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I. Introduction

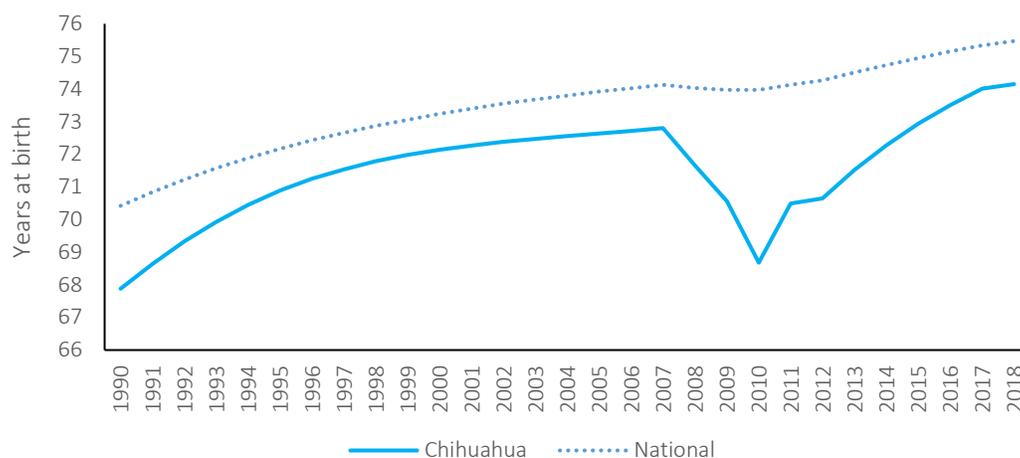
On December 11, 2006, the recently elected president of Mexico, Felipe Calderón, declared a War on Drug Trafficking by deploying the army to fight cartels in the state of Michoacán. Among the factors that motivated this decision were the increasing power and political influence of drug cartels in certain regions, the rise in drug use among the Mexican youth, and the polarization derived from the political instability produced by the accusations of fraud in the electoral results (Rios, 2013). A sharp increase in violence followed this move, especially along main drug trade routes along the Pacific coast and the border with the United States, which were disputed by cartels and the military (Inter-American Commission on Human Rights, 2015). The government responded by deploying more soldiers to fight cartels in the streets in these areas.

Violence escalated rapidly with the increase of military and federal police troops, especially those in the Northern border, where criminals had easy access to American-made arms to secure trade routes that connected them to their largest market across the border. The State of Chihuahua, just south of New Mexico and Western Texas, was particularly affected by drug related violence and crime, which in turn had a spillover effect on other crimes that are related to cartel activities. In March 2008, President Calderón announced the deployment of 2,026 Military troops and Federal Police officers under the “Joint Operation Chihuahua” (SEDENA, 2008), and these were joined later by 5,000 more troops (Villalpando, 2009). Additionally, the Federal Government established the Fund for Public Security of States (FASP) and the Subsidy for the Security of States and Municipalities (SUBSEMUN), which transferred funds to the state administration and some municipal governments to invest in local police forces.

By 2010, the state of Chihuahua had the highest homicide rate of any sub-national entity in the world, being almost 20 times higher than WHO’s definition of violence outbreak (UNDP, 2013). The conflict became a public health issue, becoming the leading cause of death in the region and drastically decreasing the life expectancy of the State’s population (Figure 1). Violence also

had an impact on social cohesion that derived from the privatization of public spaces, and the making of protection only for those who could afford it.

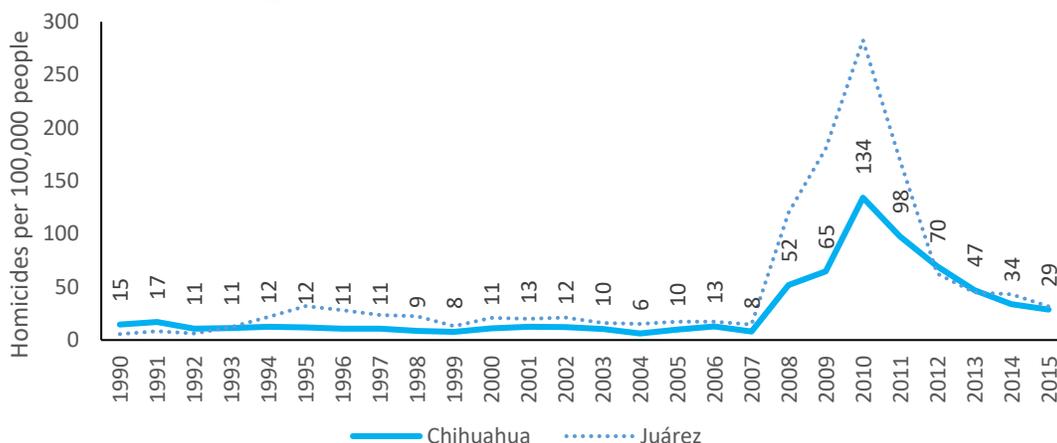
Figure 1. Life expectancy at birth for the State of Chihuahua



Source: Created by author using Vital Statistics, Life Expectancy (INEGI, 2017a)

During this time, Ciudad Juárez and Chihuahua, the two largest cities in the state accounted for most violence and crime, both in absolute and relative terms. Figure 2 shows the sharp increase in homicides in both places between 2008 and 2010 and a slower decrease onwards. This prompted the introduction of a wide variety of responses seeking to reduce, prevent and understand criminal activity in urban areas, especially for crimes related to drug trafficking. For instance, the Federal Government, which had previously deployed the army and funded policing interventions under SUBSEMUN, introduced a new strategy method to deter crime from hot spots. Three to four of such areas in each city received funds from 2013 to 2016 under the National Program for the Social Prevention of Violence and Crime, usually referred to as the National Program for Crime Prevention (PRONAPRED). The municipal and state governments also created their own crime preventing and reducing strategies, but a lack of cooperation between levels of governments, based on ideological differences, hindered their success and permanence in many cases.

Figure 2. Homicide rate in selected municipalities



Source: Created by author using Vital Statistics, Mortality (INEGI, 2017a) and state population projections (CONAPO, 2015)

Non-state actors were also very active in both cities. Local Chambers of Commerce, motivated by the effect of violence over the state's ability to attract investment funded a variety of crime prevention interventions. For instance, businesspersons in Ciudad Juárez started paying a self-imposed Payroll surtax that was later devoted to crime prevention activities. Statewide, they created the Trust for Competitiveness and Citizen Security (FICOSEC), which provides resources for social interventions and infrastructure, as well as police related initiatives. They further established the Citizens' Observatory for Prevention, Security and Justice (Observatorio Ciudadano: Prevención, Seguridad, Justicia, hereinafter the Citizens' Observatory), which produces reports of crime incidence and geographical distribution that are useful for other private and public organizations. Non-governmental organizations (NGOs) use these funds to develop strategies to improve social cohesion, recover public spaces for citizens or work with children to counterbalance the crime situation to which they have been exposed.

However, private responses were not always positive for the community as a whole, especially in terms of connectivity, accessibility and equitable access to public security. Neighbor associations pushed for the gating and fencing of many of the cities' previously publicly accessible streets, either through legal or illegal means (Breach Velducea, 2010), resulting in almost a tenth of the current population of the City of Chihuahua living in restricted access areas. Developers responded to security demands from homebuyers and created more gated communities with

enhanced security measures, privatizing public space and security, which lead to a potential suspension of the public rule of law and a further social differentiation between a protected middle class and the rest (Glebbeek & Koonings, 2016). These places even became a source of contention for residents and authorities, and potential safe havens for criminals (García, 2011).

The variety of responses to crime and violence in these cities deserves special attention. The work of public government agencies (SESNSP, 2017) and privately funded research centers shows that crime incidence and violence have in fact sharply decreased since 2010 (Observatorio Ciudadano de Chihuahua, 2017), especially for high impact offenses. For example, the Citizens' Observatory (2017) reports that the number of voluntary homicides fell from 3,903 in 2010 to 1,232 in 2016, while that of car thefts decreased from 28,654 to 3,931 in the same period. However detailed these studies, most have not questioned the impact of different types of interventions on the overall incidence and spatial distribution of crimes in Chihuahua. Specifically, none of them has studied how they alter environmental factors that create or decrease opportunities for crime, nor the way this affects crime in neighboring areas, which is important due to the place-based nature – they target specific geographic locations where violence clusters (USAID, 2016)– of many of these interventions.

Place-based interventions are attractive to authorities and policymakers because they provide a resource-efficient option that recognizes that crime concentrates in 'hot spots.' These are places where rationally motivated individuals find the proper environment that provides opportunities to locate, identify and target victims (P. L. Brantingham & Brantingham, 1981). In this sense, they contain the four basic elements of a crime, which are "the interaction of a potential offender and a suitable target in the absence of capable guardianship" (Tilley, Farrell, & Clarke, 2014, p. 59). As a result, targeting specific times and locations provides practical benefits that allow lawmakers and enforcers to focus limited resources at places and times with large numbers of crime events (Weisburd et. al, 2006).

Among place-based interventions, the situational prevention framework, which partially inspires PRONAPRED funding in polygons and, to some extent, gated communities, remains one of the most popular tactics. This approach includes measures that are directed towards specific forms of crime, and result in the manipulation of the place as a way to reduce opportunities for crime and increase perceived risks (Clarke, 1983). In this sense, it tries to block crime opportunity and improve the environment that results in criminal activity (Miethe, 1991), rather than addressing the underlying social, economic or cultural causes that deterministic theorists believe are the basis of criminal behavior (Guerette & Bowers, 2009).

The situational prevention approach has borrowed its theoretical foundations from different theories and areas of criminology. From Felson's routine activity theory, it directs attention to the convergence of offenders, victims and guardians (Clarke, 1997; Guerette & Bowers, 2009). Environmental criminology is the foundation of the attention to the place where the interaction between actors occur, including an examination of its physical and social characteristics as well as crime patterns (P. L. Brantingham & Brantingham, 1981; Eck & Weisburd, 1990). A third influence comes from the rational choice theory, which assumes that offenders weigh opportunities, costs and benefits of specific offenses before engaging in criminal behavior (Cornish & Clarke, 1987). This approach includes measures of different kinds. Clarke (1997) lists sixteen of such opportunity-reducing techniques, including target hardening, access control and surveillance, which are addressed to any kind of crime.

The debate on place-based interventions and displacement of crime

Despite its sound theoretical foundations, the risk of crime displacement to places where programs are not in place has made scholars particularly skeptical about situational prevention (Hesseling, 1994; Telep et al., 2014; Weisburd et al., 2006). One of the main criticisms to place-based crime prevention strategies is that they ultimately displace crime to other types of offenses or to different locations and times with more vulnerable targets. Crime displacement is the relocation of criminal activity to a different location, time or offense, in response to preventive

efforts or changes in the environment, offender motivation or victim availability and circumstances. It is a “change in offender behavior, along illegitimate lines, which is designed to circumvent either specific preventive measures or general conditions unfavorable to the offender’s usual mode of operating” (Hesseling, 1994, p. 198). Although it was first noticed by sociologists that assumed that place-based crime prevention efforts would transfer misconducts to other places (Weisburd et al., 2006), it was not until Reppetto’s (1974) analysis of residential crime that empirical examinations of the problem were developed.

Reppetto (1976) identifies five forms of crime displacement: temporal, (committed at another time), spatial (in another place), tactical (using another method), functional (committing a different crime) and perpetrator (to other offenders). In addition, target displacement also occurs when crimes are displaced from one victim to another (Bowers & Johnson, 2003). The most widely addressed is spatial or geographic displacement (Guerette, 2009; Guerette & Bowers, 2009).

Assuming an intervention is already in place, there are other factors that influence displacement and its extent. First, offender motivation determines which offenders and what crimes are displaced (Guerette, 2009). Theft and robbery would likely be more prone to displacement than, say, homicide, since offenders who commit the first two crimes are more concerned with the value of the possessions regardless of who the victim is, whereas people who commit homicide usually have one target and different motivations to cause harm. The same can be said about offenders, since different offenders have particular motivations that lead them to criminal behavior, some of which are more likely to be replaced by non-criminal activities than others. If the offender motivation does not change, it is possible that a motivated offender will only change its target and cause displacement (Johnson, Guerette, & Bowers, 2014).

Familiarity with the area is another factor that determines displacement, since offenders are more likely to displace their actions known locations that offer minimal effort and lower risks (Guerette, 2009). As a result, areas adjacent to the intervention that share many of its

characteristics are affected should displacement occur. This is closely related to a third factor, crime opportunity, which determines the costs and benefits of relocating criminal activity. Rationally acting offenders will relocate their activities only if the benefits exceed the costs of displacement.

Some scholars have further developed the idea that, even if crime displacement is an inherent consequence of place-based opportunity-reducing techniques, it may still be a more desirable outcome than the current situation. For instance, Barr and Pease (1990) differentiate between benign and malign displacement. The first one refers to a redistribution of crime that is more socially desirable than the status quo. This occurs when crime shifts to less serious offenses, lower number of crime, or to actions that have lower impact on the community as a whole, either because they are relocated among a larger pool of victims, to places that are farther from the community, or away from vulnerable groups (Guerette, 2009). Malign displacement results on a higher number of offenses and overall negative effects in the community (Gallagher & Wilcox, 2013). This differentiation makes interventions plausible, even if they displace crime

Understanding displacement also requires the reader to perform a further examination of the reasons why crime occurs in the first place. Criminological studies mention four elements that are required for any crime to occur. 1) A potential offender and 2) a suitable target must come together in 3) a place that offers opportunities to break 4) a law (P. J. Brantingham & Brantingham, 1981; Tilley et al., 2014). Traditional approaches have tended to focus on the reasons that often lead offenders to commit crimes. Offender based studies have nurtured the rational choice theory, which assumes that offenders make decisions and choices, based on the information they perceive, to benefit from criminal behavior (Cornish & Clarke, 1987). More recent frameworks, however, adopt a crime-specific focus, which recognizes that crimes do not only result from offender motivations, but from the interaction between crimes and offenders.

In theory, displacement appears to be a likely outcome, since place-based interventions do not necessarily target root causes that lead to crime (Guerette, 2009), but environmental factors that create opportunities for it to occur, and because offenders remain on the streets and may turn their attention to other targets (Clarke & Weisburd, 1994). Guerette & Bowers (2009) recognize that this sentiment is even shared by practitioners who consider displacement a consequence of their work. However, only a few empirical studies have concluded on the existence of displacement. For instance, Gabor (1990) hypothesizes that offender adaptability and mobility make displacement possible. Other studies that have quantified displacement usually occur in situations when the targeted group shares many or all of its characteristics with the displacement group. For example, target displacement is found under circumstances that involve selective law-enforcement (Yang, 2008) – in this case a tax code targeting specific countries for import duties – whereas selective security measures are found to displace crime to targets and places without the intervention (Gonzalez-Navarro, 2013).

Most empirical evidence suggests that there is little or no evidence of crime displacement after or during place-based and other crime prevention interventions. A number of case reviews of studies focusing on crime displacement have been developed in the last two decades: Barr and Pease (1990), Bowers and colleagues (2011); Eck (1993), Hesseling (1994), Guerette and Bowers (2009) and Johnson et al. (2014). All of them arrive to the conclusion that there is not enough evidence that prevention interventions lead to displacement, and when found it is offset by the amount of crime prevented (Telep et al., 2014). One issue with case reviews is that, in their search for robustness, they overlook specific details of criminal behavior. In this sense, although they rule out that displacement is the most likely result of place-based interventions, there is no guarantee that this will hold true in every case, because it ultimately depends on the type of intervention and crime, as well as the circumstances surrounding them (Eck, 1993; Weisburd et al., 2006). Among different types of interventions, community development programs (Guerette, 2009), protective actions and private security (Miethe, 1991), policing actions (Short, Brantingham, Bertozzi, & Tita, 2010), and situational prevention strategies (Guerette & Bowers, 2009) do not result in crime

displacement. Among different geographies, displacement is equally unlikely in small, medium and large-scale interventions (Telep et al., 2014).

Furthermore, Weisburd and others (2006) conduct an evaluation of previous empirical studies and find that there is little evidence of displacement resulting from crime prevention strategies, and when it occurs it is less than the amount of crime prevented. This holds for crimes that have been assumed more vulnerable to displacement, such as theft (Weisburd et al., 2006).

Even in those cases where displacement has been documented, it tends to occur only partially (not all crime relocates to another area, but some is actually prevented from occurring at all) and usually in a more desirable way than without the intervention (Telep et al., 2014). As a result, displacement should not be an excuse for not developing responses to crime, such as crime prevention projects, enforcement programs (Eck, 1993), or opportunity reducing techniques. Additionally, even when displacement is observed, its causality is inferred to be because of the movement from the intervention area to a neighboring area (Johnson et al., 2014), when in fact the local environment of that area could be motivating offenders. Ethnographic and qualitative research on offenders are useful to determine the causality, yet even these approaches are subject to bias because captured offenders do not represent the views of free offenders.

An outstanding conclusion of current reviews is that a reverse of displacement is equally or more likely to occur. For Guerette & Bowers (2009), displacement and diffusion occur almost at the same rate, in around a quarter of the 102 analyzed studies. Weisburd and others (2006), in a controlled study of prostitution and drug markets at two sites in Jersey City, find that not only is crime not displaced, but the most likely outcome of prevention efforts is the diffusion of benefits to nearby areas. Clarke & Weisburd (1994, p. 169) define this outcome as “the spread of the beneficial influence of an intervention beyond the places which are directly targeted, the individuals who are the subject of control, the crimes which are the focus of intervention or the time periods in which an intervention is brought.” This situation, also known as the free rider effect, is based on the assumption that an improving place or guardianship in an area, can create

a sense of guardianship that deters crime around the intervention, even if nothing has actually changed (Miethe, 1991). Just like displacement, a diffusion of benefits can be spatial, temporal, among targets or from one type of crime to another (Guerette, 2009). It is also possible for interventions to lead to both displacement and to a diffusion of benefits (Johnson et al., 2014), either at different times, places, or on different crimes, offenders and victims.

A diffusion of the benefits of a crime prevention program to other areas is likely the result of an exaggerated perception of guardianship or enforcement beyond the intervention that affects an offender's rational decision to commit a crime by making potential rewards less valuable than the effort of committing a crime (Clarke & Weisburd, 1994). Diffusion occurs through two processes: discouragement and deterrence. The first one takes place when the expected reward of committing a crime is less than the effort of displacing a crime (Guerette & Bowers, 2009). Deterrence occurs when offenders overestimate the intervention and assume a higher risk of punishment in areas that are not actually covered by the intervention (Johnson et al., 2014; Weisburd et al., 2006). The idea that focused deterrence could be used to inform possible criminals of an increased risk beyond the intervention to prevent displacement is mentioned in the work of Saunders and his colleagues (2014).

Theories of criminology also provide a number of reasons for not expecting crime displacement. Johnson, Guerette and Bowers (2014) note that crime can be made more or less likely to occur by manipulating one or many of the dimensions of crime – place, target availability, lack of guardianship – independently of the offender motivation. Furthermore, they note that place characteristics influence crime of them, and arrive to the conclusion that displacement should not occur unless the alternative location shares the characteristics, attractiveness – conditions are perceived to be favorable for crime – and opportunities – volume of possible victims – than the intervened area (Johnson, Guerette & Bowers, 2014).

Most existing empirical evidence on displacement studies small-scale responses, whose general characteristics are different to middle and large-scale interventions, such as those

analyzed in this work. Particular features of these interventions could possibly create different outcomes when prevention strategies are implemented. Telep and his team (2014) arrive to the conclusion that displacement is not an inevitable outcome of large scale interventions, yet a diffusion of benefits are also not as likely. However, for Guerette and Bowers (2009), large interventions are more likely to lead to a diffusion of benefits, whereas small ones are more likely to yield malign displacement.

These conclusions, however substantial, must be taken with the understanding that they do not account for every type of crime, in every area and for every kind of criminal and target. Methodological factors, such as the selection of the size and location of target and displacement groups in the studies (Johnson et al., 2014; Short et al., 2010), the simple comparison of pre-intervention and post-intervention changes (Telep et al., 2014), and the assumption of the offenders' rational decision making (Hesseling, 1994) could produce different results in other circumstances.

Research design

This debate between theoretical and empirical studies following place-based strategies inspires this research, both because of its importance for criminology and its effects on crime prevention policies. The main research question of this work is **whether or not place-based interventions displace crime to other locations in cities**. Attention is centered on spatial displacement due to the geographical nature of place-based interventions, but other types of crime displacement, such as that of time and type of crime, are addressed whenever is adequate. Two secondary research questions seek to further explain whether displacement varies among different types of crimes, interventions and environment. These questions are:

- Do public and private approaches produce different displacement effects?
- How do factors like crime type, time after the intervention and socioeconomic environment affect spatial displacement of crime?

In order to test these assumptions, this study analyzes spatial crime displacement following two kinds of place-based interventions that occurred in the city of Chihuahua and that are representative of a larger group. The first type is the transfer of public funds for situational prevention strategies to geographically defined areas under PRONAPRED. The second one is that of gated communities, a privately financed and established protective strategy. Additionally, a third type is used to account for the effect of other interventions on the analyzed strategies. This last approach is that of community-based recovery of public spaces undertaken by the Network of Citizen Participation “1-2-3 for me and my community” (hereinafter “The Network”), an NGO that receives public and private resources to launch actions that improve the community.

Despite similarities in the responses of actors and other criminological trends in both Chihuahua and Ciudad Juárez, the analysis focuses on the former. The selection of Chihuahua as a case study is based on the high incidence of different types of crimes, the number of interventions, the availability of georeferenced data, its urban nature, the accessibility of authorities and community leaders to speak about the issue, and the possible impact on policy-making that derives from this research.

However, the most important element is that interventions in Chihuahua tended to be less affected by extraordinary resources and overlapping with other activities, making the results of this analysis more generalizable to other cities in the country. The reason is that the concentration of homicides, especially those targeting women, and other high-impact and high-visibility crimes, as well as the resulting forced displacement of more than an eighth part of the Ciudad Juárez’s inhabitants (Albuja, 2014) and the widespread media coverage, made the federal government particularly aware of the situation in Ciudad Juárez. As a result, the Federation, and even international organizations, devoted especial resources to fund violence prevention mechanisms in the city (Ethos Laboratorio de Políticas Públicas, 2015), which accelerated the pacification of the city, but are an exception in the country. The main example is “*Todos Somos Juárez*” (We are all Juárez), a holistic strategy launched by the federal government that aims to prevent the social roots of insecurity through the rebuilding the social fabric with community participation and

coordination among different levels of government (Calderón, 2013). Between 2010 and 2011, the Federal Government devoted 401 million pesos to the strategy (Calderón, 2013), in addition to the rest of the funds it received from other nationwide programs. This amount is more than what the municipality of Juárez received from the PRONAPRED from 2012 to 2016, and thus would likely influence any other type of crime prevention intervention.

Chihuahua is the capital city of the state of Chihuahua in Northern Mexico, a territory located on a main trade route of both legal and illegal merchandise between the United States and Mexico. According to the most recent Population Survey (2015), the three municipalities that conform its metropolitan area host 918,339 inhabitants, out of which 897,398 lived in the contiguous metropolitan area, according to my estimations.¹ This makes Chihuahua the second largest urban area in the state, only after Ciudad Juárez, which has a population of over 1.3 million residents. Both cities gained international distinction during the early 2010s, due to the high incidence of drug-related crimes, especially homicide, which brought the state to lead list of most violent subnational entities in the world, according to the Citizens' Council for Public Security and Criminal Justice (2011). In general, violence and crime have decreased since then, but many of the policies, strategies, and changes in lifestyle that initially emerged as a response to crime are now commonplace.

The analysis is relevant because many urban areas in Latin America and the Caribbean, like some Mexican cities, experience high rates of crime and violence associated with organized crime, poverty and the lack of social mobility. According to the United Nations Development Programme (2013), in the first decade of the century more than one million people in the region died in crime related events. A variety of policies have been implemented to tackle crime and violence at the national, regional or local scale in different countries, with mixed outcomes. For instance, some relatively successful approaches, such as Social Urbanism in Medellín, Colombia, have favored violence prevention programs, whereas others have embraced mixed policing, judicial and social

¹ Since censuses occur every ten years and population surveys are only available for larger geographies, I estimated 2016 and 2017 population at the block level using the electoral roll from March 2017. The methodology is described in page 68.

approaches, as in the case of Rio de Janeiro's Unidades de Policia Pacificadora (Ethos, 2015). The inconclusive evidence supporting the success of prevention policies calls for an exhaustive assessment, not only of their direct results in the area of intervention, but on the overall pacification of cities.

It is also important because it is one of the first attempts to study displacement from place-based social interventions in Mexico, despite this being a common critique of them. During the interviews conducted for this study, PRONAPRED managers at the local level, the director of an NGO working on the recovery of public spaces and researchers on crime in Chihuahua referred to this phenomenon, but did not mention any empirical research proving it. Most studies of crime and official indicators have instead focused on analyzing the impact of programs within the intervened areas, regardless of the effects on the surrounding areas.

Data on crime events that were reported to the Office of the General Public Attorney of Chihuahua (Fiscalía General del Estado de Chihuahua – FGE) between 2010 and 2016 is available through my collaboration with the Citizens' Observatory and with researchers from the Autonomous University of Chihuahua (UACH). Information was only available for some crimes, out of which homicide, battery, car theft, pedestrian robbery, house burglary, and business burglary are chosen due to their robust sample size and their representativeness of different crime types. The first two are personal crimes (they target the person) and the rest are property crimes (their target are possessions); homicide and car theft are drug-cartel related activities, and the rest are common among other offenders. All points are aggregated into larger polygons or raster layers, to ensure the confidentiality of individual cases.

Methods

Researchers have previously studied displacement using a number of statistical methods with different levels of complexity and sophistication. Most research focuses on spatial displacement. The most widely used methodologies involve the development of comparisons

between an intervention and a displacement group, commonly using a control set to address external trends that may be affecting the observed results. Among these methods, the most commonly used are:

- Differences in differences, which estimates the difference in the average outcome in a treatment group (the intervention) minus that of the control group (a similar or contiguous group to the intervention) before and after the intervention, to compute the relation between them (Saunders et al., 2014).
- Interrupted time series, where the counterfactual is equal to the trend occurring before the intervention, and differences between the observed and expected outcomes are calculated (Gonzalez-Navarro, 2013).
- Comparing synthetic control groups and observed values to evaluate retrospectively (Saunders et al., 2014)
- Odds ratios compare the likelihood of a crime occurring in an area before and after the intervention (Johnson et al., 2014)
- Computation of Mean Effect Sizes, which compare pre-intervention and post-intervention crime rates or counts, using a comparison (displacement) group to compute a ratio of displacement (Bowers & Johnson, 2003; Guerette & Bowers, 2009; Telep et al., 2014).
- Weighted Displacement Quotients (WDQ), which measures outcomes in the displacement group and ties these changes to the intervention group, in addition to controlling for overall trends using a group that is similar to both the targeted area and the area of possible displacement.

This study uses a variation of Bowers' and Johnson's (2003) Weighted Displacement Quotients (WDQ) to test the hypothesis that each of the analyzed interventions displaces crime to other locations. To do so, a crime count per 100,000 inhabitants is calculated for each year in the *Intervention Area* (IA). A *Displacement Area* (DA) of 400 meters for gated communities and 500 meters for PRONAPRED interventions is drawn around the IA, and the same indicator is calculated for this area (Table 1). Consistent with the literature on crime displacement, previous empirical analyses, and the rational theory of criminology, the displacement area is adjacent to the

intervention because offenders are expected to move to areas that are close and familiar if displacement is to happen (Guerette, 2009). The same estimation is performed for a *Control Area* (CA) that shares the general characteristics of the IA and the DA. The CA is also drawn as an equal diameter buffer around the DA, under the assumption that adjacent areas are likely to be the most similar. It must be noted that a normalization per population may not be the most adequate measure for all crimes: business robberies could be better normalized by the number of commercial units, house robberies by the number of houses, vehicle thefts by the number of automobiles or by the number of commuters. However, the analysis uses the same unit to make rates comparable between crimes and across time, and it also accounts for the lack of demographic data on a yearly basis.

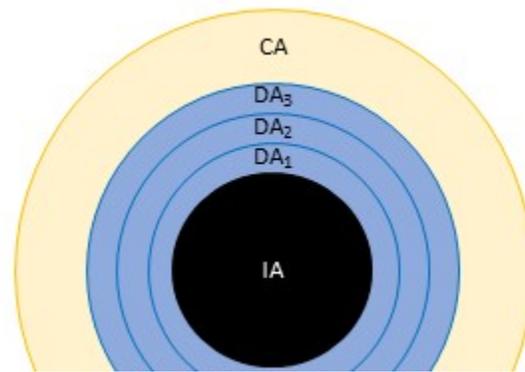
Table 1. Areas for the estimation of WDQ

| | Buffer size | |
|------------------------|------------------|--------------------------|
| | <i>PRONAPRED</i> | <i>Gated communities</i> |
| Intervention Area Size | Large | Medium |
| Displacement Area | 0m - 500m | 0m - 400m |
| Subarea 1 | 0m - 200m | 0m - 100m |
| Subarea 2 | 200m - 400m | 100m - 200m |
| Subarea 3 | 400m - 500m | 200m - 400m |
| Control Area | 600m - 1,000m | 400m - 800m |

Source: Created by author

The Displacement Area is further divided in three inner buffers starting from the Intervention boundary, as seen in Figure 3. This increases the chance that a negative Weighted Displacement score is in fact related to crime that would have otherwise occurred in the intervention area. In addition, since PRONAPRED polygons are so large that it is unlikely that the intervention addresses everyone within the polygon, I estimate inner displacement by comparing crime rates of areas close to a smaller-size place-based intervention, the public spaces of the Network and buffers around them. Different buffer sizes are used to account for the diverging characteristics of each of the analyzed interventions. It must be noticed that they are further adapted in order to include only populated areas

Figure 3. Areas used in the calculation of WDQ



Source: Created by author based on Bowers and Johnson (2003)

The differing proportions of each geography and at each time (pre and post-intervention) are estimated by dividing the crime rate in the DA over that of the CA by the rate in the IA over that in the CA. In other words, the analysis compares the change in crime rate in the DA versus the success of the intervention. WDQ values are calculated for every type of intervention between the year before it is launched and each year after it is in place, since the effects of the program can take some time to impact crime rates. This means that there are multiple t_1 values that are compared always to one t_0 , which is the year before the intervention started. Finally, I calculate WDQ for each type of crime to assess if crime types influence spatial displacement and to compare the results among them.

Consistent with Bowers and Johnson (2003), the formula to calculate WDQ is:

$$WDQ = \frac{DA_{t_1}/CA_{t_1} - DA_{t_0}/CA_{t_0}}{IA_{t_1}/CA_{t_1} - IA_0/CA_{t_0}}$$

Where:

IA = crime rate per 100,000 inhabitants in the intervention polygon

DA = crime rate per 100,000 inhabitants in the displacement buffer

CA = crime rate per 100,000 inhabitants in the control area

t_0 = before the intervention

t_1 = after the intervention

The quotients are then interpreted according to Table 2. A value of more than one means that a diffusion of the benefits in the displacement buffer is greater than the effect of the program in the intervention. A value close to -1 shows that all crime that would have happened in the intervention occurs instead in the displacement area. A value of less than -1 means that not only did crime increase both in the intervention and displacement zones, but more in the outer zone, which means that instituting the program was a worse move than not doing anything.

Table 2. Interpretation of WDQ values

| <i>WDQ Value</i> | <i>Interpretation</i> | |
|------------------|--|----------------------------------|
| $WDQ > 1$ | Diffusion greater than direct effects | Positive net effect of program |
| $WDQ \sim 1$ | Diffusion about equal to direct effects | |
| $1 > WDQ > 0$ | Diffusion but less than direct effects | |
| $WDQ = 0$ | No displacement or diffusion | |
| $0 > WDQ > -1$ | Displacement but less than direct effects | |
| $WDQ \sim -1$ | Displacement about equal to direct effects | No net benefit to program |
| $WDQ < -1$ | Displacement greater than direct effects | Program worse than doing nothing |

Source: Reprinted from Bowers, K. J., & Johnson, S. D. (2003). *Measuring the geographical displacement of crime*. *Journal of Quantitative Criminology*, 19(3), p. 286

There are two main differences between this model and the one presented by Bowers and Johnson (2003). First, I normalize the crime count by the population of the area to account for population changes across time. Second, I complement the analysis using Mean Effects to test the assumptions emerging from the interpretation of WDQ values, especially to test if the intervention did in fact reduce offenses.

One of the caveats of WDQ that has been discussed before is its inability to measure the amount of crime displacement. To respond to this issue, I perform an additional analysis to buffers, crimes and times in which displacement is attested, which is based on the guidelines provided by Guerette (2009). Citywide trends are used to estimate a counterfactual amount of crimes that would have happened in case the intervention was not in place, and the difference between this value and the actual count of crimes is computed.

The analysis also takes a qualitative approach to fill the gaps of the geospatial section. I conducted interviews with a number of high-ranking officials, from former mayors and directors of the Public Security Department to PRONAPRED local managers, as well as with people from NGOs. In addition, the sites were analyzed through detailed observation and visit to some of the sites in March, 2017. Had the resources and time for this research been more ample, interviews with convicted criminals or ethnographic reports could have been developed to try to attest causality when displacement is found using the quantitative approach, as done by Weisburd and his colleagues (2006). However, the qualitative approaches provide some insight about displacement and diffusion when they occur, inform the design of the quantitative method, and provide alternative explanations when the estimated WDQ values do not show consistent patterns.

Limitations

Despite its reliance on previous empirical studies, its solid theoretical foundations, and the large dataset, the analysis has a number of limitations that must be acknowledged. First, it relies on the assumption that an increase in crime rates in the displacement area is caused by the intervention and not by other factors. I try to account for this issue by performing a secondary analysis within the displacement area, controlling for other variables that modify the “place”, such as marginalization, and conducting interviews with officials and practitioners. Another problem emerges from the selection of the displacement area and its size. If crime displacement does occur, it is assumed that its direction is towards a buffer, which, in theory, would be the most similar and nearby region where crime opportunities prevail, reducing the costs of crime displacement. However, no surveys or interviews are performed on former and current offenders, and it is they who ultimately decide if an intervention causes them to relocate their criminal activities, where they go, or if they instead find legal work alternatives. Finally, there is also contamination between interventions, since their proximity results in overlapping buffers in which different interventions can have a variety of impacts, including both displacement and a diffusion of benefits.

Other limitations to this study emerge from problems with the reliability, dimension and quality of the available data. For instance, there are a number of reasons to believe that the information shared by the Attorney's Office of Chihuahua does not reflect the complete reality. The National Survey on Victimization and Public Security Perception (ENVIPE) reports that approximately 88.2% of crimes in the city of Chihuahua are not reported to the authorities or, to a lesser extent, they don't include enough evidence to derive into investigation (INEGI, 2016a). The number varies across crimes, and this explains why car theft is more common than other offenses in the data set, but it remains high for all of them. Nevertheless, the official data that I use does show patterns that are similar to the results of victimization surveys. This means that, although the exact number of criminal events happening in a place is unknown, I can use the available data to estimate displacement from one place to another, especially because apparent errors with the data do not appear to be spatially clustered.

Additionally, conversations with Human Rights Advocates inform that even crimes that were reported may not appear in the database, due to the efforts of the 2010-2016 state administration to depict an image of security, which they claimed was one of the most successful topics. This notion is supported by a recent study by *México Evalúa*, a Mexican think tank that specializes on the analysis of public spending, in which they find that some state governments in Mexico consistently modify their figures on homicides to hide the problem, either by not reporting all cases or by classifying them as involuntary manslaughter, rather than as culpable homicide (David, Furszyfer, & Gallegos, 2017). In fact, a closer examination of the data shows that this is an issue for the study, since the number of unspecified and accidental homicides increases sharply at the expense of an extreme reduction in the number of culpable homicides.

The data includes attributes regarding the time and date of all crime events, which reveal problems with the quality of the data that need to be addressed. For instance, only 34 entries occur between October and December 2013, which is clearly a mistake if it is compared to the average amount of reported crimes for other quarters in that and the following year, especially because all these crimes were homicides. The problem is deeper when I analyze it crime by crime,

since non-reporting appears to affect differently each type of crime. For example, battery cases are unreported during the fourth quarter of 2013 and during most of 2015, which shows why the distribution of cases spatially does not match the behavior of other years.

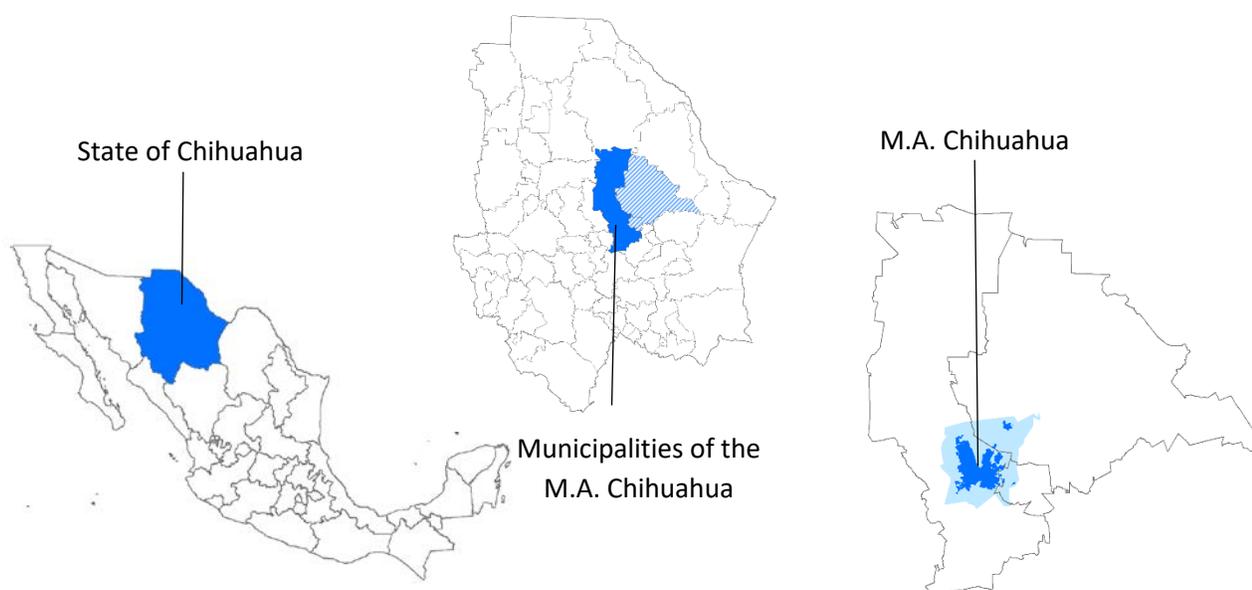
Finally, information about the interventions, especially gated communities and the PRONAPRED is scarce, hard to access, incomplete, and at many times incoherent. Although the general guidelines and program design of the PRONAPRED are public information, there is not enough data about its practice and the overlapping nature of its spending makes it difficult to analyze. Additionally, the defunding of the strategy in 2017 at the national level resulted in the closing of the website *nosmuevelapaz.mx*, where all the information about yearly transfers to local authorities, established projects and measured impacts was publicly accessible. However, I obtained some of this information from the website, the social media accounts for the program,² and through interviews with program managers. In addition, previous program analyses from *México Evalúa* provided some insight about the development of the program. In the case of gated communities, I drew their location using Open Street Maps and Google Earth, and obtained an estimate of the year they were initially developed or fenced, but exact data was unavailable, even after contacting municipal authorities. This issue has been attested by (Cahill, 2011) in previous works using WDQ. As a result, and because the initial time is different for each gated community, I assume 2010 as the pre-intervention year, and the rest of the years as an intervention. This way, it is possible to capture the change triggered by gated communities during the intervention, but not necessarily as a pre- and post-intervention analysis.

² Twitter: @nosmuevelapaz; <https://twitter.com/nosmuevelapaz?lang=es>
Facebook: PRONAPRED Chihuahua 2016;
https://www.facebook.com/PRONAPREDCHIHUAHUA2016/?hc_ref=SEARCH

II. Context

The geographic location of Chihuahua plays a large influence on the city's relative success in terms of economic activity and social development, yet also on the high incidence of crime. The city of Chihuahua is located around 350km south of the border between Mexico and the United States (Texas and New Mexico). Administratively, it is the capital of the state of Chihuahua, the largest in terms of territory in among Mexican states. It is also the seat of the municipality of Chihuahua, and contains 99% of its population. The rapid growth between 1990 and 2010, pushed the limits of the city off the municipality of Chihuahua and now conforms, together with the municipalities of Aldama and Aquiles Serdán, the Metropolitan Area of Chihuahua (MACH). However, the vast majority of the population still resides in the municipality of Chihuahua (See Figure 4).

Figure 4. Location of the State, Municipality and City of Chihuahua within larger geographies



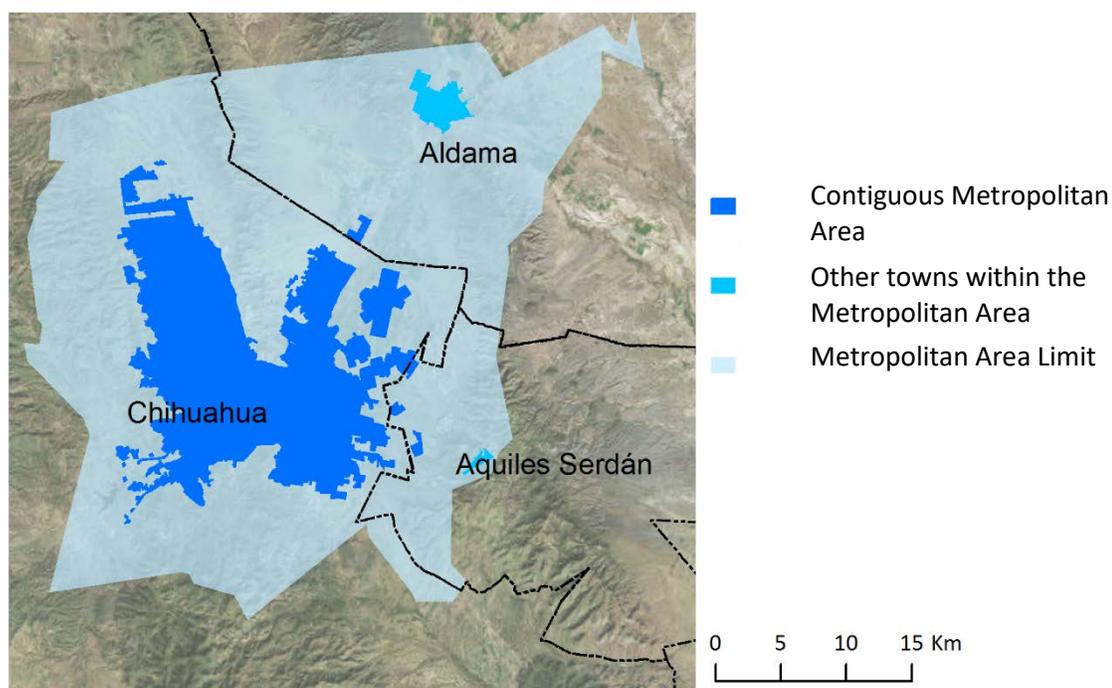
Source: Created by autor using data from Programa de Ordenamiento y Desarrollo Territorial de la Zona Metropolitana Chihuahua (2016) and INEGI.

Note: The municipality of Chihuahua is marked with solid fill to differentiate it from other municipalities of the metropolitan area, since it is the core and contains most of its population.

The city is located on one of the main illegal drug trade routes in the world, and has been in an area of conflict between the Juárez and Sinaloa/Pacífico Cartels for the timeframe of this

analysis (Angel, 2016; BBC, 2010). Cocaine, opiates and marijuana flow *en route* from South America and other areas in Mexico to the United States (UNODC, 2016), while weapons and cash make its way from the United States to Mexican Cartels. These, in turn, are used by Drug Cartels to fight other criminal groups for to establish a *plaza*, an area of economic and geostrategic significance under their exclusive control, in which they levy a tax – *piso* – for drug-related activities (Cantor, 2014). These battles directly increase the homicide rate, but indirectly affect other types of crimes. In a personal interview, Heliodoro Araiza, Director of the Public Security Department of Chihuahua from 2011 to 2013, notes that other crimes, such as car theft and extortion, are highly related to drug-related homicides. As a result, a high relation between the dropping homicide rate in Chihuahua and other crimes between 2010 and 2015 is expected, the impact of preventive efforts to further decrease the incidence of some or all of these activities is uncertain.

Figure 5. Populated zones of the Metropolitan Area of Chihuahua



Source: Created by author using data from Programa de Ordenamiento y Desarrollo Territorial de la Zona Metropolitana Chihuahua (2016) and INEGI (2016)

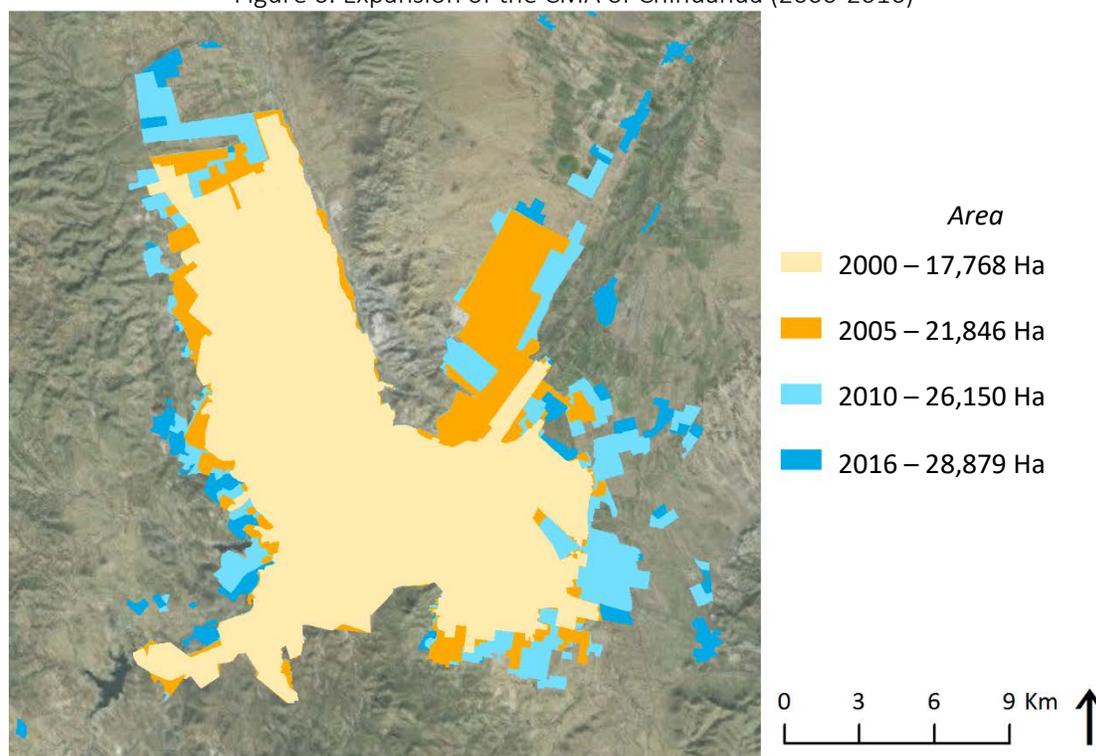
For this analysis, I have developed an alternative geography, the Contiguous Metropolitan Area (CMACH), depicted in Figure 5, which comprises the city of Chihuahua proper, and recently

developed neighborhoods within the municipalities of Aldama and Aquiles Serdán that are only accessible from Chihuahua, and are economically and socially tied to the city. The whole towns of Aldama and Santa Eulalia are not considered part of this area, even though they are officially within the MACH, in order to ensure the compatibility between the crime data and geographic boundaries. Since both towns are historically detached population centers that still maintain a larger degree of independence from the city of Chihuahua, crimes in these areas are less likely to appear in the dataset. In addition, the boundaries of the CMACH contain only places that are currently populated, as registered by the latest Urban Development Plan of Chihuahua (September 21, 2016), since urban crime is only expected in these areas. Even though the initial database contains information about crimes occurring in scarcely populated suburban areas and roads between towns, these events follow different dynamic and mobility that are not addressed by this study.

Social and Economic characteristics

Chihuahua ranks 18th among Mexican metropolitan areas in terms of population, but 8th in terms of populated area. According to the Mexican Ministry of Social Development, in 2010 the density of the Metropolitan Area of Chihuahua was only 30.3 people per hectare, the second lowest among mid-size cities in the country (ONU-Hábitat, 2015). This number increased to 32.9 in 2017 according to my estimations, but remains low compared to other urban areas. Like other cities in Mexico, the area of Chihuahua has increased at a higher rate than its population. For instance, while the population between 2000 and 2016 has grown 39% (2.4% per year), its area has increased 56.2%, as portrayed in Figure 6. The growth has not occurred evenly around the city center, and its non-circular geography is due to its location in a valley surrounded by mountains to the East and West, and traversed by a mountain chain from North to South.

Figure 6. Expansion of the CMA of Chihuahua (2000-2016)



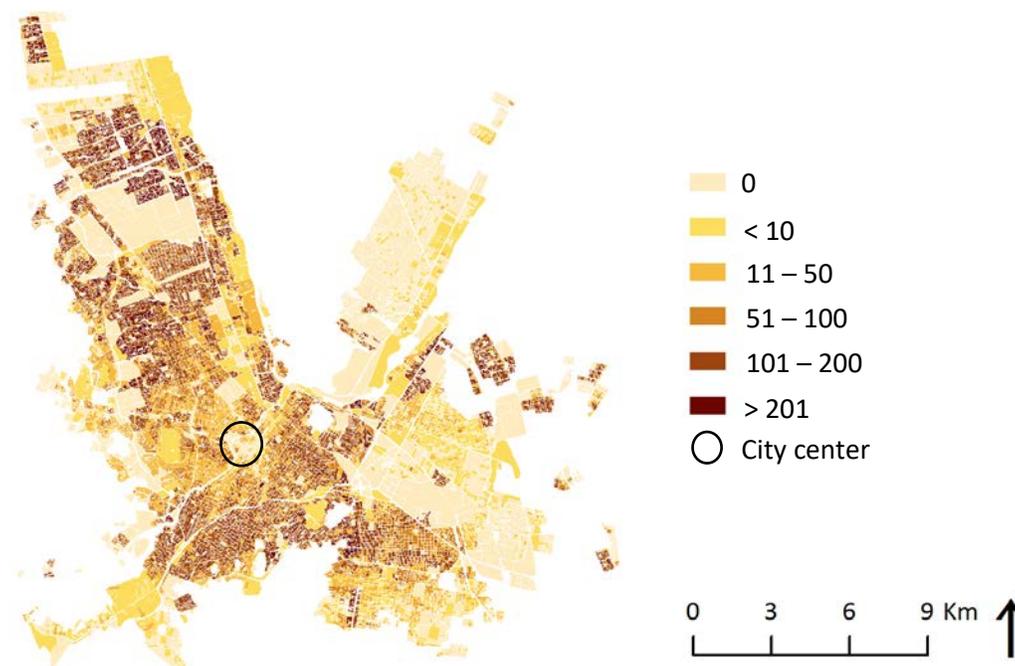
Source: Created by author using data from INEGI (2000 – 2016)

Two processes have reinforced the low density of the city. First of all, the rapid growth of urban areas in the sixties and seventies (Garza & Rivera, 1993), as well as the economic boom of the State of Chihuahua during the nineties, resulting from the growth of the *maquiladora* industry, attracted many people to the city. Secondly, Crédito INFONAVIT, a Mexican national housing policy established since the seventies, has provided access to formal housing to millions nationwide in mass-produced neighborhoods in peripheral areas, which are far from services, transit and employment opportunities (OECD, 2015).

Many neighborhoods in Chihuahua have been established under this model. Additionally, the city does not follow a concentric model of development, in which urban areas grow as a series of buffers from a Central Business District (Álvarez de la Torre, 2011). Instead, high density neighborhoods tend to cluster around sub-centers that are scattered throughout the city (Gobierno del Estado de Chihuahua, 2016a). Figure 7 shows that the population density is low in the city center, and remains relatively low in its surrounding area, while newer INFONAVIT

developments in the North, Northwest and East, as well as non-INFONAVIT areas in the South, have higher densities. Large patches of unpopulated areas, usually devoted to heavy industry, also exist within the city.

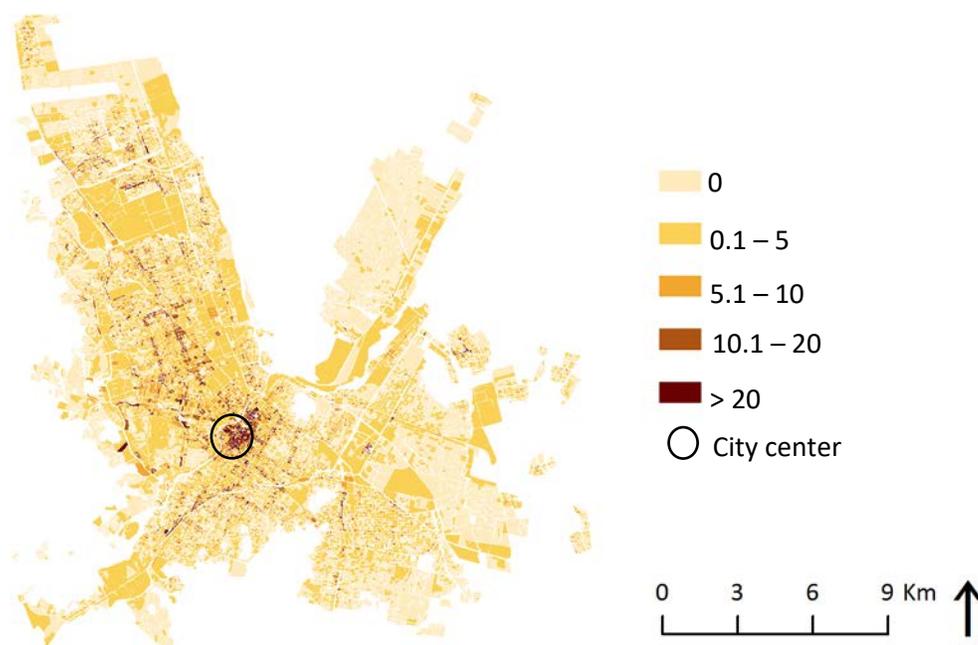
Figure 7. Population density per square kilometer in the CMA of Chihuahua.



Source: Created by author using own estimates based on INEGI (2010) and Electoral roll (INE, 2017)

Businesses follow an opposite trend and cluster around the downtown area and along main roads, as seen in Figure 8. This has an implication for the types of crimes that are committed in each area. For instance, business and pedestrian robberies are more common in areas with a higher concentration of commercial units, while house burglaries occur mainly in areas with a high concentration of houses. Car thefts occur in both places, but especially in areas with large parking lots and at busy street intersections. Personal crimes, such as homicide and battery, are less likely to be affected by this geographic dynamic, since they are oriented towards a movable target (an individual).

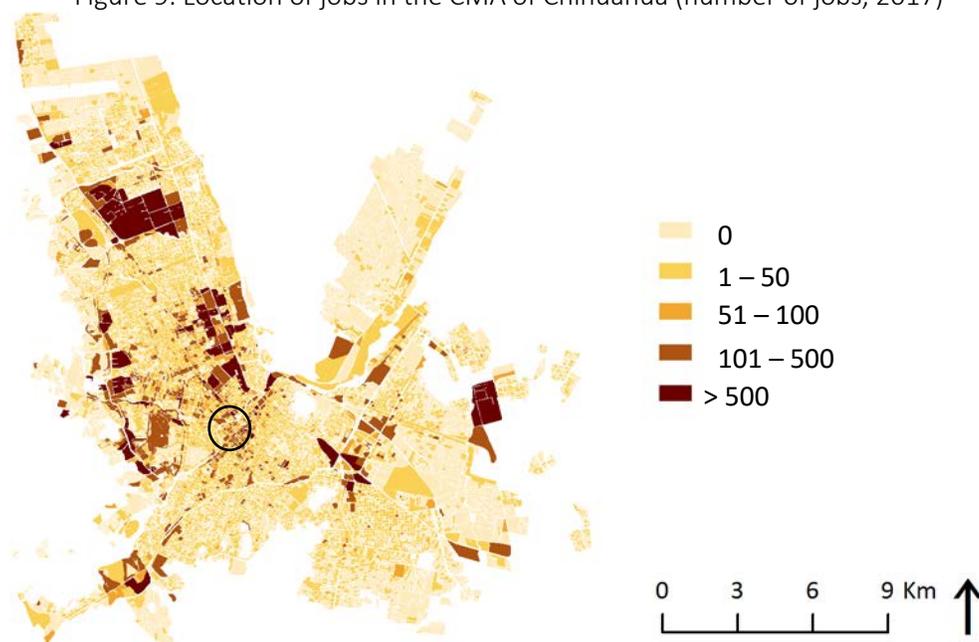
Figure 8. Density of businesses per block in the CMA of Chihuahua



Source: Created by author using data from the National Statistical Directory of Economic Units (INEGI, 2017a)

The pattern of urbanization of Chihuahua, with a population distributed among sub-centers that have a weak relation with the city center, follows the distribution of jobs of the city. This distribution is shown in Figure 9. There is not a single location with high density of jobs, but rather a group of sub-regions that concentrate part of the employment opportunities to different extents. A cluster of *maquiladora* plants are found in the North and East of the city, heavy national industry is located to the East and Southwest, and services are mostly located along the *Periférico de la Juventud* Highway, located to the East and Central areas. Similarly to the density of commercial units, job locations impact criminal activity in terms of the type, time and place of offenses, as well as on the type of victims and their vulnerability.

Figure 9. Location of jobs in the CMA of Chihuahua (number of jobs, 2017)



Source: Created by author using data from the National Statistical Directory of Economic Units (INEGI, 2017a)

In addition to employment locations, the type of industries found in the city also have an impact on crime rates and their characteristics. The success of the *maquiladora* industry created abundant, yet low-wage, employment opportunities that attracted people to cities in Chihuahua, especially women. However, its dynamics have been shown to result in income vulnerability, economic recessions, and weak family structures that lay the foundations for violence (Vilalta & Muggah, 2014). Cecilia Olivares, director of the Network, speaks about this dynamic in an interview, and specifically about the effect of single working mothers whose children become easy targets of gangs. However, the results of Vilalta and Muggah (2014), although showing a correlation of certain economic factors on homicide, do not show any spatial relation between location of *maquiladoras* and this crime. This indicates that the unintended effect of the sector on the underlying causes of crimes is not spatially focalized around the industry, but rather spread throughout neighborhoods with significant number of inhabitants employed by the sector.

In this sense, according to the latest Economic Census (INEGI, 2014a), out of 247,217 jobs in the city of Chihuahua, 98,276 (37.5%) of them were in the manufacturing sector, as shown in

Figure 10. This represents an increase of 35% from the previous economic census (2009), but the figure that year reflects the impact of the 2008 economic crisis in the United States. The sector is the largest in the city, but its share is lower than in other towns in the state that are more dependent of it.

Figure 10. Share of jobs by economic sector in the CMA of Chihuahua (% , 2014)



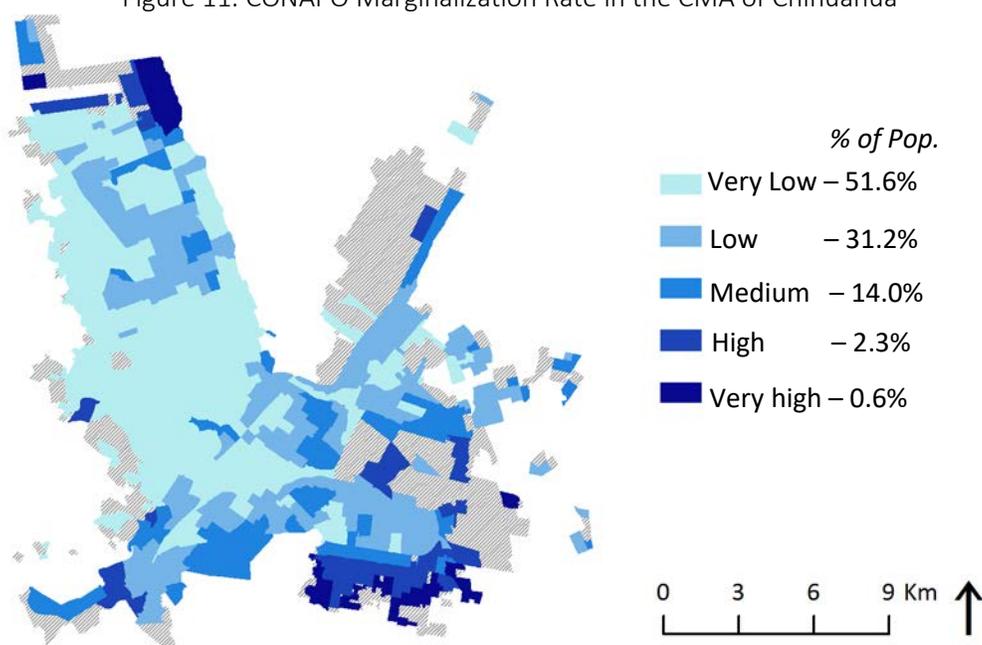
Source: Created by author using data from the Mexican Economic Census (INEGI, 2014a)

Regarding the geographic distribution of crimes in the city, aspects of the environment potentially increase opportunities for offenders (P. J. Brantingham & Brantingham, 1981). These elements are usually studied at a micro-level, since even factors like the presence of fences, vegetation, sidewalks and street lighting can influence the decision-making process of offenders. However, the large scale of this study calls for a larger unit of analysis to function as a proxy variable for the physical environment of places of crime. Accordingly, social marginalization and the rate of abandoned houses are used in this study due to their availability and relation with the built and social environments.

The marginalization index is a measure created by the National Population Council (CONAPO) that takes into account the educational level, school attendance of children, access to healthcare, infant mortality, access to housing, availability of sewage, toilet and water, building material, number of habitable rooms, and access to basic electronic appliances and automobile

(CONAPO, 2010b). This creates an estimate that reflects the socioeconomic characteristics of neighborhoods based on the access of their population to basic goods and services. In this sense, a lower marginalization reflects more access to goods and services, whereas a high marginalization is found in areas with low access to opportunities. Of all metropolitan areas and cities over 100,000 inhabitants in Mexico, Chihuahua has the highest proportion of people living in areas with very low marginalization (CONAPO, 2010a). However, these areas are 44% of the territory for which this variable has been measured and only 32% of the territory of the CMA of Chihuahua, as seen in Figure 11. As a result, many places, although housing less population, are likely to show the signs of higher marginalization.

Figure 11. CONAPO Marginalization Rate in the CMA of Chihuahua



Source: Created by author using data from Mexican Census, INEGI (2010) and marginalization index, CONAPO (2010)

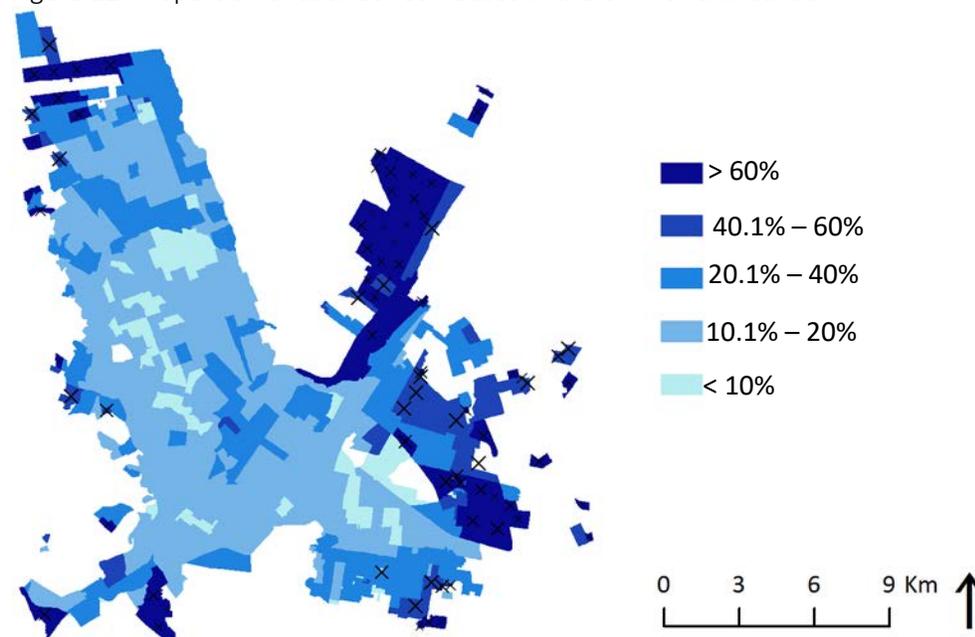
Note: Cross-hatched areas do not have a marginalization index calculated by CONAPO due to their scarce population

Areas with very low marginalization occur mainly in the Central, Northern and Western Areas of the City. An exception is the downtown area, which has higher levels of marginalization, yet this figure should be interpreted carefully since this area was subject to a large redevelopment after this variable was calculated. Marco Quezada, mayor of Chihuahua from 2010-2013, mentions

that this revitalization represents the approach towards the recovering of public spaces that his administration undertook to reduce violence. This is one of the three main strategies of his period, the other ones being focalized social interventions and the dignifying of police actions. Social interventions were launched in two polygons to the North and South of the city, in areas with medium and high marginalization indices. Neighborhoods in the Southeast side of Chihuahua are among the most marginalized.

There is evidence that elements like segregation and housing abandonment are thought to attract crime, exacerbate insecurity, and decrease the security perception in neighborhoods (OECD, 2015, p.82). Housing abandonment is a major problem in neighborhoods in the periphery (Figure 12), mainly in commuter towns developed under the INFONAVIT model, since they were either never inhabited or their disconnection to urban services and transit forced many of its previous residents to abandon their residences. Non-occupied houses are also common in semi-urban locations, composed mostly of farms.

Figure 12. Proportion of abandoned houses in the CMA of Chihuahua

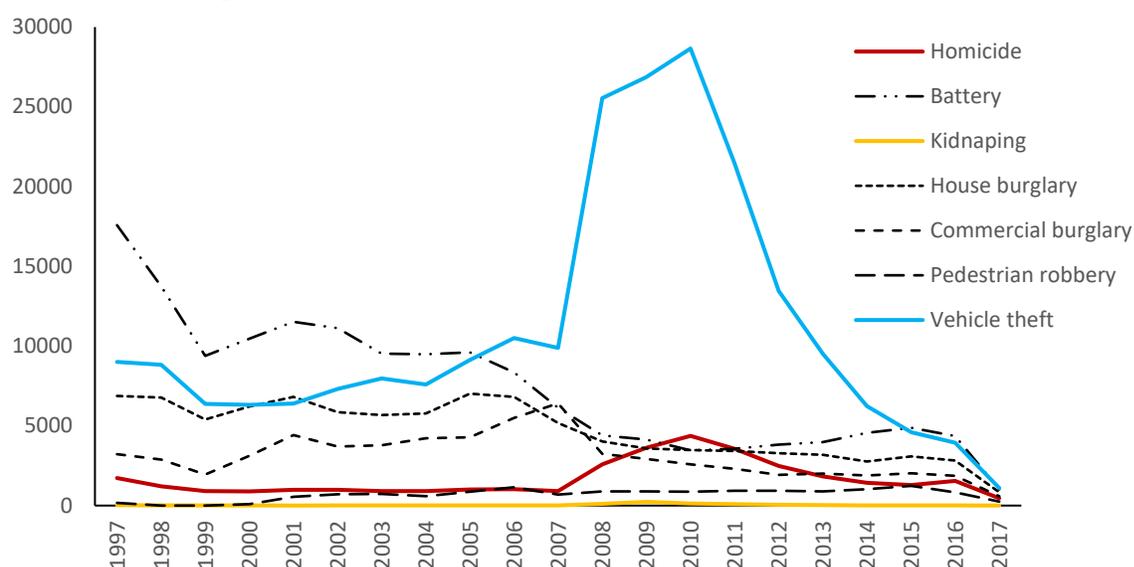


Source: Created by author using data from Mexican Census, INEGI (2010)

Crime in Chihuahua

The period between 2008 and 2011 in the state of Chihuahua was marked by a sharp increase in the number of crimes and an even greater perception of insecurity. Using data collected by the Executive Secretary of the National System of Public Security (SESNSP), Figure 13 shows that, even though crime rates as a whole did increase, not all types of crimes were equally affected. For instance, high impact crimes, such as homicide, kidnaping and vehicle thefts, augmented at a much higher pace than other crimes. It is no coincidence that these crimes thrived during the period when the Mexican Army combatted drug cartels in the streets in Chihuahua, since these are highly correlated to cartel activities (See *Cantor, 2014* for a further explanation of activities of Mexican Drug Cartels). Nevertheless, the visibility of these offenses makes them increase the perception of insecurity, regardless of the behavior of other crimes. The extremely sharp increase in car thefts is further explained in an interview with Marco Quezada and Heliodoro Araiza, Director of Municipal Public Security of Chihuahua (2011-2013): criminal groups stole automobiles, either with or without violence, to commit other misconducts or activities related to drug trade, and abandon them afterwards. Thus, the motif behind these property crimes is not the object itself, but the activities related to them.

Figure 13. Number of crimes in the state of Chihuahua by type of crime

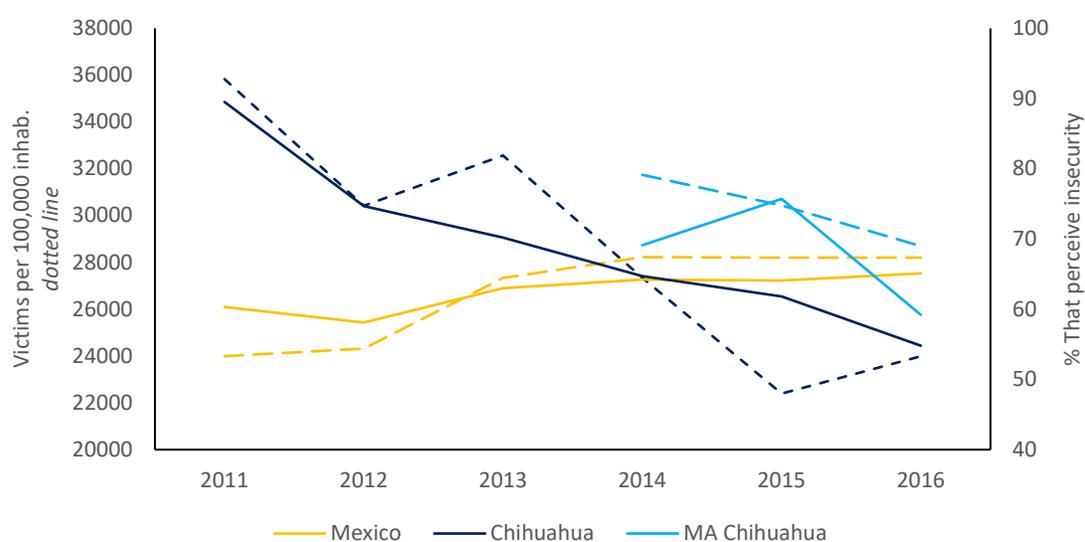


Source: Created by author using data from *Datos Abiertos de Incidencia Delictiva del Fuero Común* (SESNSP, 2017)

A process of pacification started in 2011. Figure 13 shows that the number of reported high impact crimes decreased drastically, whereas other types of crimes remained relatively unchanged. It is important to highlight that these numbers, just like the data used in this analysis, is based on reported offenses for which there is enough evidence to start an investigation. Estimates emerging from the ENVIPE (2016), show that nine of ten crimes in the State of Chihuahua are unreported or not followed by an investigation – this amount is called the *cifra negra* (black figure). However, the decreasing trend of reported offenses is consistent with the results of the National Victimization Surveys between 2011 and 2016, in which the number of victims per 100,000 inhabitants decreased from 36,000 to 24,000.

The proportion of people reporting feeling insecure in their municipality sharply dropped among residents of the state of Chihuahua, mirroring the actual drop in crimes, as seen in Figure 14. In the five years since the creation of ENVIPE, the share of *Chihuahuenses* stating that they perceive their community to be insecure fell by more than 40%, from 89.5% in 2011 to 54.8% in 2016. This trend is in fact the opposite in the country as a whole, with both more people perceiving insecurity and the number of victims rising in the same period.

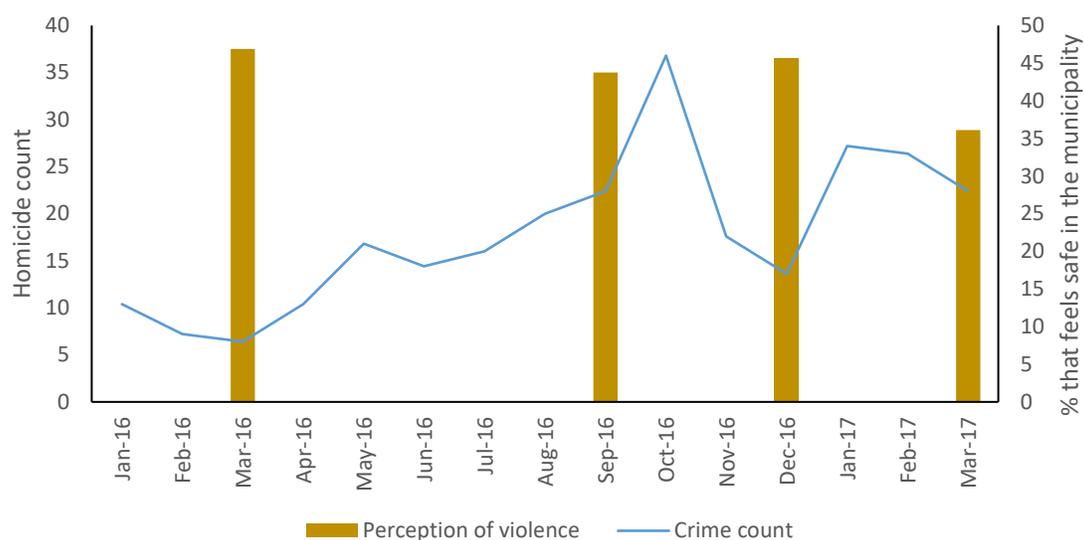
Figure 14. Victimization rate and perception of insecurity in selected geographies (2011 – 2016)



Source: Created by author using data from the National Survey on Victimization and Perception of Public Security – ENVIPE (INEGI, 2011, 2012, 2013, 2014b, 2015, 2016)

The Metropolitan Area of Chihuahua was no exception to the statewide trend, but information on victimization is available for a shorter period. According to ENVIPE, the number of victims of crime decreased between 2014 and 2016, and the perception of insecurity showed a downward trend, although both rates remained higher than the state and national averages, as seen on Figure 15. In this period, the victimization rate fell from 32,000 to 29,000 victims per 100,000, while the perception of insecurity decreased from 69% to 59% of respondents.

Figure 15. Homicides and perception of security in 2016-2017



Source: Created by author using data from *the National Survey on Urban Public Security* (INEGI, 2017b), *the report on crime incidence* (Observatorio Ciudadano de Chihuahua, 2017) and crime data of the Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua.

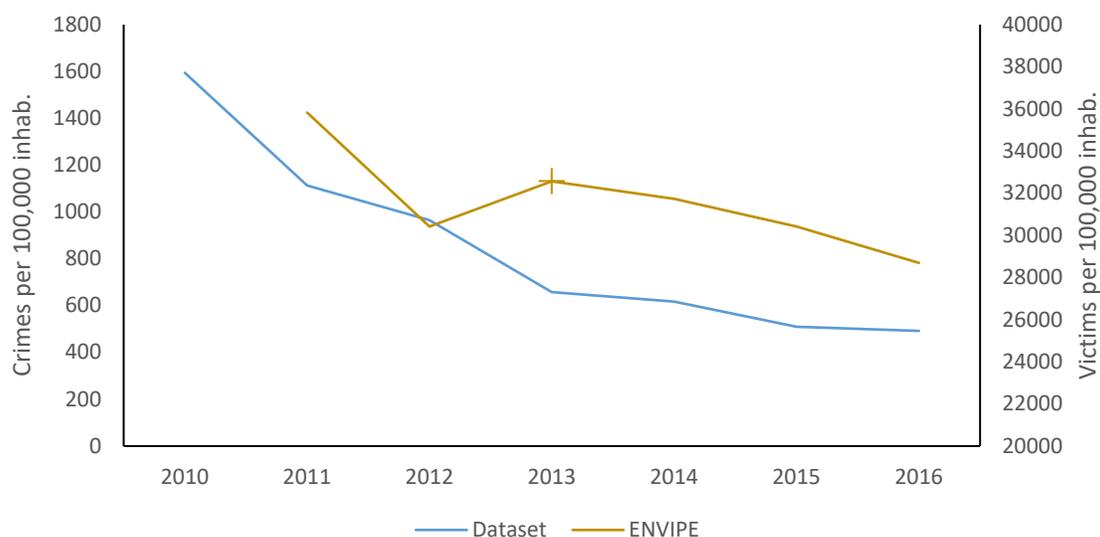
After the election of a new governor from an opposition party in June 2016, crime rates slightly increased, but their impact on the perception of security was strong. One possible explanation is that some high impact crimes, such as homicide, skyrocketed to levels that were similar to those in 2008. Figure 15 shows the steep increase in the number of homicides in the second half of 2016 and the fall of almost 10% in the proportion of people that feels safe in the municipality of Chihuahua. This increase makes this analysis important as a way to prove why successful well-planned policies matter, since it coincides both with the change of an administration (and its state level policies), but also with the announcement of the defunding of PRONAPRED (See Ayala & López, 2016), one of the interventions analyzed by this analysis. The success of these policies is not only significant for the reduction of crime *per se*, but because of

the way crime affects everyday activities of citizens. For instance, in 2014, 85% of people from the city of Chihuahua declared not letting their kids play outside because of crime, whereas 69% claimed they had stopped going out at night and 52% would not take a walk anymore (INEGI, 2014b).

The low level of crime reporting must be taken into account in this study. The latest ENVIPE survey shows that, in the MA of Chihuahua, 88.2% of crimes are not reported or an investigation is not started. This number is lower than the national average that stands at 93.8%, but it is so high that it has implications for this analysis. First of all, it forces the author to recognize that one of the limitations of this study is that, due to its reliance on reported crime, only a fraction of the offenses are part of the analysis. Secondly, it forces researchers to assume that the reported data is representative of the overall crime activity, which may not be the case due to the differences in crime reporting that exist among social groups, genders, regions, age groups and other sociodemographic groupings, as well as among types of victims. For example, vehicle thefts are by far the most reported crime, with 80% of the cases having an investigation associated to them (INEGI, 2016), while kidnapping and raping have much lower reporting rates, likely due to the impact they have on victims. Third, I assume that crimes were clearly and truly reported by the authorities, and political or economic motivations did not influence the selection of cases.

A comparison between the dataset used in this study and the results of victimization and public security surveys is useful to test the reliability of the available information. According to the latest three ENVIPE, the most commonly reported crimes in the Metropolitan Area throughout the period were car theft, fraud, extortion, threats, and pedestrian robberies. This at least partly explains the reason why two thirds of the georeferenced points correspond to vehicle thefts, the rest being explained by the higher rate of reporting for that crime. Figure 16 shows that the crime rate from the dataset follows an overall similar trend to the victimization rate of the survey, with a sharp reduction between 2010 and 2013 and a more stable but still decreasing rate for the rest of the years.

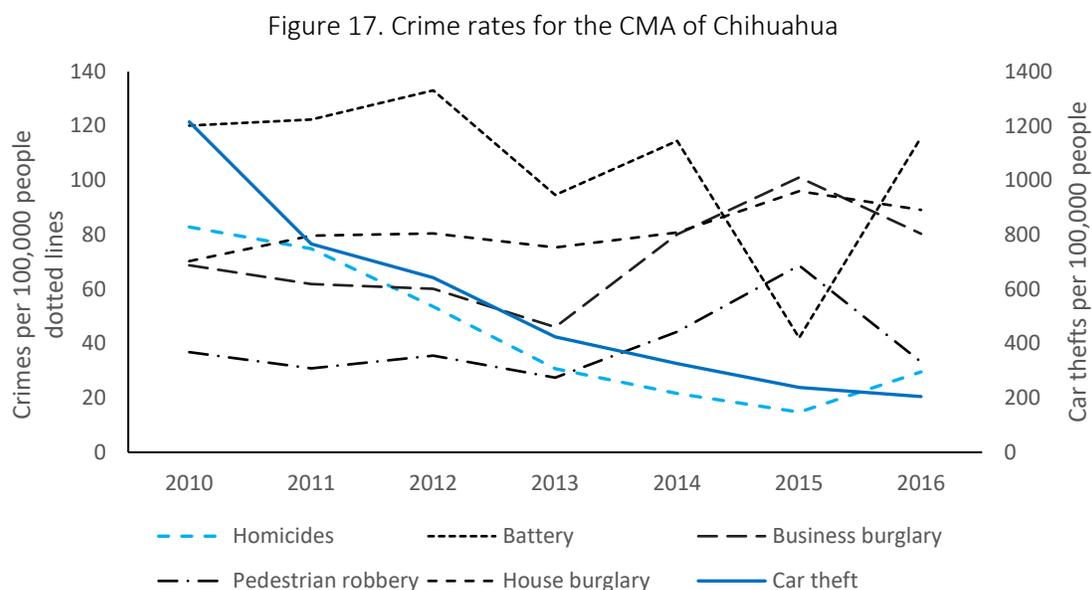
Figure 16. Comparison between analyzed dataset and victimization surveys



Source: Created by author with data from ENVIPE (INEGI, 2011, 2012, 2013, 2014b, 2015, 2016) and crime data of the Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua.

Note: ENVIPE data before 2014 refers to the state rate, due to the unavailability of data at a smaller level of aggregation

Having noted that in general the dataset, although underreporting, appears to emulate the trends of unreported crimes, it is worth highlighting that georeferenced points also distribute unevenly among sites, times, types of crimes and victims in the Contiguous Metropolitan Area of Chihuahua. For instance, the number of reported homicides and car thefts as a proportion of the total number of analyzed offenses has continuously decreased between 2010 and 2016, making the distribution of offenses more even among crime types. This is visible in Figure 17, which shows that while in 2010 car theft prevalence was ten times higher than that of battery (the crime with the second highest rate), the ratio had fallen to about two to one in 2016. It also shows that crimes that are related to Drug Cartel activities sharply decreased in the same period, just as they did statewide, while other offenses, especially property crimes, have remained mostly unchanged or without showing a clear trend. The major exception is for house burglaries, which have gradually increased throughout the years.

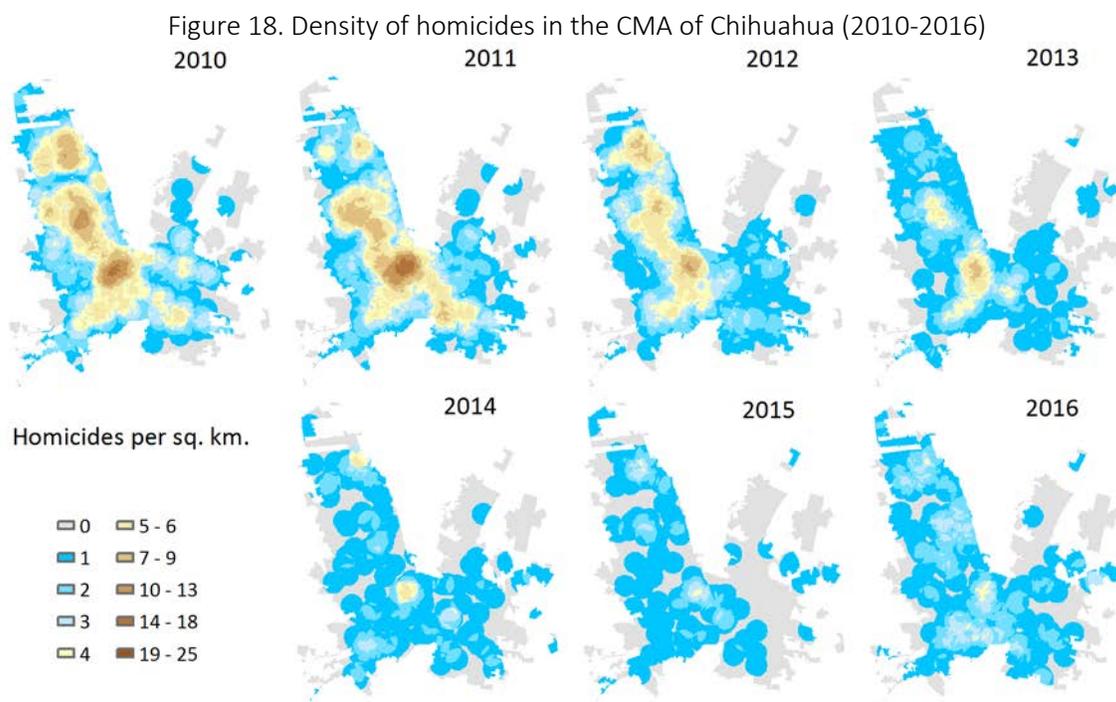


Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua, and own population estimations

These offenses, as well as their trends in time, are also unevenly distributed geographically. For some crimes, this distribution follows predictable trends that are related to the prevailing uses of the area in which they occur. For instance, business and pedestrian robberies concentrate in areas with a high density of economic units, while house burglaries are more likely to occur in areas with higher population densities. Personal crimes, such as homicide and battery, occur in a larger variety of contexts, but 'hot spots' appear to be stable along time. The evolution of the geographic patterns of each crime deserves special attention due to the relevance of this variable to this analysis.

Figure 18 shows the evolution of homicides and their location between 2010 and 2016. Overall, the number of homicides decreases in this period throughout the city, but most of the city remains at least one kilometer away from any point where a homicide occurred during the year. Three areas consistently concentrate more homicides than the rest of the city. These are the INFONAVIT-based dense (highest population density) residential neighborhoods in the North, the mixed mid-density residential and commercial zone in the North Central side of the city, and in the downtown area. All these areas have low marginalization rates, and some places with relatively high homicide density are even in neighborhoods with very-low marginalization. Neighborhoods

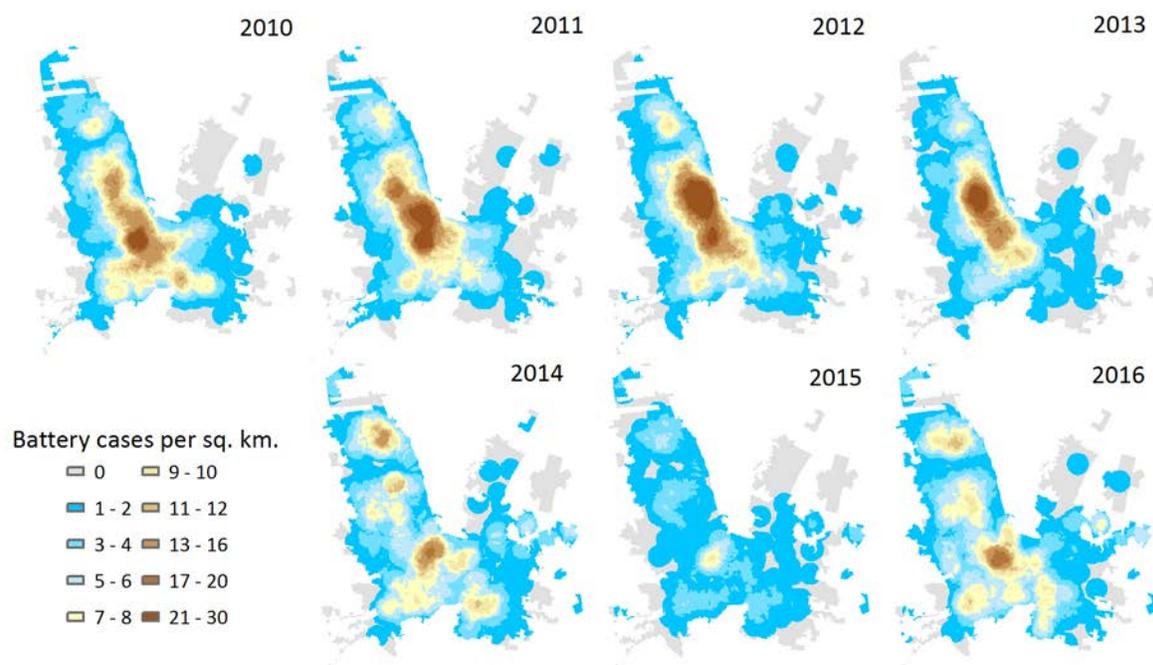
in the South are also affected some years, and a considerable increase is visible in the extreme East in 2016, in relation to the same location previous years.



Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

The number of battery cases per 100,000 inhabitants has been more stable during the analyzed period, except for an unusual drop in 2015 that raises doubts about the quality of the data. Among the crimes this study analyzes, the distribution of battery is the one that is the most similar to homicides, the other personal crime. However, batteries concentrate largely in a greater area expanding from the downtown area and mid-density residential neighborhoods in the North Central zone, although the incidence there has consistently decreased between 2013 and 2016 (Figure 19). Most of this zone falls within very-marginalization neighborhoods with an average proportion of abandoned houses. Between 2014 and 2016, battery cases cluster in a more compact area in the city center, and sub centers with high incidence appear in dense neighborhoods to the extreme North of the city.

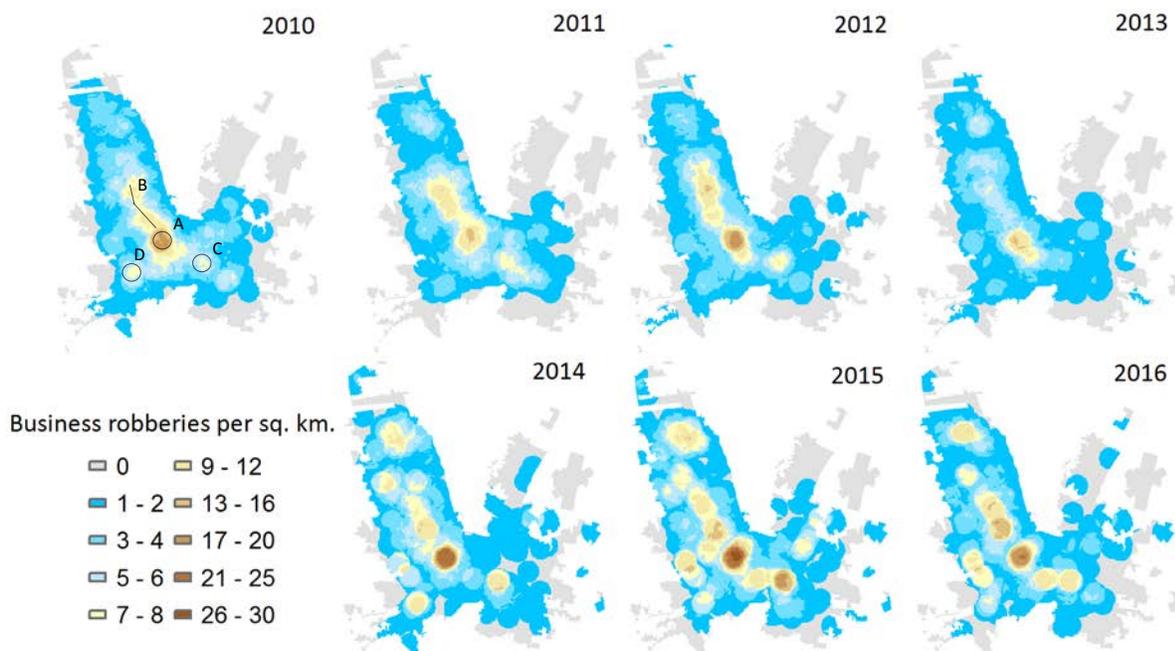
Figure 19. Density of battery cases in the CMA of Chihuahua (2010-2016)



Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

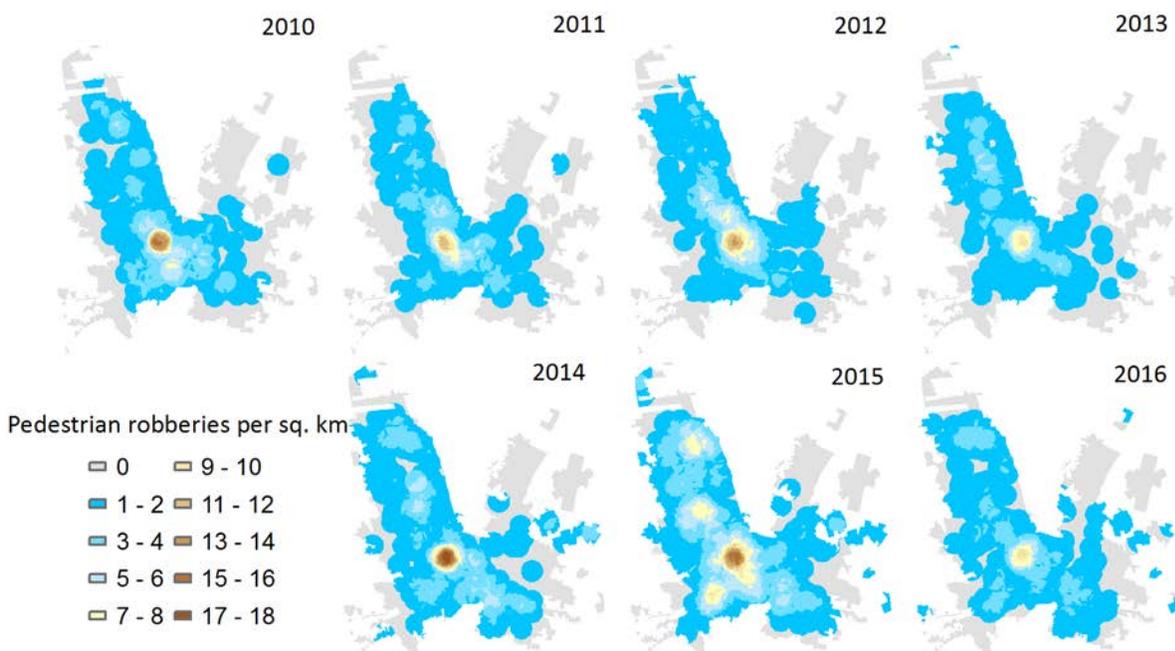
Both the incidence and the spatial distribution of property crimes, except vehicle theft, have been more stable in the years for which there is data available. Business robberies occur especially in areas with high density of economic units. These are A) the downtown area, B) a corridor that stretches from the city center to the North along the Universidad Avenue, around the C) Southeastern sub center at the intersection of Fuentes Mares Boulevard and Nueva España Street, and in an upper-end commercial area in the Southeast, D) along Periférico de la Juventud Highway, as seen on Figure 20. Although the business robberies are consistently more common in the central area, recent years have shown a higher prevalence of these offenses at sub-centers, which have a large number of supermarkets, shopping malls, restaurants, cinemas, and other types of commercial establishments.

Figure 20. Density of business robberies in the CMA of Chihuahua (2010-2016)



Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

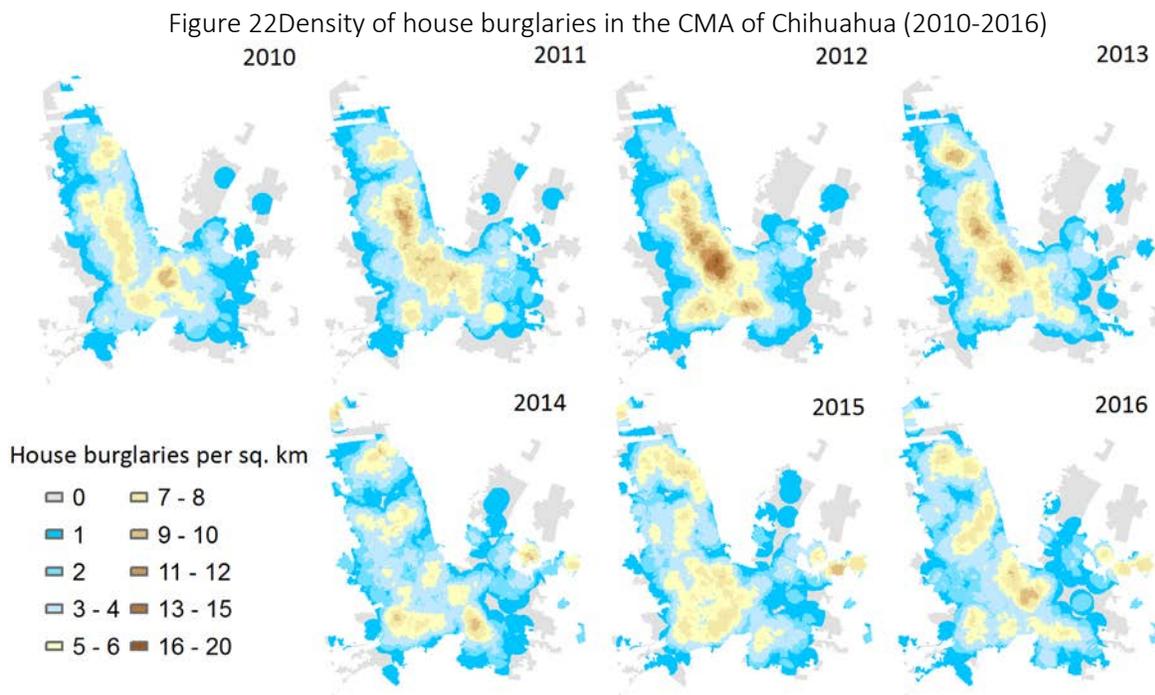
Figure 21. Density of pedestrian robberies in the CMA of Chihuahua (2010-2016)



Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

Figure 21 shows that pedestrian robberies occur all over the city, but are highly assembled in the city center. Their distribution follows the same pattern of business robberies along the analyzed time, but with a concentration in the city center, where the daytime population is likely higher than the number of residents. This is likely the result of the higher walkability and availability of public transit options. Pedestrian thefts are also a very rare crime in to the West of the city, the area with the highest proportion of gated areas in the city, but also one of its main commercial districts; as well as in peri-urban semirural settings.

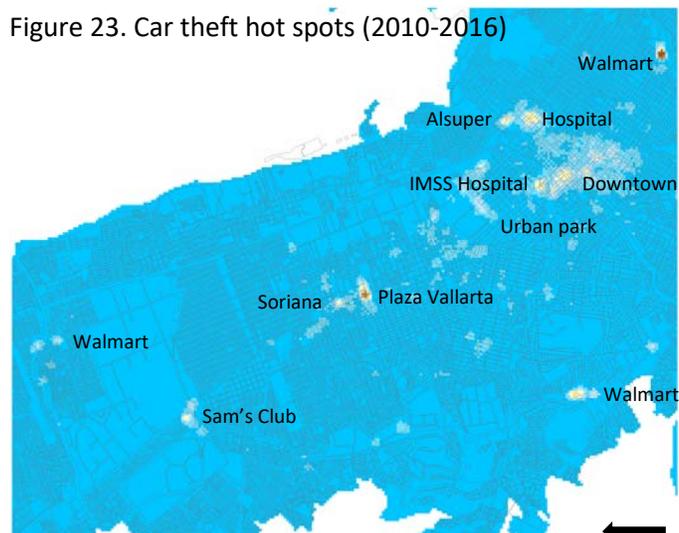
House burglary is the crime that shows the most dispersion among observed crimes throughout the period. Figure shows that at least half of the city lies within an area where at least five burglaries have been reported to the authorities, which makes the actual figure likely to be more than twenty-five, based on report-estimates of ENVIPE (2016). It is also visible from the figure that areas with higher incidence correlate with population density and the location of sub-centers. Another feature of this offense is that, while most reported crimes occur at a higher number on the Northern side of the city, house burglaries are equally likely to occur on the Southern half of the metropolitan area.



Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

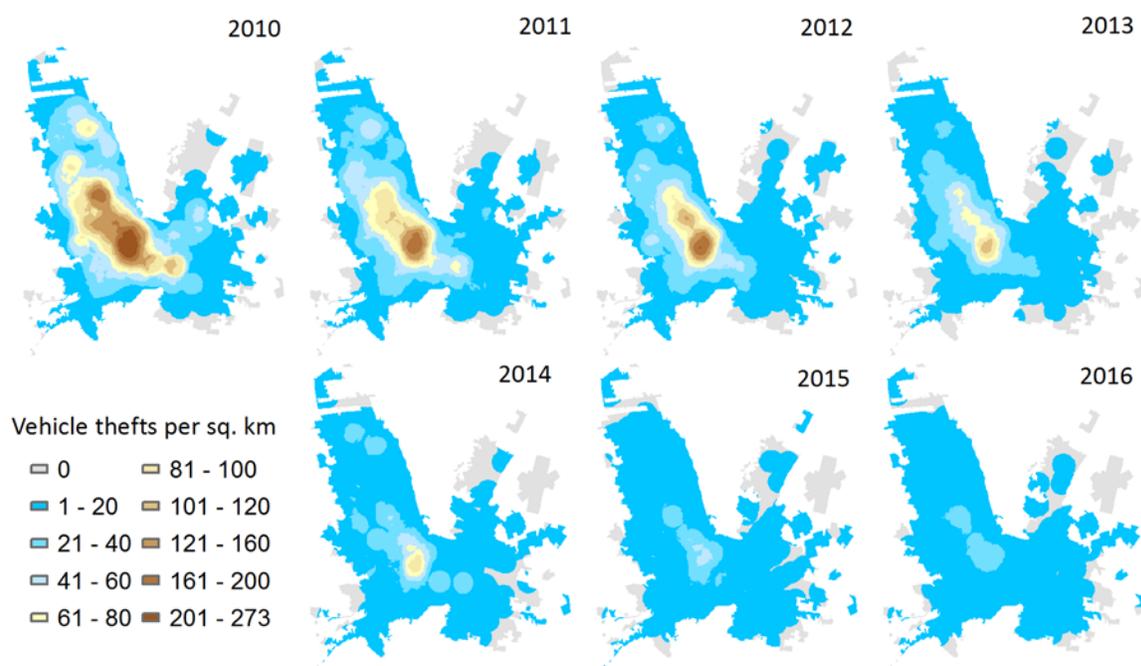
Figure 22 also show an interesting feature of the effect of recent (less than 10-years old) INFONAVIT-based commuter neighborhoods located at the extreme North and East of the metropolitan area, which are not geographically connected to the rest of the urban area. These areas passed from having zero house robberies reported in 2010 to more than ten in the surrounding kilometer, some of them becoming 'hot spots' compared to the rest of Chihuahua. These neighborhoods also have a high proportion of abandoned houses.

Vehicle theft is the crime that has decreased the most since 2010. Figure 24 shows that, although their spatial distribution appears to remain unchanged, their number decreases so much that it is hard to locate 'hot spots' for incidence counts that were low at the beginning of the period. Areas of high prevalence include the city center and the commercial corridor to the North of the city. However, a further examination of this crime in Figure 23, reveals that car thefts are spatially located in very specific regions, especially around supermarkets and shopping malls with large parking facilities, hospitals and parks with large amounts of street parking and the city center.



Source: Created by author using data from the Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

Figure 24. Density of vehicle thefts in the CMA of Chihuahua (2010-2016)



Source: Created by author with data Attorney's Office of Chihuahua via the Citizens' Observatory of Chihuahua

III. Place-based responses to crime

The extremely elevated rates of high impact crimes in proportion to the population of the city between 2008 and 2011 prompted governments, chambers of commerce and many citizens to launch responses to counteract the activities of criminal organizations and offenders. These interventions had a wide variety of objectives, ranging from reviving the city's commercial and industrial sectors, strengthening the social fabric, providing spaces for social coexistence, educating children, improving the quality of police forces, and even granting protection to specific groups. The responses varied in terms of their extension, location, strategies, and implementing authority and each require a separate examination to account for their differing characteristics.

This study focuses on a selection of place-based interventions, and analyzes their effect on the spatial displacement of crime. I choose to focus on gated communities and polygons of the National Program for the Social Prevention of Crime and Violence, because the former represents a private approach that seeks to guarantee security for a specific population, while the latter is a

public intervention whose objective is to serve vulnerable groups and impact on the city as a whole.

Then, I mention some other crime-prevention approaches launched in Chihuahua during the last decade, to recognize the possible effect of these on the crime events that are subject to analysis. This means that the overlapping nature of these programs with respect to the place-based interventions of this study is likely to produce effects on the spatial distribution of crimes that could contaminate the results of this analysis. It is important to mention some of their characteristics and evaluations (when available) to assess the extent to which they successfully reduced crime prevalence or failed to do so and if their areas of influence or displacement overlap with either gated communities or PRONAPRED polygons.

National Program for the Social Prevention of Violence and Crime

In 2012, the Federal Government enacted the General Law for the Social Prevention of Violence and Crime, which mandated the creation of the National Program for the Social Prevention of Violence and Crime (PNPSVD) with the objective of “providing protection of freedom, security and justice” and allowing citizen and community participation in interventions, through interventions with precise, clear and measurable objectives (DOF, 01/24/2012, Art. 20). The program includes four types of prevention strategies, which are the social, situational, community-based, and development and recidivism (Secretaría de Gobernación, 2013). It is usually referred to as the National Program for the Prevention of Crime (PRONAPRED) and in May 2014, it increased its scope and its sources of funding. The program was positively received as a new approach to prevent that did not involve the deployment of the military or Federal Police Forces, but rather relied on the improvement of underlying social issues.

Until 2016, PRONAPRED was one of the most recent, relevant and least assessed instruments for violence prevention. Its objective was to fund both national and local level interventions that sought to reduce structural factors that lead to crime and violence at the

individual, familial, socio-economic, community and institutional-governmental level (Secretaría de Gobernación, 2013). To do this, the program was organized in four different levels. National Strategies received funds to implement nationwide projects, such as media campaigns. A second group of actions assigned complementary funds to the 300 municipalities or state governments – when there is a unified state police body – that receive the police-oriented Subsidy for the Strengthening of Security (FORTASEG). A third line of action coordinated the work and funds of nine Federal Secretariats –represented by the Intersecretariat Commission –and seven government institutions assigned to violence and crime prevention policies in 100 municipalities.

A fourth area of the program, and the largest in terms of budget, grants funds to certain municipalities to perform urban acupuncture projects in neighborhoods within federally defined boundaries – which I call PRONAPRED polygons – with the engagement of community organizations and the participation of civil society. Projects that are allowed to receive these funds must have one of the following goals:

- Increasing cohesion and citizen participation
- Reducing crime and violence vulnerability among risk groups
- Generating contexts that favor communal living
- Strengthening institutional capacity for social prevention (Secretaría de Gobernación, 2013)

Between 2012 and 2016, the program distributed more than 10 billion pesos to local governments all over the country (Ayala & López, 2016). The resources were only given to municipalities that had been previously selected based on quantitative variables. These include demographic characteristics (population, households, education, unemployment, access to health, drug consumption, teenage pregnancies, marginalization indices, poverty, inequality and house quality), criminal activity (reported violent robberies, homicides, batteries, and kidnapping and rape cases) and social capital (number of community-based organizations) (Chapa Koloffon & Ley, 2015). A fraction of the selected places also included qualitative assessments, usually visits to the site. The amounts were then distributed each year, according to the guidelines that were

published in the Official Gazette, usually using a formula that weighed 25% the population of the polygon, 25% crime incidence, using the number of homicides as a proxy, and 50% was a fixed value depending on the area covered by public safety institutions (DOF, 2016).

A set of more than 400 smaller polygons within these municipalities were then selected based on demographic and crime indicators, as well as with input from local actors, as the location of the situational prevention strategies. For instance, in Chihuahua, the Citizens' Observatory and researchers from the Autonomous University of Chihuahua (UACH) contributed to the demarcation of polygons. For the purposes of this analysis, I consider these areas place-based interventions, since they have clearly defined boundaries in which a policy – PRONAPRED – is implemented through situational and community based strategies that aim to reduce crime opportunity. Nevertheless, these areas are so large and contain such a large population that it is necessary to recognize that the benefits of the program are unlikely to impact the whole place evenly. In fact, prominent public policy analysts like Viridiana Ríos claim that strategies should focalize in very specific areas and offenders to be successful, rather than in large polygons (Ríos, 2016)

The amount of money devoted to the program was sharply reduced in 2016 and finally eliminated from the 2017 Federal Budget, although the project of the Decree provided that FORTASEG resources can now be used for the social prevention of crime and violence (Presidencia de la República, 2016). Although the program does not currently receive resources, it is still part of the programmatic structure of the Ministry of the Interior, and many of its activities have been absorbed by other programs with more diffuse objectives that remain in places. This makes relevant the assessment of its success in terms of the reduction or displacement of crime.

Previous analyses have highlighted that PRONAPRED was characterized by its discretionary nature, lack of transparency and accountability mechanisms and disconnection between means and ends of the projects it funds. México Evalúa published one of the most complete assessments of the program at the national and local level. In this evaluation, Chapa Koloffon & Ley (2015) find

that the selection of municipalities and polygons lacked transparency and a clear methodology, diagnoses were not used to define actions, which lead to the selection launching of strategies that lacked empirical or theoretical basis as violence prevention measures; and that the benefits of the program were highly concentrated in some vulnerable groups but left others unattended.

A constant criticism of PRONAPRED is concerning the wide range of actions that it funded and their questionable relation to crime prevention. For example, Chapa Koloffon & Ley (2015) mention that a large portion of the budget was spent on the recovery of public spaces, without being based on situational prevention strategies, and on media campaigns that were not actually related to crime prevention, while strategies that have been proved more effective, such as scholarships and academic programs to prevent school dropout among teenagers, were very uncommon. They further provide two examples of activities with very questionable relation to crime prevention, which are the distribution of reading glasses and hearing aids, which rely on the assumption that they can prevent violence by reducing school dropout rates, but have not been proved successful. Citing a USAID analysis of thousands of interventions in Central America (2016), Viridiana Ríos (2016) notes that the recovery of public spaces should be accompanied with workshops on emotion management trainings, which have proved to be more successful than infrastructure by itself. Leaders of NGOs that receive PRONAPRED funds in Chihuahua even note that there is a disconnection between means and ends in the projects in which they work with PRONAPRED. Table 3 identifies some of the most common actions that were funded under PRONAPRED in the selected polygons one of its four years. There is no evidence that some of these, like the construction of new buildings and community gardens, are linked to crime.

Table 3. Actions funded with PRONAPRED resources in 2014

| <i>Activity</i> | <i>% of activities</i> | <i>% of budget</i> |
|------------------------------|------------------------|--------------------|
| Recovery of public spaces | 4.9 | 13.5 |
| New building | 1.5 | 11.7 |
| Habilities/values workshops | 17.1 | 10 |
| Sports | 7.6 | 9.7 |
| Artistic/cultural activities | 8.3 | 6.5 |
| Profession workshops | 7.3 | 6.2 |
| Rehabilitation of building | 1.4 | 4.8 |
| Building equipment | 2.3 | 3.9 |
| Tematic campaigns | 6.6 | 3.3 |
| Community leaders training | 3.4 | 3.2 |
| Cultural events | 4.5 | 2.5 |
| Neighbor networks | 3.6 | 2 |
| Campaigns | 1.9 | 2 |
| Public servant training | 2.9 | 1.6 |
| Community festivals | 1.8 | 1.4 |
| Transfers of goods | 0.8 | 1.3 |
| Evaluation | 1 | 1 |
| Scholarships | 0.9 | 0.9 |
| Community gardens | 1.1 | 0.8 |
| Participatory diagnose | 2 | 0.8 |
| Talks | 2 | 0.7 |
| Conflict resolution | 0.9 | 0.7 |
| Police engagement | 0.9 | 0.4 |
| Weapon exchange | 0.2 | 0.1 |

Source: Adapted from México Evalúa. *PRevenición del Delito en México: ¿Cuáles son las prioridades?* (Chapa Koloffon & Ley, 2015)

In addition to the availability of third party evaluations of the program design, the Ministry of the Interior releases the extent to which performance indicators of the program are met as a measure of success. The program has five objectives related to the higher goal of improving public security. According to surveys it has succeeded in terms of increasing the proportion of people that is engaged with their community to solve a number of problems, like burglaries and gang violence. However, at a national level, it has failed to decrease the perception of insecurity in the public space and in the community as a whole, which impacts the development of places the reinforce citizen security (Secretaría de Gobernación, 2016).

Despite the availability of information regarding the program design and performance, an assessment of the displacement of crime resulting from the intervention does not exist, despite this being a common critique of the program among local government officials, community leaders

and even program implementing authorities. To address this situation, this study analyses crime displacement in polygons in the three polygons of the city of Chihuahua, which are all located in the municipality of Chihuahua, as seen in Figure 23. Polygons are referred to by their number in evaluations and official documents, and together they account for about a tenth of the area of the city, which is a very large area for a place-based approach.

Figure 25. PRONAPRED polygons in the CMA of Chihuahua



Source: Created by author with data from Observatorio Ciudadano de Chihuahua and INEGI.

The three PRONAPRED polygons share many social and demographic characteristics, as seen in Table 4. For instance, each has a population of around 60,000 and population densities that are two to three times higher than the rest of the blocks of the city. This may be related to the fact that they are mostly composed of areas where the land use is mostly habitational. The three polygons rank low in terms of abandoned housing stock, which is likely due to the age of most neighborhoods in them. Since they are not located in areas with urban growth and do not include INFONAVIT-style housing for the most part, houses tend to be older than in other regions. This dynamic is also related to the low population growth rate, which is even lower than the city average and negative in the case of Polygon 2.

It is interesting to notice that most of the population living within the boundaries of PRONAPRED interventions is located in areas with low marginalization rates and a large percentage also live in areas with medium marginalization. This proportion is much higher than the rest of the city, which has about two thirds of the population living in very low marginalization. However, it is also significant that the polygons do not include any areas with high or very high marginalization.

Table 4. Demographic and crime characteristics of PRONAPRED polygons in Chihuahua

| | <i>P1</i> | <i>P2</i> | <i>P3</i> | <i>PRONAPRED</i> | <i>Rest of the city</i> | |
|------------------------|---------------|-----------|-----------|------------------|-------------------------|-------|
| Area (km2) | 6.7 | 6.9 | 9.1 | 22.6 | 171.7 | |
| Population (2010) | 57,884 | 60,853 | 60,925 | 179,662 | 632,416 | |
| Population (2016) | 63,432 | 58,531 | 66,025 | 187,988 | 726,474 | |
| Annual Pop. Growth | 1.6% | -0.6% | 1.4% | 0.8% | 2.5% | |
| Density (2010) | 8,621 | 8,859 | 6,724 | 7,934 | 3,683 | |
| Density (2016) | 9,447 | 8,521 | 7,286 | 8,302 | 4,231 | |
| Marginalization (Pop.) | VL | 14.3% | 4.4% | 37.1% | 18.7% | 62.4% |
| | L | 60.7% | 87.1% | 41.1% | 63.0% | 21.7% |
| | M | 24.9% | 8.1% | 21.8% | 18.2% | 11.7% |
| | H | 0.0% | 0.0% | 0.0% | 0.0% | 2.9% |
| | VH | 0.0% | 0.0% | 0.0% | 0.0% | 0.8% |
| | NA | | | | 0.4% | |
| Abandoned Houses (%) | 12.7% | 12.6% | 12.6% | 12.6% | 22.2% | |
| Homicides | 28.9 | 29.2 | 52.6 | 37.2 | 42.5 | |
| Battery | 78.4 | 79.4 | 115.2 | 91.5 | 101.9 | |
| Robbery | Business | 24.2 | 54.1 | 60.7 | 46.5 | 72.4 |
| | House | 60.7 | 66.8 | 79.0 | 69.0 | 78.9 |
| | Vehicle | 202.9 | 273.8 | 355.4 | 278.6 | 575.9 |
| | Pedestrian | 24.5 | 36.6 | 32.2 | 31.1 | 38.8 |
| | With violence | 24.4% | 28.0% | 23.5% | 25.2% | 23.2% |
| without violence | 75.6% | 72.0% | 76.5% | 74.8% | 76.8% | |

Source: Created by author with data from INEGI (2010), INEGI (2015), INE (2017) and Attorney's Office via the Citizens' Observatory of Chihuahua.

Note: Marginalization categories stand for VL – Very Low, L – Low, M – Medium, H – High, VH –Very High ; Crimes are measured as a rate per 100,000 people, except for violence/non violence attribute, which shows the proportion from the total number of robberies that report this variable.

Despite the demographic resemblance of the three polygons, Table 4 shows that the crime rate varies among them. Polygon 3 has a higher ratio (and number) of offenses occurring in respect

to its population, for almost every crime. Homicide and battery rates in that polygon almost double that of the other polygons, while vehicle thefts and house and business burglaries are more common than in the other two. Polygons 2 and 3 have a relatively high rate of pedestrian and business robberies when compared to Polygon 2, due to the presence of commercial corridors in them that result in a larger concentration of economic units. However, in general, areas within PRONAPRED polygons in Chihuahua have a lower rate for every analyzed crime, a fact that raises questions about the selection of the polygons in the first place.

The success of the program at the city level and its impact on crime displacement does not rely only on the location and physical characteristics of the interventions, but also in the type of crime prevention activities that are held within them. I obtained data from the official website of the program, nosmuevelapaz.gob.mx, but it is not available after the defunding of the program, which makes it more difficult to access information about the spending and types of activities that were funded. In Chihuahua, the Federal government relied on the State government to manage the program resources and distribute them among organizations working in or outside the polygons within the four municipalities (two before 2015) that were eligible. These actors were in many cases educational institutions that would then work with volunteers or other organizations to launch activities, as shown in Table 5.

Once these organizations received the funds, they would engage in a wide range of activities. For instance, one of this organizations manages a Facebook profile that shows that the activities that were developed with resources from the program in 2016 include mainly sports classes and tournaments. However, there are also art and musical exhibitions and workshops, entrepreneurship activities, and even conferences on violence for kids and on statistical methods to measure crime prevention.³ In 2016, the *Colegio Nacional de Educación Profesional Técnica del Estado de Chihuahua* (National School of Professional Technic Education of the State of Chihuahua), received funds to train youth in detention centers on hydroponic production.

³ These activities are found in https://www.facebook.com/pg/PRONAPREDCHIHUAHUA2016/posts/?ref=page_internal

Table 5. Distribution of PRONAPRED resources in Chihuahua in 2016 by recipient

| | Polygon 1 | Polygon 2 | Polygon 3 | Outside | Total |
|------------------------------------|--------------|--------------|--------------|--------------|---------------|
| Normal Superior | | | | | 3,563,965.07 |
| <i>Promote reporting</i> | 481,215.05 | 556,375.00 | 556,375.00 | | 1,593,965.05 |
| <i>Positive parenting</i> | 333,333.34 | 533,333.34 | 533,333.34 | | 1,400,000.02 |
| | | | | 570,000.00 | 570,000.00 |
| UACH | | | | | 9,602,467.01 |
| <i>Participatory diagnose</i> | 300,000.00 | 300,000.00 | 300,000.00 | | 900,000.00 |
| <i>Research</i> | 333,333.00 | 333,334.00 | 333,334.00 | | 1,000,001.00 |
| <i>Program evaluation</i> | | | | 1,000,000.00 | 1,000,000.00 |
| <i>Communication</i> | | | | 1,000,000.00 | 1,000,000.00 |
| <i>Pub. servant training</i> | | | | 556,667.56 | 556,667.56 |
| <i>Self-employment init.</i> | 715,267.00 | 715,266.45 | 715,265.00 | | 2,145,798.45 |
| <i>Art in correction ctrs,</i> | 1,000,000.00 | 1,000,000.00 | 1,000,000.00 | | 3,000,000.00 |
| | | - | - | | - |
| Colegio de Educación Profesional | | | | 2,477,448.57 | 2,477,448.57 |
| Red por la Participación Ciudadana | | | | 448,000.00 | 448,000.00 |
| Total | 3,163,148.39 | 3,438,308.79 | 3,438,307.34 | 6,052,116.13 | 16,091,880.65 |

Source: Created by author with data from nosmuevelapaz.mx

Interviews with program managers reveal details of PRONAPRED that, according to them, affect the results of the interventions. First, they mention the overlapping nature of the program and FORTASEG, a police based crime control Federal program that includes a social prevention component. Second, they mention that the deferment of transfers from the state governments to the end of the fiscal year leaves them with less than three months to spend or plan the spending of the resources, which forces them to start working even before the baseline surveys are finished. This is an important flaw because interventions thus are not based on the recorded needs of the population living in the polygons nor in empirical evidence. The issue is related to the poor design of the statistical instruments that are sent by the federal government to measure baselines, usually requiring a large number of very long interviews with poorly worded and often intrusive questions, inadequate answer options, and no coherent order. Finally, they note a lack of coordination between organizations working with Federal resources and the municipal government, which has its own programs oriented towards the reparation of the social fabric. However, they have more coordination with private initiatives, such as FICOSEC (Trust for Citizen

Security, which also funds the Citizens' Observatory), NGOs, and foreign sources of funding, such as the representation of USAID in the city.

Finally, the politicization of these resources, as well as the corruption associated with the decentralization process (Brueckner, 2000), limit the impact of the program. In Chihuahua, interviewed officials mention the inflexibility of the previous administration to allow a freer flow of the funds to local municipal authorities or local program managers, usually as a political strategy. Similarly, the *Red por la Participación Ciudadana* (Network for Citizen Participation), which received funds to implement round tables to discuss good practices and experiences among prevention strategies in Chihuahua, claims that the previous state administration diverted funds from the program (Prieto, 2017). Similarly, strategies to prevent corruption make program more rigid and wasteful, especially when it comes to statistical controls, which rely on the previously mentioned surveys and on evaluations after the program.

Gated communities

Studies of crime and violence traditionally regard gated communities as a privatization of security and public spaces that causes socio-spatial segregation of cities (Glebbeek & Koonings, 2016), rather than as a crime prevention strategy. However, I address their protective approach as a crime prevention strategy, even though it differs from traditional situational approaches in that it only seeks to prevent offenses within physically defined boundaries that cut social interaction. In this sense, gated communities modify the environmental factors that create the opportunity for crime, through the use of fences, walls, surveillance and other deterrence strategies (Glebbeek & Koonings, 2016), creating the possibility of crime displacement to neighboring areas, especially when they do not share these conditions. As a result, they become of importance for this analysis.

This forms of urbanization have become common throughout middle-size and large Latin American cities. Borsdorf and Hidalgo (2008); Borsdorf, Hidalgo, and Sánchez (2007); Borsdorf,

Hidalgo, and Vidal-Koppmann (2016) link their emergence and expansion to the regularization processes that occur with globalization and the spread of neoliberalism. A common feature of them is that they tend to occur in the city peripheries, many times next to informal or working-class settlements, are car-dependent, and although they may cluster in certain areas, they can occur in every direction, provided there is car infrastructure linking them to other gated areas (Borsdorf et al., 2007). In addition, they have become a common feature in Latin American cities to the extent that they are not only the home to the rich, but also to the middle class, and some even contain social housing (Enríquez Acosta, 2007).

Figure 24 shows that gated communities are highly concentrated in the city periphery, especially along a corridor in the Western side of the city, an area that has very low marginalization. Suburban style gated developments exist on a corridor on the Northwest side, along the highway that links the Contiguous Metropolitan Area to Aldama City (a satellite town in the Metropolitan Area). Smaller gated communities are spread along the Central Areas and in newer developments to the East.

Figure 26. Gated communities in the CMA of Chihuahua



Source: Created by author using data from Openstreetmaps, Google Maps and on-site visits.

Gated communities not only differ in their location, but also in their size, environments and population. Traditional gated communities are located in the West, close to the city Center, are larger, car-oriented and were first developed in the eighties. They were home to the city upper classes, have large homes and plots, strict land use enforcement, and usually contain private sport clubs and parks, and even golf courses. A second wave of gated communities appeared as suburban communities in the city periphery. These have grandiose gates with security guards, features that reinforce a sense of differentiation between the inside and the outside of the community.

The violence between 2008 and 2012 prompted a new wave of gated communities that emerged from the fencing of previously open neighborhoods and streets, in which residents organized themselves to restrict access to their streets and provide security. During this time, municipal authorities allowed the gating of streets provided they followed a process that included a viability assessment by the city council, the written consent of most of the residents, ("Reglamento de Desarrollo Urbano Sostenible del Municipio de Chihuahua," 2013) and that residents paid for any walls, fences, gates, personnel and materials. Between 2007 and 2011, the municipal government received 376 requests from neighbor organizations to fence off their streets, out of which 128 were approved and 83 rejected, according to the Department of Urban Development, whereas an additional 150 streets were closed without permit (García, 2011). An interview with Marco Quezada, mayor of Chihuahua in 2011, reveals that the municipal authorities were compelled to grant permits to viable projects due to the extraordinary situation. However, they recognized possible negative impacts on social cohesion and security of gated communities, including conflicts among neighbors, blocking to emergency services, and guards that could be colluded by criminal groups due to the conditions of private security firms. A further

New gated communities of the three types are still established, and a fourth type has emerged. Social housing under INFONAVIT schemas, usually located in densely populated suburban areas, occurs both on the East and Northwest side of the city. This type has increased the proportion of the population of these communities that live in areas with marginalization that

is not very low, as seen in Table 6. However, 92% of gated communities are still in areas with very low marginalization rates.

Table 6. Selected demographic and crime characteristics of gated communities in Chihuahua

| | Gated communities | Rest of the city | |
|-------------------------|-------------------|------------------|-------|
| Area (km ²) | 16.3 | 178.1 | |
| Population (2010) | 59,222 | 752,856 | |
| Population (2016) | 79,727 | 834,735 | |
| Annual Pop. Growth | 5.77% | 1.81% | |
| Density (2010) | 3,640 | 4,227 | |
| Density (2016) | 4,901 | 4,687 | |
| Marginalization (Pop.)* | VL | 92.2% | 49.7% |
| | L | 7.3% | 32.7% |
| | M | 0.3% | 14.2% |
| | H | 0.2% | 2.4% |
| | VH | 0.0% | 0.7% |
| | NA | | 0.4% |
| Abandoned Houses (%) | 25.4% | 18.5% | |
| Homicides | 9.2 | 44.2 | |
| Battery | 26.1 | 106.2 | |
| Robberies | House | 37.1 | 80.2 |
| | Vehicle | 136.2 | 545.8 |
| | Pedestrian | 6.7 | 39.9 |
| | With violence | 24.5% | 23.5% |
| | without violence | 75.5% | 76.5% |

Source: Created by author with data from INEGI (2010), INEGI (2015), INE (2017) and Attorney's Office via the Citizens' Observatory of Chihuahua.

Note: Marginalization categories stand for VL – Very Low, L – Low, M – Medium, H – High, VH – Very High ; Crimes are measured as a rate per 100,000 people, except for violence/non violence attribute, which shows the proportion from the total number of robberies that report this variable.

* marginalization rates and abandoned houses are measured at the AGEb level, and include areas not within gated communities

Table 6 also shows that about 9% of the city inhabitants live in these areas, up from 7% in 2010, a fact that is explained by a growth rate that triples that of the rest of the city. The share of abandoned houses is higher than that of the rest of the city, which is likely due to the age of developments, as well as the growth of new gated social housing communities. In terms of crime, these neighborhoods in the aggregate have a crime rate that is much lower than that of the rest of the CMA of Chihuahua, for all of the offenses measured in this study. For instance, personal

crimes and vehicle theft have rates that are a fourth of that of non-gated areas. House robberies are somewhat more common, but still only twice less likely to occur inside a gated community. Pedestrian robberies are the least common offense reported in these areas, a fact that may also be related to the lack of businesses and their prioritization of car transportation.

Other approaches

The local government has been one of the most active actors regarding public safety. Under the administration of Marco Quezada between 2010 and 2013, the municipal government of Chihuahua made this issue one of its pillars and a base for many of the policies it launched. Mr. Quezada and Mr. Heliodoro Araiza, Director of Municipal Public Security of Chihuahua during his administration, mention in an interview that their strategy included three types of activities: social interventions, recovery of public spaces and the improvement of the police forces:

- Social interventions included the creation of 'world class' sport spaces, cultural and academic centers and health facilities in two polygons (North and South) that were drawn based on poverty, schooling, crime, and drug vending data. These projects were mainly oriented towards children living in these areas. Equal access to technology was one of the main goals of the interventions, and laptops and tablets were given based on participation, fostering the involvement of the community.
- The recovery of public spaces was closely related to social interventions. The city center and the area surrounding *El Rejón* dam in Southwestern Chihuahua received special attention. Their redevelopment sought to reactivate the spaces and become a source of pride for inhabitants, since the city suffered an identity crisis resulting from its labeling as a drug cartel territory. The recovery of the park included large events, but an accident during a Monster Truck Exhibition forced these activities to come to an end.
- The third approach sought to enhance police forces by dignifying their work, offering them training and providing spaces for them and their families. Heliodoro Araiza, Director of Municipal Public Security at that time, mentions that the strategies included salary increments

(almost doubling previous wages) that were accompanied by individual and team productivity bonuses, the provision of adequate armament, and the deployment of elements based on spatial information and their participation in organizational planning. In addition, they created the Center of Integral Development for Police officers (CEDIPOL), a high-quality recreational space for elements and their families. These improvements were based on good practices from Colombian cities, and they sought to decrease the risk of police collusion with criminal organizations.

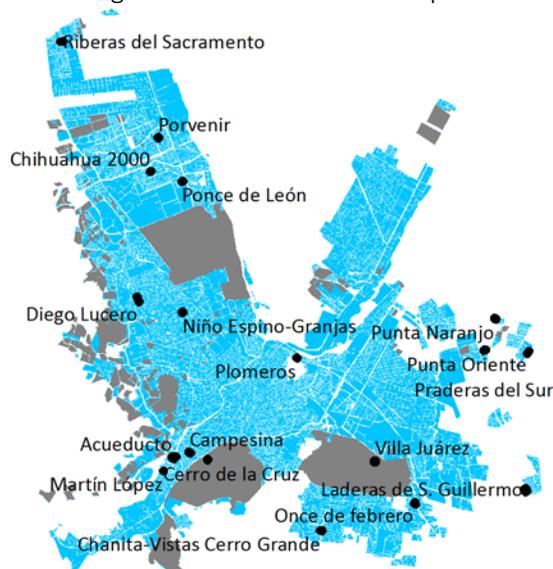
These interventions were funded by the municipality in cooperation with other levels of government and the private sector, and they sought to engage NGOs. For instance, the private initiative provided funds for health facilities and for CEDIPOL. Police armament was obtained through the use of the federal subsidy FORTASEG – then called SUBSEMUN – and from the Ministry of National Defense. Results were measured with a local survey on the perception of security, carried by Tecnológico de Monterrey, a local private university, as well as with anecdotal evidence. The state government also partially funded the recovery of both the City Center and El Rejón Park.

A number of issues arose when cooperating with other levels of government. Social interventions received PRONAPRED resources in 2013, but ideological differences between the mayor's office and the State governor complicated the transfer of funds. Additionally, the anticorruption provisions of Federal funds made them untimely and difficult to use. The former mayor notes that the following administration did not continue with many programs, and mostly those funded by the private sector remain in place.

The lack of spatial data of focalized interventions, as well as the non-spatial nature of the municipal police program, makes it difficult to include municipal interventions in the model. This forces the author to assume that the distribution of the effects was even throughout the city. Nevertheless, I try to account for some of this external effects by including one of the longest-standing place-based situational prevention strategies in the model. This is the recovery of public spaces carried out by The Network through community-based interventions.

The Network implements mainly primary prevention strategies in 18 public spaces located throughout the city in areas that suffer either marginalization, high crime rates or low social cohesion (Figure 25). Primary prevention strategies focus on improving the well-being of members of the community (Inter-American Development Bank, 2012), and, as such, the Network's main role is to reactivate the public space to engage the community by providing social, sport and cultural activities, and training to address underlying sources of violence. Network's public spaces are mainly located in areas that are not usually covered by other programs, like PRONAPRED or municipal strategies, since the organization prioritizes this aspect in its selection process. Other factors that are considered are poverty and the crime incidence reports created by the Citizens' Observatory. In this sense, only two of the Network's Public Spaces are located within PRONAPRED polygons (Cerro de la Cruz and Villa Juárez), and a number of them are close to them to potentially influence displacement.

Figure 27. Network's Public Spaces



Source: Created by author using data from, Google Maps, INEGI (2016) and Facebook profiles of the Network's Public Spaces.

Cecilia Olivares, director of the Network speaks about the normal process to launch an intervention. The first step is a community based programming strategy in which inhabitants choose the uses they want to give to the space. Then, members of the Network make sure these

activities are offered and find initial funding for them. During the development of these activities, Network coordinators detect leaders in the community, who then conform “Social Networks” that define the future of the interventions, as well as necessities of the community in terms of access to public services. The next step is based on the method of Crime Prevention through Environmental Design (CPTED), and they train the engaged population in the detection of areas with high crime incidence. An advantage of this is that it captures crimes that are not reported, but are known to the community. It also makes the population more engaged with the prevention of violence in their community, especially that that is gender-based or towards children.

The model is implemented during one year by a coordinator who gradually releases leadership to members of the community. This aims to strengthen communities that previously relied heavily on government transfers. By the third year, all activities are organized by members of the community, who continue attending workshops on crime prevention and restorative justice provided by the Network or other organizations, like USAID. This way, continuity of the intervention is in the hands of the community regardless of the situation of the Network. Currently, the organization is taking steps to include secondary prevention (working with populations at risk of becoming offenders or victims) to their framework.

Created in 2009 and being official recognized in 2011, the Network is one of the NGOs that have been working on crime prevention for the longest time in Chihuahua. Their work has been recognized by USAID, the Federal Ministry of the Interior (which manages PRONAPRED), and the United Nations. Organization members claim that in a matter of days, offenders (usually members of the community) leave the public space for other spaces, change the time they use it, or seek help from the organization. According to Mrs. Olivares, a study on social cohesion and security perception of the School of Social Works, found that the perception of security improves in a buffer of 400 meters around the intervention, and that some crimes decrease, although it does not affect high impact crimes, such as homicides.

Despite this success, the organization has faced constraints in their collaboration with governments. For instance, some administrations have stopped funding their activities, likely due to opposing ideologies to previous mayors. However, their collaboration with the private sector and international donors has provided them funds to expand.

IV. Analysis

The estimation of Weighted Displacement Quotients is a quantitative approach to measure crime displacement from one area to another that was developed by Bowers and Johnson (2003). I use this method to measure crime displacement from polygons receiving funds from PRONAPRED to neighboring areas in the Contiguous Metropolitan Area of Chihuahua between 2013 and 2016, for six types of crimes. The timeframe spans from the conception of the strategy to its defunding in 2016. I repeat the same approach for gated communities using a larger time frame, from 2010 to 2016, since gated communities were present for the whole time, and were established at different times.

The six crimes I analyze are homicide (*homicidio*), battery (*lesiones*), vehicle theft (*robo de vehículo*), pedestrian robbery (*robo a transeúnte*), house burglary (*robo a casa habitación*) and business burglary (*robo de establecimiento comercial*).⁴ Data on crime events was obtained in collaboration with the Citizens' Observatory of Chihuahua (Observatorio Ciudadano de Chihuahua) and researchers from the Autonomous University of Chihuahua (UACH), and it includes all offenses of the abovementioned typologies, which were reported to the Office of the General Public Attorney of Chihuahua (Fiscalía General del Estado de Chihuahua – FGE) between 2010 and 2016. The data was georeferenced by staff from the Citizens' Observatory, who also provided

⁴ Some crime typologies from the Mexican judicial system do not have an equivalent in English. In this study, homicide refers to all homicides (incidental, involuntary manslaughter, self-defense and culpable homicide). *Lesiones*, which I translate as battery, include both battery and assault. Vehicle theft and commercial and house burglaries do not involve violence in many jurisdictions, but rather taking unguarded objects or trespassing a property with the intent of robbing. Pedestrian robberies usually involve violent from the perpetrator to the victim. For the purposes of this work, all these crimes include both violent and non-violent instances, following the definition used by the Attorney's Office of Chihuahua.

information on PRONAPRED geography. However, additional steps are taken to ensure that it reflects the reality.

The first step is the creation of the database from the original information. Seven different tables, one for each year, were merged into one table that included all crimes. This required the filtering of some crimes that are not addressed in this study, as well as the standardization of the fields of every original table. Data changes from one year to another due to the use of different categories in the original reporting. Only obvious matching types from one year to another were altered to create a standardized version (e.g. when the difference was due to capitalization or grammatical differences, or when some typologies were stated under subtype instead of type). The final table includes a total of 52,095 crimes, which were then displayed on ArcMap 10.5, a Geographic Information Systems (GIS) software, using the World Geographic Coordinate System WGS 1984, which was also used by the Citizens' Observatory in the *georeferencing* process. The points that were within the boundaries of the Contiguous Metropolitan Area, or less than 100 meters away were then selected and exported into a new *shapefile*,⁵ since this research only studies urban crime. This leaves a total of 50,515 crimes.

It must be mentioned that the boundaries of the Contiguous Metropolitan are also defined by the author, based on official definitions and satellite imagery. For the urban area within the municipalities of Chihuahua and Aldama, I used the settlement limits (*límite poblacional*) established in Figure 10 of the Program Territorial Development and Land Use Planning of the Metropolitan Area of Chihuahua (*Programa de Ordenamiento y Desarrollo Territorial de la Zona Metropolitana de Chihuahua - Gobierno del Estado de Chihuahua, 2016a*). Satellite imagery is used to estimate neighborhoods in Aquiles Serdán, since only developed land was desired. The polygons chosen resemble those of the legal definition, but do not include larger urban localities that have been traditionally separate from Chihuahua, such as Aldama City and Santa Eulalia.

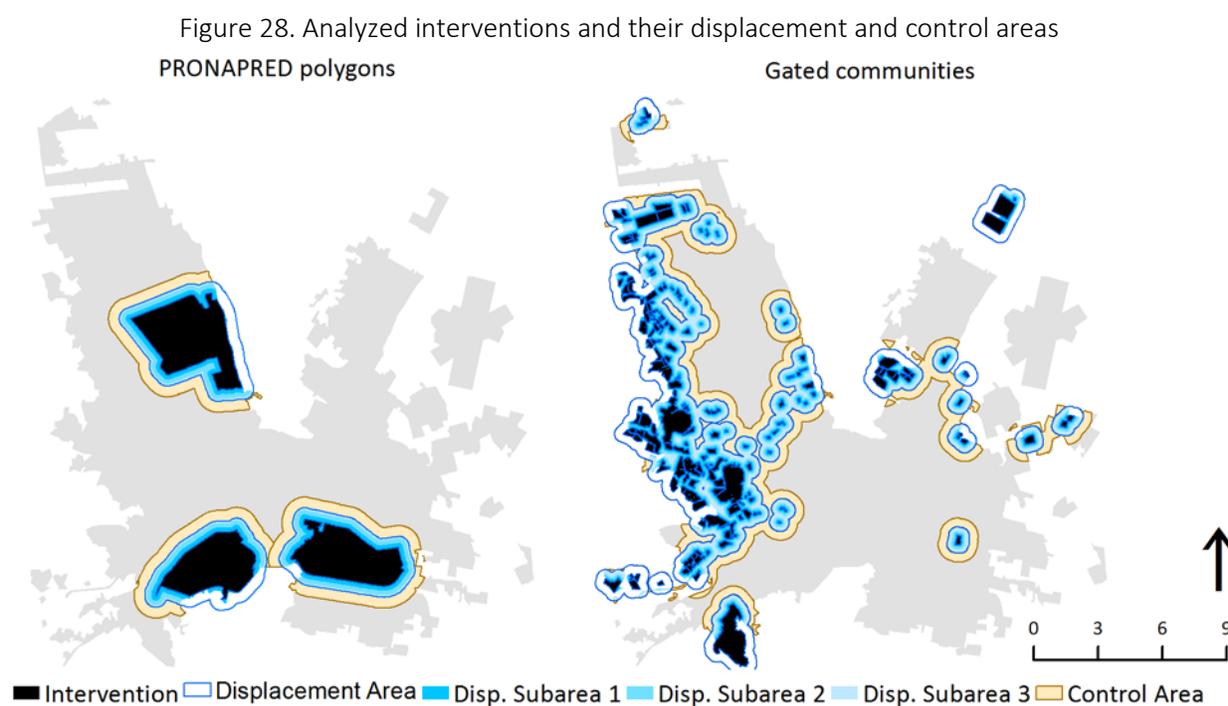
⁵ A shapefile is a vector data storage format for storing the location, shape, and attributes of geographic features. (<http://doc.arcgis.com/en/arcgis-online/reference/shapefiles.htm>)

Although WDQ can be calculated for crime counts, crime rates are computed to account for the possible effect on crime of different population growth rates throughout the city, especially due to the relatively high number of people living in densely populated social housing developments that are less than ten years old. This poses an additional problem since population estimates at the block or census tract level are only available on a ten-year basis, 2010 being the most recent count. As a result, the second step involves the estimation of populations for the following years. I use the March 17, 2017 population of precincts according to the electoral roll (*Lista Nominal*) of the National Electoral Institute (INE) to estimate a linear population change between 2010 and 2017 for each block. The electoral roll is used because it is the only publicly available population count at small geographical levels that is constantly updated, but issues with this data must be acknowledged. First, it only counts people who are at least 18 years old who registered to vote. Since voting registration is a requirement to obtain a national identification card (*credencial de elector*) with a 10-year expiration date and for many procedures, it is assumed that most people do enroll due to the benefits of obtaining this card, yet it is also likely that some people maintain the card with their previous address. The second issue is that it does not share the same source of the 2010 census data, which was collected by INEGI following a different methodology. Third, the boundaries of electoral precincts are not used by INEGI, which instead uses blocks (*manzanas*) and census tracts (*AGEBs*⁶) for small-scale statistical analyses.

To estimate the population by year, I first join a precinct shapefile that contains 2010 census information (total population and total population 18 and over) at that level with the 2017 electoral roll data table. Then I estimate the total population in 2017, assuming that the proportion of people over 18 that lived in the precinct in 2010 has not changed. Precincts that were subdivided take the value of the previous geography. An adjustment of -10% of the children population is made to account for the aging of the population. A field with information regarding the precinct in which it is located is added to the INEGI block shapefile by performing a spatial join. Not all blocks have housing use, and they are unpopulated. To account for this issue, population growth rates are only estimated for blocks that are not 'Services' according to INEGI, nor they are

⁶ Área Geoestadística Básica – Basic Geostatistical Area

larger than 1,000 square meters and have a population of less than 6 persons or an area larger than 10,000 square meters and a population of zero in 2010. The dissolve tool is used to count the number of blocks within each precinct, and the 2017 precinct population is then divided by the number of blocks, under the assumption that all blocks have the same population, which is unlikely, but not a problem since the data is later aggregated for the analysis. Finally, the 2017 block population is added to the original block shapefile and a linear population growth is estimated for each year between the value of 2010 and that of 2017.



Source: Created by author. Data for PRONAPRED polygons acquired from Citizens' Observatory

The third step is the creation of displacement and control areas, as seen above in Figure 26. Based on the familiarity approach of rational crime theories (Guerette, 2009), I assume that the displacement area occurs in a buffer around the analyzed intervention, which is likely to be the most similar place in the city in terms of physical design, connectivity, socioeconomic factors and other underlying factors that affect crime. The buffer for gated communities is 400m, which is based on a conversation with Cecilia Olivares, director of the Network, about the area of influence of small-scale interventions. They are 500m long for PRONAPRED polygons, due to the

larger size of the intervention. Displacement areas are further subdivided in three areas to perform an additional analysis, in which the WDQs of the three subareas are compared as a way to prove that displacement or diffusion are indeed related to the intervention, and are not related to other events. The control area is drawn as a buffer of the same length starting from the border of the displacement area, under the assumption that this zone is also the one that shares the most characteristics with both the intervened and the displacement area.

Having noted that other actors launched crime prevention interventions in the city during this time, the model tries to account for differences between displacement areas with other interventions and those without them. The areas of influence of public spaces intervened by the Network serve as an approximation of the effects of other programs on potential intervention by PRONAPRED, due to their place-based approach and their recognition as one of the most successful measures in the city. These areas are pictured in Figure 27 and, at least many of them in the South fall within the polygons and displacement areas of polygons 1 and 2 of PRONAPRED

Figure 29. Network interventions and their overlap with PRONAPRED



Source: Created by author. Data for PRONAPRED polygons acquired from Citizens' Observatory, data for Network Interventions retrieved from Facebook profiles of the Networks' Public Spaces

The fourth step involves the creation of two tables, one for crime points and one for blocks, which include attributes about their location in respect to PRONAPRED polygons, Gated communities, Network interventions and their respective buffers. This is necessary to ensure the confidentiality of the data, and it allows the author to know this information regardless of the exact point location of the crime. I then use Excel Pivot tables to count the number of crimes per year according to their characteristics. In the same way, a table with all the blocks and their populations and location with respect to the analyzed areas is created, and filtered in the same way to obtain the population of each of the areas between 2010 and 2016.

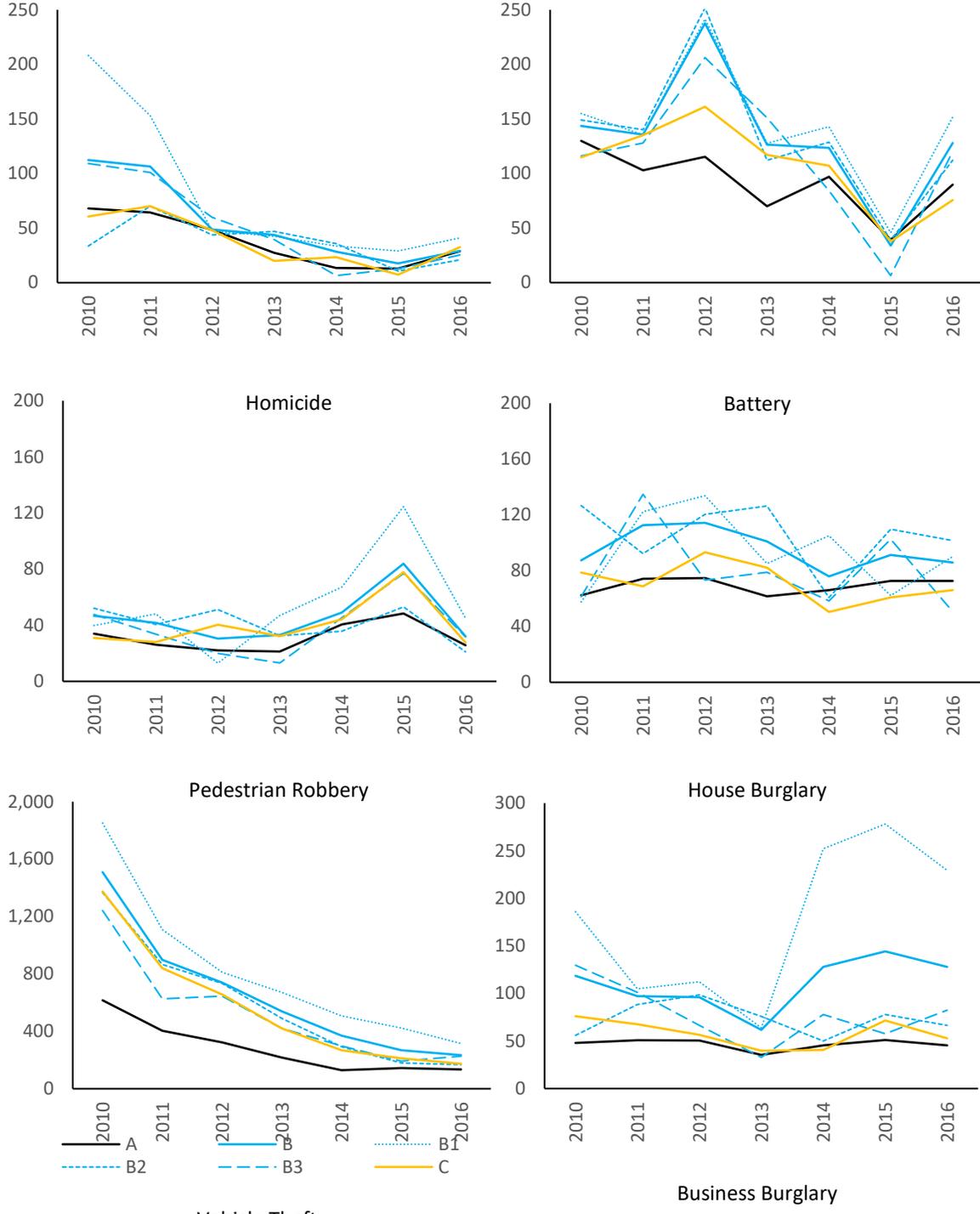
Weighted Displacement Quotients for PRONAPRED

Using information from the abovementioned tables, I first perform an exploration of the situation within PRONAPRED polygons, possible displacement areas, and control groups to examine crime rates throughout the period. Figure 28 shows that most crimes in these areas followed patterns similar to those of the rest of the city. For instance, crimes related to drug cartel activities decreased sharply, while other types of property crimes remained relatively stable, although showing an increase.

However some, features stand out. Battery cases in 2015 decreased, although this is likely be caused by flaws in the data. Additionally, the same year showed an increase in the number of pedestrian robberies and business robberies for the three areas of analysis. In addition, it is visible that the crime rate in the subarea that is closest to PRONAPRED polygons tends to be higher for homicides, pedestrian, vehicle and business robberies for multiple periods. On the other hand, PRONAPRED polygons seem to have lower rates of pedestrian robberies, vehicle thefts and business and house burglaries, a fact that raises questions regarding the selection of polygons based on crime incidence. It is important to note that, according to the analyzed data, the number of crimes committed every year decreased less in PRONAPRED polygons than in the rest of the city during the time of the intervention. In 2016, 45% less crimes were reported in the city than in 2012. This proportion was only 35% in areas receiving PRONAPRED funds. The situation is especially evident in Polygon 2, which only saw a decrease of 7%. The available data is not enough

to conclude that the intervention, and no other factors, caused a lower decrease in crime, but it shows that the intervention did not successfully trigger a larger reduction.

Figure 30. Crime rates per type of crime in PRONAPRED polygons and areas of analysis



Source: Created by author using data from Citizens' Observatory
 Note: A = intervention, B= displacement area, C= control area

Weighted displacement quotients are calculated for each year with respect to 2012. This year corresponds to time zero because the intervention was launched in 2013, so the first results are expected for this year. All years are calculated and shown in Table 7 because interventions can produce their results at different times, and WDAQs are interpreted according to the methodology.

Table 7. Weighted Displacement Quotients for PRONAPRED polygons

| <i>Crime</i> | <i>Buffer</i> | 2013 | 2014 | 2015 | 2016 |
|--------------------|---------------|--------|--------|--------|--------|
| Homicide | DA | 3.27 | -0.44 | 1.85 | 1.00 |
| | DA1 | 3.19 | -1.04 | 3.94 | -2.22 |
| | DA2 | 4.02 | -1.43 | 0.71 | 2.18 |
| | DA3 | 2.03 | 2.26 | 0.67 | 3.85 |
| Battery | DA | 3.31 | -1.69 | -1.77 | 0.46 |
| | DA1 | 3.42 | -0.86 | -0.88 | 1.08 |
| | DA2 | 5.08 | -1.89 | -1.63 | -0.17 |
| | DA3 | -0.10 | -2.59 | -3.41 | 0.66 |
| Business Burglary | DA | 81.43 | 6.39 | -1.75 | -21.19 |
| | DA1 | 212.77 | 18.52 | -10.53 | -68.85 |
| | DA2 | -94.03 | -2.21 | 3.63 | 14.00 |
| | DA3 | 197.90 | 3.26 | 2.05 | -11.15 |
| House Burglary | DA | -0.04 | 0.55 | 0.70 | 0.24 |
| | DA1 | 7.73 | 1.28 | -1.05 | -0.24 |
| | DA2 | -4.79 | -0.17 | 1.31 | 0.83 |
| | DA3 | -3.39 | 0.73 | 2.30 | -0.06 |
| Vehicle Theft | DA | 5.88 | -20.96 | 0.77 | 0.76 |
| | DA1 | 13.87 | -55.00 | 4.07 | 2.02 |
| | DA2 | 1.97 | 2.31 | -1.39 | -0.53 |
| | DA3 | 0.68 | -10.61 | -0.39 | 1.14 |
| Pedestrian Robbery | DA | 2.39 | 0.95 | 4.21 | 1.05 |
| | DA1 | 10.05 | 3.22 | 16.75 | 3.43 |
| | DA2 | -2.35 | -1.24 | -7.67 | -1.33 |
| | DA3 | -0.80 | 1.43 | 6.46 | 1.70 |
| All crimes | DA | 8.41 | 1.89 | 0.91 | 0.87 |
| | DA1 | 20.39 | 5.97 | 4.20 | 2.29 |
| | DA2 | 1.59 | -0.76 | -1.21 | -0.26 |
| | DA3 | 2.34 | 0.40 | -0.33 | 0.73 |

Source: Created by author using data from Citizens' Observatory

The results do not show any constant pattern, except for an apparent diffusion of benefits (values higher than zero) in 2013 for all crimes except house burglaries, which tends to dissipate with time. The only consistent exception is for pedestrian robberies, in which an apparent diffusion

of benefits appears to occur during the four years, obtaining values above or very close to one. This means that crime not only decreased in PRONAPRED polygons, but also in the surrounding areas. Although the causality cannot be attested, the high values in subarea 1 and its reduction when distance from the intervention increases, provide proof that the change may be due to PRONAPRED funded strategies. Additionally, since the rate of pedestrian robberies has risen at a much lower rate than in the rest of the areas, the program seems to be successful in deterring this crime.

The next step considered whether marginalization rates of the area prone to displacement affected the levels of displacement. I calculated WDQ for each year and for each marginalization rate. Since the analysis is on the displacement areas, the crime rates and population remained untouched for the intervention and control areas, and only new crime and population estimates were conducted in the displacement area. An analysis of variance of WDQ values shows that the level of marginalization affects displacement/diffusion with a significance level of 10%, and that the expected change is an increase towards diffusion of crime to areas with low and medium marginalization, but a, movement towards a diffusion of benefits in neighborhoods with very low and high marginalization levels. Table 8 shows the results of the F-test used for the analysis of variance, in which I used numerical values for marginalization levels (1 = Very low – 5 = Very High). This is potentially related to the idea that offenders move to familiar areas, and since PRONAPRED polygons mainly contain areas in low and medium marginalization, crime would be expected to move to zones with the same rates. I exercise caution in the interpretation of these results, mainly because the number of crimes reported in certain areas (specifically in areas with high marginalization, which account for only 2% of the city population), as well as their population, is very small, and a small change can trigger large changes in criminalization rates.

Table 8. F test for marginalization effects on displacement/diffusion

| | Df | Sum | Sq Mean | Sq F value | Pr(>F) |
|---|----------|----------|----------|------------|--------|
| marg | 3 | 401 | 133.67 | 2.679 | 0.0517 |
| year | 3 | 88 | 29.17 | 0.585 | 0.6266 |
| Residuals | 89 | 4440 | 49.89 | | |
| --- | | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | | |
| (Intercept) | marg2 | marg3 | marg4 | | |
| | 2.255497 | -0.26673 | -1.41239 | | |
| | year2014 | year2016 | year2016 | | |
| | -1.66169 | -2.42415 | -2.23594 | | |

Source: Created by author and Salomón, Jacobo (ETH-Zurich) using data from Citizens' Observatory

Finally, I estimate WDQ values for areas within a 400m buffer from Public Spaces of the Network, and find that a diffusion of benefits occurred throughout the period for battery cases, and business and house robberies, while displacement occurred for homicides in the first year (see Table 9). This means that, although homicide rates decreased from 45 to 23 per 100,000 people during 2012-2013 period, the change in homicides did not decrease more than that of the intervened area. However, a causal relation can only be assumed. Yet these results are consistent with the anecdotal information provided by Cecilia Olivares, who in an interview asserted that the Network interventions in public spaces had reduced business robberies and businesses were thriving around the interventions, while the impact on high impact crimes, such as homicides was negligible.

Table 9. WDQ values for Network Areas of Influence within PRONAPRED influence

| | 2013 | 2014 | 2015 | 2016 |
|--------------|-------|-------|-------|-------|
| All crimes | 15.39 | 2.81 | 2.22 | 2.01 |
| Homicide | -1.33 | -0.01 | -0.24 | -0.13 |
| Battery | 8.77 | 2.09 | 0.15 | 1.38 |
| Business R | 1.22 | 0.48 | 0.15 | 0.42 |
| House R | 4.89 | 0.95 | 0.84 | 0.54 |
| Vehicle R | 4.38 | -1.18 | -0.40 | -0.45 |
| Pedestrian R | -2.55 | 0.48 | 1.73 | 0.26 |

Source: Created by author using data from Citizens' Observatory

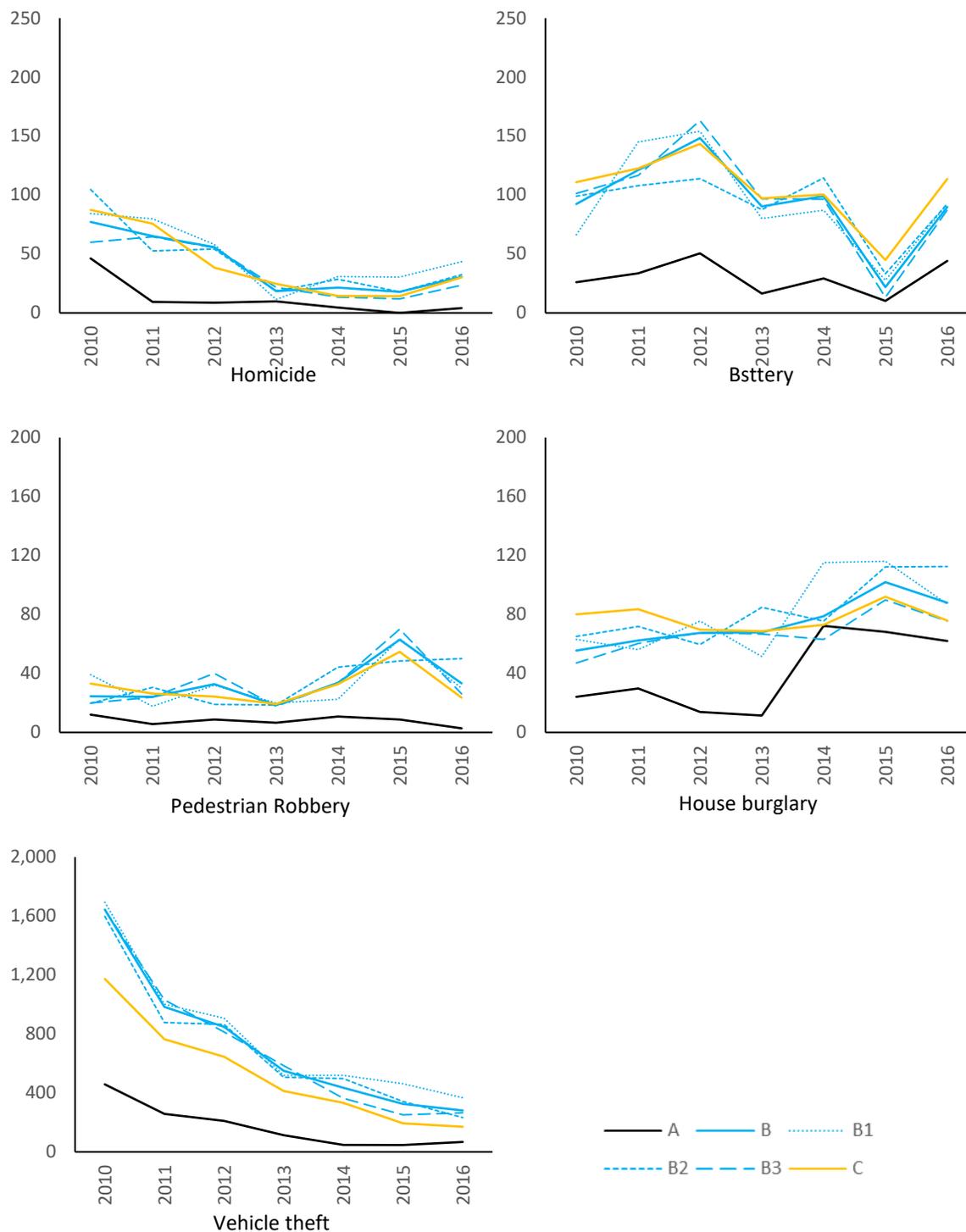
Displacement caused by gated communities

I take a similar approach to study displacement of crime in areas adjacent to gated communities. Crime rates are lower in gated communities than in any other area analyzed this far, including PRONAPRED polygons (see Figure 29). This is the case for all types of crimes, except house burglaries, which show an increase in crime rates between 2013 and 2014 that is much higher than that of the rest of the city. However, this could be related to a number of factors, including the attractiveness of houses in areas that are considered higher-income, the relaxation of protection measures (e.g. allowing the gates to be open during daylight hours), or the actual attractiveness of a gated area. Crime rates are not computed for business robberies, since gated communities are completely residential areas, and business robberies recorded in these areas are likely georeferencing errors.

The analyzed data shows that although gated communities consistently had lower crime rates than the rest of the city, the gating of new areas was not a successful measure to further reduce the number of offenses happening in them. This is demonstrated by a slower reduction in the number of crime events per year in comparison to the rest of the city. While the total number of crimes happening in the city decreased by 65% between 2010 and 2016, it only did so by 50% in gated communities. In fact, this number has increased steeply in the last three years for gated communities.

In terms of displacement, the analysis fails to find sustained trends of either diffusion of crime or displacement of benefits for most crimes, as seen on Table 10. The only apparent case of displacement of crime is for pedestrian robberies, but the causality is not satisfied by the subarea analysis, since most displacement seems to happen in the outer subareas, rather than right next to the intervention. On the other hand, house robberies seem to show a diffusion of benefits that is about equal to the effects of the intervention, but this does not mean that gated communities reduced house robberies around them, since the intervention actually increased house robbery rates.

Figure 31. Crime rates per type of crime in gated communities and areas of analysis



Source: Created by author using data from Citizens' Observatory
 Note: A = intervention, B= displacement area, C= control area

Table 10. WDQ values for gated communities and their areas of influence

| <i>Crime</i> | <i>Buffer</i> | <i>2011</i> | <i>2012</i> | <i>2013</i> | <i>2014</i> | <i>2015</i> | <i>2016</i> |
|--------------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Homicide | B | 0.05 | -1.88 | 1.02 | -2.91 | -0.71 | -0.33 |
| | B1 | -0.22 | -1.82 | 3.80 | -5.62 | -2.22 | -1.21 |
| | B2 | 1.24 | -0.71 | 3.37 | -3.75 | -0.11 | 0.31 |
| | B3 | -0.42 | -2.50 | -1.49 | -1.16 | -0.28 | -0.23 |
| Battery | B | 4.05 | 1.73 | -1.43 | 2.76 | 37.37 | -0.27 |
| | B1 | 15.25 | 4.09 | -3.34 | 4.88 | -1.98 | 1.43 |
| | B2 | -0.33 | -0.85 | -0.12 | 4.46 | 16.72 | -0.51 |
| | B3 | 0.96 | 1.92 | -1.19 | 0.88 | 66.86 | -0.96 |
| House Burglary | B | 0.94 | -2.72 | -2.18 | 0.56 | 0.94 | 0.90 |
| | B1 | -2.08 | -2.91 | 0.30 | 1.15 | 1.07 | 0.69 |
| | B2 | 0.87 | -0.42 | -3.16 | 0.32 | 0.92 | 1.30 |
| | B3 | 2.40 | -3.79 | -2.85 | 0.40 | 0.88 | 0.79 |
| Vehicle Theft | B | 2.11 | 1.32 | 0.61 | 0.37 | -1.89 | 44.14 |
| | B1 | 2.48 | 0.59 | 1.58 | -0.48 | -6.34 | 127.08 |
| | B2 | 4.00 | 0.33 | 1.15 | -0.53 | -2.73 | 0.73 |
| | B3 | 0.98 | 2.16 | -0.13 | 1.25 | 0.67 | 27.12 |
| Pedestrian Robbery | B | -1.18 | -124.45 | -8.86 | -8.55 | -2.02 | -2.71 |
| | B1 | 3.35 | -27.97 | 5.76 | 14.44 | 0.08 | -0.36 |
| | B2 | -3.74 | -37.67 | -14.84 | -22.25 | -1.42 | -6.17 |
| | B3 | -2.04 | -214.63 | -12.78 | -12.47 | -3.33 | -2.03 |
| All crimes | B | 1.74 | 0.32 | 0.55 | 0.42 | -2.44 | 0.61 |
| | B1 | 1.36 | -0.36 | 1.38 | -1.02 | -8.06 | 7.47 |
| | B2 | 3.15 | 0.77 | 0.90 | -1.74 | -2.57 | 0.48 |
| | B3 | 1.21 | 0.41 | -0.03 | 2.21 | 0.31 | -2.61 |

Source: Created by author using data from Citizens' Observatory

Since a very large part of gated communities (at least 93%) is located within areas of very low marginalization, I do not conduct a test to show the effects of marginalization scores on crime displacement. The reason for this is that, even if the results showed displacement within proper significance levels, the population living in any area other than very low marginalization would be so small that a small change in crime rates would cause a large change in WDQ values.

However, about 6,000 people live in possible displacement areas that are less than 400m away from Network public spaces, so the analysis of this variable is adequate for the study. The results are shown in Table 11. A diffusion of benefits larger than the effects of the fences within the community is found for vehicle thefts between 2011 and 2015, while a displacement of crime for house robberies appears to occur in the same period. Nevertheless, the clustering of this

population among neighborhoods in the Eastern side of the city could indicate that these values are rather the results of spatial differences.

Table 11. WDQ values for Network Areas of Influence within gated community influence

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------------|-------|-------|-------|-------|-------|-------|
| All crimes | 3.14 | 2.89 | 3.60 | -2.35 | -3.97 | 1.77 |
| Homicide | 0.65 | -0.27 | -0.11 | 0.13 | 0.07 | -0.24 |
| Battery | -0.19 | 0.32 | 0.32 | -2.64 | 0.07 | 2.73 |
| House R | -0.28 | 0.00 | -1.09 | -1.66 | -2.81 | 3.97 |
| Vehicle R | 1.88 | 3.30 | 4.38 | 3.36 | 4.83 | -8.59 |
| Pedestrian R | 0.43 | 0.11 | 0.00 | -0.56 | -1.52 | -0.82 |

Source: Created by author using data from Citizens' Observatory

V. Conclusions and Recommendations

The analysis does not find evidence of displacement for most types of crimes to areas surrounding gated communities. Similarly, it does not conclusively provide sufficient evidence that social interventions, such as PRONAPRED, have a positive effect (diffusion of benefits) on crime rates in neighboring areas at the city level, although regional variations within the city likely occur. The only exception is for pedestrian robberies, which are shown to decrease in PRONAPRED buffers and increase around gated communities throughout the analyzed period. Although the numbers must be read carefully because both types of interventions did not successfully reduce this crime in areas of, this calls for a small-scale study of pedestrian robbery displacement, including interviews with offenders to attest the causality of the intervention as the driving force towards displacement. However, this finding shows that, at least for certain types of crimes, private protective approaches are related to an increase of crime in neighboring areas, while public place-based interventions can potentially decrease offenses in and around them.

The analysis also provides evidence that crime displacement or a diffusion of benefits, when either occurs, are likely to happen in areas that more or less share some socioeconomic characteristics with the area of intervention. Specifically, it shows that crimes within PRONAPRED

polygons are more likely to relocate to areas with low and medium marginalization rates, which are also, where the majority of the population of these polygons live. This is also stated by some rational choice theorists who claim that offenders are more likely to move to places that are either more familiar to them or that provide environments to which they can adapt easily (Clarke, 1983; Guerette, 2009; Weisburd et al., 2006). However, the analysis is only able to state this with a 10% confidence level, and other possible explanations need to be considered.

Another finding of this study is that other interventions launched in areas with place-based interventions have an impact on the displacement of crime or the diffusion of benefits, and are likely to produce uneven changes in crime rates among areas of displacement. For instance, the public spaces intervened by the Network of Citizen Participation “1-2-3 for me and my community”, a successful place and community based primary prevention approach in the city of Chihuahua, deters crime displacement from PRONAPRED polygons for most property crimes, although not for high impact personal crimes, such as homicides. This means that, even if crime displacement occurs from the intervention to adjacent regions, this additional intervention reduces the negative impact of the other analyzed intervention.

Finally, the study shows that, although displacement has not been a consistent effect of the analyzed interventions, these have also not prevented crimes at hot spots at a higher rate than that of the rest of the city. This means that the reduction in the number of crimes, or crime rates, is related to citywide trends, rather than to the intervention itself. These trends emerge from socio-economic environment, the presence of other organizations and other place, community and crime-based government programs launched in the region, the dynamics of criminal organizations, and even the political context. However, they could also be related to a poor design of the interventions. For instance, PRONAPRED polygons in Chihuahua are not located in areas with above average criminal activities, but rather in places where crime is already low.

These conclusions and findings emerging from the quantitative analysis, as well as the literature on crime displacement and the interviews that constitute the qualitative core of this study, help the framing of the following recommendations:

- **For future research on displacement:**

- 1) **Analyze the problem at a smaller scale.** The previous finding is based on a sample of crime points that are mostly located within a particular area of the city, and around only one PRONAPRED polygon. Crime displacement is better analyzed at a small-scale, rather than at a city level as was performed by this study. This is consistent with the opinion of many environmental criminologists, who claim that the opportunities for crime are influenced by small features like corners, abandoned plots or houses, trees, shadows or surveillance cameras. A large-scale approach was taken to study PRONAPRED interventions and the phenomenon of gated communities as a whole with sufficient data points, but further studies should be conducted to demonstrate the success of place-specific interventions.
- 2) **Displacement should be studied hand-in-hand with crime prevention triggered by the intervention at hot spots.** This analysis shows the evolution of crime rates together with weighted displacement quotients to ensure that the changes captured by the methodology were in fact in the expected direction. For instance, although displacement is found for pedestrian robberies from gated communities, and an opposite diffusion of benefits is found for PRONAPRED polygons, both intervened areas also showed an increase of this crime within their boundaries.
- 3) **Establish a causal relation between interventions and crime displacement / diffusion of benefits.** A number of methods are available to prove the causal relation between both concepts. Due to time and resource limitations, this study uses subdivisions of the displacement area, under the assumption that more crime would move to places closer to the intervention. A more sound approach requires interviewing offenders and former offenders and asking them if the intervention affected their decision to either commit or not commit a crime.

- 4) **Take into account that larger context that influences both crime prevention and displacement.** This study provides contextual information about the socioeconomic and crime characteristics of the analyzed city, as well as its relation to a national problem, that of the war on drugs, which had local impacts that generated more crime in the city. A further examination should take into account the effect of other federal programs, such as SUBSEMUN, and municipal level interventions, like the three mentioned in this paper, on the outcomes of place-based interventions.
 - 5) **Study the displacement of pedestrian robberies at a smaller-scales and using normalization measures that account for non-resident population.**
 - 6) **Take into account the dichotomy between reported and actual crime rates.** Data from ENVIPE (2016) shows that in Chihuahua, only 12% of crimes are reported and followed by an investigation. This is one of the highest proportions in the country. Certain interventions, such as the community-based approach of the Network, make residents more aware of criminal activities in their neighborhoods and more likely to report crimes and make demands to their authorities. This would mean that their problems would be more visible, both in media articles and on crime databases. In fact, this analysis finds that areas surrounding the Network's public spaces have decreased their crime count 5% less than gated communities, 11% less than PRONAPRED polygons and 20% less than the whole city. However, anecdotal evidence, as well as an analysis of specific crime types shows that this may be related to higher reporting rates.
- **For policymakers looking to design a successful place-based prevention strategy, it would need to:**
 - 1) **Provide community-based planning of interventions, rather than dictating policies from the center.** The experience of the Network shows that community participation does not only reactivate public spaces, but makes populations more aware of their surroundings and necessities and fosters their cooperation on detecting potential crime hot spots.
 - 2) **Reduce the scale of its interventions to areas that are real crime 'hot spots'.** PRONAPRED polygons in Chihuahua (and other cities) are large in terms of area and population, with

areas between six and nine square kilometers and populations surrounding 60,000 people. As such, it is impossible for the program to reduce crime opportunities for all potential targets and places. A closer collaboration with communities can help with the identification of hot spots that require special attention.

- 3) **Base federal level interventions on empirical evidence, and adapted to specific place-based needs.** The analyzed data showed that PRONAPRED did not reduce crime in the intervened polygons more than the reduction that occurred in the rest of the city. One of the reasons mentioned by program managers, the director of the Network and the assessment made by Chapa Koloffon and Ley for México Evalúa (2015) is related to the questionable relation of many of the program's actions to crime prevention. This evidence should not only come from previous interventions in the area or in other places, but from reliable information collected by program managers. This requires providing more time for local-level managers to measure baselines and capture community needs through well-designed surveys.
- 4) **Coordinate the implementation with programs launched by state and municipal governments, as well as communities.** In Chihuahua, the municipal and state governments established place-based primary and secondary prevention interventions in clearly defined areas that did not coincide with those drawn by PRONAPRED or those where NGOs worked. This prevented cooperation in areas where programs did not overlap.
- 5) **Make the municipal rather the state government the distributor of federal funds at the city level.** The municipal government is in a more direct contact with community organizations and, as such, it should understand better the specific problems that make some areas more prone to crime, especially if it is in constant contact with community organizations. Additionally, according to the interviews and research that are part of this analysis, the addition of the state government in place-based strategies does not only make the distribution of resources inefficient, but potentially increases corruption and misappropriation of funds.
- 6) **Standardize the selection of intervention areas and actions.** Although the selection of municipalities that receive the funds follows a standardized formula, it tends to favor

those with large populations, rather than those more affected by crime. Additionally, the selection of the polygons is obscure and, at least in the case of Chihuahua, they target areas with crime rates that are lower than those of the rest of the city across time.

- 7) **Provide more transparency on how the funds are spent.** Provide public access to how funds are spent and not only to who executes them, and establish an understanding that results of the program within and outside the intervention may take long to appear due to the long-term nature of many of the actions.
- **For city government officials facing pressures from neighborhood organizations and developers to privatize public spaces:**
 - 1) **Although gated communities are not shown to displace most types of crime, their impact on social cohesion make them undesirable.** In Chihuahua, the privatization of security appears to create less crime than in other areas, but this is also likely related to other socio economic characteristics that accompany them, such as very low marginalization rates. Research on gated communities in other cities, especially in Latin America, notes that they privatize security and suspend the rule of law within their boundaries. Additionally, they create an alternative city for the middle and upper classes, connected by car-dependent transportation systems, and that segregates them from the rest of the population.
 - 2) **Gated communities can also have a negative impact on citywide crime prevention.** In addition to the segregation they produce, gated communities create a problem can potentially affect public crime prevention strategies. For instance, they produce spaces that are ruled by internal codes and where the police and other public vehicles have restricted access. In Chihuahua, Heliodoro Araiza notes that, despite the huge investment in improving the salaries of police officers to prevent them from colluding with criminal organizations, people would opt to rely on private security guards with salaries that were one fourth of that of a police officer. Additionally, houses in these areas have been used to hide armament, victims and criminals (García, 2011). Furthermore, these communities

have been found to create problems among their inhabitants, who do not always agree on the fencing of the street and the operational costs (García, 2011).

- **For those seeking to establish long-term interventions:**
 - 1) **State and municipal governments, the private sector, and NGOs should work together to ensure the permanence of successful programs, regardless of administration changes.** The analysis of local level intervention shows that public approaches are unlikely to be adopted by future administrations, even those from the same party, unless a combination of actors are involved. In Chihuahua, Marco Quezada and Heliodoro Araiza spoke about the discontinuation of their three-prong strategy by the following administration, which also emerged from the Institutional Revolutionary Party (PRI). They further explained the problems to obtain federal resources through the state government, despite the both levels being administered by PRI. However, some of their strategies, like a Hospital in Vistas Cerro Grande or CCEDIPOL, which receive a large support from private sources, remain in place and are some of the most successful measures. Similarly, Cecilia Olivares speaks about the problems of the Network to obtain support from certain administrations, despite having received the recognition of national and international organizations. However, they still receive funds from the private sector, and even from the communities, to launch the recovery of public spaces.

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