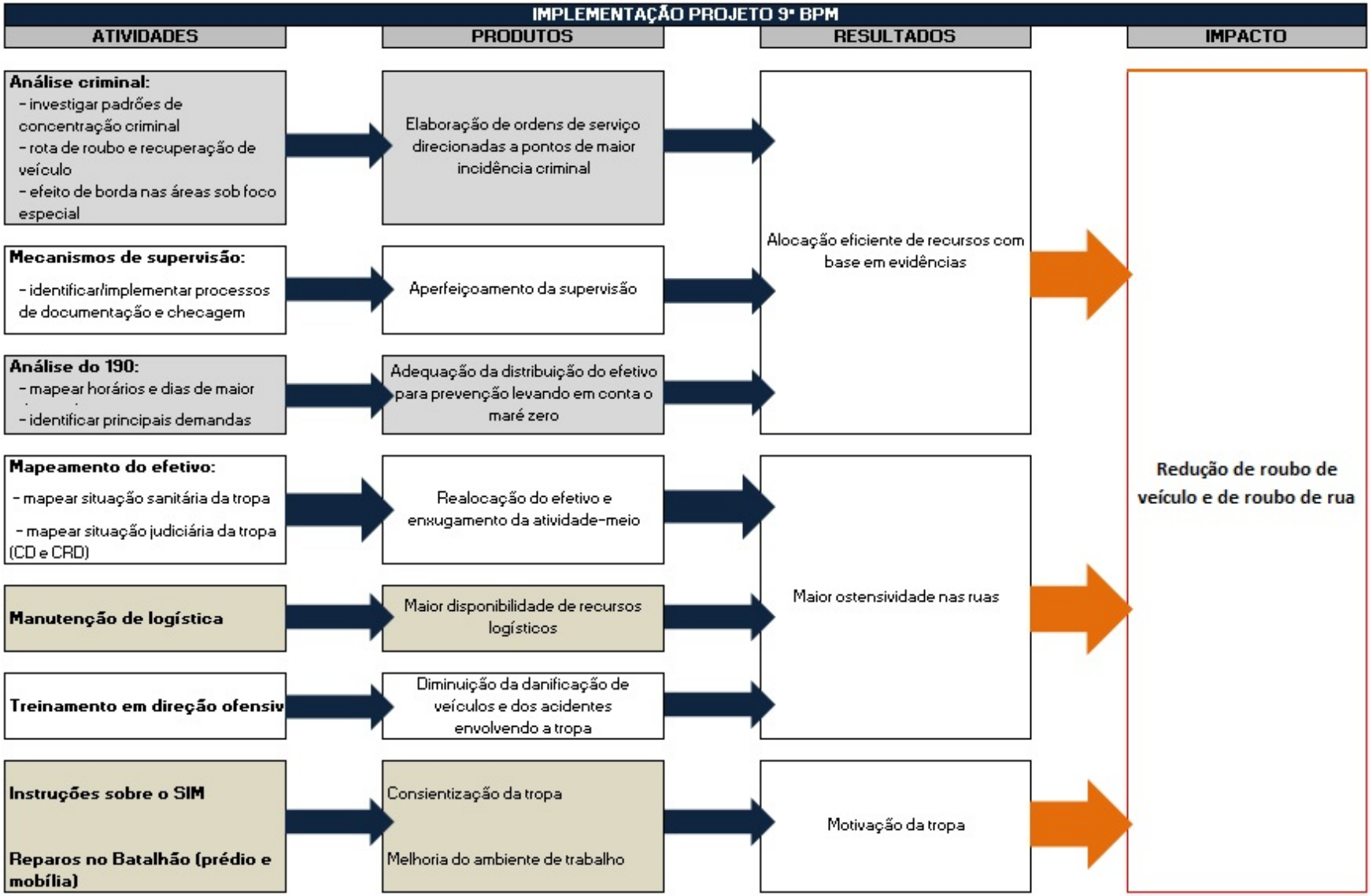


Identification of priority areas

Área	CISP	Casos de Roubo de Veículo	(%)
Área 01: Mercadão de Madureira (Av. Edgard Romero)	29	79	5%
Área 2: Cavalcante/Rua Iguaçu	29	58	4%
Área 03: Turiaçu/R. Conselheiro Galvão	29	52	3%
Área 04: Vaz lobo (Av. Edgard Romero)	29	10	1%
Área 05: Av. Brasil	40	244	15%
Área 06: Colégio (Rua Toriba)	40	67	4%
Área 07: Honório Gurgel (Passagem da linha do trem onde passa o Rio Acari)	40	55	3%
Subtotal das 7 áreas		**565**	**35%**
Total (geocodificado)		**1.613**	**100%**



Theory of Change



16 percent reduction in crime in a 12 month period

Tabela 4 — Contribuição das CISP para a redução de Roubo de Veículo na área do 9º BPM

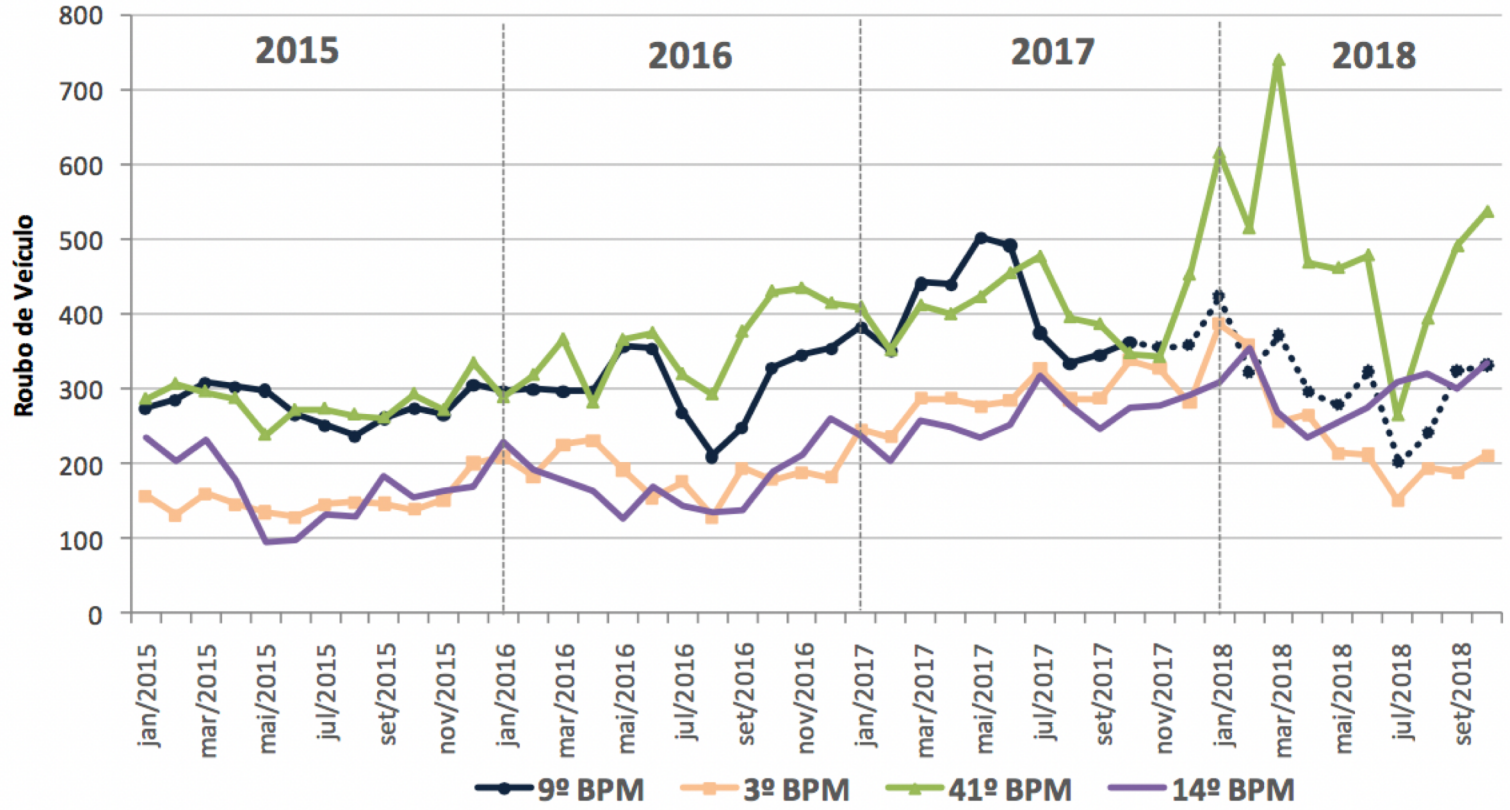
CISP	Roubo de Veículo (nov/16 -out/17)		Variação (%) de roubos em nov/17-out/18 em relação aos 12 meses anteriores (nov/16-out/17) (C)	Contribuição em pontos percentuais 100*(B)* (C)
	Casos (A)	Distribuição (%) (B)		
CISP 29*	1.544	34%	-10%	-3
CISP 30	770	17%	15%	2
CISP 40	2.226	49%	-30%	-15
Total	**4.540**	**100%**	**-16%**	**-16**

* Nota: o total de ocorrências da CISP 29 considera a atual área da CISP 29 durante os 24 meses investigados. Ou seja, para o período anterior a julho/2017 foram somados os casos que constam como CISP 28, mas hoje pertenceriam à CISP 29.

Fonte: Elaborado pelo ISP com base em informações da PCERJ.

Comparison with other areas

Figura 39 — Evolução mensal de Roubo de Veículo no 3º BPM, 9º BPM, 14º BPM e 41º BPM, 2015 a 2018



Nota: Período do atual comando destacado na linha tracejada.

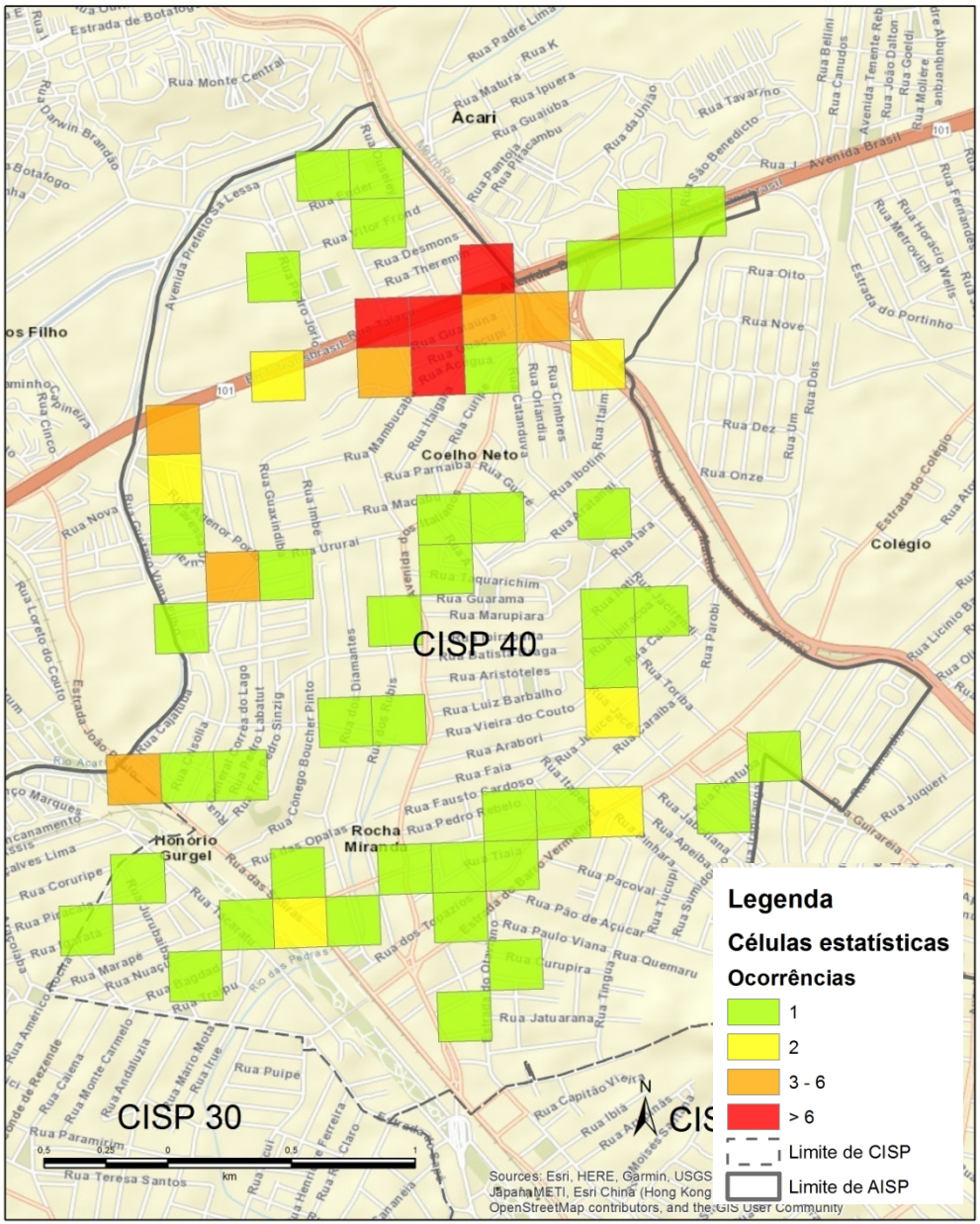
Fonte: Elaborado pelo ISP com base em informações da PCERJ.

GOVERNO DO Rio de Janeiro
PERTO DE VOCÊ

SECRETARIA DE SEGURANÇA

ISP Instituto de Segurança Pública

CISP 40 - Concentração de roubos de veículos em Setembro de 2018, por célula estatística



Vehicle robberies in 2018

- **CISP 40** experienced a 30 percent reduction
- Reduction was concentrated at hotspots (área da Av. Brasil);

What they did?

9º BPM: Too many problems and emergencies

Conclusion

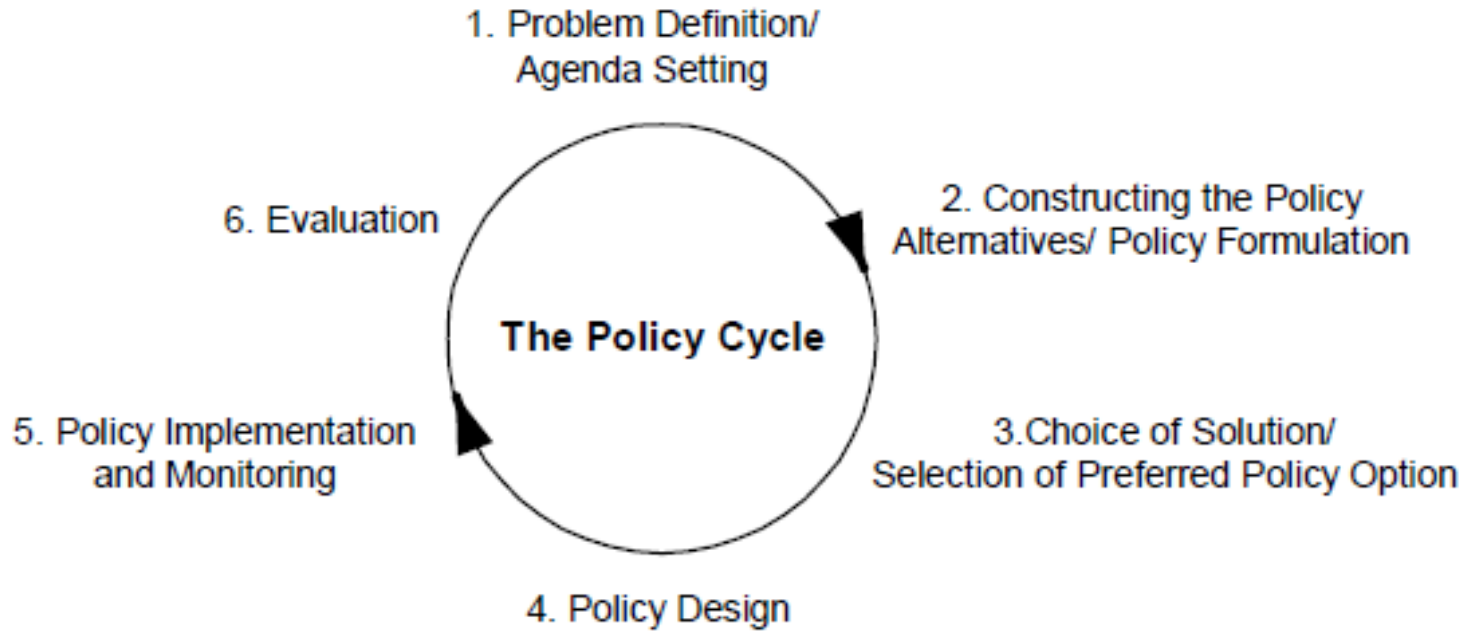
- Crime distribution in Rio de Janeiro follow patterns found in other cities.

- Hotspot policing can potentially reduce crime rates in Rio de Janeiro municipalities

- There is an amazing opportunity to improve service deliver by using data to identify priority areas and target scarce resources.

- Data analysis is not enough. It is necessary to apply it with management systems to incentivize its use.

The Policy Cycle



Source: Young and Quinn (2002)

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