Shots fired: Unraveling the 2015 Surrey gang conflict using social network analysis

by

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Abstract

The ever-changing gang landscape in British Columbia (BC) has seen periods of escalated retaliatory gang violence, most recently in 2015, in Surrey, BC, Canada. The 'face' of the gang problem in Surrey is that of South Asian males in their early twenties. Homicide among this population is an unrecognized public health crisis, as over the last decade, there have been over 150 deaths and counting of South Asian males related to gang violence in the Lower Mainland. A cross-disciplinary tool that police can use to advance their understanding of gangs, conflicts and violent victimization is social network analysis (SNA). The ego-networks of the 23 confirmed gang-related gun homicide or attempted homicide victims in Surrey, in 2015, are constructed using police data from 2011 to 2015. The present study a) assesses the overall structure to understand the Surrey gang conflict, b) conducts centrality analyses to identify those individuals (victims and non-victims) at the highest risk of gunshot victimization and c) explores the potential consequences of being central in the victim network. Results indicate that 299 of the 355 individuals in the overall network are connected to each other, including 18 of the 23 victims, who are more likely to be brokers. A high-risk group is identified, with two or more direct connections to victims that are at the highest risk of victimization. Finally, results show that 2016 and 2017 victims are among the most central in the network. Policy and practical implications are discussed with reference to these findings.

Keywords: Social network analysis; Surrey; gangs; violence; conflicts; victims

Dedication

I dedicate this work to the memory of my *Nanaji* and *Papaji* (my grandfathers), whose strength, hard work and dedication to family shaped the person I have become. You are both a guiding light in my life, and have inspired me to be courageous, take risks, reach my highest potential and never give up. I hope I have made you proud.

I also dedicate this work to the young men and women who have befallen victim to the gang life. It is never too late to turn things around.

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To my parents: your belief in me has meant everything. You support me with love, understanding and patience in everything I do. You came to this beautiful country in the 70s and made a life for yourself. The values you have instilled in me – hard, honest work, a good education, respect, compassion and community, ground me and are at the heart of everything I do. I feel like I can do anything in life with you in my corner.

To my family and friends: my sincerest thanks to you for your unwavering support. You have encouraged me and stood by my side during this long journey. It was not easy but having you lift me up during stressful times and share my joys during small milestones definitely helped. To my friends, many of whom are on the frontlines working with young people as police officers, educators, substance abuse professionals, researchers - I thank you for serving with heart and duty.

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To my senior supervisor, Martin: what a ride it has been! My last and biggest thanks is to you. Your passion, drive and commitment to academia are second to none. Thank you for being patient with me, and providing me with advice and guidance throughout the research process. You saw me balance my academic and professional life and always gave me motivation to continue.

This topic has always been close to my heart. There are two areas of research I have always had a keen interest in, policing and gangs, and this topic gave me a chance to delve deeper into both. I remember being a teenager reading the news about the senseless deaths attributed to gang violence that were occurring in my community. There is a strong need to reshape the conversation on gang violence and who we define as victims. Here is my small contribution.

May your choices reflect your hopes, not your fears. – Nelson Mandela

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Chapter 1.

Introduction

In Canada, gang violence with suspected global connections to drug trafficking is a serious and growing public health and safety concern (Beare & Hogg, 2013; Marshall, DeBeck, Simo, Kerr & Wood, 2015; Tigri, Reid, Turner & Devinney, 2016). In 2015, there were 98 gang-related homicides in Canada, up from 16 in 2014 (Statistics Canada, 2016). In British Columbia (BC), specifically the Lower Mainland region covering the southwest corner of BC, has seen a rise in gang violence over the last several years (Bouchard & Hashimi, 2017). Retaliatory gang-involved drive-by shootings in the Lower Mainland have gained intense publicity. The impact of gang crime is multi-faceted, being social, psychological, cultural, economical and physiological in nature.

One city within the Lower Mainland that has received particular attention as it relates to crime is Surrey, BC. The year 2015 was the season of "shots fired" in Surrey, as there were 56 shootings between March and December 27th, 2015, of which 44 occurred in a span of 38 days (Bolan, 2015c; Thom, 2015). From a public viewpoint, the shootings are seemingly random, and as it relates to policing, police are often left playing 'catch-up' (McConnell, 2015). There are gaps as it relates to understanding how conflicts play out, specifically in a BC context, what makes an individual at risk of gun homicide victimization and what strategic, data-driven and innovative methods and tools police can utilize operationally to prevent and reduce gun violence.

In this thesis, I utilize social network analysis (SNA), specifically network structures composed of nodes (individuals) and ties (interactions) that connect them, to construct the 2015 Surrey gang conflict network. The network is constructed using the ego networks of the 23 victims of gang-related gun homicide/attempted homicide in Surrey, BC, in 2015 using police data from 2011 to 2015. The full network was generated from the police files, including co-offending files, of the 23 victims during 2011 to 2015 to extract their associations. I assess the overall network structure and determine if the network can be described as a single conflict, if the victims were connected to each other and if there were subgroups that formed that could provide insight into the structure and specific, notable characteristics. Using a centrality analysis,

I then determine who in the network is most central (victims and non-victims) and whether there were some individuals who were more central than others, for the purpose of identifying who is socially closest to gun homicide victims. A foundational premise is analyzing network structure to determine how one's network position can influence individual risk of victimization. Furthermore, I identify a high-risk group based on those individuals in the network with two or more direct connections to victims. These steps are undertaken based on the hypothesis that greater exposure and social closeness to previous homicide victims in one's social network increases one's own risk of victimization. This can be conceived as social distance (i.e. how many steps removed one is from a homicide or attempted homicide victim).

To advance understanding of network structures and gang conflicts, I determine if there is a relationship between victims' "average centrality", a measure of overall importance, and victims' shooting sequence (i.e. the order in which the shooting events occurred). Several studies have used SNA to suggest the diffusion of gun violence occurs through person-to-person interactions using the concept of social contagion (i.e. the spreading of beliefs, attitudes and behaviors through social interactions) (Papachristos, Wildeman & Roberto, 2015a; Papachristos, Braga & Hureau, 2012; Papachristos, Braga, Piza & Grossman, 2015b; Green, Horel & Papachristos, 2017). Gun violence is socially contagious, meaning the activities, behaviors and actions happening around an individual, will affect what happens to that individual (Green et al., 2017). The impact is not only limited to gang members, as they associate and interact with non-gang members who are equally exposed (Bichler, Norris & Ibarra, 2020). The risk of gun victimization can move through time, and be transmitted from person to person in a particular pattern (Braga et al., 2010). Exploring the relationship between average centrality and shooting sequence will allow insight into the gang conflict that unravelled over a one-year period (2015) and whether there was a contagion effect.

Lastly, in this thesis I explore potential consequences of being central in a victim network. I determine who in the network was a victim of gun homicide and attempted homicide in 2016 and 2017 to explore what it means to be central in a victim network and how it impacts future victimization.

Few have studied the structure of gang violence in a Canadian context using a victim-centered lens. This is the first study that analyzes a specific gang conflict in a

Canadian city with a unique gang landscape using SNA and hypothesizes that greater exposure and social closeness to previous homicide victims in one's social network increases one's own risk of victimization. This study provides strategic and policy implications, especially as it relates to policing and the use of SNA for gun violence intervention and prevention.

Surrey, BC, a suburb of Vancouver, is centrally located in the Lower Mainland, approximately 30 kilometers east of downtown Vancouver. Surrey has a population of 517,887 (Statistics Canada, 2017). It includes six distinct districts: Fleetwood, Whalley / City Centre, Guildford, Newton, Cloverdale, and South Surrey. Surrey is the third largest city by area and the second largest city by population (City of Surrey, 2017). Surrey is home to the largest school district and Royal Canadian Mounted Police (RCMP) detachment in BC (City of Surrey, 2020b). It is a young city, with a quarter of its population aged 19 years and younger, the largest number of youth in a BC municipality (City of Surrey, 2012). In the 1980s, a large percentage of South Asians began concentrating in Delta and Surrey, cities that historically employed migrant labor (Johal, 2007, as cited in Buffam, 2016). Approximately 32%[1] of Surrey's population is made up of South Asians (Statistics Canada, 2017). Indo-Canadian gangs set themselves up as "mid-level players" in the local distribution of drugs in the early 1990s (Gordon, 2000). In Metro Vancouver, the reappearance of gang violence involving South Asian men has reproduced the phenomenon, the 'Indo-Canadian gangster' (Buffam, 2016). While not all of the conflicts involve Indo-Canadians, the racial criminality at play is hard to ignore. Since the 1990s, there have been over 150 deaths of Indo-Canadian males contributed to gangs and/or criminal involvement (Bailey, 2015). This figure continues to grow (Bolan, 2020). What is even more concerning is that the mean age of gang members who are murdered has declined over time (Buffam, 2016). Other key features of this particular phenomenon include the level of violence, specifically involving firearms, and the frequency of which these acts are being committed in public space (Jingfors, Lazzano & McConnell, 2015; Illegal Firearms Task Force, 2017).

Gang members who want to shield their activities from police targeting efforts, will often conduct their business in public places where many innocent by-standers can act as a deterrent. Rival gang members may use the public platform to then "capitalize

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[1] The population of Surrey is 517,887, which includes 168,040 South Asians (32%) (Statistics Canada, 2017).

on the opportunity" regardless of the risk to the public (Prowse, 2012). This is especially significant to police as it concerns threats to public safety (Illegal Firearms Task Force, 2017). Among gang members, the goal is to minimize collateral damage, since it is known that gang violence will lead to public outcry and outrage, which will then put pressure on politicians and the police to amp up enforcement related efforts (CFSEU-BC, 2015d). Police consistently suggest that if any individual is associated with gang members involved in the drug trade, they put themselves at considerable risk (Gushue et al., 2018). Not only themselves, but anyone they choose to surround themselves with.

The ever-changing landscape in BC has seen periods of escalated gang violence in 2002, 2006, 2009, 2012 and again in 2015[2] (Buffam, 2016). Many high profile incidents have impacted the gang landscape in the Lower Mainland, such as the "Surrey 6" murders involving the Red Scorpions and the Bacon Brothers (Airola & Bouchard, 2020; Gushue, Lee, Gravel & Wong, 2018) and the death of gang leaders in the Dhak/Duhre group (Bouchard & Hashimi, 2017). The attrition of gang members, by way of death, incarceration or simply aging out, has helped pave the way for many new groups to enter (Bouchard & Hashimi, 2017). News articles characterized the shootings in 2015 as being fuelled by drug trafficking conflicts driven by money (CBC, 2015). Conflicts are often the result when former alliances have fractured and turned on each other (Bolan, 2018). Conflicts patterns suggest that a vendetta among affiliated individuals drive shootings (Papachristos, 2009). News stories often report on gun-fire exchanged between gangs, without specific knowledge of who was targeted and at-risk, as police will often only report vague information such as targets were "known to police" and had a "criminal history". One is often left to wonder what contributes to gun violence, who is at risk of getting shot and what can be done to reduce or stop the violence. While research suggests that majority of street gangs are short-lived and disorganized, "some have institutionalized, and a number of these [gangs] show signs of evolving into more serious criminal enterprises, becoming more networked, technologically savy and internationalized, less visible, more predatory and sometimes more violent" (Ayling, 2011, p. 1).

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[2] According to the Combined Forces Special Enforcement Unit of BC (CFSEU-BC), there were 35 gang-related attempted homicides in BC in 2015, the highest figure since 2009 (CFSEU-BC, 2015a). Additionally, there were eight gang-related homicides in BC in 2015 (CFSEU-BC, 2015a).

BC's gang landscape can best be described as fluid, encompassing loose connections, allegiances and shifting loyalties (McConnell, 2015; Bolan, 2018; Illegal Firearms Task Force, 2017). This fluidity is also related to gang processes and gang members changing roles within a structure (McCuish, Bouchard & Corrado, 2015), dipping in and out of gang membership, working with different groups in different capacities (Prowse, 2012) and who is most likely to be victimized. Research suggests the fluid nature of gangs is best measured through SNA (Bichler et al., 2019; Sierra-Arévalo & Papachristos, 2015; Bouchard, 2020). As it relates to a conflict, a gang will often shift or change, as the conflict may cause the group to become more cohesive or divide (Airola & Bouchard, 2020). As a supplemental investigative tool, police can utilize SNA to identify those individuals at the highest risk of victimization, those who are in social proximity to homicide victims for intervention, prevention and education. SNA, as the current study will demonstrate, provides an applied framework that is systematic, replicable and has the ability to be implemented in programs. The structure of the conflict in Surrey will reveal social processes that can present opportunities for intervention.

The following section outlines the chapter breakdown in the thesis. Chapter two presents a review of the literature including an overview of SNA, what factors effect gang victimization including homicide victimization and how violence is seen as being contagious. Furthermore, the chapter discusses how the structure of a network can be used to determine how network position influences individual outcomes, co-offending networks and the selection of co-offenders, the importance of the victim/offender nexus in the gang context and what police have done with this information.

Chapter three outlines the data and methods utilized in the current study including the data source, the extraction of associations and ties, overall network measurements and individual-level measurements, why a co-offending network was most appropriate, a subgroup analyses used to help understand overall structure and lastly, the overall analytic strategy used. I construct the social network of the 2015 Surrey gang conflict from the 2015 gang-involved victims of gun homicide/attempted homicide and their associations from police files in 2011 to 2015.

In Chapter four, the results are broken down into three components. First, the overall structure including network characteristics and subgroup formation is assessed.

In examining the overall network, several key questions arise: *Can the Surrey conflict be described as a single network? Are the victims connected to each other? What are the characteristics of the victims and other individuals in the network?* Secondly, the individuals within the network specifically as it relates to centrality measures and direct connections to victims are analyzed. I assess who in the network is central and if some individuals are more central than others, in light of what these results can mean in terms of potential victimization. Centrality analyses are undertaken based on the hypotheses that the most central individuals will be at the highest risk of gunshot victimization from a social proximity standpoint. Next, to understand how the conflict played out, the relationship between sequencing and average centrality is examined. Lastly, the potential consequences of being central in a victim network are explored. *What does it mean to be central in a victim-network and how does it impact one's risk of being a victim in 2016 and 2017? Is social distance to 2015 victims associated with victimization in 2016 and 2017?*

Chapter five discusses and interprets the findings. Specifically, it highlights a change in approach and lens that the study uses, closely examining the overall structure, subgroups and their unique characteristics. Furthermore, it assesses the findings of those who are socially closest to victims, namely those with high centrality measures and direct connections to victims, in light of literature in this area. Chapter five then unpacks the results of exploring future victimization using centrality, demonstrating that delving deeper into centrality measures and positions allows some semblance of forecasting future victims. Lastly, strategic and policy implications on a broader level are explored, followed by a BC-specific discussion on implications.

Chapter six explores some of the limitations of the study including missing data, the use of node centrality, police data and issues around incompleteness and inconsistency, the use of algorithms to understand criminal networks and potential legal and ethical ramifications to consider. Chapter seven concludes with a discussion of the motivation behind the study and its importance. Future avenues of discovery are identified.

Chapter 2.

Literature Review

2.1. Social Network Analysis

Researchers have consistently studied how the connections among individuals impact what we feel, think and do (Papachristos, 2014). Crime is naturally a "networked" concept, a group behavior that usually occurs between two or more individuals (Charette & Papachristos, 2017; Papachristos, 2013, 2014). Over and above key demographic indicators such as age, race and sex, who one chooses to spend their time with and the types of activities they engage in are critical features when it comes to criminality and victimization. This "groupness" intensifies inner social processes, creating gang norms, different behaviors and fluid structures (Papachristos, 2013). Relationships can be "kinship ties, 'friends of friends', employment, community-of-interest participation, or communication links activated through these associations" (Prowse, 2012, p. 15).

SNA is one way our understanding of these social structures and processes can be enhanced as it offers a theory methodological lens, which is cross-disciplinary (Wasserman & Faust, 1994). Furthermore, it provides depth to the study of gang organization and structure by "measuring the sets of relationships that make up gangs' underlying social structure" (Sierra-Arévalo & Papachristos, 2015, p. 161). This underlying structure looks at the position of actors within, and has the ability to influence "behaviors, opinions, and attitudes" (Papachristos, 2014, p. 348). It is important to note that although the structure of individuals' networks can influence their lives, individuals still have agency where choices can be made about producing, maintaining or demolishing ties, connections and associations (Papachristos, 2014).

A gang member may dip in and out of membership, as he/she has the flexibility to distance him or herself from future involvement in gang activities, join a new gang or form a new gang (Prowse, 2012). Moreover, the gang member may choose to work with different individuals for different operations, or have a more involved role for certain operations as opposed to others. Furthermore, when it comes to conflict, a gang will

often shift or change, as conflict may cause a group to become cohesive or divide. One of the hallmarks of gang conflict is the use of firearms to perpetuate violence.

Furthermore, the "gang effect" is essential to describe when viewing gangs through a network lens. The "gang effect" is when belonging to a certain group, "carries with it a structured pattern of relations" (Papachristos, 2009, p. 84). Gang members then use this network as a sort of map to carry out their violent acts, as such, the individual and the collective work hand in hand. While individual members are self-serving, their activities, which often include murder, are done as a collective, producing a collective identity (Papachristos, 2009, Papachristos, Hureau & Braga, 2013). Beare & Hogg (2013) found that tension exists between the self and the collective because of contradictory expectations regarding their own self-interests regarding notions of "reputation, image, [and] status" (p. 429).

The fluid nature of gang membership and involvement can best be measured using SNA (Descormiers & Morselli, 2011; Sierra-Arévalo & Papachristos, 2015; Bouchard, 2020). SNA plays a critical role in our understanding of relational processes and social structures where the position of actors can impact individual attitudes, actions and outcomes (Papachristos, 2014). With respect to the current study, the 2015 Surrey gang conflict is mapped out using the ego networks of the victims. Using SNA, an overall structure is produced with positions of individuals in the network relative to victims. SNA plays a crucial role in the understanding of gang conflicts and social closeness to victims for the purposes of identifying those most at risk of homicide victimization.

2.2. Gang Victimization

Overwhelmingly, research suggests that those with the highest probability of victimization, including homicide victimization, include: gang members, those with violent arrest history, Black males, youth coming from a poverty-stricken neighborhood, being involved in gang activity and having family criminality (Ezell & Tanner-Smith, 2009; Loftin, 1986; Papachristos, 2009; Papachristos et al., 2015a; Wintemute, 2015). Furthermore, in a study that explored how neighborhood characteristics are associated with social disadvantage and homicide risk in the U.S., Jones-Webb and Wall (2008) found that neighborhoods that contained higher concentrations of minorities had higher homicide rates.

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Gun violence can be transmitted through interpersonal relationships or networks, be it social, friendship, criminal, kinship or other types of ties that can link individuals or groups (Papachristos et al., 2012). The more types of ties that can be analyzed, the more information that can be gleaned from networks, offering a "bigger picture" (Sierra-Arévalo & Papachristos, 2015). Different types ties say something different about behavior.

It is a well-documented fact that gang membership is strongly associated with heightened levels of victimization (Pyrooz, Moule Jr., Decker, 2014). The risk of victimization extends to not only gang members but also other individuals in their social networks (Papachristos et al., 2015b). Social networks play a critical role in our understanding of social distance and closeness to others. Theoretically speaking, social networks exist to connect members of any given community. Within this network, the social closeness between any two individuals would increase, as the count of interactions between each pair increases (Gravel, Allison, West-Fagan, McBride & Tita, 2016). Gang members operate in an environment, with an acute awareness that displays of violence can impact their reputation (Gravel et al., 2016) along with that of their gangs. Gang members enter into "social contracts of non violence with socially close others" to lessen their chances of victimization, to feel protected from others and to enhance their status (Gravel et al., 2016, p. 18).

When analyzing gang violence and its effects, one cannot ignore the role that threat plays. Decker (1996) defines threat as the "potential for transgressions against or physical harm to the gang, represented by the acts or presence of a rival group" (p. 244). Threats are an integral component of the daily lives of gang members. They are important because they may lead to future acts of violence and work in two ways: through increasing solidarity and through contagion (Decker, 1996).

The gap this study fills is to understand gang victimization based on social proximity to victims in a Canadian city with a unique gang landscape using SNA, in order reduce and prevent victimization. As previously mentioned, the network was formed from a list of all victims of gang-related homicides and/or attempted homicides in 2015, in the Surrey, BC. At the crux of the current study, the positions of the individuals in the network are used to identify those most central and with two or more direct connections to victims in order to identify potential victims of gang violence.

2.3. Social Contagion

In Criminology, contagion refers to "subsequent acts of violence caused by an initial act; such acts typically take the form of retaliation" (Decker, 1996, p. 245). The concept of contagion was explored by Loftin (1986) who used an analogy to compare infectious diseases to serious assaultive violence. Loftin (1986) suggested that like infectious diseases, which if unchecked can possibly be destructive to a whole population of people, serious assaultive violence has the potential to spread (or infect) because those offences are encouraged by social contact. Loftin (1986) argued that serious assaultive violence is subcultural, and therefore similar to disease, where there is the potential to infect a vulnerable population. She argues that it is distributed socially in ways that suggests contagious transmission in the way it is spatially clustered, and reciprocal (meaning offenders themselves had been victims). Similar to gun violence, when assaultive violence happens, individuals tend to plan for their own protection.

Similarly, Bond and Bushman (2017) provided more evidence that violence is contagious by testing the hypothesis that violence among adolescents in the U.S. spreads like disease through social networks. Participants in their study were more likely to have involved in a serious fight, have hurt someone badly and pulled a weapon on someone if a friend had engaged in similar behavior. The influence spread up to four degrees of separation for serious fights, two degrees for hurting someone badly and three degrees for pulling a weapon on someone. Moreover, just like contagious diseases, individuals exposed to violence can develop a wide spectrum of possible outcomes, and the spread can occur rapidly or gradually, depending on many factors (Bond & Bushman, 2017).

Studies have analyzed the structure of co-offending networks to see how one's network position influences individual risk of gun victimization. Co-offending is when "two or more individuals engage in a delinquent or criminal act together" (Bastomski, Brazil & Papachristos, 2017, p. 2). These studies have shown that gun violence is highly concentrated in specific parts of co-offending networks, and that the social distance of individuals in the network to gunshot victims, significantly influences their own risk of gun victimization (Papachristos et al., 2012; Papachristos & Wildeman, 2014; Papachristos et al., 2015a; Tracy, Braga & Papachristos, 2016). Further, this concentration is associated to social contagion (i.e. "the spread of beliefs, attitudes, and behaviors

through social interactions") (Green et al., 2017, p. 327; Papachristos, 2009; Papachristos et al., 2012; Papachristos et al., 2015a; Papachristos et al., 2015b; Tracy et al., 2016; Braga, Papachristos & Hureau, 2010). Contagion through social ties is a crucial process to understand why certain individuals become victim to gun violence, while others who may be exposed to similar environments and who hold similar risk factors do not. Green et al. (2017) suggested that through these social interactions, an individual becomes exposed to gun violence with former subjects of gun violence, meaning those who have been shot may be more apt to be embedded in the network and environment where guns are present and gun violence may come to fruition.

Papachristos et al. (2012) examined all fatal and nonfatal gunshot injuries in a co-offending network of 763 individuals within Boston's Cape Verdean community. Papachristos et al. (2012) found that roughly 85% of all gunshot victims were in a single network representing less than five percent of Cape Verdean's population. Using adjusted logistic regression models, a greater percentage of immediate associates who were gunshot victims were associated with an increased odds of individual gun victimization. Moreover, each network association removed from another gunshot victim reduced the odds of gun victimization by nine percent. "Each social network step away from a gunshot victim decreases one's odds of getting shot by approximately 25 percent" (Papachristos et al., 2012, p. 1000). This effect was above and beyond the saturation of gunshot victimization in one's peer network, age, prior criminal activity and other individual and network variables. Our social networks are a good indication of how and where our time is spent, and also make us an active part of our associates' worlds. It is important to explore the contexts, effects and patterns all at work within our social networks.

Similar to the study by Papachristos et al. (2012), Papachristos and Wildeman (2014) used data for a single community to estimate the association of an individual's exposure to gun homicide in a co-offending network and the risk of individual gun homicide victimization across a high-crime African American community of approximately 82,000 residents in Chicago. The basic principle was to treat gun homicide as a blood-borne pathogen, something that is transmitted from person to person through risky behaviors (Papachristos, 2014). Blood-borne pathogens need specific behavioral conditions to expand within a population (Papachristos, 2014). Findings revealed that gun homicide victimization was highly concentrated within a

single component of individuals, containing less than four percent of the neighborhood's population but accounting for 41% of all gun homicides that occurred during the study period of five years. Being among the four percent increased an individual's odds of being killed by a gun by 900%. Logistic regression models showed that each social tie removed from a gun homicide victim decreased one's odds of being a gun homicide victim by approximately 58%. Papachristos et al. (2015b) also found that there was an extreme concentration of fatal and non-fatal injuries within a small social network in Newark. Nearly one third of all shootings occurred in a network that contained less than four percent of the city's total population. Being directly or indirectly associated to a gang member in the co-offending network had a significant effect on one's probability of being shot by 94% (Papachristos et al., 2015b).

Papachristos et al. (2015a) used the Chicago Police Department's arrest data to analyze the entire co-offending population of Chicago in an attempt to estimate the true distribution of gun violence victimization risk in a large city. The co-offending network comprised of 169,725 individuals represented approximately six percent of the total population of Chicago and 40% of all individuals arrested during the study period. They found that 70% of all non-fatal gunshot victims were located in the co-offending network. Papachristos et al. (2015a) found that the "greater the extent to which one's social network is saturated with gunshot victims, the higher one's probability of also being a victim" (p. 147). Moreover, this study showed that for individuals with two or fewer immediate associates (the majority of individuals in the network), their likelihood of being a victim was two or three times greater if one of their associate's was a victim then if they had no exposure to victims. It was not only direct associations that played a role in victimization, it was also the associates of one's criminal associates that influenced one's risk of gunshot victimization (Papachristos et al., 2015a).

One of the more recent studies to explore the idea that patterns of gun violence share many similarities to that of infectious disease was conducted by Green et al. (2017). Using police records of individuals who were arrested together for the same offence, the researchers mapped a network of 138,163 individuals who had been co-offenders (arrested for the same crime) over an eight-year period in Chicago to examine how violence spread within the network. In order to understand contagion, there is an assumption that co-arrestees would have close social ties and collectively engage in risky behavior. The researchers found that 63% of the 11,123 total shootings in the

network were a part of a longer chain of gunshot victimization. The results reinforced the idea that modeling the spread of gun violence on social contagion was in fact a better predictor of who would likely become a victim than modeling demographics such as age, gender and residence. A combined contagion-demographic model outperformed both individual approaches. Again, the conclusion that was reached was that the closer one is to a gunshot victim, the increased risk of being shot one had (Green et al., 2017). This study suggests that to protect the most vulnerable individuals with a risk of being shot, police must examine who they are and how they are connected to others.

Branas, Jacoby & Andreyeva (2017) built off of what Green et al. (2017) studied, but went one step further acknowledging narrowing in on select individuals or "hot people" was important, however, equally important was the idea of altering one's environment "hot spot" within which gun violence operates, and in certain situations will be more effective than exclusively focusing on individuals. Branas et al. (2017) suggested that the same "high risk" individuals would continue to cycle through the same environments that if left unchanged, will persist in giving the factors conducive to violence. Furthermore, interventions that focus on "hot people" may be unsustainable, as many times they rely on funding and resources (Branas et al., 2017).

Repeatedly, these studies using SNA have demonstrated that violence occurs disproportionately among a small, identifiable network of people who are at risk of victimization and offending. Moreover, these studies have emphasized that social distance and social closeness to a homicide victim matter. Meaning, how removed an individual is or how close one is to a homicide victim in a network that they share, will influence one's own victimization. The closer one is to a gun homicide victim, the greater the risk of fatal gunshot victimization.

The current study uses the structure of the co-offending network created from the 2015 Surrey gang conflict victims and their associates to determine how one's position influences individual risk of gun victimization. Essentially, the concept of social contagion is used to describe how violence and the risk of victimization can spread through a social network. The underlying point is that the actions and behaviors of one's network neighbors will impact what happens to them. Victims in the current study impact and influence actors around them – just how this influence manifests is what the current study examines. To protect the most vulnerable individuals from the risk of being shot,

police must examine who they are and how their associations, ties, relations and connections are impacted. Furthermore, the retaliatory nature of the gang conflict and how it plays out is another important concept to explore as it relates to sequencing of shooting events. Building on the work of Branas et al. (2017) that acknowledged that one's environment "hotspot" within which gun violence operates in is important to explore, in addition to "hot people", the policy and practical implications of the current study's findings are discussed.

2.4. What have Police Done with this Information?

As gangs have evolved over time, police have also had to become more agile, innovative and sophisticated in their techniques, policies, strategies, procedures, tactics, systems and assets. One method police can use to advance their understanding of conflicts, gangs and violent victimization is SNA. Police departments have gradually used SNA for criminal intelligence, reviewing relations among individuals based on information retrieved from investigative work (Sparrow, 1991). Beyond criminal intelligence, police use SNA in investigations to monitor social media behavior and predictive analytics (Papachristos & Sierra-Arévalo, 2018). The various methods and techniques available in SNA provide police officers and criminal analysts utility, as they have the possibility of identifying individuals most at risk of gun victimization within network structures.

In 2013, the Chicago Police Department conducted a predictive policing program pilot, which was planned to reduce gun violence that had become a major crisis for the city (Saunders, Hunt & Hollywood, 2016). The program incorporated a Strategic Subjects List (SSL) of individuals who were at the highest risk of being victims of gun violence. These individuals were then forwarded to local police leaders for preventative intervention. Results revealed that using arrestee social networks did advance identifying future homicide victims, but the number was too low to have meaningful impact on crime. Less than one percent of homicide victims (three out of 405) were identified in the model. To summarize, at-risk individuals were not more or less likely to become victims of homicide as a result of the SSL, as well as the city homicide trend showing no significant change. One significant finding was that individuals on the SSL, however, were more likely to be arrested for a shooting (Saunders et al., 2016).

When attempting to understand gangs through SNA, a review of The Boston Gun Project is necessary, because it became a framework for other interventions. The Boston Gun Project was initiated to understand the purported nexus of the rising youth violence and use of firearms in Boston (McGloin, 2005). As part of the analysis, researchers identified local gangs and their relationships between each other, which were then produced on sociograms, showcasing connections and linkages within the gang landscape (McGloin, 2005). These research processes helped to demonstrate why particular geographical areas were experiencing a spike in violence and which street gangs were most connected, which assisted law enforcement with targeting and intervention efforts (McGloin, 2005). This example illustrates how the use of SNA when analyzing gangs in a strategic and targeted fashion is beneficial given its policy implications.

Police strategies gaining increasing popularity include focused deterrence strategies, which refer to "a family of strategies based on core deterrence principles, but which employ innovative methods to deploy traditional and non-traditional enforcement techniques" (Papachristos, 2013, p. 56). Problem-oriented policing is one way to understand and prevent intricate gang violence problems. This type of policing uses the "pulling levers" deterrence strategy which highlights criminal justice and social service efforts on a small number of prolific offending gang members who are responsible for the majority of gun violence problems (Braga, Pierce, McDevitt, Bond & Cronin, 2008). Police directly warn those at risk of the dire consequences to their actions, involve community and family members, along with service providers to offer an alternative to the gang lifestyle and explore employment and health related services. An evaluation by Braga et al. (2008) revealed that the pulling levels strategy has merit and was associated with a decrease in the number of gun homicide and aggravated assault incidents.

One of the criticisms of predictive policing is that there can be a possibility of racial profiling. Proponents of SNA have suggested that what is being done is the opposite of profiling, as it is individuals' own positions within the network and who their associations are that the risk is based on, not personal characteristics such as race. Many times victims themselves have been or will be offenders (Chen, 2009), which suggests that the victim/offender nexus is important to explore.

In BC, ethnicity was an overwhelming variable in targeting individuals by police in the 1990s (Gill, 1998). For instance, in BC the Indo-Canadian Gang Task Force was established in 2002 to address violence in the Indo-Canadian community (Gravel, Wong & Simpson, 2018). This task force was disbanded in 2004 and reinstated in 2005 as the BC Integrated Gang Task Force, which combined the gang-related efforts of multiple police forces in BC (Ministry of Public Safety and Solicitor General, 2006). The BC Integrated Gang Task Force was created in response to meetings between Indo-Canadian leaders and the provincial government over the growing concern of gang violence and the murder of over 90 young men in the previous decade (Ministry of Public Safety and Solicitor General, 2006). Other changes came in 2005 with the creation of CFSEU-BC, and later its expansion in 2009 (Gravel et al., 2018). In fact, news articles in 2005 focused exclusively on multiple cases involving Indo-Canadian victims of gang violence (Gravel et al., 2018).

Investigating how gang violence spreads through a network supports intelligence-led policing efforts. Intelligence-led policing is composed of several basic principles including, "a strategic future oriented and targeted approach to crime control", recognizing, examining and managing risks and utilizing intelligence to assist in the targeting of resources and priority areas, and the disruption of crime groups (Clarke, 2006, p. 4; Ratcliffe & Guidetti, 2008; Beare & Hogg, 2013). Risk assessment is often used as a diagnostic and prognostic tool (White, 2008), used to determine an individual's needs and deficits, along with which individuals will be most likely to offend and be victimized.

Predictive policing has gained immense popularity world-wide because it is progressive, forward thinking and cost effective (Ferguson, 2012), allowing police agencies who are forced to do "more with less" to be proactive with limited resources (Perry et al., 2013; Papachristos & Sierra-Arévalo, 2018). With budgets that are in constant flux, it forces police administration to be more efficient, while still being answerable to the public and government and fulfill their legal obligations.

Predictive policing applies quantitative techniques to identify prospective targets for police intervention and crime prevention, and allows for the forecasting of statistical predictions (Perry, McInnis, Price, Smith, Hollywood, 2013). It has become a "loosely" used term encompassing "any crime fighting approach that includes a reliance on

information technology (usually crime mapping data and analysis), criminology theory, [and] predictive algorithms" (Ferguson, 2012, p. 265). Analytical and investigative tools and techniques include the use of undercover officers, informants and surveillance (Maguire, 2000). Examples of conventional crime analysis include crime mapping, hot spot identification, regression models, heightened awareness and risk associated with areas surrounding recent crime, graphing/mapping frequency of crimes, among others (Perry et al., 2013).

Law enforcement's use of predictive technologies may be executed through in-depth analysis of incoming gang/criminal intelligence reports and instruments that summarize known risk factors. The majority of these methods include assessing individual risk (Perry et. al, 2013). For instance, agencies such as CFSEU-BC "enhance intelligence sharing, coordination and strategic deployment against threats of violence posed by organized crime groups and gangs in BC" (CFSEU-BC, 2013, 2015b). Police agencies seek to understand the organized crime environment in Canada, an environment that has seen increased mobility, sophistication and changing personnel with various backgrounds, driving police agencies to remain nimble. It is estimated that 188 criminal groups exist in BC, where the gang and organized crime landscape is enterprise-driven (CFSEU-BC, 2013). Senior officers from the RCMP meet weekly as part of the National Tactical Enforcement Priority (NTEP) and Provincial Tactical Enforcement Priority (PTEP) programs (CFSEU-BC, 2013).

At an organizational level, police agencies now regulate activities and the deployment of resources around formal "business plans", "targets" and "performance indicators", with importance placed on "co-ordinated teamwork, with increased specialization of skills and functions" (Maguire, 2000, p. 317). One method police use to target is through the use of hotspots, which can be "mapped, ranked, [and] classified by offence type" (Sherman, 2013, p. 398). With respect to targeting in particular, police should apply suitable research to appropriately allocate resources on "predictable concentrations of harm from crime and disorder" (Sherman, 2013, p. 383). Once these targets are established, they should be systematically and strategically reviewed using tested police methods.

The Canadian response to organized crime has included identifying organized crime targets through analyzing police information and "the proactive cultivation of

human source and other data sources", using 'real-time' intelligence to prioritize targets according to threats, the appropriate sharing of intelligence among the Canadian police community at all levels and the undertaking of proactive enforcement (Castle, 2008, p. 140). The RCMP in Canada relies upon "actionable intelligence" and the availability of resources for proactive and reactive enforcement action (Castle, 2008, p. 140). Operational commanders need to make strategic and well-planned decisions; otherwise there is a risk of "ad hoc and arbitrary target selection" (Castle, 2008, p. 140).

Data-informed, strategic, timely and accountable decisions to reach those individuals at the highest risk of gun victimization for intervention, prevention and education are at the forefront of the policy implications explored in the current study. SNA is a useful tool for police as it allows patterns, interactions, associations and linkages between people and groups to emerge from the data – something police use to build intelligence and learn new information. In mapping out conflicts that stretch across wider geographical areas, for example, police can draw connections and relationships within the larger gang landscape. It is important to start from a focused and meaningful starting point and expand the scope as necessary.

In the interest of narrowing the focus of high-risk individuals, a data reduction method is utilized in the current study, which can outline subgroups and their specific characters. Operationally, police can use SNA data to understand subgroups and cliques, set their priorities, and build boundaries based on data that is already being collected (Bouchard, 2020; Hashimi & Bouchard, 2017). SNA is not meant to undermine any existing policing strategies and tactics, in fact, caution is warranted that it should be used to supplement existing best practises and not be used exclusively. Like any new strategy, SNA in an operational setting will need to be reviewed and evaluated to determine what is working and what is not, to identify gaps, limitations, risks, benefits and opportunities for advancement and improvement.

There is a predictive policing element in what the current study proposes. Based on network positions, those individuals in close social proximity to victims of the 2015 Surrey gang conflict are identified and I hypothesize, these individuals are most at risk of gun victimization. The focus is on potential victims, and never offenders. Police can use this information in the context of "Duty to Warn" for preventative intervention of those

individuals at risk of gunshot injury, ultimately reducing the gun violence that plays out on the street.

2.5. Victim/Offender Nexus

Although victimization research is sparse in comparison to offending research, it has become increasingly popular (Katz, Webb, Fox & Shaffer, 2011; Taylor, 2008; Taylor, Freng, Esbensen & Peterson, 2008; Wells & Chermak, 2011). Studies on victimization have uncovered that there is an overlap between violent victimization and offending (Chen, 2009; Hallsworth & Silverstone, 2009; Saunders et al., 2016), which also includes homicide victimization (Ezell & Tanner-Smith, 2009). This overlap was highlighted as a key feature of the Surrey gang conflict in news media at the time of the shootings (Dhillon, 2015; Global News, 2015). Just how a gang conflict contributes to the victim-offender overlap, is an important element to consider within the gang context. Research suggests when it comes to a conflict, a gang will often shift or change, as it may cause a group to become more cohesive or fragment (Airola and Bouchard, 2020), which in turn can impact offending and victimization.

A gap in research exists with respect to how gang membership contributes to the victim-offender overlap, despite gang members being twice as likely as non-gang members to be both victims and offenders (Pyrooz et al., 2014). Gang members should not only be viewed as offenders by criminal justice and research professionals, but violent victimization should also be considered interwoven with gang membership, at the onset, during and once they discontinue from the gang (Peterson, Taylor & Esbensen, 2004; Taylor, 2008). Offenders and victims both share similar risk factors, as they both engage in risky behavior. Shared experiences and relationships affect us – the individuals we engage with, are influenced by and are exposed to, will ultimately impact our decisions and actions. Chen (2009) argues that the link between offending and victimization is "significant and stable over time, after dynamic protective/risk factors and persistent individual heterogeneity are controlled" (p. 130). Further, Chen (2009) adds that violent victimization, which includes being shot, is mostly the consequence of increased offending and the lack of relationship to conventional institutions.

Research has consistently found that violent victimization is highest among gang members followed by former gang members, gang associates, and non gang members,

and that offending will increase the risk of victimization (Katz et al., 2011). However, once involvement in gang crime is controlled for, gang membership does not impact the gang members' serious violent victimization, implying that membership alone may not provide protection from victimization, offering even more support for the victim-offender overlap (Katz et al., 2011). If all that is known about a gang member is that he/she is a gang member, this information is not telling, as it fails to adequately record the extent of involvement in the gang and what their risk exposure to violence would be (Katz et al., 2011). However, inferences can still be made regarding one's position within the network with respect to embeddedness (Pyrooz, Sweeten & Piquero, 2013), organization and structure.

Gang structure is an important concept that many researchers have studied as it relates to offending and violent victimization. Criteria such as "turf, symbols, organizational structure, permanence, [and] criminality" are all generally agreed upon by researchers, in addition to having a sense of identity (Decker, 1996, p. 243; Papachristos, 2013). Decker, Katz & Webb (2008) found that gangs are not very well organized. In their study, both current and former gang members indicated like levels of organization and mediocre organizational complexity. Interestingly, the respondents in the study came from a juvenile detention facility, which suggests that they may be less knowledgeable about their respective gang's organization. Decker et al. (2008) revealed that low levels of organization in a gang could still have consequences for gang member offending and victimization. The more organized the gang, the more its members will be involved in violent offending, drug selling and violent victimization (Decker et al., 2008).

Given what has been researched with respect to the victim-offender nexus, Schreck, Fisher & Miller (2004) examined whether delinquent peer associations promote the likelihood of violent victimization, with a focus on what impact structural characteristics of peer networks had on victimization risk. Schreck et al. (2004) found that network location and density make violent victimization more likely to exist. If an individual has a prominent location within a dense delinquent network, it does not necessarily mean that they will be protected from violent victimization, instead, membership seems to keep individuals in contexts that will result in violence being directed at them (Schreck et al., 2004).

One of the unique characteristics of gangs is the group processes within the gang structure (Klein & Maxson, 2006), many of which are under-developed (Hughes & Short Jr., 2005). Group processes include "collective identities, status acquisition and maintenance, normative orientations toward criminal involvement, and extra-individual liabilities", and promote risk for violence (Pyrooz et al., 2014) and victimization. Collective identities as a concept are aligned with what Hughes and Short Jr. (2005) refer to as "wolf packing", which is described as small groups of rival gang members engaging in violence, which expands to more members, ultimately reaching widespread gang violence. This spreading of violence is associated with the risk that can spread to non-gang members (Bichler et al., 2020). Other micro-level processes involving gang member disputes include "socio-economic conditions…ethnic and racial tensions, and group norms" (Hughes & Short Jr., 2005, p. 70).

The fluid nature of gang membership is well documented and can best be measured using SNA (Descormiers and Morselli, 2011; Sierra-Arévalo & Papachristos, 2015; Bichler, Norris, Dmello & Randle, 2019; Prowse, 2012). In fact, it is appropriate to describe BC's gang landscape as being fluid, entrenched with loose connections, alliances and allegiances (McConnell, 2015; Bolan, 2018; Illegal Firearms Task Force, 2017). Shifting loyalties and allegiances, risky endeavors in the gang world (Bolan, 2018), may increase one's vulnerability, contribute to conflict and ultimately victimization. At times individuals are likely victims, and other times offenders, giving credence to the victim-offender nexus. Moreover, this fluidity can also take shape when individuals "lay low" after a shooting, dip in and out of membership, switch groups (Bolan, 2018), work with different people for different operations or fulfill a small role versus a big role for specific offences (McCuish et al., 2015). An example of this fluidity was highlighted in Airola & Bouchard (2020), who examined the Surrey Six murders in Surrey, BC, and found that the network they constructed showed signs of fragmentation post shootings and the role of the leaders diminished, which has been consistent with other studies (Morselli & Petit, 2007).

Bichler et al. (2019) use the theme of fluidity to assert that future efforts may benefit from using SNA to examine and pinpoint groups using information about interactions instead of formal gang membership. The current study seeks to understand the Surrey gang conflict via interactions using SNA. By mapping out the network, connections between individuals emerge with the victims as the foundation. How socially

close individuals are to victims will impact their risk of victimization, because those are potential pathways for transmission. The very fact that gangs, membership and related processes are fluid is why particular attention should be paid to interactions, especially because they will provide insight into social structure, advancing our knowledge of conflicts.

2.6. Factors that Effect Homicide Victimization

2.6.1. Gang Membership

Many studies have notably featured gang membership as being a determinant for victimization and offending (Decker et al., 2008; Ezell & Tanner-Smith, 2009; Green et al., 2017; Papachristos, 2009; Papachristos et al., 2012; Papachristos & Wildeman, 2014; Papachristos et al., 2015a; Peterson et al., 2004; Pyrooz et al., 2014; Taylor et al., 2008; Taylor, 2008). However, a lot can still can be explored with respect to the social order of murder, for instance who kills who, when, where and for what reason (Papachristos, 2009).

Research suggests that gangs are fluid entities (Prowse, 2012), as membership encompasses strength, force and longevity, in other words the connection gangs members have to the gang (Pyrooz et al., 2013). In keeping with the theme of fluidity, Bichler et al. (2019), suggested that gangs can have multiple names, "boundaries are dynamic" and that larger gangs could form smaller subgroups each with their own names, and that a gang member can have multiple affiliations over time (p. 903). Gang membership carries specific risks because of involvement in violent offending and the drug trade, as well as one's level of membership in the gang (Pearce, 2009; Peterson et al., 2004). Reasons for the relationship between gang membership and an increased risk of victimization can be attributed to lifestyle and routine activities, in particular delinquency and the availability of drugs and/or alcohol, as found by Taylor et al. (2008). Bouchard and Spindler (2010) supported this finding and found that gang members had significantly higher delinquency rates than both delinquent groups and non-group members in all illegal activities analyzed.

Another consequence of gang membership is related to social standing. A gang's ability to dominate and take over another criminal group/gang is related to its social

standing within the community (Papachristos, 2009). To maintain its social standing, gang members will engage in violent interactions, especially when "symbolic matters-such as honor and reputation – are at stake" (Papachristos, 2009, p. 78). Gordon (2000) also outlined these features as being associated to gangs in the BC context. If one has 'good' standing as a gang member, it is highly probable that he or she demonstrated a willingness to use violence to maintain face or gain respect. Luckenbill (1977) reviewed how 70 transactions that concluded in murder were systematized, finding that in all cases murder "was the culmination of an interchange between an offender and a victim", where a dispute occurred between parties who aimed to form or maintain "face" at the expense of the other (p. 177).

Geography plays a critical role in shaping the nature of gang violence. If a gang has adjacent turf with another gang, they are more likely to engage in violence than those who do not have adjacent turf; additionally prior conflict, even when gangs do not share turf boundaries, is a factor that predicts gang violence (Papachristos et al., 2013). If a gang member lives in a neighborhood with rival members even after holding gang status and crime constant, they would be significantly more likely to be a victim of violence, than those who did not live in areas with rivals (Katz et al., 2011).

Another reason why the gang lifestyle is particularly risky is because of retaliatory violence from rival gangs and members of one's own gang. "[O]ne's street credibility amasses in a cumulative fashion whereby each act of vengeance, successful competition, or display of street savvy enhances one's reputation" (Lewis & Papachristos, 2020, p. 1830). Beare and Hogg (2013) indicate that gang membership rarely provides the supportive family that lure youth into belonging, but is rather "characterized more by tension, violence, and betrayal, both from rival gangs members and from fellow gang members" (p. 421). The group, not the individual, adopts a structure of conflict, violence and threat that shapes future violent acts (Sierra-Arévalo & Papachristos, 2015), thus reinforcing the concepts of 'spreading' and social contagion.

How deeply involved gang members are in criminal activities, reveals the extent of the exposure they have to a risky lifestyle, which in turn increases their exposure to the potential for reciprocal acts from rivals (Katz et al., 2011). Gang embeddedness as a concept was explored by Pyrooz et al. (2013), who found that those gang members who were more immersed with, and identified with the gang remained in the gang longer,

while those less embedded left the gang earlier. Similarly, Descormiers (2013) found that criminally embedded individuals began earlier and stayed longer in gangs than other individuals. It makes sense that those more entrenched in the inner workings of gangs would have greater exposure to the lifestyle, and thus would be at more risk of victimization. In terms of network positions, and gang members holding various roles, it would be safer for gang members to be on the periphery (Bright & Delaney, 2015; Schreck et al., 2004). However, peripheral members may not be the individuals who are in the "thick of it", reaping the benefits of being in a gang, such as receiving opportunities or financial gain.

Embeddedness as a concept was also explored by Bastomski et al. (2017) who found that a neighborhood's structural embeddedness within Chicago's neighborhood co-offending network impacted its homicide rate. The diffusion of violence from one neighborhood to the next may only have an effect within neighborhoods that are deeply entrenched in the citywide co-offending network. Just as highly embedded individuals, highly embedded neighborhoods are exposed to various criminogenic factors (Bastomski et al., 2017).

In the current study, specific attribute information related to gang membership was mostly unavailable. The lack of this information can be due to several factors including the mean age of those involved, "fluid" identities where there is no allegiance to any one particular gang or the intelligence was just not available. Nonetheless, given parameters used by RCMP in compiling the list of victims in the current study, gang membership, involvement and/or association played a role in victimization.

2.6.2. Firearm Carrying

Firearm carrying is a significant correlate of the transmission of gun violence, especially as it relates to peer networks and gangs. Possessing a firearm holds multiple meanings for criminals, as the symbolism inherent in the act gives the carrier power (Hallsworth & Silverstone, 2009). Participants in Hallsworth and Silverstone's (2009) study suggested that while engaged in illegal activities that exposed them to the risk of violence, or when one's personal safety was threatened, it was appropriate to carry a gun. Similarly, Wells and Chermak (2011) found that involvement in gun crimes in a sample of probationers was linked to an increased risk of gun victimization.

To understand how social networks facilitate access to firearms, Roberto, Braga and Papachristos (2018) conducted a network analysis of a co-offending network for the City of Chicago to determine how close any offender may be to a firearm. Roberto et al. (2018) found that gang membership reduced the potential network distance (how close someone is) to known firearms by 20% or more, and the closer gang members are to guns, the greater their risk of gunshot victimization.

Tigri et al. (2016) found that carrying a firearm was linked with involvement in delinquency and gang membership, an association that weakened with age. This decreasing effect with age makes sense, given that gang involvement for the majority of individuals occurs in their youth, and for a short period of time (Peterson et al., 2004). Likewise, Watkins, Huebner and Decker (2008) found that gun-involved behaviors prevailed among adult and juvenile arrestees, although juveniles were more likely to carry and use a gun compared to adults. This finding perhaps suggests that juveniles are more likely to engage in risky behavior, or that given their respective roles, they may need protection from guns. In fact, juveniles were four times as likely to report carrying a gun regularly and twice as likely to suggest they used a gun in the last year in comparison to adults (Watkins et al., 2008). Findings in their study also validated that gun behaviors of juveniles were largely due to gang membership, whereas having access to guns, fear and the risks of arrest impacted adult behaviors (Watkins et al., 2008). Hallsworth & Silverstone (2009) found that older criminals were able to manipulate younger criminals into carrying and using firearms, consequently 'passing' on the risk.

In the U.S., Duggan (2001) found that increases in gun ownership led to a considerable increase in the overall homicide rate (Duggan, 2001). Given this, it is logical that regulating or controlling gun ownership will have an effect on homicide rates. The fewer individuals that have guns, the less likely death will occur.

It is important to understand how those individuals involved in the gang lifestyle facilitate access to, possession and use of firearms. Two of the key attributes the current study analyzes with respect to the violence/crime profile of individuals in the current study are Firearms Interest to Police (FIP) notifications on police files and Firearms Prohibition (those individuals who are prohibited from owning and/or possessing firearms). These attributes are crucial, as the current study is looking at who is at risk of

gun victimization based on social proximity to victims of gun victimization. Understanding the role of firearms in the overall gang landscape allows a window into the social environments of those involved in the conflict.

2.7. Co-offending

Co-offending and networks together have been understudied (Bouchard & Malm, 2016). Co-offending is the perpetuation of an offence by more than one person (Weerman, 2003). Co-offending networks are largely based on behavior, as two people engage in risky situations with risky others, as such they might influence social contagion processes (Papachristos et al., 2015b). Given the overlap between victim and offender populations more generally, the construction of co-offending networks further captures exposure to potential victimization as well as the events (police interactions) indicative of risky behavior. Risky behaviors leading to police interactions and arrests increase one's exposure to individuals, situations and behaviors conducive to violence, and more specifically gun violence (Papachristos et al., 2015a).

Mapping networks has allowed researchers to realize not simply that gang members do not limit themselves to their own gang members when co-offending, but can extend their decisions to non-gang members and members belonging to other gangs (Papachristos et al., 2015b; Bouchard & Malm, 2016; Bouchard, 2020). The concept of risk spreading from gang members to non-gang members in a co-offending network has been explored in several studies (Bouchard & Konarski, 2014; Morselli, 2009; Papachristos et al., 2015b; Bichler et al., 2020). Non-gang members can include associates that do not co-offend and "hang out", socialize or share a familial relationship with individuals. The principle of multiplexity implies that "individuals can be connected in multiple ways or through multiple types of relationships" (Papachristos & Smith, 2014, p. 99; Feld, 1981). Although these individuals may not be committing crimes together per se, their association may be considered "suspicious" by police, which may then initiate a police stop/check. Further, these studies provide additional evidence that gang members select co-offenders from a broader social network from which gang and non-gang members belong. Gang members are cognizant of the fact that their association with others that are similar to them is a risky behavior (Schreck et al., 2004) and one that carries an increased risk of violence for themselves and others with whom they associate (Papachristos et al., 2015b).

Selecting co-offenders can be based on many factors including by offence type, level of embeddedness and homophily. Decisions to select co-offenders are not random, and can be based on specific offences (Bouchard & Malm, 2016; McCuish et al., 2015; Morselli, 2009). For instance, drug trafficking requires many offenders with various roles, ranging from being "basic" to more involved (Morselli, 2009; Bright & Delaney, 2015). These roles may also be assigned based on how embedded gang members are in their respective gangs. Murder usually involves a division of labour and a certain degree of sophistication and advanced planning and similar to drug trafficking, can involve different roles (McCuish et al., 2015). Relatedly, Bouchard (2020) explores the concept of criminal "collaboration", which refers to individuals working together to produce a criminal result. Collaboration "serves as a generic, umbrella concept that encompasses other terms including collusion, conspiracy, co-offending, or cooperation" (p. 434). Although co-offending normally form dyads or triads, a small minority of offending groups consist of four or more persons (Weerman, 2003). Ouellet, Bouchard & Charette (2018) found that large groups that adopted closed structures were more likely to survive. Specifically, groups that form alliances with other organizations are "better equipped to access, screen, and recruit new members, and they may enhance the opportunity for selection" (p. 24).

Co-offending decisions may also be based on similar others, as per the principle of homophily, which assumes that individuals who share similar traits or characteristics are more likely to connect with one another (Weerman, 2003). McCuish et al. (2015) found that being in the same gang may be a homophily effect which plays a role in the recruitment of co-offenders. Understandably, in choosing targets that are "socially close", this may result in greater transparency of what is occurring in one's own social network (Gravel et al., 2016). Similarly, Charette and Papachristos (2017) found some stability in co-offending relationships over time for frequent offenders, and offenders were more likely to keep co-offenders who were similar to them in terms of "neighborhood, age, gender, and race, and when they were in the same gang" (p. 9). Most co-offending relationships are unstable, temporary and short-lived, and conclude after the first experience or incident. However, once an individual finds a good partner, he or she is more likely to remain with that partner. The more experiences one has with a co-offender, the more trust that is built (Bouchard, 2020) and the higher likelihood that that particular co-offender will be chosen for future offences (Charette & Papachristos, 2017).

Charette and Papachristos (2017) found that past experiences led to trust and the increased likelihood that co-offending would continue into the future. Bouchard (2020) argues that mechanisms of trust – how they are created and what they accomplish are best understood with network data. An important finding for the current study is that they also found that peers' violent victimization decreased the likelihood that two individuals would continue to co-offend. This suggests that the risk of one's peers influences one's own decisions (Stafford and Warr, 1993).

In another example, Li and Liu (2016) found that there was a high level of homogeneity among offenders in Chinese drug trafficking networks, as they shared the same demographical and socioeconomic data. For the offenders in their study, "[c]o-offending served as a form of social exchange that provided them with not only appreciation, acceptance, information, and services but also the right and opportunity to share the profit" (p. 14). Gang violence tends to occur within racial groupings, which is also true for gang-related homicide (Papachristos, 2009). Using the concept of homophily which lends itself to the formation of racially homogenous groups, it makes sense then that gang rivalries would occur between homogenous individuals too (Gravel et al., 2016). In other words, homophilous processes can shape gang violence.

Malm, Bichler and Nash (2011) examined co-offending associations among criminal organizations in BC and found a high level of connectivity across groups and that distinct clusters of similar nodes in the same area were not evident. Nodes of various ethnicities were dispersed across the network and there was a lack of distinct, ethnically homogenous clusters. Groups tended to co-offend within their own group 45-55% of the time, which meant that there was a substantial amount of co-offending occurring across ethnic lines.

In regard to the current study, the underlying assumption is that individuals who are arrested or stopped by police together (1) have an affiliation and know each other and (2) engage in risky behavior together, in this case, illegal behavior. The study accounts for co-offending, as co-offending ties are one of the three types of ties examined when constructing the network. The network is built from victims and their associations in the police files, which include co-offending associations and the sharing of risky lifestyles. Co-offenders in this case are treated as having had pre-existing

relationships rather than as a point-in-time estimate of when the relationship formed (Green et al., 2017).

2.8. How Does Murder Happen?

Murder is an action, and does not occur randomly. It is best understood as an interaction between two people who likely know each other, and is ruled by patterns of social relations (Papachristos, 2009). What are these patterns and what kinds of social relations create murder? Gang murder does not abruptly culminate with the death of someone, as Papachristos (2009) describes, it will "persist in the organizational memory of the gang, which is governed by norms of retaliation and violent mechanisms of social control" (p. 76). Similarly, Papachristos et al. (2013) suggest prior conflicts drive future violence. This organizational memory is what promotes future violence. Murdering or attempting to murder has the ability to change gang dynamics and mold future moves of opposing gangs, and at times within the same gang. For some gangs, it can be a time to "step up their game and take over", while others may take the "wait and see" approach.

The concepts of power, dominance, status, rank, reputation, money and longevity are all at stake for gang members. The combination of a prior network structure and a competition for dominance predicts murder between gangs, especially when it comes to disputes over turf (Papachristos, 2009). Relationships within gang networks shape projected patterns of "conflict, collective action, and murder" (Papachristos, 2009, p. 76). Although an individual is the one ultimately responsible for pulling the trigger (Gravel et al., 2016), Papachristos (2009) argues that murder occurs within a larger network structure between factions, and it is the "structure that determines who kills whom" (p. 84). This is important, as one of the benefits of SNA is to analyze structure within a network rather than assume it (Morselli, 2009).

Murder within a gang context is not an isolated event; network structure, patterns, prior conflicts and a struggle for dominance all play a role in why murder occurs. In the Surrey gang conflict, the network structure and connections within are analyzed to explore how the conflict carries out, and who potential victims will be.

2.9. The Current Study

The current study uses a victim-centered lens to examine the 2015 Surrey gang conflict using SNA, to identify those individuals at the highest risk of gun victimization based on social proximity to victims. The current study maps the social environments of the 23 gang-involved victims of gun homicide/attempted homicide in 2015, in the City of Surrey, using police data from 2011 to 2015. These individuals were chosen as a starting point since the aim of the study is to identify those closest to victims for the purposes of intervention and prevention. The study's first objective is to assess the overall network structure, and specifically if the conflict can be described as a single network, if the victims are connected to each other and if subgroups form in the network.

To advance understanding of network structures and gang conflicts, the second objective is to assess centrality measures of those individuals in the network and to determine if specific individuals are more central than others. The study hypothesizes that those who are central and in close social proximity to victims of gun homicide and attempted homicide, will be at the highest risk of gun victimization. As a measure of overall importance, "average centrality" of victims and its relationship with victims' shooting sequences is determined, to understand the gang conflict that unravelled over a one-year period. In other words, the way violence spreads through interactions in the network is examined (Papachristos et al., 2015a; Papachristos et al., 2012; Papachristos et al., 2015b; Green et al., 2017) to ultimately improve violence prevention strategies and policies. Furthermore, individuals with two or more direct connections to victims are identified as the "high-risk group", which is at the highest risk of victimization. I explore what it is that makes someone more likely to be a victim in a gang context, from an attribute and network perspective.

Finally, the last objective explores the potential consequences of being central in victim network. To undertake this, those individuals from the network who were victims of gun homicide in 2016 and 2017 are identified to determine if social distance to 2015 victims is a predictor of future victimization. Strategic and policy implications are explored with a specific focus on policing highlighting the advantages of SNA with an overall goal of preventing and reducing gang violence, followed by a BC-specific discussion with reference to the study's findings. The approach used in the current study is a first step in using SNA in a Canadian context with a unique gang landscape to

explore a gang conflict in a young, growing and diverse city, which provides valuable information to reduce gun violence.

Chapter 3.

Data & Methods

Police departments have gradually begun using SNA for criminal intelligence and reviewing relations among individuals based on information retrieved from investigative work (Sparrow, 1991). The various methods and techniques available in SNA provide police officers and criminal analysts utility, as they have the possibility of identifying individuals most at risk of victimization within network structures. Using central positioning for the effective targeting of individuals is more valuable than traditional methods such as link analysis and will strengthen police's ability in making predictions for meaningful intervention (Berlusconi, Calderoni, Parolini, Verani & Piccardi, 2016; Bouchard and Malm, 2016). Enforcement strategies have the potential to become more "focused and nimble" (Papachristos, 2013, p. 55). However, SNA should not be used exclusively in such environments, as not every piece of data and considerations are used to conduct the analyses. SNA is best used in combination with existing police expertise from the field (Hashimi & Bouchard, 2017).

To construct the homicide victimization network in the current study, a list of all victims of gang-related homicides and/or attempted homicides in 2015, in the City of Surrey, BC, was obtained from the BC RCMP in "E" Division (n = 23). More specifically, using specific search parameters, a list[3] of gang related homicides and attempted homicides in Surrey was created by CFSEU-BC and verified by the "E" Division Criminal Analysis Section (EDCAS), both units working within RCMP "E" Division Headquarters. Furthermore, EDCAS worked in consultation with Operations Strategy Branch at "E" Division HQ to facilitate data access, transfer, collection and analysis. To formulate the list, CFSEU-BC identified a violent, targeted shooting event as "gang-related" whenever the victim or offender was linked to organized criminal activity within the City of Surrey,

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[3] The list can be qualified as 'conservative' as there are potentially other victims, which may not have met the threshold of being "gang related" by CFSEU-BC. Only those that were confirmed were included in the list of 23, however by no means is this an exhaustive figure. Constructing a network using police data produces a conservative measure of a person's network because the data recorded are what is known to police and what is recorded within police files (Papachristos et al., 2015b). There are likely other associates involved in the victims' network that have not come to the attention of police, which may overemphasize the importance of certain individuals.

BC. Research suggests that common factors used to define gang-related homicides can include the type of weapon used, the victim's relationship to the offender, and any association involving the victim or family members to an organized crime group or street gang (Jingfors et al., 2015).

For each of the 23 victims, EDCAS provided a date and time block of when the fatal/non-fatal gunshot occurred. The date and time blocks were estimations as they relied on when the shooting was phoned into or responded by police. For the 23 victims (n=23), 13% were murdered (n=3), while 87% were attempted homicide victims who survived (n=20).

Gangs in BC are policed by CFSEU-BC, which is an integrated unit made up of police officers from 13 different police agencies (CFSEU-BC, 2015b). CFSEU-BC's mandate is to "target, investigate, prosecute, disrupt and dismantle the organized crime groups and individuals that pose the highest risk to gang violence" (CFSEU-BC, 2015b).

The RCMP is an agency of the Ministry of Public Safety Canada. The BC RCMP provides municipal, provincial and federal policing in a wide array of areas ranging from First Nations communities, remote villages to major cities such as Surrey, BC. Surrey has the largest RCMP detachment in Canada (City of Surrey, 2020b). Permission to conduct this research was obtained from the RCMP's Data Release Committee, Surrey Detachment and the Simon Fraser University's (SFU) Research Ethics Board.

3.1. Data Source

The aim of the project is to build a database of all individuals connected to the 23 gang-related homicide/attempted homicide victims. In doing so, data from two official police databases was utilized: Police Records Information Management Environment of British Columbia (PRIME-BC) and Canadian Police Information Centre (CPIC). PRIME-BC is a multi-jurisdictional police records management and computer-aided dispatch system covering only the Province of BC, essentially allowing policing partners to view

an individual's police history in 'real time'. Anytime an individual has a police encounter[4] in BC, be it as a suspect, witness, complainant or victim, initiated either by an individual or by police, a record is created in PRIME-BC.

Each record or police file contains information inputted by the respective officer such as the incident date, file number, location, entities, offence in question and a brief synopsis outlining the nature and details of the interaction. Entities are those individuals, vehicles or businesses linked to the specific incident in question. Over time, once additional information is learned through investigative work, the assigned officer(s) is able to go back into the record to update information, as necessary. In addition to the aforementioned types of files, officers are also able to create "street check" files, which are generally pro-active in nature.

CPIC is a system operated by the Canadian Police Information (CPI) Centre under the stewardship of National Police Services, on behalf of the Canadian law enforcement community (Canadian Police Information Centre, 2020). CPIC provides crime-related information, and is the only national information-sharing system that connects criminal justice and police partners across Canada and internationally (Canadian Police Information Centre, 2020). Some of the information contained within CPIC includes criminal record file information such as conviction history, summary of police-related information (i.e. acquittal, stay of proceedings, charges withdrawn) and criminal record synopses.

3.2. Network Extractions: Associates & Ties

Beginning to construct a social network from police data requires making a decision of whom data will be collected around. A network must extend from a meaningful starting point(s), in this case victims of gun homicide or attempted homicide. Since the main objective of the current study is to determine who is at risk, based on closeness to gang-related homicide or attempted homicide victims, the co-offending

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[4] Caution is to be used when examining police encounters as a measure of an individual's criminal/violent nature. There can be many encounters that are non-criminal in nature, including a speeding ticket or a curfew check. Furthermore, uncooperative victims of homicide/attempted homicide may cause police to initiate contact even more so. Hashimi and Bouchard (2017) similarly found that many events analyzed in their study were of a non-criminal nature, and that at times the context and behavior were not criminal. One should not assume that all participants in the recorded police events are criminal (Bouchard, 2020).

network was built starting with 23 victims of gun homicide or attempted homicide related to organized crime in the City of Surrey, BC in 2015. As Bouchard (2020) asserts, "network composition will be shaped by the seeds from which it grew" (p. 457). It is important to note that although the starting point for this study is the victims of the 2015 gang conflict, in many cases the victims and the perpetrators are one in the same. News media coverage highlighted that in 2015 in the City of Surrey, there were 44 drive-by shootings, with approximately half of those shootings occurring in a span of 38 days (Thom, 2015). Initially characterized as being attributed to a "gang war" over turf between South Asian and Somalian males (Dhillon, 2015; Global News, 2015), this characterization was later disproven from what the network characteristics demonstrated.

To form ties from police files, Papachristos et al. (2015a) and Fujimoto and Valente's (2012) "affiliation exposure" models were utilized. These models convert two mode-affiliation (associates linked to common events) to a one-mode co-membership matrix (symmetric matrix linking victims and their associates based on common events). This process allows the structure of the network to be measured, specifically overall size, density, cohesion and the extent of overlap amongst the victims and their common associates.

The coding strategy selected for the current study was modeled closely to the one used in Hashimi and Bouchard (2017) where police directed the starting point to two targets, 'Thug' and 'Veteran', whose ego networks were constructed by querying all police interactions each of them had from 2006 to 2013. With the current study, an ego network for each of the 23 victims (or seeds) was constructed by querying all police files in the Lower Mainland district server within PRIME-BC based on associations to the victims. Each police event or incident from 2011 to 2015 was analyzed for each of the 23 victims.

Based on the research agreement I had with the RCMP, only those events that were from an RCMP detachment or specialized unit (such as CFSEU-BC or Provincial Traffic Services) in the Lower Mainland district PRIME server relating to the 23 victims were included for analysis, while events created by independent police departments such as Vancouver Police Department and Delta Police Department were excluded. The other servers in PRIME-BC (North, Southeast, Island District and CFSEU-BC) were not

used for the analyses, meaning that if the 23 victims had files in other parts of BC such as Prince George, Kelowna or Victoria, this information was omitted from analysis. Furthermore, files from other provinces and territories in Canada were also not included in the current study. The fact that only the Lower Mainland server in BC was used in the current study is a limitation, as there may be valuable police-related data in the other servers (and other provincial/territorial databases) pertaining to the mobility of 23 victims and associations across the country. Thus, a complete police interaction picture is not achieved. Moreover, according to the *Youth Criminal Justice Act* (2002), an individual that is 18 years of age is considered an adult. Thus, those events where the victim was under 18 years of age were also excluded.

Only those events where the victim was in the presence of at least one other associate and where an actual tie or link could be established were captured. In other words, if an event listed the victim as the only entity, these files were omitted since there were no associations or links to be made. In the case where an associate was absent, an affirmation had to be made as to the associate's involvement for the event to be included in the analysis.

Utilizing a systematic approach, the same rules were applied to each victim to ensure consistency. For instance, beginning with victim 1, from 2011 to 2015, every police event and the associated pages were analyzed. An event on PRIME-BC can have multiple pages, authored by multiple officers. The details of the event were reviewed to extract entities or individuals involved and to learn the context and circumstances behind why an event was created. If an association was evident, then this information was documented. For instance, in Figure 1, Victim 1 is the starting point in constructing the network. All of Victim 1's events in PRIME-BC from 2011 to 2015 were examined. Associates A to D were all listed as entities in the various event files for Victim 1. Meaning, they were checked by police with Victim 1 at least once from 2011 to 2015. If during a police stop Associate C was driving Victim 1 and Associate D, there is an assumption that all parties knew each other, hence the link between Associate C and D in Figure 1.
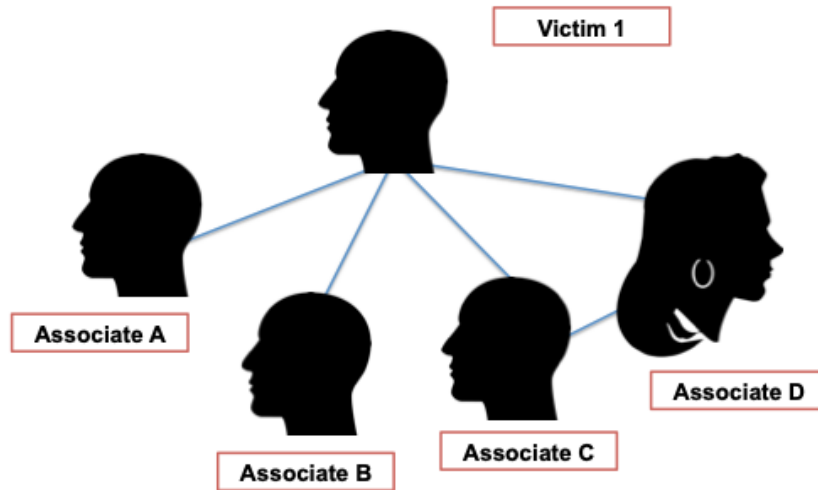
Figure 1.   **Constructing the Network From Associations in Police Files**

Figure 2 illustrates the ego network of the victim N1742 (red node at the centre). The ties between victim N1742 and his associates are evident via grey lines. The ties came from file(s) that were analyzed in PRIME-BC. Of note, one of N1742's ties is with another victim, N1664 (red node to the far left).
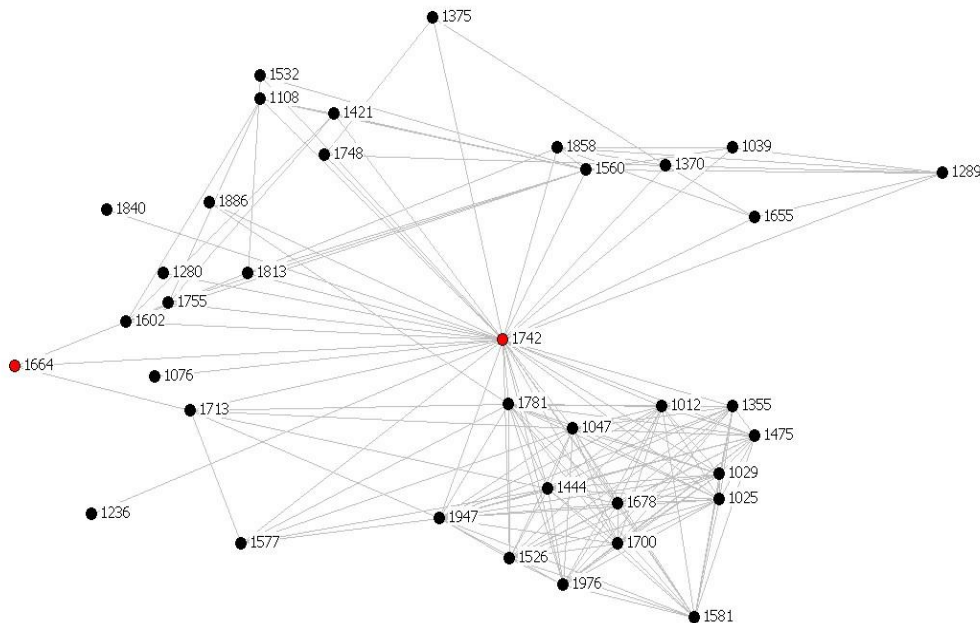
Figure 2.   **Example of Ego Network of N1742 and His Associates (n=37)**

The details from each victim and their associations were used to create an edgelist. An edgelist format is a set of rows, each one identifying two nodes (or individuals) and the type of tie or connection they share (Hanneman & Riddle, 2005). In the current study, the edgelist contained the 23 victims and who they were linked with in police files from 2011 to 2015. The edgelist contained 355 individuals and 1,246 ties. Additionally, the edgelist captured the type of tie between the two individuals (i.e. social, criminal conflict or co-offending), whether the social interaction was of a positive or negative nature, whether the two individuals shared a familial tie, the date of the interaction, the location of the interaction, the city the interaction took place in, the type of criminal activity involved (if any), whether both individuals were physically present and whether the event occurred before or after the victim's shooting. The edgelist was dichotomized and symmetrized to generate a binary file from a multiplex network.

As aforementioned, there were three types of ties that individuals within the network could have shared: social, criminal conflict or co-offending. All ties were labeled as social ties, which were defined as events where no criminal conflict was present with another individual and no offence was committed with another individual. A social tie could have been negative in nature, or non-negative (positive). The second type of tie that could exist between individuals was a criminal conflict tie, in which a conflict existed between individuals. The conflict could have played out through gun violence or by other means such as assault or threats. The last type of tie, a co-offending tie, was where a criminal offence was committed between individuals. For instance, if individuals were fleeing from police, or were found in a vehicle together where police located cocaine, then this constituted co-offending. Co-offending is not the same as having criminal acquaintances or friends, as one can associate with offenders but still not co-offend themselves (Weerman, 2003). An offence had to have been observed. All types of ties were 'unweighted', meaning there was no indication of the strength of the tie or relationship or when such relationship formed. While some individuals in the network may have deep-rooted and lengthy relationships (Warr, 2002) with each other, others may have loose and temporary associations. Unfortunately, the data available from PRIME-BC does not allow precise coding on the strength of each relationship.

Table 1.   **Types of Ties Broken Down by Victims and Non-Victims**

	Social Ties	Criminal Conflict Ties	Co-offending Ties
Number of Victims (n=23)	23 (100%)	7 (30%)	19 (83%)
Number of Non-Victims (n=332)	325 (98%)	16 (5%)	68 (20%)

As indicated by the Table 1, all 23 of the victims had social ties. Additionally, 325 of the 332 non-victims (98%) had social ties in the network. Of all three types of ties, social ties were the most common. With respect to criminal conflict ties, seven of the 23 victims (30%) had criminal conflict ties, while 16 out of the 332 (five percent) non-victims had criminal conflict ties. Generally, criminal conflict ties were more common among victims than non-victims. Lastly, 19 of the 23 victims (83%) had co-offending ties, whereas 68 of the 332 (20%) non-victims had co-offending ties. A much larger proportion of victims had co-offending ties compared to non-victims.

The nature of the ties derived from police interactions varied from being brief and inconsequential, to lengthy and detail-oriented. Given the noted discretion that police officers have in capturing their interactions (Crank, 2014), it is logical that the nature of the ties would vary. Victims could have been linked to individuals through various means, some of which include:

     a) In social settings that may not have been criminal in nature (i.e. in a restaurant or bars/clubs). The linking of individuals in social settings that may or may not be criminal in nature is noteworthy, as it relates to the "spreading" of violence from gang members to non-gang members, a concept explored previously (Papachristos et al., 2015b).

     b) In the context of a criminal investigation where ties were established based on encounters with police.

     c) In car-related events, where associates were stopped together in a car based on a license plate check initiated by police.

Through the data collection process, there were some incidents where not all entities were carded to a specific file, however, through further inquiries and checks many of these individuals were identified either by analyzing subsequent events, or confirming their identity through other details such as date of birth. Much of this can be attributed to missing information where police officers did not complete all the necessary

steps in a police file such as confirming and validating personal details including date of birth or identifying and linking all entities to a particular file. If certain police files contained incomplete information for entities where identities could not be validated, then those entities were not included in the analysis. For example, if a victim had a tie with a person only carded as "Simon", with no last name or other identifying information, then no tie was recorded.

Other incidents where individuals may have been connected included where a lone individual was pulled over by police in a vehicle that was registered to another individual. If the registered owner of the vehicle was not physically present, then they were not included. As was the case if an absent individual's fingerprints were found at the scene, then they were also not included. Furthermore, there were some police events that were "large scale" in nature, involving numerous entities. For example, when the victim in question was in attendance at a high-profile gang member's funeral where hundreds of individuals could have been carded to a single file, an assumption was not made that the victim was someone connected to everyone else carded to the file. There had to have been a declaration, or another key piece of information to establish the linkage between the victim and others. Other scenarios where researcher discretion was used was for co-offending ties. In such cases, co-offending was only established as a tie where the offence was serious in nature. For instance, where marijuana residue was found in a vehicle, or the smell of marijuana was present in a vehicle without actual marijuana found, these incidents were not classified as "co-offending". Co-offending incidents that were "serious" in nature included weapons-related offences, causing a disturbance, "hard drug" related offences and attempted murder.

The data was 'cleaned' through several processes. Once all events were added to the edgelist, and the attributes of those individuals were collected, a thorough check was completed to ensure that each event was only counted once, despite multiple police agencies/units attending (i.e. CFSEU-BC has one file for an event, and Surrey Detachment has another file for the same event). Another step in the 'cleaning' process involved ensuring that an event was only captured one time, despite it coming up for more than one victim (i.e. if at least two victims were involved in the same file).

3.3. Associate Attributes

To maximize our understanding of relationships between individuals in a network, in addition to assessing structural properties, it is also essential to examine attribute information for individuals. Attributes of individuals can provide contextual information so that the social environments of those in the networks could be better understood. PRIME-BC was used to extract the type of tie between victims and their associates and individual-level attribute information, as outlined in Table 2.

Table 2.   Attribute Information Extracted from PRIME-BC

Attributes
Whether individual was victim of gun homicide or attempted homicide in 2015
If 2015 victim, whether the shooting resulted in attempted murder or murder
If 2015 victim, date of shooting
If 2015 victim, time block of shooting
Age
Sex
Ethnicity
City of Residence
Total PRIME-BC Events (2011-2015)
Whether individual had any police cautions on their file (i.e. Armed & Dangerous, Escape Risk, Violent, Mental Health/Suicidal)
Gang Membership
Gang Type
Number of Charges
Whether individual was a victim of gun homicide or attempted homicide in 2016
If 2016 victim, whether the shooting resulted in attempted murder or murder
Whether individual was a victim of gun homicide or attempted homicide in 2017
If 2017 victim, whether the shooting resulted in attempted murder or murder
Whether individual was given a Duty to Warn notification from police during 2013-2017

In order to understand the criminality/violence profile[5] of individuals in the network, other key pieces of information were collected from CPIC as outlined in Table 3 below.

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[5] The violence profiles were formulated based on what is collected in police databases, and may not fully reflect the true violent nature of an individual.

Table 3.   Attribute Information Extracted from CPIC

Violence Profile Attributes
Criminal Record
Firearms Interest to Police (FIP) status
Firearms Prohibition status
Number of convictions until end of 2015
Number of charges until end of 2015
Date of first conviction
Nature of Conviction (i.e. Violence, Drugs, Property, Administrative)
Summary of Police Information (i.e. Violence, Drugs, Property, Administrative)

With respect to those attributes collected from CPIC, an individual's criminal record will list convictions and the date of those convictions. CPIC also details any pending charges and all previous charges (all those that have not been purged) that led to an acquittal or stay of proceedings. A firearms status on CPIC can fall under two categories: "FIP", or "Firearms Prohibition". A FIP indicator is where an individual may be of interest to firearms officers. The indicator is automatically added to or removed from CPIC as a result of a link between an individual's PRIME offence codes and an individual's PRIME entity codes. If a FIP indicator is present on an individual's file, firearms officers at the RCMP Canadian Firearms Program are alerted to closely examine the individual in question, and their eligibility for a firearm or firearms license.

A FIP indicator will be added to CPIC if the following criteria are met:

- If any offence code is related to Violence, Abuse, Drugs, Breaching (anything), Mental Health, Firearms and/or Robbery

- If any entity's role is one of Charged, Recommend Charges, Suspect, Suspect Chargeable, Emotionally Disturbed Person, Lookout and/or Applicant

A "Firearms Prohibited" indicator is where an individual is prohibited from carrying a firearm. This specific indicator may carry an expiry date or be indefinite. With respect to the nature of one's conviction or summary of police information, violent offences included those such as assault with a weapon and homicide, drug-related offences included those such as possession and possession for the purposes of trafficking, property related offences included theft and administrative offences included those such as breaching a court-ordered condition.

3.4. Network Measurements & Individual-Level Measurements

The following section identifies the network-level measurements and individual-level measurements that were utilized in the current study.

3.4.1. Network Measurements

For the current study, visuals and measures were computed using UCINET 6.660 and Netdraw version 2.164 (Borgatti, Everett & Freeman, 2002). Several network-level measurements are used to describe the network, including density, clustering coefficient, average degree and centralization. *Density* refers to how connected a network is and is expressed by the total number of actual ties in a network divided by the total number of potential ties within that particular network (Wasserman & Faust, 1994). Density reflects the overall intensity of the connected actors: the more connected the network, the greater the density. A dense network will have lot of activity or a larger number of ties existing between individuals. Density takes into account the network's entire composition, allowing a deeper understanding about the connections of those in the network. Additionally, a dense network will mean that information will spread with more speed, as there are more pathways for information to travel. Density also signifies the extent to which actors have high levels of social capital and/or social constraint. A tie between two actors represents the presence of social activity, be it of a social or criminal nature.

The *clustering coefficient* assesses the distribution of density across actors. The overall clustering coefficient is calculated by first measuring the density of ties in each node's ego network (*individual clustering coefficient*), which are then averaged across all nodes to obtain the *overall clustering coefficient* (Watts & Strogatz, 1998; Borgatti, et al., 2013). The idea of clustering coefficient[6] is generally, the tendency for individuals to form clusters around them. A small clustering coefficient suggests that clusters are unlikely to occur, whereas a high clustering coefficient demonstrates that the actors have "close collaboration and efficient communication" (Iwanski & Frank, 2014, p. 54).

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[6] Hanneman & Riddle (2005) define the overall graph-clustering coefficient as the average of the densities of the clusters of all actors.

Average degree indicates on average, how many individuals, individuals know. Average degree is not as influenced by size as density is. The average degree also gives an overview of how cohesive the network is. Most individuals in the main component (largest component in the overall network) know 5.40 other actors.

Centralization is a property of the network as a whole (Freeman, 1978; Hanneman & Riddle, 2005) and measures the extent to which direct connectivity in a network is concentrated or dominated by a single node. The main component in this network had a degree centralization score of 0.119, or 11.9%. One can expect centralization to be generally high in co-offending networks because the network is contingent on ties to the victims of the Surrey gang conflict.

3.4.2. Individual-Level Measures: Centrality of Actors

In this analysis, four normalized network measures were utilized: degree, betweenness, closeness and eigenvector centrality. Freeman's (1978) research introduced the theoretical underpinnings for degree, betweenness, closeness and eigenvector centrality. *Degree centrality* reflects the number of connections an actor has, essentially, the extent to which an actor is "in the thick of things" (Freeman, 1978; Wasserman & Faust, 1994). In a gang or criminal organization context, individuals with many connections are important to examine, especially as it relates to an increased risk of being victimized. A high degree centrality, having many direct contacts, may reveal an individual who is active in a particular gang behavior, such as drug dealing (Papachristos, 2006). As previously mentioned, violence attributed to drug conflicts was a central feature of the current study. Victimization can be experienced at the hands of customers, allies, police and enemies. As an individual involved in street-level drug dealing, the customer base one establishes and maintains, the allies one uses to move ahead in the gang or criminal organization (McCuish et al., 2015), the targeting one experiences from police, the enemies one forms, all contribute to importance, thus impacting victimization. Morselli (2010) suggested "visible" individuals have a higher risk of detection from police and their enemies, which increases their vulnerability, and thus possibly making them susceptible to victimization. Although a position of prominence or prestige may seem desirable to co-offenders in the network, it ultimately means that these individuals are more at risk of coming into harm's way. Those individuals more

entrenched in the inner workings of the criminal world (i.e. those more embedded) face a heightened risk of victimization.

An actor can be central because he/she has many contacts (degree centrality), whereas someone else may have few contacts but is still considered important because he/she is the connection between others that may not be tied to one another (Morselli, 2010; Papachristos, 2006; Wasserman and Faust, 1994). *Betweenness centrality* can be a powerful measure in its own right, as it counts the number of times a node lies on a geodesic or shortest path, between two other nodes (Freeman, 1978). An actor scoring high on betweenness centrality functions as the "'quickest bridge' connection" by way of the shortest path between other actors (van der Hulst, 2009, p. 107). These particular actors are powerful in that they ensure core business operations are completed and they "have the ability to isolate, influence, manipulate or prevent contact between other parties" (van der Hulst, 2009, p. 107). In other words, those with more of a "quality based set of contacts" can be characterized as having high betweenness centrality (Morselli, 2010, p. 384).

In addition to considering the degree and betweenness centrality measures individually, it is beneficial to combine them to understand the combined ways in which individuals contribute in the network. Schwartz and Rouselle (2009), who built on Borgatti's (2006) key player approach, incorporated the relative strength of actors as well as the relationships between actors and labeled this combination as "network capital". Taking this approach one step further, Westlake, Bouchard and Frank (2011) used network capital to identify key players in child exploitation networks, merging both connectivity and severity as a measurement of network capital. Further building on Westlake et al.'s (2012) contribution, Hashimi and Bouchard (2017) utilized network capital in the context of modern police targeting processes. In proposing a target prioritization framework, Hashimi and Bouchard (2017) used network capital to rank members of a network, complementing two investigative tactics to focus police efforts on more strategic targets.

Closeness centrality examines the distance of an actor to all others in a network by paying particular attention to the distance from each actor to all others (Freeman, 1978; Hanneman & Riddle, 2005). Distance from other actors is essential for understanding the opportunities or constraints that one may experience as a result of

their position. Geodesic distance is the number of relations in the shortest possible walk from one actor to another, often the "optimal" or most "efficient" connection between two actors. If two actors are adjacent, the distance between them is one (meaning it takes one step for a signal to be passed from the source to the receiver). An individual may have many connections that provide opportunity and limitations, however only some of these ties may be of significance. Fewer path lengths may mean efficiency and less difficulties or vulnerabilities in a criminal context. Alternatively, longer path lengths may indicate longer time for information to diffuse across a network, or that actors are generally disconnected from each other. In the current study, I hypothesize that fewer path lengths to a previous victim indicates an increased risk of future gun victimization.

Eigenvector centrality, similar to degree centrality, measures a node's influence, and how connected a node is to other well-connected nodes (Bonacich, 1972). Eigenvector centrality takes into account the connectedness of other nodes in the network, highlighting strategically connected individuals. For instance, Bouchard and Konarski (2014) used eigenvector centrality to determine "core" members, as opposed to just any type of affiliation to the 856 gang in their study.

Differentiating between various centrality measures provides readers with an insight into the various roles nodes can play in a network. However, several studies have frequently combined centrality measures for the purpose of identifying the most important or influential nodes (Abbasi & Hossain, 2013; Fei & Deng, 2017). Abbasi and Hossain (2013) developed hybrid (combined) centrality measures (i.e. degree, closeness and betweenness) and found that they were good measures to demonstrate the importance of an actor in a network. Similarly, Fei & Deng (2017) acknowledged that many existing studies only focus on a single measure. In their study, they combined the advantages of existing centrality measures for sorting nodes in a complex network. The research done by Iacobucci, McBride, Popovich & Rouziou (2017) examined the same four centrality measures in the current study to understand the extent to which conceptual differences were produced in variances in empirical performance. They found that the four centrality measures were highly correlated, suggesting the results provided similar information about actors in their network, however emphasizing that they did not diminish conceptual distinctions. Instead, they suggested that their findings demonstrated "robustness", providing similar information about nodes' positions in the network. Generally, most networks have a specific set of nodes that have either high or

low scores across centrality measures. Despite having theoretical and distinctive differences, different centrality measures may behave similarly in a real network, and in the real world. In the current study, this similarity is captured with a new network measure called *"average centrality",* which takes the average of the four centrality measures: degree, betweenness, closeness and eigenvector centrality. The current study proposes average centrality as an overall, general network measure of importance/critical positions in the network.

3.5. Co-offending Network

Dial-a-doping is the prominent method in which drugs are sold in the Lower Mainland, especially among lower-level groups (Airola & Bouchard, 2020; Illegal Firearms Task Force, 2017) and provides some context as to the environments that victims operate in. Drugs are available through a phone call 24/7, which suggests that there is likely several individuals involved in the operation, working shifts to ensure coverage and individuals involved in making and packaging drugs. Given that drug trafficking and gangs are prominent features of the landscape in which the 2015 Surrey gang conflict played out, the most common type of network for these features is a co-offending network. Furthermore, given that serious offences are often committed by more than one person (Weerman, 2003) and that the current study's network is constructed from homicide/attempted homicide victims, constructing a co-offending network was most appropriate.

Co-offending is defined as the perpetuation of an offence by more than one person (Weerman, 2003). For the current study, a co-offending network was created by linking individuals through police records for a five-year period, January 1st, 2011 to December 31st, 2015. The approach used was similar to the one used by Papachristos and Wildeman (2014) and Hashimi and Bouchard (2017), where police records were used to determine network ties between two individuals. As a starting point, a list of the homicide/attempted homicide victims in 2015, from the City of Surrey was obtained from CFSEU-BC. Then, beginning with each of the 23 victims, every police incident or event from 2011 to 2015 was analyzed to establish possible ties. The resulting network contained 355 unique individuals and 1,246 ties, where individuals had a co-offending tie to at least one other person arrested during the study period.

To form ties from police files, Papachristos et al. (2015a) and Fujimoto and Valente's (2012) "affiliation exposure" models were utilized. These models convert two-mode affiliation (associates linked to common events) to a one-mode co-membership matrix (symmetric matrix linking victims and their associates based on common events). This process allows the structure of the network to be measured, specifically overall size, density, cohesion and the extent of overlap amongst the victims and their common associates.

3.6. Subgroup Analyses

Two different data reduction techniques were run to ascertain if there were natural subgroups or community structures that formed in the full network: Girvan and Newman and faction analysis[7]. The Girvan and Newman algorithm identifies cohesive communities by applying Freeman's notion of betweenness centrality to all edges in a network (Girvan & Newman, 2002). With this particular technique, the larger the Q, the better the fit. The Girvan and Newman technique searches for edges that separate nodes.

In faction analysis, an algorithm is used to best fit the actors into groupings and then it measures how best this fit is (Borgatti, Everett & Johnson, 2013). Fitness in faction analysis[8] using 'speed' provides the number representing the amount of errors found in the group solution. With faction analysis, the larger the fitness, the more errors that are present. Errors will account for how many connections are present that are not in a cluster. Faction analysis looks for subgroups that are highly connected between the factions, and not connected to others outside (Hanneman & Riddle, 2005). Faction analysis creates a division, and forces a solution with each actor belonging to one faction, and one faction only (Borgatti et al., 2013).

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[7] See Appendix A for fitness values for Faction Analysis and Q values for Girvan and Newman technique.

[8] Fitness in faction analysis using speed indicates the number representing the amount of errors found in the group solution. The larger the fitness, the more errors that are present. Errors will account for how many connections are present that are not in a cluster. In faction analysis, an algorithm is used to best fit the actors into groups, and then measures how best this fit is (Borgatti et al., 2013, p. 191). Faction analysis looks for sub-groups that are highly connected between the factions, and not connected to others outside (Hanneman & Riddle, 2005). Faction analysis creates a division, and it forces a solution with each actors belonging to one faction, and one faction only (Borgatti et al., 2013, p. 191). According to the faction analysis run, the best fit indicated seven groupings.

The assumption is that networks will naturally divide themselves into subgroups or clusters. These subgroups may present social groups or homogenous cliques where members may be more likely to interact, spend time with one another and possibly engage in risky behavior such as committing crimes. Usually, most people interact with a small set of others, many of whom know or are familiar with one another (Hanneman & Riddle, 2005). The natural clustering that occurs may be indicative of shared attributes, attitudes or membership which make up social structure.

Westlake and Bouchard (2016) analyzed over 4.8 million webpages and mapped the hyperlink networks surrounding child sexual exploitation websites to determine website characteristics that comprised child sexual exploitation related communities. The community detection methods utilized to identify cohesive subgroupings that comprised a larger network of websites included Girvan and Newman along with the faction analysis algorithm. Ultimately, Girvan and Newman was less adept at handling directed networks and factional analysis was chosen as the method. Furthermore, Ouellet and Bouchard (2018) applied a number of community network detection algorithms to detect groupings of offenders; and ultimately decided on Girvan and Newman as it provided the highest modularity score and greatest face validity with the data. Both community detection methods have demonstrated usefulness in identifying subgroupings that allow data to be interpreted in a more meaningful and focused manner.

3.7. Analytic Strategy

The current study hypothesizes that greater exposure and closeness to previous homicide victims in one's social network increases one's own risk of victimization. This can be conceived as social distance (i.e. how many steps removed one is from a homicide or attempted homicide victim). The underlying assumption is that individuals who are arrested or stopped by police together (1) have an affiliation and know each other and (2) engage in risky behavior together, in this case, illegal behavior. Co-offenders in this case are treated as having had pre-existing relationships rather than as a point-in-time estimate of when the relationship formed (Green et al., 2017).

1) Assessing the overall structure

- The overall structure of the full network is explored. The network structure will reveal if the Surrey conflict can be described as a single network and if the victims are connected to each other.

- Part of exploring the overall structure also involves determining if naturally formed subgroups emerge using the Girvan and Newman method, and assessing if subgroups have unique characteristics.

- The attribute information of those in the network is assessed, specifically demographic information and violence/crime profiles.

2) Analyzing the individuals within the network

- The social environments of the individuals in the network are analyzed to identify central victims and non-victims using degree, betweenness, closeness, eigenvector and average centrality. These analyses are undertaken, based on the hypothesis that the most central individuals will be at the highest risk of gunshot victimization from a social distance/proximity standpoint. Centrality analyses are conducted to determine if some individuals are more central than others.

- I run a Spearman's rank order correlation to determine if there is a relationship between the victims' shooting sequence and their average centrality measures. This analysis will allow a deeper understanding into the conflict and connectedness of the network.

- Individuals with two or more direct connections to 2015 victims are highlighted, allowing the identification of a "high-risk group" that is at the highest risk of gun victimization. I then examine the demographic and violence profile of the high-risk group, and run Independent T-Tests to determine if differences between both groups exist.

3) Exploring the potential consequences of being central in the victim network

- Individuals in the main component who were victims of homicide/attempted homicide in 2016 and 2017 are identified, along with their demographic and violence profiles. A centrality analyses is run for the 2016 and 2017 victims.

- Lastly, I run Independent T-Tests to determine if social distance to 2015 victims is associated with victimization in 2016 and 2017.

Chapter 4.

Results

4.1. Assessing the Overall Structure

The current study aims to capitalize on the social embeddedness of gang-related shootings in order to understand the risk of gunshot victimization from a social distance/proximity standpoint. To do this, I first begin by exploring the overall structure of the network, including examining network characteristics. Additionally, I determine if the Surrey conflict can be described as a single network, and if the victims are connected to each other. Furthermore, I assess the structure to determine if there are subgroups that formed, including any unique characteristics of subgroups. Finally, I examine the attributes of those individuals in the network, including demographic information and violence/crime profiles.

4.1.1. Network Structure: Full Network & Main Component

Full Network

Overall, 1,246 queried events were analyzed for 23 victims. Extracted from the 1,246 events were 355 individuals in the full network (including the 23 victims) and 1,163 ties among the individuals in the network.

Figure 3.   Network Structure of Full Network (n=355)

Figure 3 provides a visual representation of the full network in the Surrey gang conflict of 2015. The density of the full network is 0.007, meaning 0.7% of all possible ties are present. The low density is expected, since the network contains full information on only 23 of the 355 individuals. Upon visual inspection, two key observations are evident. There is a larger, connected main component to the bottom right and there are several smaller clusters towards the periphery in the upper left corner.

Main Component

Figure 4 provides a visual representation of the main component in the 2015 Surrey gang conflict network. The main component contains 299 nodes and 840 ties. The 18 victims are depicted in red, with their unique node numbers (i.e. N1742). The main component has a slightly higher density than the full network at 0.009[9] (or 0.9% of all possible ties present).

When exploring the degree to which clustering occurs in a network, it is important to compare the clustering coefficient to the overall density, as it measures the degree to

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[9] Similarly, the main component in Bouchard, Hashimi, Tsai, Lampkin and Jozaghi's (2018) network had a density of 0.011 (1.1% of all possible ties are present). To construct the network, every respondent named up to 10 of his or her contacts.

which nodes in a network tend to cluster together. Because the overall density was relatively low (0.7%), one would also expect the densities of the "clusters" to be low (Hanneman & Riddle, 2005). The clustering coefficient for the full network is 0.438 (43.8%), while the main component has an overall clustering coefficient of 0.446 (44.6%). The clustering coefficient in the current study appears to be relatively low compared to similar studies (Morselli, 2009; Ouellet & Bouchard, 2018; Wood, 2017) [10][11][12]. Network characteristics broken down for the full network and main component can be found in Table 4.

Table 4.   **Network Characteristics of Full Network and Main Component**

	Full Network	Main Component
Nodes	355	299
No. of Ties	1,163	840
Density	0.007	0.009
No. of Victims	23	18
Clustering Coefficient	0.438	0.446

Now that the overall structure has been assessed, specifically examining the full network and the main component, some key questions arise: *Can the Surrey conflict be described as a single network? Were victims connected?*

The study's first major finding is that 299 of the 355 individuals (84.2%) in the full network are connected to each other, including 18 of the 23[13] victims (78.3%), providing a sense that the 2015 conflict was one where shooting victims/perpetrators likely knew each other. These 18 victims have the most connections, indicating a level of importance. As mentioned, mapping the networks of each victim created the network.

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[10] Morselli (2009) compared clustering coefficients between Bo-Gars members and the remaining gang and non-gang participants in the network and found that non-gang members had a high clustering coefficient (61%), followed closely by members of the smaller gangs (other gangs, 58%), while Bo-Gars members were significantly lower in their clustering patterns (35%).

[11] Ouellet & Bouchard (2018) found that the Toronto 18 network in their study had a clustering coefficient of 0.74 (74%), while the Toronto 40 network had a clustering coefficient of 0.54 (54%).

[12] Wood (2017) analyzed the structure of a heroin trafficking network and found that it exhibited a large local clustering coefficient (80.1%), indicating that most traffickers are members of complete triadic structures. Additionally, the high clustering coefficient implies that approximately 80% of connected trafficker pairs share at least one mutual collaborator. Trafficking networks, Wood (2017) suggests are highly cliquish and that mutual partners may play a key role in brokering new collaborative relationships.

[13] Five victims and their networks were not connected to anyone else in the full network. All five victims and their networks were removed to facilitate network measurements and interpretations.

The fact that 18 of the victims are connected to each other, is an unexpected research finding. These findings serve as justification for the decision to conduct all results and analyses using only the main component from this point onwards. Furthermore, focusing on the main, connected component will allow for a more focused analyses and a richer understanding of the victims' social environments and the conflict that played out.
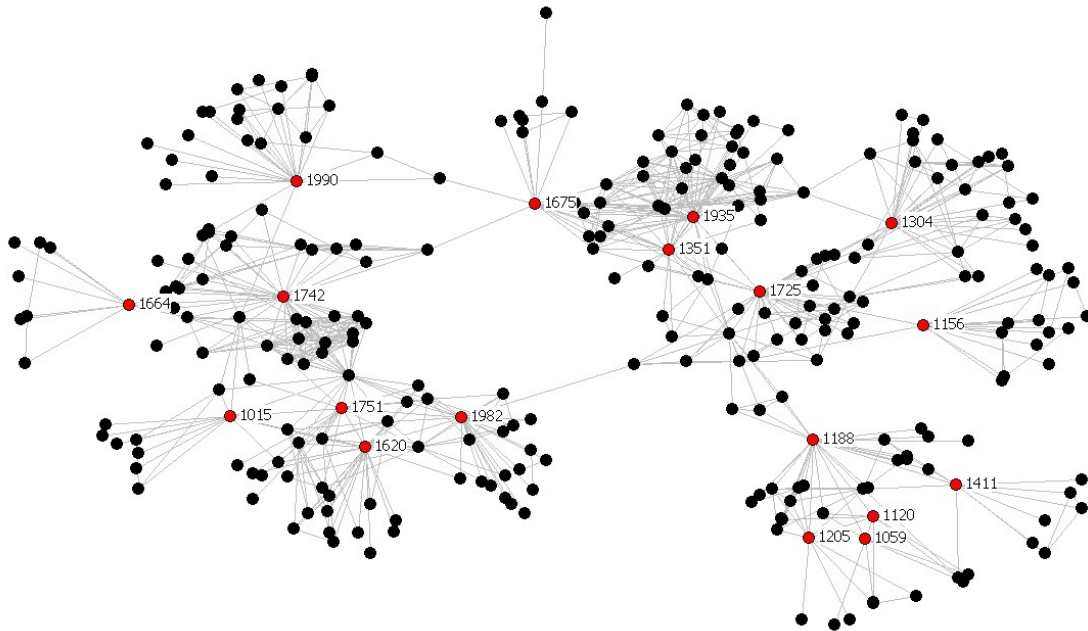
Figure 4. **Network Structure of Main Component (n=299) with Victims Identified in Red (n=18)**

Looking closer at the main component, the conflict is perceived to be a two-faction conflict with seven victims on the left side and 11 victims on the right side. At the time of the conflict, the media portrayed the gang conflict as a two-sided turf war (Dhillon, 2015), which is confirmed by the network structure. The detached components in the full network contain five of the victims who were likely not involved in the conflict.

4.1.2. Subgroups in the Main Component of the 2015 Surrey Gang Conflict

Assessing the overall structure of the network will allow police to understand fragments or clusters, the overall picture and social environment of the victims. Techniques that detect community structures identify cohesive subgroups, with the underlying assumption that those in the subgroup assume a level of homophily and

behavior. The assumption is that individuals in the same subgroup are more likely to interact with each other as opposed to the larger network.

To ascertain an understanding of subgroups and natural clusters in the victim-based network, the Girvan and Newman method was chosen as the best fit[14]. The information shows that there is a peak at the Q value of 0.78 (10 clusters); however, the eight-subgroup solution satisfied the criteria of face value validity and parsimony, hence why Girvan and Newman was chosen as the data reduction technique for the current study. In the current study, the eight-subgroup solution was used for analysis. However, the eight-subgroup solution took all but one individual. Subgroup eight, consisting of a single node, was removed from the analysis[15], leaving seven subgroups that were analyzed.

While running the various iterations, it was found that a seven-subgroup solution also contained a single node as a subgroup, and combined two subgroups that should have been examined independently given their characters, thus the decision was made to consider eight subgroups to describe the network, with the eighth, single node removed.

Using the Girvan and Newman technique, the visual depiction in Figure 5 shows seven subgroups used in the analysis. Upon first inspection, it is obvious that there are two larger clusters, one to the left and the other to the right. The cluster on the left has three subgroups within, while the larger cluster on the right contains four subgroups. The larger nodes in the visual below represent the 18 victims. As expected, some of the clusters form around the victims as the network was formed from their police interactions; however not all victims have their own clusters. The victims' networks overlap into multiple communities. For instance, subgroup six in Figure 5 is a community which includes three victims: N1935, N1351 and N1675.

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[14] See Appendix A for detailed Q values for two to 20 clusters.

[15] Subgroup 8 consisted of a single node (N1405) and was a South Asian female whose only two connections are with two other victims, both of whom belong to two different subgroups, one and sex. The female is 22 years old (close in age to the victims), with limited crime/violence indicators.

Figure 5.   **Network Structure of Main Component by Girvan & Newman Community Membership (Seven Subgroups)**

Legend:
- subgrp 1
- subgrp 2
- subgrp 3
- subgrp 4
- subgrp 5
- subgrp 6
- subgrp 7
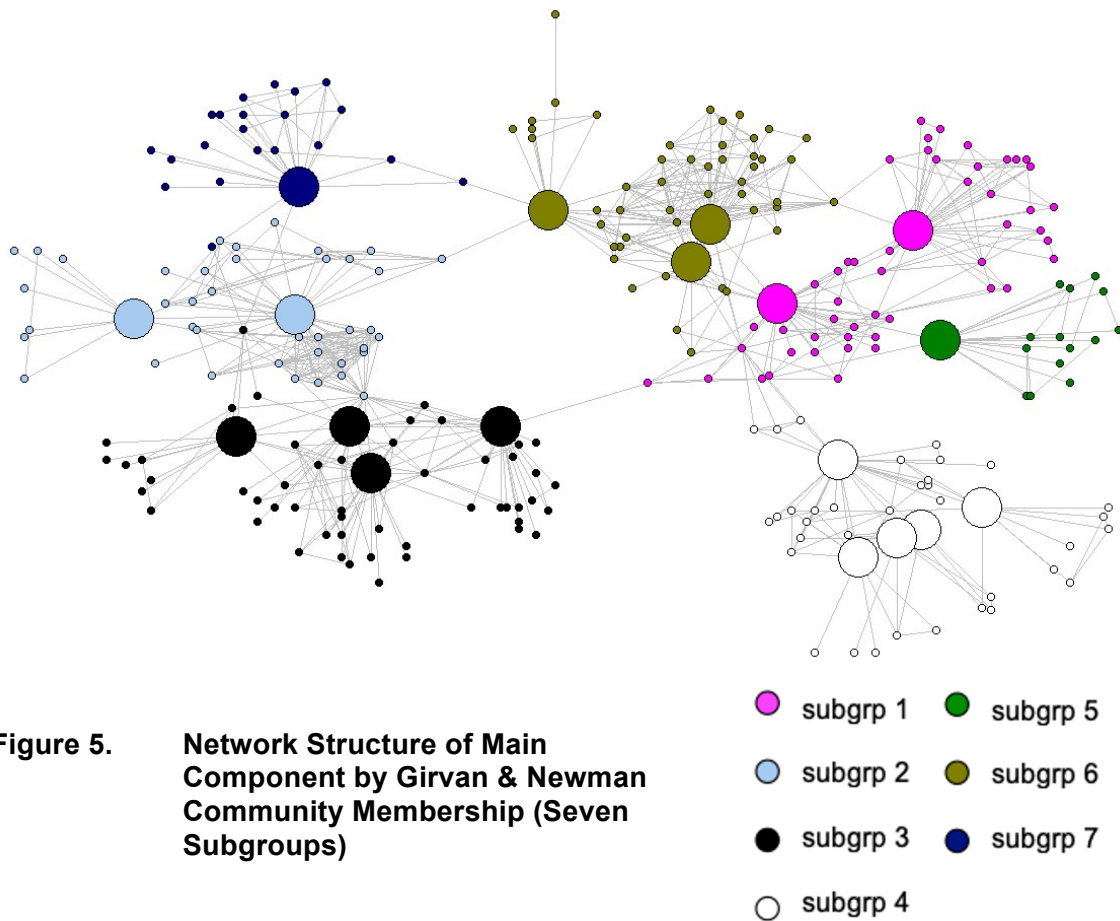
In order to understand the character of each subgroup, the attributes of the members within are summarized in Table 5. Carefully analyzing the columns for each subgroup provides a quick understanding into their character.

Table 5.   **Attribute Information of Members in Each Subgroup**

	1	2	3	4	5	6	7
N	54	46	57	46	16	54	25
No. of Ties	128	180	133	89	24	200	46
Density	4.5	8.7	4.2	4.3	10.0	7.0	7.7
Proportion of Victims	3.7	4.3	7.0	10.9	6.3	5.6	4.0
Mean Age 2015	25	27	29	25	25	25	25
Race							
South Asian	85.2	89.1	86.0	87.0	81.3	79.6	24.0
Caucasian	1.9	4.3	10.5	4.4	12.5	7.4	44.0
Other	13.0	6.5	3.5	8.7	6.3	13.0	32.0
Sex							
Male	83.3	87.0	73.7	91.3	93.8	83.3	68.0
Criminal Record	48.1	47.8	54.4	32.6	43.8	33.3	56.0
Firearms Interest Police (FIP)	53.7	52.2	64.9	58.7	50.0	61.1	72.0
Firearm Prohibition	13.0	19.6	17.5	4.3	6.3	5.6	16.7
Mean Total Police Events (2011-2015)	31.8	30.5	34.5	26.8	25.8	31.9	41.3
Num. of 2015 Victims	2	2	4	5	1	3	1

With respect to the densities of the subgroups, subgroup five has the highest density, indicating that 10% of all possible ties are present. The next highest, are subgroups two, six and seven with densities of 8.7%, 7.0% and 7.7%, respectively. Although these are not the highest density units, their members exhibit around 4.7 ties with one another on average. The highest internal mean degree is for subgroup two (8.09) and subgroup six (7.22), suggesting relatively high levels of connectivity within the subgroups. From these results, community detection helps uncover higher density pockets within the network, that have more than 10 times the density of the full network itself.

The proportion of victims, or victimization rate for each subgroup is calculated, providing a novel measure to analyze the concentration of victimization for a given subgroup embedded within the larger network. Subgroup four has the highest proportion of victims (10.9%), while subgroups three and five have the next highest, 7.0% and 6.3%.

Subgroups one to six are homogenous in terms of race and gender: South Asian males. Almost every subgroup is comprised of South Asian individuals with the exception of subgroup seven, where South Asians make up 24%, Caucasians make up 44% and 'other' races make up 32%. Essentially, 76% of subgroup seven is non-South Asian. Subgroup seven also has the highest number of females, 32% compared to the other subgroups. The next highest number of females is in subgroup three, with 26.3%.

Where some differences between subgroups start to appear is with mean age. All subgroups are around the same mean age, approximately 25 years. However, subgroup three is older than the others, with a mean age of 29 and it also contains four of the 18 victims. The mean age of this subgroup is important to note, as the mean age of the 18 victims is 22.

In terms of violence/crime indicators, subgroups four and six have an average of approximately 33% for criminal record, while all other groups have an average of approximately 50%. This perhaps indicates that subgroups four and six may be less violent than the other groups. The group with the highest percentage for criminal record was subgroup seven, the non-South Asian majority group. Similarly, the group with the highest percentage of FIP notifications on their police files was also subgroup seven (72%). Outside of subgroup seven, the next most violent group in terms of having FIP notifications on their police files was the "older" subgroup three (64.9%). Subgroup seven also had the highest number of average police contacts at 41.3%, with the next highest being the "older" subgroup three (34.5%).

Out of subgroups one to six, those that are comprised of mostly South Asian males, subgroups three ("older" subgroup), four and six have approximately 60% of individuals who have FIP notifications on their police files. Of note, five of the 18 victims were in subgroup four.

For firearms prohibitions, the "older" subgroup three, the non-South Asian violent subgroup seven and subgroup two stood out, as they had the highest percentages compared to the other subgroups. Being prohibited from carrying firearms indicates that the individual in question is involved in serious crimes having to do with firearms. Subgroup two had almost 20% of individuals prohibited from carrying firearms, while subgroup seven had almost 17%.

In the next section, I examine the attributes of those individuals who were in the main component compared to those not in the main component.

4.1.3. Attributes of Individuals in the Network

Now that the overall structure of the network is understood, I delve into the social structures of the individuals in the main component to analyze demographic information and violence/crime indicators compared to those outside, and compared to the 2015 victims. Table 6 breaks down the attribute information of the 299 individuals in the main component, and compares with the 56 individuals who were not in the main component, and the 18 victims in the 2015 Surrey gang conflict.

Individuals in the main component are younger (mean age 26), majority South Asian males, as compared to those outside of the main component who are older (mean age 32), majority Caucasian males, and inclusive of almost one-third females.

With respect to violence/crime indicators, several key observations are made. Generally, compared to those in the main component, slightly more of the 56 nodes outside of the main component have a criminal record and are prohibited from carrying firearms. However, it is still imperative to note that overall, the main component has a high propensity for violence (59% may be of interest to police as it relates to firearms). This finding is significant in and of itself.

Those in the main component have an average of 32 police interactions from 2011 to 2015, as compared to the 56 nodes outside the main component (average of 39). Given their older age, it is not unreasonable to expect the 56 nodes to have a slighter higher average police encounter count. For all centrality measures, individuals in the main component have higher measures than the 56 nodes outside of the main

component. These findings provide a general sense of who is in the main component and further validate why it is selected for all analyses in the current study.

Table 6.   **Attribute Information of Individuals in the Main Component (n=299), Individuals Not in the Main Component (n=56) and Victims of Gun Homicide in 2015 (n=18)**

		299 Nodes in Main Component	56 Nodes Not in Main Component	18 Victims in Main Component
Mean Age in 2015		26	32	22
Ethnicity	South Asian	80%	14%	94%
	Caucasian	9%	55%	6%
	Other	11%	31%	0%
Sex	Male	82%	66%	100%
Criminal Record		44%	52%	72%
Firearm Interest Police (FIP)		59%	45%	100%
Firearm Prohibition		12%	16%	28%
Mean Total Police Events (2011-2015)		32	39	63
Mean # of Connections		5.40	2.50	21.70
Mean Degree Centrality		0.02	0.01	0.07
Mean Betweenness Centrality		0.01	0.00	0.13
Mean Closeness Centrality		0.22	0.10	0.26
Mean Eigenvector Centrality		0.02	0.00	0.04
Mean Average Centrality (4 Measures)		0.07	0.03	0.12

Table 6 is now used to focus on the 18 victims, compared with the social structures of those individuals in the main component. The 2015 victims have a mean age of 22, compared to the mean age of those in the main component, which was 26, suggesting collectively the victims are young. As aforementioned, a quarter of Surrey's population is aged 19 years and younger, the largest number of youth in a BC municipality (City of Surrey, 2012). The mean age of the victims is particularly noteworthy as it speaks to the level of violence and seriousness of the conflict. Furthermore, it paints a picture of who is involved the conflict. Comparatively speaking, the mean age of those outside of the main component (32) represents an older, more disconnected group.

All of the 2015 victims are males, and 94% of them are South Asian, which is similar to the main component which contains 80% South Asians. As previously mentioned, South Asians make up approximately 32% of the population of Surrey

(Statistics Canada, 2017). This finding suggests that the conflict is focused on one community. With respect to gender, approximately 18% were female in the main component, compared to none of the 2015 victims.

When examining the violence/crime indicators of the 2015 victims, several key findings emerge. First, 72% of the victims had a criminal record, which given their young age is significant. Comparatively, 44% of those in the main component had a criminal record. Every single one of the victims had a FIP notification on their police file, and almost one third (28%) were prohibited from carrying firearms. Again, given their young age, these results are noteworthy. Of those in the main component, close to 60% had a firearms notification, while 12% were prohibited from carrying firearms. Another key finding is the number of police interactions victims had with police between 2011 and 2015. The victims had almost double the police interactions as compared to those in the main component and outside of the main component. Lastly, the 18 victims had an average of 21.7 connections, while those in the main component had an average of 5.4, and those outside of the main component had 2.5 connections.

Overall, the attribute and violence/crime indicators suggest the 18 victims tended to be younger South Asian males, with a serious record of violence, more so than others in the main component, or outside of the main component. Not only are they more violent, but they are more likely to have a FIP notification on their police files, be prohibited from carrying firearms, interact with police more[16] and be more connected.

4.2. Analyzing the Individuals within the Network

In this section, I delve deeper into analyzing the individuals within the network by assessing centrality, and if there were some individuals who were more central than others. Centrality analyses are undertaken based on the hypothesis that the most central individuals will be at the highest risk of gunshot victimization from a social distance/proximity perspective. Thereafter, using the average centrality measure, I assess if there is an association between the victims' shooting sequence and their average centrality. Finally, and still aligned with assessing risk of victimization, I examine

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[16] Although this finding is noteworthy, a reason for more police interactions may have been because of the victims' role as a shooting victim. Police could have initiated more interactions with the victims because of their role, or they could have been deeper entrenched after their shootings.

those individuals who have two or more direct connections to victims to identify a high-risk group, based on the hypothesis that the "high-risk" group is at the highest risk of gun victimization.

4.2.1. Who's Most Central?

In order to situate the results and be able to interpret them in meaningful way, it is first pertinent to undergo a centrality analysis for the purpose of identifying the most central victims and non-victims. The most central actors are identified, based on the hypothesis that they are at the highest risk of getting shot. Beginning with the victims, Table 7 identifies the betweenness centrality and average centrality scores, along with which subgroup the victims belonged to[17].

Table 7.   **Centrality Measures of Victims of Gun Homicde/Attempted Homicide in 2015 in the Main Component, Ranked by Betweenness Centrality (n=18)**

18 Victims	Betweenness	Average Centrality	Subgroup
1725	0.32	0.19	1
1982	0.30	0.19	3
1675	0.27	0.16	6
1188	0.26	0.15	4
1935	0.20	0.16	6
1742	0.15	0.24	2
1990	0.15	0.12	7
1351	0.14	0.13	6
1304	0.12	0.12	1
1156	0.10	0.10	5
1620	0.08	0.12	3
1751	0.06	0.11	3
1411	0.05	0.08	4
1664	0.05	0.08	2
1015	0.05	0.09	3
1205	0.03	0.07	4
1120	0.02	0.06	4
1059	0.01	0.06	4

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[17] See Appendix B for a full centrality analyses completed for the 18 victims in the 2015 Surrey gang conflict and the 281 non-victims in the main component, ranked by highest top 20 betweenness centrality.

Table 7 demonstrates that victims in the 2015 gang conflict have relatively high betweenness centrality scores, meaning many of them are the lone connections between groups who may otherwise not be connected which is visually depicted in Figure 6. The significance of these scores is highlighted in subsequent sections.

I now examine the centrality scores of the individuals in the main component (Table 8), drawing specific attention to the top 20 individuals ranked by highest betweenness centrality. The victims from the 2015 gang conflict have been identified in bold font. Table 8 shows that those with the highest betweenness centrality scores included majority 2015 victims.

Figure 6 visually displays the main component, with node size set by betweenness centrality values. The larger the node, the higher its betweenness centrality score. The 20 highest betweenness scores are in purple, with the labels visible. The 18 victims contain a red rim.

Table 8.   **Centrality Measures of 299 Actors in Main Component (Ranked by Top 20 Betweenness Centrality)**

Main Comp	Degree	Betweenness	Closeness	Eigenvector	Avg. Centrality (4 Measures)
1725	**0.11**	**0.32**	**0.33**	**0.00**	**0.19**
1288	0.05	0.30	0.32	0.00	0.17
1982	**0.09**	**0.30**	**0.30**	**0.06**	**0.19**
1675	**0.07**	**0.27**	**0.30**	**0.00**	**0.16**
1228	0.02	0.26	0.32	0.00	0.15
1188	**0.10**	**0.26**	**0.26**	**0.00**	**0.15**
1935	**0.12**	**0.20**	**0.32**	**0.00**	**0.16**
1581	0.09	0.18	0.28	0.38	0.23
1742	**0.13**	**0.15**	**0.25**	**0.41**	**0.24**
1990	**0.08**	**0.15**	**0.24**	**0.00**	**0.12**
1351	**0.08**	**0.14**	**0.31**	**0.00**	**0.13**
1289	0.03	0.13	0.27	0.05	0.12
1304	**0.10**	**0.12**	**0.26**	**0.00**	**0.12**
1835	0.01	0.10	0.25	0.00	0.09
1156	**0.06**	**0.10**	**0.25**	**0.00**	**0.10**
1620	0.09	0.08	0.26	0.07	0.12
1484	0.02	0.06	0.24	0.04	0.09
1751	**0.06**	**0.06**	**0.27**	**0.06**	**0.11**
1411	**0.04**	**0.05**	**0.21**	**0.00**	**0.08**
1664	**0.04**	**0.05**	**0.20**	**0.05**	**0.08**
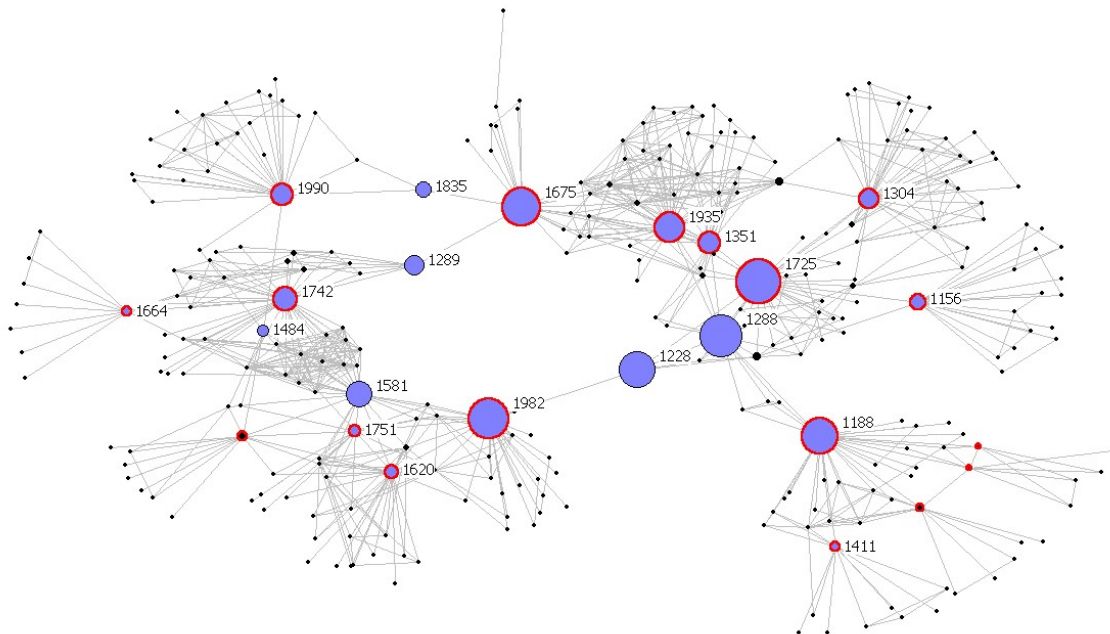
Figure 6. **Top 20 Highest Betweenness Scores in the Main Component (Purple) and 2015 Victims (Red Ring)**

In interpreting both Table 8 and Figure 6, several key findings emerge. First, those with the highest betweenness centrality scores are generally victims, with the exception of N1484, N1581, N1835, N1289, N1228 and N1288. Secondly, Figure 6 shows that a ring-like structure forms in the middle of the network, made up of those with the highest betweenness centrality scores. These individuals are the ones who are generally holding the smaller subgroups together, forming the overall component. These findings highlight the importance of the role of the broker in the gang conflict.

It is important to determine if the centrality measures used in the study are correlated. As such, Table 9 breaks down the correlations between measures in the main component.

Table 9. **Correlations Between Centrality Measures in Main Component**

		Degree	Betweenness	Closeness	Eigenvector	Average Centrality (4 Measures)
Degree	Pearson Correlation	1	.657**	.561**	.477**	.836**
	Sig. (2-tailed)		.000	.000	.000	.000
Betweenness	Pearson Correlation	.657**	1	.516**	.078	.645**
	Sig. (2-tailed)	.000		.000	.181	.000
Closeness	Pearson Correlation	.561**	.516**	1	.165**	.610**
	Sig. (2-tailed)	.000	.000		.004	.000
Eigenvector	Pearson Correlation	.477**	.078	.165**	1	.765**
	Sig. (2-tailed)	.000	.181	.004		.000
Average Centrality (4 Measures)	Pearson Correlation	.836**	.645**	.610**	.765**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	299	299	299	299	299

The results indicate that all measures are strongly correlated to each other, except betweenness centrality and eigenvector centrality. In fact, eigenvector centrality as a measure seems most different from the other measures. Moreover, average centrality appears to capture the essence of each separate centrality measure, as it is correlated to all measures of centrality, especially degree centrality.

Degree and betweenness centrality being significantly correlated suggests that some actors positioned with high connectivity also have high brokerage capacity. Research suggests that combining degree and betweenness scores rather than interpreting each measure separately, can be used to identify strategically positioned key actors in a criminal network (Bright, 2015).

Conceptually, each centrality measure represents a different process by which key players might influence the flow of information through a social network. The fact that the measures are not perfectly aligned justifies examining some of them individually.

However, as the data suggests, average centrality captures the essence of all four measures well, which justifies utilizing it in contexts where specific centrality measures are not required. Overall, the results suggest that most victims and non-victims with high centrality measures do not fit one "profile", and that the network is complex. This complexity is linked with the notion of network capital where individual actors benefit from structural features, in this case positionality within the enter network.

4.2.2. Shooting Sequence and Victims' Average Centrality (Ranked)

Part of the data collected for this study was the date and time block of when each shooting event occurred (see Appendix F). In having assessed the victims' and non-victims' centrality, I set out to determine if there was a relationship between the sequence of shooting events and the average centrality measure (ranked) for the victims.
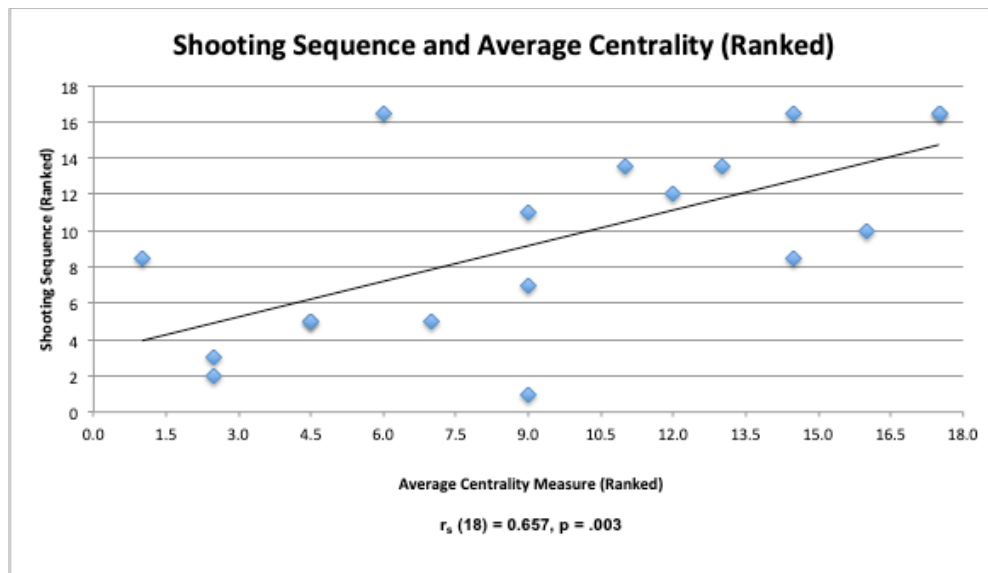
Figure 7.   Shooting Sequence of 2015 Victims and Their Average Centrality (Ranked)

Figure 7 shows the average centrality measure ranking (*x* axis), along with the order or sequence of the shootings, ranked for each of the 18 victims (*y* axis). Those victims with the same date and time range share the same sequence number. An initial observation when visually examining the scatterplot suggests a fairly linear pattern of the nodes. A Spearman's rank order correlation was run to determine if there is a relationship between the 18 victim's shooting sequence and their average centrality

measures. Results indicate a strong, positive correlation, which is statistically significant (r_s (18) = 0.657, p = .003).

Out of the first seven victims shot, five of them had the highest average centrality measures, suggesting that the most "connected" victims were generally getting shot first, and that they were connected with more other victims. Even within their own "cluster" or subgroup, the individuals that were most connected were generally getting shot earlier. With respect to the sequence of shootings using a date and time range, generally, it appeared that the shootings went through a large cluster and then moved to another large cluster where more than one shooting would likely occur before moving onto another cluster. This diffusion-like pattern in the network reveals individual choices depend on what other people do. Individuals are influenced by their particular network neighbors. With respect to choices, each individual is at least implicitly aware of the previous choices made by everyone else and takes these into account when making their own choices. Individuals link to others who are similar to themselves, and in turn can become more similar to their neighbours over time.

4.2.3. Direct Connections to 2015 Victims

From a network perspective, in addition to high centrality scores, another method of determining those socially closest to victims is by examining individuals with direct connections to two or more 2015 victims, as these individuals, I hypothesize, are at the high risk of victimization. A research decision to use two direct connections as a threshold aligned with other studies (Décary-Hétu & Dupont, 2012) and seems reasonable given that everyone in the network would have at least one connection to a victim because of the way that the network was constructed. An overlap in knowing more than one victim may reflect common interests such as engaging in similar, risky activities.

In a network of 299 individuals, some individuals hold crucial and more involved roles in the conflict, while others play less important roles. As such, this line of inquiry is focused on those individuals who are directly connected to two or more victims, as it provides an understanding of connectedness in the main component, beyond the fact that 18 victims were connected to each other. Establishing a threshold allows us to look

at the data using a different lens, and possibly distinguish between those more embedded versus those who are not.

Table 10. **Individuals in the Main Component with Two or More Direct Connections to 2015 Victims**

ID	Direct Connections to 18 Victims	ID	Direct Connections to 18 Victims	ID	Direct Connections to 18 Victims
1581	5	1010	2	1485	2
1188	**4**	1043	2	1522	2
1288	4	1046	2	1527	2
1067	3	1096	2	1600	2
1167	3	1101	2	**1620**	**2**
1279	3	1146	2	1640	2
1315	3	1175	2	1670	2
1351	**3**	1187	2	1695	2
1446	3	1191	2	1713	2
1484	3	1206	2	1734	2
1496	3	1228	2	1749	2
1535	3	1269	2	1812	2
1701	3	1282	2	1835	2
1751	**3**	1289	2	1858	2
1773	3	1369	2	1928	2
1869	3	1405	2	1965	2
1935	**3**	1479	2	1975	2
				1989	2

Table 10 identifies those individuals in the network who have direct ties to two or more 2015 victims[18]. In total there are 52 individuals (17.4%) in the main component that have two or more direct connections to victims of gun homicide. Hereafter, this group will be referred to as the "high-risk group". Broken down, there is one individual with five direct connections, two individuals with four direct connections, 14 individuals with three direct connections and 35 individuals with two direct connections to victims. There are also five victims in the high-risk group (bold font), four of which have three or more direct connections with other victims (N1188, N1351, N1751, N1935).

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[18] See Appendix C for Top 20 for Betweenness Centrality in High-Risk Group (2+ Direct Connections).
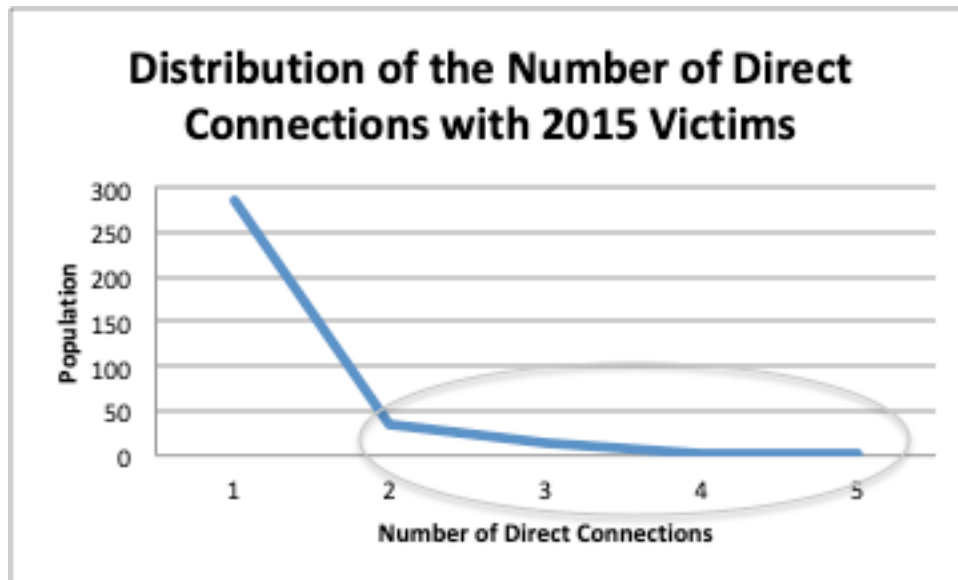
Figure 8.   **Distribution of the Number of Direct Connections with 2015 Victims**

Figure 8 shows the distribution of the number of direct connections for the 299 individuals in the main component, with the circle representing the high-risk group. All 299 individuals in the main component are at a risk of being in the cross fire, as they have a connection to at least one victim. However, findings indicate that a large part have a connection to two victims, specifically. Additionally, a smaller group had connections to three or more victims in the network. The identification of this high-risk group is significant and begs the questions*, who are these individuals? What attributes do they share? From a network perspective, do they look similar to the victims?*

Table 11.   Attribute Information of High-Risk and Low-Risk Group

		Direct Cnx 2+ Victims (52 Nodes) "High-risk Group"	Direct Cnx <2 Victims (247 Nodes) "Low-risk Group"	Sig. (2-Tailed)
Mean Age in 2015		23	27	.000***
Ethnicity	South Asian	92%	77%	
	Caucasian	2%	11%	.042*
	Other	6%	12%	
Sex	Male	90%	81%	.092
Criminal Record		50%	43%	.378
Firearm Interest Police (FIP)		83%	54%	.000***
Firearm Prohibition		10%	13%	.554
Mean Total Police Events (2011-2015)		42	30	.003*
Mean # of Connections		9.30	4.60	.000***
Mean Degree Centrality		0.03	0.02	.000***
Mean Betweenness Centrality		0.04	0.01	.000***
Mean Closeness Centrality		0.25	0.22	.000***
Mean Eigenvector Centrality		0.02	0.03	.680
Mean Average Centrality (4 Measures)		0.08	0.07	.000***

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 11 displays the attribute information for the high-risk group (52 actors) and the low-risk group (247 actors)[19]. Results reveal that individuals who are socially closer to victims, the high-risk group, share a network and socio-demographic profile with victims. Individuals who had more direct connections to the victims, that is, individuals with the shortest distance to victims, were almost identical to victims in terms of profile: younger, more likely to be South Asian and with a history of violence. As we move away from victims, the victim profile starts to dissipate; individuals are older with fewer police interactions. These findings are not unexpected; the individuals who hang out together will be more alike. However, what is important to note is how clear the boundaries are between the profiles of those most at risk and others. And now, by having made the connections between victims and all of their contacts, I rank order individuals by social distance to existing victims, allowing some form of prioritization.

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[19] See Appendix D for Test for Difference in Mean Centrality for High-Risk and Low-Risk Group.

Bivariate analyses demonstrate that there is a significant relationship between age and high and low risk groups. Other findings are that there is moderate significance with ethnicity and high and low risk groups and a significant relationship with FIP notification, mean total for police events and mean number of connections and high risk and low risk groups.

An Independent T-Test was conducted to determine if there is a significant difference between the means of the two groups for all centrality measures and the high-risk and low risk group. Results indicate that the means between the two groups are statistically different from each other for all measures except for eigenvector centrality.

The high-risk group was among the most central in the network. Assessing direct connections to victims will reveal a subset of individuals at a high risk of victimization themselves based on social proximity. The analyses completed thus far reveal the most central victims and non-victims in the network, narrowing in on the idea that the most central individuals are at an increased risk of being a victim in subsequent years.

4.3. Exploring the Potential Consequences of being Central in a Victim Network

As part of the data collection, each of the 299 individuals in the main component (including the 18 victims) was searched in PRIME-BC to determine if they were victims of homicide/attempted homicide in 2016 and 2017. Demographic and violence/crime indicators between three groups, victims in 2016 and 2017, non-victims in 2016 and 2017 and victims in 2015, are compared. Finally, the findings up until this point, lead us to one fundamental question, *is social distance associated with increased risk of getting shot in later years?*

4.3.1. Attribute Information of 2016 and 2017 Victims

Out of the 299 individuals in the main component, eight individuals were victims of homicide/attempted homicide in 2016 and 2017[20]. There were nine shooting incidents, and eight victims, indicating that one of the victims was shot in 2016 and in 2017

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[20] See Appendix E for a visual of the main component highlighting the eight victims in 2016 and 2017.

(N1043). When closely examining the eight victims in 2016 and 2017, two key findings appear: new victims emerged and victims from 2015 remained and were re-victimized, proving their resiliency by remaining active in the criminal world. Three of the eight victims were victims from 2015, while five were new.

Table 12. **Attribute Information of Victims of Gun Homicide in 2016 and 2017 Victims (n=8), Non-victims in 2016 and 2017 (n=291) and Victims of Gun Homcide/Attempted Homicide in 2015 (n=18)**

		8 Victims from 2016-2017 in Main Component	291 Non-Victims from 2016-2017 in Main Component	18 Victims in Main Component
Mean Age in 2015		23	26	22
Ethnicity	South Asian	88%	80%	94%
	Caucasian	12%	10%	6%
	Other	0%	10%	0%
Sex	Male	100%	82%	100%
Criminal Record		88%	61%	72%
Firearm Interest Police (FIP)		100%	58%	100%
Firearm Prohibition		38%	12%	28%
Mean Total Police Events (2011-2015)		71	31	63
Mean # of Connections		13.90	5.20	21.70
Mean Degree Centrality		0.05	0.02	0.07
Mean Betweenness Centrality		0.11	0.01	0.13
Mean Closeness Centrality		0.25	0.22	0.26
Mean Eigenvector Centrality		0.01	0.03	0.04
Mean Average Centrality (4 Measures)		0.11	0.07	0.12

Table 12 outlines the attribute information for the eight victims, along with violence/crime indicators. The 2016 and 2017 victims were highly connected South Asian males, with a mean age of 23, which is consistent with the mean age of the 18 victims of 2015 (22).

Compared to non-victims in the network, the 2016 and 2017 victims were younger, all males and more violent. Both 2016 and 2017 victims and non-victims were majority South Asian. Furthermore, the 2016 and 2017 victims had higher centrality measures for all measures except for eigenvector centrality.

When comparing the demographic information of 2016 and 2017 victims with 2015 victims not many differences appear – both are younger, predominately South Asian males. What really stands out when comparing both groups of victims is their violence/crime profiles. The 2016 and 2017 victims are even more violent than the 2015 victims, with almost 40% being prohibited from carrying firearms, 88% having a criminal record and 100% having a FIP notification on their police file. The 2016 and 2017 victims also have more police encounters on average, than the 2015 victims. This finding is striking, given the high percentage of police encounters the 2015 victims had compared to those in the main component.

4.3.2. Centrality Analysis of 2016 and 2017 Victims

Table 13 identifies the centrality measures of the eight victims of 2016 and 2017, including the average centrality. Of note, the table is in descending order of betweenness centrality and average centrality, and the 2015 victims are identified in bold font. Key findings regarding these 2015 victims include:

- N1725 ranked first, N1188 ranked sixth and N1351 ranked 11th among 299 individuals or highest betweenness centrality;

- All three 2015 victims (i.e. N1725, N1188 and N1351) were in the top 11 for highest degree centrality among 299 individuals in the main component;

- N1725 ranked first and N1351 ranked fifth for highest closeness centrality among 299 individuals in the main component;

- All three were in the top 25 for highest average centrality, among 299 individuals in the main component; and

- N1725 and N1351 ranked third and fourth for shooting sequence.

Regarding non-2015 victims, N1289 ranked 12th for highest betweenness centrality, 14th for closeness centrality and 26th for average centrality among 299 individuals in the main component. Additionally, N1043 ranked 24th for betweenness centrality and eighth for closeness centrality. As previously mentioned, N1043 was a victim of gun homicide in 2016 and in 2017. To summarize, the 2016 and 2017 victims were among the most central in the main component, as five of the eight were in the top 25 for highest betweenness centrality.

Table 13. **Centrality Measures and Subgroups of Victims of Gun Homicide in 2016 and 2017 (n=8)**

2016 and 2017 Victims	Degree	Betweenness	Closeness	Eigenvector	Average Centrality (4 Measures)	Subgroup
1725	**0.11**	**0.32**	**0.33**	**0.00**	**0.19**	**1**
1188	**0.10**	**0.26**	**0.26**	**0.00**	**0.15**	**4**
1351	**0.08**	**0.14**	**0.31**	**0.00**	**0.13**	**6**
1289	0.03	0.13	0.27	0.05	0.12	2
1043	0.02	0.03	0.29	0.00	0.08	1
1602	0.02	0.00	0.20	0.04	0.07	2
1258	0.01	0.00	0.21	0.00	0.05	4
1157	0.01	0.00	0.17	0.00	0.05	2

On face value, by examining network positions for the 2016 and 2017 victims, one can arrive at the conclusion that the risk of being a victim of gun violence is very high. Four of the eight victims were in the "high-risk" group having direct connections to two or more 2015 victims, including N1188 and N1351 (2015 victims). Broken down, N1188 had four direct connections to 2015 victims, N1351 had 3 direct connections and N1289 and N1043 had two direct connections each.

As shown in Table 13, the victims from 2016 and 2017 came from four subgroups: one, two, four and six. Some noteworthy observations about these subgroups include:

- Subgroup two had the highest percentage of firearms prohibition (19.6) and the highest number of South Asians (89.1);

- Subgroup four had the highest victimization rate (10.9) containing the highest number of 2015 victims (5). Subgroup four also had the lowest percentage of firearms prohibition (4.3) and criminal record (32.6); and

- Subgroup six had the second lowest firearm prohibition (5.6) and criminal record (33.3).

4.3.3. Is Social Distance to 2015 Victims Associated with Victimization in 2016 and 2017?

After examining some of the characteristics of the eight victims from 2016 and 2017, a key question remains unanswered, *were they better connected than others?*

Three Independent T-Tests were performed for the current study[21] using UCINET. Independent T-Tests were utilized to compare the average means for degree, betweenness, closeness centrality, eigenvector centrality and average centrality between two groups, those that were victims of gun violence in 2016 and 2017 (8 individuals) and non-victims (291 individuals). The hypothesis being tested is those that were victims of gun violence in 2016 and 2017 would have significantly higher average means than non-victims. As per Table 14, results indicate statistical significance, 2016 and 2017 victims of gun violence had higher average means for degree, betweenness, closeness and average centrality, than non-victims. The T-Test comparing the average means for eigenvector centrality between the same two groups indicated no statistical significance.

Table 14.   Test for Difference in Mean Centrality for 2016 and 2017 Victims and Non-Victims

	Victims in 2016 & 2017 (8 Nodes)		Non-Victims in 2016 & 2017 (291 Nodes)			
	Mean	Standard Deviation	Mean	Standard Deviation	Difference in Means	Two-Tailed Test (Significance)
Degree Centrality	0.05	0.04	0.02	0.02	0.03	0.00
Betweenness Centrality	0.11	0.13	0.01	0.04	0.10	0.00
Closeness Centrality	0.25	0.06	0.22	0.03	0.03	0.00
Eigenvector Centrality	0.01	0.02	0.02	0.08	0.01	0.86
Average Centrality (4 Measures)	0.11	0.05	0.07	0.03	0.04	0.01

It is important to note that because there are only eight individuals in one group, the findings lack power and an indication of significance can always be due to chance. The statistical significance for degree, betweenness, closeness and average centrality is indicative of a difference in the expected direction. The results indicate that among the 299 individuals in the main component, the eight individuals who were shot in 2016 and 2017 were among the most central in the network. Examining centrality measures allows

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[21] The default 10,000 trials was selected to create the permutation based sampling distribution of the difference between the two means (Hanneman & Riddle, 2005).

a level of forecasting of future victims; however, *are the differences large enough to be of practical importance?*

Given the small sample size it is logical to examine the effect size, a standardized measure of the size of an effect. The effect size calculation, called Cohen's *d*, will allow us to measure the magnitude of mean differences.

Table 15.   Effect Size of Mean Differences – Cohen's *d*

	Effect Size - Cohen's *d*
Degree Centrality	1.43
Betweenness Centrality	2.27
Closeness Centrality	1.12
Average Centrality	1.25

All four effect sizes' indicate a large effect size, with betweenness centrality having the largest effect, followed by degree centrality. The average betweenness centrality scores for shooting victims in 2016 and 2017 were 2.27 standard deviations higher than the average betweenness centrality scores for non-victims in 2016 and 2017, and thus the eight victims were better connected than the non-victims. For example, a Cohen's *d* above one means that the difference between the two means is larger than one standard deviation from the mean. Taking betweenness centrality into account, a Cohen's *d* above two implies a difference that is two standard deviations from the mean. These results provide confirmation that the difference in centrality observed is important enough to warrant attention, and also that further investigation with larger samples is recommended.

Chapter 5.

Discussion

Gang violence in the Lower Mainland has been the focus of political, police, media and policy circles for many years, requiring solutions that are innovative, strategic and evidence-based. SNA looks at the position of actors within a social structure, and can influence "behaviors, opinions, and attitudes" (Papachristos, 2014, p. 348). It makes available various methods and techniques providing utility and allows the possibility of identifying individuals most at risk of victimization within network structures. This study has demonstrated that beyond examining individual attributes to understand criminal behavior, it is also useful and often more telling to look at network positions and measurements in order to understand who is most at risk of victimization from a social distance perspective. Furthermore, creating the network structure from victims allows for intelligence to emerge from the data, without forcing interactions and relationships and minimizing assumptions. In addition to the associations and network patterns that emerge from the data, systematically coding individuals assists in understanding the overall "big picture" (Sierra-Arévalo & Papachristos, 2015). This section delves deeper into what the results mean and offers broad strategy and policy implications, namely how police can utilize victimization networks for violence reduction and prevention. Additionally, to contextualize results, the chapter concludes with implications that are BC-specific with reference to the unique and evolving gang landscape.

5.1. A Change in Lens & Approach

Instrumental to the methodology of SNA is the lens in which the findings should be viewed from. Led by researcher Andrew Papachristos, the concept of social contagion refers to violence being seen as an infectious disease or an epidemic, meaning if an individual is exposed to a disease, they themselves are at an increased risk of contracting the disease (Braga et al., 2010; Green et al., 2017). Gun violence concentrates in networks (Braga et al., 2010) and is socially contagious, meaning the activities, behaviors and actions happening around an individual, will affect what happens to that individual (Green et al., 2017). The risk of gun victimization can move

through time, and be transmitted from person to person in a particular pattern (Braga et al., 2010).

Over the years, media outlets have described the uptick in shootings in the Lower Mainland as an epidemic, however instead of focusing on victims, the narrative largely focuses on targeting offenders for enforcement (Bolan, 2009; Little, 2018; CFSEU-BC, 2015d). McConnell (2015) suggests that formalized responses of the government and the police have been the formation of high-profile gang units, "[t]hese highly visible police agents represent the "war" against the behaviour of the deviant group" (p. 180), again stressing enforcement. Research, however, suggests a shift in thinking, to view violence as an epidemic, a public health crisis and one where intervention and prevention efforts are taken from a victim-centred approach, not from the perspective of offenders (Braga et al., 2010; Green et al., 2017). If violence is seen as a disease that spreads, then one can understand more about the way in which it spreads in hopes of forecasting, preventing, stopping or slowing further violence, retaliation and death. With this lens, the health and safety of those in harm's way is prioritized (Green et al., 2017). Criminal justice professionals, researchers, educators, etc. should not only view gang members as offenders, but violent victimization should also be considered interwoven with gang membership, at the on set, during and once gang members discontinue (Peterson et al., 2004; Taylor, 2008). Giving credence to the victim/offender overlap, offenders and victims both share similar risk factors, as they both engage in risky behavior such as meeting up with strangers, selling drugs and shooting someone with a firearm, etc.

5.1.1. Overall Structure

Creating the social structure unveiled a close-knit network and the study's first major finding, which is that the Surrey gang conflict in 2015 can be described as a single network that connected 299 of the 355 (84.2%) individuals, including 18 of the 23 victims (78.3%). These findings suggest one localized conflict, in which victims and offenders knew of each other. Furthermore, the 18 victims had a connection to each other, and the shootings occurring were not random, unconnected, separate events or pockets. It was a single conflict that played out over a one-year period. These findings are supported by Papachristos (2009), who asserts that murder does not randomly occur and that it is ruled by patterns of social relations. Murder is governed by norms of retaliation, as such;

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prior conflicts will drive future violence (Papachristos, 2009), giving us a window into how the Surrey gang conflict played out.

5.1.2. Subgroups Within the 2015 Conflict

Specific attention should be paid to the subgroups within the main component of the Surrey gang conflict network, as the formation of subgroups can impact exposure to victims. Within the main component, the Girvan and Newman data reduction technique revealed seven subgroups each with their distinct character and uniqueness. Subgroups one to six were ethnically homogenous, including majority South Asian males. It is worth noting that 'South Asian' in the current study, refers to those individuals whose roots originate from the Northern Punjab region of India and whose mother tongue is Punjabi. An important factor that influences group formation is homophily – the notion that individuals will interact with others who are similar to themselves more often than with dissimilar others (Gravel et al., 2016; Athey & Bouchard, 2013; Papachristos et al., 2013). Subgroup seven, however, contained 76% of non-South Asians, had almost one third females and had the highest percentage for criminal record, FIP notifications and average police encounters. The data suggests that subgroup seven was a mixed-gender, non-South Asian, violent group. All subgroups had a mean age of approximately 25 with the exception of subgroup three, which had a mean age of 29 and contained four of the 18 victims, indicating the existence of an "older" targeted group. These results are meaningful in that they suggest a shared value system within subgroups, among other similar characteristics such as attending the same high school, growing up on the same street or neighborhood, working the same drug line or for the same boss. In communities or subgroups such as these, social relationships are solidified and maintained through reciprocated attachment, which can be further enriched over time (Athey & Bouchard, 2013). In conjunction with additional investigative intelligence, police may be able to come to conclusions about the nature of specific groups and gain deeper understanding of subgroupings. For instance, subgroup three, the "older" group and subgroup seven the non-South Asian violent group, stand out as having the highest percentages for firearms prohibition compared to the other subgroups. Being prohibited from carrying firearms is indicative of serious criminal behavior and a propensity for victimization.

One might have expected there to be 18 separate subgroups based on the 18 victims, but the Girvan and Newman algorithm allowed us to identify larger subgroups

that, for the most part, contained more than one victim. For subgroup 4 that included five victims, police are going to want to pay extra attention to the make up of that particular group, in the event that the conflict continued and there were more victims. Furthermore, from a social distance perspective, the exposure to violence to non-victims in subgroup four, will impact their victimization, as they are at a heightened risk. The subgroup containing many victims may be indicative of a gang/criminal group or a particular drug line that is being targeted for takeover. From a policing perspective, as a conflict plays out in the Lower Mainland, it becomes even more important to narrow the focus and understand subgroups, specifically, which group have been targeted, which group is likely to be targeted, and who within that group is likely to be targeted based on closeness to other victims. In line with the current research, in examining communities in Lower Mainland, Hashimi and Bouchard (2017) also identified cohesive subgroups as a useful tool for exploiting the criminal nature of those subgroups by police. While Hashimi and Bouchard (2017) used Lower Mainland policing data to contribute to target prioritization for law enforcement, this study contributes findings that demonstrate a shift in lens; potential victims can be targeted for effective intervention and prevention.

Athey and Bouchard (2013) examined the presence of communities in their analysis of the Bay Area Laboratory Cooperative (BALCO) scandal, which involved the production and distribution of illegal steroids to professional athletes in a facility in California. The authors performed a Girvan and Newman algorithm to determine whether distinct communities formed around specific sporting communities, or whether the BALCO network was a single, connected community. Athey and Bouchard (2013) found a core group of athletes centralized around a single actor, surrounded by five peripheral communities that formed around specific athletic interests. Consistent with the current study, the use of the Girvan and Newman algorithm provides utility in detecting communities or subgroups to understand network structure and behaviors among subgroups embedded within a larger social network.

5.2. Exposure and Closeness to Victims

Crime and delinquency is a group phenomenon (McGloin & Rowan, 2015; Warr, 2002), one that includes collaborative structures (Bouchard, 2020), where individuals can adopt a myriad of roles when engaging in criminal behavior (Bright & Delaney, 2015). Drive-by shootings are not random events and require the presence of

companions to fulfill various roles (McCuish et al., 2015). For instance, in a drive by shooting there may be individuals who monitor or carry out surveillance of the target, the driver of the car carrying the shooter, an individual to drive a getaway car and another to destroy evidence (i.e. vehicle that carried out shooting, clothes, firearm). The individuals involved in initial acts of violence, may not be the ones who retaliate, thus creating a web of conflict (Bichler et al., 2020; Lewis & Papachristos, 2020). The main component embodies a collective overlap of social ties, co-offending ties and criminal conflict ties. It is one collective risk bubble signifying some ties that are risker than others. Different factors can impact one's risk level and exposure including level of embeddedness, and as the current study will demonstrate, centrality scores and direct ties to victims as determinants of future victimization.

Centrality

The current study found that those with the highest betweenness centrality scores were generally victims, suggesting the role of the broker in the gang conflict is a major takeaway. This study has demonstrated that centrality matters and is useful in demonstrating closeness to victims and the likelihood of future outcomes based on that closeness. Without mapping out each victim's ego network, connections painting the "bigger picture" would not have been made, and ties between individuals and subgroups would not be visible. In a policing context, an individual with many ties may be indicative of someone who is important and connected to many people (high degree centrality). Whereas, someone else with fewer contacts may still be important because they are the link between other individuals or groups who may not otherwise be connected to each other (Wasserman & Faust, 1994; Papachristos, 2006; Morselli, 2010). It becomes easier to identify those with high betweenness scores if an entire structure is mapped out. Further, mapping out a network structure and examining centrality may assist police in understanding why someone would be victimized based on their position. In a gang context, someone with high betweenness centrality controls information, and can manipulate and prevent contact between other individuals or groups (van der Hulst, 2009). This individual could be divulging key information back and forth between groups, or may have left one group for another (Bolan, 2018; Illegal Firearms Task Force, 2017), which may place them in a vulnerable position to be victimized.

Using the hypothesis that the most central individuals will be at the highest risk of gunshot victimization, the current study identified individuals who are in close social proximity to victims, with the goal of identifying the next victims of homicide/attempted homicide. These steps are crucial for understanding the diffusion of violence in the Lower Mainland of BC and in particular, Surrey, at a time where violence is attributed to specific, connected yet competing groups. From a public standpoint, the shootings are seemingly random and from a policing perspective, police oftentimes play 'catch up' and respond in a reactive manner (McConnell, 2015). Mapping out the network and specifically examining centrality allowed the identification of individuals who may otherwise not be on police's radar (Bouchard & Konarski, 2014). Victims of gang violence are not always who one would expect, even for police. The current study provides a method that establishes the social foundation of homicide (and attempted homicide) in Surrey, BC, with implications for strategic interventions for high-risk individuals. I provide an applied framework that is systematic, replicable and has the ability to be implemented in programs, such as the Gang Exiting and Outreach Program under CFSEU-BC (CFSEU-BC, 2015c).

Average Centrality

In addition to the role of the broker being significant, this study also demonstrated the benefit of the combined measure, average centrality, as a general measure of importance in the network. Average centrality appeared to capture the essence of each individual centrality measure. The benefits of using a combined network measure are supported by other research (Abbasi & Hossain, 2013; Fei & Deng, 2017), in identifying the most important individuals, and in the case of the current study, those closest to victims. Iacobucci et al. (2017) examined the same four centrality measures as the current study and found that they were highly correlated. In a practical sense, different centrality measures may behave similarly in the real world, as such the findings show that combining centrality measures may provide robustness. From a practical sense and to obtain a better understanding of the conflict that played out, the association between average centrality measure and victims' shooting sequence is explored.

Average Centrality & Sequencing

Findings revealed that there is a relationship between the 18 victims' shooting sequence and their average centrality measures, indicating a strong, positive correlation.

Out of the first seven victims shot, five of them had the highest average centrality measures, suggesting the most "connected" victims were generally getting shot first, and that they were connected with more other victims. In line with the current study's findings, Papachristos (2009) has written extensively about the reasons why gang members murder: "they live in a structured set of social relations in which violence works its way through a series of connected individuals" (p. 75). The gang identity revolves around friends and foes that shape individual "choices of action, including the selection of murder victims" (Papachristos, 2009, p. 75).

Order or sequencing is significant when it comes to how a gang conflict unravels, as the initial shootings can be considered key events because they may reveal victims with central, key roles, or the "reason" for why the conflict begins in the first place. What follows is likely a retaliatory tit-for-tat like pattern (Decker, 1996; Papachristos, 2009; Papachristos et al., 2013, 2015a), providing an indication of who in the victim's circle will be shot next. As shootings play out, murders can actually help gangs form or break apart (McCuish et al., 2015), which is another reason why it is essential to consider sequencing in a conflict. The current study's findings suggest that individuals are influenced by their particular network neighbours, building on importance of assessing centrality, these findings emphasize shooting sequence/order and its relationship to centrality and that one should look no further than a victim's neighbours to get an idea of future victims. We influence people we associate with, and they, in turn, influence us. The actions and choices of our neighbors will shape our actions and choices, including the decision to carry out murder and who. Gang murder occurs through "an epidemic-like process" where opposing factions vie for "positions of dominance, and aggregate patterns of murder arise" as these gang members create a network of relations "that shape future patterns of conflict, collective action, and murder" (Papachristos, 2009, p. 76). In other words, murdering or attempting to murder has the ability to change future gang dynamics and mold future moves, which is what the current study demonstrated in 2016 and 2017, as the conflict continued. Papachristos (2011) suggests that murder is more likely to occur if there are "turf wars" between gang members and if there are prior murderous relations among members. In the Lower Mainland of BC specifically, since mid- to late- 1990s, criminal gangs emerged "using firearms in acts of extreme violence to manage sophisticated criminal enterprises and a lucrative but localized drug trade" (Illegal Firearms Task Force, 2017). "[V]iolent turf wars, execution-style homicides and

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open air shootings" were the result of competition for territory or turf (Illegal Firearms Task Force, 2017, p. 15).

As supported by Green et al. (2017), the findings suggest violence can spread, both in terms of one act to many others, and one type of violence (i.e. threats, intimidation, theft) to others (i.e. drive-by shootings, stabbings, etc.). The current study's findings demonstrate this concept of social contagion – the spread of violence can provide insight into how to treat gun violence (Braga et al., 2010; Green et al., 2017). The shooting sequence in the current study was akin to contagious disease spreading, in that it tended to cluster in similar ways. Bond and Bushman (2017) described a cluster as a collection of cases of a particular disease, closely grouped in time and place. As demonstrated by Appendix F, which showcases the date and time associated with each shooting incident, the violence spread quickly. The conflict played out for a year; however, had the highest level of activity early on, with all 18 incidents occurring within the first six months of the year and more than half of the incidents occurring within the first three months of the year. Green et al. (2017), found that there were about 83 days between shootings in their study. For instance, if person A gets shot, the individuals around person A are at severe risk for approximately three months. This heightened risk then diminished slowly, and if another shooting event occurs, the level of risk bounces back up again. Using this research, the timing of interventions by police can be leveraged.

Direct Connections

In addition to examining centrality measures, another way to examine those at the highest risk of gun victimization is to examine direct connections to victims. Individuals in the main component with two or more direct connections to 2015 victims are extracted and closely analysed. Results indicated that 17.4% (52 individuals) had at least two or more direct connections to victims, identifying a "high risk" group, which also contained five 2015 victims. An even smaller group had three or more direct connections (17 individuals including four victims). The attribute data suggest those with the shortest distance to victims share a network and a socio-demographic profile – they are more likely to be a young, South Asian males with a high propensity for violence. Exploring the social environments of those individuals with direct connection to two or more victims, and victims themselves, provides insight into their behavior and choices, which they do

not necessarily know at the time of connection. Having those direct connections can reflect common interests and activities such as engaging in crime, and may be indicative of individuals who are deeply entrenched in the gang lifestyle.

5.3. Centrality & Future Victimization

Green et al. (2017) describe the cascading of shooting events where a shooting will occur, and then a short time later an associate will get shot, following by another shooting event. In the case of the current study, I analyzed shooting events that occurred in 2016 and 2017, and found that the conflict continued to cascade two years later. In 2016 and 2017, out of the 299 individuals in the main component, there were eight shooting victims and nine shooting events. While new victims in 2016 and 2017 emerged, three of the eight victims were victims in 2015. With respect to their demographic profile, 2016 and 2017 victims were similar to 2015 victims – young, highly connected South Asian males with an even higher propensity for violence. Four of the eight 2016 and 2017 victims were in the "high risk" group and were highly central in almost all categories. One of the most important findings in the current study was that 2016 and 2017 victims were central in the 2015 network. They were better connected than others and among the most central in the network. This implies, of course, that they were connected to many victims in the network. Furthermore, the eight individuals who got shot were more likely to be brokers in the network, positioned between subgroups who may not otherwise have been connected.

In unpacking these results, it is evident that delving deeper into centrality measures and direct connections to victims allows some semblance of forecasting future victims. Borgatti and Li (2009) emphasized that a node's position can determine in part the opportunities or constraints it may encounter, suggesting that position plays a crucial role in a node's outcome. The current study's findings contribute to this line of inquiry from a Canadian context - selecting positions of strength and centrality in 2015, allowed us insight into victimization in later years.

The network was constructed from the 18 victims' ego networks, specifically analyzing five years worth of police data (2011 to 2015), derived from shooting events which occurred over a one year period. As time goes on, networks will change and there will be new, unexpected victims and some that are not surprises. In the current study,

while the three 2015 victims, N1289 and N1043 may have been expected due to their high centrality measures, N1602, N1258 and N1157 were unexpected. Police scrutiny and detection of those involved in the gang lifestyle will intensify and evolve and those individuals that were once central may not be central anymore and vice versa. Research has supported the notion of criminal networks decentralizing and re-ordering themselves in response to growing law-enforcement targeting (Bright and Delaney, 2013; Morselli & Petit, 2007; Ouellet, Bouchard & Hart, 2017). Network vulnerability can come from internal threats from competitors and allies, and external threats such as the police. Bright and Delaney (2013) explore changes in roles in their drug trafficking network, and found a shift in operation was required due to police pressure and was implemented to avoid a possibility of being detected by landlords or neighbors in their study. In the current study, this is relevant as it demonstrates how victimization may force networks to adapt and change over time. One way to obtain a deeper understanding of adolescents involved in homicide is to follow their criminal trajectories (McCuish et al., 2015).

5.4. Strategic & Policy Implications

Utilizing SNA in police investigations allows for "an evidence-based assessment" where investigators "identify structure rather than assume it" (Morselli, 2010). As a supplemental investigative tool, police can utilize SNA to identify those individuals at the highest risk of victimization, those who are in social proximity to homicide victims for intervention, prevention and education. By focusing on victims and their known associates and those who are most central, social networks can surface (McGloin, 2005), which can also be used in real time to prevent serious violence through the identification of victims and potential victims. By mapping out a network and utilizing this approach, it may also be possible to identify lesser-known associates who would not otherwise been targeted (Bouchard & Konarski, 2014) and identify subgroups with among the overall landscape.

Moreover, taking a public health approach to gun violence reduction is necessary and timely, given that the gang violence has continued in the Lower Mainland (Bolan, 2020). Using a victim-centered approach, the findings can be used to inform police decision-making with the ultimate outcome of reducing and preventing further violence. SNA has allowed us to understand the 2015 Surrey gang conflict better by way of the relationship between sequencing and average centrality. For police specifically, SNA can

be used to understand conflicts and how violence spreads on a local level, and possibly extend beyond that to larger regions. For example, this study can be replicated by police detachments to understand what is occurring in their geographical areas and for agencies such as CFSEU-BC to understand conflicts in the Lower Mainland and beyond. Bichler et al. (2019) support this notion, by understanding violence and how it diffuses through networks, "there is a better chance of developing focused-deterrence strategies that minimize displaced aggression, reduce gang conflict, and ultimately, improve public safety" (p. 876). Police can also use meaningful data to minimize the likelihood of triggering new conflict. Lastly, from an operational and practical sense, the RCMP and other police departments can use these findings for the purposes of Duty to Warn.

The current study has demonstrated that criminal groups need to be thought of as networks (Ouellet et al., 2018), and that this shift in thinking will enhance policing interventions. Policing interventions that utilize dated concepts of criminal organizations being structured as hierarchies as opposed to networks may have the tendency to focus on unproductive strategies (Bouchard, 2020; Bright et al., 2014). With respect to the utility SNA provides, police departments already have the data required to construct social networks of co-offenders. Co-offending networks will be easier to construct than gang-networks, as more complete data is available for individuals that have been arrested together, or interacted with police.

Eliminating gang violence altogether is likely an impossible task, but what this study shows is that SNA can be used as a supplemental investigative tool to produce meaningful results that will potentially reduce victimization. In 2015, the municipal government in Surrey announced funding for an additional 100 RMCP officers to police the community (Dhillon, 2015), which was followed up in April 2016 with another $23 million from the provincial government for gang enforcement in BC (Bolan, 2016). The solution to gang violence is not always more "boots on the ground". From a strategic standpoint, an investment in adopting SNA would yield many benefits, over and above existing investigative tools. Police departments would benefit from investing in a centralized database, software such as UCINET, training for criminal analysts, partnerships with academia, and an expansion of existing public service/ municipal employees and research capabilities because of the time requirements to construct and map out networks.

In addition to an investment in human resources and databases/systems and given that policing and social services must make targeted interventions in a timely fashion with limited resources (Hashimi & Bouchard, 2017; Papachristos & Sierra-Arévalo, 2018), focusing on a small percentage of the population most impacted by gun violence (Green et al., 2017), will yield better outcomes than traditional methods. Furthermore, the findings of the current study focus on one particular community, suggesting that police may need to revisit their strategies as it relates subgroups with specific characteristics (i.e. younger, violent, South Asian). The current study identified key individuals in the network with high betweenness centrality scores, those that connected individuals and/or subgroups who may not otherwise have been connected. Through added investigative intelligence, it may be learned that these individuals' roles or positions are contributing to their victimization, be it for switching allegiances or passing key information back and forth. Additionally, extra attention should be paid to the "high-risk" group, those individuals with the most direct connections to victims. Specifically, the individuals with three, four and five direct connections to victims should be prioritized.

Data-driven decisions and focused, targeted, timely and strategic efforts to reach high-risk individuals will be most effective. Specialized policing gang units, such as CFSEU-BC build intelligence by examining patterns, interactions and associations. This is where SNA comes in useful, especially as it relates to boundary specification and target prioritization (Bouchard, 2020; Hashimi & Bouchard, 2017). For example, data reduction techniques such as Girvan and Newman and faction analysis can assist police in narrowing down a specific subset of individuals to look into. In the current study, those subgroups that were either the most violent or contained the most victims warrant further attention.

As Joffres and Bouchard (2015) found, patterns in clustering in social networks have implications for police when it comes to planning. Mapping out a network and beginning from a strategic starting point allows researchers (or crime analysts) to examine the potential impact of interventions prior to executing them. Depending on the policing goals to be achieved, the results one ends up with may be unexpected and useful. For instance, in the current study, had 2015 victims' ego networks not been mapped, I would not have known that as many as 18 victims were connected in a single localized conflict. Bichler et al. (2019) confirm these assertions, suggesting that

analyzing interactions in a network format, in addition to spatial or geographic context of inter-gang activity, will enhance suppression efforts.

Police, policy-makers, criminal intelligence analysts, researchers and educators should refrain from treating delinquents, criminals and victims as if they exist in isolation (Bright, 2015; McGloin, 2005). Social patterns and processes, interactions and associations between potential offenders and victims are crucial to examine along with their impact on behavior. With respect to policing, Bouchard (2020) cautions that using ethnicity as a driver of policing priorities may create human rights violations and that the use of ethnicity "as an overarching classification of organized crime is counterproductive" (p. 448). In BC, this was seen with the formation of the Indo-Canadian Gang Task Force in 2002, which was later renamed. A network approach can highlight boundaries and provide a richer understanding of subgroups through interactions that may be part of the 'bigger picture' (Sierra-Arévalo & Papachristos, 2015).

Once identified, police departments can leverage SNA to direct programs, services, intervention strategies, opportunities and resources in order to maximize the impact of scarce resources and help prevent murders in Surrey, BC. Given that the Surrey RCMP is transitioning to become its own police force, it is an opportune time to take inventory of the investigative approaches used by the department, and to introduce SNA and its benefits. It is important to note that strategic intervention is not specific to policing, they can also include interventions for trauma, PTSD, mental health and substance abuse. Various points of intervention exist before an individual starts coming to the attention of police (i.e. education, social services, health and employment) (Green et al., 2017). Most of these systems have direct access to individuals, however they may not be resourced adequately or have the appropriate training to provide such support. Integration and coordination are vital (Gravel et al., 2018), especially as it relates to having systems that 'speak' to each other.

Periods of intense gang activity in the Lower Mainland are often followed by pleas from police for cooperation, political pressure, provincial and federal governments dedicating more financial and human resources to prevention and intervention efforts (Bouchard and Hashimi, 2017). However, there is a gap when it comes to meaningful, inventive, sustained and intelligence-led solutions. Strategies to combat organized crime need to be province-wide and multi-pronged if they are to be effective (Illegal Firearms

Task Force, 2017). There have been government initiatives that have identified a need for a whole-of-government collaborative and coordinated approach for organized crime (Illegal Firearms Task Force, 2017). The need for coordination is also present among academia and policing agencies, as there is no agreed-upon definition for "gang" and "gang-related homicide" (Jingfors et al., 2015). Specifically, policing (Gravel et al., 2018), research, the education system and public health work in a 'siloed' fashion where information and intelligence sharing between systems and departments can be improved (Illegal Firearms Task Force, 2017).

Ideally, policy and evidence-based approaches converge to form meaningful and sustainable action. Analyzing police data alone cannot capture an accurate portrayal of gang violence, as so much crime goes uncaptured and unreported. In fact, McConnell (2015) found the research participants' perceptions of the police in combating the gang problem in BC revolved around enforcement. The majority of individuals in the current study are young, South Asian males with criminal records. The public will form their opinion about gangs from two important sources: police and the media (Gravel et al., 2018; Gushue et al., 2018). Too often media discourse, politicians, local citizens emphasize the violent nature of gangs (Gushue et al., 2018) and suggest a "get tough on crime" approach, stressing enforcement (McConnell, 2015; CFSEU-BC, 2015d), "getting in the face of gangsters" (Gravel et al., 2018) and stiffer sentences. Furthermore, Gravel et al. (2018) found that the Surrey Six murders in Surrey opened a policy window where some police departments took advantage of it to establish the need for more suppression based approaches.

Those involved in gang conflicts are too often perceived as offenders and not victims. Specifically, the media plays an important role in shaping the narrative, opinions and attitudes about gangs – and often highlight the dangers associated with highly organized gangs (Gravel et al., 2018; Gushue et al., 2018). In many cases, some of the "so called gangsters" are teenagers. As a society, we must shift our thinking and dialogue about the lives we value and understand that these lives are worth saving. Although a tactical/enforcement function is one necessary and essential component to policing violent gangs (McConnell, 2015), it should not be the only and it should be data-guided. It is crucial to revisit the concepts of community policing, especially when it comes to policing diverse, younger and immigrant populations. Gang units should have strong community partnerships and relationships embedded within their functions.

Enforcement and community policing practices are often at odds, which may be one of the reasons why un-cooperation from the public exists. In addition to re-visiting the community policing theory, there needs to be a 'marriage' between policing and academia. Academic partners will be the ones that develop algorithms based on experiments, and ensure testing and peer review.

The balance between "enforcement" and "prevention" was recognized in Symons' (1999) study addressing the racialization of the street gang issue in Montreal. The integrated approach of prevention and repression identified that "network building"; "partnership" and "consultation" were key facets in dealing with gangs. However, research has also recognized that specialized gang units "do not interact well with the community, do not have much to do with prevention, do not form partnerships well, do not engage in problem-solving activities effectively, and fail to have a geographic focus" (Decker, 2007, p. 731).

Relying solely on police data poses challenges, as it is often unavailable, inconsistent, static (snapshot in time) or incomplete. Furthermore, the lack of consensus regarding the definition of 'gangs' and blurred boundaries (Papachristos, 2006; Bouchard & Konarski, 2014; McConnell, 2015; Jingfors et al., 2015; Bichler et al., 2019; Bouchard, 2020) further complicates matters. Unlike other major cities that may see turf-based crime, in the Lower Mainland, predominant trafficking methods include 'dial-a-doping' and other unconventional methods such as social media (i.e. Snapchat). Those involved in the gang lifestyle will find innovative ways to do their business. For example, Bichler et al. (2019), found that even when gang member were prohibited from "hanging out", they still found a way to use online platforms such as Youtube to intimidate the community, insult rivals, make inflammatory statements and recruit individuals. In a Canadian context, this may mean that even with court-ordered conditions, gang members will still find ways to continue their activities. In fact, in the Lower Mainland, rival gangs have posted rap songs advocating murder (Bolan, 2020).

The single most important operational implication for police is to use these findings and this methodology within the context of policing and Duty to Warn[22] for the purposes of preventing further victimization and ultimately saving lives. In Canada, litigation has been established that in certain circumstances, police have a duty to warn those at risk of the dangers presented by a particular situation or individual. This common law duty to warn manifests when police have information establishing a foreseeable risk – the greater the risk to harm to the physical or mental wellbeing of an individual, the greater the probability that a duty to warn exists. In the current study the 52 individuals in the "high-risk" group could have been potentially warned about their risk of victimization. Decisions on who to warn would still need to be based on intelligence, however, SNA could supplement and inform those decisions. Similar to the "pulling levers" deterrence strategy explored by Braga et al. (2008), police would directly warn those at risk of the dire consequences of their actions and involvement in the gang lifestyle. With the particular deterrence strategy explored by Braga et al. (2008), in addition to police, community members, family and service providers were involved and offered an alternative to the gang lifestyle. Braga et al. (2008) found this strategy to be promising as there was an associated decrease in the number of gun homicide and aggregated assault incidents in their study.

5.5. The BC Context & Implications

Gangs are not new to BC's Lower Mainland, and the uniqueness of them has been documented among scholars and government (McCuish et al., 2015; Bouchard & Hashimi, 2017; Gordon, 2000; McConnell, 2015; Totten & Totten, 2012; Gahunia, McConnell & Bain, 2019; Illegal Firearms Task Force, 2017). Although delving fully into the BC gang landscape is not in the scope of the current research, it is important to note that prior to the shootings in 2015, two rival gangs, the United Nations and the Red Scorpions, were emerging in BC during the period of 2004 to 2015 (Gushue et al., 2018). BC has experienced a high number of gang-related shootings, many of which have resulted in fatalities (Bouchard & Hashimi, 2017). The 2015 gang conflict in Surrey, BC, had some defining features, which helps to contextualize the findings. There were a

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[22] See Appendix G for a list of those individuals who received a Duty to Warn for a five-year period (2013 to 2017). Of note, N1157 who received a Duty to Warn in 2016, was an unexpected victim in 2016 and 2017. Further, N1097 who received four Duty to Warn files over a three year period (2013 to 2015), did not stand out in the network data.

record number of shootings in a short period of time, which caused panic and fear among the public and heightened public safety rhetoric politically (Saltman, 2018), given that so much of the 'gun play' was occurring in public space (McConnell, 2015; Gahunia et al., 2019; Illegal Firearms Task Force, 2017). The year 2015 was the season of "shots fired" in Surrey, as the reckless street-level shootings played out, police were often left playing "catch up" arriving at crime scenes only to find bullets and burned out vehicles a short time later. In 2015, there were over 2000 incidents involving the criminal use of firearms in BC[23] (Illegal Firearms Task Force, 2017). The Surrey gang conflict followed a 'tit-for-tat' pattern of retaliatory violence (Papachristos, 2009), and what emerged was an environment fraught with discontent and mistrust. Research suggests violence is almost always reciprocated among gang members (Bichler et al., 2019; Papachristos et al., 2013, 2015a). The consequences of retaliated violent acts, sometimes death, "create a network structure between disputants – sustained patterns of animosity, conflict and interaction" (Papachristos, 2009, p. 81). Violence, intimidation and threats are a gang member's way of preserving power and gaining respect and fear and entangled with those factors are money and conflict (Totten & Totten, 2012; Prowse, 2012).

Gang conflicts are dynamic and have the ability to ebb and flow, start and stop and go through periods of intense activity and pressure followed by ease and calmness. The ever-changing nature of conflicts also means that the individuals targeted might not be those expected. Furthermore, targeting one gang will generate ripple effects and impact the larger, social landscape that includes other groups (Bichler et al., 2020). Not everyone targeted with gun homicide is always known to police and as Papachristos (2009) states, "…there is little rhyme or reason to who kills whom" (p. 75). Murder as an interaction, occurs between two people, more often than not, who know each other and tend to resemble one another socially and demographically (Papachristos, 2009), as is the case with the current study.

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[23] Incidents included offences such as homicide, attempted homicide, robbery, assault, uttering threats, break and enters and careless use (Illegal Firearms Task Force, 2017). During the investigations into these incidents, over 3000 illegal firearms seized by police (Illegal Firearms Task Force, 2017). It is important to note, not all of the incidents were attributed to gangs and organized crime.

5.5.1. Young Age of Victims Warrants Early and Urgent Intervention

The 18 victims in the main component had a mean age of 22, ten years younger than the mean age of those outside of the main component. This finding alone is significant and noteworthy - the young age of those involved, given the severity of the criminal acts (drive-by shootings) being carried out, is a defining feature of this particular conflict and what makes it different than others. The current study's findings are in line with research that suggests the mean age of gang members who are murdered has declined over time (Buffam, 2016) and that juveniles are more likely to carry and use guns compared to adults (Watkins et al., 2008).

In early June 2018, high school students 17-year-old Jaskaran "Jesse" Bhangal and 16-year-old Jaskarn "Jason" Jhutty were fatally shot bringing to light the reality and danger of gang recruitment targeting younger and younger individuals (Holmes, 2018). Neither one of the teenagers were known to police. Youth are primarily targeted and groomed for high-risk activities such as dial-a-doping as higher-ranking gang members know that they are less likely to be stopped by police, and even more consequential, be charged with crimes of a serious nature. Adolescents are commonly provided firearms in order to settle disputes or take over business lines (Sinoski, 2009).

Contrary to what was found in this conflict, research by Watkins and Moule Jr. (2014) suggests that older, more sophisticated gang members are more likely to be in possession of a firearm than juvenile members. Similarly, Clements & Akiyama (2011) found that "hardcore" gang members are typically involved in violent activities such as shootings and murder. The current study's findings reveal that the 2015 victims (mean age 22) and the 2016 and 2017 victims (mean age 23) were involved in drive-by shootings. It is possible that younger dealers are being used as pawns to carry out shootings for older members who try and remain insulated from "street level" activities (Little, 2018). In fact, research supports this notion that older criminals can manipulate younger criminals into carrying and using firearms (Hallsworth & Silverstone, 2009). Although the exact dynamics between older and younger gang-involved individuals in BC was not the focus of the current study, the findings in the current study suggest that the combination of these two factors, young age and serious, violent criminal acts is distinctive.

In this conflict, the young age of the victims is even more pronounced when the average number of police encounters is observed for victims (63) – almost double compared to those in the main component (32). Overall, the 18 victims tended to be younger, more likely South Asian males, and have a record of violence more so than others in the main component, or outside of the main component. Not only are they more violent, but the victims are more likely to have a FIP notification on their police files, be prohibited from carrying firearms and be more connected. This research highlights the need to bolster prevention and education efforts to teenagers and early adolescents. In fact, Surrey RCMP already recognize the importance of taking education to elementary school students regarding gang recruitment, personal safety and smart decision-making (Little, 2018).

Delinquent and criminal activities cut across all ages. However, the transition of when adolescent groups become involved in more serious gang activity is 'blurry' (Ayling, 2011; Bolden, 2012; Jingfors et al., 2015). There is crossing of a threshold from delinquent youth to gang member that policy-makers, police and educators must be privy to. The fact that the 18 gun homicide/ attempted homicide victims were so young highlights the fact that intervention is required urgently, so that they do not become further entrenched and potentially become tomorrow's bonafide gangsters. In BC, there are examples of groups that started off as 'average high-school kids' in the Lower Mainland and went onto become criminal organizations (Illegal Firearms Task Force, 2017), such as the 856 gang (Bouchard & Konarski, 2014), the United Nations and the Red Scorpions, who were primarily Asian until they joined forces with the Caucasian Bacon brothers (McConnell, 2015; Airola & Bouchard, 2020; Gushue et al., 2018). Difficult to define, this crossing of a threshold evolves gradually and may include escalation of seriousness of offences, opportunities to engage in and learn more about sophisticated crimes that my be geographically spread out, opportunities to gain standing with those more embedded in the gang world, exposure to firearms, weapons and serious violence, a more thorough understanding of the business of drugs including pricing, quantities, measurements and naming, and over time, increased interactions with police.

5.5.2. Localized Conflict Focused on One Community: South Asians

Across Canada, gang activity cuts across socio-economic and ethnic groups (McConnell, 2015; Totten & Totten, 2012; Descormiers & Morselli, 2011; Malm et al., 2011; Bouchard, 2020). The involvement of South Asians in Lower Mainland gangs can be traced back to the gang wars of the 1980s and 1990s between high-profile Indo-Canadian gangsters, most notably Bindy Johal, whose reputation and influence continues to extend beyond the borders of BC (Jingfors et al., 2015). When analyzing the gang landscape in the Greater Vancouver area specifically, Gordon (2000) reported that the gang membership of those belonging to criminal business organizations was "ethnically shaped" and tended to "meet the needs of both organization members and their families", suggesting familial and other social ties to be a defining feature of gangs in the Lower Mainland. Furthermore, Descormiers (2013), whose research involved retrospective self-reported and official data gathered from 73 gang members in Burnaby, BC, also highlighted the influence of family members already involved in gangs, when differentiating early and late-onset gang members in the study's sample.

Over the years, BC gangs have been characterized as being multi-ethnic within the same gang and multi-ethnic in regards to their business networks (McConnell, 2015; McCuish et al., 2015; Malm et al., 2011; Bouchard, 2020). For example, from 2010 to 2013, there were enterprise criminal groups persistent in BC; meaning business coalitions were commonplace between groups who were at one-point rivals (CFSEU-BC, 2013). Similarly, Malm et al. (2011) examined co-offending associations among criminal organizations in BC and found a high level of connectivity across groups. Nodes of various ethnicities were dispersed across the network, and there was a lack of distinct, ethnically homogenous clusters. Although the findings suggest that monolithic ethnic groups involved in the gang lifestyle in BC may warrant further attention, Bouchard (2020) cautions that effective boundaries of criminal organizations should be first measured by social relations, and not attributes such as ethnicity.

This research is particularly significant given that, for over a decade, there have been over 150 deaths [and counting] of Indo-Canadian men involved in gang violence in Metro Vancouver (Bailey, 2015; Totten & Totten, 2012). The over-representation of Indo-Canadians in gang homicide as a unique feature has been reaffirmed by scholars including McConnell (2015) and Jingfors et al. (2015) who found that while Indo-

Canadians represent only six percent of the population in BC, they represented over 24% of the gang homicide victims between 2003 and 2013. These findings are important as they 'set the stage' for gang violence among South Asian men in years to follow, as the Lower Mainland continues to see gang violence grip the South Asian community. It is important to note that despite this over-representation, the majority of South Asian individuals are not gang members (McConnell, 2015).

Twenty years after Gordon's (2000) research, the data in the current study's findings show the victims and their associates are overwhelmingly young South Asian males. These findings are consistent with Papachristos' (2009) research on gang violence in Chicago, which found that most conflicts concern a common ethnic group. Building on recent studies that analyze race and crime at a micro-level, I examine a social network built from the victims of the 2015 Surrey gang conflict and their associates in which young age and ethnicity add an intricate layer that cannot be understated. In this conflict, 94% of the 2015 victims were South Asian males, akin to 80% of those in the main component. While organized crime groups and gangs in the Lower Mainland have become more ethnically diverse in recent years (McConnell, 2015), these findings are notable but not surprising giving Surrey, BC's make up (Statistics Canada, 2017). Although public and media discourse around gang related violence in the Lower Mainland is often racialized with a focus on South Asian males (Johnston, 2016), it is one component of the overall gang landscape in BC, not the only one.

Mapping the network reveals that the Surrey conflict can be described as a single network, connecting 299 of the 355 individuals in the network, including 18 of the 23 victims (78.3%). These findings suggest one localized conflict, in which victims and offenders knew of each other. This was also further validated by news media stories released at the time in which the Police Chief of Surrey, in an unprecedented and rare move, released images of the young men involved in the shootings, describing the conflict as two groups competing over turf (Bolan, 2015a; Dhillon, 2015; Global News, 2015). Releasing the images of those involved was also done as a tactic to put pressure on extended friends and family, who remained largely silent, to turn information over to police. Un-cooperating victims, offenders and witnesses are another feature prevalent in the Surrey gang conflict. This wall of silence extended to the individuals' parents who many times turn a blind eye to the criminal activities of their children and adhere to a

strict code of silence. On the extreme end there may also be a blatant obstruction of police investigations (Bolan, 2015a). Withholding information from police is not specific to any one racialized group, however it is worth stating that South Asians place value to the family "collective" as opposed to the individual (Ghuman, 1994). The importance of the family unit and its image is an important aspect of South Asian culture and likely contributes to the code of silence. Family name and honor (*izzat*) is central to South Asian identity as it shapes who people are (Ghuman, 1994). In every respect, reputation and image are critical, which was reaffirmed by Gordon (2000), who outlined defending honor and reputation as features that could be attributed to gangs in BC. The subthemes of un-cooperating victims and a wall of silence, beg the larger question of how police can deal more effectively with ethnic and immigrant communities. The gang-involved individuals in the current study are generally second generation, with parents who have immigrated to Canada.

5.5.3. Risk Associated with Dial-a-Doping

In BC, there is a major emphasis on dial-a-doping and a gang landscape that is defined by its violent nature (McCuish et al., 2015; Airola & Bouchard, 2020; McConnell, 2015; Illegal Firearms Task Force, 2017). The shootings involved in the 2015 gang conflict were fuelled by drug trafficking conflicts driven by money (CBC, 2015). Analogous to pizza delivery service (Sinoski, 2009), gang members will often use low-level traffickers to use their own vehicles or drive rental vehicles, and coordinate multiple cellular phones (Bolan, 2015b). McConnell (2015) suggested gangs in BC operate with minimal connection to geographical areas, and are commodity-based, stating drugs "are the lifeblood of gangs in BC" (p. 194). Drug traffickers will distribute a phone number to drug users, and will deliver them upon receipt of a phone call or text message (McConnell, 2015). High-level organized crime figures supply resources and weapons to lower-level crime groups and launder profits (Illegal Firearms Task Force, 2017). The money associated with dial-a-doping then flows up the chain to support criminal organizations, which leads to power struggles and gang wars (Sinoski, 2009), ultimately ending in homicide/attempted homicide.

Inherently, dial-a-doping is one of the riskiest activities to undertake in the gang lifestyle (Airola & Bouchard, 2020; Illegal Firearms Task Force; 2017). In fact, as mentioned previously, using high school students to traffic drugs is strategic on part of

older gang members, as they are less likely to be on police's radar (Little, 2018). In fact, in the Lower Mainland context, gang members use rental vehicles to be evasive from police, and use rental vehicles in the commission of drug trafficking and in shootings (Bolan, 2015b; Illegal Firearms Task Force, 2017). There are a number of unknowns present when a gang member partakes in dial-a-dope dealing, which is what makes this particular criminal act so risky, not only is it typically undertaken outdoors and out in the open but the gang members are driving around the city with large sums of money and/or drugs, and are unsure of who is on the other end of the phone. Those who engage in crime in public are more likely to be detected by police than those who do it in private, and that this exposure is what increase's vulnerability (Rosenfeld, Jacobs & Wright, 2003).

In the current study, the majority of victims survived the homicide attempts on their lives. As such, the fear and paranoia associated with being an attempted homicide victim should not be overlooked. Research conducted by Molidor (1996) suggests that one of the most negative aspects of being in a gang is constant fear and paranoia, a universal theme. The gang lifestyle and activities are fraught with distrust, anxiety and hyper-vigilance, which in many cases will further push criminals to only associate with the same people and frequent the same places. Research supports the notion that gangs do not provide a sense of family, and instead much of the gang lifestyle is fraught with stress, tension, violence and betrayal (Beare & Hogg, 2013; McConnell, 2015). There are multiple sources of this fear. For instance, gang members may look for opportunities to take advantage and betray each other, even within the same gang (Bear & Hogg, 2013). Enemies are continuously on the hunt to target gang members or those that gang members surround themselves with. The police's aim is to dismantle criminal organizations (CFSEU-BC, 2015b), and incarcerate gang members; intelligence teams exist whose sole job it is to conduct surveillance and gather evidence. Customers may be chasing gang members who 'ripped' them off with low-quality product (Sinoski, 2009). The subtheme of fear and paranoia is one of the primary reasons why gang-involved individuals carry weapons such as batons, brass knuckles, bear mace, and of most relevance to the current study, firearms.

5.5.4. Access and Use of Firearms

The availability, access and use of firearms, along with the frequency with which shootings are carried out in public space are other defining and important features of the BC gang landscape (Illegal Firearms Task Force, 2017). Jingfors et al.'s (2015) study examining gang-related homicides in BC through media reports from 2003 to 2013, found that firearms were the weapons of choice in 73% of gang-related homicides in BC. The findings in the current study reveal that despite their mean age, the majority of victims have a criminal record and almost double the amount of police interactions than those in the main component. Most striking is that one third of the victims were prohibited from carrying firearms and all of them had FIP notifications, suggesting firearms are readily available and routinely used (Illegal Firearms Task Force, 2017). Roberto et al. (2018) used the network approach to map out the risk of exposure to guns in a network, specifically, how close offenders were to guns in the city of Chicago. Findings showed that on average, any person in their network was 2.5 "hand shakes" away from a gun. In the context of Chicago's illegal gun markets, the findings suggested guns are relatively close. Roberto et al.'s (2008) study, using the network approach, would need to be replicated in the Lower Mainland context to determine how many "handshakes" away any person in the network is from a gun. Regardless of city or circumstance, gangs play a key role in facilitating access to guns.

If an opposing gang wants to send a message to another gang, they will do so through street level workers. One of the consequences of groups fighting over turf is that gang members are carrying firearms and are willing to shoot one another over frivolous matters. Drug dealing is intertwined with extreme level of violence (McCuish et al., 2015; Airola & Bouchard, 2020; McConnell, 2015), and in the case the BC landscape, a desire to maintain an image and establish street credibility.

Carrying a firearm is also associated with peer influence and maintaining a certain image. Research suggests that the socialization process of gang members involves a shaping of one's "identity and sense of self", and firearms assist gang members "project their violent identities" and a "tough image" (Stretesky & Pogrebin, 2007, p. 85, 90). McConnell (2015) dives deep into the construction of gangs in BC, and outlines that people joining gangs in BC are generally seduced into a gangster lifestyle, including a "Hollywood-like image of a fast-paced life of pretty girls, nice cars, expensive

restaurants, and VIP passes to nightclubs" (p. 160). Jingfors et al. (2015) add that in BC the gang dynamic involves affluence and status.

Other scholars have also reaffirmed a gang's ability to dominate another criminal groups is related to its social standing and reputation within the community (Papachristos, 2009; Totten & Totten, 2012; Lewis & Papachristos, 2020). To maintain its social standing, gang members often engage in violent interactions, especially "when symbolic matters – such as honor or reputation – are at stake" (Papachristos, 2009, p. 78). Lewis & Papachristos (2020) emphasize symbols such as "toughness, honor, charisma and criminal prowess are major determinants of social standing" (p. 1831). There is willingness by gang members to use violence to obtain or maintain respect, which in the current study is carried out through shootings.

Chapter 6.

Limitations

The findings in this study should be interpreted with an understanding of the limitations. The first limitation is that of missing data. Police data was the primary source used to construct the network. Police files for a five-year period (2011 to 2015) were reviewed for each of the 23 victims of homicide/attempted homicide in 2015 in the City of Surrey. The list containing the names of the 23 victims provided by CFSEU-BC can be qualified as conservative. There may be other potential victims, which may not have met the threshold of being "gang-related" by CFSEU-BC. Other missed data includes those police-involved interactions with victims when they were under the age of 18. Furthermore, the study captured police interactions from the Lower Mainland PRIME-BC server. The victims associate with gang members and non-gang members in interactions that often go undetected by police. Hence, key connections can be missed.

The data came from one server, the Lower Mainland server in PRIME-BC. Thus, associations and interactions occurring in other servers, by non-RCMP police departments, and other provincial/territorial police databases were missed and the true nature of the victims' ties with others are underestimated. Nevertheless, the victims and their associates generally reside, socialize and conduct their activities in Surrey, and other RCMP jurisdictions, so the study provides a good sense of their social environments. Relying strictly on police data fails to capture the complex realities of gang members. The use of multiple sources of data can compensate for limitations of any one source (Bouchard, 2020). This can include supplementing police information with methods such as police surveys and interviews with actual gang members, etc.

Another limitation to consider involves using node centrality (Airola & Bouchard, 2020). The 23 victims will have high node centrality due to the fact that the network was constructed from their interactions. Once an individual is a victim of gun violence, it is possible that police detection increases, leading to increased encounters with them. Next, caution is warranted on the transferability and applicability of this research to other contexts (McCuish et al., 2015). Gang conflicts are dynamic and no one conflict is ever the same. Contextual information is provided to help understand and give meaning to

the data. It is possible that the same method replicated in a different setting would yield completely different results. With that said, gang violence is not specific to any one jurisdiction, city, region or country. Determining how to reduce victimization is a universal issue, and one best done through SNA.

Intelligence-led approaches to policing allow flexibility in choices of tactics, and sufficient time to "strike", are more likely to result in meaningful convictions, and overall support "more fruitful collaborative working" (Maguire, 2000, p. 319-320). The construction of criminal networks are unique due in part to qualities such as secrecy and efficiency, as such, the problem of incompleteness in police data is something that warrants attention. As suggested by Oatley & Crick (2015), data problems that exist can include "incorrectness, unintentional data entry errors or intentional deception by criminals; and, inconsistency, with many records of same person from difference contacts or sources" (p. 5). This is a limitation of criminal networks derived from police data. There may be several police officers that contribute to a police file, and of those, some may be detail-oriented and fulsome, while others are brief. Similarly, Sparrow (1991) suggested that police databases are full of incomplete data, so there is a strong likelihood that true nodes or links will be unobserved, and an accurate picture of the gang environment not be fully understood. However, this can be negated by the fact that the incompleteness will be systematic (Sparrow, 1991). Additionally, the fact that police officers are dealing with victims of gun homicide/attempted homicide, one can expect them to be consistent and detailed in their reporting. Other risks include "net widening", or expanding the boundaries too much and including individuals who otherwise should be excluded (Bouchard, 2020; Ferguson, 2019). To overcome this, it is very important to understand context, and spend the time to carefully review police data.

There are risks that police agencies need to be aware of before utilizing complex algorithms to understand criminal networks and base decisions for investigative purposes. There is an underlying assumption that police file management is accurate, which is not always the case. As Ferguson (2012) states, "the precision assumed in statistical probability may not reflect the accurate crime numbers" (p. 317). Intelligence gathered from police surveillance is required to be inputted into databases in a timely fashion to be useful which is one of the reasons why in recent years there has been a move to "real-time" reporting (Ferguson, 2012). Furthermore, algorithms are to be used with caution as there are risks to strictly following data that can be biased for

recommendations on police actions. As such, Papachristos and Sierra-Arévalo (2018) assert that data-driven analytics are optimal when predictive models are cross-verified against the expertise of real people. Additionally, there should be a thorough and transparent review process of any strategies that are used (Papachristos & Sierra-Arévalo, 2018). This transparency includes police and other relevant stakeholders being aware of what data is being used and how it is being collected and analyzed.

If police focus their efforts on individuals who associate with gang members using predictive technologies, there are potential legal (constitutional) and ethical ramifications to seriously consider (McGloin, 2005; Papachristos & Sierra-Arévalo, 2018), since gang members associate with other gang members and non-gang members. Maguire (2000) suggests several aspects of predictive technologies are highly controversial such as "rights, liberties and accountability; police integrity and ethics; choices of targets; effectiveness; and the extent to which police practice has actually changed 'on the ground'" (p. 320). Moreover, how such predictive policing technologies impact communities of color is important to consider (Ferguson, 2019).

The use of various technologies and the increased collection, exchange and storage of personal information and the methods used to obtain it, have the tendency to raise deeper questions about the reliability, transparency and applications of the technologies being utilized and the rights of citizens (Ferguson, 2012; Maguire, 2000). Intrusive methods and the lack of transparency (Papachristos & Sierra-Arévalo, 2018) may lead to citizens developing anti-police attitudes. White (2008) suggests that a heightened awareness from law enforcement vis-à-vis surveillance and other intervention initiatives, based simply on associates, can lead to an increased chance young people "adopt a 'gang' identification", and subsequently engaging in violent and/or criminal behavior (p. 158).

Chapter 7.

Conclusion & Future Directions

Gang violence is a growing public health and safety concern in Canada (Marshall et al., 2015). The impact of gang crime is multi-faceted, and requires solutions that are innovative, collaborative and data-driven. As an evolving city in Canada, Surrey, BC, has seen an increase in drive-by shootings by alleged gang members in the last several years (Mangione, 2016). The year 2015 was a tumultuous one, especially the first half of the year that saw a shooting almost every few days (Thom, 2015). The rules of engagement for gang members have changed over time, as gang members are now more fluid in how their business is conducted, who it is conducted with and who is considered a threat.

The current study advances understanding of gun violence by modeling it as social contagion: gun violence is concentrated and moves among high-risk populations. It aims to examine the social environments of the 2015 Surrey gang conflict victims to determine who is most at risk for gun victimization based on centrality scores and direct connections. The greater exposure and closeness to previous homicide victims in one's social network, the greater one's own risk of victimization. The current study showed that 2016 and 2017 victims were among the most central in the 2015 network. In a Canadian context, the use of SNA, specifically social proximity and direct connections to victims, allowed a level of forecasting future victims. The eight individuals who were shot in 2016 and 2017 were more likely to be brokers in the 2015 network. Papachristos (2009) suggests, "[g]ang members come and go, but their patterns of behavior create a network structure that persists and may very well provide the conduit through which gang values, norms, and culture are transmitted to future generations" (p. 119).

The motivation behind studying a gang conflict was to determine which gang members posed the biggest risks to public safety with the overall goal of preventing loss of life. The study's findings focus on a specific community, young South Asian males in the City of Surrey, from a victim perspective to understand gang behavior, how violence spreads and what can be done to prevent further violence. Policy implications were explored, specifically for police, for the purposes of demonstrating the many benefits of

SNA and provide insight into the practical application of network analysis. Those individuals who have befallen victim to the gang lifestyle cannot be lost causes; society should not give up on them. As a society, we must provide a foundation that is accepting and empathetic, and a willingness to be part of the solution. SNA allows one to understand the "big picture" and gives clarity to data in a meaningful and heuristic manner (Sierra-Arévalo & Papachristos, 2015). It can assist police in resource deployment strategies, targeting and enforcement, intervention, prevention, education and identifying "key players". With respect to resources, police administration seeks to be the most effective and efficient in resource allocation and police officer deployment. Police agencies aim to be forward looking, intelligence-led and proactive as much as possible. With SNA, police and analysts can use police data, which is already being collected in a manner that is systematic, replicable and can be supplemental to investigations. This study has shown that SNA as an analytical technique provides utility for police – a solution that is innovative, efficient and will provide strategic and informed outcomes.

Beyond the police, a collective effort to combat gang violence is required, especially as it relates to a BC-specific strategy. The BC gang landscape which includes unique features is highlighted, including the common way drugs are sold/distributed, the ease in which firearms are accessed and used, the young age in which members are recruited, and for this particular conflict, those involved coming from the South Asian community. The uniqueness of BC's gang landscape also involves gang members coming form well-to-do families (McConnell, 2015; Totten & Totten, 2012; Gushue et al., 2018; Illegal Firearms Task Force, 2017). With respect to motivations, those involved in the gang lifestyle often do so by choice (McConnell 2015; Gahunia et al., 2019). McConnell (2015) asserts that the 'typical' indicators of gangs – geographically based, color-wearing and graffiti walls are not prevalent in BC, hence referring to the phenomenon as unique.

Parents of at-risk youth and school administrators in Surrey should remain committed to providing youth the resources, support, opportunities and acceptance they need to develop into contributing members of society. If social problems of gang violence are not addressed in a collaborative and innovative way, the social fabric of society can be disrupted. The exploration of these topics allows researchers and other stakeholders to appreciate the uniqueness and convolution of gangs and its processes,

and design programs and strategies for interjection, prevention and education. It will however require a shift in thinking, especially as it relates to police. McConnell (2015) raised this important topic; police will need to consider how they construct those in the gang lifestyle and accept desistance where gang members change their lives around. He acknowledges that police appear reluctant to alter their positions, which could possibly lead to gang members becoming further embedded in the gang lifestyle (McConnell, 2015). In BC, a shift is starting to be seen with programs such as the Gang Intervention and Exiting Program within CFSEU-BC (CFSEU-BC, 2015c).

With respect to future research, there are many directions this line of inquiry can take. The current study's findings provide confirmation that the difference in centrality observed between 2016 and 2017 victims and non-victims in the 2015 network was important enough to warrant consideration, however future studies should investigate this phenomenon with larger sample sizes, which would provide power and confidence. Other studies could look into adopting multiple sources of data to provide an even richer and more complete understanding of networks.

I constructed the network from the point of view of the 23 victims and for shooting events that took place over a one-year period. In the future, it may be telling to map out their associate's associates to further examine the connected nature of network. Beyond just Surrey, BC, other jurisdictions should undertake this exercise on an annual basis with the victims of gang-involved homicide/attempted homicide to determine changes in the network over time and what it means for conflicts. Longitudinal studies can be used to see how centrality measures fluctuate. Additionally, police can also map out each year's victims to determine if all victims are connected, if the same victims are repeatedly being targeted, if new victims emerge, if the same patterns can be observed and how conflicts transform. For example, a gang conflict in the Townline Hill area of Abbotsford, BC, involving two groups of approximately 40 men from the South Asian community fighting over drug lines (Hopes, 2015), could be mapped out using SNA. This particular conflict later evolved into a more wide-ranging, multi-jurisdictional, "Lower Mainland gang conflict" (Hopes, 2019). If SNA is utilized early, strategically, systematically and accepted into policing broadly, conflicts can be thwarted before they start to unravel, as police can identify those most at risk for the purposes of intervention and prevention.

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Appendix A.

Data Reduction: Faction Analysis and Girvan Newman Clustering

Faction (Priority: Speed)	Fitness
2 Factions	26184
3 Factions	17032
4 Factions	12448
5 Factions	9848
6 Factions	7878
7 Factions	6682
8 Factions	5760
9 Factions	4942
10 Factions	4440
11 Factions	4186
12 Factions	3668

Girvan-Newman Clustering	Q Value
Partition with 2 clusters	0.490
Partition with 3 clusters	0.530
Partition with 4 clusters	0.560
Partition with 5 clusters	0.650
Partition with 6 clusters	0.720
Partition with 7 clusters	0.710
Partition with 8 clusters	*0.770*
Partition with 9 clusters	0.770
Partition with 10 clusters	0.780
Partition with 11 clusters	0.780
Partition with 12 clusters	0.770
Partition with 13 clusters	0.770
Partition with 14 clusters	0.760
Partition with 15 clusters	0.760
Partition with 16 clusters	0.760
Partition with 19 clusters	0.750
Partition with 20 clusters	0.740

Appendix B.

Centrality Analyses

Table B.1. **Centrality Measures of 18 Victims (Ranked by Betweenness Centrality)**

18 Victims	Degree	Betweenness	Closeness	Eigenvector	Average Centrality	Subgroup
1725	0.11	0.32	0.33	0.00	0.19	1
1982	0.09	0.30	0.30	0.06	0.19	3
1675	0.07	0.27	0.30	0.00	0.16	6
1188	0.10	0.26	0.26	0.00	0.15	4
1935	0.12	0.20	0.32	0.00	0.16	6
1742	0.13	0.15	0.25	0.41	0.24	2
1990	0.08	0.15	0.24	0.00	0.12	7
1351	0.08	0.14	0.31	0.00	0.13	6
1304	0.10	0.12	0.26	0.00	0.12	1
1156	0.06	0.10	0.25	0.00	0.10	5
1620	0.09	0.08	0.26	0.07	0.12	3
1751	0.06	0.06	0.27	0.06	0.11	3
1411	0.04	0.05	0.21	0.00	0.08	4
1664	0.04	0.05	0.20	0.05	0.08	2
1015	0.05	0.05	0.23	0.05	0.09	3
1205	0.04	0.03	0.21	0.00	0.07	4
1120	0.03	0.02	0.21	0.00	0.06	4
1059	0.02	0.01	0.21	0.00	0.06	4

Table B.2.   Centrality Measures of 281 Non-Victims in Main Component (Ranked by Top 20 Betweenness Centrality)

Non-Victims	Degree	Betweenness	Closeness	Eigenvector	Average Centrality (4 Measures)
1288	0.05	0.30	0.32	0.00	0.17
1228	0.02	0.26	0.32	0.00	0.15
1581	0.09	0.18	0.28	0.38	0.23
1289	0.03	0.13	0.27	0.05	0.12
1835	0.01	0.10	0.25	0.00	0.09
1484	0.02	0.06	0.24	0.04	0.09
1695	0.03	0.03	0.25	0.00	0.08
1043	0.02	0.03	0.29	0.00	0.08
1175	0.03	0.02	0.26	0.00	0.08
1187	0.06	0.02	0.27	0.00	0.09
1701	0.07	0.02	0.27	0.00	0.09
1096	0.04	0.01	0.26	0.05	0.09
1046	0.02	0.01	0.25	0.00	0.07
1560	0.03	0.01	0.23	0.05	0.08
1279	0.04	0.01	0.28	0.00	0.08
1812	0.02	0.01	0.23	0.04	0.07
1858	0.02	0.01	0.23	0.04	0.07
1535	0.04	0.01	0.25	0.03	0.08
1749	0.02	0.01	0.25	0.00	0.07
1661	0.01	0.01	0.23	0.00	0.06

The table above displays the top 20 non-victims ranked by highest betweenness centrality.

Appendix C.

Top 20 for Betweenness Centrality in High-Risk Group (2+ Direct Connections)

High Risk Group (Top 20)	Betweenness	Average Centrality (4 Measures)	Low Risk Group (Top 20)	Betweenness	Average Centrality (4 Measures)
1288	0.30	0.17	**1725**	**0.32**	**0.19**
1228	0.26	0.15	**1982**	**0.30**	**0.19**
1188	**0.26**	**0.15**	1675	0.27	0.16
1935	**0.20**	**0.16**	1742	0.15	0.24
1581	0.18	0.23	**1990**	**0.15**	**0.12**
1351	**0.14**	**0.13**	1304	0.12	0.12
1289	0.13	0.12	**1156**	**0.10**	**0.10**
1835	0.10	0.09	**1411**	**0.05**	**0.08**
1620	**0.08**	**0.12**	1664	0.05	0.08
1484	0.06	0.09	**1015**	**0.05**	**0.09**
1751	**0.06**	**0.11**	1205	0.03	0.07
1695	0.03	0.08	**1120**	**0.02**	**0.06**
1043	0.03	0.08	**1059**	**0.01**	**0.06**
1175	0.02	0.08	1560	0.01	0.08
1187	0.02	0.09	1661	0.01	0.06
1701	0.02	0.09	1190	0.00	0.07
1096	0.01	0.09	1370	0.00	0.07
1046	0.01	0.07	1440	0.00	0.07
1279	0.01	0.08	1781	0.00	0.17
1812	0.01	0.07	1013	0.00	0.06

The table above displays betweenness and average centrality measure for the top 20 individuals in the high-risk and low-risk group, in descending order of betweenness centrality. Victims have been identified in bold font. While there are five victims in the high-risk group, the low risk-group includes 13 victims.
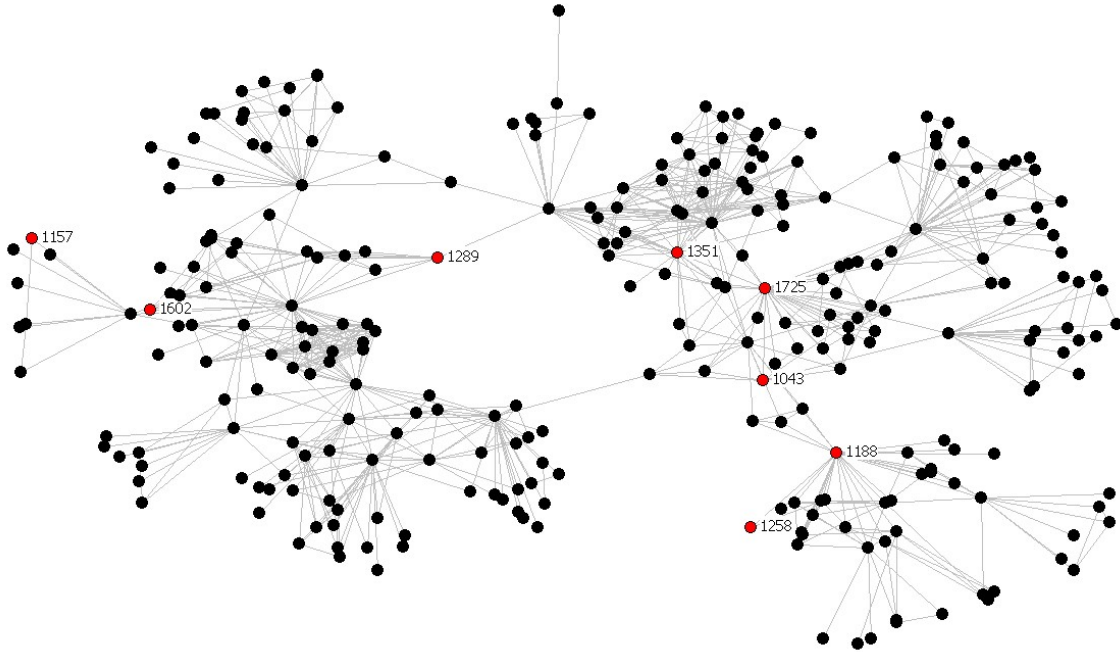
Appendix D.

Test for Difference in Mean Centrality for High-Risk and Low-Risk Group

	High-risk Group (52 Nodes)		Low-risk Group (247 Nodes)		Difference in Means	Two-Tailed Test (Significance)
	Mean	Standard Deviation	Mean	Standard Deviation		
Degree Centrality	0.03	0.03	0.01	0.02	0.02	0.00
Betweenness Centrality	0.04	0.07	0.01	0.04	0.03	0.00
Closeness Centrality	0.25	0.03	0.22	0.03	0.03	0.00
Eigenvector Centrality	0.02	0.06	0.03	0.08	0.01	0.68
Average Centrality (4 Measures)	0.08	0.04	0.07	0.03	0.01	0.00

Appendix E.

Main Component Outlining Eight Victims of 2016 and 2017

Appendix F.

Date and Time Block of Shooting Events for 18 Victims

Victim	Shooting Date	Shooting Time
1620	18-Jan	04:01 to 08:00
1431	25-Feb	20:01 to 24:00
1982	01-Mar	12:01 to 16:00
1725	10-Mar	00:01 to 04:00
1351	10-Mar	16:01 to 20:00
1675	10-Mar	16:01 to 20:00
1935	10-Mar	16:01 to 20:00
1304	12-Mar	16:01 to 20:00
1664	26-Mar	20:01 to 24:00
1742	26-Mar	20:01 to 24:00
1205	28-Mar	20:01 to 24:00
1990	01-Apr	08:01 to 12:00
1578	08-Apr	00:01 to 04:00
1156	19-Apr	00:01 to 04:00
1765	06-May	00:01 to 04:00
1621	08-Jun	08:01 to 12:00
1015	13-Jun	20:01 to 24:00
1751	13-Jun	20:01 to 24:00
1059	15-Sep	16:01 to 20:00
1120	15-Sep	16:01 to 20:00
1188	15-Sep	16:01 to 20:00
1411	15-Sep	16:01 to 20:00
1140	21-Nov	00:01 to 04:00

Appendix G.

Duty to Warn Files for 2013 to 2017

ID	Total Duty to Warn Files	2013	2014	2015	2016	2017
1441	1	1				
1097	4	1	2	1		
1157	1				1	
1802	1				1	