

Crime and police activity during the COVID-19 pandemic in Rio de Janeiro, Brazil

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Abstract *This paper analyzes crime reports and police activity in Rio de Janeiro during the first months of the COVID-19 pandemic. The results indicate there was an overall drop in crime rates starting in April, especially in property crimes, which plummet to extremely unusual levels when compared with previous patterns. This pattern is most likely associated with an unprecedented decline in public mobility in some areas of the state. We show that the most significant reductions in street robberies occurred in neighborhoods where there was a greater decline in presence on the streets. Measures of police activity, in particular drug seizures and different types of arrests, displayed a reduction comparable with the drop in criminal indicators. In contrast, the number of police killings followed a unique pattern: in April, immediately after the adoption of social distance measures, this indicator increased above the average from the previous four years; as of May, however, it assumed a downward trend, which turned into extraordinarily low levels in June. The extreme variation in the use of force by the police during the pandemic reinforces the documented dissonance between police lethality and criminal dynamics in Rio de Janeiro, shedding light on the mechanisms that regulate police violence in the state.*

Key words *Public Security, COVID-19, Violence*

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Introduction

On 13 March 2020, the Government of the State of Rio de Janeiro adopted social distancing measures aimed at slowing down the spread of the novel coronavirus (Sars-CoV-2). These rules included restrictions on gatherings in public spaces, stay-at-home orders and the closure of non-essential businesses. In the following month, there was a 50% increase in the mean social distancing index in the state¹. The reduction in urban transport in the capital and other municipalities directly affected a broad set of social dynamics – ranging from economic activities to crime patterns.

In June, as areas across the state showed a drop in the number of COVID-19 cases and deaths, the government began to issue new guidance easing distancing measures and gradually expanding in-person activities. Despite the resumption of activities, however, preliminary data suggest that the pandemic and the contention measures are likely to have a lasting impact, reconfiguring different aspects of life in cities².

The impacts of the pandemic and social distancing measures have imposed a series of changes in the routine of people and cities, with numerous social and economic consequences³. From a crime perspective, economic and criminological theory can help us understand how the COVID-19 pandemic affects criminal behavior⁴. On the one hand, social distancing resulted in a sharp reduction in the number of people on the streets, which in turn led to a decrease in the number of potential crime targets and economic returns from crime committed in public spaces. On the other, however, domestic and cybercrimes tend to rise as interaction within the home and internet transactions increase. While social distancing alters victim exposure, at the same time people not previously involved in crime may also be led to engage in illegal activities, especially those who have lost income due to job loss or the economic downturn. Studies in various North American and Colombian cities^{5,6} show a sharp fall in the occurrence of a number of crimes, while changes in homicide rates were more erratic. Numerous studies have also pointed to an increase in cases of domestic violence.

In view of the above, the main goal of this study was to compare indicators of crime and police activity in Rio de Janeiro in the months before and after the introduction of strategies to curb the spread of Sars-CoV-2. In addition to criminal behavior, we also examine how po-

lice activity was affected during social distancing and the association between changes in activity and crime trends. We believe that the findings of this study will contribute to understanding the relationship between crime dynamics and police actions in the state.

Methodology

This study examines trends in indicators of violent crime and police activity in Rio de Janeiro after the implementation of social distancing measures to curb the spread of the novel coronavirus. To this end, we used data on crime incidents and police activities for the period January 2016 to June 2020 obtained from the Public Security Institute (ISP-RJ, acronym in Portuguese). The results are divided into three distinct units of analysis: the state of Rio de Janeiro, neighborhoods in the city of Rio de Janeiro, and Integrated Public Security Areas (IPSA), which is the area patrolled by each respective military police battalion.

The ISP-RJ is responsible for the monthly compilation and disclosure of crime statistics for Rio de Janeiro. The data were extracted from the institute's website and organized into the following core categories: a) crimes against life (murder, armed robbery resulting in death, aggravated assault resulting in death, manslaughter, aggravated assault, and rape); b) property crimes (street robbery, motor vehicle robbery, cargo robbery, residential burglary and theft by false pretenses); and c) police activity (drug seizures, in flagrante delicto arrests, arrest warrants, seizures of rifles, and police killings).

The choice of categories was based on two main criteria: accuracy of the data for showing changes in crime dynamics and relevance of the categories to the management of public security in the state. First, the reporting rates and types of crime considered here allowed us to observe variations in crime dynamics with greater certainty. In this regard, the reporting of other types of crime in police stations may have been affected by social distancing measures. The use of these types of crime would therefore have compromised the consistency of the analyses. Second, intentional lethal violent crimes (murder, armed robbery resulting in death, aggravated assault resulting in death), vehicle and cargo robbery, and street robberies are key indicators in the state's integrated police goals system⁷.

To facilitate the comparison of indicators with different dimensions, for example robbery

and murder, we compared how each type of offense varied in April, May and June 2020 relative to its own behavior in last five years (2016-2020). To this end, we used the statistical concept of Z-score, which levels out data variability and enables the comparison of indicators with different incident rates and variability over time. According to this metric, a Z-score of zero indicates that the number of cases of a particular crime is equal to the historic mean. The Z-score is measured in terms of standard deviations from the mean, providing a measure of the dispersion of a dataset. Based on certain statistical assumptions, the presence of an observation with more than two standard deviations above or below the mean indicates that the probability of the event occurring is less than 5%. This measure therefore reveal show typical or atypical the value of a particular indicator in the period of social distancing is relative to previous trends.

The probabilities associated with Z-score values are based on specific hypotheses regarding the statistical distribution of incidents. For the purposes of the present study, it was implicitly assumed that the data follow a normal distribution and the possibility of autocorrelation was ignored in order to simplify the interpretation of the phenomenon. These assumptions would be considered strong if the aim of the study was to model the data generation mechanism, make forecasts or causal inferences. However, since the aim was to provide standardized metrics to identify atypical behavior in crime rates or police activity, these simplifying assumptions serve the purpose of facilitating the interpretation of events with more than two standard deviations away from the mean.

With the aim of understanding what explains the differences in the crime indicators, we used data on presence on the streets captured by cameras in public spaces compiled by the company Cyberlabs and made available from January 2020. The data records the number of people on the streets every 15 minutes, making it possible to aggregate numbers by month and neighborhood and verify whether rises and falls in these numbers are correlated with differences in crime indicators. However, the data provided by Cyberlabs does not cover the entire state and is limited to the following neighborhoods in the city of Rio Janeiro: Centro, Flamengo, Botafogo, Copacabana, Ipanema-Leblon, Tijuca, Barra da Tijuca and Jacarepaguá. Given the small number of neighborhoods covered by the data and the fact that they are located in more affluent and less violent

areas of the city, the scope of the analysis in these areas was limited to the most common crimes in these neighborhoods, such as street robberies. Although this sample of neighborhoods is not representative of Rio de Janeiro and the period covered is limited to the first months of 2020, this exercise allowed us to gather evidence on the mechanisms underlying the differences in crime indicators in the state during the first months of the pandemic.

Results

Between March and June 2020, the main indicators of crimes against life and property crime were much lower than the monthly average of the past five years (2016-2020). Table 1 highlights the months in which the values for the main property crimes and crimes against life were more than *two standard deviations away from* the mean between 2016 and 2020.

Except for isolated cases, all crimes showed a downward trend in 2020, with these trends becoming considerably more pronounced after the beginning of the pandemic. In April and May respectively, the reduction in rape and aggravated assault was three times greater than the historical patterns, meaning that the probability of these indicators showing a decline of this magnitude is less than 0.1% in normal times. Intentional lethal violent crimes (ILVC) (murder, armed robbery resulting in death and aggravated assault resulting in death) showed a sharp reduction in May and June. Only cargo robbery and manslaughter did not show differences of this magnitude after the implementation of the social distancing measures. In the opposite direction to the other indicators, theft by false pretenses showed an extremely atypical increase in June.

The main hypothesis for this marked change in the indicators is the decrease in presence of people on the streets due to the social distancing measures, resulting in a reduction in opportunities for crime. However, the lack of data on presence on the streets across the state makes it difficult to test this hypothesis. In this regard, the company Cyberlabs compiled data that can be used to calculate presence on the streets in eight neighborhoods in the state capital (Centro, Flamengo, Botafogo, Copacabana, Ipanema-Leblon, Tijuca, Barra da Tijuca and Jacarepaguá) in the first semester of 2020. Counting is conducted using council surveillance cameras spread throughout the city. By cross-referencing this

Table 1. Property crimes and crimes against life (Z-score) between January and June 2020, state of Rio de Janeiro.

Period	Crimes against property				Crimes against life				
	Street robbery	Vehicle robbery	Cargo robbery	Theft by false pretenses	Burglary	ILVC	Manslaughter	Aggravated Assault	Rape
Jan/20	-0.2	-0.6	-0.7	1.4	-1.1	-0.6	-0.8	0.2	-0.4
Feb/20	-0.4	-1.0	-1.5	0.8	-1.7	-1.1	-0.4	0.2	0.1
Mar/20	-1.4	-1.5	-1.8	0.1	-1.2	-0.4	-1.5	-1.3	-0.9
Apr/20	-2.7	-2.2	-1.9	-0.7	-1.9	-1.3	-1.6	-2.7	-3.3
May/20	-2.8	-2.5	-1.3	0.8	-2.4	-2.0	-1.6	-3.1	-2.9
Jun/20	-2.6	-2.4	-1.6	3.4	-2.8	-2.2	-1.1	-2.3	-0.4

Source: Elaborated by the authors based on data from the Public Security Institute (ISP-RJ).

data with police data, it is possible to determine whether there is a direct relation between presence on the streets and street robbery in these neighborhoods. If this is the case, we would expect higher reductions in this type of crime in the months where decreases in presence on the streets is greater.

Graph 1 shows that this relationship was strong for some neighborhoods. The polygons and letters on the graph represent the difference (in percentage points) in presence on the streets (horizontal axis) and in the total number of street robberies (vertical axis) for each neighborhood relative to February, the month immediately preceding the implementation of social distancing measures. The letter X represents the values in January. As expected, these observations are the closest to zero on the horizontal axis, meaning that they showed the smallest difference in presence on the streets in relation to February. The black and white squares, triangles and circles represent the differences in March, April, May and June, respectively.

Graph 1 shows that there was a positive association between crime and presence on the streets: in the months and neighborhoods in which the reduction in presence on the streets was greater, there was, on average, a larger fall in street robberies (correlation coefficient =0.73). For example, in April, Centro neighborhood registered an 86% drop in the two indicators in comparison to February. Although based on a small sample of neighborhoods and short time interval, this data provides suggestive evidence of the importance of presence on the streets in explaining variations across crime indicators, especially considering that when controlling for the fixed effects of neighborhood and month, a fall

of 10% in presence on the streets was, on average, associated with a fall of 7.8% in street robberies. This finding reinforces the thesis that this offence is a crime of opportunity⁸.

Considering that reducing crimes against life and property are strategic aims of the state's civil and military police secretariats and the atypical trends in these indicators in April, May and June, it is equally important to examine trends in police activity in the period after the implementation of social distancing measures.

Graph 2 uses the concept of Z-score to examine trends in the main indicators of police activity after the implementation of social distancing measures. The indicators registered a sharp reduction, with two or more standard deviations below the mean between 2016 and 2020. There was a sharp fall in drug seizures (–2 standard deviations in March, April and June), in flagrante delicto arrests (–2 in April and –3 in May and June) and arrest warrants (–3 in April and –2 in May and June). Seizures of rifles were also lower than the historic mean, although the result was within the normal pattern of the data, except in June, when incidents were atypically low.

Unlike the crime indicators and other police activity indicators, which saw a generally downward trend during the period, total number of police killings peaked in April (1.7 standard deviations above the mean in the period 2016 to 2020). In May, however, the value was close to zero, followed by an atypical reduction in June (2.1 standard deviations below the mean).

These findings suggest that in the first three months of the pandemic, the use of deadly force by the police did not follow the trend of violent crime and the other indicators of police activity. It is noteworthy that there was a reduction of

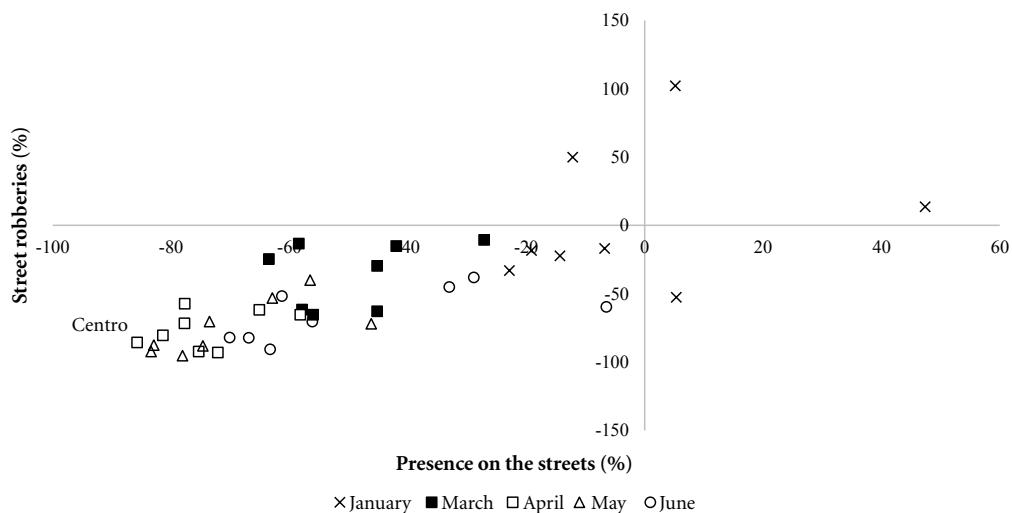


Gráfico 1. Percentagem de diferença na presença nas ruas x percentagem de diferença em roubos de rua por bairro e meses em 2020 (comparado a fevereiro 2020), estado do Rio de Janeiro.

Source: Elaborated by the authors based on data from Cyberlabs and the Public Security Institute (ISP-RJ).

more than 2 standard deviations in drug seizures in April, the same month in which police killings showed a sharp rise in the metropolitan region. The time series also reveals two opposite trends in 2020: an initial gap between commonly associated indicators, followed by a closing of this gap in June.

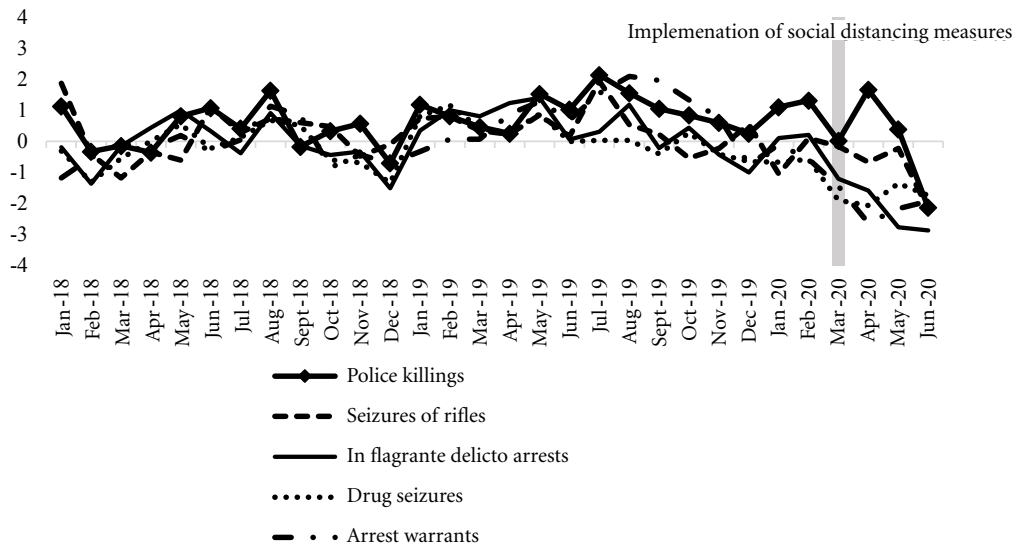
This may be the result of local variations in the indicators. In other words, the increase in the total number of police killings may represent the police response to the resurgence of criminal activities in particular neighborhoods and areas across the state. Graph 3 shows the relationship between trends in crimes against life and police lethality from April by area. The graph shows differences in indicators of ILVC (horizontal axis) and police killings (vertical axis) by IPSA⁹. An ascending or descending line with clusters of polygons indicates these variables are positively or negatively associated. The area of each IPSA is the precinct patrolled by the respective military police battalion.

The polygons to the right of the vertical line show a positive difference in the number of ILVC in comparison to the mean. The polygons above the horizontal line show a positive difference in number of police killings in comparison to the mean. This means that the observations in the top

left quadrant indicate the IPSAs that registered an increase in the number of police killings and fall in number of ILVCs. In contrast, the bottom right quadrant contains the IPSAs that showed a reduction in police killings and increase in the number of ILVCs.

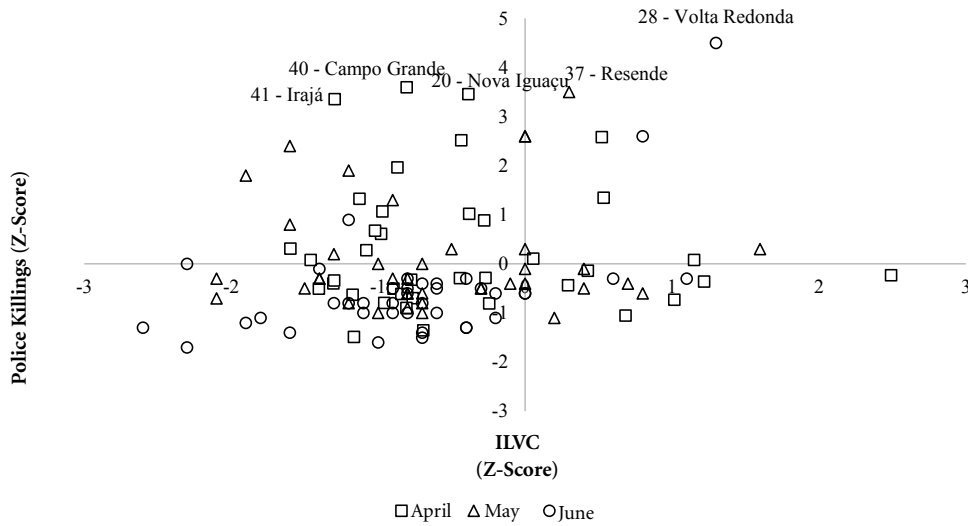
The lack of a clear pattern in the dispersion of the IPSAs in April, May and June indicates that, reciprocally, the two variables are only weakly correlated in the period (correlation coefficient = 0.18). The crimes against life dropped in almost all areas, and in many areas the reduction was well below the mean in the period 2016 to 2020. Police killings, however, was not related to criminal offences. Although there is a slight positive slope in the polygons brought about by the results in June, this association is in the opposite direction to what would be commonplace, which suggests that greater police confrontation reduces crime.

Graph 4 shows the number of police killings between April and June 2020 by IPSA. The length of the lines indicates the extent of the typical pattern of dispersion in each location. The black dots represent the local mean of police lethality in the four years preceding the pandemic, while the squares, triangles and circles represent the numbers for April, May and June, respectively.



Graph 2. Time series of indicators of police activity and violent crime. Differences between means in standard deviations relative to the period 2016 to 2020, state of Rio de Janeiro.

Source: Elaborated by the authors based on data from the Public Security Institute (ISP-RJ).



Graph 3. Difference between ILVC and police killings in April, May and June 2020 by IPSA, state of Rio de Janeiro.

Source: Elaborated by the authors based on data from the Public Security Institute (ISP-RJ).

For observations with differences greater than two standard deviations – very unlikely events under usual conditions – the polygons are located away from (below or above) the line. This facilitates the identification of atypical differences

in both locations where incidents are more common and those with a low number of incidents. In April, the IPSAs Tijuca (6) and Magé (34) registered numbers of police lethality that were two standard deviations higher than mean of

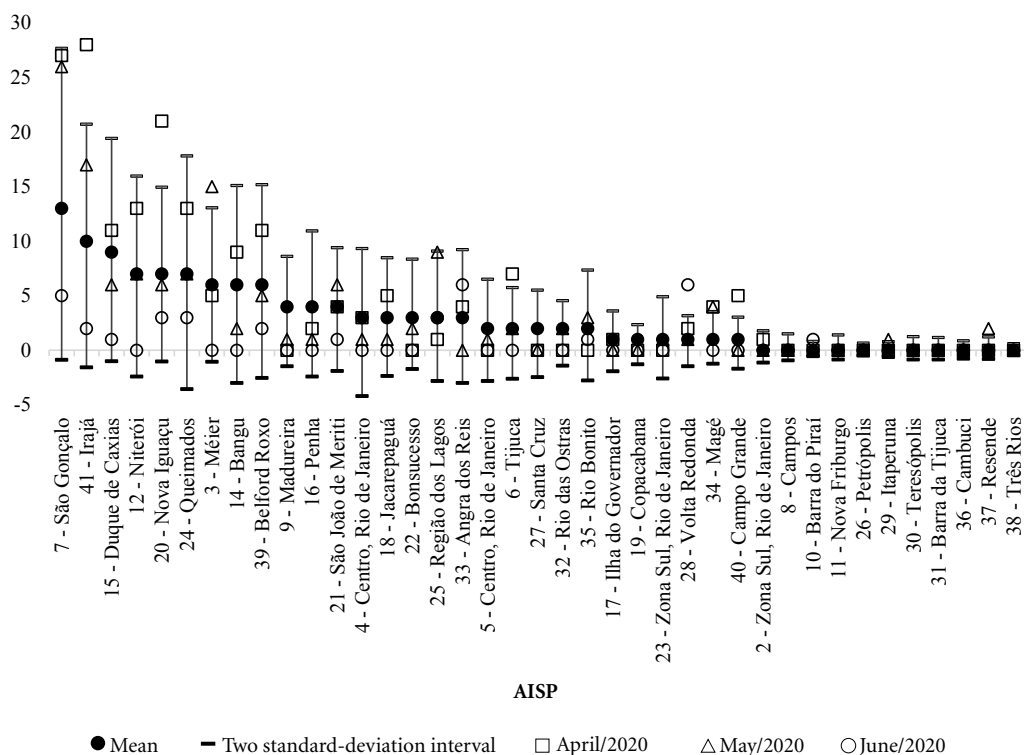
the previous four years. In statistical terms (and with the caveats mentioned in the Methodology section), this indicates that the possibility of the event occurring is less than 5%. In the IPSAs Campo Grande (40), Nova Iguaçu (20) and Irajá (41), there is an even greater difference to the historical mean, above three standard deviations, which is associated with events occurring with 1% probability at random. The difference was also large in the IPSA São Gonçalo (7), despite not exceeding the two standard deviations threshold. Together, these six IPSAs account for 51.4% of total police lethality in this month – 91 of 177 cases, the second highest number recorded in the state.

In May, atypical differences in the use of deadly force were less frequent and found mainly outside the metropolitan region, in IPSAs such as Resende (37) and Itaperuna (29). In the metropolitan area of Rio de Janeiro, there were atypical events in Meier (3) and Magé (34). São Gonçalo (7) was once again close to the upper limit of the

two standard deviations range and registered a relatively high absolute value. In June, following a decline in numbers of deaths, a large part of the IPSAs experienced police killings below the historical means. Only Volta Redonda (28) and Barra do Pirai (10) showed an atypical increase in cases. Despite being atypical, these increases are not very significant in absolute terms, considering that the total number of police killings in June was 34, the lowest monthly number in six years.

Discussion

Our analysis shows that there was a sharp fall in crime incidents starting in April 2020. In the two months after the implementation of the social distancing measures, property crimes dropped to more than two standard deviations below the historical mean, while rape and aggravated as-



Graph 4. Police killings between April and June 2020 relative to its historic mean between 2016 and 2020, state of Rio de Janeiro.

Source: Elaborated by the authors based on data from the Public Security Institute (ISP-RJ).

sault fell by more than three standard deviations. ILVCs were sharply reduced in May and June. Indicators of police activity, such as carrying out arrest warrants and drug and arms seizures also registered an important reduction. Only deaths resulting from police intervention showed a different trend, increasing sharply in April 2020.

The atypical trends in violent crimes and most of the indicators of police activity seem to be associated with the exceptional circumstances of the analyzed period, particularly the unprecedented decline in presence on the streets across the state. The data obtained from Cyberlabs show that reductions in street robberies were greater in neighborhoods where the reduction in presence on the streets was greater. Although the small sample of neighborhoods and short time interval do not allow a more robust test of this hypothesis, these findings support the thesis that the reduction in presence on the streets is an important factor in the fall in crime.

The reduction in crime incidents in Rio de Janeiro is similar to that found in other parts of the world, including cities in Colombia⁵ and the United States (US)⁶, and other regions in Brazil, such as São Paulo, Minas Gerais, Rio Grande do Sul and Amazonas¹⁰, which also adopted social distancing measures.

Abrams⁶ analyzed trends in 15 crimes in 25 cities in the US during the COVID-19 pandemic. Residential burglaries, robberies and drug crimes saw a sharp fall in comparison to prior years. Among violent crimes, there was a drop in the number of aggravated assaults. However, there was no statistically significant reduction in homicides and shootings relative to previous years.

A study by Alvarado et al.⁵ in Colombia reported that various crimes fell after the introduction of social distancing measures. Between March and August 2020, there was a 16% drop in homicides in comparison to prior trends. The drop was greater in urban areas and among men. In the same period, car theft dropped by 45% across all regions. Police productivity saw a relevant drop in terms of number of arrests, except for arrests related to non-compliance with health measures, which saw a significant rise.

The fall in property crimes found in these studies may be interpreted in the light of economic theory, which investigates how incentives affect crime^{4,8}. Social distancing measures caused a sharp drop in the number of people on the streets, reducing potential crime targets and economic returns from crime. The negative effect of this shock may have been compensated to a

certain extent by the engagement of people not previously involved in crime with illegal activities, especially those who have lost income due to job loss or the economic downturn. However, the data indicate that the effect of reductions on opportunity for crime was greater than the effects of other determining factors.

In Rio de Janeiro, the unique trend in police killings in the midst of the COVID-19 pandemic corroborates the findings of Monteiro et al.¹¹, who point to a weak association between police lethality and violent crimes at local level in Rio de Janeiro. Analyzing the period between 2003 and 2019, the authors demonstrated that the increase in the use of deadly force by the police was not followed by a decline in property crimes and crimes against life. Quite the contrary, for some indicators, the rise in police killings is not correlated with increased criminal activity, although in this case the magnitude of the effects is low.

In the context of the COVID-19 pandemic, characterized by highly exceptional circumstances, the weak link between these dimensions becomes even more evident. Despite a significant sustained fall in most crimes since April, police lethality in the state continued to rise, reaching values far above the historical mean in some regions. In May, the number came close to the pattern in prior years (2016-2020), representing a drop relative to the previous month, but still remaining at historically high levels. In June however there was an extraordinary fall in police lethality, with more than *two standard deviations away from* the mean across practically all the state's IPSAs.

In an attempt to clarify this unique pattern in police lethality in the first half of 2020, Monteiro et al.¹² analyzed weekly police involvement in shootouts in the metropolitan region. Using data from the platform *Fogo Cruzado* (crossfire), the authors reported that trends in the number of shootouts and official number of police killings were similar. Immediately after the introduction of the state decree introducing social distancing measures, there was an unsustainable fall in the participation of police officers in shootouts, which soon returned to high levels in April and the first weeks of May. Subsequently, the number of cases began to decline and remained extraordinarily low in June, in consonance with the atypical finding from the official data compiled by the ISP-RJ.

The decline in police involvement in armed confrontations coincides with a meeting reported by Rio newspapers between the state governor,

Wilson Witzel, and state heads of public security. During the meeting, the governor ordered the interruption of police raids during the humanitarian response in *favelas*¹³. In the following weeks, the number of shootouts involving police remained low, after Justice Edson Fachin's (of the Supreme Court) decision to limit police operations in the state¹⁴. Given its importance, this point in particular has been widely addressed by several analysts¹⁵; however, the unusual pattern in police activity even before this decision also casts light on the influence of the chain of command on how police carry out their activities on the streets.

Considering the history of public security in the state of Rio de Janeiro over recent decades^{16,17}, it is possible to argue that the use of deadly force by Rio's police is endemic – it is persistent and prevalent throughout the state. This reinforces the importance of gaining a more in-depth understanding of the mechanisms that regulate police violence in the state. In this sense, with the aim of paving the way for further investigations, we highlight two characteristics of this phenomenon that have become prominent during the health emergency caused by the novel coronavirus: the concentration of police killings in specific areas and the role played by the chain of command in the results of police action.

First, as is typical of endemic problems, the use of deadly force by police is subject to occasional upsurges. This pattern is evident in certain regions, especially in April, when the number of police killings was far above the mean, even in areas where excessive levels are recurrent. Episodes of this nature signal that police lethality is not evenly distributed across the state, as various studies on this topic show^{18,19}.

Theoretically, the incidence of cases should be related mainly to the local dynamics of violent crime, yet the weak association between the phenomenon and crime indicators denotes that other elements have a decisive influence, such as organizational and corporative factors, which generally do not follow efficiency criteria^{18,20}. This aspect in particular reinforces the need for systematic investigations into the procedures involved in police action and its results, with the aim of identifying situations and behaviors that stimulate the use of lethal force.

Second, with regard to more general factors determining police lethality, one of the elements that stand out in the context analyzed by this study is the contribution of the chain of command to the maintenance or reduction of police

violence. According to Cano et al.²¹, different levels of command can affect how police carry out their activities, including the use of deadly force. The synchrony observed between the governor's order and the reduction in police involvement in armed confrontations demonstrates, to some extent, the vitality of the internal and external control structures governing the use of excessive force – despite the well-documented obstacles to the adequate functioning of these mechanisms²².

A weekly analysis shows that the reduction in shootouts involving police occurred approximately 10 days before Justice Edson Fachin's decision. This reinforces our understanding that the administration's posture and high command politics – governor, state secretary, police commander etc. – can have a significant impact on levels of police lethality, as has been observed in other moments of recent history²³.

Conclusion

Our findings show consistent reductions in the crimes investigated across the state of Rio de Janeiro in the three months following the implementation of social distancing measures. For most crimes, these reductions represent atypical differences with more than *two standard deviations away from* the historical mean. These findings resemble those found in other parts of the world that also imposed restrictions to curb the spread of COVID-19 during this period.

Similar reductions were also observed in the indicators of police activity, which saw a strong and sustained downward trend. This trend was particularly pronounced for arrests and drug and arms seizures. The only indicator that diverged from this pattern was police lethality.

The atypical trends in violent crimes and a large part of the indicators of police activity appear to be associated with the exceptional circumstances of the moment, particularly the unprecedented decline in presence on the streets across the state. The analysis of the data on presence on the streets in the capital obtained from Cyberlabs shows for example that reductions in street robberies were greater in neighborhoods where the reduction in presence on the streets was greater.

However, what explains the unique trend in the use of deadly force by police after the adoption of social distancing measures? The analyses presented indicate that police increased the use of force without clear justification and that this

was not associated with upsurges in crime. This increase was stifled in June in response to political and judicial decisions, resulting in a sharp atypical reduction. Thus, the only public security indicator that followed its own unique pattern, apparently unrelated to the exceptional circum-

stances of the pandemic, was police killings. This finding underlines the challenge to understand and address excessive deadly force, especially with regard to the geography of police killings and the role of institutional hierarchies in the use of force by the police in Rio de Janeiro.

Collaborations

JCM Monteiro: article design and critical review of the manuscript. EF Carvalho: analysis and data collection, and final review of the article. RC Gomes: writing, literature review and final review of the article. All authors approved the final version of the study.

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