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Bus Robberies in Belo Horizonte, Brazil: Solutions for Safe Travel

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Bus Robberies in Belo Horizonte, Brazil: Solutions for Safe Travel

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Abstract

This study examines the spatial patterns and other situational determinants leading to the high number of bus robberies in Belo Horizonte. Main research questions include patterns of robberies, spatial concentration, locations prone to robberies, and environmental characteristics therein. This study also provides a variety of safety measures based on the Situational Crime Prevention approach. The Rapid Assessment Methodology (RAM) was employed using both quantitative and qualitative data. It involves spatial analysis, direct observation of hot spots using a safety audit protocol, and focus group discussions with key participants. Bus robberies involve minimum risk and low detection and arrest. The “hottest products” to be stolen include electronic devices and cash. The robberies occur at specific times and locations depending on opportunity. As many crimes go unreported, police data have inaccuracies. Therefore, it is impossible to verify the exact location of the robberies. This study concludes that for safe travel preventive measure should focus on reducing crime opportunities. A collaborative effort is needed from agencies and individuals alike. Further research should focus on examining why the majority of bus robberies are

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concentrated in only two main bus routes. Are these hot spots just recent spikes or are they chronic?

Keywords

public transport crime in Brazil, Situational Crime Prevention, bus robberies, safety in public transportation, opportunity and crime

Introduction

Although underreported, public transport crime generates fear and insecurity among riders, staff, and the public at large in many urban cities worldwide. In developing economies, especially in the Latin American region, the issue is much more evident, with an escalation of assault and harassment in the public transport environment constantly portrayed on daily news. As a high majority of the public depend on the public transport system to commute, enhancing public safety and security has become a priority for governments, public service providers, and transport authorities in the region. Nonetheless, there are very few studies in Brazil, Mexico, El Salvador, and Chile that have extended policy recommendations for the control and prevention of crimes committed in public transport environments (Natarajan et al., 2015; Paes-Machado & Levenstein, 2004; Vilalta, 2011). Studies have indicated that the lack of safety in public transport is related to the failure of the infrastructure, inefficient public transport systems, lack of institutional network, and government neglect, as well as to the poor conditions surrounding it (Natarajan et al., 2015; Newton, 2004), all of which contribute to creating many opportunities for crime. In this article, we provide a systematic analysis of public transport crime—specifically, bus robberies in Belo Horizonte, one of the major cities in Brazil—with the aim of providing insights for urban planning practices and advancing the various safety needs inherent to public travel worldwide.

After going through both academic and gray literature, Natarajan et al. (2015) found that over the past three or four decades, there are more than 500 studies focused on public transport crimes in general and only 40 studies focused on bus crimes, mostly undertaken in developed countries. They reported that public transport crime is frequently classified according to the target: (a) crimes against the system (e.g., vandalism/graffiti, theft of fares collected, and terrorism); (b) crimes against staff (e.g., assaults on drivers or conductors); and (c) crimes against passengers (e.g., robberies, assaults, and sexual harassment of women). Furthermore, Smith and Clarke (2000) stated

that a variety of crimes are committed in different modes of transportation including trams, buses, subways, commuter trains, taxis, and jitneys and that they are concentrated on specific routes, bus stops, railway stations, and so on. Hence, preventive measures will differ among these environments and between each specific crime identified within the classifications.

Literature Review: Theory, Research, and Prevention Implications for Bus Crimes

Crime opportunity theories. Most studies identified in the literature were undertaken to prevent or reduce bus crimes and were guided by crime opportunity theories including Cohen and Felson's (1979) Routine Activity theory, Cornish and Clarke's (1986) Criminological Rational Choice perspective, and Brantingham and Brantingham's (1984) Crime Pattern theory. Although they differ in the levels of explanations, the common ground for crime opportunity theories is that any explanation of human action must encompass: (a) the person who commits the act, (b) the immediate setting in which the act occurs, and (c) the interaction between person and setting variables (Natarajan, 2011). The environment or setting factors that provide the opportunity to commit the bus robberies are the focus of this study.

Mobility patterns of offenders and victims in transport environment. According to the Crime Pattern theory (Brantingham & Brantingham, 1984), victimization is seen to be dependent on the intersection of routine pathways (or activity spaces) used by both offenders and victims. These are largely defined by nodes (such as home, work, school, and recreational places) and paths (subway or train lines or bus routes) in their daily travel routines—all are relevant for understanding crime victimization patterns in public transportation (Natarajan, Schmuhl, Sudula, & Manda, 2017). This links to recent acknowledgment of the value of “the whole journey approach” (Ceccato & Newton, 2015; Loukaitou-Sideris et al., 2002; Natarajan et al., 2015; Natarajan et al., 2017; Newton, 2004, 2014; Newton & Bowers, 2007; Smith & Clarke, 2000; Smith & Cornish, 2006) in understanding and reducing crime in public transport systems. This approach recognizes three main components: The Walking Environment, that is, walking to and from the bus/train stops (origin and destination points); the Waiting Environment, that is, waiting for the bus or train; and the Riding Environment, that is, on the bus or train. Crime concentrations have been found at each of these three environments (Newton, 2008; Tompson et al., 2009). Many studies have discovered that fear of crime or environmental safety is a crucial factor in people's modal choice of walking

or riding a bus (Ingalls et al., 1994). As Newton (2004) states, the public transport network brings increased accessibility to places, which creates distinctive patterns of offending.

Pearlstein and Wachs (1982) found that 88 out of 223 bus routes in Southern California experienced serious and frequent incidents of crime. More recently, Newton's (2008) study confirmed not only that "en route" bus-related crime is positively associated with crime in the area it passes through but also that the risk of crime is elevated on routes that have multiple access points to these high crime areas.

Crime concentrations and situational determinants. The literature validates that the characteristics of transit/bus stops and their surrounding environment facilitate the occurrence of predatory crime, including robberies, which suggests that crime concentrates near public bus stop locations (Hart & Miethe, 2014; Kooi, 2013; Levine, Wachs, & Shirazi, 1986; Loukaitou-Sideris, 1999; Loukaitou-Sideris et al., 2002; Newton, 2008; Yu, 2009). In a study of 24,023 street segments (data 1989-2004) in Seattle, Weisburd, Groff, and Yang (2012) found that the *number of bus stops is an indicator of the street segment having a chronic crime problem.*

In their study of 100 Los Angeles bus stops, Liggett, Loukaitou-Sideris, and Iseki (2003) examined the presence of obvious escape routes (alleys), land use patterns, the condition of the area (vacant lots and incivilities), and the characteristics of the stops and the street. The presence of liquor stores and litter, as well as wait time, visibility, and whether or not the stop was in the historic core of the city, were all significant predictors of the natural log of the number of crimes per 100 riders. Stucky and Smith (2017) also noted that the relationship between bus stops and crime was conditioned by land use configurations: commercial and industrial land uses heightened the occurrence of bus stop crime. Zhang (2016) attested that land use characteristics can affect transit use at various spatial scales, such as at a trip's origin and destination zones, at neighborhoods in which the traveler lives, or in an area surrounding a bus or rail station and that very dense residential and commercial development may trigger a rise in *crimes*, leading to a fall in ridership.

Using direct observation, mapping, interviews, and surveys, Loukaitou-Sideris (1999) examined social and physical environments around the top 10 crime-ridden bus stops in Los Angeles during 1994 and 1995 and found that seven out of 10 of the bus stops where crime most frequently manifests were in downtown Los Angeles.

Crime opportunity structures can be measured by different features indicating the availability of suitable targets, the laxness of capable guardians,

and the absence of place managers (Clarke & Eck, 2005; Cohen & Felson, 1979); understanding the role that environmental factors play in creating opportunities for crime is paramount. The above discussion on crime concentration and offender and victim mobility patterns in public transport environments is crucial for comprehending the various facets of environment that provide the rationale for various forms of environmental crime prevention, including Crime Prevention through Environmental Design (CPTED), Defensible Space, Designing Out Crime, and, most importantly, Situational Crime Prevention (SCP; Clarke, 1997), which also underlines the importance of Problem-Oriented Policing. In sum, guided by crime opportunity theories, as SCP dictates, most studies of bus crime are in the first place undertaken to understand and suggest prevention measures in the public transport crime environment.

Public Transport Crime in Brazil

In Brazil, one of the fastest growing economies in the Latin American region, bus robberies have been reported to be on the increase in most urban centers. Numerous people have either witnessed violent crimes or been victimized personally; many have even been shot to death as they attempt to resist (Paes-Machado & Viodres-Inoue, 2017). In 2016, the Confederação Nacional do Transporte público (National Confederation of Public Transport) conducted a large study based on a sample of more than 1,000 bus drivers in 169 municipalities across the country and reported that the foremost problem faced by bus workers is armed robbery and the associated physical assault. Furthermore, the report informs that the fear of being a crime victim while working is the second highest reason for transport workers to resign from their jobs.

Buses have been the main public transport for most Brazilians in major cities for many decades, and thus the problem of bus crimes is nothing new. In the 1990s, the incidence of robberies in buses climbed so high that it led to mobilization and protests from workers and their union in one of the largest Brazilian cities, Salvador. Generally composed of poor young males of African descent, offenders continue to challenge and overcome security measures that have been implemented (Paes-Machado & Levenstein, 2004). This helped to reduce the loss of revenue as far as the bus companies were concerned. Criminals then shifted their focus to robbing bus workers and passengers of their personal belongings, specifically any cash or jewelry. However, more recently, the black market for electronic devices such as cell-phones, iPads, and laptops has been booming in Brazil. These “hot products,” which criminals typically obtain at gun point, are a major concern. Using data on bus robberies collected by the Department of Public Security in the state

of Bahia, Brazil, from 2013, Sousa, Pitombo, Rocha, Salgueiro, and Delgado (2017) illustrated the use of spatial analysis in determining the locations of high risk for these crimes. Nevertheless, this study did not examine the high-risk locations themselves, particularly in terms of their characteristic features that provide opportunities for robberies in buses. This study provides a whole picture providing a detailed analysis of what we need to know and what needs to be done to reduce robberies in Belo Horizonte.

This Study

Public Transport System and Bus Crimes in Belo Horizonte

Belo Horizonte, the capital of the state of Minas Gerais, is the third largest metropolitan region in Brazil, with a population of approximately 2.5 million and an area of 331 km² (Prefeitura Belo Horizonte, 2017). Composed of metro, buses, and micro-buses, the city public transportation system transports 1.5 million individuals daily on average. Specifically, the bus system is made up of 300 bus lines controlled by 50 private companies aggregated into four consortiums.

In 1997, Belo Horizonte implemented the “BHBUS project” (Belo Horizonte Bus Project), integrating stations to facilitate bus transfers. In 2011, the city was the first in Brazil to develop a mobility plan (PlanMob-BH) designed in line with the National Urban Mobility Policy (PNMU) to be implemented for the next 20 years (Oliveira, 2014).

On March 8, 2014, the MOVE Bus Rapid System (BRT) system was implemented with the intent to improve the current public transport system, as well as to accommodate the number of visitors who would be using public transport during the World Cup event that Belo Horizonte was hosting. As anticipated, a sharp increase in ridership followed the implementation of the MOVE BRT system, which clearly had improved safety measures in addition to alleviating the chronic problem of a crowded and aging transport system in the city. Nonetheless, the city faced an increase in robberies in buses among other challenges, such as rapid population growth and the explosion of informal collective transport modes.

Figure 1 shows the sharp increase in robbery in buses between 2012 and 2016 reported to police despite a drop-in ridership and increased automobile use in Belo Horizonte. Smith and Clarke (2000) explained this trend: “the drop-in ridership means there is less guardianship from other passengers and crime risks increase even more” (p. 200).

The above plotted police data (Figure 1), particularly in the period between 2012 and 2016, show that robbery in buses in Belo Horizonte escalated from

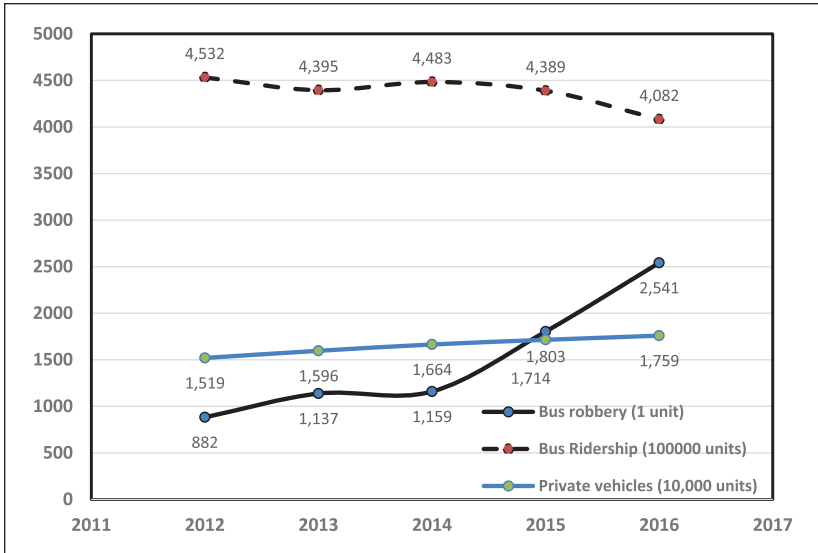


Figure 1. Bus robberies, bus ridership, and use of private vehicles in Belo Horizonte (2012-2016).

882 in 2012 to 2,541 incidents in 2016, an increase of 65%. Furthermore, police records indicate that most of the robberies involved electronic goods, especially smartphones (which represent 82% of the “hot” products targeted by bus robbers citywide). The term CRAVED (Concealable, Removable, Available, Valuable, Enjoyable, and Disposable) model coined by Clarke (1999) does seem consistent with the attributes that are attractive to these robbers. Although all the attributes are important, according to Clarke (1999) the disposal feature of the hot products was predicted to have the greatest effect on how often a specific kind of item was stolen.

Method

Research Questions

As demonstrated in Figure 1, it can be inferred that the new MOVE BRT system may not be the main cause of the increased bus crimes; hence, we resort to concepts rendered by bus crime literature to explore this increase. Guided by crime opportunity theories, we posed the following research questions to examine spatial patterns, concentration, and other situational determinants to understand the bus robberies in Belo Horizonte. What types of

crimes are most common in buses? Where specifically do the robberies occur? When do the crimes occur? Who are the offenders and victims? Why do they commit crime? How do they do it? Are there any spatial concentrations? Which locations are specifically prone to bus robberies? What are the environmental characteristics of the locations with high concentrations of robbery? We undertook various analyses using both quantitative and qualitative data to answer the research questions in the vein of suggesting prevention polices and policing strategies.

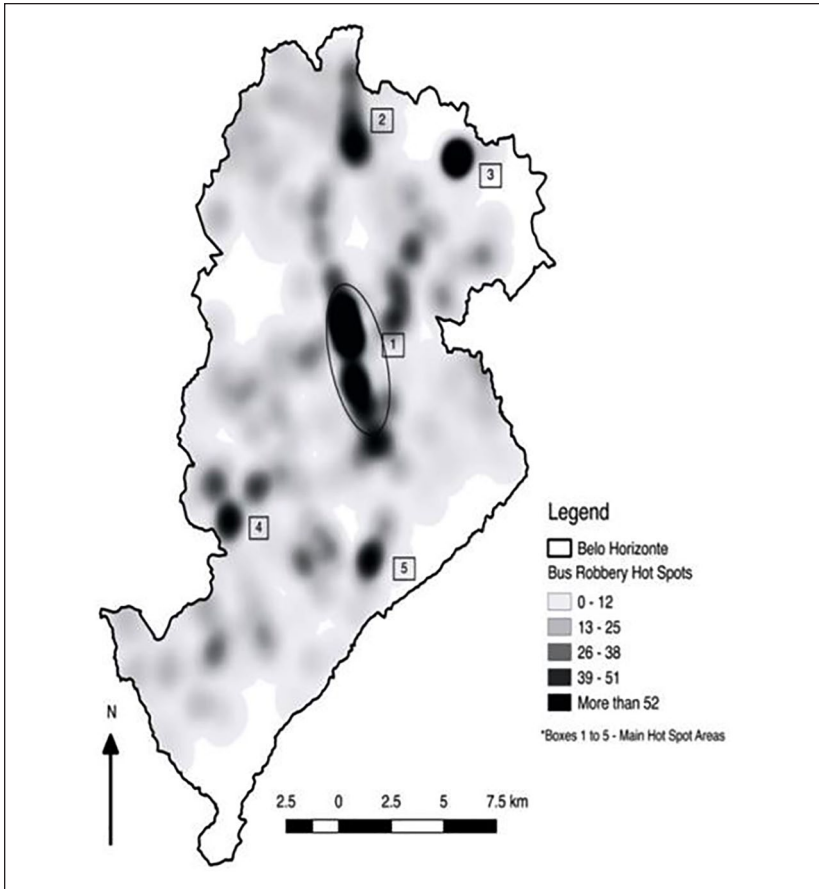
While maintaining a mindfulness of crime opportunity theories, this descriptive exploratory study aims to answer the research questions posed above by employing the RAM to examine the patterns of bus robberies—why, when, and where they occur, what causes them, who is involved, as well as how they are committed. This will in turn shed light on possible prevention polices to deal with crimes in the public transport environment in Belo Horizonte. Used heavily in public health field, this methodology has been proven to be efficient for the study of crime, particularly in developing countries (Natarajan, 2016; Natarajan et al., 2015) to find timely solutions for the problems in hand.

Understanding the situational contexts in which crimes occur necessitates both qualitative and quantitative data—what Creswell and Clark (2017) call a “mixed method design.” Mixed methods not only help researchers to understand “the whole picture” of the problem under study but also aid in answering the specific questions posed in this research. As illustrated earlier, the study sets out to identify the crime concentrations and analyze the environment that provides opportunities for bus robberies. This requires a sequential exploratory strategy involving steps/phases of analysis (listed subsequently) that begin with quantitative data for mapping and identifying the most crime-prone locations, and qualitative data for reasoning out the situational context where robberies occur in space in time. Hence, for the purposes of this research, we used both secondary and primary sources for data. They include police data; direct observation of locations using a safety audit protocol; and focus group discussions with bus drivers, conductors, public transport union staff, bus owners, police officers, and bus users.

Data Analysis and Findings

Phase 1: Exploring Spatial Patterns of Bus Robberies in Belo Horizonte

First, we used geo-referenced data composed of robberies reported during the period of 2012 to 2016, recorded by the Military Police in Belo Horizonte.



Map 1. Kernel density estimation of bus robberies in Belo Horizonte (2012-2016).

They define bus robbery as the stealing of any item by physical force or threat, combined with the use of a weapon, against bus passengers, drivers, or fare collectors. We mapped the bus robberies over a city reference map and produced a kernel density function map (see Map 1) for visualizing spatial patterns and for identifying “hot spots.”

The kernel density function map shows that bus robberies are highly concentrated at a citywide level and confirms that bus robberies are geographically clustered in certain locations throughout the city, particularly in five specific areas. One of the major clusters includes an area close to the center of the city and extends further north, including BR 356 Highway and President

Table 1. Twelve Spatial Clusters of Bus Robberies.

Spatial cluster	Routes	Crime (%)
1	Teresa Cristina Ave	64 (3.3)
2	Raja Gabaglia Ave	66 (3.4)
3	BR 356 Highway	65 (3.4)
4	Dom Pedro I Ave	74 (3.9)
5	Padre Pedro Pinto Ave	81 (4.2)
6	BR-262 Highway	85 (4.4)
7	MG-020 Highway	97 (5.1)
8	Juscelino Kubitschek Ave	113 (5.9)
9	Amazonas Ave	137 (7.2)
10	Senhora do Carmo Ave	230 (12)
11	Cristiano Machado Ave	357 (18.6)
12	Presidente Antonio Carlos Ave	546 (28.5)
Total N		1,915

Antonio Carlos Ave. This avenue has lanes exclusively for BRT buses as well as those for conventional buses and all other vehicles. It also circumvents some shantytowns (*favelas*) and other impoverished neighborhoods. The second cluster, located in the northern region, is characterized by governmental buildings, as well as two airports, Pampulha Airport (Domestic) and the *Confins* International Airport. These airports are served by two main bus routes, including President Antonio Carlos and Cristiano Machado Avenues. The third cluster is in the northeast region of Belo Horizonte, one of the major transportation hubs in the city—Sao Gabriel which connects to other parts of the city via Cristiano Machado Ave and MG 020 Highway. The fourth cluster is in the western region of the city including important avenues such as Amazonas Ave, Tereza Cristina, Afonso de Melo, Sinfronio Machado, and BR-262 Highway. This cluster embraces the largest transportation hub in the city, which connects to the largest shopping mall in the region. Finally, the fifth cluster is in Senhora do Carmo and Raja Gabaglia Avenues, the most prosperous areas in the city. These avenues lead toward the BH Shopping Mall and circumvent some of the major shantytowns, respectively, *favela Papagaio* and *Aglomerado Morro das Pedras*.

Robbery concentrations in bus routes: 80/20 Pareto principle. The police data provided further information on the bus routes where robberies were reported. It can be inferred from Table 1 that 12 routes had 78% of the bus robberies reported citywide (BHTRANS). These routes correspond to 2.62% of the

public transport routes of the whole city (see Table 1 for the distribution of robberies in each of the hot routes).

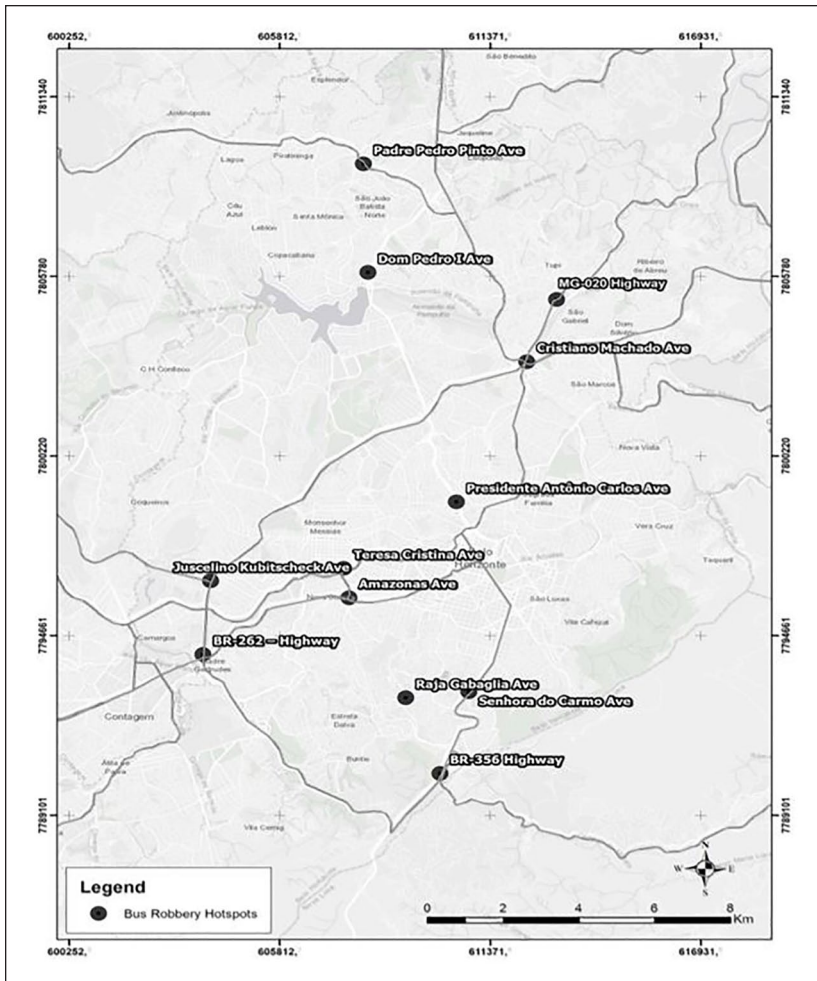
This finding confirms Pareto's principle known as the 80/20 Rule, which asserts that a small proportion of any type of phenomenon is responsible for a high proportion of the outcomes. Of these 12 "hot routes," two of them (Antonio Carlos and Cristiano Machado) accounted for 36% of the total number of robberies.¹ This further underscores the degree to which these two hot routes are dangerous.

Robbery hot spots: spatial cluster analysis. Using QGIS software, we performed a spatial cluster analysis to identify the exact location with the highest density of crimes in each of the 12 routes identified in the earlier phase. The robbery incidents are marked on the map using their geographic coordinates, thus establishing a geo-referenced line of the group of streets within the 12 routes. The robbery incidents (point data) are identified by their distances relative to a point of origin in the street. Monte Carlo simulations enabled us to scan a one-dimensional window of variable size to identify sections in which the incidence rate of robberies is greater than expected. The R software further assisted with the use of graphic interfaces and street maps obtained from the Google Maps platform to visually represent these hot spot locations (see Map 2). The method used is an extension of the geo-spatial time-scan model that considers point events scattered along a street (or set of streets). Locations with high incidences of bus robberies are marked with push pins (see Map 2).

In sum, the aforementioned spatial analyses using the number of incidents of robberies identified hot spots within the risky bus routes in hot areas. This identification of specific spots in the routes is pertinent to the city government's efforts to generate intervention(s); however, we also need to know the characteristic features of these locations, which we describe below by undertaking Phase 2 to identify the specific interventions.

Phase 2: Assessing Characteristic Features of Hot Spots

As recommended in the literature (Levine & Wachs, 1985; Levine et al., 1986; Loukaitou-Sideris et al., 2001; Natarajan et al., 2015; Paes-Machado & Viodres-Inoue, 2017; Pearlstein & Wachs, 1982), we used direct observation techniques to examine the characteristic features of the immediate environment of the 12 hot spot locations identified in the earlier step. Direct observation not only assisted in gathering the real-time contextual features but also ensured the highest degree of "ecological" validity.



Map 2. Twelve bus robbery hot spots in Belo Horizonte (2012-2016).

The field observation of the hot spots was undertaken during a weekday afternoon by the primary author of this article along with a local research assistant (hired for this data collection purpose) using the safety audit protocol that was developed for an earlier study to gather information on environmental characteristics (Natarajan, 2016). The aim was to glean ways of improving the physical environment in ways that will reduce the opportunities for crime. Each of the 12 locations was observed and the information on

Table 2. Direct Observation of 12 Hot Spots.

Environmental characteristics	1	2	3	4	5	6	7	8	9	10	11	12	Total
Commercial area	1	1	0	1	1	1	1	1	1	1	1	1	11
Bus stops	1	1	0	0	1	1	1	1	1	0	1	1	9
Graffiti	1	0	0	1	0	1	1	1	1	1	1	1	9
Favela	0	0	1	1	0	1	1	1	1	1	0	1	8
Vehicular bridge	1	0	1	1	1	1	0	1	0	1	1	0	8
Vacant lots	0	0	1	1	1	0	0	0	0	1	1	0	5
Pedestrian bridges	1	0	1	0	1	0	0	1	0	1	0	0	5
BRT MOVE lanes	1	0	0	0	0	0	0	0	0	1	1	1	4
Isolated areas	0	0	0	1	0	1	0	0	1	0	1	0	3
Shopping malls	0	0	0	0	0	1	0	0	0	0	1	1	3
Mixed area	0	0	0	0	0	0	0	1	0	0	0	1	2
Homeless	0	0	0	0	0	0	0	0	0	1	0	0	1
Total	6	2	4	6	5	7	5	6	5	8	8	6	68

Note. BRT = bus rapid system.

the 12 features (see Table 2) were coded as “1” if present. We used Google Street View to validate our direct observation of the location to describe the environmental characteristic features of the hot spots.

The direct observation data (Table 2) indicate that most hot spots share similar environmental features. A high majority of the hot spots have conventional bus stops, as well as commercial/business buildings with conspicuous graffiti. Another important feature is that eight of the hot spots are near *favelas* or low-income neighborhoods and have vehicular bridges. Furthermore, there are alleyways, narrow pedestrians’ paths, and mazes present in at least five of the 12 hot spots, providing opportunities for easy escape. As in other studies, five of the locations have vacant lots. In addition, only a small number of hot spots are concentrated within isolated areas, characterized by factories and warehouses as well as shopping malls on highways or along avenues where MOVE BRT lanes operate. Only a few clusters exist within mixed areas composed of residential and commercial buildings where there is pedestrian movement or pedestrian bridge and homeless shelter. Interestingly, the three hot spots located within the hot routes including Senhora do Carmo Ave, Cristiano Machado Ave, and Presidente Antonio Carlos Ave (see Table 2) displayed the greatest number of features that would make them vulnerable to crime opportunities.

The aforementioned findings support the results of previous research, indicating the relevance of locational features of the public transport crime

environment. High-risk locations for bus robberies are influenced by the physical structures of the land use, which contributes to reducing public surveillance, signs of physical disorder that indicate a lack of place managers, and easy escape routes. The attractiveness of these locations is further enhanced by proximity to impoverished areas.

Phase 3: Focus Group Discussions: The Five W and One H Approach

In Phases 1 and 2, we examined the spatial and environmental aspects of bus robberies in Belo Horizonte, but we needed more information in reasoning out the dynamics of crime patterns and their constituents (the offenders, victims, guardianships, and temporal as well as place dimensions). Guided by Poyner's (1986) five Ws (Where, When, What, Who, and Why) and H (How) questions which serve to break up a larger problem into its constituent parts, focus group discussions were undertaken to obtain a detailed account of the stakeholders' perspectives (including police officers, bus drivers, conductors, managers, public transport union staff, and passengers) on bus crimes including robberies. We found that the perception of fear and other causal factors including disorder and incivilities; the physical conditions and functionality of the bus system; the individual behaviors of bus operators, offenders, and victims; the quality of the public transport; and environmental features and surrounding locations where bus crimes are prevalent is crucial in understanding the phenomenon of bus robberies. As the aforementioned stakeholders are the main beneficiaries of the bus system, the focus group discussions also revolved around safety measures that are in place currently and the additional measures that are needed to control and prevent bus-related crimes, specifically robberies, in space and time.

A total of 125 individuals participated in 12 separate focus groups. Participants in each group included police officers patrolling high-risk routes, bus drivers and fare collectors serving the most vulnerable bus routes and areas, union representatives, and university students who use buses both day and night. The primary author of the research conducted the focus group discussion in the native language. Two research assistants aided in taking notes. With the help of union representatives, a snowball sampling method was employed to recruit bus drivers and fare collectors at different bus terminals. The focus groups' discussion with these selected individuals who volunteered to participate was conducted at the corresponding bus terminals where they report. The focus groups with police officers were held at two separate police precincts located within areas that are at a high risk for bus robberies. Finally, through the university website the students who were bus users were

recruited and the discussions with them were conducted at the University campus. Each of the group discussions took an average of 2 hr each.

As this research involved human subjects, all necessary steps were taken to protect the privacy and confidentiality of the participants of the focus group discussion as required by the Institutional Review Board (IRB). Appropriate measures were taken to secure confidentiality, privacy, and anonymity. Only those who volunteered to participate with written consent were included.

Where and When does bus robbery occur? Robberies occur often on conventional buses with routes crossing low-income areas and *favelas* (where crimes such as drug trafficking, black market activity, and other deviant activities take place) rather than on the express MOVE BRT bus lanes. Although MOVE BRT buses accept only electronic travel cards, the conventional buses accept both cash and cards. Furthermore, the conventional buses make more stops along expressways and avenues that pass through commercial areas distant from the city's downtown, which accordingly cause the buses to be considered as slow in service; these often stop in areas that are considered a high risk for crime.

The participants of all groups concurred that bus robberies mostly occur in the early morning hours (from 5:00 a.m. to 7:00 a.m.) and in the evenings (from 6:00 p.m. to 10:00 p.m.) when police surveillance is at minimum. This time is also popular as it combines people leaving work and going out for evening activities. Most participants agree that bus robberies occur particularly when buses are full.

Why have robberies in buses become a chronic problem? What can be done to deal with them? In general, bus operators agree that crime in buses has increased in the last 5 years (from 2012 to 2016) and that electronic goods have been the main target for robberies. The bus environment provides an opportunity for offenders to rob many victims with low effort and risk. Their effort is made easier for them by riders who are careless with their cellphones and often have them out in plain view, make them easy targets. Furthermore, the illegal market for stolen cellphones is readily available and difficult to detect and disrupt. Although International Mobile Equipment Identity (IMEI) is required to lock/unlock a cellphone or to check if a cellphone has been stolen, criminals have been able to unlock cellphones by purchasing unlocking devices on the Internet, although these are prohibited in Brazil, or by deleting the cellphone IMEI. Although some cellphones have been protected against the deletion of IMEI, hackers have managed to find other ways to unlock the cellphones. In addition, even when the IMEI has not been deleted,

the phone can be sold in parts at street value. The illegal market of cellphones is further facilitated on social media such as Facebook groups, WhatsApp, and so on. Hence, different strategies are required as robberies of cellphones are established and function in various types of environments—on the streets, in commercial stores, in shopping malls, and on the Internet. Criminals realize that the intended crime can be performed in a short period of time and can yield a high reward at a low risk of being caught. Consequently, the level of impunity is very high, and many criminals never face any form of punishment. The limited visibility of installed CCTV cameras makes theft even less risky for the criminals. Often, they break these cameras, wear a hood or hat to avoid recognition, and/or remove the memory card from the cameras. Accordingly, participants of the focus groups have insisted that there should be more cameras installed in better positions to capture all angles.

Although the electronic travel card has helped to reduce robbery inside buses, it has not been able to deter criminals from robbing passengers and staff. The fact that many crimes go unreported further reduces the risks for offenders. Although the bus companies' policy states that bus drivers should report the crime to the police, they are instructed to do so only at the end of their work shift. This procedure obviously represents a major drawback for bus drivers, who prefer not to comply because to do so would incur endless hours of dealing with police bureaucracy following a full day of work. On the contrary, if drivers decided to report the crime immediately after the incident has occurred, bus company owners would then have to deal with the operating costs of a trip interruption. Similarly, passengers tend not to report crimes because of the endless bureaucracy that would ensue. Some individuals prefer not to report the crime due to the fact that they may not have the IMEI required by the police, without which it is difficult to investigate and track the robbed phones. This may be a problem in Brazil, where many phones have been purchased illegally without obtaining any receipt.

Finally, fare evasion and disturbances in buses have also contributed to the increase in robbery in buses. Oftentimes, a group of young males will board a bus, usually a conventional bus, without paying and proceed to threaten drivers and conductors. This has escalated feelings of insecurity and fear, particularly at certain bus stops located on the outskirts of the city, and specifically in poor neighborhoods (the hot spots identified earlier). These youths tend to travel in groups of two or more and usually jump turnstiles, engage in bus surfing, and verbally threaten drivers. Many youths travel by bus to soccer games or to various concerts during weekends, when they behave in an unruly manner that cannot be controlled by the bus operators. Because these disturbances are considered misdemeanors, they often go unreported. Bus operators feel powerless to take any action in this situation, as they feel constantly

threatened by those young men, most of who are also involved in bus robbery.

Who are “they” and how did “they” do it? According to one of the participants who had 6 years of experience, perpetrators of robbery on buses are composed mostly of young men between 18 and 30 years of age, dressed in baggy trousers, hoodies, and hats or caps with firearms, knives, or other imitated weapons (like a fake gun that looks real) used to threaten and frighten victims. They usually have sport tattoos, oddly shaped eyebrows, and tinted colored hair. Although the stereotype of criminals can lead to labeling some innocent individuals as suspicious, operators can identify the likely robbers with “reasonable suspicion,” as criminals repeatedly target buses at the same bus stops and along the same routes. When buses cross their neighborhoods, they board with the intention to rob, which makes it easy not only to commit the crime close to their home turf but also to escape quickly and evade detection.

On the contrary, some perpetrators prefer to board the bus at the bus terminal in their own neighborhood in the morning (first trips) and wait for it to get a bit of distance away before committing a crime. This serves their purpose because the bus terminal caters to many routes that interconnect with many conventional/transfer buses making numerous local stops, affording opportunities to hold up more people and make hasty exits. According to law enforcement narratives, near specific bus stations many thieves get in buses and rob passengers just a few blocks after departure. At this point, the bus is relatively full, with all seats taken, and the criminals escape through alleyways with relative ease.

As mentioned earlier, offenders usually act in groups of two or three comrades—each one with a different modus operandi. In some cases, one of the offenders enters first through the front door to confront the bus driver and the fare collector and to announce the robbery, whereas the other robbers enter from the back door and steal from passengers. In other circumstances, some two or three offenders enter at the front door and approach the driver with some form of weapon, announcing a stick up. One of them stays close to the driver while his comrades jump the turnstile, robbing the fare collector and passengers. After stealing from everyone in their view, criminals finish by giving the driver a command to stop at a place that will facilitate their escape. This is usually near the entrances of *favelas* or other low-income neighborhoods where the chance of being caught is very slim and they can prepare for the next opportunity at short notice.

If an offender is acting alone, he (most often) usually enters the bus and takes a seat at the back of the bus without raising any suspicion. At the right

moment, when the bus is about to stop, he threatens the person next to him or her with a gun or other instrument and then exits the bus quickly. Acting by surprise, the odds of being seen by other witnesses is very low. In some cases, a robber acts alone but, upon arrival, is picked up by a comrade riding a motorcycle.

Some opportunistic thieves steal cellphones through bus windows. They do not even have to board buses. This seems to be a new trend in the downtown city area. Some careless riders hold their cellphones near open windows, particularly in conventional buses that are not furnished with air conditioning, making themselves easy targets for opportunistic criminals. When the bus stops at a red light, a bus stop, or in traffic, thieves who are passing by see the opportunity, reach through the window, grab the cellphone, and flee.

Although the perspectives of bus drivers, conductors, union staff, management, and police officers are very useful in illuminating the various crimes committed on bus lines, particularly striking was the bus users' testimony; these participants attested to other, underreported problems beyond bus robberies, including sexual harassment and the fear experienced when using the public transport system.

Discussion and Conclusion: Finding Solutions for Safe Travel

Bus robbery is a notorious opportunistic crime in most developing countries. The high demand for "hot products" such as cellphones and other electronic devices has contributed to the quick generation of illegal markets for this merchandise (Clarke, 1999). These markets go beyond the streets and commercial stores and have reached the intangible world of the Internet—especially, the darknet. This has become very appealing for many thieves, especially because of the anonymity of the transactions. Although the smartphone industry has continued to improve security measures, many other factors have challenged these measures, making these products more available and accessible to people who want to buy them at reduced costs.

As informed by the focus group discussions, bus robberies involve mostly unemployed, low-income young males targeting hot electronic items such as cellphones, which are highly available and accessible. The crimes are often concentrated along routes of conventional buses, which is in line Block and Davis's (1996) assertion that more public transit generates more robberies. Although the introduction of the MOVE BRT may not have ultimately had a major impact on bus robberies, our spatial analysis indicates that bus robberies do concentrate in some of the routes served by BRT. For example, as

identified by the spatial cluster analysis, Presidente Antonio Carlos and Cristiano Machado avenues, the main routes where BRT-exclusive lanes operate alongside lanes for conventional buses and other vehicles, are where many robberies were reported when compared with 10 other clusters. This warrants further focused research to understand what exactly make these two routes vulnerable for bus robberies. It also raises the question, are these hot spots merely recent spikes, or they are chronic? Answering these questions will help researchers to identify solutions for dealing with the robberies. Spelman and Eck (1987) noted if risks at locations are stable, then hot spots will stay hot, whereas community problem-solving techniques may reduce crimes and disorder substantially.

Most crimes are committed earlier in the morning and later in the day or at night leaving these locations quiet and without a sufficient degree of surveillance, thus providing opportunities for bus robbery. Police departments may need to dispatch more police patrols in the 12 hot spot locations at least during the high-risk times.

The characteristic features of the 12 hot locations on hot routes revealed that they are mostly located in or near commercial areas, bus stops, *favelas*, vehicular bridge, vacant lots, pedestrian walkways, isolated areas, and/or shopping mall. This indeed requires the city planning division's attention to integrate public safety. Graffiti and the homeless in some areas have also been identified. Furthermore, our analyses suggest that criminals are more likely to get off buses in front of parking lots, gas stations, car dealers, supermarkets, factories, or street intersections, as well as near favelas. As per Crime Pattern Theory, these locations are primarily crime generator areas where large numbers of people are attracted for reasons unrelated to criminal motivation. However, if these places are not secured properly, eventually they can become more attractive as they provide many opportunities to commit various crimes. In sum, all the aforementioned findings are in congruent with the literature on public transport crime conducted in the United States and other cities in developing countries.

According to Clarke's (1983) SCP perspective, criminally disposed individuals will commit more crimes if they encounter more criminal opportunities, and individuals who are generally law-abiding can be drawn into committing specific forms of crime if they regularly encounter easy opportunities for these crimes. The findings of this study indicate that there is a pressing need to develop prevention measures that are immediate and practical for bus management, urban planning departments, police departments, the local government, and bus users to address the increasing bus robberies in Belo Horizonte. Using Clarke's 20 of the 25 techniques of situational prevention, in Box 1, informed by the literature and focus group discussions, we suggest

Box 1. Addressing Robberies in Bus Environment through Clarke's 20 SCP Techniques.

Increase Efforts

1. *Target harden*: place mirrors; build strong pillars in the bus stops; introduce anti-robbery screens
2. *Control access to facilities*: redesign door system; require exact fare system; require electronic travel cards; require random checking in buses and at the bus shelters
3. *Screen exits*: require swiping the travel card when exiting
4. *Deflect offenders*: redesign pedestrian walks, alleyways; block streets and make it one way near favelas
5. *Control tools/weapons*: install metal detector in high-risk bus shelters; disable stolen phones and laptops

Increase Risks

6. *Extend guardianship*: take routine precautions when travel alone; have alarm buttons, emergency phone in the bus and bus shelters; install alert; communications on the screen at the front of the bus; introduce neighborhood robbery watch; encourage people to intervene when they see a crime happening inside the bus and waiting at the bus stop
7. *Assist natural surveillance*: provide extensive lighting in bus stops, bus terminal, streets and in buses, favelas; make the windows clear in buses; trim bushes in the bus routes, shelters; design using defensible space concepts-increase the size of the bus shelters; do not wear earbuds while you are in the bus or waiting or walking
8. *Reduce anonymity*: require bus drivers, conductors uniform and name tags.
9. *Use place managers*: require transport police inspectors at high-risk routes and require them to report to crime incidents to police; introduce kiosk near bus stops in high-risk routes; require CCTV in buses and shelters that serve the high-risk routes
10. *Strengthen formal surveillance*: allocate more military police patrolling in hot spot location; increase police surveillance on street vendors, pawn shops and other stores that sell stolen goods; require corporate businesses to require security guards in their commercial areas

Reduce Rewards

11. *Conceal targets*: encourage passengers to hide their electronic goods; encourage the passengers not to store personal and financial information in phones.
12. *Remove targets*: require the passengers not to flash their cash, electronic goods; require passengers not to use mobile phones in buses; move bus stops away from pawn shops, liquor stores, and pubs.
13. *Identify property*: encourage passengers to install tracking system in their phones and laptops; name stickers in their electronic phones (permanent markers) that cannot be removed; encourage cell phone manufacturers to make the parts with ID number; require cellphone companies to have unique identifiers for each phone
14. *Disrupt markets*: require police to check black market shops; require license for street vendors; require stringent penalty for stores that buy stolen goods
15. *Deny benefits*: encourage passengers to unlocking identification codes of all types of cellphones; tag graffiti; activate GPS for tracking the phone

Remove Excuses

16. *Set rules*: set harassment codes; set penalties for those selling stolen goods
17. *Post instructions*: post the penalties for robberies and other crimes in the buses; ask the passengers to register the phone with network providers; encourage reporting if they see crime happening
18. *Alert conscience*: post photos of offenders in strategic locations; remind the penalties for bus crimes; store the IMEI number
19. *Assist compliance*: provide hotlines to report bus crimes; provide dust bins with clear bags near bus stops; encourage phone owners to report their service providers at once after the robbery
20. *Control drugs & alcohol*: promote limited use of alcohol; encourage media to alert the passengers of bus robberies; encourage Facebook, twitter to alert the public about safety.

Note. IMEI = international mobile equipment identity; SCP = situational crime prevention.

SCP measures to make changes intended to discourage potential offenders by increasing the risks or difficulty of crime and by making it less rewarding or excusable. Smith and Clarke (2000) suggested that when these measures are

in place it might bring some diffusion of benefits by reducing other crimes in the hot spots identified in this study. Needless to say our suggested SCP measures demand a collaborative effort of various stakeholders for safe travels in the city.

Aside from efforts to reduce opportunities for crime, reducing the motivation of the young men in committing the bus robberies also needs attention. As a start, the police can identify the repeat offenders in the system and employ focused deterrence strategies (Kennedy, 2012).

In conclusion, RAM is quite useful for undertaking studies in developing countries to diagnose issues of crime that need immediate attention in a short span of time. Sequential analysis of both quantitative and qualitative data assisted not just in understanding the dynamics of bus robberies but also in identifying some tangible solutions to deal with them. This study relied on official data on bus robberies for in-depth analyses that are reported to police, but there are many more that have gone unreported. Furthermore, we could not infer from the data if the bus crimes happened in the bus while riding, or while waiting at the bus stops, or walking to the bus stop, as the police do not record such information. These limitations, however, do not impede this exploratory research in answering the specific questions it has posed, as this is the first study in Belo Horizonte that focuses on bus robberies in finding solutions for safe travel. We hope that the SCP recommendations will serve the stakeholders for the purposes of thinking through and enacting and enforcing policies.

Finally, fear of crime is a major concern among passengers, even when studies show relatively low levels of crime on public transport. This apparent discrepancy between passenger perception and the crime rate may perhaps be due to the underreporting of crimes. Encouraging the public and finding more efficient ways to report the crime will assist in understanding the impact of bus crimes in the city, which will in turn expedite the local government's efforts to develop appropriate policies in the future.

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Note

1. Presidente Antonio Carlos and Cristiano Machado avenues are main routes where BRT exclusive lanes were introduced along with other lanes for conventional buses and other vehicles. President Antonio Carlos corridor is the main transportation hub in the city, carrying around 400,000 passengers daily and serving 35,000 commuters in the morning rush hour. This corridor covers 14.7 km and is interconnected with three other avenues—Antonio Carlos, Pedro I, and Vilarinho. Cristiano Machado Ave covers 7.1 km and serves approximately 300,000 passengers daily, with 25,000 commuters at the morning rush hour. There are nine enclosed transfer bus stations along this corridor. The Cristiano Machado corridor connects to the Sao Gabriel MOVE Integration station in the northeast region and terminates in the city's center. Any research materials including data and samples of this manuscript can be accessed by contacting the authors.

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