The author(s) shown below used Federal funding provided by the U.S. Department of Justice to prepare the following resource:

CRIME, PLACE, AND NETWORKS IN THE AGE OF THE INTERNET:

THE CASE OF ONLINE-PROMOTED ILLICIT MASSAGE BUSINESSES

A dissertation presented

By

Ieke de Vries

to

The School of Criminology and Criminal Justice

In partial fulfillment of the requirements for the degree of Doctor of Philosophy

in the field of

Criminology and Justice Policy

Northeastern University

Boston, Massachusetts

March 2020

CRIME, PLACE, AND NETWORKS IN THE AGE OF THE INTERNET:

THE CASE OF ONLINE-PROMOTED ILLICIT MASSAGE BUSINESSES

A dissertation presented

By

Ieke de Vries

ABSTRACT OF DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Criminology and Justice Policy
in the College of Social Sciences and Humanities of
Northeastern University
March 2020

2

Abstract

The association between crime and place is one of the most empirically supported notions in criminology. However, less is known about whether the internet has impacted the environmental conditions that contribute to crime in physical space. To address this gap, this dissertation examines the intersection of crime, place, and networks in the context of online-promoted illicit massage businesses (IMBs). IMBs are establishments that host a wide variety of crimes and deviancies, and have recently gained attention due to their connection to human trafficking operations. While commercial sex and sex trafficking in IMBs are promoted through online classifieds and review boards, the illicit behaviors still require an offline act or transaction in stationary locations such as storefronts. Therefore, IMBs offer a compelling case to understand whether a criminology of place perspective applies to online-promoted crimes.

Using innovative data and robust, quantitative and computational methods, this study shows that the geography and use of IMBs are driven by environmental conditions that are central to criminological theory about crime and place. However, the findings also suggest subtle changes to the geography of online-promoted crimes. In particular, IMBs and clientele demand were identified in neighborhoods that on the one hand feature aspects of social disorganization and crime opportunity theories, and on the other hand were theoretically unanticipated (e.g. in advantaged areas). Moreover, many clientele traversed neighborhood boundaries to frequent IMBs, connecting both spatially proximate and distant neighborhoods in patterns of crime. Lastly, the findings show the limitations of current policing models that are challenged by the locational flexibility of IMBs. Overall, these findings raise questions about a criminology of place in the digital age, call for theoretical integration, and a response model that engages online and offline domains and involves partnerships within and outside of the criminal justice system.

Acknowledgments

I am grateful for everyone who has helped me approach academia as a collective endeavor to find solutions to complex problems and supported me throughout my PhD. The impetus of this work stems from conversations with and assistance from the Attorney General's Office in Suffolk County, especially Beth Keeley and Sindhu Kadhiresan. It is through them that I gained a strong interest in the issue of IMBs. They also connected me to several other partners in Massachusetts, Washington State, and Texas, the three sites of this study. I am grateful for the generous time each of these partners have devoted to this project and it is encouraging to see the investment in the field to think creatively about solutions to the problem. Furthermore, this research has been supported by a Graduate Research Fellowship of the National Institute of Justice (2018-R2-CX-0005), which underscores the importance of this issue at the national level.

I am eternally grateful for the support of my advisor, Dr. Amy Farrell, who has taken me under her wing for the last five years, supported me through every academic and personal challenge, and taught me how to grow as an independent scholar. You are the expert, leader, and mentor that I would like to be for others, and I could not have wished for a better advisor who helped and trusted me to experiment with ideas. As the co-director of the Violence and Justice Research Laboratory (VJRL), you have also provided me with plentiful opportunities to develop leadership and mentorship skills through fruitful collaborations with faculty and students. Many of my ideas developed in the VJRL and were challenged by each of the lab members who have graciously offered their time to review parts of this dissertation. My appreciation for your time extends to Shea Cronin and Maddie, who at various times were part of this journey.

I am also immensely thankful for the input of each of my committee members, Dr. Anthony Braga, Dr. Nick Beauchamp, and Dr. Andrew Papachristos. You have taken on a role

4

beyond what is commonly expected from committee members. Your time, feedback, and thoughts have been instrumental to improving previous versions of this dissertation. Your unique set of perspectives helped ensure the quality and impact of this project, especially as it pertains to your expertise on policy-oriented research on violent crimes, advanced network techniques to illuminate crime complexities, and the application of computational statistical tools in the social sciences. I am honored to have had the opportunity to learn from your work and perspectives.

This dissertation builds upon the support of various others who directly have contributed to my academic work. This includes Dr. Jack McDevitt, Director of the Institute of Race and Justice, and Dr. Carlos Cuevas, co-director of the VJRL. Your feedback and our conversations have provided an important foundation for my academic work, and encouraged me to focus on its purpose to impact policies addressing crime and victimizations. Thank you also, Dr. Greg Zimmerman, for always being available to discuss, read, and provide feedback on my work. Laurie Mastone, Jennifer Smith, Dakotah Kennedy, and Linda Cook: Thank you for helping me navigate a PhD trajectory. I am also sincerely grateful for the assistance of Nan Regina and Andrea Goldstein at the Institutional Review Board (IRB) in helping me obtain research approval for this study. Jason Radford, thank you for your generous time and commitment since the very start of the project, even though you were still working on your own PhD. With your help, I have devoted myself to a computational social science. Stuti, I am incredibly thankful for our friendship since day one and your help in so many different ways, including never holding back on feedback when you thought it would make my work better. Katie and Jen, thank you for making this process a fun one during our (nearly) weekly writing sessions, and to show me how to take life with a grain of salt. I am immensely proud of and grateful for our friendship. Emma, Andrea, Eileen, Monica, Andrew, and Beck: Your work has helped me to improve mine and to

5

grow together as part of fun and hard-working cohorts has been a true asset of my PhD. Sarah, Candi, Kelly, Matt, and Stephen: Thank you for listening to my ramblings, engaging in many conversations, and sharing your exciting ideas. This is also an opportunity for me to thank Corinne Dettmeijer-Vermeulen, who had a vital role in shaping my career path by believing in my capabilities, and investing time to improve those. As the Dutch National Rapporteur on Trafficking in Human Beings, you have laid the ground for a policy-oriented research agenda.

I wish I could mention and thank every other person with whom I have interacted and most likely talked about research in some of kind of way. A special thanks go to my parents and sisters for understanding my motivation to pursue a path that is so different from yours. While having lived in different parts of the world and being confronted by the difficulty of being away at several occasions, you have always shown trust and support and joined every journey with me by being just a phone-call away. You have taught me how to learn and how to work hard toward my goals, and showed me the value of being exposed to different perspectives, which drives the interdisciplinary nature of my research. I am also grateful for the friends who stayed on my side throughout my PhD, who know what it is like to pursue a PhD, and whom I deeply trust to share my thoughts. In particular, Julia and Suzy, I have been so fortunate to walk this path together with you and could not have wished for better support and friendships that have now extended beyond our Somerville house. Thank you, Sanne, Bert, Bastian, Rosa, Annelien, Hanne, and Tess, for bringing a little piece of home in Boston, and Bastian, also for your econometric perspectives on this study. Maarten, thank you for always being a continuous source of love and support. You challenge me to push further, beyond my own knowledge and skills, and to embrace every inquiry as one big learning opportunity. Lastly, to all my cousins, nephews, and nieces: I hope you find a way to create your unique learning path.

Table of Contents

Tables

Figures

Chapter 1   Introduction

Illicit massage businesses (IMBs) are a matter of public concern. While presumably

hidden, crime and victimization in IMBs occur in stationary locations such as physical

storefronts, offices, or apartments, of which at least 9,000 exist across the U.S. (Polaris, 2018).

IMBs operate under the guise of legitimate massage while hosting a wide range of different illicit

events, including commercial sex, human trafficking, robberies, and organized crime (Dank et

al., 2014; Polaris, 2018). In addition to hosting crime events, a recent study suggests that IMBs

can also increase overall levels of crime and disorder in their surrounding neighborhoods (Huff,

Wallace, Riggs, Katz, & Choate, 2018). As such, IMBs might be understood as risky facilities, a

term that has also been used to describe nightclubs, pubs and taverns, red light districts, or other

facilities that can host or generate crime (Bowers, 2014; Eck, Clarke, & Guerette, 2007; Roncek,

1981). Nonetheless, IMBs differ from these risky facilities because their existence explicitly

relies on illicit means. In addition, IMBs are often promoted by publicly accessible online

platforms that advertise commercial sex, and provide clientele unheralded access to the locations

of IMBs (Bouché & Crotty, 2017; Chin, Takahashi, & Wiebe, 2019; Huff et al., 2018).

Although the presence of IMBs is not new (Armstrong, 1978; Bartley, 1994; Bryant &

Palmer, 1975), they have only recently been couched as part of a national human trafficking

problem (Polaris, 2018). Human trafficking involves the exploitation of sexual services and labor

through force, fraud, or coercion,[1] and can manifest itself in IMBs through exploitative

---

[1] Commercial sex and sex trafficking are criminalized under different federal and state legislations. Sex trafficking is criminalized as a form of human trafficking under the Trafficking Victims Protection Act (TVPA) in 2000 that defines it as "the recruitment, harboring, transportation, provision, obtaining, patronizing, or soliciting of a person for the purposes of a commercial sex act, in which the commercial sex act is induced by force, fraud, or coercion, or in which the person induced to perform such an act has not attained 18 years of age" (TVPA,

12

circumstances such as forced sexual services, long working hours, no or little pay, or working and living in the same location. In response to concerns about human trafficking victimizations, the Department of Justice has awarded over $100 million to anti-human trafficking efforts that involve the identification and protection of victims, in addition to investigations and prosecutions of offenders (U.S. Department of United States Department of Justice, 2019). While not all these resources are devoted to combatting IMBs, these venues are considered as one of the top venues for sex trafficking. For example, about a fifth of the calls to the National Human Trafficking Hotline in 2019 concerned IMBs, which comprised the largest group compared to a variety of other places such as residences or hotels (National Human Trafficking National Human Trafficking Hotline, n.d.). On local level, police departments often respond to IMBs and other human trafficking problems using traditional vice tactics, such as reactive investigations, sting operations, or undercover work (e.g. Blakinger, 2016; see more broadly Farrell, Dank, et al., 2019; Farrell & Pfeffer, 2014). In addition to police, municipalities have also begun to respond to the problem of IMBs, for example by updating ordinances that impose stricter licensing requirements for massage therapy or facilitate closures of illicit venues (Polaris, 2018).

Despite increased concerns about human trafficking in IMBs, gains in our understanding of the locations and networks where these resources are most needed have been impaired by the absence of a coherent theoretical model, data and methods. Common problems in research on human trafficking are missing or flawed registrations, and limited access to public records about the problems (Farrell & de Vries, 2020; Farrell et al., 2009; Zhang, 2012).[2] The recent online

---

2000: Section 103, 8a). The elements of force, fraud, and coercion do not need to be proven for an act to be classified as commercial sex. In practice, different perspectives exist on the distinction or overlap between commercial sex and sex trafficking (De Vries & Farrell, 2019).
[2] An ongoing study about risk markers in online reviews of IMBs provides evidence of a 24/7 availability of women who live and work inside IMBs and are being rotated across venues,

promotion of IMBs – and human trafficking generally – leaves a digital footprint of illicit

behaviors, which this study utilizes to examine the geography of online-promoted crimes and

deviancies. A few prior studies have begun to analyze online classifieds or review boards to

estimate demand for commercial sex or explain an increasing number of IMBs in populous or

more affluent neighborhoods (Bouché & Crotty, 2017; Chin et al., 2019; Crotty & Bouché,

2018). While these studies suggest a systematic nesting of IMBs in certain neighborhoods, they

have not examined the geography of IMBs through the lens of criminological theory. It is

therefore possible that important crime-permissive features at the neighborhood level or at more

discrete locations are overlooked.

1.1   Theories of Crime and Place

This dissertation is guided by theories of crime and place. In particular, ecological and

situational theories of crime have been central in studies on other risky facilities (e.g. Bowers,

2014; Eck et al., 2007; Roncek & Maier, 1991) and may also provide viable explanations for the

geography and networks of IMBs. Contrary to theories of criminality that seek to explain why

certain individuals or groups have an increased propensity to commit crime, ecological and

situational theories of crime focus on the presence or absence of elements in the environments

surrounding crime events (Natarajan, 2017). Broadly, such theories posit that explanations of the

motivations behind criminality are insufficient to explain why, where, and when crime events

occur. Instead, theories of crime often imply an intricate connection between criminal

which can point to potential human trafficking situation (de Vries and Radford, in preparation).
However, using these risk markers to identify human trafficking with certainty is challenged by
the fact that human trafficking is often only one of the problems associated with IMBs. This
conflates signals of human trafficking with other crime and social problems such as robberies,
violence by clientele, and social inequality and stratification.

dispositions and place, the latter term is used broadly here to refer to any physical environment, big or small, that can exhibit crime-favoring features (see, about the use of the term 'place, Sampson, 2013).

The hypothesized place features that explain a nonrandom concentration of crime differ by theory and geographic focus. Two theories are prominent in the literature on crime and place and are central throughout this dissertation. First, social disorganization theory focuses on the neighborhood-level features associated with rapid change and socio-economic deprivation that make it difficult for a community to maintain social ties and prevent crime within their neighborhoods. The theory's roots go back to early observational work on commercial sex establishments, illicit vice areas, and disadvantaged communities (Heap, 2003; Park & Burgess, 1924; Reckless, 1925), which suggests some relevance for the context of IMBs. Second, crime opportunity theories emphasize the environmental features that signal low risk and high rewards, often at micro-geographic places such as blocks or street segments, and when the behaviors of offenders and suitable targets converge (Cullen, 2010; Felson & Clarke, 1998; Wilcox & Cullen, 2018). Both social disorganization and crime opportunity theories merit further examination in the context of IMBs, because the theories together may help illuminate an illicit market driven by rewards and risk avoidance as well as socio-economic problems associated with illicit and potentially victimizing means of employment in IMBs.

While these theories may help explain the spatial concentration of IMBs, they provide less guidance on how crime diffuses across geographic span. To explain such spatial diffusion, criminologists increasingly turn to social network processes. That is because many crime types are networked in the sense that individuals can co-offend or operate within a social network of other law-violating individuals (Papachristos & Bastomski, 2018; Schaefer, 2012; Tita & Radil,

15

2010). Crimes can then diffuse across geographic span through various social processes. For example, offenders can engage in crime in multiple neighborhoods or co-offend with someone residing in a different neighborhood. In doing so, they span a social tie between these neighborhoods, which are then connected in a complex system of crime and deviancy (see Sampson, 2004). It is through these inter-neighborhood ties that crime and deviancy can travel from one place to another. This diffusion has been observed in research on crime problems such as gang violence (Papachristos & Bastomski, 2018; Schaefer, 2012), and can be of particular importance for the problem of IMBs that involves the rotation of owners, clientele, and providers across venues (Polaris, 2018).

Through explanations of the spatial and geographic patterning of crime, a criminology of place helps inform crime responses that are directed at a physical space. To guide crime control and crime prevention strategies, criminologists have historically drawn from deterrence theory, which posits that crime can be prevented by increasing perceptions of risk among individuals contemplating illicit behaviors (Gibbs, 1975; Nagin, 2013a; Zimring & Hawkins, 1973). While altering the perceptions of risk among individuals is not in and of its own linked to place, discouraging individuals by diminishing criminal opportunities in their local environments is. Prevention through deterrence and reducing crime opportunities are often sides of the same coin when the objective is to increase perceptions of risk disproportionately to the perceived benefits from crime (Nagin, Solow, & Lum, 2015).

1.2   The Applicability of Place-Oriented Explanations to Online-Promoted Crimes?

Although the above theories have proven to be suitable, place-oriented explanations for the concentration, diffusion, and prevention of crime, the online promotion of IMBs raises an

important question: To what extent is crime indeed intricately linked to physical environments, when online platforms can reduce a dependency on physical cues and signal illicit opportunities at large geographic span? More precisely, is the presence and market for online-promoted IMBs driven by those environmental cues that are central to ecological and situational theories on crime? These questions are important for a criminology of place given that our communication patterns increasingly move toward an online space, potentially making the role of physical space less relevant to many social processes (Small & Adler, 2019; Wellman, 2001), including that of offenders.

Indeed, crime and deviant groups increasingly maintain a strong online presence and communicate with each other through online platforms like Twitter, Facebook, or crime-specific platforms such as those advertising for commercial sex (Blevins & Holt, 2009; Decker & Pyrooz, 2012; Pyrooz, Decker, & Moule Jr, 2015). In an online setting, motivated offenders can learn about illicit opportunities in any physical location (Holt, Blevins, & Kuhns, 2008, 2014; Wall, 2007), although this exposure to illicit opportunities might not change the geography of crime when online behaviors mirror offline empirical realities (see Mok, Wellman, & Carrasco, 2010; Sampson, 2017; Wellman & Hampton, 1999). While there is no doubt that new crimes and new modalities of crime are facilitated by online domains (Wall, 2007), little is known about how online domains may challenge our understanding of where and why crime occurs and question the effectiveness of existing responses to crime. This empirical void motivated the current study's purpose to explore offline geographies of online-promoted IMBs.

17

This resource was prepared by the author(s) using Federal funds provided by the U.S. Department of Justice. Opinions or points of view expressed are those of the author(s) and do not necessarily reflect the official position or policies of the U.S. Department of Justice.

1.3   This Study

The present study examines the relevance of traditional notions on the intersections of crime, place, and networks in the context of online-promoted IMBs. Theories about social disorganization, crime opportunities, social networks, and deterrence guided the analyses, which sought to answer the following questions about how an online facilitation may challenge our traditional place-based understanding of crime:

1. Do spatial proximity and physical cues of neighborhoods help explain the geography of IMBs within cities?

2. To what extent do web-facilitated clientele networks of IMBs connect neighborhoods in patterns of crime and deviancy and are clientele travels driven by spatial proximity and physical neighborhood features?

3. How do police enforcement actions impact the geography of online-promoted IMBs?

These questions were examined through innovative data and methods. Publicly-accessible data pertaining to 2,301 IMBs that were reviewed between 2011 and 2017 were extracted from one of the most popular review boards for sexual services in IMBs in the U.S.[3] These online data were matched with theoretically-relevant data about the neighborhoods where IMBs were located, including socio-economic characteristics, land use information, crime statistics, police presence, and spatial data. Place features were collected for census tracts and

---

[3] The web address is not provided in an effort to preserve confidentiality of providers, website users, and locations. While the website does not present a complete list of all IMB locations, it represents a sample of interest to the current study: those IMBs that were promoted by an online, popular platform. It should be noted that it is highly unlikely that the implementation of the Fight Online Sex Trafficking Act and the Stop Enabling Sex Traffickers Act (FOSTA-SESTA) had an impact on the findings. This law is an amendment to Section 230 of the Communications Decency Act (CDA) of 1996 and makes it possible to charge individuals and corporations behind websites for sharing sexually-explicit content and facilitating sex trafficking. The law was adopted in April 2018, and analyses in this dissertation concerned the year 2017 or earlier years.

18

cities in Massachusetts, Texas, and Washington State, which are states that host a substantial number of IMBs, and have prioritized the response against human trafficking problems in IMBs at municipalities and local police departments. Census tracts were selected as an approximation for neighborhoods (see also Morenoff, Sampson, & Raudenbush, 2001; Peterson & Krivo, 2009), where online social interactions might have a reasonable impact on intra- and inter-community ties. Using census tracts as the unit of analysis also allowed a comparison of the findings with previous studies on IMBs.

Each of the above research questions were answered through combining a theory- and data-driven approach in three interrelated empirical papers. The first paper applied a multilevel model to identify whether social disorganization and crime opportunity theories jointly help explain the spatial patterning of IMBs across census tracts. In a second paper, statistical social network analyses were used to examine how online clientele networks of IMBs connect both spatially proximate and distant neighborhoods in crime and deviancy. Clientele may not fall in traditional offending categories but are important to consider as conduits for the diffusion of deviant norms and illicit behaviors across neighborhoods. In a third paper, a quasi-experimental research design was used to analyze the impact of police enforcement actions on the prevention of new IMBs in or near the targeted areas. Subsequently, machine-learning techniques were used to assess a predictability of new locations of IMBs within cities after a series of police enforcement actions.

Together, the contribution of these papers is fourfold. First, this study fills a gap in prior research on IMBs or commercial sex and sex trafficking, much of which has been theory-agnostic or challenged by data limitations. With that in mind, the present study integrates innovative data, appropriate theory, and robust quantitative assessments. Through relying on

19

place-oriented theories and analyzing information about the locations of IMBs, the study of

IMBs is being situated in prior work on the larger ecological and social contours surrounding

crime events. Second, this dissertation contributes to theory development by extending the

application of theories on crime and place to an online-promoted crime type. Prior work has

urged criminologists to test "the extent to which criminological "facts" – the age-crime curve,

gender invariance, victim-offender overlap and peer effects – extend into online settings"

(Pyrooz et al., 2015, p. 494). This study presents the spatial and geographic distribution of crime

within cities as one such fact that might be impacted by the internet. Third, the study seeks to

contribute to a methodological discussion about a computational criminology that draws on new

forms of data and interdisciplinary methods, yet is not disconnected from important theoretical

concepts (see, about the integration of a data- and theory-driven approach, Lazer & Radford,

2017; Snaphaan & Hardyns, 2019). Fourth, this study provides an empirical model that can

direct crime prevention and crime control measures to those areas where they are most needed.

1.4   Roadmap of the Dissertation

The following chapters proceed as follows. Chapter 2 provides the theoretical

background for the theories guiding the analyses, highlighting central notions about social

disorganization, crime opportunities, social networks, and deterrence. The purpose of this

chapter is not to provide a comprehensive assessment and critiques of each of the theoretical

perspectives, but to introduce the core theoretical concepts that will be tested in the context of

online-promoted IMBs. Chapters 3, 4 and 5 include the three empirical papers, each of which

will describe the relevant theoretical and empirical background, data, and methods in more

detail. The overarching conclusions, limitations, and implications will be discussed in Chapter 6.

Chapter 2   Theoretical Background

An understanding of the geography of crime within cities is rooted in theories that have been developed prior to the emergence or popularity of the internet. The increasing use of the internet by crime and deviancy groups (Blevins & Holt, 2009; Pyrooz et al., 2015) can have implications for the core tenets of these theories, especially as it pertains to the offline geographies of online-promoted crimes. Considering that the internet allows for rapid, weakly regulated, and somewhat anonymous travel of information, crime can diffuse across greater distance (Wall, 2007). For example, an emerging literature has examined how online propaganda and online recruitment allowed terrorist groups to instigate acts of violence within and across regions (Weimann, 2006). Furthermore, cybercrimes such as online fraud (Holtfreter, Reisig, & Pratt, 2008) or antisocial and extremist groups (Chau & Xu, 2007; A Corb, 2011) can target victims virtually in any location, without relying on physical space at all.

Still, most theories of crime and place are not concerned with the extent to which crimes diffuse across geographic areas as large as countries or regions. Instead, the most fundamental theories of crime and place have been developed and tested with reference to local crime problems, those that concentrate within cities, such as robberies, gang violence, and illicit drug markets. The role of online domains in changing the geography of such crimes has had limited theoretical and empirical attention. While recent sociological or social media studies suggest that online activities may simply reflect offline identities and behaviors (see Mok et al., 2010; Sampson, 2017; Wellman & Hampton, 1999), it is possible that an increasing access and use of the online space has some impact on the geographic distribution of crime. Consider, for example, that the locations of burglaries can be influenced by an offender's ability to identify easy escape routes (e.g. a backyard) through Google Street View. Or, more pertinent to the present study,

21

clientele of commercial sex in IMBs can identify new venues online, beyond those that are located on their routine travels between work and home. Although the extension of a myriad of theories to the online domain could be discussed, the focus in this study on the distribution of online-promoted crimes *within cities* drives the following selection of theories.

2.1   Social Disorganization

Social disorganization theory explicitly links crime to the features of neighborhoods. The theory finds its roots in the Chicago School, particularly the work of Park and Burgess who examined the implications of industrialization and urbanization on crime and social problems in Chicago's neighborhoods in the 1920s (Park & Burgess, 1924). Park and Burgess' observations were articulated in the concentric zone model, which suggested that the expansion of central business districts created an adjacent "zone in transition", where the invasion of businesses activity in residential areas would cause some residents to leave while the most economically disadvantaged would stay behind. These zones in transition featured the highest levels of crime and deviancy in the city (Park & Burgess, 1924), including illicit and deviant sexual behaviors (Heap, 2003; Reckless, 1925). Other zones experienced fewer crime problems the further they were away from the central business district (Park & Burgess, 1924).

The concentric zone model laid the ground for what was later formalized as the social disorganization theory by Shaw and McKay (1942), which puts emphasis on the economic, cultural, and social deprivation that can accompany rapid and unintegrated urban change. The theory specifically links low socioeconomic status, population heterogeneity and residential instability to crime problems in neighborhoods. These neighborhood features were not hypothesized to directly cause crime, but indirectly would increase crime through reduced levels

22

of informal social control. For example, constant residential turnover challenges social relations and interactions between neighbors who may then be less likely to engage in informal social control mechanisms, such as calling out deviant behaviors or reporting crime to the police. Similarly, racial and ethnic heterogeneity was thought of as being associated with different cultural backgrounds and potential dissonance in values upon which to build cohesion and integration among residents. It is important to recognize that increased exposure to crime and victimizations in heterogeneous settings can also be explained by systemic social and economic inequality and relative deprivation (Bursik & Webb, 1982; Hipp, 2007). Furthermore, recent studies have challenged the connection between racial and ethnic heterogeneity, immigration, and crime, for example by showing crime-reducing effects of an influx of immigrant populations through a revitalization of disadvantaged areas and strengthening of familial bonds (Lee & Martinez, 2009; Martinez Jr & Stowell, 2012; Martinez Jr & Valenzuela Jr, 2006).

Social disorganization theory has undergone several important changes since the 1940s, especially in response to criticism about the lack of theoretical power due to vague mechanisms that link socio-economic problems to crime (Bursik, 1988). In that regard, a key contribution comes from the work of Sampson and colleagues who demonstrated collective efficacy as a critical factor that mediates the relationship between social disorganization and crime (Sampson & Groves, 1989). Collective efficacy combines the role of informal social control and social ties by suggesting that a cohesion among neighborhoods, for example through community-based organizations and neighborhood initiatives, can drive collective civic action against a problem (Sampson, 2012; Sampson, Raudenbush, & Earls, 1997).

Several other reformulations of social disorganization theory have been made since its first proposal by Shaw and McKay, including changes that draw attention to the structure of

23

contemporary cities that are socially and economically different from Chicago before the 1950s that provided the larger societal, historical, and temporal context for the development of the theory (Bursik Jr & Grasmick, 1993, p. 275; Kubrin & Weitzer, 2003). This has led to further refinements to the theory, for example by including additional social disorganization factors such as income inequality or factors of modern urban change such as gentrification (see, for a discussion, Kubrin & Weitzer, 2003). Despite these updates to the theoretical components, an important question regarding the applicability of social disorganization theory to contemporary cities yet awaits further empirical inquiry: How do online domains impact local patterns of (im)mobility, social cohesion, or the way we respond to neighborhood problems and initiate collective civic action?

2.1.1   Social Disorganization and Online Domains

Online domains are a particularly relevant larger social context that could influence local neighborhood dynamics, although it may not change the pervasive nature of spatial inequality that has been a "mainstay of the American urban landscape" (Sampson, 2017, p. 8958). As Sampson (2017) noted, neighborhoods constantly change, but patterns of urban (im)mobility and the distribution of social ties continue to be driven by economic resources and deprivation (see also Sampson, 2004). This is no less true for the distribution of online social ties, which have shown to be divided along demographic, socio-economic, and educational lines (Castells, 2002). Given these structural inequalities in the distribution of offline and online social networks, the neighborhood features that have traditionally been associated with limited social and economic stratification, such as mobility and social cohesion and integration, can continue to underlie spatial inequality in exposure to violence within cities (Sampson, 2004, 2017). More explicitly,

24

this would suggest that social disorganization theory maintains its relevance despite technological changes to our social fabric.

Nonetheless, more theoretical development and research is needed to understand whether traditional notions on neighborhood crime fit the urban landscape of cities in the 21st century. At least three potential factors of change within the urban landscape should be considered in empirical studies: 1) online domains may provide a means to further develop social cohesion (Goldsmith & Crawford, 2014; Hampton & Wellman, 2003), which can help monitor and encourage action against social and crime problems in neighborhoods; 2) social ties may span across neighborhoods when online domains take away significant physical barriers to connect (although structural inequality continues to be pervasive to such inter-neighborhood ties); and 3) deviant ties may develop online (Blevins & Holt, 2009; Maratea & Kavanaugh, 2012; Wall, 2007), out of sight of neighbors who might otherwise intervene. The latter could suggest that online-promoted crimes may occur in neighborhoods regardless of the socio-economic composition of these neighborhoods.

2.2   Crime Opportunities

With their roots in Hawley's human ecology theory of community structure that stresses the interdependence of crime with place and human activities (Hawley, 1950), crime opportunity theoretical perspectives seek to identify the environmental features that provide numerous opportunities for crime (Cullen, 2010; Felson & Clarke, 1998; Wilcox & Cullen, 2018). These features are often identified through an economic rationale of markets to emphasize that crime occurs within a choice framework of motivated offenders weighing benefits and risks of crime (Clarke & Cornish, 1985). This is different from the precursors of contemporary crime

25

opportunity perspectives, which relate back to the work of Cloward and Ohlin who also focused on crime opportunities, but argued that these would arise within a social learning framework of delinquent subcultures providing the skills, norms, and instrumental support for illicit behaviors (Cloward & Ohlin, 1960; Natarajan, 2017).

2.2.1 Rational Choice, Routine Activities, and Crime Pattern Theories

Drawing further upon a choice framework, scholars commonly distinguish between three crime opportunity theories: rational choice theory, routine activity theory, and crime pattern theory. Unsurprisingly, rational choice perspectives are at the heart of crime opportunity theories and, in their simplest form, assume that would-be offenders make a calculated decision based on the benefits and costs of engaging in crime (Clarke & Cornish, 1985; Cornish & Clarke, 1986, 2017). This decision, however, is inevitably shaped by individual perspectives, experiences, and constraints (Clarke & Cornish, 1985; Cornish & Clarke, 1986). To some extent, this "bounded rationality" was incorporated in the work of Clarke and Cornish (1985) when they situated their reasoning within a sociology of deviance, criminology, economics, and cognitive psychology. Drawing on these different fields, Clarke and Cornish argued that decision-making processes stem from both internal and external factors: "The existence of a suitably motivated individual goes only part of the way to explaining the occurrence of a criminal event – a host of immediately precipitating, situational factors must also be taken into account" (Clarke and Cornish, 1985, p. 164). In other words, criminal decision-making is imperfect and conditioned by the specific contexts in which it takes place. In addition, implicit to the term "risk taking" is uncertainty due to a lack of information about the certainty of punishment, and motivated offenders may rely on both calculated assessments and heuristics, that is "rules of thumb", when

an opportunity to engage in crime and delinquency arises (Clarke & Cornish, 1985, p. 160; Kahneman, 2011; Tversky & Kahneman, 1974).

Routine activity theory places the actions of motivated offenders within a triangle of actors that also involves potential victims and crime preventers. By emphasizing the interconnectivity between a physical environment and human actions, the theory posits that crime events occur when the behaviors of motivated offenders and suitable targets converge in time and space under weak capable guardianship (Cohen & Felson, 1979; Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980). Capable guardians can be authorities such as police or security guards with the ability to prevent crime by exercising formal social control. Later work by Eck (1995a) adds the role of 'controllers' who have the capacity to change the routines of victims, discourage offending, or regulate and monitor places (e.g. landlords), or "super controllers" as being the individuals, organizations and institutions that can incentivize controllers to prevent crime. Examples of super controllers are regulatory agencies that tighten regulations and monitoring policies or insurance companies that threaten to raise a landlord's insurance when there is suspicion of crime in a certain building. While routine activity theory emphasizes mechanisms of formal social control, it also assigns a role to "intimate handlers" as being the friends, families, neighbors, or anyone else familiar to the offender, and who can informally influence a would-be offender's decision-making process (Eck, 1995a; Felson, 1995).

Eck's (1995b) application of routine activity theories to illicit retail market places offers a particularly useful framework for the current study. As Eck suggests, illicit market activities need to be situated in locations that are known to buyers and sellers yet attract minimal suspicion. Complete concealment or displacement of illicit market activities is not preferred because this would make it less likely that buyers, sellers, and offenders converge in place and

27

time. Instead, Eck (1995) expects that illicit market activities blend into familiar and legitimate surroundings as a strategy to create and maintain a marketplace. At the same time, poorly-maintained areas also offer increased opportunities for crime events because place managers might have limited interest or ability to regulate the behaviors of people using their property. Examples are small apartment buildings in inner-city areas where property managers lack the resources to screen for illicit events or turn a blind eye for crime as long as they receive the rent.

Crime pattern theory situates this decision-making process within a spatial and geographic context by stating that crime occurs in those locations where environmental cues signal low risk, high likelihood of rewards, and acceptable efforts (Brantingham & Brantingham, 1993, 2013). For example, specific types of land use such as retail areas can function as 'crime facilitators' by attracting a large number of people without pre-existing ties, including would-be offenders. Other crime facilitators can be related to a specific street infrastructure, such as street permeability (e.g. number of ways in and out) or street accessibility from major highways through offramps. For example, a freeway off-ramp provides for an easier getaway and might attract crimes such as robberies (e.g. Hipp & Williams, 2019). Thus, among the above crime opportunity theoretical perspectives, crime pattern theory puts most emphasis on how a physical environment can affect visibility of crime opportunities.

Empirical support for crime opportunity theories initially emerged from macro and meso-level studies. For example, as a first assessment and in the development of routine activity theory, Cohen and Felson (1979) analyzed whether the increase in U.S. crime rates could be explained by changes in the overall routine activities of a U.S. society. Drawing on longitudinal data covering the years 1947 to 1974, they observed that increases in labor force participation among married women were associated with increased crime rates. To explain this, Cohen and

28

Felson argued that more households were left unattended during the day as a result of this labor force participation change, making these households suitable targets for crimes like burglaries. In a similar vein, Messner and Blau (1987) used data about the 124 largest standard metropolitan statistical areas (SMSAs) in the U.S. and demonstrated that out-of-home activity (e.g. leisure activities outside of the such as sports) were positively correlated with crime rates. On neighborhood level, Sampson and Wooldredge (1987) identified opportunity structures for victimization such as increased street activity (increased risk for victimization) and percentage single-adult households in each community (households more likely to be left unattended). However, they also noted that several socio-economic structures, such as family disruption or unemployment, had larger impacts on victimization.

Recent work suggests that macro neither meso-geographic units are the most powerful unit of analysis for crime opportunities when considering that most crime events tend to occur at only a few discrete locations. For example, Weisburd and colleagues (2004) demonstrated that, between 1989 and 2002, half of Seattle's crime incidents were concentrated at only 4.5 percent of city's street segments. Similarly, Braga, Hureau, and Papachristos (2011) find that half of Boston's commercial robberies between 1980 and 2008 were concentrated at approximately one percent of the city's street segments and intersections. Even crime types that do not necessarily rely on public space, such as domestic disturbances, have found to be concentrated at less than ten percent of street addresses and intersections (Sherman, Gartin, & Buerger, 1989). This spatial concentration of crime is so persistent across time that Weisburd proposes the "law of crime concentration" and calls for empirical analyses on microgeographic hot spots (Weisburd, 2015).

With the growing digitization of granular levels of data since the 1980s, the number of studies providing explanations for crime concentration at microgeographic units is growing. Eck

29

and Weisburd (1995) have provided a framework that helps summarize these findings by four themes (see also Braga & Clarke, 2014). First, certain *facilities* can host or generate crime by attracting offenders and suitable targets under minimum supervision of possible crime controllers such as landlords (e.g. bars, see Eck et al., 2007; Groff & Lockwood, 2014; Roncek & Maier, 1991). Second, physical and social characteristics of a place can impact its *attractiveness for offenders* such as type of homes or the visible presence of burglar alarms (e.g. Hakim, Rengert, & Shachmurove, 2001). Third, features providing *offender mobility*, such as a freeway on-ramp (Hipp & Williams, 2019) or bus-stops (Groff and Lockwood, 2014), have shown to be important correlates of crime events at discrete locations. Fourth, offenders select their *targets* such that risks are acceptable and do not outweigh the expected gains. For example, homes nearby affluent neighborhoods can attract burglars as they signal gains but limited risks (Rengert & Wasilchick, 2000).

2.2.2 Crime Opportunities and Online Domains

Technological advances change our daily routines and may, by extension, have an impact on crime opportunities (Felson, 1987). The internet is undoubtedly a major technological change and studies have called out the online domain as the new "virtual convergence space" where the activities of offenders and victims can converge in an online setting (e.g. Pyrooz et al., 2015, p. 476). A few prior studies have utilized these new online settings to revisit crime opportunity theoretical concepts, albeit mostly in the context of cybercrimes. These are crimes that are fully committed in a virtual environment, as opposed to crimes that still require an offline act or transaction (e.g. illicit drug markets or commercial sex). For example, a study by Holtfreter and colleagues (2008) support the extension of routine activities (and self-control) to online

30

consumer behaviors and internet fraud. Using survey data about 922 adults in Florida, their analyses show that greater participation in remote and under-guarded online shopping behaviors increases an individual's risk to be targeted in an online fraud scheme (see, for another example on online fraud, Reyns, 2013). However, the authors also note that target attractiveness and expected rewards might be less relevant theoretical notions in the context of online fraud victimization. Furthermore, an increasing amount of studies draw on crime opportunity theories and specifically rational choice perspectives to examine offender's decision-making processes in online settings. In particular, general social media or crime-oriented websites can contain "crime scripts" (Holt, 2013, p. 206), which provide individuals the information, motivations, and justifications for illicit opportunities such as online frauds, cyberstalking, or online piracy (Clarke, 2004; Yar, 2005).

While these studies illustrate the possibility to extend the ideas of crime opportunity theories to online settings, they provide little clarity on the extent to which online cues replace, supplement, or reinforce offline crime opportunities. More pertinent to the current study is recent qualitative work that has relied on crime opportunity theories to examine the "virtual subculture of Johns", buyers of commercial sex, in online review boards (Blevins & Holt, 2009). Drawing on content analyses of reviews of commercial sex venues, these studies provide evidence for motivated offender's screening techniques to identify illicit opportunities online while engaging in illicit behaviors offline. In further aiding the location choices of illicit and deviant behaviors, clientele may also use online domains as collective warning systems to help avoid law enforcement apprehension, for example by temporarily displacing to different areas (Holt et al., 2008, 2014).

When considering the implications of online settings for an offline geography of crime, three scenarios deserve further attention in the application of crime opportunity theories. First, routine online behaviors may be spatially patterned in the same way as offline behaviors when offenders respond to online cues about the characteristics of neighborhoods they are familiar too, actively search for crime opportunities in nearby areas, or seek to use a secure platform to connect with their peers. Second, crime and deviancy might have the potential to diffuse toward different areas within cities when online platforms alert would-be offenders to opportunities beyond their own neighborhoods or routine travels. Third, online domains may also illuminate illicit opportunities to capable guardians and, as such, provide for possible points of interdiction in both offline and online settings. Drawing upon such scenarios, Chapters 3 and 4 examine the applicability of crime opportunity theoretical concepts to the offline locations of IMBs and the geographical coverage of clientele networks, respectively.

2.2.3   Integrating Social Disorganization and Crime Opportunities

Although social disorganization and crime opportunity theories have substantially different theoretical foci and are often measured using different geographic units of analyses, recent work has called for their integration in explanations of the geography of crime within cities. The central argument is that illicit opportunities can be contextualized by broader neighborhood dynamics (Braga & Clarke, 2014; Smith, Frazee, & Davison, 2000; Weisburd, Groff, & Yang, 2014; Wilcox & Land, 2017). As such, a theoretical integration could improve explanations of the geography of crime in at least two interrelated ways.

First, an integrated theoretical approach can strengthen explanations of local crime events (Weisburd et al., 2014). This is supported by studies that report statistical significance of both

social disorganization and crime opportunity variables and an overall improved model fit of models that account for both sets of theories. For example, a study using crime incident data for automobile theft in blocks, Rice and Smith (2002) identified that opportunity (e.g. vacant/parking lots), offender traffic (e.g. commercial areas), low community control (e.g. low number of owner-occupied places), and other social disorganization variables (e.g. proximity to downtown areas) improved explanations for automobile theft in blocks. Furthermore, in a study on crime hot-spots in Seattle's street segments, Weisburd, Groff, and Yang (2012) document strong support for crime opportunity variables (e.g. presence of employees and public facilities) as well as variables that can be associated with socially disorganized areas, such as physical disorder and lower property values. However, they find no statistical significance for common social disorganization variables such as population heterogeneity or mixed land use.

Second, neighborhood dynamics can moderate the effect of local crime opportunities (Wilcox, Land, & Hunt, 2003). An example is a recent study by Jones and Pridemore (2019) who analyzed data about violent and property crimes on street segments and in neighborhoods in Lexington, Kentucky. They find that social disorganization variables such as neighborhood (in)stability and mixed land use moderate the effects of local crime opportunities. As an illustration, public places independently attracted more violent and property crimes, but these places were associated with lower levels of property crimes in stable neighborhoods.

In addition to strengthening explanations on where crime occurs, social disorganization and crime opportunities also provide complementary, and to some extent overlapping, perspectives on crime prevention strategies through social control mechanisms (Braga & Clarke, 2014). The theories are complementary when considering that formal social control mechanisms exercised by police or other capable guardians can be the sole crime preventers in areas with low

levels of informal social control. The theories overlap regarding the role of informal social control: Similar to social disorganization theory that suggests that positive connections between residents help reduce crime (Sampson & Groves, 1989), crime opportunity theories refer to positive influences from relatives, friends, and other "intimate handlers" who can discourage would-be offenders or reduce target suitability (Braga & Clarke, 2014; Eck, 1995a; Felson, 1995).

2.3   Social Networks and Crime Opportunities

A neighborhood-based understanding of crime also involves the social networks that make up the communities in these neighborhoods. A social network is a bounded set or sets of individuals, organizations, or any other actors upon which relationships can be defined (Wasserman & Faust, 1994). Through these relationships, people can influence each other and capital, goods, information, and ideas can flow between any two actors (Jackson, 2010; Wasserman & Faust, 1994).

The study of social networks has become popular in criminology in two distinct ways. On the one hand, studies have shown that social networks can reduce crime and deviancy through inducing neighborhood satisfaction, cohesion, and social organization (McGloin & Kirk, 2010; McGloin & Nguyen, 2013). On the other hand, social networks can create numerous opportunities for crime through exposing people to acts of crime, providing instrumental support, or facilitating the diffusion of information, capital, and norms (Carrington, 2014; McGloin & Nguyen, 2013; Papachristos, 2011; Wasserman & Faust, 1994)

Clearly, the role of social networks in crime and deviancy requires an integration with criminology theories, many of which already acknowledge the social processes related to peer

34

selection, influence, and exposure (McGloin & Nguyen, 2013; Papachristos, 2011). Of most

relevance to the present research are the social interactions that initiate or broaden an offending

repertoire and awareness space of opportunities for crime (Andresen & Felson, 2009). These

social opportunities imply an embeddedness of crime in structures of social relationships. This is

similar to what Granovetter meant when he pivoted the term social embeddedness as the

systematic nesting of economic action in larger social contexts and structures (Baker & Faulkner,

2009; Granovetter, 1985; Uzzi, 1999). These larger social contexts can also involve the structural

neighborhood conditions that shape the extent to which crime-involved networks emerge within

and across neighborhoods. It is possible that networks can serve as an alternative way to

establish familiarity, security, and access to crime, which potentially reduces the dependency on

ecological cues (Carrington, 2014; Eck, 1995b; Morselli, 2013). With a minimal dependency on

a physical environment, illicit activity can remain hidden for the public or authorities while

potentially diffusing crime across place, time, and individuals.

Research on commercial sex and sex trafficking has taken a more instrumental approach

to the study of social networks by examining the structures of criminal networks. In doing so,

most studies have relied on court records to analyze trafficking operations. For example,

Campana (2016) constructed Nigerian sex trafficking rings from police records in Europe and

identified a loosely organized network structure as opposed to previously presumed hierarchical

organized crime structures. Denton (2016) examined criminal networks based on labor

trafficking court cases and illuminated that the most important actors did not always receive the

most severe sentencing. With the availability of online data, recent studies have begun to

construct human trafficking networks from online classifieds that contain similar language or

identifying information such as shared phone-numbers (e.g. Ibanez, 2015), although these studies

35

oftentimes still rely on court records to determine and search for the characteristics of human trafficking. A few studies have qualitatively begun to describe how IMBs are connected through shared ownership of venues or the frequent rotation of commercial sex providers between IMBs (Chin et al., 2019; Dank et al., 2014; Polaris, 2018).

To date, the role of clientele networks in driving commercial sex and sex trafficking in IMBs has received the least empirical attention, in spite of prior work that has suggested an elevation of commercial sex through a growing online community of clients that review sexual services and learn about illicit opportunities through online classifieds and review boards (Bouché & Crotty, 2017; Holt, Blevins, & Fitzgerald, 2016; Holt et al., 2008, 2014). While online clientele communities may not fall in the traditional offending categories, these web-facilitated clientele networks are important as they create and maintain the social opportunities for crime. When location choices of clientele are still driven by choice-structuring features in neighborhoods, the geographical coverage of these clientele networks can reveal the specific place features that facilitate the diffusion of demand across neighborhoods.

2.3.1 Spatial Networks

Social networks, including crime and deviancy networks, are often spatially bounded given that they tend to be centered around shared nodes of activity (e.g. shopping centers, gyms, schools). Therefore, we often socialize with people in spatial proximity to us because of increased opportunities to connect and because it takes the least amount of effort (Blau, 1977; Zipf, 1949). Criminal and deviant individuals seem to operate in a similar way given that prior studies demonstrate that connections with criminal peers often stay within spatially proximate neighborhoods (Kirk & Papachristos, 2011; Mears & Bhati, 2006; Peterson & Krivo, 2009). This

36

relates to the spatial concentration of crime within neighborhoods and explains the focus in criminology on *intra*community dynamics or "internal characteristics of a "neighborhoods' neighbors" (Sampson, 2012, p. 61).

However, *inter*community dynamics are important when considering that many daily routines traverse neighborhood boundaries (Phillips, Levy, Sampson, Small, & Wang, 2019; Sampson, 2012). In daily routines, residents often cross neighborhood borders several times a day, for example when traveling between work and home. Every move between neighborhoods spans a tie between the origin and destination (Sampson, 2012, p. 311), and neighborhoods then become "nodes in a larger network of spatial relations" (Sampson, 2004, p. 158). A more persistent form of inter-neighborhood ties is caused by residential mobility, where residents move between different communities (Sampson, 2004, 2012).

As far as it pertains to criminal activity, illuminating the connectivity between neighborhoods is of utmost importance to understand processes of crime diffusion. While criminologists have embraced the notion that internal neighborhood dynamics can be influenced by dynamics external to that neighborhood (Mears & Bhati, 2006), only a few studies have empirically addressed the role of social networks in creating pathways through which crime travels. For example, Sampson examined the connectivity between neighborhoods through residential mobility patterns of families with and without a criminal history. Neighborhoods were overall highly connected, and families, with or without a criminal history, were likely to migrate to spatially proximate neighborhoods and those that had demographic or socio-economic similarities to the origin neighborhoods. Thus, oftentimes, these mobility patterns are driven by processes of "homophily", which means that we tend to connect with minds alike (McPherson, Smith-Lovin, & Cook, 2001), or in spatial terms, tend to travel to familiar or similar-looking

neighborhoods (Sampson, 2012). Later studies corroborate such findings on spatial homophily

using different spatial networks of crime and deviancy such as gang co-offenders that reside in

different neighborhoods (Bichler, Malm, & Enriquez, 2014; Papachristos & Bastomski, 2018;

Schaefer, 2012)

2.3.2 Spatial Networks and Online Domains

Increasingly so, online domains have allowed social networks to become "loosely

bounded", "sparsely knit", and "spatially unbounded" (Phillips et al., 2019, p. 469; Wellman,

2001, p. 2031). This, particularly, may challenge our neighborhood-based understanding of

crime and a city's social fabric generally given that individuals can now rely on social support or

information outside one's own neighborhood (Wellman & Hampton, 1999). Indeed, social

network studies have drawn attention to changing social worlds as communication patterns move

online and take away physical barriers to connect. Some have claimed that our ability to maintain

long-distance social relations would imply the death of distance (Cairncross, 1997), yet most

studies seem to emphasize that spatial proximity continue to shape many online-facilitated

relationships (Barthelemy, Gondran, & Guichard, 2003; Mok et al., 2010; Wellman & Hampton,

1999; Yook, Jeong, & Barabási, 2002). Some even illustrate that internet access can help shape

local neighborhood identity and social cohesion (Hampton & Wellman, 2003), as well as

community engagement in crime reporting (Keymanesh et al., 2020).

Despite the implications for the concentration, diffusion, and prevention of crime,

criminologists have been slow to analyze how online communications may influence spatial

networks of crime and deviancy. In an attempt to fill this empirical void, Chapter 4 presents

online-promoted IMBs and their clientele networks as an illuminating case to assess web-

facilitated networks of crime and deviancy. That is because the possibility to link an online promotion of illicit opportunities to offline behaviors enables an assessment of the role of spatial proximity and physical space in the formation of web-facilitated networks and behaviors. It is the online facilitation of clientele networks that may challenge traditional notions on the spatial diffusion of illicit behaviors and deviant norms.

2.4   Deterrence and Crime Opportunities

While social disorganization, crime opportunity, and spatial networks make explicit assumptions about the interconnectivity between crime and place, deterrence theory – as a last important theoretical perspective to discuss – is not inherently about place but has important implications for place-oriented responses to crime. Deterrence theory builds upon a rational choice framework by positing that would-be offenders refrain from crime when they perceive the risk of apprehension and legal punishment to outweigh the benefits (Gibbs, 1975; Zimring & Hawkins, 1973). In its original formulations, the theory states that increasing the certainty, severity, and swiftness of punishments can reduce the attractiveness of engaging in crime (Clarke & Cornish, 1985; Cornish & Clarke, 1986). Most contemporary consensus exists on the effectiveness of increasing a perceived rather than objective likelihood of detection (Apel, 2013; Nagin, 2013a, 2013b; Nagin et al., 2015; Paternoster, 2010).

When referencing strategies that alter these perceptions of risk, the deterrence literature often distinguishes between general and specific deterrence (Cook, 1980). General deterrence seeks to influence the perceptions on the likelihood of punishment among a general population, and may involve increased penalties, police presence, or traditional crackdowns. Specific deterrence targets chronic offenders and seeks to prevent their future offending, for example

39

through strategies that are focused on a group of individuals at higher risk to engage in violence (e.g. gang members).

The effectiveness of altering perceptions of crime risks needs to be understood in relation to perceived crime opportunities, which are part of an offender's decision-making process (Cornish & Clarke, 1987; Nagin et al., 2015; Sherman et al., 1989). As was discussed earlier, this decision-making process can be structured by specific features of neighborhoods and discrete locations (see section 2.2). In particular, crime pattern theory would highlight the choice-structuring features that signal risk, rewards, or efforts (Brantingham & Brantingham, 2013), and routine activity theory highlights the features that facilitate a convergence of offenders and suitable targets in time and space (Cohen & Felson, 1979; Felson, 1987; Felson & Cohen, 1980).

While a more detailed discussion of crime opportunity theories was included in a previous section, it is important to reiterate that these theories attribute a role to formal social control mechanisms in reducing crime. Formal social control can be exercised by authorities such as specific entities in the criminal justice system, specifically the police who are often the first responders to crime problems and whose (symbolic) presence or actions may reduce the opportunity for crime. To that end, crime opportunity theories redirect the role of police as apprehension agents that seek to alter perceptions of risk by signaling certainty of punishment to a role of police as sentinel agents that seek to discourage motivated offenders by affecting the distribution of criminal opportunities in a local environment (Eck & Weisburd, 1995; Felson, 1995). This aligns with the notion of "capable guardians" (Cohen & Felson, 1979) who can exercise formal social control to the extent that benefits from crime are no longer proportionate to the effort and risks, which includes efforts that alter the underlying causes of crime (Nagin et al., 2015; Weisburd & Majmundar, 2018).

40

However, police are traditionally trained as apprehension agents that respond to criminal events that have already occurred, and tend to use reactive law enforcement strategies such as investigations or rapid patrol, often in response to tips from concerned community members. Such responses are also commonly deployed against human trafficking problems. Indeed, the police response to IMBs is often delegated to vice units who use sting operations, undercover work, or reactive investigations to identify and respond to human trafficking victimizations (Farrell, Bright, de Vries, Pfeffer, & Dank, 2019; Farrell, Dank, et al., 2019). These vice tactics have received much criticism given concerns about harm to victim-police relationships and the reluctance of trafficked persons to self-identify as victims due to complex emotional attachments to their exploiter, coping strategies, or distrust toward police (Farrell, Dank, et al., 2019). But, even without consideration of the unique nature of human trafficking victimizations, reactive police enforcement models have had limited or no effects in part because they are not informed by scientific evidence on the nonrandom distribution of crime problems (Nagin, 1998, 2013b).

Instead, there is ample evidence of the effectiveness of proactive policing strategies that are evidence-informed, target specific places or likely offenders, and draw on both the prevention mechanism of deterrence and crime opportunity reduction efforts (Weisburd & Majmundar, 2018). For example, a systematic review on hot-spots policing indicates that problem-oriented policing, which involves an evidence-based model using information about where and when crime occurs (Goldstein, Goldstein, & Hill, 1990), generates stronger effects than police enforcement alone (Braga, Turchan, Papachristos, & Hureau, 2019). As a more specific example, the effectiveness of a focused deterrence strategy like Boston's Operation Ceasefire has been attributed to a combination of traditional and nontraditional policing tactics and partnerships with community and social service organizations (e.g. Braga, Hureau, &

41

Papachristos, 2014; Braga, Kennedy, Waring, & Piehl, 2001). In short, powerful crime control strategies honor core deterrence ideas, rely on a wide variety of tools, and engage various partners in crime control and crime prevention strategies (Weisburd & Eck, 2004).

2.4.1 Deterrence, Crime Opportunities, and the Online Domain

While proactive place-based approaches have proven to be effective against various crime types that are concentrated at discrete locations (e.g. robbery or gang violence), there is little clarity about the impact of general or specific deterrence strategies against online-promoted crime problems such as IMBs. Few studies have begun to argue that problem-oriented policing strategies cannot readily be applied to cybercrimes (Walker, Brock, & Stuart, 2006), whereas others suggest that core deterrence ideas and knowledge about effective policing models can be upheld even in an online environment (Williams, 2007). For example, police can use automated messaging to signal increased risk of punishment or rely on online "place managers" (e.g. website owners) to deny would-be offender's access to (parts of) websites (Williams, 2007).

The focus on offline problems that are online-promoted sets the present study apart from the above studies that focus on cybercrimes. When the geography of online-promoted crimes is indeed nonrandom and when these crime types are thus intricately linked to place features, evidence-informed strategies can target specific places and diminish criminal opportunities in these places. Nonetheless, online domains pose a significant challenge to place-based policing models. In particular, the relative anonymity of websites can allow them to continue to signal illicit opportunities regardless of intensified policing efforts. In addition, these websites provide motivational cues for deviant and illicit behaviors, promote demand at virtually any geographic span, and aid locational flexibility of offline venues and behaviors.

42

Prior qualitative work about commercial sex and sex trafficking has alluded to these challenges. These studies have provided rich accounts of how clientele of IMBs use online review boards to search for local illicit opportunities (Holt et al., 2016; Holt et al., 2014). At least among an active group of clientele, exposure to these illicit opportunities may be larger than direct exposure to risk, making it challenging for any strategy to increase a perception of risk disproportionately to illicit opportunities. Furthermore, online domains may aid a collective awareness of intensified police monitoring that can further increase the adaptiveness of illicit markets to disruptions such as police enforcement actions, for example by clientele temporarily displacing to other locations (Holt et al., 2008, 2014). With that in mind, Chapter 5 examines the impact of the current response to online-promoted IMBs, and includes a discussion on how problem-oriented and place-based approaches may help improve the current response.

Chapter 3   Risky Facilities, Crime Opportunities, and Urban Transition: The Case of

Online-Promoted Illicit Massage Businesses

Introduction

Although cities have had illicit massage businesses (IMBs) throughout decades (Armstrong, 1978; Bryant & Palmer, 1975), the growing number of IMBs across cities in the U.S. and their connectivity to human trafficking operations has raised recent concerns about these venues. IMBs are risky facilities that host a wide range of crime and victimization types. In addition to human trafficking, concerns exist about a wide range of other crime types such as violence committed by clientele, robberies and organized crime (Dank et al., 2014; Polaris, 2018). These problems occur in stationary locations such as physical storefronts, yet the demand for illicit services such as commercial sex is now fueled by online classifieds, reviews, and forum posts. These online platforms provide clientele access to the locations of IMBs in virtually any neighborhood. However, it is unclear whether this online promotion means that IMBs become "spatially unbounded", that is disconnected from physical space. To that end, this study seeks to understand which spatial and geographic mechanisms drive online-promoted IMBs to particular neighborhoods.

In doing so, this study relies on socio-ecological and situational theory that have also guided previous studies on the location of risky facilities (e.g. Bowers, 2014; Eck et al., 2007; Roncek, 1981; Roncek & Maier, 1991; Wilcox, Quisenberry, Cabrera, & Jones, 2004). In particular, social disorganization theory puts emphasis on the neighborhood features that challenge a community's ability to maintain social ties and informal social control to prevent crime within their neighborhoods (Shaw & McKay, 1942, 1969). In addition, crime opportunity perspectives focus on the physical and social characteristics, often at discrete locations, that

44

signal illicit opportunities and facilitate a convergence of motivated offenders and suitable targets under weak capable guardianship (Cullen, 2010; Felson & Clarke, 1998; Wilcox & Cullen, 2018). Recent work has called for an integration of both social disorganization and crime opportunity theories, in particular because socio-economic neighborhood dynamics can provide the context for local illicit opportunities (Smith et al., 2000; Weisburd et al., 2014; Wilcox & Land, 2017).

While these theories have guided decades of research about the spatial concentration and variability of crime within cities, it is important to assess whether traditional assumptions of crime and place continue to apply to risky facilities and crime events that are promoted by online media. That is because online domains allow for the travel of information about illicit opportunities through which crime can diffuse across large geographic span (Holt, 2013; Wall, 2007). This may reduce a dependency on specific environmental conditions, yet it remains unclear whether online-promoted types of crime and deviancy emerge in theoretically unanticipated areas.

Therefore, the present study extends the testing of theoretical concepts from both social disorganization and crime opportunity theories to the context of online-promoted IMBs. The analyses draw on user-generated review boards, which are online platforms where clientele post and read reviews about illicit sexual services in IMBs, to gather and analyze the locations of online-promoted IMBs in 4,318 census tracts across 104 medium-sized and large cities. These data were merged with geospatial and population data and analyzed through multilevel logistic regression models. The analyses examine why an IMB was placed at a specific location as a function of neighborhood processes and city contexts. The city-level context is important because the geography of crime can differ by city size (e.g. Hipp, Wo, & Kim, 2017), and the

response to IMBs is often initiated by city authorities and involves the closure of parlors, clientele arrests, or police investigations into sex trafficking or related crimes (Polaris, 2018).

The findings provide a comprehensive view of the neighborhood features that are associated with the presence of online-promoted IMBs. As such, it seeks to provide new theoretical leads for the role of online domains in adjusting traditional assumptions about which physical features of neighborhoods attract crime facilities. Knowing about the geographic correlates of online-promoted crime problems provides policy-relevant insights as to where place-based crime prevention and control strategies may be effective. As such, the findings have implications for situational crime prevention, local level urban planning efforts, and awareness-raising strategies. The following sections begin with a review of the literature on social disorganization and crime opportunities, followed by a set of hypotheses outlined for the current study. After introducing the data and methods, the findings from a multilevel model will be presented. The study concludes with a discussion of the theoretical and practical implications of the study.

Risky Facilities and the Case of Illicit Massage Businesses

IMBs are both crime absorbers and potential crime generators. That is because they are not only a venue for commercial sex and human trafficking, but can also attract a wide range of other illegitimate activities such as robberies, organized crime, and money laundering activities (Dank et al., 2014; Huff et al., 2018; Polaris, 2018). Furthermore, recent work suggests that IMBs or other sexually-oriented premises have the potential to increase overall levels of neighborhood crime and disorder (Huff et al., 2018). These crime-absorbing and crime-

46

generating effects align with the "risky facilities" terminology that describes facilities such as nightclubs, dance halls, red light districts, or pubs and taverns (e.g. Bowers, 2014).

These risky facilities are of concern when they host (i.e. absorb) or increase (i.e. generate) crime in their immediate neighborhoods (e.g. Bowers, 2014; Eck et al., 2007; Roncek, 1981; Roncek & Maier, 1991; Wilcox et al., 2004). For example, places such as banks, bars, gas stations, or sports facilities have shown to be at increased risk to crimes such as burglaries when they are located in popular areas where they are more likely to feature in the collective awareness spaces of offenders (Brantingham & Brantingham, 2013; Eck et al., 2007). In addition to an internal risk of crime, a study covering 25,000 blocks in Chicago found that risky facilities such as bars and nightclubs attracted more robberies (Bernasco, Block, & Ruiter, 2013). More pertinent to the present context, facilities such as strip clubs or adult shops have been associated with higher violent, property, disorder, and total amount of crime at both the specific locations of these businesses and in their neighborhoods (Edwards, 2010; Tewksbury & McCord, 2014).

Although IMBs differ from risky facilities such as pubs and taverns because their inherent purpose is to offer illicit services, the systematic nesting of these establishments in certain neighborhoods might be driven by the same processes that attract other risky facilities. The literature on risky facilities has overwhelmingly drawn on theories about the geographic distribution of crime within cities to explain where, why, and when risky facilities host or generate disorder and crime (Eck et al., 2007; Roncek & Maier, 1991; Roncek & Pravatiner, 1989; Sampson & Raudenbush, 1999; Wilcox et al., 2004). These theories merit relevance in the context of IMBs given the geographic correlates of IMBs that have been identified in prior studies. For example, recent studies have suggested a clustering of IMBs in proximity to central business districts or non-residential areas (Chin, Kim, Takahashi, & Wiebe, 2015; Chin et al.,

2019; Crotty & Bouché, 2018), perhaps because of resident objections to sex-related crimes, immorality, and public nuisance associated with these places (Hubbard, Boydell, Crofts, Prior, & Searle, 2013; Hubbard, Matthews, & Scoular, 2009; Prior & Crofts, 2012). In addition, when IMBs are located in retail areas, this can be a strategy to benefit from business incentives and a shared pool of clientele from shopping malls, high-traffic areas, or restaurants and coffeeshops (Chin et al., 2019; see, in the context of illicit retail markets, Eck, 1995b). IMBs have initially been linked to relatively deprived areas (Chin et al., 2015), although later studies suggested a greater likelihood of IMBs in populous and affluent areas (Chin et al., 2015; Chin et al., 2019).

Furthermore, prior work has identified a significant spatial concentration of IMBs in cities in California and Texas (Chin et al., 2019; Crotty & Bouché, 2018), in spite of other studies noting the possibility that illicit markets avoid a spatial concentration to limit local competition, minimize law enforcement attention (a clustering of illicit facilities is difficult to hide), or as a means to culturally and linguistically isolate immigrant female workers, the latter of which can increase their vulnerability, and thwart the development of social ties among workers across IMBs (Chin et al., 2019; see, in the context of illicit markets generally, Eck, 1995b). It can also be argued that the online promotion of IMBs increases locational flexibility of commercial sex venues (Venkatesh, 2011), which possibly further reduces the need for these venues to be spatially proximate to each other in order for clientele to find them.

While demonstrating a systematic nesting of IMBs in particular neighborhoods, none of these prior studies on IMBs have systematically explored the issue through the lens of criminological theory. A criminological perspective on the location of IMBs is necessary given the documented crime and victimization in these places and to avoid that common geographic correlates of crime are overlooked. The following sections introduce social disorganization and

crime opportunity theoretical perspectives that guide this study's analyses on the spatial and geographic distribution of online-promoted IMBs.

Urban Transition and Social Disorganization

Commercial sex establishments or illicit vice areas were central to early theoretical developments of criminological and sociological perspectives on crime and place. Specifically, Park and Burgess' work stems from field research related to Chicago's vice districts and dance hall patrons in addition to immigrant and African-American communities, apartment house dwellers and various other populations (Heap, 2003; Park & Burgess, 1924; Reckless, 1925). Through observations of the types of areas where these behaviors and populations were concentrated, Park and Burgess mapped the socio-economic process of a city into distinct "natural areas" that were thought of as representing a natural, ecological growth of the city at the time (Park, 1926, p. 8). These natural areas were formally articulated in the concentric zone model, which depicted areas from the Central Business District (Zone I) to the Zone in Transition (II), the Working Class Zone (III), the Residential Zone (IV), and the Commuters' Zone (V) (Park & Burgess, 1924). Altogether, these zones were presented as an outward progression of less crime, disorder or nonnormalities. Like most crimes and social deviancies, illicit and nonnormative sexual behaviors were presumed to be confined to the inner-transitional zones that experienced a rapidly changing socio-economic landscape and intensified levels of poverty (Park & Burgess, 1924; Reckless, 1925). In contrast, crime and disorder was assumed to be less prevalent in zones further away from a central business district (Park & Burgess, 1924).

The work of Park and Burgess is important to mention not only because of the historical link with commercial sex establishments, but also because the neighborhood features associated

49

with crime in transitional zones have been integrated as popular components in theoretical and empirical inquiries on crime in subsequent decades (Veysey & Messner, 1999). In particular, social disorganization theory (Shaw & McKay, 1942, 1969) focused on three structural neighborhood features that Park and Burgess had observed in transitional zones: low socioeconomic status, population heterogeneity, and residential mobility. Shaw and McKay (1942, 1969) hypothesized that these neighborhood dynamics would indirectly cause crime through reduced levels of informal social control. Indeed, rapid changes to a community resulting from residential turnover or heterogeneous settings[4] might reduce the potential for social relations and interactions, which can make it less likely that neighbors would act upon a set of shared values to call out deviant behaviors and crime.

Although the mechanisms through which these neighborhood features would contribute to crime have long remained unclear (Bursik, 1988; see also Kubrin & Weitzer, 2003), the work of Sampson and colleagues (Sampson & Groves, 1989) identified the role of collective efficacy as the key factor that links relative deprivation to crime. Collective efficacy was defined as the "social cohesion among neighbors combined with their willingness to intervene on behalf of the common good" (Sampson et al., 1997, p. 918). Later empirical work has largely supported the role of low levels of collective efficacy as a key mechanism that mediates the effects of structural socio-economic conditions on neighborhood-level crime (Sampson, 2006). Several other refinements to the theory have been made, in part to acknowledge that contemporary cities are structurally different from Chicago in the 1940s that provided the historical context for the

---

[4] It is important to note that the theorized link between population heterogeneity and crime has received scrutiny and mixed empirical support. Its inclusion in empirical work needs a nuanced interpretation where racial or ethnic communities are not inherently linked to crime but where mixed populations can be associated with limited opportunities for social interactions resulting in lower social control or guardianship (Bursik, 1988; Kubrin & Weitzer, 2003).

50

development of the theory (Bursik, 1988). For example, studies have accounted for structurally changing cities by adding variables such as urbanization or gentrification (Sampson & Groves, 1989; Veysey & Messner, 1999). These processes may create sharp income inequalities between the relative wealth from businesses districts with lower incomes, creating an overall situation of relative deprivation (Hipp & Kubrin, 2017; Morenoff et al., 2001).

One may question the applicability of social disorganization theory to crime problems in the 21st century because many social interactions move toward the online domain, which has potential implications for neighborhood-level socio-economic processes. While little research has directly examined social disorganization theory against the background of online interactions, recent work by Sampson (2017) is suggestive of the continued importance of social disorganization theory in a digital age. Sampson argues that online interactions tend to reflect offline empirical realities, including structural inequalities that have shaped America's urban landscape throughout history (Sampson, 2017, p. 8958). Thus, even though neighborhoods constantly change, and online domains can further induce such changes, social interactions continue to be divided by demographic and socio-economic backgrounds. This implicates that factors associated with social disorganization, including residential mobility, inequality, and instability, likely continue to drive the geographic distribution of crime within cities. Sampson's work aligns with a broader range of studies that have suggested that our communication, both online or offline, is divided along demographic and socio-economic lines (Castells, 1996, 2002). The extent to which online domains affect the local geography of IMBs is yet unclear. That is because IMBs are promoted by online classifieds and review boards that have the explicit purpose to facilitate crime and deviancy. Although clientele can use the internet to identify IMBs

in virtually any neighborhood, it is unclear whether this online promotion implies a disconnect between the local presence of IMBs and neighborhood processes.

Crime Opportunities

Another foundational set of theories that is commonly used to explain the nonrandom distribution of crime within cities are crime opportunity theories (Cullen, 2010; Felson & Clarke, 1998; Wilcox & Cullen, 2018). Three crime opportunity theories are commonly included in the literature on crime and place, all of which share the purpose to identify where and under which circumstances crime events occur (Natarajan, 2017). First, rational choice perspectives rely on an economic rationale and a choice framework within which motivated offenders work to weigh benefits against risks of crime (Clarke & Cornish, 1985; Cornish & Clarke, 1986, 2017). Second, routine activity theory situates these motivated offenders within a triangle of actors that also includes potential victims and capable guardians (Cohen & Felson, 1979; Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980). Capable guardians can be any individual or organization with the ability to exercise formal social control, such as police. Crime events are then hypothesized to occur under the circumstance that behaviors of motivated offenders and suitable targets converge in time and space under weak capable guardianship (Clarke, 1995; Cohen & Felson, 1979; Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980). Third, crime pattern theory puts emphasis on the spatial and physical cues that influence a would-be offender's assessment of risks and opportunities of crime and victimization (Brantingham & Brantingham, 1993, 2013). For example, street permeability or street accessibility can facilitate offender mobility and provide an easier getaway or access to crime (e.g. Hipp & Williams, 2019).

52

Although crime opportunity theories are frequently measured at microgeographic units such as blocks or street segments (Weisburd, 2015; Weisburd et al., 2004), crime opportunity theories merit attention in the context of the current study that focuses on neighborhoods. This is because prior work has suggested that IMBs might indeed concentrate in areas where the demographics and socio-economic features represent a greater likelihood for clientele and suitable targets to converge under the least chances of detection (Chin et al., 2019; Crotty & Bouché, 2018). This can be in populous and legitimate surroundings, where IMBs can create and maintain a marketplace while avoiding attracting suspicion. This would align with Eck's application of routine activity theories to illicit retail market places (Eck, 1995b). According to Eck (1995b), areas that attract illicit retail markets are accessible and known to both buyers and sellers, yet suffer from limited oversight by local place managers such as landlords turning a blind eye for crime events. In a similar vein, easy access points such as proximity to businesses districts (see Crotty & Bouché, 2018), bus or subway stops, or proximity to a freeway may also increase the pool of potential customers who come across IMBs in routine travels to and from work. Altogether, the importance of such infrastructural cues would also align with the literature suggesting that criminogenic opportunities might emerge along major nodes of activity such as shopping centers, employment areas, or other places where people naturally concentrate (Brantingham & Brantingham, 2013; Eck et al., 2007; Felson, 1987; Hipp & Williams, 2019).

Whereas crime opportunity theories provide suitable explanations for the locations of illicit marketplaces (Eck, 1995b), and may therefore also drive the geography of IMBs, it is unclear how online domains replace, reinforce, or supplement environmental conditions that exhibit crime opportunities. Recent work has extended the testing of crime opportunity theoretical concepts to online domains, albeit this has mostly been done in the context of

53

cybercrimes that are fully committed in a virtual environment. For example, studies have begun

to examine decision-making processes of offenders using their communication on crime-oriented

websites that can contain "crime scripts" (Holt, 2013, p. 2016) and provide motivated offenders

the necessary information, justification, or encouragement to engage in crimes such as online

frauds, cyberstalking, or online piracy (Clarke, 2004; Yar, 2005). In addition to cybercrimes, a

few studies have relied on situational crime prevention or routine activity theory to explore

online behaviors and profiles of crime and deviancy groups that use the internet to engage in

illicit behaviors offline, such as buyers of commercial sex (Blevins & Holt, 2009) or gangs

(Decker & Pyrooz, 2012; Pyrooz et al., 2015). However, limited knowledge exists about the

offline geographical distribution of crimes and deviant behaviors by such groups.

Integrating Crime Opportunities and Social Disorganization

Whereas social disorganization and crime opportunity theories have long been considered

as inherently different theories with different explanatory and geographic foci, the shared

emphasis on environmental conditions contributing to crime may suggest that the theories

together can strengthen explanations of the geographic distribution of crime within cities (see,

for a more comprehensive discussion, Braga & Clarke, 2014; Smith et al., 2000; Weisburd et al.,

2014; Wilcox & Land, 2017). In particular, recent work has begun to show that neighborhood

dynamics can both contextualize and supplement crime opportunity theories in explanations of

where crime occurs (Weisburd et al., 2014; Wilcox & Land, 2017; Wilcox et al., 2003). For

example, in a study on automobile thefts in blocks of a large southeastern U.S. city, Rice and

Smith (2002) showed that a broader set of ecological and situational variables based on both

social disorganization and routine activity theories improved the explanatory power of their

54

models, albeit social disorganization was most predictive of automobile theft. Similarly, in a longitudinal study on property and violent crime in Seattle street segments, Weisburd, Groff and Yang (2012) found significant effects and an overall improved model fit for both routine activities and social disorganization measures. Here, routine activities had stronger and more consistent effects on street-level crime. More recently, Jones and Pridemore (2019) analyzed data about street segment counts of violent and property crimes from Lexington, Kentucky and found support for both routine activity and social disorganization theories, but a neighborhood context moderated the effects of street segment level opportunity and social disorganization.

A theoretical integration seems particularly necessary in the context of online-promoted IMBs because it may help understand how services of oftentimes more marginalized communities meet the demand of more advantaged clientele (Chin et al., 2019; Polaris, 2018). More precisely, the combination of both theories would help evaluate whether IMBs are located in areas that feature the relative deprivation among marginalized communities versus areas that feature illicit opportunities for clientele who can now identify the locations of IMBs through online platforms. While both social disorganization and crime opportunity theories offer clear, integrated, and empirically-supported theoretical frameworks, it remains empirically unclear which spatial and geographic features attract online-promoted problems such as IMBs.

Current Study

The current study integrates concepts from social disorganization and crime opportunity theories to examine which neighborhood-level conditions directly affect the likelihood of IMBs within cities in Massachusetts, Texas, and Washington. These states were selected to allow for a comparison across three geographically and socio-economically distinct states where a

55

significant amount of attention and resources has been devoted to the issue of IMBs (Polaris, 2018). Because social disorganization and local crime opportunities may operate differently across city contexts and the response to IMBs is often initiated at city level, this study assesses the local geography of IMBs as a function of both neighborhood- and city- level features.

Three interrelated hypotheses are being examined. First, it is hypothesized that IMBs are more likely in socially disorganized neighborhoods as observed through concentrated disadvantage, residential instability, population heterogeneity and income inequality. Social disorganization would explain the presence of IMBs in these areas through reduced levels of informal social control as well as by featuring the socio-economic situation of a population that depends on the income from IMBs. Second, it is hypothesized that neighborhoods attract IMBs when they meet the routine travels and behaviors of clientele, for example in areas with a relatively larger male population, that are easily accessible through a highway, and retail areas. Third, it is expected that stronger police presence reduces the likelihood of IMBs both in neighborhoods and cities. The city-level context is particularly important given that the response to IMBs has predominately been initiated at city level, by law enforcement, municipalities or other authorities that are concerned with the presence of IMBs (Polaris, 2018).

Methods

Data

The locations of IMBs were retrieved from one of the most popular national review boards. [5] Information about a total of 1,863 IMBs with reviews between 2015 and 2017 was

---

[5] The web address is not provided in an effort to preserve some confidentiality of commercial sex providers, website users, and locations where potential victimizations occur.

obtained for Massachusetts (N=377), Texas (N=1,064), and Washington (N=422).[6,7] Online samples may not be representative of all IMBs, although this would only bias the findings when missing establishments were located at systematically different geographies. While more research needs to be conducted to evaluate the empirical representativeness of online samples, the digitized and detailed nature of the current sample provides for a theoretically relevant sample of IMBs where indications of commercial sex were observed, reducing the false positives (legitimate massage therapy flagged as IMBs) to a minimum.

The addresses of 99% of the facilities (N = 1,854) were successfully geocoded to the 2017 census tracts and place shapefiles from the United States Census Bureau. Census tracts are small geographic areas with an average population size of approximately 5,000 residents and are frequently the unit of analysis for ecological theories of crime (e.g. Morenoff et al., 2001; Peterson & Krivo, 2009; Schaefer, 2012). When census tracts intersected with multiple cities, tracts were geocoded to the cities with which they had the largest spatial overlap to avoid duplicates. Furthermore, because social disorganization and crime opportunity theories have been developed and most frequently tested in urban contexts, the sample of the present study was reduced to census tracts in cities that had a minimum population size of 50,000. While still maintaining variation across medium-sized and larger cities, this threshold also avoids a reverse nesting of small towns in larger census tracts (e.g. in rural areas). This resulted in a sample of 4,531 census tracts in 115 cities.[8]

---

[6] These years represent a more active and recent use of the website: About 81% of all online-promoted IMBs between 2011 (the start of the website) and 2017 had reviews in 2015-2017.
[7] This is the number of IMBs after manual checks for potential duplicates. IMBs that shared addresses and a strong similarity in names were considered duplicates. IMBs that shared addresses but had different names, re-opened using different names, or were located in the same building with other IMBs were not considered duplicates.
[8] Census tracts without population were excluded from the analyses.

Information about the presence of IMBs was merged with geographically and, as far as possible, time-matching geospatial and population data for census tracts and cities. On census tract level, this included 1) demographic and socio-economic data from the 2013-2017 American Community Survey (ACS), which was downloaded from the National Historical Geographic Information System (Manson, Schroeder, Van Riper, & Ruggles, 2018); 2) spatial adjacency and distance measures calculated from the census tracts shapefiles; 3) the geographical coordinates of police stations in the three states using Google's Place Application Programming Interface (API), which were geocoded to the census tracts shapefiles; and 4) OpenStreetMap (OSM) to obtain comparable land use information across the three states (retail, commercial, residential, and industrial land use).[9] City-level demographic and socio-economic data were also obtained through the 2013-2017 ACS, in addition to 1) information about the number of fulltime police employees with arrest power from the 2017 Census of Governments[10]; and 2) crime arrest data from the 2016 Uniform Crime Reporting (UCR) Program (Kaplan, 2018). After accounting for missing information, a total of 4,318 census tracts in 104 cities were retained in the final analytical sample. These cities had a total of 1,368 IMBs with reviews between 2015 and 2017.

Figure 1 shows the distribution of census tracts with IMBs versus those without IMBs across cities. A larger darker-marked bar indicates a greater absolute number (left) or relative

---

[9] OpenStreetMap (OSM) is an open-source collaborative platform containing geospatial data. While not including the precise land use estimates, OSM has been cited for its relative reliable presentation of street maps and land use (e.g. Arsanjani, Mooney, Zipf, & Schauss, 2015).
[10] Another commonly-used source of organizational information about law enforcement agencies is the Law Enforcement Management and Administrative Statistics (LEMAS), coupled with the Census of State and Local Law Enforcement Agencies (CSLLEA). However, at the time of this research, the most recent years covered by these datasets were 2013, and 2008, respectively. In addition, these data do not distinguish between police employees with and without arrest power. These limitations, while oversee-able in many analyses, motivated the use of the census government employees dataset (2017) in the current study. Data were obtained for municipalities and townships.

58

proportion (right) of census tracts that had IMBs compared to census tracts that did not have

IMBs. Following these figures, there is variability of census tract exposure to IMBs across cities,

which supports the notion that the city-level context needs to be considered when explaining the

local presence of IMBs.

Figure 1   Census Tracts With and Without IMBs: n (left) and % (right).
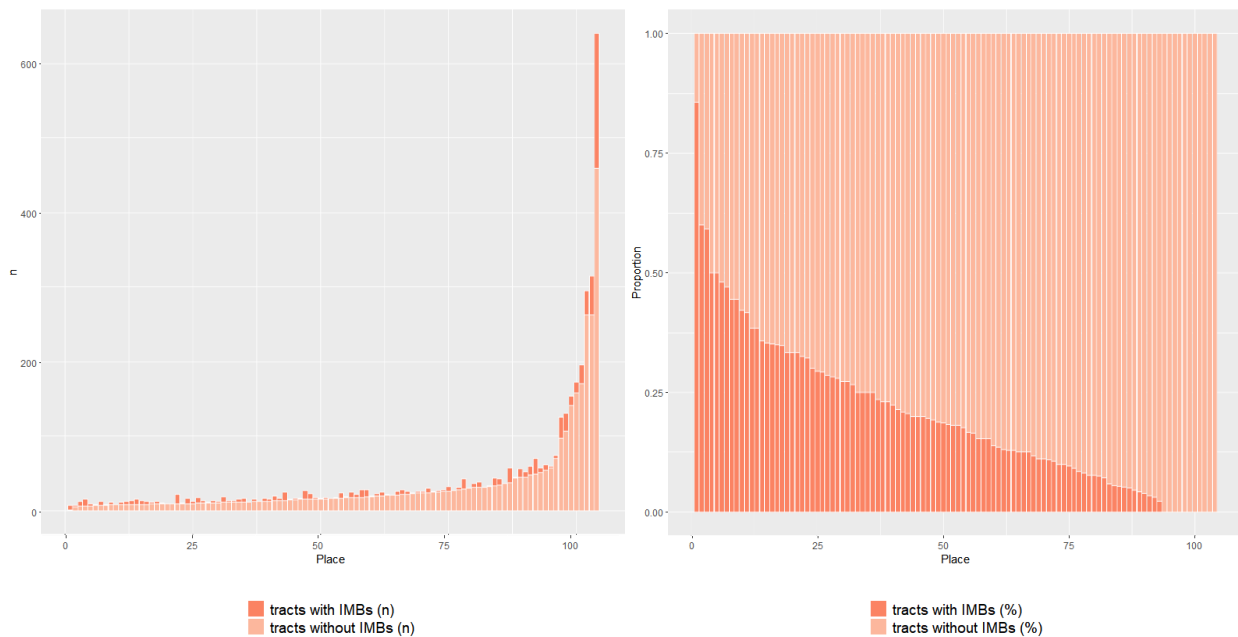
Note. Every bar represents one city (marked by its index). N = 104.

Outcome Measure

The dependent variable represents whether or not a census tract had at least one IMB that

was reviewed between 2015 and 2017 (1 = 'Yes'). Nearly a fifth of the census tracts (18.50%, n

= 799) had at least one IMB (see Table 1). Most of these occupied census tracts had one IMB

(n=527), compared to census tracts that had two (n=154), three (n=56), four (n=27), or more than

five (n=35) IMBs.

Tract-Level Covariates

Social Disorganization: The analyses included four measures as proxies for social disorganization: Concentrated Disadvantage, Residential Instability, Racial/Ethnic Heterogeneity, and Income Inequality. *Concentrated Disadvantage* is included as an indicator of local economic deprivation and was calculated by standardizing the averaged sum of the following standardized variables: percent families with an income below the poverty level; percent female-headed households with children; and percent of the tract population age 25 and older that was unemployed. Cronbach's alpha between these three standardized items was 0.77 (95% CI [0.76, 0.78]). *Residential Instability* was measured through the sum of the following standardized variables: percent renters, percent of the population that changed houses in the past year (Cronbach's alpha was 0.78, 95% CI [0.76, 0.79]). *Racial/Ethnic Heterogeneity* was based on Blau's (1977) index, calculated as $1 - \sum \pi^2$, where π refers to the proportion of each racial or ethnic group. A higher index represents a greater population heterogeneity, which for the current sample ranged between 0 (tract contains only one racial or ethnic group) to 0.803 (substantive population heterogeneity). The average was 0.478 ($sd = 0.181$). *Income Inequality* was included as the standard deviation of the household incomes in the past twelve months, calculated using the midpoints of each census-provided income bin. These midpoints were log-transformed and multiplied by the number observations in each bin such that means and standard deviations could be calculated (see Hipp & Kubrin, 2017). A higher standard deviation represents greater variation in mean income levels within census tracts. The average was 1.050 ($sd = 0.259$).

Crime Opportunities: Four theoretical constructs were created based on crime opportunity theoretical perspectives that argue that the features of certain locations provide favorable conditions for crime and deviancy. First, as a measure of plausible motivated

60

offenders, the percent *Male* of a population was included as a proxy for clientele demand for sexual services in IMBs ($\bar{x} = 0.494$, $sd = 0.042$). Second, ease of access to IMBs was included as a binary variable that represents whether or not a *primary road* (e.g. interstate highway) runs through a census tract (1 = 'Yes'). This was the case for 1,198 census tracts (27.744%). Third, to assess whether IMBs were systematically located around allied, legitimate businesses, possibly to benefit from a shared pool of clientele or workers, or to minimize suspicion by authorities, a set of four binary variables were included that indicate whether or not a census tract had a higher percentage *of commercial, retail, residential*, or *industrial land use* than the city's average (1 = 'Yes'). These binary measures were preferred instead of more common measures representing percentage land use because of substantial spatial differences in tract size. Because the size of census tracts is determined by the number of residents, smaller cities tend to have spatially larger census tracts. This has complications for the calculation of land use measures. For example, a retail center of a small city may account for only a small percentage of a census tract whereas an equally-sized retail center of a big city more likely accounts for a bigger percentage of a census tract. Most census tract were residential areas (N = 1,322, 30.62%), followed by retail centers (N = 833, 19.29%), commercial centers (N = 586, 13.57%), and industrial centers (N = 448, 10.38%). Fourth, to account for local guardianship, a binary variable representing whether or not a census tract was within one mile from a police station (1 = 'Yes') was included. Using the *geosphere* package in R (Hijmans, 2019), this measure was calculated using the shortest distance from a tract centroid to the nearest police station. A total of 1,167 census tracts (27.03%) were within one mile of a police station.

Table 1   Descriptive Statistics for Tracts and Cities

	Measure	*Descriptive Statistics*		
		$\bar{x}$ / N	sd / %	Range
	IMBs (1 = 'Yes')	799	18.504	-
Tracts	Population (log)	8.423	0.543	2.485 – 10.774
	Concentrated Disadvantage	0	1	-1.784 – 7.359
	Residential Instability	0	1	-2.012 – 5.761
	Racial/Ethnic Heterogeneity	0.478	0.181	0.000 – 0.803
	Income Inequality	1.050	0.259	0.000 – 10.389
	% Male	0.494	0.042	0.293 – 1.000
	Primary Road through Tract	1,198	27.744%	-
	Commercial Center	586	13.571%	-
	Retail Center	833	19.291%	-
	Residential Center	1,322	30.616%	-
	Industrial Center	448	10.375%	-
	Police Within Mile	1,167	27.026%	-
Cities	City Size > 100,000	47	45.192%	-
	Police Agency Size (per 1,000)	1.717	0.484	0.824 – 3.764
	Violent Crime Arrests (per 1,000)	5.202	3.024	0.620 – 18.279
	Prostitution Arrests (per 1,000)	0.096	0.171	0.000 – 0.818
	MA	22	21.154%	-
	TX	63	60.577%	-
	WA	19	18.269%	-

City-Level Covariates

Several covariates were included on city-level. First, the analyses controlled for city-level

population to account for the different city sizes included in the sample. This was accounted for

as a binary variable representing whether or not (1 = 'Yes') a city had a population of 100,000 or

more (*City Size*). This variable was included to control for nesting of IMBs in smaller cities,

where theoretical mechanisms might work differently than in larger cities that have received

more theoretical and empirical attention. The sample concerns 47 large cities versus 57 medium-

sized cities. *Agency Size* was included as the total fulltime officers with arrest power, which on

average was 1.717 officers per capita (*sd* = 0.484). In addition, *Violent Crime Arrest Rates* were

included and covered arrests for murder, manslaughter, rape, robbery, and assault ($\bar{x}$ = 5.202;

62

$sd = 3.024$). Lastly, the number of *Prostitution Arrest Rates* per capita was included to control

for variation in police focus on prostitution-related crimes and victimizations ($\bar{x} = 0.096$; $sd = $

0.171). Lastly, the analyses account for whether cities were in Massachusetts (N = 22, 21.154%)

or Washington (N = 19, 18.269%) as opposed to Texas, which was the reference category (N =

63, 60.577%).

Analytic Approach

Hierarchical generalized linear modeling for binary outcomes was used to estimate the

odds of an IMB in a given census tract as a function of the socio-economic features of that tract

and city-level variables. Multilevel techniques do not violate the assumption of independent error

terms and are more appropriate than fixed-effects models that would not allow for estimating

city-level effects (Raudenbush & Bryk, 2002). To validate the relevance of a multilevel model,

an unconditional model, without the independent variables, was estimated to assess whether the

odds of an IMB in a census tract (level one, *i*) depends on the city (level two, *j*), such that:

$$(1) \text{ Level 1: } y_{ij} = \beta_{0j} + r_{ij}$$

$$(2) \text{ Level 2: } \beta_{0j} = \gamma_{00} + \mu_{oj}$$

$$(3) \text{ Mixed: } y_{ij} = \gamma_{00} + \mu_{oj} + r_{ij}$$

Here, the error terms are denoted with *r* for the census tracts and μ for the cities. Additionally,

β_{0j} is the intercept that represents the average likelihood of an IMB in a city, and y_{00} is the

overall intercept. A Likelihood Ratio Test comparing the unconditional model with an intercept-

only logistic regression confirmed that the unconditional model was a significantly improved fit

to the data (p < 0.001). Because a logistic distribution has a variance of $\frac{\pi^2}{3}$, the between-city

variance of 0.731 corresponds with an approximation of an intra-class correlation (ICC)

of $\frac{0.731}{0.731 + \pi^2/3} = 0.182$. This means that 18.2% of the reliable variation in the outcome is

attributable to city-level variation.

Next, the impact of level-one (X) and level-two (Z) variables will first be estimated in two

separate models and then jointly in a combined model as follows:

$$(4)\ Level\ 1\ Covariates: y_{ij} = \beta_{oj} + \sum_{t=1}^{T} \beta_{t_0} X_{t_{ij}} + \mu_{oj} + r_{ij}$$

$$(5)\ Level\ 2\ Covariates: \beta_{oj} = \gamma_{00} + \sum_{c=1}^{C} \gamma_{0_c} Z_{c_{ij}} + \mu_{oj}$$

$$(6)\ Level\ 1\ and\ 2\ Covariates: \beta_{oj} = \gamma_{00} + \sum_{t=1}^{T} \beta_{t_0} X_{t_{ij}} + \sum_{c=1}^{C} \gamma_{0_c} Z_{c_{ij}} + \mu_{oj} + r_{ij}$$

Here, T refers to the census tracts for which the impact of variables X will be estimated. C refers

to the cities for which the contextual effect of variables Z will be estimated. Continuous variables

were grand-mean centered to avoid multicollinearity between the independent variables and the

intercept, and to facilitate interpretation such that each main effect can be interpreted as the

effect of a variable when other variables were at their means of zero. Analyses were conducted in

R (R Core R Core Team, 2019) using the *lme4* package for multilevel modeling (Bates,

Maechler, Bolker, & Walker, 2015).

Findings

Geographic Correlates Associated with the Locations of IMBs

Table 2 presents the Odds Ratios (ORs) and 95% confidence intervals from the multilevel

models. ORs above one can be interpreted as an increased likelihood of IMBs for a census tract

64

in a given city whereas ORs less than one indicate a decreased likelihood. Model 1 presents the findings of a mixed model (equation 6). Largely consistent with social disorganization theory (hypothesis 1), an IMB was between 1.5 and 6 times more likely in census tracts with increased population (OR = 1.579, 95% CI [1.315, 1.897]), residential instability (OR = 1.278, 95% CI [1.158, 1.411]), population heterogeneity (OR = 5.749, 95% CI [3.078, 10.736]), and income inequality (OR = 1.578, 95% CI [1.071, 2.325]). These findings confirm the idea that several features of transition zones, especially population heterogeneity, were associated with an increased presence of risky facilities. However, the negative impact of concentrated disadvantage contradicts prior work on neighborhoods and crime and here suggests that IMBs were less likely to be found in disadvantaged areas (OR = 0.644, 95% CI [0.572, 0.725], which equals a decreased odds of 35.6%). In addition, two effects are consistent with crime opportunity theoretical perspectives (hypothesis 2). First, IMBs were more likely to be found around legitimate businesses, in retail centers (OR = 1.603, 95% CI [1.291, 1.993]). Second, census tracts that were easily accessible through primary roads were also more likely to attract IMBs (OR = 1.221, 95% [1.007, 1.482]).

While corroborating several aspects of social disorganization and crime opportunity theories, the impact of police presence is less clear (hypothesis 3). Surprisingly, a police station within a mile distance increased the odds for a census tract to have IMBs, by a factor of 1.252 (95% CI [1.018, 1.542]. However, this effect was more pronounced in smaller cities as follows from Model 2 that adds an interaction term between the presence of a police station within a mile distance and a binary variable representing city population size that was larger than 100,000. To aid the interpretation of this interaction effect, Figure 2 presents the marginal effects of the interaction term. It follows from the figure that, at least in small cities, neighborhoods within a

65

mile distance of a police station were also the neighborhoods that were more likely to have IMBs, compared to the neighborhoods that were at least a mile away from a police station. In larger cities, a police station had little effect on the presence of IMBs.

Similarly, a larger city-level police force with arrest power did not seem to influence the local likelihood of IMBs. However, it is important to note that the effect of police presence may depend on how police are deployed rather than the number of police officers. An important factor on city-level was violent crimes per capita, which had a negative impact on the odds for a tract to have IMBs. An increase in the per capita number of violent crimes was associated with a decreased likelihood of IMBs by a factor of 0.907 (95% CI [0.848, 0.969]), equaling a decrease of nearly 10%. Lastly, the odds for a neighborhood to have IMBs were higher in Washington, compared to Texas. There were no significant differences between Massachusetts and Texas.

Figure 2   Marginal Effects of the Interaction between Police Mile Away and City Size
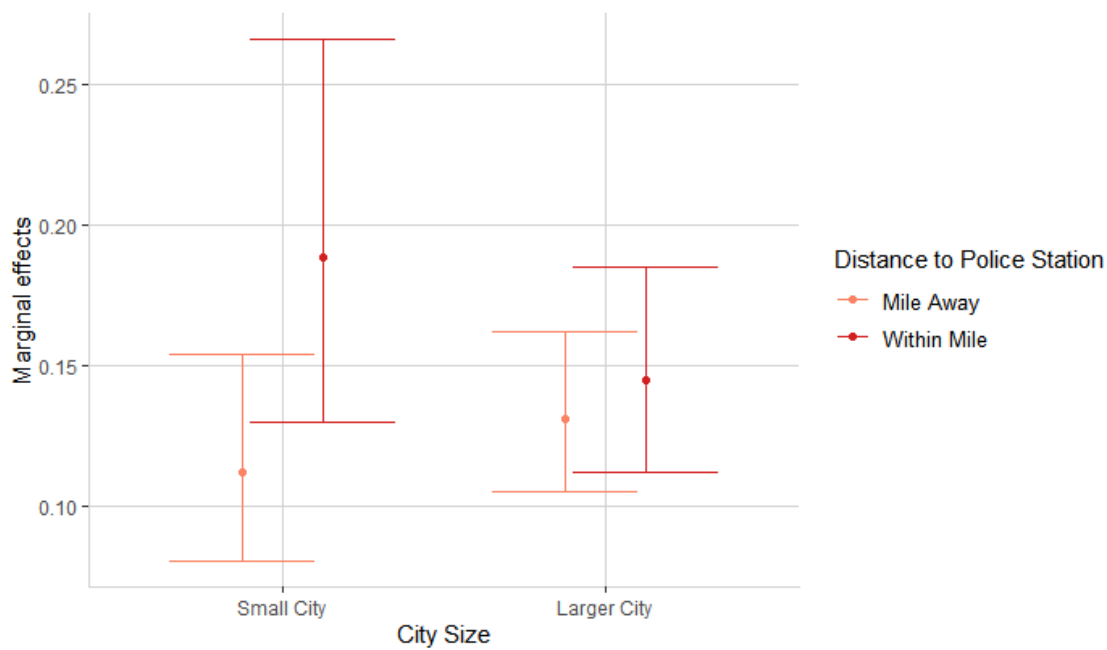
Sensitivity Analyses

To assess the rigor of the findings, a spatial lag of the residual errors from Model 2 was added in sensitivity analyses to control for dependence of errors in the regression models. To determine if spatial autocorrelation between census tracts was present, a Moran's I using the residual errors was calculated for each city separately. Spatial weight matrices were created using the *spdep* package in R (Bivand, Pebesma, & Gomez-Rubio, 2013), and are here based on queen contiguity-based weights that consider tracts sharing a common edge or vertex as neighboring tracts. Spatial autocorrelation was identified in less than 10% (n = 7) of the cities and was generally weak or modest (Moran's I <= 0.306). This finding suggests that the overall presence of IMBs was spatially dispersed across neighborhoods within cities. Furthermore, Model 3 in Table 2 shows that adding a spatial lag to the model increased the local likelihood of IMBs but had otherwise a negligible impact on the significance or effect sizes.

Discussion and Conclusion

This study extended theoretical notions from social disorganization and crime opportunity theories to online-promoted IMBs. While the online promotion through review boards may reduce the dependency on physical cues to signal illicit opportunities (Chin et al., 2019; Venkatesh, 2011), the findings corroborate the intricate relationship between crime and place as hypothesized by these theories. However, this study also shows that neither theory is a fully accurate or sufficient explanation on its own.

Following the results from a multilevel model, a census tract in an average city was more likely to have an IMB when it faced higher levels of disorganization, urban change or instability.

Table 2   Findings from Hierarchical Logistic Regression Models

Variable	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Census Tracts						
Population (Log)	1.579***	[1.315, 1.897]	1.581***	[1.316, 1.898]	1.576***	[1.313, 1.893]
Concentrated Disadvantage	0.644***	[0.572, 0.725]	0.641***	[0.570, 0.722]	0.645***	[0.573, 0.727]
Residential Instability	1.278***	[1.158, 1.411]	1.280***	[1.160, 1.413]	1.279***	[1.158, 1.412]
Racial/Ethnic Heterogeneity	5.749***	[3.078, 10.736]	5.579***	[2.983, 10.436]	5.501***	[2.940, 10.292]
Income Inequality	1.578*	[1.071, 2.325]	1.584*	[1.081, 2.319]	1.579*	[1.071, 2.329]
% Male	0.240	[0.030, 1.914]	0.259	[0.033, 2.069]	0.296	[0.037, 2.358]
Commercial Center	1.206	[0.944, 1.539]	1.203	[0.942, 1.537]	1.195	[0.935, 1.528]
Retail Center	1.603***	[1.291, 1.993]	1.603***	[1.290, 1.993]	1.598***	[1.285, 1.987]
Residential Center	0.917	[0.752, 1.118]	0.919	[0.753, 1.12]	0.925	[0.758, 1.129]
Industrial Center	1.066	[0.810, 1.403]	1.060	[0.805, 1.395]	1.064	[0.808, 1.401]
Primary Road	1.221*	[1.007, 1.482]	1.231*	[1.015, 1.494]	1.225*	[1.009, 1.487]
Police within Mile	1.252*	[1.018, 1.542]	1.842**	[1.209, 2.808]	1.870**	[1.227, 2.852]
Cities						
City Size (>= 100,000)	1.037	[0.726, 1.483]	1.195	[0.813, 1.756]	1.212	[0.827, 1.775]
Police Agency Size (Per 1,000)	0.783	[0.515, 1.188]	0.791	[0.521, 1.204]	0.783	[0.518, 1.183]
Violent Crime Arrest (Per 1,000)	0.907**	[0.848, 0.969]	0.908**	[0.849, 0.971]	0.908**	[0.850, 0.971]
Prostitution Arrest (Per 1,000)	1.185	[0.456, 3.078]	1.157	[0.444, 3.015]	1.160	[0.452, 2.971]
MA	1.674	[0.995, 2.815]	1.571	[0.929, 2.655]	1.564	[0.931, 2.629]
WA	1.806**	[1.153, 2.828]	1.813**	[1.156, 2.842]	1.775*	[1.139, 2.769]
Interaction Term						
City Size * Police within Mile	-	-	0.610*	[0.381, 0.977]	0.600*	[0.374, 0.963]
Spatial Autocorrelation						
Spatial Lag	-	-	-	-	1.419***	[1.174, 1.715]
Intercept	0.279**	[0.130, 0.599]	0.245***	[0.113, 0.532]	0.261***	[0.121, 0.561]
Random effects cities σ^2 (σ)	0.352 (0.594)		0.355 (0.596)		0.338 (0.581)	

Note. OR = Odds Ratio; *CI* = Confidence Interval. * p < 0.05; ** p < 0.01; *** p < 0.001.

This was observed through residential instability, population heterogeneity, and income inequality. However, concentrated disadvantage, a key pillar of social disorganization theory, had a theoretically unanticipated impact. In other words, affluent rather than disadvantaged areas attracted IMBs. While this finding contradicts the many empirical tests of social disorganization theory, it aligns with prior work on the location of IMBs or adult and sex-related businesses that are frequented by higher-income clientele (Chin et al., 2019; Edwards, 2010). More research is needed to understand whether a benign neglect toward potential victimizations in IMBs bypasses the social control mechanisms that keep out other crimes in advantaged areas.

Furthermore, if not in rapidly changing areas, that is controlling for social disorganization measures, IMBs were more likely in areas with increased crime opportunities through greater population density, easy access provided by primary roads, and in retail centers. However, the role of police presence is yet unclear. For example, IMBs would locate in neighborhoods despite a potential proximity to police stations even though routine activity theory hypothesizes that capable guardianship can prevent crime (Cohen & Felson, 1979; Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980). On city level, a larger per capita police force also did not prevent the local likelihood of IMBs, and more research is needed to understand how police are and should be deployed to prevent the presence of IMBs.

Two sets of explanations can be provided for the theoretical paradox in these findings, which support a theoretical integration and highlight the role of online domains in subtly changing the geography of online-promoted crimes. First, a theoretical integration is doing more justice to the empirical complexity of IMBs. In the present context, it helps explain where illicit labor from more marginalized communities has greater potential to meet the demand and routine travels of clientele with the financial means to pay for illicit services (Dank et al., 2014; Polaris,

69

2018). Furthermore, from a crime opportunity perspective, structural neighborhood characteristics (e.g. population heterogeneity) might not only reduce levels of informal social control but may also signal a larger pool and lower costs of finding employees, especially when considering that IMBs largely employ racial or ethnic minorities (Dank et al., 2014; Polaris, 2018).

Crime opportunity perspectives are also helpful to explain the increased odds of IMBs in more populous, affluent, as well as retail areas, where risky facilities can blend into legitimate settings to benefit from a shared pool of clientele under relatively weaker levels of guardianship compared to other areas in the city (Eck, 1995b). Furthermore, the significant role of primary roads aligns with the journeys to crime literature based on which it can be argued that IMBs are strategically located in easily accessible areas that allow out-of-city or even out-of-state travel, match the routine travels of clientele, or reduce the effort to engage in illicit behaviors (Boivin & D'Elia, 2017; Brantingham & Brantingham, 1995). In addition to facilitating demand, the proximity to a highway can also facilitate the observed inter-city and inter-state rotation of providers (Dank et al., 2014; Polaris, 2018).

Whereas these explanations put emphasis on the importance of crime opportunity perspectives, the findings support a joint relevance of social disorganization theory to strengthen explanations of the geography of online-promoted IMBs. In particular, the findings indicate that complex social mechanisms involving urban change, social stratification and inequality contribute to the problem of IMBs. These are mechanisms that are commonly associated with reduced levels of informal social control and may also drive the dependency of a marginalized community on the income of illicit, shadow or less-regulated economies. Furthermore, it is important to note that several of the above crime opportunity features may also attract IMBs

70

through lower levels of informal social control. For example, informal social control tends to be lower in busy, retail and commercial areas compared to quiet residential areas because of the number of daily non-residents that are less likely to interact with each other and act upon a set of shared values to prevent crime (e.g. Hipp & Williams, 2019; Lockwood, 2007; Wilcox et al., 2004).

In addition to the relevance of a theoretical integration, various of these surprising findings might also relate to online domains that affect the geography of online-promoted crimes. Consider, for example, that an earlier study by Chin et al. (2015) initially found a stronger likelihood of IMBs in low-income areas, yet their later work reported on a clustering of IMBs in higher-income areas (Chin et al., 2019). The authors explain this difference through an online promotion of these places that offers indoor sex venues increased locational flexibility, moving them into higher income and suburban areas (Venkatesh, 2011). Online review boards might also allow IMBs to be situated alongside allied, legitimate businesses, where their presence looks less suspicious and where clientele can rely on online reviews to separate illicit venues from their legitimate counterparts. These online reviews generally help clientele to locate IMBs who oftentimes traverse neighborhood borders to find illicit massage (see Chapter 4). Lastly, it is possible that an online signaling of illicit opportunities allows IMBs to be located in areas despite a potential police presence. While more research is needed, recent qualitative work has shown how clientele use review boards as a way to warn about intensified police monitoring or to develop the idea that law enforcement arrests are avoidable by temporarily frequenting IMBs in another area (Blevins & Holt, 2009; Holt et al., 2008, 2014).

Furthermore, in providing clientele access to the exact locations of IMBs, these online platforms might also reduce the need for IMBs to be in spatial proximity to each other (although

71

ecological cues remain important considerations for these places). Sensitivity analyses showed that IMBs were spatially dispersed within cities, which contradicts the extant literature on crime concentration (e.g. Morenoff & Sampson, 1997; Morenoff et al., 2001). Even so, a spatial dispersion of IMBs is consistent with the literature on illicit market places and can be a strategy to avoid local competition of illicit premises or law enforcement attention (Eck, 1995b), or may be a way to culturally and linguistically isolate providers (Chin et al., 2019).

Several limitations need to be considered when drawing conclusions from the findings. First, it is yet unclear why police stations were associated with substantially increased odds of IMBs in smaller cities. It is possible that a local police station in small cities reflects another underlying condition that attracted IMBs, such as affluence or accessibility through highways. More research is needed to unpack this effect. Relatedly, future research may also seek to improve the current measures of local and contextual guardianship by examining a broader set of guardianship mechanisms such as security alarms, camera systems, community-based guardianship, or city-level regulations that do not involve the criminal justice system.

In addition, given the cross-sectional nature of this study, no causal directions can be established, which is a particularly important note of caution for the interpretation of crime arrest effects. Although the present study revealed that city-level crime arrest rates were associated with reduced odds for IMBs, another study found that the presence of IMBs implied the subsequent increase in local crime and disorder (Huff et al., 2018). The extent to which IMBs indeed bring in crime and disorder in neighborhoods remains an important future inquiry (see, for examples, Edwards, 2010; Huff et al., 2018; Tewksbury & McCord, 2014).

Lastly, while reviews posted on web forums are increasingly being used to collect data about hard-to-reach populations such as clientele of commercial sex (Holt & Blevins, 2007),

72

gangs (Pyrooz et al., 2015), and hate groups (Chau & Xu, 2007), few studies have examined the representativeness of online samples of a total population. Although the analyses are based on one of the most comprehensive review boards for IMBs in the U.S, it is certain that some premises were not promoted through the website. This could introduce a bias when these premises were located in systematically different neighborhoods. At the same time, the current sample represents online-promoted IMBs and the processes to explain the existence of hidden or entirely offline IMBs might be different than the ones identified here.

Limitations notwithstanding, this research yields important implications for the applicability of criminological theory to online-promoted risky facilities. The importance of both social disorganization and crime opportunity theories aligns with relatively recent studies that call for a theoretical integration to strengthen explanations of local crime problems (Weisburd et al., 2014; Wilcox & Land, 2017; Wilcox et al., 2003). With these findings, the study also seeks to provide a basis for a criminological research agenda that is attuned to the role of online media in facilitating an ideal environment or convergence space for crime. With this in mind, the extension of fundamental criminological theories to other types of online-promoted crimes merits attention in future research. Furthermore, this study encourages analyses that provide further depth to the aggregate measures used in this study. For example, while the analyses confirm the importance of aggregate land use measures (Sampson & Raudenbush, 1999), it is possible that particular land uses such as bars, nail salons or legitimate massage therapy create different opportunity structures for crime. Further granularity can also be provided by examining the specific determinants for risky facilities at street segments, especially because different variables may matter at different geographic units of analysis and "there is no single 'appropriate' level of aggregation" (Hipp, 2007, p. 674).

On a practical level, the joint relevance of ecological and situational perspectives to explain the locations of risky facilities can direct crime-prevention and crime-control resources to areas where IMBs are most likely. Whereas criminal justice strategies may not be the (sole) answer to risky facilities that host potential victimizations stemming from socio-economic vulnerability and marginalization, this study highlights the importance of strengthening local informal social control mechanisms. Both social disorganization and crime opportunity theories provide avenues for strengthening informal social control, through neighborhood ties (Sampson & Groves, 1989) or relying on individuals and institutions that are in a position to regulate or monitor the behaviors of would-be offenders (Eck, 1995a; Felson, 1995). Measures that seek to strengthen informal social control within a community may include awareness-raising strategies among residents about potential victimizations in their neighborhood.

In addition, given the systematic nesting of IMBs in retail areas, these awareness-raising strategies should engage local "place managers" such as business owners, landlords, or anyone else that is in the position to control or regulate the establishments or behaviors of clientele and potential criminal networks. Furthermore, policies need to be sensitive to the lack of immediate clustering that may increase a cultural and linguistic isolation of providers and limit their opportunities to connect and seek help when needed. This observation requires an active outreach and a victim-centered approach by police, community organizations, or victim service agencies. Overall, this study seeks to encourage more research on online-promoted risky facilities that combines theory, open-source data, and empirical research to inform a broader set of effective and non-discriminatory crime prevention strategies.

74

Chapter 4   The Role of Spatial Proximity and Physical Cues in Networks of Crime and

Deviancy in the Age of the Internet: The Case of Illicit Massage Businesses

Introduction

The traditional notion that criminal, deviant, or any other type of social interactions depend on opportunities in physical space (Blau, 1977) is now challenged with opportunities to connect through online domains (Small & Adler, 2019). Indeed, past work on gangs, illicit drug markets, and terrorism has begun to show that crime and deviant groups maintain a strong online presence (Blevins & Holt, 2009; Pyrooz et al., 2015; Wall, 2007). Online interactions with deviant peers may drive deviant groups to criminal activity outside of original neighborhood-based geographies. This would support a broader array of research on social networks, which suggests that physical space has become "unnecessary to many network processes" (Small & Adler, 2019, p. 1). At the same time, many studies demonstrate that online connections continue to be localized into narrow geographies (see, for a comprehensive review of the literature, Small & Adler, 2019). However, to date, the geographic coverage of web-facilitated networks of crime and deviancy has received little empirical attention.

In order to illuminate whether online networks of crime and deviancy span across greater spatial distance, the extent to which illicit behaviors traverse neighborhood boundaries and, as such, span ties between neighborhoods, need to be studied. These inter-neighborhood connections represent what Sampson meant with neighborhoods becoming "nodes in a larger network of spatial relations" (2004, p. 158). A network of neighborhoods can capture the diffusion of crime and deviant norms as a function of spatial distance or other geographic and social features. Only a few prior studies have examined how crime can diffuse toward different urban areas as a result of criminal networks transcending neighborhood boundaries, for example

75

when gang members reside in different neighborhoods (Papachristos & Bastomski, 2018; Schaefer, 2012). This study posits that technology – specifically here, the Internet - has the potential to further facilitate this diffusion through online social interactions and increased exposure to crime opportunities in distant areas.

Using data from online reviews about illicit massage businesses and their clientele in Houston, the purpose of this study is to develop an understanding of the spatial patterning of web-facilitated networks of crime and deviancy. The term 'illicit massage businesses' (IMBs) is used to refer to venues that purport to offer massage but where illicit events such as commercial sex and sex trafficking have been documented. IMBs have recently received heightened attention in public and policy discourse due to their growing presence in many U.S. cities and concerns about a connection to human trafficking operations (Bouché & Crotty, 2017; Polaris, 2018). In addition to human trafficking, concerns exist about a wide range of crime and acts of deviancy, including verbal, physical, and sexual violence by clients, robberies, and organized crime (Chin et al., 2019; Dank et al., 2014). These concerns are profound in Houston, a city that has attracted more IMBs than most other cities in the U.S. (Bouché & Crotty, 2017), perhaps because of its local geo-economic conditions such as proximity to an international border, connectivity to the rest of the U.S., and a substantially large economic sector in sex-related businesses that not only involve IMBs but also other venues for commercial sex such as strip clubs and cantinas (Farrell, McDevitt, & Fahy, 2008, p. 100).

While the presence of IMBs in cities is not new (Armstrong, 1978; Bryant & Palmer, 1975), the establishments are now being promoted through online classifieds and review boards that provide clientele with the locations of IMBs in virtually any neighborhood (Blevins & Holt, 2009; Holt et al., 2008, 2014). This offline-online interaction makes the problem of IMBs a

76

compelling case to analyze the geographies of web-facilitated networks of crime and deviancy compared to past work on the spatial networks of crime that has not directly measured the role of the internet in connecting spatially proximate or distant areas in patterns of crime. Furthermore, the online-offline link in this study is also unique compared to studies on other forms of commercial sex and sex trafficking that are not connected to a stationary location.

The following section outlines several theoretical mechanisms that help explain under which circumstances criminal and deviant behaviors can span ties between neighborhoods. The data and methods sections describe how this study observes inter-neighborhood networks through offline visits to IMBs as documented in online reviews. Next, structural and geographic properties of the resulting networks will be presented, followed by a series of statistical models that identify the features explaining the formation of inter-neighborhood networks. The findings yield important implications for future studies on crime, place and online networks, and have direct relevance for crime prevention and control strategies, specifically those addressing the diffusion of deviant norms and the use of technology to target sex trafficking and related crimes.

Offline Inter-Neighborhood Tie Formation

Besides social networks that reduce crime and deviancy through inducing neighborhood satisfaction, cohesion and social organization (Kasarda & Janowitz, 1974; Sampson, 1988; Sampson & Raudenbush, 1999), social networks can provide favorable conditions for crime through exposing people to acts of crime, providing instrumental support, or facilitating the diffusion of information, capital, and norms (Carrington, 2014; McGloin & Nguyen, 2013; Morselli, 2013). When these latter social networks traverse neighborhood boundaries, they span

77

ties between neighborhoods, and it is through these ties that crime can diffuse across greater distance.

A few studies have begun to analyze such neighborhood networks, mostly in the context of gang co-offending or routine travels of delinquents (Bichler et al., 2014; Boivin & D'Elia, 2017; Davies & Johnson, 2015; Papachristos & Bastomski, 2018; Schaefer, 2012). Broadly, these studies as well as extant literature on the geographies of crime networks suggest four mechanisms that explain why criminal and deviant groups traverse neighborhood boundaries and, as such, span ties between these neighborhoods.

First, the key mechanism of interest is *spatial proximity.* The importance of spatial proximity is based on a general social principle that we are more likely to socialize with others who are spatially proximate to us because of increased opportunities and the least amount of effort involved to connect (Blau, 1977; Zipf, 1949). A decaying likelihood to form a tie when spatial distance increases has consistently been reported for networks of criminal peers who are most likely to operate within spatially proximate neighborhoods (Hipp & Perrin, 2009; Kirk & Papachristos, 2011; Morenoff et al., 2001; Tita & Greenbaum, 2009).

Second, the probability of a tie between any two neighborhoods can depend upon an attribute of either neighborhood. This implies a *social selection process* (Robins, Elliott, & Pattison, 2001), whereby a specific attribute of a neighborhood, such as income or crime levels, increases the likelihood of a tie with any other neighborhood. Prior work has consistently shown increased levels of offending in socially disorganized communities with higher levels of concentrated disadvantage, which can make it difficult for communities to build social bonds that prevent and control criminality (Papachristos & Bastomski, 2018; Sampson & Groves, 1989; Schaefer, 2012; Shaw & McKay, 1942, 1969). However, when acts of offending require victims

78

and offenders without a pre-existing relationship to be in the same place, crime opportunity theoretical approaches may provide more suitable explanations for behaviors that transcend neighborhoods. For example, routine activity theory suggests that places can attract crime when they operate as a "shared activity space" where daily routines, such us commutes between work and home or easy access through a proximity of a highway facilitate a convergence of suitable targets and offenders in time and space under weak capable guardianship (Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980; Miró, 2014). Capable guardians can be police or any other authority whose presence or actions can reduce the odds of crime events. In addition to police and other entities that exercise formal social control, capable guardians can be place managers with supervisory responsibility, or any other person or organization exercising informal social control and in whose physical or symbolic presence a crime is less likely to occur (Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980). These situational cues may be particularly important for a pool of clientele that are more advantaged, and social deprivation is then unlikely the mechanism that drives their illicit behaviors (Chin et al., 2019; Polaris, 2018).

Third, *social proximity* can help explain why social and crime-involved ties span between more distant areas, specifically when these have similar characteristics, such as related to race and ethnicity, socioeconomic status, or religion of residents. This is generally understood as a pattern of homophily (Feld, 1982; Lazarsfeld & Merton, 1954; McPherson et al., 2001). Homophily effects translate well to the context of illicit marketplaces, where a social proximity between individuals or places can help establish familiarity, security, and access. This may explain why individuals, for example those engaging in commercial sex or illicit drug markets, travel to distant yet similar-looking areas that provide a sense of security or an expectation to meet like-minded individuals (Eck, 1995b). Furthermore, findings from studies on gang co-

79

offending confirm that when gang members extend ties beyond their own or adjacent neighborhoods, they are more likely to co-offend with someone residing in neighborhoods that are similar in levels of disadvantage, racial and ethnic composition, proportion of single-parent households, and criminal activity (Papachristos & Bastomski, 2018; Schaefer, 2012). Spatial and social proximity of any two neighborhoods may overlap because neighboring areas often also possess similar socio-economic features (Feld, 1981; Hipp & Perrin, 2009; Tita & Radil, 2010).

Fourth, inter-neighborhood tie formation can be a function of *endogenous network effects*, meaning that "a tie comes into place in response to the existing local social environment within which the two individuals [or neighborhoods] operate" (Lusher, Koskinen, & Robins, 2013, p. 19). Two central processes have been highlighted in the literature: preferential attachment and triad formation. Preferential attachment is often simplified to the idea that "the rich get richer" (Barabási & Albert, 1999; Merton, 1968) and here implies that ties between neighborhoods are more likely when any of these neighborhoods are among the most popular areas for offending. Furthermore, triad formation is often simplified to the idea of "a friend of a friend is a friend" (Wasserman & Faust, 1994) and would imply that neighborhoods that share a connection to a third neighborhood (two-paths) are also more likely to be connected to each other. This is often measured in the form of triangles or path closures, which have shown to be common in crime-involved networks that rely on social connections to gain familiarity, trust, or stay under the radar of law enforcement (Carrington, 2014; Morselli, 2013).

In summary, if not because of spatial proximity, inter-neighborhood ties can form as a result of social proximity, social selection processes, or network effects. What has largely been left unexplored in relation to these processes is the extent to which web-facilitated interactions may allow crime to move further afield, in different patterns, or draw on different mechanisms.

Web-Facilitated Inter-Neighborhood Tie Formation

Online technologies have changed our social worlds as communication patterns move online and take away significant physical barriers to connect. The emergence of web-facilitated social networks has been thought of as "the death of the distance" (Cairncross, 1997), whereby online communications no longer depend on place-bound communities (Wellman, 2001). Using data from social networking sites such as Twitter and Facebook, studies have found that online media indeed offer the opportunity for significant long-distance social interactions, yet continue to be localized in part because social media has become more location-aware with the possibility to geotag information (Barthelemy et al., 2003; Mok et al., 2010; Wellman & Hampton, 1999; Yook et al., 2002). Overall, research provides mixed leads as to whether the internet replaces, supplements, replicates, or otherwise alters the geography of offline interactions (see, for a review, Small & Adler, 2019).

For offenders and potential victims, the internet can function as a "virtual convergence space" (Felson, 2006; Pyrooz et al., 2015). However, the geographical coverage of this digital space is theoretically ambiguous. Similar to what is being suggested in the broader literature on social networks, online networks of crime and deviancy may reflect pre-existing offline behaviors in localized geographies. For example, several studies examining social media use among gang members have suggested that online interactions increasingly replace the word-of-mouth strategy to channel reputations and activities (Decker & Pyrooz, 2012; Pyrooz et al., 2015). Furthermore, routine online behaviors may be spatially and socially patterned in the same way as offline behaviors, particularly given that structural inequalities continue to shape our offline and online interactions (Sampson, 2012, 2017). At the same time, online domains may also reinforce environmental conditions that exhibit crime opportunities, for example when

81

offenders respond to online cues about the characteristics of neighborhoods, actively search for crime opportunities in nearby areas, or seek to use a secure platform to connect with peers.

At the same time, new opportunities arise for motivated offenders to connect with potential victims as well as with each other in virtually any geographic area (Wall, 2007). Online platforms are somewhat anonymous, subject to limited regulations, and allow for a rapid flow of information. These criteria have shown to be of importance to deviant groups and criminal networks involved in crimes such as cybercrimes, terrorism, or race supremacy groups, who can expand the recruitment of members beyond local or regional audiences to whole countries and continents, thus instigating acts of violence in and beyond a region (Burris, Smith, & Strahm, 2000; Abbee Corb, 2011; Daniels, 2013; Holt & Bossler, 2008; Reid & Chen, 2007). While online-promoted crimes differ from cybercrimes in that the illicit acts still occur in physical space, it is possible that online domains alter the location choices of offenders.

In addition, online interactions, such as conversations in social media or forums, may facilitate connections among like-minded individuals and encourage their involvement in crime and deviant behaviors (Pyrooz et al., 2015; Wall, 2007; Wellman, 2001). The internet offers abundant opportunities to bully, harass, or engage in deviant illicit acts online, which could also activate criminal propensities in an offline setting (Pyrooz et al., 2015). In addition, virtual subcultures – as seen in the context of deviant, sexual behaviors – provide normative orientations or justifications that dictate and reinforce deviant behaviors (Blevins & Holt, 2009; Maratea & Kavanaugh, 2012; Pyrooz et al., 2015). This would change the spatial patterning of crime and deviancy when the reach of illicit behaviors spans greater distance or when individuals would unlikely be involved in illicit behaviors without the facilitation of the web.

Web-Facilitated Clientele Networks of IMBs

The spatial patterning of web-facilitated behaviors can be examined directly through the formation of online social networks as documented in social media or crime-specific websites (e.g. hacking websites or review boards for commercial sex). Online clientele networks of IMBs are an interesting case to examine whether the afore-mentioned four mechanisms help explain inter-neighborhood tie formations that are partially constructed through an online platform. IMBs have raised public alarm, especially because of concerns related to commercial sex and sex trafficking (Bouché, 2017; Huff et al., 2018). Sex trafficking was only recently criminalized in 2000 (Trafficking Victims Protection Act, TVPA), though concerns about commercial sex, sex crimes, and sex trafficking are historically rooted in complex debates about exploitation, rights of marginalized groups, and links to organized crime (Farrell & Fahy, 2009).

Similar to many other forms of crime and deviancy, the existence of IMBs is driven by social demand and interactions. However, these interactions extend beyond the typical victim-offender or offender-offender interactions and entail a broad social demand of clientele who not necessarily engage in illicit behaviors per se, but may find resonance for sexual behaviors, addictions, and potential abuse in online reviews and forums. IMBs in the U.S. heavily draw on online review systems that function as any other service review sites but are here specifically designed for IMBs (Bouché & Crotty, 2017).

These online platforms not only leave a digital footprint of offline visits, but also present new opportunities for clientele to locate sexual services elsewhere and disperse illicit events to areas beyond traditional locations such as red-light districts (Chin et al., 2019; Dank et al., 2014; Murphy & Venkatesh, 2006; Venkatesh, 2011). This is because clients may report about important cues for others to weigh perceived rewards against risks. For example, Holt, Blevins

and Kuhns (2008) document how clients share detailed information about sexual services that were offered, which may drive other clientele to travel to these places in expectation of the same services. Reviewers may also report about the presence of police to dissuade other clientele from going to areas where police are actively monitoring IMBs and where the risk of law enforcement apprehension is perceived to be higher (Holt et al., 2008).

Now that clients can learn about the location and features of IMBs and their neighborhoods through online reviews, they may be inclined to travel greater distances, spanning ties between distant areas if those areas match their interests and routines and under the assumption that there is little risk of arrests (Blevins & Holt, 2009; Holt et al., 2008). This would be consistent with the extant literature on offender's location choices, which suggests that offenders weigh the expected rewards, risk and effort when choosing to travel towards areas to engage in illicit behaviors (Boivin & D'Elia, 2017; Brantingham & Brantingham, 1995; Cornish & Clarke, 1987). To date, the specific circumstances through which web-facilitated interactions connect distant neighborhoods in patterns of crime and deviancy have not been examined.

Current Study

This study seeks to identify the processes that influence inter-neighborhood tie formation as observable through online clientele networks of IMBs. The clientele networks that span across different neighborhoods are important to understand in light of the diffusion of deviant norms and instrumental support for crime and deviancy across a city. The broader purpose is to understand whether the formation of online crime-involved networks is influenced by spatial or social proximity, specific neighborhood features, or network properties. Following the theoretical overview in the previous sections, this study hypothesizes that spatial proximity still

matters for inter-neighborhood tie formation through web-facilitated IMB visits; yet ties may span across greater distance through online reviews that may motivate visits to IMBs 1) in different census tracts 2) that are socially proximate; 3) have particular features that facilitates the convergence of suitable targets, motivated offenders, and absence of capable guardianship; and 4) as a result of network-specific characteristics.

Methods

Data

Information about online clientele networks of IMBs in the city of Houston was extracted from one of the most popular national review board for sexual services in IMBs in the U.S.[11] Publicly accessible information about the location of IMBs, the user IDs of clients, and the dates and number of online reviews was obtained. Although online reviews may not be representative of all clientele, they likely capture a theoretically-relevant pool of more motivated clientele: Those who are willing to go through a paywall to read and post sexually-oriented reviews.[12] In addition, recent research applied a camera tracking system to find that the number of online reviews is proportional to the number of actual, offline visits in IMBs (Bouché & Crotty, 2017).

The addresses of a total of 436 IMBs that received reviews in or prior to 2017 were geocoded to 197 census tracts using shapefiles from the United States Census Bureau, which included tracts within or intersecting with Houston's city borders. Census tracts are commonly used in studies to examine the ecological correlates of crime (e.g. Morenoff et al., 2001; Peterson

---

[11] The name of the website was not mentioned in order to preserve some anonymity of the users, commercial sex providers, and locations where potential victimizations occur.
[12] Basic information about IMBs and their clientele is available without registration, but users have to create a paid user account should they want to read and post reviews.

85

& Krivo, 2009; Schaefer, 2012). The IMBs had a total of 5,627 review posts, which were posted by 1,985 unique user accounts between 2011 and 2017. These online data were used to first create a two-mode, tract by IMB matrix, where each of the cells represent the number of clients who visited and posted a review about an IMB i in a given census tract j. This matrix was then multiplied by its transpose to obtain a symmetric one-mode, tract by tract, matrix. The cells in this adjacency matrix count how many unique clients posted reviews about an IMB in both tract i and j, thus spanning a tie between i and j. A total of 6,601 of such ties were detected between the 197 census tracts that had IMBs.

To obtain attribute information for the census tracts, online characteristics of IMBs were merged with geographically and, as far as possible, time-matching geospatial and population data. Demographic and socio-economic information was obtained through the 2013-2017 American Community Survey (ACS), downloaded from the National Historical Geographic Information System (Manson et al., 2018). Crime incident data were obtained through the Houston Police Department's (HPD) website. Monthly incident reports from 2017 were aggregated to one file containing an address range for incidents about aggravated assaults, auto theft, burglary, murder, rape, robbery, and theft.[13] A total of 119,621 offenses were geocoded to census tract shapefiles. Only 112 addresses (0.094%) could not be geocoded to a census tract due to address errors. While recognizing the limitations of official records (e.g. under-reporting of crimes, or registration of crimes under different incident codes), the HPD police incident data were among the few and best sources available to study crime at the level of census tracts. To

---

[13] The HPD only provides an address range (e.g. Street 100-199) and zip code as the smallest level of granularity. Because these ranges may occasionally cross tract borders, both the lower and upper bounds were geocoded to census tracts and separate analyses were conducted with the lower and upper bounds, respectively. Using either the lower or upper bounds in the analytical models had little bearing on the findings. Presented findings are based on the upper bounds.

obtain an indication of law enforcement's visible and operational presence on a census tract level, the geographical coordinates of police stations were obtained through Google's Place Automated Programming Interface (API) in and around the Houston area, which were then used to calculate the shortest distance from a census tract to the nearest police station.

Measures

Tract Attributes (nodes): Four sets of tract attributes, dyad covariates and overall network features are included in the models (see Table 3). To examine social selection processes, several main effects of tract attributes were assessed, which mostly stem from crime opportunity theoretical perspectives. Most tract attributes were extracted from the ACS and included as a network statistic that takes the sum of a continuous attribute of tract i and j, or the number of times a tract with a particular binary attribute appears in an edge in the network. First, population count was included to test whether clientele networks span ties across the more populous areas. The natural log of the population count was included in the estimation models to account for skewness of this measure ($\bar{x}$ = 8.603; min = 2.197, max = 9.750). Other tract features account for potential demand, supply, easy access, and capable guardianship. Specifically, two demographic features were included: the proportion men ($\bar{x}$ = 0.500; sd = 0.038) and the proportion of residents belonging to a racial or ethnic minority ($\bar{x}$ = 0.664; sd = 0.243). These measures tap into the key demographic characteristics of clientele and providers, respectively (Polaris, 2018).

Drawing on crime opportunity perspectives, this study also assesses the role of several factors that may influence clientele location choices. In particular, the role of easy access was included as the direct availability of a primary road that intersected with a tract (1 = 'Yes'),

87

which was the case for about a third of the tracts (n = 68, 34.5%). As a measure for increased

capable guardianship exercised by police presence, this study assesses whether a tract was within

a mile distance of a police station (1 = 'Yes'). Using the geocoded locations of police stations,

the shortest distance of each census tract centroid to the nearest police station was calculated

using the *geosphere* package in R (Hijmans, 2019). For 37 census tracts (18.8%), the closest

police station was within a mile distance from a tract's centroid. While police stations may not

be representative of patrol, they present a visible stationary presence of police that could function

as a deterrent for illicit behaviors (see e.g. Holt et al., 2008).

Various other tract attributes were accounted for. Because prior work has consistently

shown the relation between concentrated social disadvantage and co-offending networks

(Papachristos & Bastomski, 2018; Schaefer, 2012), a measure of concentrated social

disadvantage was included as the standardized averaged sum of the following standardized

variables: per cent families below the poverty level, per cent female-headed households with

children, and per cent 16+ population unemployed (range = -1.754, 3.245).[14] Furthermore, two

crime incident measures were included using the HPD crime incident reports. The role of

robbery incidents and rape incidents per capita was assessed because both of these crime types

have been associated with crime and deviancy in IMBs (Polaris, 2018),and are not strongly inter-

correlated. On a population of 1,000 residents, 4.679 robbery incidents (sd = 23.826) and 0.339

rape incidents were reported within a tract (sd = 0.423). Lastly, the count of IMBs that had

received reviews in or prior to 2017 ($\bar{x}$ = 2.335, sd = 2.007), and the total number of reviews ($\bar{x}$

---

[14] These variables loaded onto a single factor (Cronbach's alpha = 0.74, 95% CI [0.68, 0.8]). The
level of disadvantage was recoded to zero for one census tract that had missing information.
Recoding was preferred instead of excluding this tract from the analyses, which would impact
the connectivity toward other census tracts. Robustness checks with and without this census tract
did not result into substantially different findings.

= 29.782, *sd* = 35.102) were included as proxy measures for the overall online popularity of a census tract. Review count was rescaled to bins of five reviews each, to aid the interpretation.

Social Distance (dyads): The extent to which census tracts were dissimilar was calculated for levels of concentrated social disadvantage, to assess potential ties across socio-economically distinct areas, and for crime incidents per capita to assess whether clientele travelled between neighborhoods with varying levels of crime. Each of these dissimilarities were included as a single network statistic that takes the absolute difference of continuous values for tract *i* and *j*.

Spatial Distance (dyads): The direct distance between each census tract centroid was included in miles. The average distance between any two census tracts was 14.997 miles (*sd* = 8.803, range = 0.370, 46.085). Because distance likely exhibits a decay effect (see Hipp & Perrin, 2009; Zipf, 1949), the distance measure was log transformed. The logged distance averaged 2.486 miles (*sd* = 0.745).

Network Statistics (networks): The role of two endogenous network properties were assessed. Tie formation as a result of transitivity was assessed by including geometrically weighted edgewise shared partners (GWESP) that capture transitive triads (if tracts *i* and *j* are connected to tract *k*, they are likely also connected to each other) and geometrically weighted dyad-wise shared partners (GWDSP) that capture ties that arise from two-paths instead of triads (tracts *i* and *j*, and tracts *j* and *k* are connected, but tracts *i* and *k* are not).

Analytical Strategy

Social network analysis was used to describe the structural features of census tract networks that were formed through online clientele networks. Next, the spatial and social determinants of inter-neighborhood tie formations were estimated through dyad independence

89

models and exponential random graph models (ERGMs). These techniques are essentially modified logistic regressions that do not violate the assumption of independence, which is unrealistic in network data where a single node (here: census tract) can be involved in multiple dyads. As a class of statistical models, ERGMs allow for the probability of a tie to depend on the presence of other ties inside a network (Lusher et al., 2013). The unit of analysis is the tie between any two census tracts, which in the current study represents whether or not clientele traveled between any two census tracts ($y_{ij} = 0|1$).

This tie between any two census tracts was estimated as a function of network characteristics and neighborhood features. To avoid that the estimates capture isolated incidents, the outcome measure was coded '1' when *two or more* unique clientele traveled between the same census tracts to frequent IMBs. These multiple ties ('strong ties') are arguably a better reflection of the true underlying network and less subject to sampling error when a wrong address of an IMB is listed (see also: Hipp & Perrin, 2009). As is shown in the Appendix, goodness of fit indices were appropriate for the models estimating these strong ties. This retained a sub-sample of 3,083 inter-tract connections. For purposes of comparison, descriptive statistics are provided for both this subsample of strong ties and the full sample of any tie.

Models that only include terms pertaining to the dyads and nodes (i.e. spatial and social distance, and tract features) were estimated through Maximum Pseudolikelihood Estimations (MPLE), which present regular logistic regression formats. Once higher-order network statistics were included (e.g. transitivity terms), a maximum likelihood was estimated through Markov Chain Monte Carlo (MCMC) simulation methods. In ERGMs, the probability of a set of ties, *Y*, is a function of nodes, node and dyad characteristics, and network terms such as the number of edges in the network. The parameters for these statistics are obtained through a stochastic

90

process that compares the observed network with random networks, where ties are modeled as a random variable. In its basic form, an ERGM is formalized as follows:

$$\Pr(Y = y) = \left(\frac{1}{k}\right) \exp\{\textstyle\sum \eta_A\, g_A\, (y)\},$$

which captures the sum of the coefficients, n_A, for each network statistic g_A. A is the index for each included statistic in the network $g(y)$ and k is the normalizing constant for the network distribution (Lusher et al., 2013; Papachristos & Bastomski, 2018). All analyses were conducted in R, using the *sna* package (Butts, 2016) for descriptive analyses and the *statnet* suit of packages (Handcock, Hunter, Butts, Goodreau, & Morris, 2008) to estimate ERGMs.[15]

Table 3   Summary Statistics for Tract Attributes

Variable	$\bar{x}\ (sd)\,/\,N\ (\%)$	Range
Population (Log)	8.603 (0.656)	2.197, 9.750
Male (%)	0.500 (0.038)	0.415, 0.634
Racial/Ethnic Minority (%)	0.664 (0.243)	0.000, 0.993
Primary Road (1 = 'Yes')	68 (34.5%)	-
Police Mile Away (1 = 'Yes')	37 (18.8%)	-
Concentrated Disadvantage (Scale)	0 (1)	-1.754, 3.245
Robbery Incidents (per 1,000)	4.679 (23.826)	0.000, 333.333
Rape Incidents (per 1,000)	0.339 (0.423)	0,000, 1.835
IMB Count	2.335 (2.007)	1,14
Review Count	29.782 (35.102)	1, 214
Miles in Distance (Log)	2.486 (0.745)	0.041, 3.137

Findings

Network Structure

Online clientele networks spanned 6,601 ties between 197 census tracts with IMBs in Houston. Figure 3 reports on the tie strength for each of these connections, as represented by the

---

[15] MCMC.burnin = 10,000,000; MCMC.interval = 10,000; MCMC.samplesize = 200,000.

number of unique clients that traverse a census tract border to visit IMBs. Nearly half of the connections (N=3,083, 46.7%) represented multiple clients crossing the same census tract borders. Table 4 reports on several structural measures of these census tract networks. The graph density statistic of 0.342 indicates that the observed 6,601 connections accounted for 34.2% of all possible connections. Strong ties, caused by multiple clients, accounted for less dense networks, about 16.0% of all possible connections. On average, a census tract was connected to 67 other tracts, which indicates that clients traversed census tract borders to a rather high degree. A few census tracts were extremely well-connected (up to 162 other census tracts, i.e. nearly all tracts with IMBs) though substantially fewer have strong ties (on average 31 census tracts). This is displayed in Figure 4, which also further supports the modeling of strong ties through exponential models as opposed to the modeling of a nearly uniform degree distribution of any tie. If not directly, any two census tracts were indirectly connected in about two steps and at a maximum of only four or five steps. Transitivity was high regardless of tie strength, which essentially means that when clients spanned ties between tracts A and B as well as A and C, they likely also spanned a tie between B and C.

Using the sample of strong ties, the geographic distribution of the degree size of each of the census tracts is shown in Figure 5.[16] Darker-colored areas represent the high-degree census tracts that have many ties with other areas in the city. The figure suggests a spatial concentration of high-degree tracts, which was confirmed by a significant spatial autocorrelation index (Moran's $I = 0.301$, $p < 0.001$).

---

[16] The geographic distribution of strong ties was similar to the one for all ties, which indicates that strong ties are a representative sample of the underlying clientele networks of online-promoted IMBs. Spatial concentration of inter-neighborhood degree was less profound when including all ties (Moran's $I = 0.149$, $p < 0.01$).

92

Table 4   Structural Network Measures of Census Tract Networks

Network Feature	Network Statistic	
	Any Tie *N = 6,601*	*Strong Tie* *N = 3,083*
Graph Density	0.342	0.160
Mean Degree (*sd*)	67.015 (41.956)	31.299 (31.518)
Min-Max Degree	0-162	0-136
Number of Isolates	3	31
Transitivity	0.639	0.544
Diameter	3	4
Centralization (through Degree)	0.485	0.534
Average Path Length	1.675	1.872

Figure 3   Distribution of Tie Strength
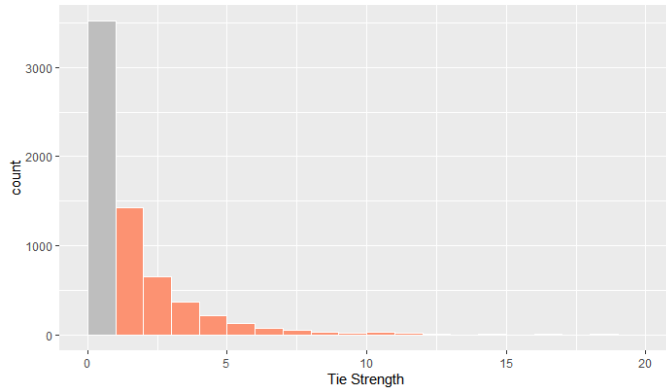
Note. Strong ties are marked with a darker color.

Figure 4   Degree Distribution of Any Ties (Left) and Strong Ties (Right)

93
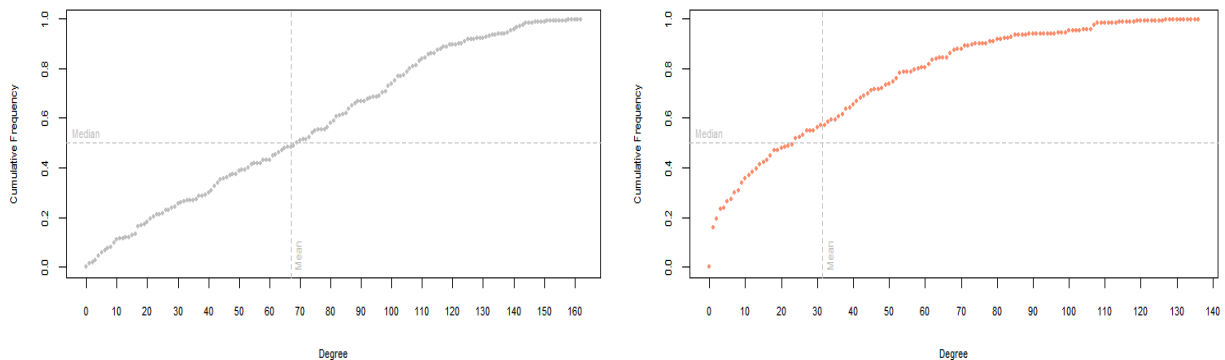
Figure 5   Geographic Distribution of Census Tract Degrees as Observed through Online Clientele Networks (Strong Ties)
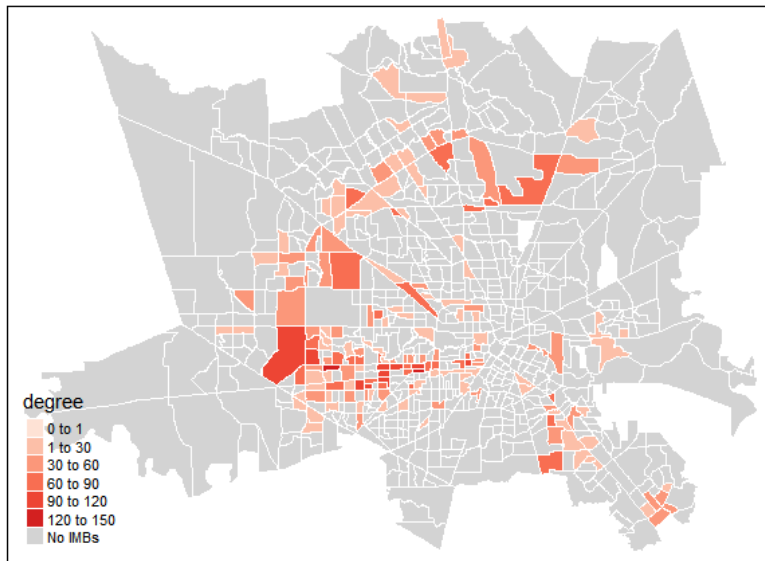
Explaining Inter-Neighborhood Tie Formation

Table 3 presents the log-odds of features that can drive tie formation between census tracts as observed through multiple clients traveling between census tracts to frequent IMBs. The first three models are dyad independence models that were conditioned upon census tract features, spatial, and social distance measures. A final ERGM was estimated to test higher-order interdependencies between census tracts, mainly to evaluate the extent of potential bias in the preceding models when accounting for network effects.

Model 1 presents the determinants for any tie formation between census tracts as a result of tract attributes and spatial distance. The edges term operates as the intercept and suggests that, even though the network was rather dense, ties had an overall low probability of existing. This is common in network models when density is lower than 50% (Lusher et al., 2013). As follows from the negative coefficient associated with the spatial distance measure, spatial distance was

94

an obvious impediment to tie formation between any two census tracts. In addition to spatial proximity, several physical cues helped explain clientele travels between neighborhoods. In particular, ties between census tracts were less likely in areas where a police station was within a mile distance, but more likely in areas that had the following characteristics: Relatively more men who could make up a pool of potential clientele; a relatively larger racial or ethnic minority among which a sub-group might experience socio-economic deprivation and therefore an increased dependency on the work provided by IMBs; and a higher rate of reported rape offenses. A tract's direct intersection with a primary road was negatively associated with clientele inter-neighborhood travels, although this effect was accounted for in a model that includes the network terms (further discussed below). Concentrated disadvantage was negatively associated with clientele inter-neighborhood travels. This suggests that more advantaged areas were more likely to attract clientele visits from elsewhere. Furthermore, the positive coefficient for online review counts indicates that ties were more likely to span toward the more popular areas, which were also more likely to have ties amongst each other (as can be derived from the negative coefficient for the difference in review counts between census tracts: i.e. the greater the distance in the number of reviews, the less likely a tie is formed).

A second model that omits spatial distance but adds the social distance measures shows that online clientele networks were more likely to span ties between census tracts that had similar reported rape offenses, although this was only significant under a one-tailed test in a model that accounts for both spatial and social distance measures (Model 3). Furthermore, the positive coefficient associated with the social distance measure for concentrated disadvantage suggests that clientele travels spanned ties between socio-economically distinct areas. This contradicts with prior literature on social and spatial homophily effects, as it instead points to a potential

95

diffusion of crime and deviant norms between advantaged and disadvantaged neighborhoods. Models 2 and 3 are otherwise consistent with the previous model.

A final model (Model 4) adds the network terms, which substantively improved model fit. The positive coefficient for the GWESP term along with the negative coefficient for the GWDSP term shows that ties were significantly more likely to exist as a function of transitive triads rather than two-paths. While most other effects remained largely the same, a few differences are notable. In particular, the effect of spatial proximity slightly reduced, suggesting that a spatial proximity effect was partially accounted for by a network effect. Furthermore, the role of population size substantially reduces and a tract's direct intersection with a primary road becomes insignificant, which can imply that clientele were more likely to go to more discrete areas (i.e. less populous and those that did not immediately intersect with a primary road) when they were inclined to follow the same IMB travels as their online peers. It is further notable that the effect of clientele traveling between census tracts with more reported rape incidents was now accounted for by a complex network mechanism that captures clientele travels between IMBs as triads.

Discussion and Conclusion

This study offers a first look at what drives web-facilitated inter-neighborhood tie formation in the context of deviant behaviors. Based on census tract networks that were constructed through web reviews of IMBs and merged with geospatial and population data, the analyses suggest that the content of reviews may provide contextual cues that influence the offline location choices of clientele. The networks show that clientele frequently traversed census tract borders and may diffuse deviant norms and illicit behaviors across census tracts.

96

Table 5   ERGM Results. Explaining Inter-Tract Tie Formation

	(1) β (SE)	(2) β (SE)	(3) β (SE)	(4) β (SE)
Edges	-3.510*** (0.874)	-4.513*** (0.872)	-3.897*** (0.881)	-5.748*** (0.742)
Tract Features				
Population (log)	-0.158*** (0.041)	-0.178*** (0.041)	-0.149*** (0.041)	-0.086* (0.031)
% Male	1.365** (0.508)	1.117* (0.509)	1.324** (0.511)	1.323** (0.433)
% Racial/Ethnic Minority	0.905*** (0.129)	1.107*** (0.131)	1.007*** (0.133)	0.564*** (0.101)
Primary Road	-0.103** (0.040)	-0.218*** (0.039)	-0.131** (0.040)	-0.026 (0.032)
Police Within Mile	-0.277*** (0.047)	-0.276*** (0.047)	-0.294*** (0.048)	-0.246*** (0.376)
Disadvantage	-0.137*** (0.031)	-0.206*** (0.032)	-0.174*** (0.032)	-0.135*** (0.025)
Robbery Offenses	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)
Rape Offenses	0.362*** (0.045)	0.586*** (0.054)	0.412*** (0.056)	0.176*** (0.051)
IMB Count	0.093*** (0.013)	0.098*** (0.012)	0.092*** (0.013)	0.083*** (0.014)
Review Count	0.270*** (0.006)	0.264*** (0.006)	0.270*** (0.006)	0.147*** (0.006)
Review Count Difference	-0.212*** (0.006)	-0.206*** (0.006)	-0.212*** (0.006)	-0.040*** (0.007)
Social Distance				
Concentrated Disadvantage	-	0.140*** (0.032)	0.136*** (0.032)	0.123*** (0.032)
Rape Offenses	-	-0.296*** (0.077)	-0.147~ (0.079)	-0.044 (0.077)
Spatial Distance	-0.510*** (0.034)	-	0.504*** (0.033)	-0.382*** (0.032)
Network Structure				
GWDSP	-	-	-	-0.057*** (0.002)
GWESP	-	-	-	1.499*** (0.108)
AIC	10,661	10,867	10,643	9,784
BIC	10,763	10,977	10,761	9,918

Notes. ~ p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001. Coefficients are logit coefficients.

97

As hypothesized, spatial distance continued to be a key impediment for clientele to span ties across different geographies through IMB visits. The importance of spatial proximity confirms the abundant literature on the concentration of crime and criminal networks within a set of spatially proximate neighborhoods (Kirk & Papachristos, 2011; Mears & Bhati, 2006; Peterson & Krivo, 2009). The findings are also consistent with research on the geography of social media networks generally, which has shown that web-facilitated social networks continue to be localized while allowing across greater distance (Barthelemy et al., 2003; Mok et al., 2010; Yook et al., 2002).

When controlling for spatial proximity, this study shows that clientele networks of IMBs spanned ties between distant areas for reasons that are in line with crime opportunity theoretical perspectives, especially routine activity theory (Cohen & Felson, 1979; Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980). Specifically, the odds for clientele to frequent IMBs in any two areas increased when these areas had suitable targets and motivated individuals, as represented by 1) a higher number of IMBs; 2) greater online popularity (i.e. more online reviews); 3) relatively more men (potential clientele) and 4) more minority residents (potential providers). In addition, clientele were more likely to traverse census tract borders to frequent IMBs in "under-policed" areas, which were the areas with the closest police station at least a mile away. This finding supports earlier qualitative work that had documented that clientele of IMBs tend to be aware of the illicit nature of their behaviors and seek to avoid risk of law enforcement apprehension (Blevins & Holt, 2009; Holt et al., 2008). Furthermore, clientele were more likely to travel toward and between popular areas, and were also more likely to span ties across a set of census tracts that complete transitive triads. As such, the findings provide support for both preferential attachment and triad formation as important network effects, which

98

underscores the idea that opportunities for crime events and deviant behaviors are embedded in the structure of networks of crime and deviant groups (Kleemans & De Poot, 2008).

Several findings contradict prior literature and merit attention in future studies. One seemingly surprising finding is the significant role of the percentage of male residents, which contradicts macro-level studies that rarely show a significant neighborhood effect of gender. However, the finding is in line with studies on the spatial patterning of commercial sex and sex trafficking and with the demographics of clientele who are mostly men (Bouché & Crotty, 2017; Chin et al., 2015; Chin et al., 2019; Huff et al., 2018). Furthermore, while Chapter 3 had identified a greater likelihood of IMBs to be located in populous tracts that were immediately accessible through a highway, these factors reduced the likelihood of inter-neighborhood connections through clientele travels, suggesting that clientele were more likely to travel toward low-visibility neighborhoods to frequent IMBs. It is important to note that these effects were largely accounted for in a model that included the above-mentioned network terms, which indicates that the attractiveness of low-visibility areas might be unique to an online group of clientele that follows each other's footsteps. Chapter 3 suggested a greater likelihood of IMBs in areas with high visibility (e.g. populous and with a primary road), and it is possible that the mere location of IMBs was tailored to both an online and offline group of clientele (i.e. those that read and posted reviews versus those that did not). Furthermore, social disadvantage was not associated with more clientele travels between census tracts. Instead, advantaged areas were more likely to attract clientele who tend to have an income higher than average (Polaris, 2018), albeit these clientele spanned ties between socio-economically distinct areas when frequenting IMBs in both advantaged and disadvantaged areas. As such, clientele travels associated with IMBs connected socio-economically distinct neighborhoods in patterns of crime and deviancy.

Lastly, the significant association between clientele visits and reported rape incidents in a particular area may be explained by prior literature that suggests sexually-oriented reviews may be permissive of sexual deviancies, assault, and harassment (Cunningham et al., 2018). However, this finding also needs to be interpreted against the background of a well-known underreporting of rape incidents, which would bias the findings when the reporting is disproportionately distributed across geographic areas. A refined geographical measure of sexual aggression is generally needed in studies on crime and victimization, and would also help evaluate the robustness of this study's finding. There is some evidence that ties were more likely to span between areas with similar rates of rape offenses, which could support the idea that sexually-oriented reviews can instigate social homophily along lines of sexual preferences, including preferences that signal violent offline acts of sexual assault or rape (Blevins & Holt, 2009; Holt et al., 2008; Thornberry, Krohn, Lizotte, Tobin, & Smith, 2003). However, that finding was accounted for by network mechanisms that captured triad formations in clientele travel patterns.

It also follows from these findings that the features driving web-facilitated inter-neighborhood tie formation differ from the processes identified in prior studies on gang co-offending or illicit drug markets (Papachristos & Bastomski, 2018; Schaefer, 2012). The findings here focus on a clientele demand for an illicit market and provide stronger support for crime opportunity perspectives, specifically the notion that an individual's location choices depend on the extent to which the features of an area match a client's expected rewards (e.g. guaranteed services and online popularity), effort (spatial proximity), and risk (police at least a mile away) (Brantingham & Brantingham, 1995; Cornish & Clarke, 1987).

This study is not without limitations. While the findings are consistent with past theoretical and empirical work on crime and deviancy and also support the broader array of

literature on the geographies of online social networks, an obvious limitation is that the findings may be context-specific to the city of Houston and the problem of IMBs. Future studies should replicate the theoretical and methodological approach of this study to different geographical contexts and crime types. In addition, future work may also observe inter-neighborhood ties through other types of connections between IMBs, for example through shared ownership of storefronts, rotation of providers, and criminal networks. Furthermore, additional information might need to be obtained to further understand inter-neighborhood connections. For example, it would be important to measure routine travels between clientele anchor points (e.g. home or work) and the location of an IMB. In the present study, the connections between census tracts only represented where clientele decided to frequent IMBs. No information on the home addresses of clients or any information about clients other than the places they reviewed was available.

Some may perceive the lack of empirical delineation between commercial sex and sex trafficking as a limitation. However, the goal of this study was not to identify distinct drivers for commercial sex and sex trafficking, and it is important to note that individuals have varying experiences, beyond the binary distinction of commercial sex versus sex trafficking. Concerns exist about a range of different problems in IMBs, including labor exploitation and labor trafficking, verbal abuse, sexual harassments, and violence that stems from racial, ethnic, or gender biases (Chin et al., 2019; Dank et al., 2014). Future research and policy efforts should draw on a victim-centered approach, and be considerate of the fact that varying experiences may result from social inequalities, discrimination, and lack of alternative choices.

While recognizing these limitations, this study emphasizes the continuing importance of spatial proximity in the formation of web-facilitated networks of crime and deviancy, and

101

contributes to prior work by offering new theoretical and methodological inroads that help explain why any two distant areas are connected in patterns of crime and acts of deviancy. As access to the internet continues to expand and the use of social media becomes virtually anywhere in the U.S. an inherent part of daily routines, including those of criminal and deviant groups (Pyrooz et al., 2015), this study draws attention to the need to be alert to potentially changing geographies of criminal and deviant networks. While this study focused on physical distance as one aspect of space, future work should also examine the role of space through physical arrangements of streets, or the spatial composition of an area where "fixed places" such as squares or community organizations serve as foci areas and facilitate social interactions (Small & Adler, 2019).

On a practical level, the findings yield important implications for crime control and prevention strategies. By showing that clients frequently travel across census tract borders to visit different IMBs, this work hints at the limitations of current criminal justice strategies such as on the ground vice operations that shut down IMBs in particular areas. These shutdowns may have a limited effect when clientele are willing to traverse census tract borders even at larger geographic span, meaning that IMBs can easily relocate and attract their clientele back. The mere stationary presence of police seems to be an effective mechanism to keep away clientele who fear apprehension by law enforcement, although future work is needed to understand police responses in more detail as well as the role of other potential capable guardians such as local business owners or landlords. Following the findings in this study, policy efforts should focus on curbing the diffusion of crime and deviant norms across neighborhoods, through focusing on clientele illicit and deviant behaviors, targeting and disrupting clientele networks, and through strengthening social and protective mechanisms in the most popular areas where there is demand

102

for IMBs. The aim of such efforts should be to prevent problems related to abuse, sexual assault or rapes. These efforts may also involve awareness raising of the varying victimizing experiences in IMBs, reaching both clientele and their social communities.

To conclude, this study contributes to a theoretical and policy-relevant debate on the intersections of crime, place, and networks in the age of the internet, specifically noting the continued importance of crime opportunity theoretical perspectives such as routine activity theory (Felson, 1987; Felson & Clarke, 1995; Felson & Cohen, 1980; Miró, 2014). Drawing on the resurgence of interest in the relation between space and networks generally (Small & Adler, 2019), explaining changing geographies of crime and crime networks as a result of online communication patterns should become an increasingly important area of concern for criminologists.

Figure 6   Goodness of Fit Plots for the Estimation of Strong Ties
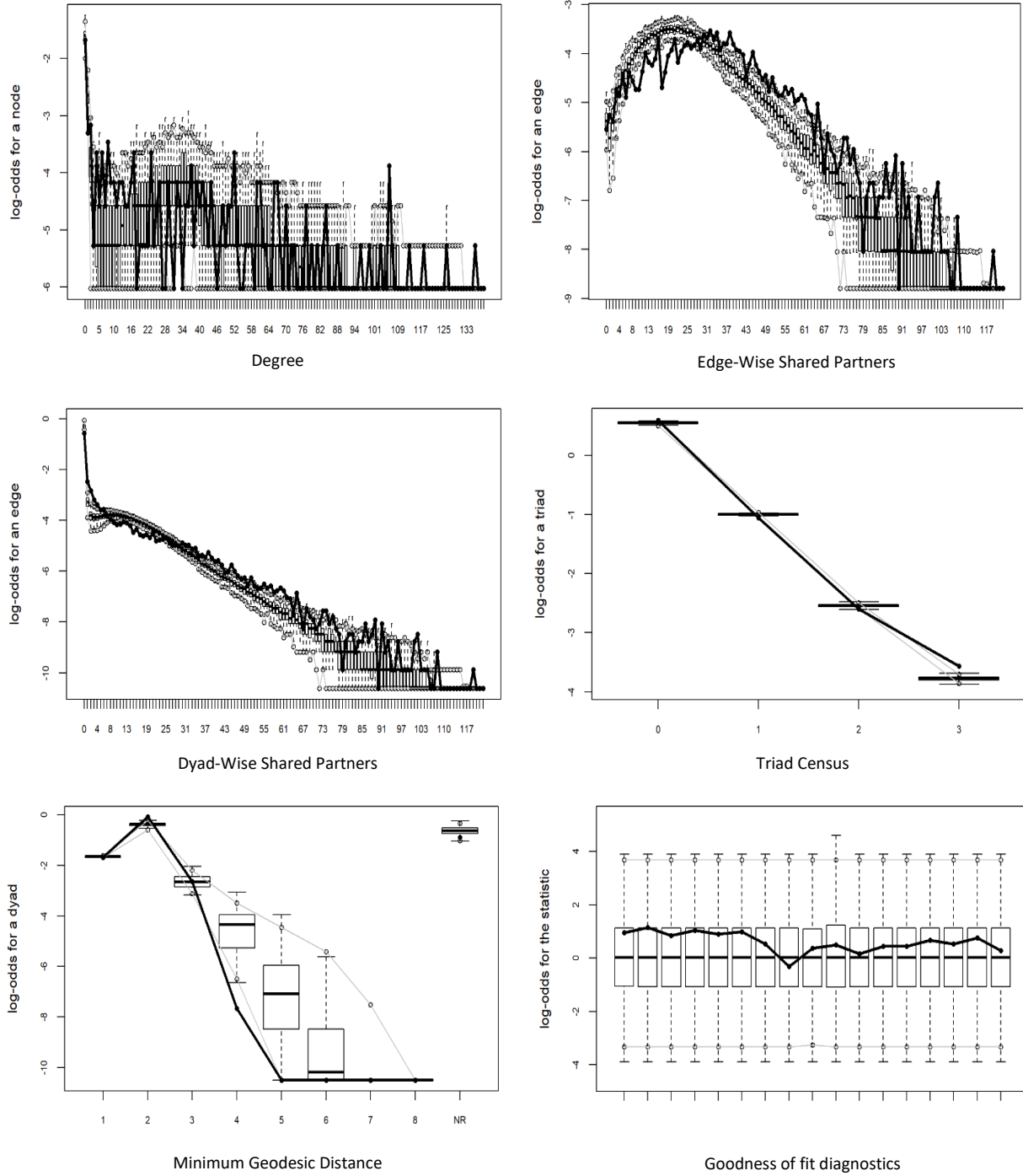
**Chapter 5	The Limits of Traditional Law Enforcement Actions in Addressing Crime**

Problems with Locational Flexibility: The Case of Illicit Massage Businesses

Introduction

An increasing amount of criminal justice resources are being devoted to the issue of human trafficking[17], many of which seek to address human trafficking victimizations in illicit massage businesses (IMBs). These venues owe their name by hosting illicit events such as commercial sex under the guise of legitimate massage. While IMBs have been identified as a problem in many urban contexts across decades (Armstrong, 1978; Bartley, 1994; Bryant & Palmer, 1975), concern about IMBs has increased in recent years due to connections of these businesses to human trafficking victimizations (Associated Press; Bouché & Crotty, 2017; Hoppa, 2018; Polaris, 2018). In fact, IMBs are considered one of the top venues for sex trafficking, and comprised the largest group of calls to the National Human Trafficking Hotline in 2019 (National Human Trafficking National Human Trafficking Hotline, n.d.). In addition to commercial sex and human trafficking, IMBs host a wide range of other problems such as robberies, organized crime, as well as physical, sexual, or emotional violence committed by clientele (Polaris, 2018).

Police have primarily deployed traditional vice tactics against IMBs, which can include rapid patrol-based responses to citizen complaints or reactive investigations usually in response to tips from concerned community members (discussed further below). While these efforts

---

[17] Human trafficking victimizations and the provision of commercial sex are legally not the same and different perspectives exist about the victimizing nature of commercial sex (see, for a discussion, De Vries & Farrell, 2019). Regardless of moral perspectives on commercial sex, it is important to recognize the marginalized position of many individuals who depend on the income from sexual services and are at increased risk to health issues, violence, abuse, and exploitation.

demonstrate an agency's willingness to respond to crime and victimization problems in IMBs, the public and criminal justice practitioners alike have expressed concerns about the limited effectiveness of the traditional law enforcement response with some suggesting a "whack-a-mole effect" where IMBs seem to continue to open anywhere in a city and sometimes even at or near a location where a police action took place (Axon, Kelly, & Braun, 2019; Wang, 2010). The online promotion of IMBs through online classifieds, review boards, or forums may contribute to the limits of traditional law enforcement responses. Such platforms provide IMBs with "locational flexibility" by offering new means to signal illicit activity, foster demand, and regain clientele back after an action (Chin et al., 2019; Holt et al., 2008, 2014; Venkatesh, 2011). Locational flexibility seems to allow IMBs to persist despite heightened traditional police attention to this low-visibility crime problem. While concerns about the effectiveness of traditional police enforcement actions constitute a key part of an ongoing policy debate about addressing IMB problems, there is little rigorous scientific evidence assessing the crime control value of these kinds of police responses.

Two broad theoretical perspectives generally support proactive police crime control strategies: deterrence and crime opportunity reduction (Weisburd & Majmundar, 2018). Deterrence suggests that police can reduce crime if they are able to convince would-be offenders that the risks of apprehension and punishment exceed the benefits of committing crime (Gibbs, 1975; Nagin, 2013a; Zimring & Hawkins, 1973). In general, the swiftness and certainty of sanctions are more salient than severity of sanctions when prospective offenders are considering whether to commit crime or not (Kennedy, 2008; Kleiman, 2009). Advertising of police strategies is one possible way to increase the perception of apprehension risk (Sherman, 1990; Zimring & Hawkins, 1973), which is important to consider because police actions against IMBs

106

are often highly publicized. Police can also attempt to reduce crime opportunities by altering the underlying conditions and dynamics that cause crime problems to persist (Weisburd & Majmundar, 2018). Alternative strategies, such as problem-oriented policing, can be used to diagnose crime problems and launch a variety of tailored responses that seek to change underlying crime opportunity structures that may discourage offenders from committing crimes (Goldstein, 1990; Braga, 2008). Crime opportunity reduction approaches could be used to good effect to understand IMB challenges such as locational flexibility and frame appropriate police responses to persistent IMB problems in local jurisdictions. Unfortunately, most traditional police responses to IMBs do not seem to consider the existing theoretical and program evaluation evidence on proactive policing efforts to get deterrence right and to diminish persistent crime opportunities.

Since our current knowledge base on the effectiveness of traditional police enforcement actions against IMBs has remained largely descriptive and anecdotal, this study has two objectives. First, a quasi-experimental research design was used to evaluate whether police enforcement actions that resulted in the closure of IMBs prevented the attraction of new IMBs in the same or adjacent areas. Second, insights on framing plausibly effective police responses to persistent IMB problems were derived through predictive analytical techniques to decompose the efficacy of police actions in the context of a broader set of neighborhood features that influence the emergence of new IMBs across a city. The analyses draw on media reports of police actions, which were linked to online review data containing the locations of online-promoted IMBs, and geospatial and population data. The findings contribute to the policing literature by providing a unique case of an illicit market that is being promoted by online platforms.

The next section provides further detail about the current police response to IMBs, followed by sections on deterrence theory and empirical evidence on effective policing strategies that guide this study's evaluation. The data and methods sections outline the research designs used for each of the above objectives. The study concludes with key findings and implications for future research and policy, which speak to the need to alter the current response to IMBs.

Law Enforcement Actions against Commercial Sex and Sex Trafficking in IMBs

An understanding of law enforcement tactics against IMBs needs to be integrated in the broader response against human trafficking. On a national level, significant criminal justice system resources are devoted to human trafficking issues. For example, the Department of Justice awarded over $100 million in 2019 alone to efforts supporting the identification of victims, and investigation and prosecution of offenders (U.S. Department of Justice, 2019). A substantial proportion of these anti-trafficking efforts concern IMBs. For example, the National Human Trafficking Resource Center (n.d.) estimates that fifteen percent of identified sex trafficking cases in the U.S. involve IMBs. Investigations of human trafficking are often delegated to vice units who commonly use traditional tools such as sting operations, undercover work, or reactive investigations to uncover human trafficking (Farrell, Bright, et al., 2019; Farrell, Dank, et al., 2019). Similar tactics are used against IMBs, which have resulted in shutdowns of illicit venues or the arrests of owners, managers, or anyone else engaged in illicit activity. These interventions are often frequently triggered by ongoing investigations or tips from concerned community members. In some cities like Houston, changes to municipality ordinances facilitate officer's right of access to IMBs and seek to prevent that venues that do not need a license (e.g. bodyworks) are exempt from police oversight (Blakinger, 2016; Polaris, 2018).

108

Although a small percentage of IMBs are directly targeted by police enforcement

actions, potential deterrence effects might work through extensive media coverage of these

actions. For example, *The Seattle Times* recently reported on a sting operation at eleven IMBs in

Seattle's neighborhoods. The action involved up to 100 local and federal police officers, was

initiated after neighborhood complaints and a lengthy prostitution and money-laundering

investigation, and ultimately resulted in shutdowns of several IMBs and the arrests of five

owners or operators (Green, 2019). While a total of 26 women were offered services during or

immediately after the action, it is not uncommon that other, similar operations involve the arrests

of individuals providing commercial sex. Many enforcement actions involved the arrests of men

soliciting for commercial sex (see, for an example, Rogers, 2017).

It is possible that media reports of actions like the Seattle operation function as a general

threat of punishment (Sherman, 1990; Zimring & Hawkins, 1973), or a socializing and

moralizing force (Cook, 1980). In addition, it may be the expectation that targeting a few players

could impact an illicit market as a whole, as has also been noted in the deterrence literature in

relation to market-oriented crime problems such as drug markets: "…we would expect that law

enforcement efforts directed at any one of the three types of actors [suppliers, middlemen, and

customers] would reduce the amount of criminal activity by the other two types of actors" (Cook,

1980: 236, *clarification added*).

But, while media reports could launch a deterrence threat and targeting a few players may

impact the market as a whole, several issues raise skepticism about the impact of enforcement

actions against IMBs. First, online platforms such as online classifieds and review boards

provide IMBs a vast clientele network who can use these platforms to stay informed about the

locations and services of IMBs. When clientele are willing to span some distance to frequent

109

IMBs in different neighborhoods, these online platforms offer the venues a locational flexibility. Clientele may also use these platforms to discuss police activity and mitigate the risk of arrests (Blevins & Holt, 2009; Holt et al., 2008).

Second, studies have warned about the ineffectiveness of reactive, traditional vice tactics against a crime like human trafficking (Farrell, Dank, et al., 2019; Farrell & Pfeffer, 2014). This is because victims of human trafficking often do not self-identify out of fear for repercussions, an emotional attachment to their exploiter(s) as well as distrust toward police (Farrell, Dank, et al., 2019). Furthermore, police officers may not have had specialized training on human trafficking, which limits their ability to separate human trafficking from other crimes and illicit behaviors such as human smuggling, document fraud, commercial sex or other illicit events that could have been part of a human trafficking event (Farrell, Bright, et al., 2019; Irwin, 2017). In the moment of an enforcement action against IMBs, it can then be difficult to identify victims or delineate human trafficking offenses from other problems. Against this background, it is also worth noting that few IMB enforcement efforts have resulted in offenders being prosecuted with human trafficking crimes across the U.S. (Polaris, 2018), one notable exception being recent successful investigations in Massachusetts (Office of Attorney General Maura Healey, 2018).

Third, in the development of enforcement strategies against IMBs, little attention seems to be given to the core ideas of deterrence theory and the literature on police intervention effectiveness. In particular, it is not clear that the current response is using an evidence-informed or place-based approach, or seeks to prevent new IMBs by diminishing local crime opportunities. And even though hot spots policing has been associated with statistically significant crime reductions in street-level drug markets or areas with active street prostitution (Weisburd et al., 2006), the applicability of these findings to the context of online-promoted settings is empirically

unclear. To inform under which circumstances and through which mechanisms police enforcement actions against IMBs could have positive, harm-reduction effects, the following sections outline the core ideas about deterrence from the policing literature.

Theoretical Background: Deterrence and Criminal Opportunities

Deterrence theory hypothesizes that would-be offenders refrain from crime when the benefits of illegal behaviors outweigh the perceived risk of apprehension and legal punishment (Gibbs, 1975; Zimring & Hawkins, 1973). Two key assumptions are that would-be offenders are rational decision-makers who weigh benefits against risks of crime and that increasing the certainty, severity, and swiftness of punishment can impact their crime decisions (Clarke & Cornish, 1985; Cornish & Clarke, 1986). While there is mixed support for a deterrence effect resulting from severer penalties (Nagin, 2013a, 2013b; Nagin et al., 2015; Paternoster, 2010), there is more consensus on the notion that a perceived – rather than objective – likelihood of detection and sanctions works as a deterrent effect among individuals contemplating illicit behavior (Apel, 2013; Nagin, 2013a, 2013b; Nagin et al., 2015). As was noted earlier, one of the ways to influence perceptions on the likelihood of punishment is the advertising of policing strategies to provoke a connection, in the public mind, between crime and the response of authorities (Sherman, 1990; Zimring & Hawkins, 1973).

The literature often distinguishes between general or specific deterrence (Cook, 1980). General deterrence strategies aim to prevent a general population from committing crime by influencing their perceptions on the likelihood of punishment, for example through increased penalties, police presence, or traditional crackdowns. Specific deterrence focuses on chronic offenders and seeks to increase their perceptions of sanctions to prevent future offending, a

111

strategy that essentially stems from persistent crime problems that were not prevented through general deterrence strategies (Nagin, 2013a).

In addition to influencing perceptions of crime risks, a discussion of deterrence also requires reference to the opportunity structures that influence a would-be offender's decision-making process (Cornish & Clarke, 1987; Nagin et al., 2015; Sherman et al., 1989). This is central to crime opportunity theories that posit that places have choice-structuring properties, some of which can attract or generate crime (Natarajan, 2017). For example, routine activity theory states that crime events are more likely in places where motivated offenders and potential victims routinely meet in the absence of capable guardians (Cohen & Felson, 1979; Felson, 1987; Felson & Cohen, 1980). Furthermore, crime pattern theory highlights the spatial and geographic features that signal risk, rewards, or efforts, and which may facilitate travel of offenders or suitable targets (Brantingham & Brantingham, 2013). According to these theories, an offender's assessment of crime opportunities can be facilitated by an awareness of environmental cues, such as busy areas or open doors (Clarke & Eck, 2005; Felson & Clarke, 1995). The environmental cues that signal illicit opportunities for IMBs were identified in Chapter 3 and include several markers of economic opportunity, such as populous, prosperous, and retail areas that are easily accessible through a highway, all of which could facilitate supply and demand for IMBs. When learning about these features in the spatial and geographic structure of a certain location and weighting those against a potential police threat, would-be offenders can adapt their standing decisions to engage in crime (Nagin et al., 2015).

Besides local crime opportunities at discrete locations, larger neighborhood dynamics provide the social context for crime (Weisburd, 2012; Wilcox et al., 2003) and, as such, can further influence a potential offender's decision to engage in crime. With that in mind, studies

112

have begun to integrate social disorganization and crime opportunities to explain local crime events (Weisburd, 2012; Wilcox et al., 2003). As shown in empirical studies, social disorganization can moderate the effect of local crime opportunities or strengthen explanations of crime at discrete locations (e.g. Jones & Pridemore, 2019). In the context of IMBs, Chapter 3 identified that a neighborhood's residential turnover, population heterogeneity, and economic inequality indeed provide favorable conditions for the presence of IMBs, in addition to the opportunity structures above. Such neighborhood features can diminish informal social control and collective efficacy (Sampson et al., 1997; Shaw & McKay, 1942), and also impact an offenders perception of low chances to get caught. Beyond the context of crime, this aligns with a broader social argument that the behaviors of individuals and groups are nested in larger social contexts and structures (Granovetter, 1985; Moody & White, 2003; Uzzi, 1996).

Drawing on both deterrence and crime opportunity theories, police can reduce crime in two important ways: as apprehension and sentinel agents (Nagin, 2013; Nagin, 2015; Nagin, Solow and Lum, 2015). Traditionally, police are trained as apprehension agents in that they respond to criminal events that have already occurred and seek to achieve deterrence through influencing perceptions of risk and signaling the certainty of apprehension. Opportunity theoretical perspectives lay the ground for situational crime prevention measures, which call upon the role of police as sentinel agents. In that role, police are the "capable guardians" that Cohen and Felson (1979) hypothesize to be one of the central actors who can discourage a motivated offender by reducing criminal opportunities (Eck & Weisburd, 1995; Felson, 1995) such that benefits from crime are no longer proportionate to the effort and risks (Braga & Weisburd, 2010; Nagin et al., 2015). In practice, a combination of strategies based on both the apprehension and sentinel roles might be most effective to discourage would-be offenders from

engaging in illicit behaviors. This implies the need for a clearer understanding of which police responses have been effective.

Empirical Evidence on Effective Police Crime Control and Crime Prevention Strategies

The effectiveness of policing strategies is dependent on the way police are deployed (Nagin et al., 2015, p. 77). Traditional forms of policing, such as random patrol or tactics similar to those observed against IMBs such as rapid response and retroactive investigations have had no or limited effects on reducing crime rates (Nagin, 1998, 2013b). These strategies are often based on a flawed assumption that criminal opportunities are available to everyone and everywhere, thus that influencing the ratio of perceived costs to crime benefits would suffice (Repetto, 1976). However, decades-long research shows that police tactics based on this assumption have not significantly reduced crime. An example is the evaluation of the Kansas City Patrol Experiment, which showed that random patrol did not impact crime levels (Kelling, Pate, Dieckman, & Brown, 1974). Current scientific research suggests that policing strategies that are not targeted to high-risk people or high-risk places are generally not effective in controlling crime (Weisburd & Majmundar, 2018).

While traditional policing has overall had limited effects, some police crackdowns – which are similar to certain vice tactics against IMBs (e.g. sting operations) – have resulted in initial deterrence effects (see, for a discussion, Paternoster, 2010). Police crackdowns aim to enhance general deterrence through "sudden increases in officer presence, sanctions, and threats of apprehension either for specific offenses or for all offenses in specific places" (see also Eck & Spelman, 1987; Sherman, 1990, p. 1). However, deterrence decay seems common for longer-term crackdowns, which led Sherman (1990) to argue that it may be more effective for residual

114

deterrence effects to have series of intermittent and unpredictable crackdowns that rotate targets, and have much publicity while the back-offs have little or no publicity. When this strategy is coupled with actual arrests, Sherman (1990) expects effects that are potentially more powerful than changing legislature or sentencing.

Nonetheless, the policing literature holds most promise for proactive policing strategies that are geographically-focused or person-oriented, and use a wide variety of tools and partners to respond to crime (Weisburd & Eck, 2004). For example, significant crime reductions have been observed for place-based approaches such as problem-oriented or hot spots policing that direct policing resources to a nonrandom concentration of crime (see, for overviews, Bowers, Johnson, Guerette, Summers, & Poynton, 2011; Braga et al., 2019; Weisburd & Majmundar, 2018). In particular, a recent systematic review documents that problem-oriented policing strategies at hot spots generate stronger effects than increased policing alone (Braga et al., 2019). The effectiveness of problem-oriented policing can be attributed to a targeted enforcement strategy that is directed at the underlying conditions of crime, and coupled with a community mobilization and partnerships with social service agencies. Overall, crime displacement toward different areas as a result of place-based strategies is not common (Bowers et al., 2011; Braga et al., 2019), in part because crime events are intricately linked to place (Weisburd, 2015), and are therefore not easily moveable across space (Weisburd, Braga, Groff, & Wooditch, 2017; Weisburd et al., 2006). Instead, there may be a diffusion of crime-control benefits to areas that are proximate to the targeted areas (Bowers et al., 2011; Braga et al., 2019).

Crime reduction effects can also result from person-focused approaches such as focused deterrence strategies that target specific crime problems and seek to change perceptions of sanction risks among potential high-risk offenders (Weisburd & Majmundar, 2018). One of the

115

most well-known, and extensively evaluated, focused deterrence strategies is Boston's Operation Ceasefire. This strategy sought to increase perceptions of punishment risks among youth involved in or at high risk to be involved in gang violence in several of Boston's neighborhoods. Despite initial skepticism about the evaluation of this operation (Fagan, 2002; Ludwig, 2005), rigorous research evaluations demonstrate statistically significant reductions of gang-related shootings as a result of person-focused (traditional and nontraditional) policing tactics and partnerships with community organizations (e.g. Braga et al., 2014; Braga et al., 2001).

In summary, the policing literature reveals limited effects of a traditional law enforcement response alone, but there are more encouraging results from proactive, evidence-informed, and targeted policing strategies. What is missing from the literature is a clear understanding of the implications of deterrence theory and policing for online-promoted crimes, where a reduced dependency on environmental cues can aid a locational flexibility, facilitate a relocation after police actions, and as such undermine the deterrent impact of police strategies. Given the limitations of traditional (vice) tactics along with an online promotion of IMBs, a robust evaluation of the impact of enforcement actions against IMBs is needed.

Current Study

The present study examines the consequences of police enforcement actions against online-promoted IMBs. Two objectives guide the analyses. First, this study seeks to evaluate the direct impact of police enforcement actions on the prevention of new IMBs in or near the targeted areas. Although these enforcement actions are aimed at reducing the number of IMBs, the policing literature suggests that a traditional, retroactive response similar to those employed against IMBs would have no or limited deterrence effects. Second, this study seeks to understand

116

whether the locations of new IMBs can be predicted beyond the directly targeted neighborhoods

using information about police interventions, IMBs' online popularity, and a neighborhood's

socio-economic composition. In doing so, it provides an understanding of the relative importance

of police enforcement actions against a broader set of neighborhood features that can influence

opportunity structures for IMBs.

Data and Methods

The primary data for this study come from one of the largest online platforms for IMBs

and media reports of police enforcement actions. The website used for the present study operates

as a review board for clientele who provide the locations of IMBs along with their reviews.[18] The

present analyses rely on publicly-accessible data about the location and popularity (e.g. number

of reviews) of IMBs. Information about a total of 2,301 IMBs with reviews in or prior to 2017

was obtained for Massachusetts (N=494), Texas (N=1,272), and Washington (N=535).[19] The

sample decision to restrict the analyses to these three states was based on a relatively higher

number of IMBs in these states compared to other states and the prioritization of police

enforcement actions against IMBs at local police departments. While the sample may not be

fully representative of the total amount of IMBs, the current sample allows for a systematic

evaluation of the impact of police actions on specifically online-promoted IMBs. IMB locations

were geocoded to the block group, census tract and place geographies from the 2017 U.S. census

shapefiles. Nearly all IMBs (N = 2,285, 99%) could be geocoded to these geographies, and were

---

[18] The web address is not provided in an effort to preserve some confidentiality of the
commercial sex providers, website users, and locations.
[19] Note further that data for duplicate entries were merged. IMBs that shared addresses and a
strong similarity in names were considered duplicate entries, whereas those that shared addresses
but had different names were not considered duplicates.

117

distributed across 1,449 block groups (5.66% of total), 1,269 census tracts (15.47% of total) across 308 places. The subsequent sections use census tracts as the units of analysis, and have the purpose to identify whether police actions prevented the opening of new IMBs anywhere within a targeted census tract. Sensitivity analyses were conducted on the level of block groups.

Media reports were used to obtain information about police actions associated with a closure of an IMB immediately at or shortly after the action. This information was obtained through the following steps. First, to retrieve a reliable sample of closed IMBs, a list with addresses was constructed for all IMBs that no longer received reviews or were flagged as "closed" by the website. This list was used as input for the Google's Place Application Programming Interface (API) to identify which IMBs continued to operate in the month of the search (December, 2019). In case an address was not found automatically by the API, a manual search was conducted. IMBs that were either reported as closed or were not found by the API were kept on the list. This strategy oversamples the number of closed IMBs, which allows for a comprehensive search of IMBs that may have been targeted in police enforcement actions. Second, a manual search was conducted for the remaining IMBs to identify any possible police enforcement action targeting an IMB (e.g. "police/shutdown IMB name address place"). Media reports typically included the name, location, and type of police operation (see, for an example, Orchard & Staff, 2011). A total of 164 IMBs were targeted in publicized stings, arrests, investigations or any other action that resulted in the closure of those IMBs anytime between January 2011 and December 2017. Those 164 IMBs were located across 121 different census tracts and 126 different block groups.[20]

---

[20] These actions were all reported in a month after the last online review and exclude police enforcement actions at locations that were not reported on the website in 2011-2017.

To obtain socio-economic characteristics about locations of IMBs, data were merged with geographically and, as far as possible, time-matching geospatial and population data. This included 1) demographic and socio-economic data from the 2013-2017 American Community Survey (Manson et al., 2018); 2) spatial adjacency and distance measures calculated from the U.S. Census Bureau 2017 shapefiles; 3) the most recent locations of police stations in the three states using Google's Place API; and 4) OpenStreetMap (OSM) to obtain comparable land use information across the three states for 2017.

Research Design

Two types of analyses were conducted. First, a *quasi-experimental research design* was applied to assess whether police enforcement actions prevented the opening of new IMBs in or near targeted areas during a five-year period between 2013 and 2017. Second, *machine learning techniques* were used to predict the location of new IMBs after police enforcement actions and in a larger context of choice-structuring neighborhood processes.

Quasi-Experimental Research Design

A quasi-experimental research design was applied to obtain a causal impact of police enforcement actions on the presence of new IMBs in or near the area where the action took place. Propensity score matching routines were applied to compare census tracts with a police enforcement action anytime between January 2013 and December 2017 (N = 102, 'treatment' tracts) with a control group of census tracts that did not face any police enforcement actions between 2013 and 2017. The specific census tracts with a police enforcement action in 2011 or 2012 were excluded from the analyses such that these years could serve as pre-intervention

119

years. Tracts that were immediately adjacent to a treated area (but not treated themselves) as well as tracts in counties without any IMB or that had no interventions in the study period were excluded from consideration as appropriate control groups.

Propensity score matching routines using the *MatchIt* package in R (Ho et al. 2011) were applied to identify an appropriate control group. These routines summarize relevant neighborhood features and use that to assign a propensity score to each tract. Pairs of treated and control tracts were matched based on their propensity scores (see Rosenbaum & Rubin, 1985). Propensity score matching was based on the following weakly-correlated neighborhood features (see the Appendix for the operationalization of these measures): Prior new IMBs in 2011 and 2012; concentrated disadvantage, racial and ethnic heterogeneity; income inequality; residential instability; % male; being located in commercial, retail, residential, or industrial center; direct intersect with a primary road; a police station within a mile distance; city size above 100,000, and state.[21] The matching resulted in a balanced sample of 95 treated tracts that could be matched to the same number of untreated tracts that served as the control group.[22] Table 6 presents the pre-matching and post-matching means for treated and untreated tracts. Insignificant p-values ($p > 0.05$) indicate an absence of difference in group means, which essentially confirms that census tracts with similar variables would have the same probability of being treated, underscoring the appropriateness of using the best-matched untreated tracts as the control group.

A longitudinal research design was used where the unit of analysis is the census tract in a given month between 2011 and 2017. The outcome measure represents the monthly cumulative count of new IMBs. To illustrate this, a census tract with a new IMB in March 2012 and also in

---

[21] See the Appendix for an operationalization of these variables.
[22] Nearest neighbor matching with a caliper of 0.2 and a ratio of 1 was applied.

120

April 2016, was coded as '1' from March 2012 until March 2016, after which it was recoded to '2'. The impact of a police enforcement action on this monthly count was analyzed using a linear two-way within-panel fixed-effects model with combined entity (i) and time (t) fixed effects. The basic estimation takes the following form:

$$Y_{it} = \propto_i + \beta_1 treatment_i + \sum_{t=2}^{T} \beta_t\, month_t + \sum_{i=2}^{I} \beta_i\, tract_i + \varepsilon_i$$

Here, Y_{ij} is the monthly count of IMBs of tract i. *Treatment* indicates whether or not a tract was treated and equals 1 for all months during or after a police enforcement action, compared to that tract's previous months (Treatment = 0) and a control group (Treatment = 0 in all months). The analyses also account for yearly linear and nonlinear trends. Analyses were conducted in R using the *plm* package for fixed-effect models (Croissant & Millo, 2018; Millo, 2017).

The validity of the estimation relies on the extent to which group differences prior to the first intervention are time constant. This assumption, known as the common trends assumption, can be met when linear regression is applied, but could become more problematic for nonlinear models where any group differences are required to be absent because exponentiated differences could introduce bias to the analyses (Ai & Norton, 2003; Athey & Imbens, 2006; Puhani, 2012). Figure 7 presents the count of IMBs across the months between 2011 and 2017 for treated versus untreated tracts. The dotted line separates the pre-intervention (prior to 2013) and post-intervention period (post 2013). Treated and untreated census tracts show a nearly identical trend prior to the first intervention, providing support for the common trends assumption.

121

Table 6   **Group Means for Treated and Untreated Areas**

Variables	Control	Treated	p-value of t-tests
City Size (> 100,000)	0.516	0.474	0.564
Tract Population (log)	8.424	8.537	0.204
Concentrated Disadvantage	-0.015	-0.077	0.686
Residential Instability	0.466	0.343	0.424
Population Heterogeneity	0.498	0.480	0.518
Income Inequality	1.127	1.046	0.431
% Male	0.506	0.500	0.409
Commercial Center	0.147	0.158	0.841
Retail Center	0.263	0.253	0.869
Residential Center	0.326	0.326	1.000
Industrial Center	0.074	0.095	0.604
Primary Road	0.358	0.326	0.648
Police within Mile	0.347	0.358	0.880
New IMBs in 2011	0.305	0.337	0.744
New IMBs in 2012	0.263	0.305	0.662

Figure 7   Monthly Cumulative Number of New IMBs in Treated and Untreated Tracts

(January 2011 - December 2017)

122
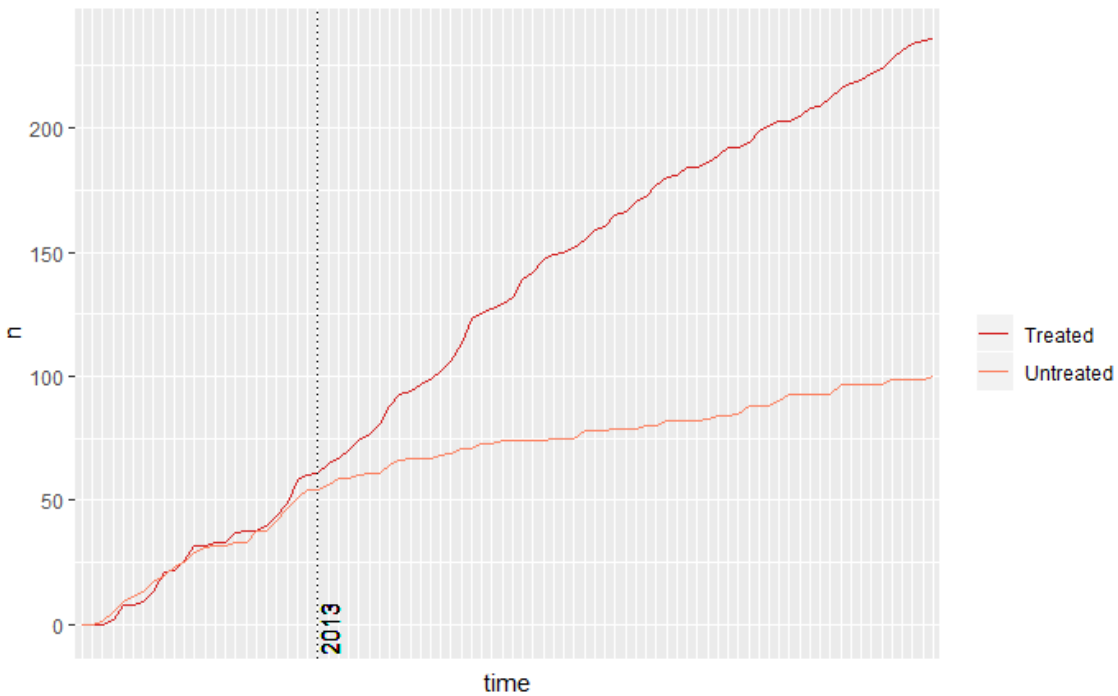
Supervised Machine Learning

While a quasi-experimental research design was used to identify the impact of police enforcement actions in or near the targeted tracts, supervised machine-learning techniques were applied to predict where IMBs would (re-)locate after police enforcement actions. As a data-driven approach, machine-learning models do not seek to explain why an event occurs but help identify *if* an event occurs as a function of a set of relatable items. This study's analyses sought to predict which neighborhoods had new IMBs in 2017 (1 = 'Yes'; N = 353, 4.4%).[23,24]

Measures

New locations in 2017 were predicted using information from a 2016 sample that comprised 200 census tracts with new IMBs in 2016 (2.5% of total). The appendix provides an overview of the key features of census tracts with and without new IMBs in 2016. Three sets of predictors were used, and broadly refer to distance and exposure to police actions, online-facilitated connectivity and popularity, and neighborhood features. The role of police interventions was examined through three variables. First, the shortest distance in miles to the closest tract where a police enforcement action took place in or before 2016 was included (*spatial proximity*). Distance between tract centroids was calculated in miles using the *spDist* function in the *sp* package in R (Bivand et al., 2013). The average distance to an intervention area was 33.290 miles, which was shorter for census tracts with new IMBs ($\bar{x}$ = 10.724) compared to those without new IMBs ($\bar{x}$ = 33.871). Second, *social proximity* to an intervention area was assessed through a binary measure that represents whether or not a tract was socially

---

[23] This is the percentage after accounting for missing information on tract-level features, which retained a sample size of 7,966 instead of 8,201 census tracts.

[24] The date of the first review was interpreted as the year of entering an online-promoted market. This does not necessarily equal the date of the actual opening.

123

connected to an intervention area through clientele that visited IMBs in both tracts. This was the case for an average of 11.1% of the tracts, and significantly more so for tracts with new IMBs (72.5%) compared to census tracts without new IMBs (9.5%). Third, to examine a potential city-level *exposure* to police enforcement actions, the analyses include the number of police enforcement interventions in a city up to 2016 ($\bar{x} = 3.125$). The average number of interventions in a city was higher for tracts with IMBs ($\bar{x} = 6.580$) than those without IMBs ($\bar{x} = 3.036$).

Three *measures of online-facilitated connectivity and popularity* were included as potential predictors for new IMBs. First, the distance to a tract with *high-degree centrality* was assessed. A tract's degree centrality is a measure of connectivity to other neighborhoods, and here indicates how often clientele traveled between tracts to frequent IMBs elsewhere. High-degree tracts had a degree centrality that was higher than the average and the distance in miles to those tracts was calculated. Second, the distance to a tract with *high-betweenness* was included. Betweenness represents the extent to which a tract frequented by clientele stands between other tracts (i.e. functions as a pass-through area) and provides for at least an indirect connection between those tracts. *High-betweenness tracts* were tracts with a betweenness score that was higher than the average. Third, the distance to a *popular* tract where the number of online reviews was higher than the average was included. Compared to tracts without new IMBs, tracts with new IMBs were more often observed in close proximity to high-degree, high-betweenness, and popular tracts (see the Appendix).

Furthermore, the role of a select set of *neighborhood features* as potential predictors was assessed, focusing on those that align with social disorganization or crime opportunity theories. While recognizing that a myriad of variables could be included, the present study assesses the predictiveness of the variables that were previously associated with the presence of IMBs (see

124

Chapter 3), including population demographics, socio-economic composition (e.g. concentrated disadvantage), land use (e.g. commercial and retail land use) and street accessibility (e.g. primary road), and the visible presence of a police station within one mile. The appendix provides an overview of the operationalization of all variables, along with the total and group means.

Estimations

Six popular machine-learning techniques were used: Gradient Boosting Machine (GBM); Regularization models; K Nearest Neighbor (KNN), Support Vector Machine (SVM), Random Forests, and Neural Networks with a Principal Component Analysis. Data were trained on 2016 data ('training sample') and predictive accuracy was assessed on 2017 data ('test sample'). Because machine-learning techniques can be ineffective in detecting rare events, the 'train sample' was randomly down-sampled such that class frequencies of the train data matched the least prevalent class. Re-sampling was done within the training function using the *Caret* package (Kuhn, 2019), retaining 40% of the train data to estimate the model. Centering and scaling of predictors was performed and spatial folds for cross-validation were created by indexing tracts by cities using the *CAST* package in R (Meyer, 2018).

All training procedures involved an internal *k*-fold cross-validation procedure, where the sample was divided in $k=10$ folds and estimates were derived from a fraction of $(k-1)/k$ of the training data. Prediction errors on the remaining fold were computed to subsequently retain the model with best predictive accuracy. Data were trained on the ROC-metric and out-of-sample validity was assessed on the 2017 sample using a variety of different performance metrics (see the Appendix). The model with optimal predictive accuracy will be presented. All models were estimated using the *Caret* package (Kuhn, 2019).

125

Findings

Findings from the Two-Way Within-Panel Fixed-Effects Models

Figure 7 shows that tracts had an increasing number of new IMBs in the post-intervention period, compared to untreated tracts. This adverse impact of police enforcement actions is confirmed by the findings of the fixed-effect regression models in Table 7. Model I shows the impact of a police enforcement action in the specific tract where the intervention took place. There, police enforcement actions were associated with a $\beta = 0.916$ statistically significant *increase* (p < 0.001) in the cumulative number of new locations of IMBs per month. This finding rejects the hypothesis that enforcement actions reduce the likelihood of new IMBs in the targeted areas.[25] To examine the localized nature of the impact of police enforcement actions, two additional analyses using different geographic units were conducted.[26] First, the impact of police enforcement actions was assessed in a buffer zone immediately adjacent to an intervention tract. As follows from the positive coefficient associated with the police action estimate in Model II of Table 7, buffer zones experienced a significant but small increase in the number of IMBs as a

---

[25] To assess the robustness of this finding, several sensitivity analyses were conducted. First, some may argue that the months prior to treatment may serve as the best control group for a post-treatment time given that neighborhood features between treatment and control are absent, assuming time indifferences. With that in mind, the models were re-estimated with only the treated tracts included where treatment was '0' for all months prior to treatment and '1' for all months after treatment. This resulted in a reduced estimate of $\beta = 0.517$ (p < 0.01, SE = 0.173, clustered robust standard errors applied). Second, while the common trends assumption has driven the choice for linear models, robustness checks involved two-way fixed effect models using (zero-inflated) negative binomial and poisson regressions. While comparison in coefficients is challenged by the linear versus nonlinear nature of the models, the magnitude of the police intervention effect is reduced but the direction of the effects was the same. For both the negative binomial and poisson model, the effect sizes equaled 0.303 (p < 0.001), which equals an incident rate ratio (IRR) of approximately 1.354. The *pglm* package in R was used for the analyses (Croissant, 2020).

[26] Similar matching procedures were performed as for the tract-level analyses.

result of police enforcement actions. Second, the impact of police actions was assessed at the block group level to evaluate whether the findings would hold even at a more micro-geographic level where the presence of new IMBs may be further restricted by space issues. Model III in Table 7 shows that the effects on block group level were similar even though the explained variance was substantially reduced. Altogether, these findings suggest that the impact of police actions was primarily localized to the census tracts where interventions took place.

While showing a localized increase of new IMBs, there is one major complication with the above analyses. So far, the analyses were restricted to a sample of treated tracts and a comparable control group. This, however, excludes a substantial number of tracts where new locations opened but where police enforcement actions may have had a less direct impact. Considering the growing number of online-promoted IMBs, it is important to understand the extent to which police actions play a role in where new IMBs are located across a city, relative to other choice-structuring features of neighborhoods.

Table 7   Findings of Within-Panel Fixed Effects Models that Measure the Impact of Police Enforcement Actions on the Cumulative Count of New IMBs

Variables	Model I Treated Tracts β (SE)	Model II Buffer Zones β (SE)	Model III Treated Block Groups β (SE)
Police Action	0.916*** (0.139)	0.085** (0.029)	0.925*** (0.218)
Yearly Trend	0.432*** (0.057)	0.086*** (0.011)	0.426*** (0.079)
Yearly Trend^2	-0.030*** (0.006)	-0.004*** (0.001)	-0.033*** (0.008)
Overall Intercept	-0.282*** (0.129)	-0.068*** (0.025)	-0.258*** (0.182)
N (Tracts * Months)	15,960	84,168	17,095
N Tracts	190	1,002	206
R^2 Within	0.397	0.107	0.225
R^2 Between	0.063	0.004	0.047
R^2 Overall	0.163	0.035	0.071

Note. SE = Clustered Robust Standard Errors.

127

Findings from the Machine-Learning Models

Machine-learning techniques were used to predict new locations of IMBs as a function of

spatial and social proximity to police enforcement actions, networks, and socio-economic

neighborhood features. The results from the model with best predictive accuracy, a gradient

boosting machine, will be presented below.[27] This model predicted more than half of all new

locations with IMBs in 2017 (see Table 9). While this is a considerable prediction score for rare

events in a volatile and dynamic market, about 18.7% of the tracts with no new IMBs were

misclassified as having new IMBs in 2017. This misclassification might indicate that other

features than those included in the models influence the location of IMBs, although it is also

possible that these false positives were at risk for new IMBs given their neighborhood features.

Figure 8 presents the variable importance associated with all predictors. Variable

importance represents a weight associated with a predictor, is always zero or positive, and cannot

be interpreted as coefficients similar to those in regression analyses. Predictors with the largest

value have relatively the most predictive power. In contrast to traditional explanatory models

such as logistic regression techniques, most machine-learning models do not assign coefficients

to the variables. One way to derive meaningful interpretation of the direction of the influence can

be obtained from the difference in group means as included in Table 11.

As follows from Figure 8, two sets of key predictors stand out. First, new IMBs were

predicted in social proximity to police enforcement actions, which represents clientele who

frequented IMBs in both the area where police intervened and the areas where a new IMB was

predicted. Spatial proximity to an intervention area further aided the predictions, although to a

---

[27] While model performance metrics were similar for the different techniques, a gradient
boosting machine was selected for its highest AUC-ROC score and specificity (see Table 8).

128

lower degree. New IMBs were more often observed in areas spatially close to interventions (on average ten miles) instead of further afield. Second, spatial proximity to popular neighborhoods mattered. In particular, tracts attracted new IMBs when they were spatially proximate to popular and highly interconnected tracts, where the number of prior online reviews or inter-neighborhood ties (through clientele frequenting IMBs in multiple neighborhoods) was higher than the average. In addition, various socio-economic tract features were important predictors. New IMBs were particularly more likely to be predicted in more advantaged, populous, and retail centers, yet also in those areas with higher levels of residential instability, and population heterogeneity. Other predictors had a decaying importance but still contributed to more accurate predictions than when these features were not included in the models.

Figure 8   Variable Importance
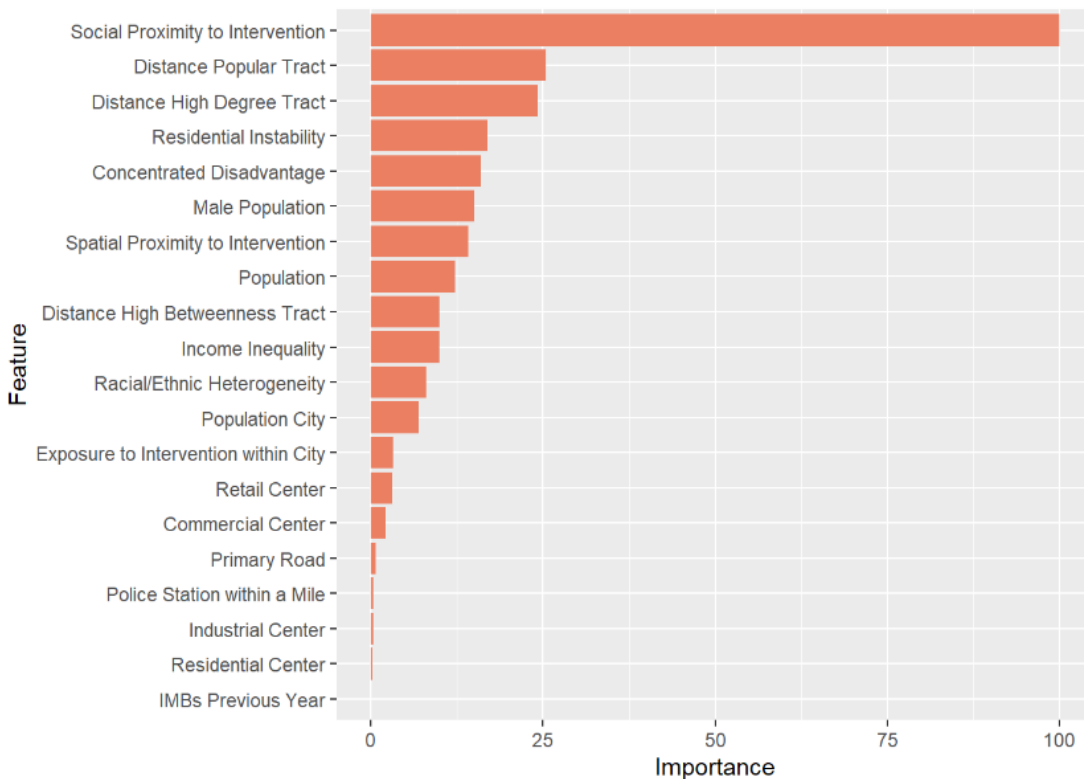
Discussion

Prior information on police enforcement actions against IMBs has largely remained anecdotal, lacking the theory and rigorous quantitative assessments that could either support or debunk concerns about the effectiveness of these actions. Using rigorous analytical techniques, the present study finds adverse effects of enforcement actions against IMBs. First, a quasi-experimental research design comparing intervention areas with a control group showed that enforcement actions were associated with a growing number of new IMBs in the targeted areas. Second, predictive machine-learning models were used to identify new locations of IMBs after police actions. The model with best predictive accuracy suggests that new IMBs were most likely identified in locations that were socially or spatially proximate to police enforcement actions. Social proximity was observed through clientele frequenting IMBs in both the intervention area and the area where a new IMB was identified. This indicates that new IMBs were identified and added to an online-promoted market by clientele who previously went to the intervention area to frequent IMBs. In response to an intervention, some clientele may have actively searched for new IMBs elsewhere and others might have identified IMBs in an area they had already frequented before, in which case a social proximity would also signal a pre-existing clientele demand.

Machine-learning models also predicted new IMBs in populous, advantaged, transitioning, and retail areas. The nesting of IMBs in these areas can be an opportunistic strategy to avoid suspicion of authorities by blending into a legitimate context (Holt et al., 2008, 2014), or a business strategy to maximize a potential pool of clientele that may also go to neighboring restaurants or shops (Eck, 1995b; Eck & Weisburd, 1995; Felson, 1987). The location of IMBs in advantaged areas is in line with recent work suggesting that an online

130

promotion moves IMBs or commercial sexual activity generally to higher-income and suburban areas (Bouché & Crotty, 2017; Chin et al., 2019; Venkatesh, 2011). Furthermore, new IMBs were identified in areas with a relatively higher residential turnover, which may offer the temporary vacant buildings for new IMBs and, along with other neighborhood features such as income inequality or racial and ethnic heterogeneity, could also allow IMBs to operate in transitioning areas with reduced levels of informal social control and collective efficacy (Sampson et al., 1997; Shaw & McKay, 1942). Altogether, these features helped predict about half of the new locations in 2017.

While a substantive amount of new locations of IMBs can be predicted using neighborhood-level information, the adverse effects of police enforcement actions are concerning. Several explanations can be provided. In particular, the literature on iatrogenic effects of policing strategies suggests that harmful effects can arise from methodological, theory, or implementation failures, which refer to inaccurate research evaluations, unsound prevention mechanisms from the outset or improper implementations (Ekblom & Pease, 1995). Theoretical failure of enforcement actions against IMBs is possible when these interventions are not clearly integrated within core deterrence principles or empirical evidence about effective deterrence prevention mechanisms. In particular, while media reports about police actions can function as a deterrence threat (Sherman, 1990; Zimring & Hawkins, 1973), it is not clear that the media reports about police actions against IMBs are part of a deliberate police strategy that seeks to alter risk perceptions of would-be offenders through communicating the certainty, severity, or swiftness of a police response to a targeted audience. Furthermore, media reports suggest that the enforcement actions against IMBs are often reactive (e.g. a response to tips from concerned community members), yet more empirical support exists for *proactive* place or person-focused

131

policing (Weisburd & Majmundar, 2018). In addition to theoretical failure, the interventions against IMBs may suffer from an implementation failure by targeting most areas only once. Therefore, instead of increasing the unpredictability that could result from rotated and repeated crackdowns (Sherman, 1990), media reports about the current response may harm the "credibility of the message" (Ekblom, 1999, p. 43) by bringing attention to the limited risks for underlying criminal networks and clientele.

Other possible reasons for adverse effects are related to the online platforms promoting illicit activity in IMBs and fostering demand, which can make the market more resistant and adaptive to traditional police interventions. Online platforms can also feed perceptions of low likelihood of detection, even when police efforts objectively intensify. For example, qualitative work describes that clientele provide details in online review boards as to where and when an action occurred (Holt et al., 2008, 2014). While some clientele may be deterred from engaging in illicit behaviors when reading such online information, other clientele may opt to "rebound" from police actions when they perceive the action as a mere imposition (see, about rebound effects, Linning & Eck, 2018; p. 319) and use online platforms to mitigate the risk of law enforcement apprehension.

Furthermore, organization scholarship can further help explain the market dynamics of IMBs that prevent police enforcement actions from having the intended effects. This is because IMBs share many characteristics with legitimate organizations operating in risky environments where there is an "ever-present potentiality of a catastrophe" (Hällgren, Rouleau, & De Rond, 2018, p. 125). Organizations that are best-equipped to adapt to unforeseen events rely on several strategies to mitigate risk, such as a high degree of interdependence, teamwork, irregular shift schedules, a steady flow of new and old colleagues, and a dynamic delegation of leadership roles

132

(Hällgren et al., 2018; K. J. Klein, Ziegert, Knight, & Xiao, 2006). These strategies are remarkably similar to the observed modus operandi of IMBs that rely on a shared pool of frequently-rotating staff and delegate management and ownership to managers (Polaris, 2018).

Organizational scholarship also suggests that disruptions can allow for new business opportunities when a situational environment allows for regaining or a relocation of supply and demand (Hällgren et al., 2018; Stecke & Kumar, 2009; Sydnor, Niehm, Lee, Marshall, & Schrank, 2017, p. 1642). With this in mind, it is important to reiterate that iatrogenic effects of intensified law enforcement strategies have been observed in other illicit markets such as drug markets or networked problems such as gang violence (see Ekblom & Pease, 1995; Linning & Eck, 2018; Werb et al., 2011). While crime and victimizations are substantially different for IMBs than for drug markets or gang violence, some of the explanations for adverse effects might be similar. For example, some scholars explain adverse effects of drug law enforcement by the departure of drug dealers that opens up opportunities for new players who are willing to work in a high-risk environment and can cause a more volatile and violent environment (Linning & Eck, 2018; Werb et al., 2011). Similarly, "weak intervention backfire" effects can occur after arresting gang members who were not the key players and unlikely impact the market as a whole, especially when "an intense recruitment in response to the loss of a member" follows (see also M. W. Klein, 1993; Linning & Eck, 2018; p. 320). Overall, these explanations may apply to the context of IMBs, where the networked nature of the problem and an online-facilitated continuous pool of supply and demand might explain new illicit opportunities after police actions.

Several limitations of the current research design may provide for alternative explanations and should be considered in future inquiries. First, machine learning models were implemented as first, exploratory approaches to the predictive nature of IMBs, and future

133

research should seek to improve the predictive accuracy and further unravel the key predictors in these models. Second, it is possible that police actions may drive a further online promotion of IMBs, for example when clientele become more active in online review boards and add reviews for IMBs that are new to the online domain but not new to the neighborhood. Third, the current study focused on strategies specific to IMBs whereas the market of IMBs could be affected by police enforcement actions against other forms of commercial sex. For example, prior literature has noted that police crackdowns targeting street prostitution may cause some clientele to choose indoor commercial sexual activities in IMBs over street soliciting (Holt et al., 2008, 2014). Moreover, a few high-profile clientele arrests or large sting operations could not be linked to a specific IMB or geographic location and were not part of this study's sample. Fourth, different types of police actions may have different effects. For example, an action resulting in the investigation of human trafficking may have different impacts than an action involving arrests of clientele. Similarly, effects may be found in one specific area (e.g. retail) but not in another (e.g. residential). More research is needed to unpack such differences across locations and types of interventions.

While encouraging future scientific inquiries that address the above limitations, the findings yield a number of research and policy implications. In particular, this study contributes to the literature on iatrogenic effects of policing strategies by showing that non-targeted enforcement actions can be associated with harmful effects. There is a need to further explore the mechanisms to explain such effects in different crime contexts (see, for an in-depth discussion about harmful efffects, Braga, 2016; McCord, 2003). Furthermore, the present study provides a new case of a crime problem that has received limited attention in evaluations of policing strategies. Most evaluations focus on problems such as gang violence, violent crimes, or

robberies, yet limited knowledge exists about the effect of policing strategies against facilities such as IMBs. Furthermore, the current study lays the ground for research on the implications of deterrence theory and prior evidence on effective policing in the context of online-promoted illicit markets. This online promotion is important for future studies on policing because it can undermine the effectiveness of law enforcement strategies when it increases locational flexibility and provides alternative means to signal illicit opportunities.

This study's findings call for the need to explore alternative responses to IMBs that involve partners within and beyond the criminal justice system. While recognizing that IMBs present a unique case of crime and victimization problems, lessons can be drawn from proactive place-based and person-focused approaches, many of which integrate diverse strategies to increase perceptions of risks and reduce criminal opportunities (Bowers et al., 2011; Braga et al., 2019; Weisburd & Majmundar, 2018). In the context of IMBs, most effective approaches might be place-based crime-control and crime-prevention efforts directed at areas where IMBs are most likely to be (re-)located, such as areas socially close to prior interventions, and populous, retail areas that maintain a vast network of clientele. While arrests or shutdowns of IMBs are likely needed in certain circumstances, the findings of this study call for evidence-informed, geographically-focused policing strategies that incorporate guardian actions. An example of a guardian action could be regular visits to an illicit premise, using initial warnings and victim outreach, while saving arrests for continued and more aggravated circumstances of offending (see, for an example of such an approach,Weisburd, Hinkle, Famega, & Ready, 2011; p. 305). Face-to-face conversations with potential offenders or facilitators may also be an important first step in altering their perceptions of apprehension risk (see, more generally, Braga, 2012). Furthermore, analyses of the popularity and networks driving IMBs would allow police to focus

135

their efforts on key players, which has shown to be more effective than randomly taking out a few actors (McGloin, 2005). Lastly, crime prevention efforts might need to be extended to the online domain to influence prostitution-related discussions among clientele and alert their conscience, for example by purposively spreading messages about crime and victimization problems or focused policing strategies (Holt et al., 2008, 2014).

The problem of IMBs is likely too complex for the police to handle alone, which calls for a number of different partnerships. There may be a particular role of "place managers" (Eck, 2002) to increase the visibility of criminal opportunities to potential guardians. Place managers could be landlords, owners of legitimate businesses in retail areas, or others in a position to organize space, regulate conduct, control access, or change the purpose or population of space (Eck, 2015; Madensen, 2007). The findings also point to the importance of alternate strategies that do not rely on the criminal justice system but can discourage offending. When considering the local opportunity structures for IMBs, these can involve measures such as ordinances preventing the opening of a new IMB at a previously targeted location, or regulations around the presence of IMBs in retail centers. Alternative approaches can also involve limiting easy access to IMBs or other ways to put barriers to revenues from illicit and potentially victimizing behaviors, in addition to providing alternative means for a labor force that depends on the income from IMBs.

Beyond the specific findings of the current study, a proposal to redesign the current response against IMBs also stems from concerns about possible harmful effects on victim identification and human trafficking investigations. In particular, concerns about a lack of victim services, an unjust focus on specific areas or groups of offenders or victims, and an unjust treatment of potential victims as offenders of commercial sex can harm the relations between

136

police and potential victims, put a barrier to victim statements and reduce overall community trust in police and police legitimacy (Farrell, Dank, et al., 2019). The importance of police-community relations cannot be underestimated given that the effectiveness of policing depends on perceptions on police legitimacy (Braga, 2012; Rosenbaum, 2006).

In conclusion, this study lays the ground for future work on policing in online-promoted markets. The findings encourage alternative approaches against IMBs using an evidence-informed and proactive approach that targets specific places and actors, draws on the role of police as both apprehension and sentinel agents, and includes structural partnerships with place managers, victim service agencies, and community organizations. Future evaluations are needed to further evaluate the effectiveness of these strategies in an online-promoted illicit market.

Appendix

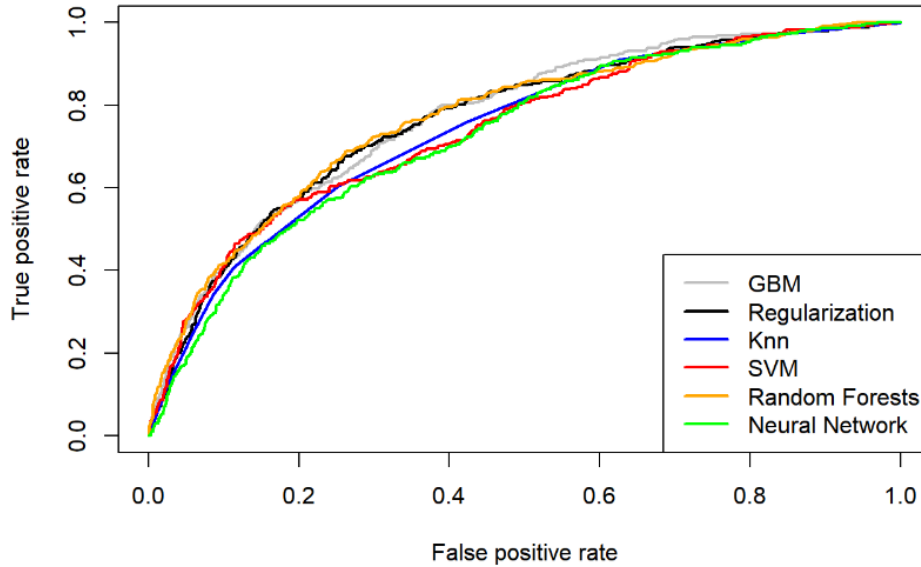**Figure 9**   ROC Curves for Each Machine Learning Model

Table 8   Model Performance Metrics for Each Machine Learning Model

	AUC-ROC	*Train Error*	*Test Error*	*Sensitivity*	*Specificity*	*Overall Accuracy [95% CI]*
GBM	0.760	0.182	0.198	0.813	0.564	0.802 [0.793, 0.810]
Regularization	0.754	0.141	0.157	0.860	0.470	0.843 [0.835, 0.851]
KNN	0.722	0.185	0.201	0.813	0.500	0.799 [0.790, 0.808]
SVM	0.741	0.126	0.142	0.876	0.473	0.858 [0.851, 0.866]
Random Forests	0.769	0.162	0.184	0.829	0.538	0.816 [0.807, 0.824]
Neural Network	0.724	0.210	0.229	0.782	0.533	0.771 [0.762, 0.781]

Notes. AUC-ROC is the Area under the Curve for the probability curve ROC (Receiver Operating Characteristics). The higher the AUC, the better the model predictions. Train and test errors represent overall incorrect predictions for the train and test samples, respectively. Sensitivity is the ratio of correct predictions of no IMBs in tracts (True Negatives) to incorrect predictions of IMBs in tracts (False Positives). Specificity is the ratio of correct predictions of IMBs in tracts (True Positives) to incorrect predictions of no IMBs in tracts (False Negatives).

138

Table 9   Confusion Matrix for Prediction Validity

	Observed 0s *(No New IMBs)*	*Observed 1s* *(New IMBs)*
Predicted 0s	6,186	154
(No New IMBs)	True Negatives	False Negatives
Predicted 1s	1,427	199
(New IMBs)	False Positives	True Positives

Table 10   Operationalization of Predictors

Variables	*Operationalization*
IMBs	
Prior IMBs	Tract had at least one IMB in 2015 (1 = 'Yes').
Police Enforcement Action	
Spatial Proximity	Shortest distance in miles between a tract's centroid to another tract where the police intervention took place.
Social Proximity	Tract i was connected to tract j through clientele frequenting IMBs in both tracts in or prior to 2016 (1 = 'Yes').
Exposure	Tract i was in a city where police enforcement actions took place (1 = 'Yes').
Networks	
Distance to High-Degree Tract	Shortest distance in miles to a tract with high degree centrality. Degree centrality represents the number of connections between any two census tracts as observed through clientele frequenting IMBs in both census tracts. High-degree tracts were those with a degree centrality that was higher than the average.
Distance to High-Betweenness Tract	Shortest distance in miles to a tract with high betweenness. Betweenness represents the extent to which a tract connects other tracts from and to where clientele travel to frequent IMBs. High-betweenness tracts were those with a betweenness score that was higher than the average.
Distance to Popular Tract	Shortest distance in miles to a tract that had more than the average number of reviews.
Population Size	
Population (Log)	Log of the total tract population.
Population City (Log)	Log of the total city population.
Social Disorganization	
Disadvantage (Index)	Standardized score of the averaged sum of the following standardized items: % families with an income below the poverty level; % female-headed households with children; % of the tract population age 25 and older that was unemployed.

Population heterogeneity (Index)	Blau's (1977) index: $1 - \sum \pi^2$, where π refers to the proportion of each racial or ethnic group.
Residential Instability (Index)	Standardized score of the averaged sum of the following standardized items: % renters % of the population that changed houses in the past year.
Income Inequality	Standard deviation of log-transformed average household incomes in the past twelve months (see, for further details about a measure of income inequality, Hipp & Kubrin, 2017).
Crime Opportunities	
% Male	Percentage male of total population.
Land Use: Retail Center	Percent retail land use was higher than the average of the city (1 = 'Yes').
Land Use: Commercial Center	Percent commercial land use was higher than the average of the city (1 = 'Yes').
Land Use: Residential Center	Percent residential land use was higher than the average of the city (1 = 'Yes').
Land Use: Industrial Center	Percent industrial land use was higher than the average of the city (1 = 'Yes').
Primary Road Intersect	A primary road (e.g. freeway) runs through a tract (1 = 'Yes').
Police Within a Mile Distance	The closest police station was within a mile (1 = 'Yes').
State	
MA	Tract was in Massachusetts.
TX	Tract was in Texas.
WA	Tract was in Washington.

Table 11   Total and Group Means

Variables	Total means		No new IMB		New IMB	
IMBs	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Prior IMBs in 2016	0.095	0.293	0.087	0.281	0.425	0.496
Police Enforcement Action						
Spatial Proximity	33.29	49.756	33.871	50.079	10.724	26.56
Social Proximity	0.111	0.314	0.095	0.293	0.725	0.448
Exposure	3.125	7.268	3.036	7.163	6.580	10.001
Spatial Networks						
Distance to High-Degree Tract	28.131	51.633	28.654	51.937	7.806	32.034
Distance to High-Betweenness Tract	28.187	47.636	28.727	47.974	7.231	23.806
Distance to Popular Tract	20.608	31.716	21.015	31.915	4.809	16.114
Population Characteristics						
Population (Log)	8.417	0.524	8.413	0.525	8.581	0.468
Population City (Log)	11.091	2.348	11.061	2.352	12.259	1.841
Social Disorganization						
Disadvantage (Index)	0	1	0.004	1.005	-0.147	0.776
Population Heterogeneity (Index)	0.432	0.187	0.430	0.187	0.524	0.164
Residential Instability (Index)	0	1	-0.012	0.996	0.458	1.053
Income Inequality	1.038	0.235	1.038	0.236	1.051	0.207
Crime Opportunities						
% Male	0.495	0.043	0.495	0.043	0.495	0.040
Land Use: Commercial Center	0.106	0.308	0.103	0.304	0.220	0.415
Land use: Retail Center	0.152	0.359	0.148	0.355	0.280	0.450
Land Use: Residential Center	0.233	0.423	0.229	0.420	0.370	0.484
Land Use: Industrial Center	0.097	0.297	0.096	0.295	0.135	0.343
Primary Road Intersect	0.257	0.437	0.254	0.435	0.395	0.490
Police Within Mile	0.255	0.436	0.253	0.435	0.320	0.468

Chapter 6   Discussion

This dissertation examined the interconnectivity between crime and place in the context of online-promoted forms of crime and deviancy. Online-promoted crimes were defined as crime types that occur in a physical environment but are facilitated through online platforms that offer a new medium to signal and communicate about illicit opportunities. These online interactions may have implications for the offline distribution of crimes within cities when they reduce a dependency on the environmental factors to determine where and when crime occurs, thus allowing for "spatially unbounded" behaviors (see, beyond the context of crime, Phillips et al., 2019, p. 469; Wellman, 2001, p. 2031). While recent work has begun to argue that online domains facilitate the diffusion of crimes such as terrorism or cybercrimes across large geographic span (Wall, 2007), criminologists have been slow to analyze the implications of increasing access and daily use of the internet for the spatial and geographic distribution of crime within cities.

To address this empirical void, online-promoted IMBs offered an illuminating case to revisit the extent to which the presence of crime and deviancy can be explained by environmental conditions as proposed by theories such as social disorganization theory and crime opportunity theories. Crime and deviancy in IMBs are promoted by online platforms such as review boards or online classifieds advertising for commercial sex, yet these problems are different from cybercrimes given that the illicit acts still require an offline location (Polaris, 2018). While IMBs have been identified as a crime and nuisance problem throughout decades (Armstrong, 1978; Bartley, 1994; Bryant & Palmer, 1975), recent concerns are articulated around human trafficking victimizations as observed through forced sexual acts, long working hours, no or little pay, and working and living in the same location. In addition, the risk to crime

142

and victimization in IMBs extends to other problems such as robberies or organized crime (Dank et al., 2014; Polaris, 2018).

Using online, geospatial, and population data and robust quantitative methods, this study provided three broad findings, which will be discussed in more detail in the next sections. First, the findings showed that the locations of IMBs in neighborhoods and cities can, for a great part, be explained by criminological theories that assume an intricate relationship between crime and place. While corroborating the relevance of theories such as social disorganization and crime opportunity theories, the findings also challenged specific theoretical components, for example by demonstrating a complex nesting of IMBs in advantaged, yet residentially unstable, and populous, yet under-guarded neighborhoods. Second, spatial network analyses documented that spatial proximity and socio-economic features mattered for clientele decisions on where to frequent IMBs. However, these findings also allude to a locational flexibility of IMBs by showing that clientele frequently travelled between distant neighborhoods, thus potentially driving a diffusion of crime and deviancy across geographic space. Third, police enforcement actions, at least in their current form, have adverse impacts by attracting rather than preventing new IMBs. The adverse impacts might result from a disconnect with the core deterrence principles or evidence on effective policing models, as well as the online promotion of these premises that aids their locational flexibility, signals illicit opportunities, and provides for an opportunity to easily gain clientele back after a shutdown (Holt et al., 2008, 2014; Venkatesh, 2011).

Prior to discussing these findings in more detail, it is important to reflect upon this study's purposes. The dissertation as a whole sought to provide new insights into the spatial and social patterning of a pressing problem that has persisted across decades (Armstrong, 1978;

143

Bartley, 1994; Blevins & Holt, 2009; Bouché & Crotty, 2017; Bryant & Palmer, 1975; Chin et al., 2019), yet to which the response has lacked data and robust research. Furthermore, this work sought to advance a criminology of place in the age of the internet by examining the applicability of traditional notions from ecological and situational theory to the context of online-promoted illicit premises. The term "place" was used broadly to refer to any geographic unit, including neighborhoods, that may exhibit crime-favoring features (Sampson, 2013). In addition to a theoretical contribution, the analyses also sought to provide a methodological contribution to a criminology that benefits from the accessibility of new, digitized data for crime-related research without being disconnected from theoretical developments. In particular, it sought to spark data-driven models that integrate a theory-driven approach (Snaphaan & Hardyns, 2019) to assess the relevance and meaning of new data and methods, and explore the social mechanisms that bring about the social outcomes captured by these data. Lastly, the findings put forward concrete policy recommendations, including situational crime prevention efforts that involve actors from within and outside of the criminal justice system, and alter both the online and offline drivers for the presence and use of IMBs. The findings will be discussed in more detail below.

6.1   Summary of Key Results

6.1.1   The Location of IMBs Driven by Social Disorganization and Crime Opportunities

Guided by social disorganization and crime opportunity theories, a first paper applied hierarchical logistic regression models to examine the likelihood of IMBs in 2017 across 4,318 census tracts within 104 medium-sized and large cities (with a population size of 50,000 or more). Overall, the findings support the applicability of several aspects of both theories, but neither theory is a fully accurate or sufficient explanation on its own. For example, income

144

inequality, residential turnover and population heterogeneity were strong geographic correlates of the presence of IMBs. However, concentrated disadvantage was not and IMBs were, in fact, more likely to be located in advantaged areas. Similarly, IMBs were nested in populous, retail centers, and areas that were easily accessible through a highway. While these are likely areas where the behaviors of clientele and suitable targets are more likely to converge, they attracted IMBs in spite of potential proximity to a police station.

While data limitations impede a direct comparison of a pre- and post-internet phase, it seems likely that online domains facilitate the location choices for IMBs. The nesting of IMBs in accessible, populous, and legitimate surroundings aside allied, retail businesses, may increase a potential pool of clientele who frequent these areas in their routine travels (see, in the context of illicit retail places more broadly, Eck, 1995b). However, this socio-economic embeddedness can also make it difficult to distinguish IMBs from other similar-looking businesses, in which case online reviews provide clientele an informational advantage about where to find illicit opportunities (Bouché & Crotty, 2017; Chin et al., 2019; Huff et al., 2018). For the same reason, IMBs may also relocate to areas in closer proximity to the routine travels of clientele such as more affluent areas considering that clientele frequenting IMBs have been identified as having an income higher than average (Polaris, 2018). This nesting in affluent areas aligns with prior studies that have observed a relocation of IMBs from lower-income areas (Chin et al., 2015) to more affluent areas (Chin et al., 2019).

Whereas these explanations put emphasis on the importance of crime opportunity perspectives and contradict the theoretical relevance of concentrated disadvantage, the findings also indicate that complex social mechanisms involving urban change, social stratification, and inequality contribute to the problem of IMBs. This supports a partial relevance of social

145

disorganization theory, at the very least to contextualize and strengthen explanations of the geography of online-promoted IMBs. While it is important to note that crime opportunity theories may have more profound effects when it is measured at more discrete locations (see Weisburd, 2015; Weisburd et al., 2012, 2014), the importance of both social disorganization and crime opportunity theories aligns with relatively recent studies suggesting that a theoretical integration can strengthen explanations of local crime problems (Weisburd et al., 2014; Wilcox & Land, 2017). In the present context, a theoretical integration helped explain where illicit labor from more marginalized communities had greater potential to meet the demand and routine travels of clientele with the financial means to pay for illicit services (Dank et al., 2014; Polaris, 2018).

The role of informal social control in the geography of IMBs is complex and requires further research. On the one hand, IMBs were located in areas thriven by residential turnover and population heterogeneity, which have historically been associated with low levels of informal social control (Shaw & McKay, 1942, 1969). On the other hand, IMBs were located in more advantaged areas where collective efficacy (Sampson, 2006; Sampson et al., 1997), and a potential willingness of neighbors to intervene, can be higher than elsewhere in a city. As a potential explanation for IMBs in advantaged areas that otherwise tend to have lower levels of crime, it is possible that a local community is not aware of crime and victimization in IMBs, or does not consider it to be their responsibility to intervene. It is also plausible that the locations of IMBs in advantaged areas is driven by the demand for illicit acts in IMBs that can exist with a certain degree of anonymity. Online platforms not only provide clientele the specific locations of IMBs, but also an online community that supports and justifies illicit and deviant behaviors (Blevins & Holt, 2009; Holt et al., 2014; see also Maratea & Kavanaugh, 2012). In other words,

146

deviant norms may develop online, out of sight of concerned community members, and clientele may seek to further hide their illicit behaviors by frequenting IMBs in areas where their presence is less suspicious.

Although these findings demonstrate that the location of online-promoted IMBs is nonrandom and intricately linked to place, the analyses do not provide ample evidence for a spatial concentration at the neighborhood-level. Modest spatial autocorrelation was found in only a few cities. This finding contradicts prior work on IMBs that found significant spatial concentration in a few large cities in California and Texas (Chin et al., 2019; Crotty & Bouché, 2018) as well as extensive research showing that a variety of crimes, including other indoor problems such as domestic disturbances, tend to concentrate in specific areas of a city (Sherman et al., 1989). Several explanations can be provided for the spatially dispersed nature of IMBs, including the possibility that an online promotion of IMBs along with a willingness of clientele to span greater distance (see Chapter 4) makes it possible for IMBs to now be located miles apart from each other. In addition, the spatially-dispersed nature of the overall market of IMBs aligns with a business-oriented strategy of illicit retail places to avoid local competition, minimize law enforcement attention (Eck, 1995b), or culturally and linguistically isolate commercial sex providers (Chin et al., 2019).

6.1.2 Web-Facilitated Inter-Neighborhood Networks of Clientele Facilitated by Network Mechanisms and Crime Opportunities

The second paper provides further depth to the potential role of clientele networks of IMBs in connecting distant neighborhoods in patterns of crime and deviancy. Clientele often frequented IMBs in multiple neighborhoods, and in doing so they connected different

147

neighborhoods in larger spatial networks of crime and deviancy. These spatial networks were

analyzed through exponential random graph models (ERGMs), which helped explain why

clientele go from one to another neighborhood to frequent IMBs. A similar spatial network

approach has been taken in a prior studies that have examined the extent to which crime

histories, gang co-offending or juvenile delinquency connect neighborhoods in patterns of crime

(Bichler et al., 2014; Papachristos & Bastomski, 2018; Sampson, 2004; Schaefer, 2012), but

much less is known about such inter-neighborhood connectivity in the context of online-

promoted crimes.

The present study provides further clarity on the extent to which an online environment

replaces, supplements, or reinforces offline crime opportunities. First, the findings show that

clientele often traversed neighborhood boundaries to frequent IMBs and in doing so, they

spanned a total of 6,601 ties between 197 neighborhoods (34.2% of the total amount of possible

connections). Nearly half of these connections represented multiple visits of clientele spanning

ties between the same set of neighborhoods. These ties were termed "strong ties", as they likely

represent a more enduring connectivity between neighborhoods. While many clientele decided to

frequent IMBs within a set of spatially proximate neighborhoods, a substantial amount of

clientele spanned ties across greater distance, thus creating pathways between both distant and

spatially proximate neighborhoods. These inter-neighborhood ties allow for the diffusion of

illicit and deviant behaviors and norms across greater distance (Wall, 2007), and might reduce

the need for IMBs to be spatially proximate to each other (see also Chapter 3).

In particular, the findings in Chapter 4 show that clientele location choices were not

disconnected from place features. Instead, the analyses provide evidence for online cues

supplementing and reinforcing offline crime opportunities. Specifically, the neighborhoods that

attracted clientele were more advantaged, had an overall higher percentage of male residents, population heterogeneity (or a greater racial and ethnic minority), and a police station at a minimum distance of a mile. These are situational features that can facilitate a convergence of motivated offenders and suitable targets in areas familiar to buyers who seek to attract minimal suspicion of authorities. Although these findings corroborate crime opportunity perspectives, specifically Eck's application of routine activity theories in illicit retail markets (see Chapter 2.2.1), offline, environmental conditions likely operate in tandem with online cues of illicit opportunities. For example, prior qualitative research using content analyses of online review boards for commercial sex have documented how clientele actively search for areas that align with their interests and routine behaviors, and collectively warn each other about intensified law enforcement efforts (Holt et al., 2008, 2014).

Lastly, the findings suggest that online domains supplement offline, environmental cues by providing the motivational cues and exposure to illicit opportunities that may instigate offline illicit behaviors and determine the geography of these behaviors. Consider, for example, that prior qualitative work has also documented the role of online domains in creating a virtual community that shares deviant, sexual interests and provides others the motivations and justifications to engage in commercial sex (Blevins & Holt, 2009; see also Maratea & Kavanaugh, 2012). With reference to these shared sexual interests, the present study demonstrates a statistically significant association between the location of rape incidents and clientele visits to IMBs. While more research is needed to understand the relation between sex crimes and clientele visits to IMBs, it is possible that the social mechanisms that drive rape incidents are the same mechanisms that drive clientele visits to IMBs across neighborhoods.

Furthermore, the analyses show that network mechanisms such as preferential attachment and triad formation (Carrington, 2014; Wasserman & Faust, 1994) were prevalent and influenced clientele location choices. This means that clientele were most likely to travel between any two neighborhoods that were already popular among clientele or to areas that served as a common source of popularity toward at least two other neighborhoods. This is an evident consequence of the online domain, given that following each other's footsteps would not have been possible without online reviews, at least not to this extent or with the same levels of anonymity.

6.1.3   Limitations of Traditional Law Enforcement Actions

Chapter 5 involved an evaluation of the role of police enforcement actions in preventing new IMBs. In response to the presence of IMBs, local police use traditional vice tactics such as rapid patrol-based responses to citizen complaints or reactive investigations triggered by tips from concerned community members. This aligns with the general response against human trafficking, which is often delegated to vice units who commonly deploy traditional tools such as sting operations or undercover work to identify human trafficking crimes (Farrell, Bright, et al., 2019; Farrell, Dank, et al., 2019). Despite concerns about the limitations of such responses in the context of human trafficking, where presumed trafficked persons do not readily identify as victims, traditional vice tactics remain among the most common response models to IMBs and human trafficking generally (Farrell, Dank, et al., 2019). This study provides an evaluation of the current response model against IMBs through two distinct analyses.

First, using media reports of police enforcement actions against IMBs between 2013 and 2017, a quasi-experimental research design was implemented to obtain a causal estimate of potential deterrence effects. The findings show seemingly illogical effects: Tracts directly

150

exposed to or in near vicinity of a police enforcement action were *more* likely to have new IMBs after the action, relative to a comparable control group. However, the adverse impact of law enforcement actions is not surprising when considering the literature on iatrogenic effects of policing strategies, which refers to potential methodological, theory, or implementation failures (Braga, 2016; Ekblom & Pease, 1995). With this literature in mind, there may be a disconnect between police enforcement actions against IMBs and theory and empirical evidence on effective policing strategies. For example, the actions received much media attention that theoretically could launch a deterrence threat (Sherman, 1990; Zimring & Hawkins, 1973), but it is not clear that media reports after the actions were a deliberate strategy of police. Furthermore, the current approach seems to differ from proactive place-based policing models that have shown to be more effective by tapping into the prevention mechanism of deterrence and crime opportunity reduction efforts, and involve a variety of tools and partnerships (Braga et al., 2019; Weisburd & Majmundar, 2018).

It is likely that the online-promoted and networked nature of IMBs poses a significant challenge to the efficacy of police actions, especially because online classifieds and review boards provide IMBs a locational flexibility and potential adaptiveness to interventions (Holt et al., 2014). This adaptiveness is aided by the dynamic market structure of IMBs of which the interconnectivity between IMBs within and across states allows for a relatively easy replacement of managers, employees, and clientele demand. This flexible market structure corresponds with organizational strategies of any legitimate business to mitigate risks from unforeseen events (Hällgren et al., 2018; Stecke & Kumar, 2009; Sydnor et al., 2017, p. 1642).

Second, the role of police enforcement actions was further evaluated in predictive analytic techniques that unpacked the efficacy of police actions in a broader context of crime-

151

favoring neighborhood features. These findings suggest that even neighborhoods well beyond the targeted areas could attract new IMBs after police enforcement actions, in neighborhoods that had a social connection to the intervention area. This social connection existed through clientele who previously had frequented IMBs in both the intervention area and the neighborhood where new IMBs emerged. Additionally, new IMBs emerged in spatial proximity to areas where a pre-existing clientele demand was already profound, as observed through the number of reviews that signal an online popularity of these neighborhoods.

In light of potential crime-prevention efforts (further discussed in section 6.3.4), the machine-learning models show a substantially predictable nature of new locations that was intricately linked to structural network and choice-structuring neighborhood features. At least half of the new locations in 2017 could be predicted using 2016 information about police enforcement actions, online-facilitated popularity of neighborhoods, and socio-economic features such as reduced levels of concentrated disadvantage, increased population heterogeneity, residential turnover, and retail centers. These are factors that align with both social disorganization and crime opportunity theoretical perspectives, which further supports an integration of these theories (see above).

6.2 Limitations

Prior to discussing the implications of these studies together, it is important to reiterate a broad set of limitations that may temper the conclusions of this dissertation. First and foremost, online review data are not intentionally designed for research purposes. As such, these data are an imperfect representation of IMBs and their clientele communities. Digital trace data are generally limited by the level of depth of observation given that human clarification to key

152

concepts and social mechanisms captured by the data is often impossible or unethical, leaving some uncertainty about the reliability and construct validity of the data (Burrows & Savage, 2014; Lazer, Kennedy, King, & Vespignani, 2014; Lazer & Radford, 2017). These limitations make it critical to triangulate theory, data, and methods such that conclusions can be interpreted against the background of a comprehensive theoretical and analytic approach. While this study sought to spark future research on crime, place, and networks in the age of the Internet, the present study's conclusions can be best interpreted in the context of the current sample of online-promoted IMBs.

The use of geospatial and population data also does not come without limitations, especially because also these types of administrative datasets are not typically designed for researchers. Hence, the use of these data impede direct tests of theoretical concepts that often require a slightly different operationalization of variables than provided by the data (Salganik, 2019). Therefore, this study constructed proxy variables to assess the broad applicability of theoretical concepts in explaining the spatial, geographic and social patterning of IMBs. The robustness of the findings was assessed through multiple sensitivity analyses, and the findings were interpreted through multiple theoretical perspectives. Even so, the findings of this study call for further research on crime, place, and networks as well as research that examines the reliability of both online and administrative data.

Some may also perceive the recent implementation of the Fight Online Sex Trafficking Act and Stop Enabling Sex Traffickers Act (FOSTA-SESTA) as a potential limitation. This law makes it possible to charge individuals and corporations behind websites for sharing sexually-explicit content and facilitating sex trafficking. FOSTA-SESTA was implemented in April 2018 as an amendment to Section 230 of the Communications Decency Act (CDA) of 1996 that would

otherwise provide tech companies immunity from being held liable for the publishing of third-party content (H.R. 1865, Allow States and Victims to Fight Online Sex Trafficking Act of 2017). The law enabled the FBI to seize Backpage.com, a website with online classifieds for commercial sex. Shortly after the implementation of FOSTA-SESTA, review forums, fringe dating websites, or other sites where commercial sex or sex trafficking could feasibly happen were taken down, moved to hosts outside of the U.S., or access to those websites was banned for U.S.-based users. While the law has likely caused some disruption to online-promoted commercial sex, it is unlikely that the law would have any bearing on the findings of this study given that data were collected well before the implementation of this law. Even so, it is impossible to assess the extent to which IMB listings or associated reviews were deleted in anticipation of the law. However, the deletion of reviews or listings would only impact this study's findings when data were missing for a specific set of neighborhoods, and there is no clear theoretical or methodological reason that would point to such systematically missing data. Other limitations were discussed in the previous chapters.

6.3 Implications

Limitations notwithstanding, the findings from the three papers advance theory on crime, place, and networks, propose methodological innovations and inform policy and practice that involve stakeholders from within and outside the criminal justice system.

6.3.1 Implications for Research on Commercial Sex and Sex Trafficking

At a general level, the papers apply an analytical framework that engages both criminal and noncriminal contexts in explanations of the spatial, geographic and social patterning of

154

online-promoted illicit premises and behaviors. In doing so, the study first and foremost sought to advance prior work that has begun to illuminate illicit activities in IMBs such as commercial sex and sex trafficking (Armstrong, 1978; Bartley, 1994; Blevins & Holt, 2009; Bouché & Crotty, 2017; Bryant & Palmer, 1975; Chin et al., 2019). While studies have assessed the risk of offending and victimization in the context of commercial sex and human trafficking, this study's emphasis on the socio-economic and organizational dimensions of IMBs redirects the focus on one or a few actors to broader neighborhood and network dynamics that exhibit opportunity structures for offending and victimization in IMBs.

6.3.2   Implications for Theory on Crime, Place, and Networks in the Age of the Internet

Jointly, the three empirical papers speak to the intersections of crime, place, and networks in the context of online-promoted forms of crime and deviancy. Overall, the findings from this dissertation support the extension of social disorganization and crime opportunity theoretical perspectives to the context of online-promoted crime types. However, the empirical complexity of an online-promoted market involving IMBs calls for a multifaceted theoretical approach that integrates crime opportunity, social disorganization, deterrence, and network theories. For example, the combination of social disorganization and crime opportunity theories help address both structural neighborhood problems and local illicit opportunities associated with IMBs. In addition, the findings underscore the relevance of network approaches to understand IMBs as a complex system problem, a networked system that involves the interactivity between many different actors (Easley & Kleinberg, 2010). In the present context, the complex system builds upon the social and spatial interconnectivity between IMBs, clientele, commercial sex providers, and various other actors (Dank et al., 2014; Polaris, 2018). This interconnectivity poses

155

significant challenges to law enforcement responses, but may also illuminate potential points of interdiction. With that in mind, Chapter 5 highlights the importance to respond to choice-structuring neighborhood features, online-promoted networks, and market-specific dynamics to increase the effectiveness of policing models against IMBs.

While confirming the spatially-bounded nature of crime and deviancy, each of the studies also produced findings that should alert a criminology of place to a potentially changing geography of crime. With crime and deviancy groups increasingly using online domains (Blevins & Holt, 2009; Pyrooz et al., 2015), there is at least the option for information and interactions to span across greater spatial distance (Wall, 2007). Prior studies have suggested that this may not drastically or immediately change the geographic distribution of crime within cities when online interactions reflect structural offline realities (Sampson, 2017). Nonetheless, social media research provides mixed leads as to whether the internet replaces, supplements, replicates, or otherwise alters the geography of offline interactions (see, for a review, Small & Adler, 2019). The present study draws attention to a complex fluidity between digital interactions and offline behaviors that can more subtly change where and when crimes occur as a result of online domains replacing the dependency on some environmental conditions while supplementing and reinforcing other conditions. Thus, while supporting criminological theory about crime and place, the surprising findings about the spatial dispersity, the embeddedness in advantaged areas, and adverse impacts of police presence or enforcement actions call for further research that is attuned to the implications of online domains on the geography of crime.

In addition to the need to further explore the offline-online link in a criminology of place, the three papers identify several other issues that can spark future research. For example, future research should assess spatial concentration and the role of physical cues on a more granular

156

level. While census tracts are frequently the unit of analysis in ecological theories of crime (e.g. Morenoff et al., 2001; Peterson & Krivo, 2009; Schaefer, 2012), local processes may work differently dependent on the levels of aggregation (Hipp, 2007, p. 674). The growing availability of digitized and administrative data increasingly allows for the operationalization of theoretical constructs at smaller units of analysis such as blocks or street segments. Further granularity can also be achieved by breaking down several broad concepts into subcomponents. In particular, retail land use as an important correlate of the presence of IMBs. This lays the ground for future research to now examine whether more specific types of land uses such as nail salons or strictly legitimate massage therapy are associated with different opportunity structures for IMBs. When examining crime at discrete locations, research may also further examine the locations of IMBs in small cities, where the idea of neighborhoods has a different meaning than in larger cities and which were excluded from the present study when the population size was smaller than 50,000. Such research would be a major contribution to the limited knowledge on the geography of crime in small cities (Weisburd et al., 2014).

Several issues regarding the presence or absence of deterrence effects deserve future research. In particular, the adverse effects of police enforcement actions underscore the need for further research on how police can effectively disrupt and prevent crime and victimization in IMBs. For example, future research may also examine what would happen if police would target those neighborhoods that are the most popular among clientele or provide the most favorable conditions for IMBs. Future work may also assess the impact of other deterrence strategies on the geographic distribution of IMBs, specifically considering a potential impact of FOSTA-SESTA or strategies that call upon the responsibility of non-criminal justice actors such as landlords of venues or a broader social or professional environment of clientele.

157

Although this study provides support for the link between crime and choice-structuring neighborhood conditions, a major question of public interest is left unanswered: Do IMBs increase crime in their local neighborhoods? While the present analyses showed a negative association between violent crimes and the presence of IMBs, a few prior studies have suggested that IMBs or sexually-oriented businesses such as adult shops can increase crime and physical disorder in their immediate neighborhoods (see, for examples, Edwards, 2010; Huff et al., 2018; Tewksbury & McCord, 2014). Future work should further assess the plausible threat of IMBs to public safety using local-level and longitudinal crime information.

Lastly, research on the role of online domains in promoting commercial sex and sex trafficking is yet to be further developed. While this was beyond the scope of the present study, prior qualitative studies on online-promoted sex-related crimes have highlighted how a normalization or justification of sexual violence, commercial sex and sex trafficking can be reinforced in online settings such as review boards (Blevins & Holt, 2009; Holt, 2007; Holt & Blevins, 2007; Mills, 1998). With that in mind, future research may examine theoretically-relevant themes such as excessive exposure to deviant behaviors, peer influence in online interactions, or the development of internal control mechanisms online. While the present study sought to guide local crime prevention and crime control strategies, research on these other themes would be better suited to guide strategies that directly target the role of online domains.

6.3.3   Implications for a Computational Criminology

With the use of new forms of data and interdisciplinary methods, this study contributes to a criminology that increasingly relies on so-called 'big data' for deductive testing of theoretical concepts and inductive development of new theories and integrated theoretical frameworks.

While there is a myriad of definitions of big data (Lazer & Radford, 2017), and a common connotation of the term is the use of large datasets, sample size is no longer an essential feature in the current usage of the term (Boyd & Crawford, 2012; Kitchin & McArdle, 2016). The volume of data can but is not necessarily a by-product of data that is digitized, created in real-time, or frequently or actively generated for non-research purposes. Such data can be detailed and exhaustive of some system but also messy and invalidated (Boyd & Crawford, 2012; Lazer & Radford, 2017; Salganik, 2019; Symons & Alvarado, 2016).

While data sources such as social media, financial track records of businesses, or digitized administrative records can generate new insights into crime problems, the complexity of these new data sources is often overlooked in applied studies that pay little attention to construct validity or the social mechanisms that explain the social outcomes captured by these data. Hence, studies have called for the need of a triangulation of methods and a theory-driven approach to contextualize and explain empirical results (Boyd & Crawford, 2012; Lazer & Radford, 2017; Snaphaan & Hardyns, 2019). The present study sought to provide an empirical model to integrate a theory-driven and data-driven approach in illuminating crime problems, especially those that are facilitated by online domains (see also Snaphaan & Hardyns, 2019).

6.3.4 Implications for Policy and Practice

While calling for future research, this study holds strong utility for public policy and practice. Broadly, the applicability of ecological and situational approaches to the context of online-promoted IMBs points to the relevance of problem-oriented strategies that alter the physical, social, and online environment in a way that limits opportunities for crime and victimization (Braga, 2008; Goldstein et al., 1990). In the present context, the applicability of

159

socio-ecological and situational approaches establishes a foundation for geographically-focused policy efforts.

Two concrete sets of practical implications follow from the findings. First, this study proposes crime-prevention and crime-control strategies that make an appeal on the criminal justice system, specifically problem-oriented policing strategies that target specific contextual causes of crime events (see e.g. Braga, 2008; Clarke & Eck, 2005; Weisburd et al., 2006). This requires a combination of crime control and crime prevention strategies that are evidence-informed, geographically-focused and involve less traditional guardian actions that discourage motivated offenders by reducing criminal opportunities (Eck & Weisburd, 1995; Felson, 1995). Prior work has suggested that face-to-face conversations with potential offenders or facilitators could be one such example of a guardian action, saving arrests for more aggravated circumstances of offending (Braga, 2012; Weisburd et al., 2011). This approach may be helpful in the context of human trafficking victimizations in IMBs, where police often face challenges to gain trust and legitimacy among a vulnerable group of potential victims that may fear arrests for engaging in illicit activity during their victimization (Farrell, Dank, et al., 2019).

Second, the findings can also inform crime prevention and crime control strategies by stakeholders outside of the criminal justice system. Considering the limited or even adverse effects of policing efforts, policies may need to be resourced to alternate strategies that help identify and effectively put a barrier to revenues from illicit and potentially victimizing behaviors. Knowledge about the environmental factors that are conducive to IMBs in areas where effective forms of guardianship is low can direct crime prevention measures toward discrete locations. The present study particularly highlights the embeddedness of IMBs in retail centers, which suggests that identification and awareness-raising strategies may need to be

160

directed at these areas in particular. Public-private partnerships, involving a collaboration between police and legitimate retail businesses, would have the potential to illuminate crime and victimization problems in IMBs at larger scale (see, in the context of labor trafficking, De Vries, 2018). Specifically, when there is awareness of potential crime and victimizations associated with IMBs, legitimate businesses and their customer base can report their suspicions to police, which relates their importance as "place managers" in response models to crime (see Eck, 2015). Based on the predictive analyses of new locations of IMBs, awareness raising strategies and holding local place managers accountable might be particularly promising prevention strategies in neighborhoods that are at increased risk for future IMBs (but have not had any yet) due to their socio-economic composition that might attract IMBs (see Chapter 5).

When approaching IMBs as a complex system problem, it follows that comprehensive efforts are needed that target IMBs, clientele and their social communities, and identify and protect potential victims. For example, in addition to a role of retail businesses, municipalities may consider updating zoning ordinances to reduce or regulate the presence of IMBs in neighborhoods that would otherwise provide the most favorable conditions for an illicit market of IMBs. Following the network analyses, policy efforts should also focus on curbing the diffusion of crime and deviant norms through clientele networks, for example by raising awareness on the potential victimizations associated with these deviant behaviors within clientele communities and their broader social contexts (e.g. family or work settings). Technological innovations would allow for automated and large-scale awareness strategies, for example through website owners as online "place managers" who might monitor and regulate online interactions, or by sending automated text messages to clientele looking for locations for commercial sex online (Williams, 2007).

161

Furthermore, the results of this study emphasize the need of policy efforts that address the socio-economic vulnerability, marginalization, and inequality associated with IMBs. Such efforts require partnerships between police, victim service agencies and community organizations that regularly visit IMBs to gain trust, help identify and prevent potential victimizations, and provide contacts, services or alternative means of employment. These regular visits would also provide a contact point for those who need services, which is critical given the spatially-dispersed nature of IMBs that increases the isolation among potential victims.

6.4   Conclusion

In conclusion, the present analyses deepen our understanding of crime, place, and networks in the age of the internet by bridging ideas from multiple criminological theories and applying novel data and robust methods. In doing so, this study provides a model for future research that assesses the offline geography of online-promoted crimes. The central premise is that online-promoted illicit markets are not disconnected from a physical space but are interdependent with the neighborhoods in which they operate. Following this premise, the present study contextualizes our understanding of crime and victimizations associated with IMBs in the surrounding public and social domains. As such, the study advances scholarship and guides public policy and practice with research on a complex crime problem that has persisted across decades and increasingly emerges as a growing concern that involves serious and multiple crime types and victimizations.

Furthermore, the findings situate the study of online-promoted crimes as an important scientific endeavor within a criminology of place that is concerned with the extent to which spatial proximity or physical cues may no longer be key to signal and facilitate illicit

162

opportunities. As more and more communications move to an online domain and criminal and deviant groups increasingly maintain an online presence (Blevins & Holt, 2009; Pyrooz et al., 2015; Quinn & Forsyth, 2005; Thornberry et al., 2003; Wall, 2007), online-promoted crimes are becoming central to a criminology of place. The findings in the present study indicate that criminological theories such as social disorganization and crime opportunity theories merit continued relevance for online-promoted crimes. However, they should also alert criminologists to potentially changing geographies of crime. Future research is particularly important given the volatility of online domains, which implies that online cues and their potential impacts on conditioning local environmental dynamics associated with crime can change.

Using innovative data and methods, this study also proposes methodological innovations for future work on crime, place, and networks in the age of the internet. With the advent of new data and methods, emerging or changing crime problems can be explored and traditional theories can be re-assessed, which will have important implications for theory development and theory testing. In the present context, a combined theory- and data-driven approach allowed for a nuanced, yet comprehensive understanding of a complex crime problem. As such, this study contributes to a computational criminology that integrates theory, new data, and interdisciplinary methods in explanations of the geography of online-promoted or other forms of emerging crime and deviancy (Berk, 2013; Johnson & Groff, 2014).

Practically, the multifaceted theoretical approach and use of interdisciplinary methods call for comprehensive crime prevention and crime control strategies that limit physical, social, and online opportunities for crime and victimizations. A specific set of recommendations was proposed to help prevent, identify, and address crime victimizations, including those associated with human trafficking. These strategies require an interdisciplinary team, which should involve

163

the criminal justice system, the private sector, community organizations, and victim service agencies, in order to effectively disrupt the market and networks that drive crime and victimizations in IMBs while securing victim outreach and services.

References

Ai, C., & Norton, E. C. (2003). Interaction terms in logit and probit models. *Economics Letters, 80*(1), 123-129.

Andresen, M. A., & Felson, M. (2009). The impact of co-offending. *The British Journal of Criminology, 50*(1), 66-81.

Apel, R. (2013). Sanctions, perceptions, and crime: Implications for criminal deterrence. *Journal of Quantitative Criminology, 29*(1), 67-101.

Armstrong, E. G. (1978). Massage parlors and their customers. *Archives of Sexual Behavior, 7*(2), 117-125.

Arsanjani, J. J., Mooney, P., Zipf, A., & Schauss, A. (2015). Quality assessment of the contributed land use information from OpenStreetMap versus authoritative datasets. In J. J. Arsanjani, P. Mooney, A. Zipf, & A. Schauss (Eds.), *OpenStreetMap in GIScience* (pp. 37-58): Springer.

Associated Press. (Jan. 24, 2018). Massage Parlor Operates Charged With Human Trafficking. *U.S. News*. Retrieved from https://www.usnews.com/news/best-states/massachusetts/articles/2018-01-24/massage-parlor-operators-charged-with-human-trafficking

Athey, S., & Imbens, G. W. (2006). Identification and inference in nonlinear difference-in-differences models. *Econometrica, 74*(2), 431-497.

Axon, R., Kelly, C., & Braun, M. (2019, July 30, 2019). Sex trafficking is behind the lucrative illicit massage businesses. Why police can't stop it. *USA Today*. Retrieved from https://www.chron.com/news/houston-texas/article/Illegal-massage-parlors-a-blot-Houston-can-t-erase-1714239.php

Baker, W. E., & Faulkner, R. R. (2009). Social capital, double embeddedness, and mechanisms of stability and change. *American Behavioral Scientist, 52*(11), 1531-1555. doi:10.1177/0002764209331525

Barabási, A.-L., & Albert, R. (1999). Emergence of scaling in random networks. *Science, 286*(5439), 509-512.

Barthelemy, M., Gondran, B., & Guichard, E. (2003). Spatial structure of the internet traffic. *Physica A: statistical mechanics and its applications, 319*, 633-642.

Bartley, N. (1994, Oct 24, 1994). Federal Way tackles massage-parlor Issue after scathing reports. *The Seattle Times*. Retrieved from http://community.seattletimes.nwsource.com/archive/?date=19941024&slug=1937704

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1-48.

Berk, R. (2013). Algorithmic criminology. *Security Informatics, 2*(1), 5.

Bernasco, W., Block, R., & Ruiter, S. (2013). Go where the money is: Modeling street robbers' location choices. *Journal of Economic Geography, 13*(1), 119-143.

Bichler, G., Malm, A., & Enriquez, J. (2014). Magnetic facilities: Identifying the convergence settings of juvenile delinquents. *Crime & Delinquency, 60*(7), 971-998.

Bivand, R., S., Pebesma, E., & Gomez-Rubio, V. (2013). *Applied spatial data analysis with R (2nd Edition).* Springer, NY: http://www.asdar-book.org/.

Blakinger, K. (2016, Dec. 5, 2016). Crackdown forces closures of illicit massage parlors, spas. Officials are making use of rules allowing them to sue, shutter illicit spas. *Houston Chronicle*. Retrieved from https://www.houstonchronicle.com/news/houston-texas/houston/article/Crackdown-forces-closures-of-illicit-massage-10707275.php

166

Blau, P. M. (1977). A macrosociological theory of social structure. *American journal of sociology, 83*(1), 26-54.

Blevins, K. R., & Holt, T. J. (2009). Examining the virtual subculture of johns. *Journal of Contemporary Ethnography, 38*(5), 619-648.

Boivin, R., & D'Elia, M. (2017). A network of neighborhoods: Predicting crime trips in a large Canadian city. *Journal of Research in Crime and Delinquency, 54*(6), 824-846.

Bouché, V. (2017). An empirical analysis of the intersection of organized crime and human trafficking in the United States: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice. (Reprinted from: April 28, 2017).

Bouché, V., & Crotty, S. M. (2017). Estimating demand for illicit massage businesses in Houston, Texas. *Journal of Human Trafficking*, 1-19.

Bowers, K. J. (2014). Risky facilities: crime radiators or crime absorbers? A comparison of internal and external levels of theft. *Journal of Quantitative Criminology, 30*(3), 389-414.

Bowers, K. J., Johnson, S. D., Guerette, R. T., Summers, L., & Poynton, S. (2011). Spatial displacement and diffusion of benefits among geographically focused policing initiatives: a meta-analytical review. *Journal of Experimental Criminology, 7*(4), 347-374.

Boyd, D., & Crawford, K. (2012). Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. *Information, communication & society, 15*(5), 662-679.

Braga, A. A. (2008). *Problem-oriented policing and crime prevention.* (Second Edition. ed.). New Jersey: Criminal Justice Press Monsey.

Braga, A. A. (2012). Getting Deterrence Right: Evaluation Evidence and Complementary Crime Control Mechanisms. *Criminology and Public Policy, 11*, 201.

Braga, A. A. (2016). The continued importance of measuring potentially harmful impacts of crime prevention programs: The academy of experimental criminology 2014 Joan McCord lecture. *Journal of Experimental Criminology, 12*(1), 1-20.

Braga, A. A., & Clarke, R. V. (2014). Explaining high-risk concentrations of crime in the city: Social disorganization, crime opportunities, and important next steps. *Journal of Research in Crime and Delinquency, 51*(4), 480-498.

Braga, A. A., Hureau, D. M., & Papachristos, A. V. (2011). The relevance of micro places to citywide robbery trends: A longitudinal analysis of robbery incidents at street corners and block faces in Boston. *Journal of Research in Crime and Delinquency, 48*(1), 7-32.

Braga, A. A., Hureau, D. M., & Papachristos, A. V. (2014). Deterring gang-involved gun violence: measuring the impact of Boston's Operation Ceasefire on street gang behavior. *Journal of Quantitative Criminology, 30*(1), 113-139.

Braga, A. A., Kennedy, D. M., Waring, E. J., & Piehl, A. M. (2001). Problem-oriented policing, deterrence, and youth violence: An evaluation of Boston's Operation Ceasefire. *Journal of Research in Crime and Delinquency, 38*(3), 195-225.

Braga, A. A., Turchan, B. S., Papachristos, A. V., & Hureau, D. M. (2019). Hot spots policing and crime reduction: an update of an ongoing systematic review and meta-analysis. *Journal of Experimental Criminology*, 1-23.

Braga, A. A., & Weisburd, D. (2010). *Policing problem places: Crime hot spots and effective prevention*. New York: Oxford University Press.

Brantingham, P., & Brantingham, P. (1993). Environment, routine and situation: Toward a pattern theory of crime. *Advances in criminological theory, 5*(2), 259-294.

Brantingham, P., & Brantingham, P. (1995). Criminality of place. *European journal on criminal policy and research, 3*(3), 5-26.

Brantingham, P., & Brantingham, P. (2013). Crime pattern theory. In R. Wortley & L. Mazerolle (Eds.), *Environmental criminology and crime analysis* (pp. 78-94). New York: Willan Publishing.

Bryant, C. D., & Palmer, C. E. (1975). Massage parlors and "hand whores". Some sociological observations. *Journal of Sex Research, 11*(3), 227-241.

Burris, V., Smith, E., & Strahm, A. (2000). White supremacist networks on the Internet. *Sociological focus, 33*(2), 215-235.

Burrows, R., & Savage, M. (2014). After the crisis? Big Data and the methodological challenges of empirical sociology. *Big data & society, 1*(1).

Bursik Jr, R. J., & Grasmick, H. G. (1993). Economic deprivation and neighborhood crime rates, 1960-1980. *Law & Society Review, 27*, 263.

Bursik, R. J. (1988). Social disorganization and theories of crime and delinquency: Problems and prospects. *Criminology, 26*(4), 519-552.

Bursik, R. J., & Webb, J. (1982). Community change and patterns of delinquency. *American journal of sociology, 88*(1), 24-42.

Butts, C. T. (2016). *SNA: Tools for Social Network Analysis. R package version 2.4.*

Cairncross, F. (1997). *The death of distance: how the communications revolution will change our lives*. Boston, MA: Harvard Business School.

Campana, P. (2016). The structure of human trafficking: lifting the bonnet on a Nigerian transnational network. *British Journal of Criminology, 56*(1), 68-86. doi:10.1093/bjc/azv027

169

Carrington, P. J. (2014). Crime and social network analysis. In J. Scott & P. J. Carrington (Eds.), *The SAGE handbook of social network analysis* (pp. 236-255): Sage Publications Ltd.

Castells, M. (1996). *The network society* (Vol. 469): Oxford: Blackwell.

Castells, M. (2002). *The Internet galaxy: Reflections on the Internet, business, and society*. New York: Oxford University Press.

Chau, M., & Xu, J. (2007). Mining communities and their relationships in blogs: A study of online hate groups. *International Journal of Human-Computer Studies, 65*(1), 57-70.

Chin, J. J., Kim, A. J., Takahashi, L., & Wiebe, D. J. (2015). Do Sexually Oriented Massage Parlors Cluster in Specific Neighborhoods? A Spatial Analysis of Indoor Sex Work in Los Angeles and Orange Counties, California. *Public Health Reports, 130*(5), 533-542.

Chin, J. J., Takahashi, L. M., & Wiebe, D. J. (2019). Where and Why Do Illicit Businesses Cluster? Comparing Sexually Oriented Massage Parlors in Los Angeles County and New York City. *Journal of Planning Education and Research*.

Clarke, R. V. (1995). Situational crime prevention. *Crime and justice, 19*, 91-150.

Clarke, R. V. (2004). Technology, criminology and crime science. *European journal on criminal policy and research, 10*(1), 55-63.

Clarke, R. V., & Cornish, D. B. (1985). Modeling offenders' decisions: A framework for research and policy. *Crime and justice, 6*, 147-185.

Clarke, R. V., & Eck, J. E. (2005). Crime analysis for problem solvers. *Washington, DC: Center for Problem Oriented Policing*.

Cloward, R. A., & Ohlin, L. (1960). *Delinquency and Opportunity: A Theory of Delinquent Gangs*. New York: Free Press.

Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity

approach. *American Sociological Review*, 588-608.

Cook, P. J. (1980). Research in criminal deterrence: Laying the groundwork for the second

decade. *Crime and justice, 2*, 211-268.

Corb, A. (2011). Into the minds of mayhem: White supremacy, recruitment and the Internet.

Google Ideas.

Corb, A. (2011). *Into the minds of mayhem: White supremacy, recruitment, and the Internet*.

Cambridge: Google Ideas.

Cornish, D. B., & Clarke, R. V. (1986). Rational choice approaches to crime. *The reasoning

criminal: Rational choice perspectives on offending*, 1-16.

Cornish, D. B., & Clarke, R. V. (1987). Understanding crime displacement: An application of

rational choice theory. *Criminology, 25*(4), 933-948.

Cornish, D. B., & Clarke, R. V. (2017). The rational choice perspective. *Environmental

criminology and crime analysis*, 29-61.

Croissant, Y. (2020). Pglm: Panel Generalized Linear Models. R Package version 0.2-2.

https://CRAN.R-project.org/package=pglm.

Croissant, Y., & Millo, G. (2018). Panel data econometrics with R: The plm package. *Journal of

Statistical Software, 27*(2), 1-43. doi:10.18637/jss.v027.i02

Crotty, S. M., & Bouché, V. (2018). The red-light network: Exploring the locational strategies of

illicit massage businesses in Houston, Texas. *Papers in Applied Geography, 4*(2), 205-

227.

Cullen, F. T. (2010). Cloward, Richard A.: The theory of illegitimate means. In F. T. Cullen & P.

Wilcox (Eds.), *Encyclopedia of Criminological Theory*. Thousand Oaks, CA: Sage.

Cunningham, S., Sanders, T., Scoular, J., Campbell, R., Pitcher, J., Hill, K., . . . Hamer, R.
(2018). Behind the screen: Commercial sex, digital spaces and working online.
Technology in society, 53, 47-54.

Daniels, J. (2013). Race and racism in Internet studies: A review and critique. *New Media &
Society, 15*(5), 695-719.

Dank, M. L., Khan, B., Downey, P. M., Kotonias, C., Mayer, D., Owens, C., . . . Yu, L. (2014).
*Estimating the size and structure of the underground commercial sex economy in eight
major US cities*: Urban Institute Washington, DC.

Davies, T., & Johnson, S. D. (2015). Examining the relationship between road structure and
burglary risk via quantitative network analysis. *Journal of Quantitative Criminology,
31*(3), 481-507.

De Vries, I. (2018). Connected to Crime: An Exploration of the Nesting of Labour Trafficking
and Exploitation in Legitimate Markets. *The British Journal of Criminology, 59*(1), 209-
230.

De Vries, I., & Farrell, A. (2019). Sex Work. *The Encyclopedia of Women and Crime*, 1-8.

Decker, S. H., & Pyrooz, D. (2012). *Gang offending and online behavior.* Paper presented at the
JRSA Forum.

Denton, E. (2016). Anatomy of offending: Human trafficking in the United States, 2006–2011.
Journal of Human Trafficking, 2(1), 32-62. doi:10.1080/23322705.2016.1136540

Easley, D., & Kleinberg, J. (2010). *Networks, crowds, and markets: Reasoning about a highly
connected world*. New York, NY: Cambridge University Press.

Eck, J. E. (1995a). Examining routine activity theory: A review of two books: Taylor & Francis.

Eck, J. E. (1995b). A general model of the geography of illicit retail marketplaces. *Crime and place, 4*, 67-93.

Eck, J. E. (2002). Preventing crime at places. In L. W. Sherman, D. P. Farrington, B. C. Welsh, & D. L. MacKenzie (Eds.), *Evidence-Based Crime Prevention* (pp. 241-294). London: Routledge.

Eck, J. E. (2015). Who should prevent crime at places? The advantages of regulating place managers and challenges to police services. *Policing: A Journal of Policy and Practice, 9*(3), 223-233.

Eck, J. E., Clarke, R. V., & Guerette, R. T. (2007). Risky facilities: Crime concentration in homogeneous sets of establishments and facilities. *Crime prevention studies, 21*, 225.

Eck, J. E., & Spelman, W. (1987). Who ya gonna call? The police as problem-busters. *Crime & Delinquency, 33*(1), 31-52.

Eck, J. E., & Weisburd, D. (1995). *Crime and place* (Vol. 4): Criminal Justice Press Monsey, NY.

Edwards, M. L. (2010). Gender, social disorganization theory, and the locations of sexually oriented businesses. *Deviant Behavior, 31*(2), 135-158.

Ekblom, P. (1999). Can we make crime prevention adaptive by learning from other evolutionary struggles? *Studies on crime and crime prevention, 8*, 27-51.

Ekblom, P., & Pease, K. (1995). Evaluating crime prevention. *Crime and justice, 19*, 585-662.

Fagan, J. (2002). Policing guns and youth violence. *The Future of Children*, 133-151.

Farrell, A., Bright, K., de Vries, I., Pfeffer, R., & Dank, M. (2019). Policing labor trafficking in the United States. *Trends in Organized Crime*, 1-21.

Farrell, A., Dank, M., de Vries, I., Kafafian, M., Hughes, A., & Lockwood, S. (2019). Failing victims? Challenges of the police response to human trafficking. *Criminology & Public Policy, 18*(3), 649-673.

Farrell, A., & de Vries, I. (2020). Measuring the nature and prevalence of human trafficking. In J. Winterdyk & J. J (Eds.), *The Palgrave International Handbook of Human Trafficking* (pp. 147-162). Cham: Palgrave Macmillan.

Farrell, A., & Fahy, S. (2009). The problem of human trafficking in the US: Public frames and policy responses. *Journal of Criminal Justice, 37*(6), 617-626. doi:10.1016/j.jcrimjus.2009.09.010

Farrell, A., McDevitt, J., & Fahy, S. (2008). *Understanding and improving law enforcement responses to human trafficking, final report, 2008, June*. Retrieved from

Farrell, A., McDevitt, J., Perry, N., Fahy, S., Chamberlain, K., Adams, W., . . . Kling, R. (2009). Review of existing estimates of victims of human trafficking in the United States and recommendations for improving research and measurement of human trafficking. *Washington, DC: Humanity United*.

Farrell, A., & Pfeffer, R. (2014). Policing human trafficking: Cultural blinders and organizational barriers. *The Annals of the American Academy of Political and Social Science, 653*(1), 46-64. doi:10.1177/0002716213515835

Feld, S. L. (1981). The focused organization of social ties. *American journal of sociology, 86*(5), 1015-1035.

Feld, S. L. (1982). Social structural determinants of similarity among associates. *American Sociological Review, 47*(6), 797-801.

Felson, M. (1987). Routing activities and crime prevention in the developing metropolis
Criminology, 25(4), 911-932.

Felson, M. (1995). Those who discourage crime. *Crime and place, 4*, 53-66.

Felson, M. (2006). *Crime and nature*. Thousand Oaks, CA: Sage Publishing, Inc. .

Felson, M., & Clarke, R. V. (1995). Routine precautions, criminology, and crime prevention.
Crime and public policy: Putting theory to work, 179-190.

Felson, M., & Clarke, R. V. (1998). Opportunity makes the thief. *Police research series, paper,
98*, 1-36.

Felson, M., & Cohen, L. E. (1980). Human ecology and crime: A routine activity approach.
Human Ecology, 8(4), 389-406.

Gibbs, J. P. (1975). *Crime, punishment, and deterrence.* New York: Elsevier.

Goldsmith, S., & Crawford, S. (2014). *The responsive city: engaging communities through data-
smart governance*. Jossey-Bass: Malden, MA

Goldstein, H., Goldstein, H., & Hill, M. (1990). *Problem-oriented policing*: McGraw-Hill New
York.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness.
American journal of sociology, 91(3), 481-510. doi:10.1086/228311

Green, S. J. (2019, March 7, 2019). Major prostitution bust: Seattle police raid 11 massage
parlors, freeing 26 women. *The Seattle Times*. Retrieved from
https://www.seattletimes.com/seattle-news/crime/a-crazy-amount-of-money-seattle-
police-raid-prostitution-network-in-massage-parlors/

175

Groff, E. R., & Lockwood, B. (2014). Criminogenic facilities and crime across street segments in Philadelphia: Uncovering evidence about the spatial extent of facility influence. *Journal of Research in Crime and Delinquency, 51*(3), 277-314.

Hakim, S., Rengert, G. F., & Shachmurove, Y. (2001). Target search of burglars: A revised economic model. *Papers in Regional Science, 80*(2), 121-137.

Hällgren, M., Rouleau, L., & De Rond, M. (2018). A matter of life or death: How extreme context research matters for management and organization studies. *Academy of Management Annals, 12*(1), 111-153.

Hampton, K., & Wellman, B. (2003). Neighboring in Netville: How the Internet supports community and social capital in a wired suburb. *City & Community, 2*(4), 277-311.

Handcock, M. S., Hunter, D. R., Butts, C. T., Goodreau, S. M., & Morris, M. (2008). statnet: Software tools for the representation, visualization, analysis and simulation of network data. *Journal of Statistical Software, 24*(1), 1548.

Hawley, A. H. (1950). *Human ecology: A theory of community structure*. New York: Ronald Press.

Heap, C. (2003). The city as a sexual laboratory: The queer heritage of the Chicago school. *Qualitative Sociology, 26*(4), 457-487.

Hijmans, R. J. (2019). *Geosphere: Spherical Trigonometry*.

Hipp, J. R. (2007). Block, tract, and levels of aggregation: Neighborhood structure and crime and disorder as a case in point. *American Sociological Review, 72*(5), 659-680.

Hipp, J. R., & Kubrin, C. E. (2017). From bad to worse: How changing inequality in nearby areas impacts local crime. *RSF: The Russell Sage Foundation Journal of the Social Sciences, 3*(2), 129-151.

Hipp, J. R., & Perrin, A. J. (2009). The simultaneous effect of social distance and physical distance on the formation of neighborhood ties. *City & Community, 8*(1), 5-25.

Hipp, J. R., & Williams, S. A. (2019). Advances in Spatial Criminology: The Spatial Scale of Crime. *Annual Review of Criminology, 3*.

Hipp, J. R., Wo, J. C., & Kim, Y.-A. (2017). Studying neighborhood crime across different macro spatial scales: The case of robbery in 4 cities. *Social science research, 68*, 15-29.

Holt, T. J. (2007). Subcultural evolution? Examining the influence of on-and off-line experiences on deviant subcultures. *Deviant Behavior, 28*(2), 171-198.

Holt, T. J. (2013). *Crime on-line: correlates, causes, and context (2nd edition)*. Durham: Carolina Academic Press.

Holt, T. J., & Blevins, K. R. (2007). Examining sex work from the client's perspective: Assessing johns using on-line data. *Deviant Behavior, 28*(4), 333-354.

Holt, T. J., Blevins, K. R., & Fitzgerald, S. (2016). Examining the economics of prostitution using online data *The Oxford handbook of the economics of prostitution*.

Holt, T. J., Blevins, K. R., & Kuhns, J. B. (2008). Examining the displacement practices of johns with on-line data. *Journal of Criminal Justice, 36*(6), 522-528.

Holt, T. J., Blevins, K. R., & Kuhns, J. B. (2014). Examining diffusion and arrest avoidance practices among johns. *Crime & Delinquency, 60*(2), 261-283.

Holt, T. J., & Bossler, A. M. (2008). Examining the applicability of lifestyle-routine activities theory for cybercrime victimization. *Deviant Behavior, 30*(1), 1-25.

Holtfreter, K., Reisig, M. D., & Pratt, T. C. (2008). Low self-control, routine activities, and fraud victimization. *Criminology, 46*(1), 189-220.

177

Hoppa, K. (2018, Feb. 20, 2018). Massage parlor owner arrested again on human trafficking

    charge. *Waco Tribune-Herald*. Retrieved from

    http://www.wacotrib.com/news/police/massage-parlor-owner-arrested-again-on-human-

    trafficking-charge/article_148786ae-e80e-564c-97de-4e986f8bb2cd.html

Hubbard, P., Boydell, S., Crofts, P., Prior, J., & Searle, G. (2013). Noxious neighbours?

    Interrogating the impacts of sex premises in residential areas. *Environment and Planning*

    A, 45(1), 126-141.

Hubbard, P., Matthews, R., & Scoular, J. (2009). Legal geographies—controlling sexually

    oriented businesses: law, licensing, and the geographies of a controversial land use.

    Urban Geography, 30(2), 185-205.

Huff, J., Wallace, D., Riggs, C., Katz, C. M., & Choate, D. (2018). Examining the association

    between massage parlors and neighborhood crime. *Crime & Delinquency, 65*(11), 1537-

    1569.

Ibanez, M. (2015). *Virtual red light districts: Detecting covert networks and sex trafficking*

    circuits in the US. (Doctoral dissertation, University of Hawai'i at Manoa).

Irwin, N. (2017). Police officer understandings of human trafficking and awareness of anti-

    trafficking measures. *Policing: An International Journal of Police Strategies &*

    Management, 40(2), 291-305. doi:10.1108/pijpsm-08-2015-0100

Jackson, M. O. (2010). *Social and economic networks*. Princeton, NJ: Princeton University

    Press.

Johnson, S. D., & Groff, E. R. (2014). Strengthening theoretical testing in criminology using

    agent-based modeling. *Journal of Research in Crime and Delinquency, 51*(4), 509-525.

Jones, R. W., & Pridemore, W. A. (2019). Toward an integrated multilevel theory of crime at place: Routine activities, social disorganization, and the law of crime concentration. *Journal of Quantitative Criminology, 35*(3), 543-572.

Kahneman, D. (2011). *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.

Kaplan, J. (2018). *Uniform Crime Reporting (UCR) Program Data: Arrests by Age, Sex, and Race, 1974-2016.* Ann Arbor: MI: Inter-university Consortium for Political and Social Research [distributor], 2018-12-29.

Kasarda, J. D., & Janowitz, M. (1974). Community attachment in mass society. *American Sociological Review, 39*(3), 328-339.

Kelling, G. L., Pate, T., Dieckman, D., & Brown, C. E. (1974). The Kansas City preventive patrol experiment. *Washington, DC: Police Foundation*.

Keymanesh, M., Gurukar, S., Boettner, B., Browning, C., Calder, C., & Parthasarathy, S. (2020). Twitter Watch: Leveraging Social Media to Monitor and Predict Collective-Efficacy of Neighborhoods *Complex Networks XI* (pp. 197-211): Springer.

Kirk, D. S., & Papachristos, A. V. (2011). Cultural mechanisms and the persistence of neighborhood violence. *American journal of sociology, 116*(4), 1190-1233.

Kitchin, R., & McArdle, G. (2016). What makes Big Data, Big Data? Exploring the ontological characteristics of 26 datasets. *Big data & society, 3*(1).

Kleemans, E. R., & De Poot, C. J. (2008). Criminal careers in organized crime and social opportunity structure. *European Journal of Criminology, 5*(1), 69-98.

Klein, K. J., Ziegert, J. C., Knight, A. P., & Xiao, Y. (2006). Dynamic delegation: Shared, hierarchical, and deindividualized leadership in extreme action teams. *Administrative science quarterly, 51*(4), 590-621.

Klein, M. W. (1993). Attempting gang control by suppression: The misuse of deterrence principles. *Studies on Crime & Crime Prevention, 2*, 88-111.

Kubrin, C. E., & Weitzer, R. (2003). New directions in social disorganization theory. *Journal of Research in Crime and Delinquency, 40*(4), 374-402.

Kuhn, M. (2019). Caret: Classification and Regression Training. R Package version 6.0-84. Contributions from Jed Wing, Steve Weston, Andre Williams, Chris Keefer, Allan Engelhardt, Tony Cooper, Zachary Mayer, Brenton Kenkel, the R Core Team, Michael Benesty, Reynald Lescarbeau, Andrew Ziem, Luca Scrucca, Yuan Tang, Can Candan and Tyler Hunt.

Lazarsfeld, P. F., & Merton, R. K. (1954). Friendship as a Social Process In M. Berger, T. Abel, & C. H. Page (Eds.), *Freedom and Control in Modern Society* (pp. 18-66). Princeton, NJ: Van Nostrand.

Lazer, D., Kennedy, R., King, G., & Vespignani, A. (2014). The parable of Google Flu: traps in big data analysis. *Science, 343*(6176), 1203-1205.

Lazer, D., & Radford, J. (2017). Data ex machina: introduction to big data. *Annual Review of Sociology, 43*, 19-39.

Lee, M. T., & Martinez, R. (2009). Immigration reduces crime: An emerging scholarly consensus. *Sociology of Crime, Law and Deviance, 13*, 3-16.

Linning, S. J., & Eck, J. E. (2018). Weak intervention backfire and criminal hormesis: Why some otherwise effective crime prevention interventions can fail at low doses. *The British Journal of Criminology, 58*(2), 309-331.

Lockwood, D. (2007). Mapping crime in Savannah: Social disadvantage, land use, and violent crimes reported to the police. *Social Science Computer Review, 25*(2), 194-209.

Ludwig, J. (2005). Better gun enforcement, less crime. *Criminology & Public Policy, 4*(4), 677-716.

Lusher, D., Koskinen, J., & Robins, G. (2013). *Exponential random graph models for social networks: Theory, methods, and applications*: Cambridge University Press.

Madensen, T. D. (2007). *Bar management and crime: Toward a dynamic theory of place management and crime hotspots.* (Doctoral dissertation, University of Cincinnati).

Manson, S., Schroeder, J., Van Riper, D., & Ruggles, S. (2018). *National Historical Geographic Information System: Version 13.0 [dataset].* Minneapolis, MN: IPUMS

Maratea, R., & Kavanaugh, P. R. (2012). Deviant identity in online contexts: New directives in the study of a classic concept. *Sociology Compass, 6*(2), 102-112.

Martinez Jr, R., & Stowell, J. I. (2012). Extending immigration and crime studies: national implications and local settings. *The Annals of the American Academy of Political and Social Science, 641*(1), 174-191.

Martinez Jr, R., & Valenzuela Jr, A. (2006). *Immigration and crime: Ethnicity, race, and violence*. New York: New York University Press.

McCord, J. (2003). Cures that harm: Unanticipated outcomes of crime prevention programs. *The Annals of the American Academy of Political and Social Science, 587*(1), 16-30.

McGloin, J. M. (2005). Policy and intervention considerations of a network analysis of street gangs. *Criminology & Public Policy, 4*(3), 607-635. doi:10.1111/j.1745-9133.2005.00306.x

McGloin, J. M., & Kirk, D. S. (2010). An overview of social network analysis. *Journal of Criminal Justice Education, 21*(2), 169-181. doi:10.1080/10511251003693694

McGloin, J. M., & Nguyen, H. (2013). The importance of studying co-offending networks for criminological theory and policy. *Crime and networks*, 13-27.

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual review of sociology, 27*(1), 415-444.

Mears, D. P., & Bhati, A. S. (2006). No community is an island: The effects of resource deprivation on urban violence in spatially and socially proximate communities. *Criminology, 44*(3), 509-548.

Merton, R. K. (1968). The Matthew effect in science: The reward and communication systems of science are considered. *Science, 159*(3810), 56-63.

Messner, S. F., & Blau, J. R. (1987). Routine leisure activities and rates of crime: A macro-level analysis. *Social Forces, 65*(4), 1035-1052.

Meyer, H. (2018). CAST: 'Caret' applications for spatial-Temporal Models. R package version 0.3.1.

Millo, G. (2017). Robust standard error estimators for panel models: A unifying approach. *Journal of Statistical Software, 82*(1-27). doi:10.18637/jss.v082.i03

Mills, R. (1998). Cyber: Sexual chat on the Internet. *The Journal of Popular Culture, 32*(3), 31-46.

Miró, F. (2014). Routine activity theory. *The Encyclopedia of theoretical criminology*.

Mok, D., Wellman, B., & Carrasco, J. (2010). Does distance matter in the age of the internet? *Urban Studies, 47*(13), 2747-2783.

Moody, J., & White, D. R. (2003). Structural cohesion and embeddedness: A hierarchical concept of social groups. *American Sociological Review*, 103-127.

Morenoff, J. D., & Sampson, R. J. (1997). Violent crime and the spatial dynamics of

neighborhood transition: Chicago, 1970–1990. *Social Forces, 76*(1), 31-64.

Morenoff, J. D., Sampson, R. J., & Raudenbush, S. W. (2001). Neighborhood inequality,

collective efficacy, and the spatial dynamics of urban violence. *Criminology, 39*(3), 517-
558.

Morselli, C. (2013). *Crime and networks*. New York: Routledge.

Murphy, A. K., & Venkatesh, S. A. (2006). Vice careers: The changing contours of sex work in

New York City. *Qualitative Sociology, 29*(2), 129-154.

Nagin, D. S. (1998). Criminal deterrence research at the outset of the twenty-first century. *Crime
and justice, 23*, 1-42.

Nagin, D. S. (2013a). Deterrence in the twenty-first century. *Crime and justice, 42*(1), 199-263.

Nagin, D. S. (2013b). Deterrence: A review of the evidence by a criminologist for economists.
Annu. Rev. Econ., 5(1), 83-105.

Nagin, D. S., Solow, R. M., & Lum, C. (2015). Deterrence, criminal opportunities, and police.
Criminology, 53(1), 74-100.

Natarajan, M. (2017). *Crime opportunity theories: Routine activity, rational choice and their
variants*. New York, NY: Ashgate.

National Human Trafficking Hotline. (n.d.). Hotline Statistics.   Retrieved from
https://humantraffickinghotline.org/states

Office of Attorney General Maura Healey. (2018, December 20, 2018). Medford women found

guilty, sentenced to prison for running extensive human trafficking and money laundering

operation. *Mass.gov*. Retrieved from https://www.mass.gov/news/medford-woman-

found-guilty-sentenced-to-prison-for-running-extensive-human-trafficking-and

183

Orchard, C., & Staff, P. (2011). Massage parlor offered 'Happy Endings', says police report. *Patch* Retrieved from https://patch.com/massachusetts/somerville/massage-parlor-offered-happy-endings-says-police-report

Papachristos, A. V. (2011). The coming of a networked criminology. In J. MacDonald (Ed.), *Measuring Crime and Criminality: Advances in criminological theory* (pp. 101-140). New Brunswick, NJ: Transaction Publishers.

Papachristos, A. V., & Bastomski, S. (2018). Connected in crime: The enduring effect of neighborhood networks on the spatial patterning of violence. *American journal of sociology, 124*(2), 517-568.

Park, R. E. (1926). The urban community as a spatial pattern and a moral order. *Urban social segregation*, 21-31.

Park, R. E., & Burgess, E. W. (1924). *Introduction to the Science of Sociology (2nd edition)*. Chicago: University of Chicago Press.

Paternoster, R. (2010). How much do we really know about criminal deterrence. *Journal of Criminal Law & Criminology, 100*, 765.

Peterson, R. D., & Krivo, L. J. (2009). Segregated spatial locations, race-ethnic composition, and neighborhood violent crime. *The Annals of the American Academy of Political and Social Science, 623*(1), 93-107.

Phillips, N. E., Levy, B. L., Sampson, R. J., Small, M. L., & Wang, R. Q. (2019). The social integration of American cities: Network measures of connectedness based on everyday mobility across neighborhoods. *Sociological Methods & Research*, 0049124119852386.

Polaris. (2018). *Human Trafficking in Illicit Massage Businesses*. Retrieved from https://polarisproject.org/massage-parlor-trafficking-report

Prior, J., & Crofts, P. (2012). Effects of sex premises on neighbourhoods: residents, local

planning and the geographies of a controversial land use. *New Zealand Geographer,*

68(2), 130-140.

Puhani, P. A. (2012). The treatment effect, the cross difference, and the interaction term in

nonlinear "difference-in-differences" models. *Economics Letters, 115*(1), 85-87.

Pyrooz, D. C., Decker, S. H., & Moule Jr, R. K. (2015). Criminal and routine activities in online

settings: Gangs, offenders, and the Internet. *Justice Quarterly, 32*(3), 471-499.

Quinn, J. F., & Forsyth, C. J. (2005). Describing sexual behavior in the era of the Internet: A

typology for empirical research. *Deviant Behavior, 26*(3), 191-207.

R Core Team. (2019). *R: A language and environment for statistical computing. R Foundation*

for Statistical Computing. Vienna: Austria.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data*

analysis methods (Vol. 1): Sage.

Reckless, W. C. (1925). *The natural history of vice areas in Chicago.* University of Chicago,

Department of Sociology.

Reid, E., & Chen, H. (2007). Internet-savvy US and Middle Eastern extremist groups.

Mobilization: An International Quarterly, 12(2), 177-192.

Rengert, G. F., & Wasilchick, J. (2000). *Suburban burglary: A tale of two suburbs*. Springfield,

IL: Charles C. Thomas.

Repetto, T. A. (1976). Crime prevention and the dsiplacement phenomenon. *Crime and*

Delinquency, 22(166-177).

Reyns, B. W. (2013). Online routines and identity theft victimization: Further expanding routine activity theory beyond direct-contact offenses. *Journal of Research in Crime and Delinquency, 50*(2), 216-238.

Rice, K. J., & Smith, W. R. (2002). Socioecological models of automotive theft: Integrating routine activity and social disorganization approaches. *Journal of Research in Crime and Delinquency, 39*(3), 304-336.

Robins, G., Elliott, P., & Pattison, P. (2001). Network models for social selection processes. *Social networks, 23*(1), 1-30.

Rogers, B. (2017, Oct. 26, 2017). Police arrest 139 at bogus brothel. 10-day sting nabs attorneys, teacher, even HPD officer. *Houston Chronicle*. Retrieved from https://www.houstonchronicle.com/news/houston-texas/houston/article/Police-arrest-139-at-bogus-brothel-12310203.php

Roncek, D. W. (1981). Dangerous places: Crime and residential environment. *Social Forces, 60*(1), 74-96.

Roncek, D. W., & Maier, P. A. (1991). Bars, blocks, and crimes revisited: Linking the theory of routine activities to the empiricism of "hot spots". *Criminology, 29*(4), 725-753.

Roncek, D. W., & Pravatiner, M. A. (1989). Additional evidence that taverns enhance nearby crime. *Sociology and Social Research, 73*(4), 185-188.

Rosenbaum, D. P. (2006). The limits of hot spots policing. *Police Innovation: Contrasting Perspectives*, 245-263.

Salganik, M. (2019). *Bit by bit: Social research in the digital age*. Princeton, NJ: Princeton University Press.

Sampson, R. J. (1988). Local friendship ties and community attachment in mass society: A multilevel systemic model. *American Sociological Review, 53*(5), 766-779.

Sampson, R. J. (2004). Networks and neighborhoods: the implications of connectivity for thinking about crime in the modern city. In H. McCarthy, P. Miller, & P. Skidmore (Eds.), *Network Logic: Who Governs in an Interconnected World?* (pp. 157-166). London: Demos.

Sampson, R. J. (2006). Collective efficacy theory: Lessons learned and directions for future inquiry. In F. T. Cullen, J. P. Wright, & K. R. Blevins (Eds.), *Taking stock: The status of criminological theory* (Vol. 15, pp. 149-167). New York, NY: Taylor & Francis.

Sampson, R. J. (2012). *Great American city: Chicago and the enduring neighborhood effect*: University of Chicago Press.

Sampson, R. J. (2013). The place of context: a theory and strategy for criminology's hard problems. *Criminology, 51*(1), 1-31.

Sampson, R. J. (2017). Urban sustainability in an age of enduring inequalities: Advancing theory and ecometrics for the 21st-century city. *Proceedings of the National Academy of Sciences, 114*(34), 8957-8962.

Sampson, R. J., & Groves, W. B. (1989). Community structure and crime: Testing social-disorganization theory. *American journal of sociology, 94*(4), 774-802.

Sampson, R. J., & Raudenbush, S. W. (1999). Systematic social observation of public spaces: A new look at disorder in urban neighborhoods. *American journal of sociology, 105*(3), 603-651.

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science, 277*(5328), 918-924.

Sampson, R. J., & Wooldredge, J. D. (1987). Linking the micro-and macro-level dimensions of lifestyle-routine activity and opportunity models of predatory victimization. *Journal of Quantitative Criminology, 3*(4), 371-393.

Schaefer, D. R. (2012). Youth co-offending networks: An investigation of social and spatial effects. *Social networks, 34*(1), 141-149.

Shaw, C. R., & McKay, H. D. (1942). *Juvenile delinquency and urban areas. A study of rates of delinquency in relation to differential characteristics of local communities in American Cities*. Chicago, IL: University of Chicago Press.

Shaw, C. R., & McKay, H. D. (1969). Juvenile delinquency and urban areas: A study of rates of delinquency in relation to differential characteristics of local communities in American cities, revised edition. Chicago, IL: University of Chicago.

Sherman, L. W. (1990). Police crackdowns: Initial and residual deterrence. *Crime and justice, 12*, 1-48.

Sherman, L. W., Gartin, P. R., & Buerger, M. E. (1989). Hot spots of predatory crime: Routine activities and the criminology of place. *Criminology, 27*(1), 27-56.

Small, M. L., & Adler, L. (2019). The role of space in theformation of social ties. *Annual Review of Sociology, 45*.

Smith, W. R., Frazee, S. G., & Davison, E. L. (2000). Furthering the integration of routine activity and social disorganization theories: Small units of analysis and the study of street robbery as a diffusion process. *Criminology, 38*(2), 489-524.

Snaphaan, T., & Hardyns, W. (2019). Environmental criminology in the big data era. *European Journal of Criminology*. doi:https://doi.org/10.1177/1477370819877753

Stecke, K. E., & Kumar, S. (2009). Sources of supply chain disruptions, factors that breed

      vulnerability, and mitigating strategies. *Journal of Marketing Channels, 16*(3), 193-226.

Sydnor, S., Niehm, L., Lee, Y., Marshall, M., & Schrank, H. (2017). Analysis of post-disaster

      damage and disruptive impacts on the operating status of small businesses after Hurricane

      Katrina. *Natural Hazards, 85*(3), 1637-1663.

Symons, J., & Alvarado, R. (2016). Can we trust Big Data? Applying philosophy of science to

      software. *Big data & society, 3*(2), 2053951716664747.

Tewksbury, R., & McCord, E. S. (2014). Crime at sexually oriented businesses. *Security*

      Journal, 27(4), 349-360.

Thornberry, T. P., Krohn, M. D., Lizotte, A. J., Tobin, K., & Smith, C. A. (2003). *Gangs and*

      delinquency in developmental perspective. New York, NY: Cambridge University Press.

Tita, G. E., & Greenbaum, R. T. (2009). Crime, neighborhoods, and units of analysis: putting

      space in its place *Putting crime in its place* (pp. 145-170): Springer.

Tita, G. E., & Radil, S. M. (2010). Spatial regression models in criminology: Modeling social

      processes in the spatial weights matrix. In A. R. Piquero & D. Weisburd (Eds.),

      Handbook of quantitative criminology (pp. 101-121). New York, NY: Springer.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases.

      Science, 185(4157), 1124-1131.

U.S. Department of Justice. (2017). Justice Department invests more than $47 million to combat

      human trafficking and assist victims. [Press release]. Retrieved from

      https://www.justice.gov/opa/pr/justice-department-invests-more-47-million-combat-

      human-trafficking-and-assist-victims

United States Department of Justice. (2019). Department of Justice Awards More than $100

    Million to Combat Human Trafficking and Assist Victims [Press release]. Retrieved from

    https://www.justice.gov/opa/pr/department-justice-awards-more-100-million-combat-

    human-trafficking-and-assist-victims

Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance

    of organizations: The network effect. *American Sociological Review, 61*(4), 674-698.

Uzzi, B. (1999). Embeddedness in the making of financial capital: How social relations and

    networks benefit firms seeking financing. *American Sociological Review, 64*(4), 481-505.

Venkatesh, S. (2011, January 1, 2011). How Tech Tools Transformed New York's Sex Trade.

    Wired. Retrieved from https://www.wired.com/2011/01/ff_sextrade/

Veysey, B. M., & Messner, S. F. (1999). Further testing of social disorganization theory: An

    elaboration of Sampson and Groves's "community structure and crime". *Journal of*

    Research in Crime and Delinquency, 36(2), 156-174.

Walker, D., Brock, D., & Stuart, T. R. (2006). Faceless-oriented policing: Traditional policing

    theories are not adequate in a cyber world. *The police journal, 79*(2), 169-176.

Wall, D. (2007). *Cybercrime: The transformation of crime in the information age* (Vol. 4).

    Cambridge, UK: Polity Press.

Wang, Y. (2010, November 1, 2010). Illegal massage parlors a blot Houston Can't Erase. Despite

    constant raids, illegal massage parlors just reopen with new names. *Houston Chronicle*.

    Retrieved from https://www.chron.com/news/houston-texas/article/Illegal-massage-

    parlors-a-blot-Houston-can-t-erase-1714239.php

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*.

    Cambridge, England: Cambridge university press.

Weimann, G. (2006). Virtual disputes: The use of the Internet for terrorist debates. *Studies in conflict & terrorism, 29*(7), 623-639.

Weisburd, D. (2012). Bringing social context back into the equation: The importance of social characteristics of places in the prevention of crime. *Criminology and Public Policy, 11*, 317.

Weisburd, D. (2015). The law of crime concentration and the criminology of place. *Criminology, 53*(2), 133-157.

Weisburd, D., Braga, A. A., Groff, E. R., & Wooditch, A. (2017). Can hot spots policing reduce crime in urban areas? An agent-based simulation. *Criminology, 55*(1), 137-173.

Weisburd, D., Bushway, S., Lum, C., & Yang, S. M. (2004). Trajectories of crime at places: A longitudinal study of street segments in the city of Seattle. *Criminology, 42*(2), 283-322.

Weisburd, D., & Eck, J. E. (2004). What can police do to reduce crime, disorder, and fear? *The Annals of the American Academy of Political and Social Science, 593*(1), 42-65.

Weisburd, D., Groff, E. R., & Yang, S.-M. (2012). *The criminology of place: Street segments and our understanding of the crime problem*. New York, NY: Oxford University Press.

Weisburd, D., Groff, E. R., & Yang, S.-M. (2014). The importance of both opportunity and social disorganization theory in a future research agenda to advance criminological theory and crime prevention at places. *Journal of Research in Crime and Delinquency, 51*(4), 499-508.

Weisburd, D., Hinkle, J. C., Famega, C., & Ready, J. (2011). The possible "backfire" effects of hot spots policing: An experimental assessment of impacts on legitimacy, fear and collective efficacy. *Journal of Experimental Criminology, 7*(4), 297-320.

Weisburd, D., & Majmundar, M. K. (2018). *Proactive policing: Effects on crime and communities*. Washington, DC: National Academies Press.

Weisburd, D., Wyckoff, L. A., Ready, J., Eck, J. E., Hinkle, J. C., & Gajewski, F. (2006). Does crime just move around the corner? A controlled study of spatial displacement and diffusion of crime control benefits. *Criminology, 44*(3), 549-592.

Wellman, B. (2001). Computer networks as social networks. *Science, 293*(5537), 2031-2034.

Wellman, B., & Hampton, K. (1999). Living networked on and offline. *Contemporary Sociology, 28*(6), 648-654.

Werb, D., Rowell, G., Guyatt, G., Kerr, T., Montaner, J., & Wood, E. (2011). Effect of drug law enforcement on drug market violence: A systematic review. *International Journal of Drug Policy, 22*(2), 87-94.

Wilcox, P., & Cullen, F. T. (2018). Situational opportunity theories of crime. *Annual Review of Criminology, 1*, 123-148.

Wilcox, P., & Land, K. C. (2017). Social disorganization and criminal opportunity. In F. T. Cullen (Ed.), *Challenging Criminological Theory: The Legacy of Ruth Rosner Kornhauser* (pp. 237-258). New York: Routledge.

Wilcox, P., Land, K. C., & Hunt, S. A. (2003). *Criminal circumstance: A dynamic multi-contextual criminal opportunity theory*. New York: Routledge.

Wilcox, P., Quisenberry, N., Cabrera, D. T., & Jones, S. (2004). Busy places and broken windows? Toward defining the role of physical structure and process in community crime models. *Sociological Quarterly, 45*(2), 185-207.

Williams, M. (2007). Policing and cybersociety: the maturation of regulation within an online community. *Policing & Society, 17*(1), 59-82.

Yar, M. (2005). The Novelty of 'Cybercrime' An Assessment in Light of Routine Activity Theory. *European Journal of Criminology, 2*(4), 407-427.

Yook, S.-H., Jeong, H., & Barabási, A.-L. (2002). Modeling the Internet's large-scale topology. *Proceedings of the National Academy of Sciences, 99*(21), 13382-13386.

Zhang, S. X. (2012). Measuring labor trafficking: A research note. *Crime, Law and Social Change, 58*(4), 469-482. doi:10.1007/s10611-012-9393-y

Zimring, F., & Hawkins, G. J. (1973). *Deterrence: The legal threat in crime control*. Chicago, IL: The University of Chicago Press.

Zipf, G. K. (1949). *Human behavior and the principle of least effort*. Oxford: Addison-Wesley Press.