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The Spatial Concentration, Stability, and Specialization of Mental Health Calls for Service: Evidence in Support of Proactive, Place-Based Interventions

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Abstract

For many decades the police have been the *de facto* responders to persons with perceived mental illness (PwPMI). However, having the police in this role has come with negative repercussions for PwPMI, such as disproportionately experiencing criminalization and use of force. In recognizing these issues, the police—and more recently, the community—have developed responses that either seek to improve interactions between the police and PwPMI or remove the police from this role altogether. However, in either case, these efforts are *reactive* in nature, responding to crises that arguably could have been prevented had a timelier intervention taken place. Further, evidence on certain police responses to PwPMI, such as Crisis Intervention Teams (CIT) and co-response teams, suggests that they endure deployment-related challenges, thus limiting their reach to PwPMI.

Drawing from the *Criminology of Place* and existing place-based policing strategies, the present dissertation argues that efforts focused on *responding* to PwPMI should instead be *proactively* deployed, targeting areas where interactions between police and PwPMI concentrate spatially. Doing so would not only result in efficient deployment of scarce resources but would permit police- and community-based efforts to have a greater reach to PwPMI and thus prevent future interactions with police. To-date, however, there have been few empirical and theoretical investigations into the spatial patterns of PwPMI calls for service that could inform such proactive, place-based efforts. Specifically, we do not currently understand: (1) the degree to which PwPMI calls for service concentrate within certain geographical contexts (such as a small city); (2) whether the degree of PwPMI call concentration and the location of these calls remain stable over time; and (3) what theoretical frameworks explain why PwPMI calls for service occur where they do. Drawing on seven years (2014-2020) of calls for service data from the Barrie Police Service and data from the 2016 Canadian Census, the present dissertation employs various methods of spatial analysis to fills these specific knowledge gaps.

Although the theoretical investigation confirmed the findings of previous work that found no association between social disorganization theory and the spatial patterns of PwPMI calls for

service, the present dissertation revealed: (1) PwPMI calls for service are highly concentrated within the context of a small city, even more so than what has previously been uncovered in larger jurisdictions; (2) the degree of PwPMI call concentration is stable over time, falling within a narrow proportional bandwidth of spatial units; and (3) PwPMI calls for service, and their concentrations, occur in the same places over time—even during the COVID-19 pandemic—and are thus spatially stable. As such, though more scholarship is needed on theories that might help explain why PwPMI calls occur where they do, the findings of the present dissertation strongly support the proactive, place-based deployment of resources to PwPMI.

Keywords

Police, Place-based Policing, Criminology of Place, Mental Health, Persons with Perceived Mental Illness, Crisis Intervention Teams, Co-response Teams, Civilian-based Response Teams, Spatial Concentration, Spatial Stability, Spatial Specialization, Social Disorganization Theory

Summary for Lay Audience

For a variety of reasons, the police have become the primary responders to persons with perceived mental illness (PwPMI). However, having the police in this role has led to consequences for PwPMI, such as being more likely to be arrested or experiencing use of force. In recognizing these issues, the police and the community have developed specialized responses to PwPMI that either aim to: (1) improve interactions between the police and PwPMI and their outcomes; or (2) remove the police from the role of responding to PwPMI.

Although research on specialized responses to PwPMI show that they are moderately effective, they face one significant drawback: they are *reactive*. In other words, specialized police and community-based efforts to PwPMI focus their resources on responding to PwPMI who are already in crisis and are therefore tasked with addressing a situation that could have been avoided had someone intervened sooner. Instead, what this dissertation argues is that specialized police and community-based efforts should be proactive in their approach, focusing on hot spots of PwPMI calls for police service to have a greater reach to the people they are intended to help.

While there is a small body of literature which shows that PwPMI calls cluster in hot spots, we still do not know: (1) the degree to which PwPMI calls cluster in smaller jurisdictions; (2) whether the degree of PwPMI call clustering remains stable year-over-year; (3) whether PwPMI calls occur in the same places year-over-year; and (4) what theories might explain why PwPMI calls occur where they do. In an attempt to inform proactive efforts to PwPMI, this dissertation sought to generate knowledge on these four areas.

While the theoretical analysis failed to uncover why PwPMI calls occur where they do, the remaining results show: (1) PwPMI calls cluster to a strong degree in a small city; (2) the degree of PwPMI call clustering remains stable year-over-year; and (3) PwPMI calls largely occur in the same places year-over-year. Altogether, the results of this dissertation provide strong evidence in support of proactive police and community-based efforts in hot spots of PwPMI calls.

Co-Authorship Statement

All research, analysis, and writing included within the present dissertation are solely the work of Jacek Koziarski.

Conflict of Interest Statement

In part, this dissertation relies on data obtained from the Barrie Police Service who serve the community of Barrie, Ontario, Canada. From July 1st 2020 through June 30th 2021, Jacek Koziarski was employed as an Independent Research Consultant with the Barrie Police Service. The work presented within this dissertation is unrelated to this employment and Jacek Koziarski received no compensation, monetary or in-kind, from the Barrie Police Service for the production of this dissertation.

Any thoughts, ideas, or opinions expressed within this dissertation are solely that of Jacek Koziarski.

Acknowledgments

Although my name is the only one that shows up on the title page and degree parchment, the writing of a dissertation and simply making it through to the end of graduate school truly takes a village. Over the last six years I received so much unconditional love, support, and guidance from family, friends, colleagues, and supervisors that it made graduate school among the most enjoyable experiences in my life!

To my M.A. thesis committee, Dr. Christopher O'Connor, Dr. Tyler Frederick, and Dr. Barbara Perry: I did not get a chance to write any acknowledgments for my thesis, but better late than never! Six years ago, I walked into graduate school not knowing what I wanted to do with my life and left UOIT two years later with a love for research and writing, all thanks to you three. While I had a relatively ambitious thesis plan to survey every police service in Canada, you three never doubted my ability or pushed me to tone my thesis down to simply get in and get out of the program. Instead, you all encouraged me and gave me the autonomy to do my thesis the way I wanted to do it; how I wanted to do it. I now realize how lucky and

rare such an experience is, particularly for students just beginning graduate school. So, thank you!

To Chief Kimberley Greenwood and Deputy Chief Rich Johnston of the Barrie Police Service: I thank you both unreservedly for the trust you have put in me while working with your organization for the last four years. The passion you both have for improving policing through data-informed and evidence-based policing is not only contagious, but a refreshing perspective within a profession in which intuition and "this is the way we have always done it" rules. And although Chief Greenwood is on her way to a well-deserved retirement, I strongly believe that in the years to come, the Barrie Police Service will become a model for how science and police practice should be intertwined, and I cannot wait to see that come to fruition.

To Dr. Jin R. Lee: I feel as though I entered graduate school with one brother and am leaving having acquired a second. I know over the years I have said this to you countless times, but I am going to put it down on paper here as well: I am not sure I would have gotten through this experience without your support. From being a co-author to listening to my bi-weekly rants about whatever issue I had on my mind, to everything else in between, you have always given me the motivation to pick myself up, dust myself off, and keep pushing forward. Had it not been for you, I am not sure I would be Dr. Koziarski right now. Thank you for everything, my friend!

To the Naccarato Family: Thank you for your unconditional love and support as I progressed through my academic journey. Over the last six years, each of you have listened to me rant about projects I was working on, vent when I was navigating through problems, or even helped support me while I was writing my comprehensive exams. I hope to be doing a little less of that from now on, but no promises!

To my brother, Maciek: When you and I used to sneak into Mom and Dad's room as kids to change their alarm clocks so that we could avoid going to Polish school, I am sure you would have never guessed that I would eventually stay in school for so long that they would have to give me a Ph.D. to kick me out. Over the last six years I have always appreciated your

curiosity about my research, and you have always kept me grounded throughout my studies with our conversations about Manchester United. Thank you for your support. Love you!

Do Mamy i Taty: Wiem kiedy byłem dzieckiem, dałem wam trudny czas z moją szkołą—bardzo nie lubiłem się uczyć i nie lubiłem chodzić do szkoły. Nie wiem kiedy albo co się w ogóle zmieniło, ale okazuje się że szkoła mi się podobała! Przez całe moje życie pokazywaliście mi wartość czeskiej pracy i chciałem to pokazać w swojej nauce. Dziękuję za waszą miłość i pomoc. Kocham was i liczę że jesteście ze mnie dumni.

Last but certainly not least, to my wife, Sydney: Over my last six years of school, our relationship grew alongside. We moved in together, we got engaged, we got Oscar, and we got married. In between these big milestone, and even the small ones, you were always there to support me during my school work in any way you could. You ensured I was well-fed whenever I had a busy day; you walked Oscar whenever I had to work a little later than expected; you listened whenever I had a tough day or just needed to vent. This degree truly should have your name next to mine because I could not have done this without you. I am deeply indebted to you for everything you have done, and I am looking forward to this new stage in our relationship where (for the very first time) I am no longer a student! I love you forever.

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Chapter 1

1   Introduction

The police have long been the first responders to persons with perceived mental illness (PwPMI) due, in part, to failures in the existing mental health system that does not have the capacity to sufficiently meet the demand for care (Adelman, 2003; Lamb et al., 2002; Sealy & Whitehead, 2003). Leaving the police with this responsibility, who are neither mental health professionals nor whose primary mandate involves mental health, has— perhaps unsurprisingly—contributed to a number of issues, such as the criminalization of PwPMI (Charette et al., 2011, 2014; Compton et al., 2022; Fisher et al., 2011; Lamb & Weinberger, 1998; Teplin, 1984; Teplin & Pruett, 1992), disproportionate use of force (Fisher et al., 2011; Laniyonu & Goff, 2021; Markowitz, 2011; Morabito et al., 2017; Yang et al., 2018), and even in some rare cases, death of PwPMI during an interaction with police (Dubé, 2016; Hall, 2014; Iacobucci, 2014; McNeilly, 2017).

In response to both the demands on police to respond to PwPMI, and calls by communities and activist groups, police agencies across North American jurisdictions have enacted various reforms aimed at improving interactions between the police and PwPMI and their respective outcomes (Dupont et al., 2007; Huey et al., 2021; Marcus & Stergiopoulos, 2022; Shapiro et al., 2015). More recently, discussions have also emerged that call for the removal of the police as the primary responders to PwPMI, demanding that civilian-based efforts respond to PwPMI instead (Dee & Pyne, 2022; Watson, Pope, et al., 2021; Yousif, 2022). However, the problem with both existing police efforts and the proposed civilian-based efforts is that they are *reactive* in nature, *responding* to PwPMI who may already be in crisis and are tasked with addressing a situation that arguably could have been prevented had a timelier intervention taken place.

Recently, some scholars have argued for the use of *proactive* policing efforts, including the deployment of police and other community-based resources to where interactions between the police and PwPMI concentrate spatially (Coleman & Cotton, 2016; White et al., 2019; White & Goldberg, 2018; White & Weisburd, 2017; Wood & Beierschmitt,

2014; Wood & Watson, 2017). The use of such approaches offers great potential for not only the use of scarce police and non-police resources in an efficient manner and having a greater reach to PwPMI, but for proactively intervening before one reaches crisis, putting them on a more fruitful path of mental health care and treatment, and—most importantly—preventing future interactions between the police and PwPMI, thus reducing the footprint of the police in the lives of PwPMI.

While there is some scholarship that examines the spatial patterns of interactions between the police and PwPMI, empirical and theorical gaps in our knowledge remain that could impede any potential attempts at proactive, place-based efforts to PwPMI. Accordingly, the present dissertation draws upon seven years (2014-2020)[1] of calls for service data from the Barrie Police Service in Barrie, Ontario, Canada to answer the following research questions:

1. To what extent do PwPMI calls for service concentrate within the context of a small city (if at all)?
2. Does the concentration of PwPMI calls for service fall within a narrow bandwidth of spatial units over time (i.e., is the proportion of spatial units that account for a defined proportion of PwPMI calls for service stable over time)?
3. Are PwPMI calls for service spatially stable or do they occur in different parts of a jurisdiction over time?
4. Is there an association between the spatial specialization of PwPMI calls for service and the tenets of social disorganization theory?

In the pages that follow, I provide a brief overview of the relevant literature on interactions between police and PwPMI and discuss issues with having the police as primary responders to PwPMI. I then shift focus to discussing alternate police and non-police responses to PwPMI. Here, I also discuss the limitations of reactivity, how the issue of reactivity been addressed within the policing context when it comes to criminal activity, and how what has been learned in this context can be translated to inform the deployment of efforts that are focused on PwPMI. Subsequently, I discuss the existing empirical and theoretical literature on the spatial patterns of PwPMI calls for service and

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[1] The study presented in Chapter 2 was written in mid-2020. As such, the analyses in Chapter 2 only draw upon six years of data (2014-2019).

conclude with discussing the specific gaps in knowledge that this dissertation will address.

1.1   Brief Note on Terminology

Before proceeding further, it is important to first discuss the terminology that will be employed throughout the present dissertation when referring to an individual subject to a mental health interaction with the police, along with outlining the justification for why the employed term was selected over other, more commonly used options in the existing literature.

As alluded to in the previous section, the term employed throughout the present dissertation is *persons with perceived mental illness*. The use of this particular term is informed by the work of Frederick and colleagues (2018) who conducted a scoping review of 92 peer-reviewed articles published between 2000 and 2017 on police interactions with PwPMI. In part, the objectives of their review were to: (1) identify the breadth and frequency of terms employed in the literature to refer to individuals subject to a mental health interaction with the police; and (2) how authors conceptualized their selected term (if at all). With respect to the first objective, Frederick and colleagues (2018) identified 23 unique terms that are employed in this body of literature, from *emotionally disturbed person*, to *mentally ill* and *person with serious mental illness*. *Person with mental illness*, however, was found to be the most commonly used term among the 92 reviewed articles (Frederick et al., 2018).

With respect to their second objective, Frederick and colleagues (2018) found—quite strikingly—that few scholars in the sample of reviewed articles made an attempt at conceptualizing their selected term. For example, this lack of explicit conceptualization meant that some scholars employed terms such as *person with serious mental illness* with no explanation or discussion as to what constituted a 'serious' mental illness nor the application of any verification methods to ensure that the individuals they were referring to in their work did indeed have a 'serious' mental illness. On the other hand, articles that did provide a definition—such as for *person with mental illness*, for example—often had

different and contrasting conceptualizations as to what a police interaction with a *person with mental illness* constituted (Frederick et al., 2018).

In light of their findings, Frederick and colleagues (2018) argue that the broad use of the term *person with mental illness* and other related terms, particularly when not explicitly conceptualized, can be a threat to study validity. This is because, within most of the reviewed studies, even though the investigators *did* employ a term to suggest that subjects of interactions with police did have a mental illness, they *did not* employ methodologies that would have allowed for the verification of whether or not an individual that was the subject of an interaction with police did—with certainty—have a diagnosed or diagnosable mental illness at the time of their interaction. Indeed, in many cases—and particularly where police-generated datasets (e.g., calls for service) are employed in a study and include hundreds, if not thousands, of interactions with police—it would be infeasible to retroactively verify whether each individual did or did not have a diagnosed or diagnosable mental illness. Compounding this issue is that while police officers do receive some mental health training, which in part includes training on identifying symptoms of mental illness (Coleman & Cotton, 2010; Cotton & Coleman, 2008), police officers are not trained mental health professionals and thus may misinterpret behaviours that an individual may be exhibiting in front of them. For example, a study by Bohrman and colleagues (2018) highlights that when police officers assess for the presence of mental illness during an interaction, it is not uncommon for officers to misinterpret symptoms of mental illness with symptoms of substance use. As such, unless explicit steps are taken to verify whether an individual subject to an interaction with police does or does not have a diagnosed or diagnosable mental illness or efforts are made by investigators to explicitly sample those with a diagnosed mental illness, there exists an inherent degree of uncertainty as to whether individuals subject to a mental health interaction with police do or do not have a diagnosed or diagnosable mental illness. Given this, Frederick and colleagues (2018) argue that terms, such as *person with mental illness*, which definitively suggest the presence of mental illness, are inappropriate.

In recommending alternative terminology, Frederick and colleagues (2018) suggest that scholarship in this area instead draw upon terminology that acknowledges the uncertainty

that is inherent within these interactions. Accordingly, their recommendation is that scholarship uses the term *persons with perceived mental illness*, which as discussed earlier, is the term that has been adopted for this dissertation. The use of this particular term is also in line with language incorporated within Australian, British, and Canadian legislation that stipulates police responsibilities when it comes to interactions with PwPMI. Mental health legislation in New South Wales and Victoria, Australia, as well as in the United Kingdom employ variations of the term *person appears to have a mental illness* (*Mental Health Act*, 2007; *Mental Health Act*, 2014; *Mental Health Act*, 1983). Further, in Queensland, Australia, Section 157B of the *Public Health Act* (2005) enables officers to intervene when an "officer believes a person's behaviour […] indicates the person is at immediate risk of serious harm and the risk appears to be the result of a major disturbance in the person's mental capacity," whereas in British Columbia (*Mental Health Act*, 1996) and Nova Scotia (*Involuntary Psychiatric Treatment Act*, 2005), Canada, on the other hand, mental health legislation employs a variation of the term *person with apparent mental disorder*. In Ontario, Canada, Section 17 of the *Mental Health Act* (1990) enables officers to act on the "opinion that the person is apparently suffering from mental disorder." In sum, legislation incorporates language such as *appears*, *apparent*, *apparently*, *believes*, and *opinion* to acknowledge the uncertainty around the presence of diagnosed/diagnosable mental illness during interactions with police, thus it is paramount that the terminology employed within the present dissertation does so as well.

1.2   Literature Review

1.2.1   Overview of Police Interactions with PwPMI

For much of the preceding century, people living with serious forms of mental illness were removed from their communities and institutionalized within psychiatric facilities— spaces in which they frequently endured inhumane treatment and/or failed to receive appropriate care (Adelman, 2003; Lamb et al., 2002). However, in the 1960s and 1970s, the deinstitutionalization of people living with mental illness took place—a process which involved two separate, but related components. The first component involved the closure of psychiatric institutions and returning those who were institutionalized to their

communities, whereas the second component concerned the funding of community-based mental health services and treatment so that once people living with mental illness returned to their communities, they could be appropriately cared for (Adelman, 2003; Lamb et al., 2002). While deinstitutionalization occurred successfully, the funding that governments pledged for community-based mental health care did not materialize (Adelman, 2003; Sealy & Whitehead, 2003). Indeed, this lack of funding for mental health care in the post-deinstitutionalization era has persisted, even through to the present day as governments have been widely criticized for chronically underfunding mental health care, resulting in a discrepancy between the care that is available and the amount of care that is required (Lurie, 2014).

Chronic underfunding of mental health care can contribute to a wide array of issues, such as a lack of psychiatric beds, leading to individuals who seek care to be turned away and/or not be provided with the care they require due to a scarcity of resources that are now often reserved for the most serious of psychiatric cases (Canada et al., 2010; Durbin et al., 2010; Sealy & Whitehead, 2003). Additionally, those who do opt to seek out mental health care are often faced with exorbitant wait times that can stretch months, if not years, contributing to problems not being addressed in a timely manner, and in some cases, escalating to the point of crisis (Children's Mental Health Ontario, 2020; Goldner et al., 2011). These mental health care accessibility issues, coupled with other social problems that may exacerbate and/or demonize mental health problems, such as strict civil commitment criteria, homelessness, poverty, and intolerance of social disorder, along with the broad, sweeping nature of the police mandate making it a 'catch all' for a number of social ills, contribute to PwPMI coming into contact with police (Borum et al., 1997; Canada et al., 2010; Koziarski & Huey, 2021; Lamb & Weinberger, 1998; Markowitz, 2011; Schulenberg, 2016; Teplin, 1984).

While PwPMI may come into contact with police for any number of reasons outside of mental illness—such as being the victim or witness in a crime, the suspect in the commission of a crime, or even the subjects of missing persons investigations, wellness checks, and traffic-related incidents (Huey et al., 2022a, 2022b; Livingston et al., 2014)—it is the police role of *Psychiatrists in Blue* (Menzies, 1987) and *Streetcorner*

Psychiatrists (Teplin & Pruett, 1992) that is becoming ever more pronounced. In fact, in 2014, several Canadian police leaders testified in the Canadian House of Commons that calls for service involving PwPMI were on a steadily increasing trajectory (Standing Committee on Public Safety and National Security, 2014). Later, work by Vaughan and Andresen (2018) corroborated this claim by finding that PwPMI calls for service were increasing by as much as 10% year-over-year in select municipalities in British Columbia, Canada. More recently, and perhaps unsurprisingly, the recent Coronavirus Disease 2019 (COVID-19) pandemic has also been found to be associated with increases in PwPMI calls for service. Indeed, research on the mental health effects of the COVID-19 pandemic has found that feelings of fear, unemployment, social isolation and other pandemic-related factors have contributed to deteriorations in self-reported mental health and heightened symptoms of stress, anxiety, and/or depression (Daly et al., 2020; Holman et al., 2020; Rossi et al., 2020; Vindegaard & Benros, 2020; Zajacova et al., 2020). Accordingly, Koziarski (2021) identified a 22% increase in PwPMI calls for service in Barrie, Ontario, Canada and hypothesized that pandemic-related stressors, coupled with closures and/or modifications to existing mental health services to curb the spread of the virus may have been to blame for the increase.

In general, studies often show that PwPMI calls for service comprise approximately 1% of services' yearly call loads (e.g., Hodgkinson & Andresen, 2019; Koziarski et al., 2022; Livingston, 2016; Lum et al., 2021; Vaughan et al., 2016; White & Goldberg, 2018). Although, recent in-depth analyses into police calls for service data suggest that PwPMI may be involved in as many as 10% of calls for service in any given year (Koziarski et al., 2022; Langton et al., 2021; Mitchell et al., 2022). PwPMI calls have also been found to require considerable police resources. Charette and colleagues (2014), for example, found that relative to non-PwPMI calls for service, PwPMI calls can not only be twice as long in duration, but can also consume up to 90% more resources. Further, should transfer to a hospital for psychiatric assessment be deemed necessary at a call, this can translate into even more time and resources being utilized. Studies, for example, have shown that officers can spend up to five hours waiting for care of the individual to be transferred to hospital staff (Schulenberg, 2016). However, even after such long wait times, there is no guarantee that the PwPMI in question will be admitted due to the lack

of psychiatric beds and other resources, as discussed earlier (Canada et al., 2010; Shore & Lavoie, 2018). These factors contribute to what is commonly referred to as the 'revolving door' of the mental health system thus enabling for some PwPMI to become so-called 'frequent fliers' in that they have tens, if not hundreds, of interactions with police on an annual basis with little-to-no intervention from the mental health system (Akins et al., 2016; Shore & Lavoie, 2018).

1.2.2   Problems with Police Being '*Psychiatrists in Blue*'

Given that the police have, as Iacobucci (2014) describes, been given the role of *de facto* mental health responders due the catch-all nature of the police mandate and the lack of suitable alternatives to fill-in gaps left by an underfunded mental health system, it is perhaps not surprising that a number of issues have come to light by having the police— who are neither mental health professionals, nor whose primary mandate deals with mental health—in this role. More specifically, although officers do receive some degree of mental health training at both the police academy and during in-service training (Coleman & Cotton, 2010; Cotton & Coleman, 2008; Lorey & Fegert, 2021; Richmond & Gibbs, 2020), studies report that officers feel unprepared (Tartaro et al., 2021; Wells & Schafer, 2006) and/or anxious during interactions with PwPMI (Wittmann et al., 2020). Likely compounding these feelings is the fact that co-occurring issues, such as alcohol and substance use, are found in between 25% and 60% of PwPMI interactions, which may exacerbate any potential complications during an interaction (Charette et al., 2011; Compton et al., 2022; Schulenberg, 2016; Shore & Lavoie, 2018). Additional complications may also surface at the point of transferring PwPMI to hospital whereby officers are tasked with communicating what they witnessed to hospital staff which, at times, may get lost in translation or even questioned (Lamb & Weinberger, 1998; Schulenberg, 2016).

At the officer-level, individual officers may also hold stigmatizing attitudes towards PwPMI as being 'erratic', 'unpredictable', or even 'dangerous', which makes some PwPMI fear coming into contact with the police (Lockwood et al., 2020; Mulay et al., 2016; Tartaro et al., 2021; Wittmann et al., 2021). Some officers may also hold the perception that interactions with PwPMI have 'nothing to do with police work' or is 'not

real police work' (Iacobucci, 2014; Schulenberg, 2016). Schulenberg's (2016) systematic social observation of interactions between the police and PwPMI identified a disjuncture between police culture and departmental policy when it came to interaction outcomes. More specifically, Schulenberg (2016) found that officers faced pressure from higher ranked officers to conclude interactions with PwPMI informally—that is, with no arrest or apprehension and transfer to hospital for assessment, just leaving them as they were— due to the length of time more formal outcomes took. Indeed, an investigation by Charette and colleagues (2011) found that hospital transfers and arrests take up to two and three times longer, respectively, than informal conclusions. However, from the departmental policy side, Schulenberg (2016) found that officers faced pressure for meeting their productivity quotas through arrests, citations, and charges. As such, officers—and particularly those who genuinely wanted to assist PwPMI—felt as though their ability to exercise their discretion was limited for being put into a position where they needed to conclude interactions with PwPMI quickly so that they could move onto other calls that could boost their personal productivity numbers (Schulenberg, 2016).

Broadly speaking, however, officers do hold a considerable amount of discretion when it comes to interactions with PwPMI and their outcomes. They may, as alluded above, conclude the interaction through 'official' means—such as apprehension and transfer to hospital if they were deemed to be a risk to themselves or others or arrest—or alternatively, they may conclude the interaction through more informal means, such as leaving the individual as they were found or referring them to a local community-based mental health service (Bittner, 1967; Teplin & Pruett, 1992). In most cases though, research shows that interactions between police and PwPMI conclude informally, with the individual in question being left as they were with no further action on behalf of the responding officer(s) (Bittner, 1967; Charette et al., 2011; Shore & Lavoie, 2018; Teplin & Pruett, 1992; Watson & Wood, 2017). There are, however, a number of situational constraints and circumstances which can make deciding how to conclude an interaction with PwPMI difficult for officers (Schulenberg, 2016; Wells & Schafer, 2006). Some interactions, for example, are said to occur within what is commonly referred to as the 'grey zone'. This is where a PwPMI does not meet the criteria for an emergency mental health apprehension and transfer to hospital, nor arrest, which leaves officers with few

options and especially so in jurisdictions where there is a lack or complete absence of community-based mental health services (Koziarski et al., 2021; Wood et al., 2017). Furthermore, interactions in said 'grey zone' can be especially complex when PwPMI do not meet the criteria for an emergency mental health apprehension or arrest, but where it may also be unsafe for an informal conclusion (Schulenberg, 2016). Such situations can ultimately lead to what Lamb and Weinberger (1998) have coined as 'mercy booking', whereby PwPMI are arrested for minor offences during 'grey zone' interactions or when there are no available psychiatric beds or community-based resources so that they can obtain mental health care through the criminal justice system (Lamb et al., 2002; Schulenberg, 2016; Teplin, 1984). Such circumstances, as Schulenberg (2016) explains, contribute to the criminalization of PwPMI.

Studies show that while arrests are generally a rare outcome for interactions between police and PwPMI (Charette et al., 2011, 2014; Shore & Lavoie, 2018; Todd & Chauhan, 2021), PwPMI have nonetheless been found to have higher likelihood of arrest than non-PwPMI (Lamb & Weinberger, 1998; Teplin, 1984; Teplin & Pruett, 1992), even when the context and severity of the offence is held constant (Charette et al., 2014). This holds true across crime categories, especially for minor, disorder-related offences for which PwPMI are two-to-five times more likely to be arrested (Charette et al., 2014; Fisher et al., 2011; Schulenberg, 2016; Todd & Chauhan, 2021). Indeed, recent work by Compton and colleagues (2022) found a staggering average number of lifetime charges and arrests for PwPMI in their sample: 12.6 and 8.6, respectively. Additionally, they also identified that PwPMI who are Black, have low educational attainment, and/or have substance use disorder had a greater number of arrests (Compton et al., 2022).

Equally concerning are issues around police use of force during interactions with PwPMI. While use of force incidents only occur in approximately 1% of all interactions between the police and the public (Baldwin et al., 2018), research by Morabito et al. (2017) finds that PwPMI not only have a higher likelihood of experiencing use of force during interactions with police, but especially so when co-occurring issues are present, such as mental health and substance use—which as discussed earlier, can be present in up to 60% of interactions (see also Fisher et al., 2011; Markowitz, 2011; Yang et al., 2018). More

recently, Laniyonu and Goff (2021) similarly examined use of force disparities between PwPMI and non-PwPMI and found that across nine police departments in the United States, PwPMI were 11.6 times more likely to experience use of force and 10.7 times more likely to be injured during an interaction with police. Recently released data from the Toronto Police Service in Toronto, Canada shows a similarly grim reality, but for PwPMI from racialized communities. Specifically, these data show that PwPMI who are Black and Indigenous are 1.9 and 1.4 times more likely, respectively, to experience use of force by a member of the Toronto Police Service than white PwPMI (Toronto Police Service, 2022). In rare instances, use of force incidents have also escalated to use of deadly force against PwPMI. In the Canadian context, for example, the deaths of Lester Donaldson, Sammy Yatim, Michael MacIssac, and others have ignited numerous reports and inquests into police use of force and police responses to PwPMI more generally, many of which have concluded with a call for enhanced training and more improved responses to PwPMI (e.g., Dubé, 2016; Hall, 2014; Iacobucci, 2014; McNeilly, 2017).

1.2.3 Alternative Police (and Non-Police) Responses to PwPMI and the Problem with Reactivity

The police have acknowledged the issues around having them in the role of *Streetcorner Psychiatrist* and have taken the lead in developing specialized responses to PwPMI that seek to improve officer training on mental health and interactions with PwPMI more generally, while reducing (or even eliminating) criminalization and use of force (Marcus & Stergiopoulos, 2022; Munetz & Griffin, 2006; Shapiro et al., 2015). Although the scholarship on each of the responses discussed below is not conclusive given that the evidence base is still being developed (see e.g., Bird & Shemilt, 2019; Dewa et al., 2018; Ghelani et al., 2022; Huey et al., 2021; Marcus & Stergiopoulos, 2022; Puntis et al., 2018; Seo et al., 2021; Shapiro et al., 2015; Taheri, 2016; Watson et al., 2017), the research that has been completed to-date does exhibit promising results for interactions between police and PwPMI.

One response-type intended to improve interactions between the police and PwPMI are known as Crisis Intervention Teams (CIT). CITs were founded in Memphis, Tennessee in the late 1980s following the death of a PwPMI during an interaction with the Memphis

Police Department and involve a multisectoral partnership between police, hospitals, psychiatric facilities, community-based mental health services, and families of those with mental illness (Dupont et al., 2007; Watson et al., 2007). Their goals are to improve interactions between police and PwPMI, facilitate the transfer of PwPMI to appropriate care quickly, and establishing networks of support for early intervention (Dupont et al., 2007; Watson et al., 2017). While scholars have done little to interrogate the effects of CIT on subject, agency, and community-level outcomes, Watson and colleagues (2017) explain that a robust body of evidence has been developed for officer-level attitudinal and behavioural outcomes that stem from the extensive 40-hour mental health training program that is part of CIT (Dupont et al., 2007; Steadman et al., 2000). Indeed, such studies show that, following CIT training, officers have improved knowledge of mental illness (Compton et al., 2014a; Ellis, 2014; Wells & Schafer, 2006), improved attitudes towards PwPMI (Booty et al., 2020; Compton et al., 2006, 2014a; Demir et al., 2009; Ellis, 2014), a higher tendency to choose a referral to a community-based mental health service or transfer to a hospital over arrest (Compton et al., 2014b; Franz & Borum, 2011; Steadman et al., 2000; Watson, Owens, et al., 2021), improved de-escalation skills (Compton et al., 2014b), improved comfort and confidence when interacting with PwPMI (Booty et al., 2020; Compton et al., 2014a; Wells & Schafer, 2006), and use less force (Compton et al., 2011; Morabito et al., 2012, 2017).

Whereas CIT is a frontline, officer-only response, some police services have developed and implemented what are broadly referred to as 'co-response teams'. Co-response teams differ from CIT in that they are commonly comprised of an officer and mental health practitioner who work together on shift and respond to PwPMI calls at the request of frontline officers, or an on-call mental health practitioner who also responds to calls on request (Iacobucci, 2014; Koziarski et al., 2021; Marcus & Stergiopoulos, 2022; Shapiro et al., 2015). One advantage of co-response teams is that a trained mental health professional is on scene and can lend their specialized training to ensure the situation is addressed with the most optimal conclusion for the individual in question (Iacobucci, 2014). While the evidence base on co-response teams similarly requires further development (see e.g., Huey et al., 2021; Marcus & Stergiopoulos, 2022; Shapiro et al., 2015), the existing research has shown that co-response teams have the potential to

reduce use of force incidents, arrests, unnecessary hospital transfers, costs associated with PwPMI calls, and time spent at PwPMI calls, while simultaneously increasing referrals to community-based mental health services, PwPMI engagement with outpatient services, and PwPMI satisfaction when interacting with the police (Bailey et al., 2021; Blais et al., 2020; Fahim et al., 2016; Kirst et al., 2015; Kisely et al., 2010; Lamanna et al., 2018; Meehan et al., 2019; Semple et al., 2021).

Beyond CIT and co-response teams, discussions have also recently emerged that call to remove the police from responding to PwPMI altogether (see e.g., Watson, Pope, et al., 2021). These calls originate from the murder of a Black man by the name of George Floyd at the hands of four officers from the Minneapolis Police Department in May of 2020 and were amplified through the subsequent 'Defund the Police' movement. More specifically, the Defund the Police movement called for a reimagining of public safety with the shifting of funds away from the police and toward services for mental health, addictions, homelessness, and other social issues with the overarching goal of eliminating the footprint of the police in the lives of those enduring one or many social issues (Cummins, 2022; Koziarski & Huey, 2021; Lum et al., 2021; Watson, Pope, et al., 2021). While the 'defunding' of the police did not obtain much traction—particularly as many police services, at least in the North American context, maintained or increased their budgets in the years following the movement (e.g., Adams, 2021; Rutland, 2022)—one call from the Defund movement that *has* materialized considerably is the development of civilian-based, non-police responses to PwPMI.

Currently, the literature on civilian-based responses to PwPMI is sparse with most evidence being contained in what is termed 'grey literature'—that is, work that has not been subjected to peer-review (Marcus & Stergiopoulos, 2022). Nonetheless, in the last two years, there has been a rapid development of pilot programs in a number of North American jurisdictions which see a civilian-based team of mental health professionals as the first responders to PwPMI in the community, with the police only being called in to assist should the situation escalate to where there may be a threat to others (e.g., Dee & Pyne, 2022; Yousif, 2022). In most cases, however, removing the police from the role of *Streetcorner Psychiatrist* through civilian-based responses has been hypothesized to be

beneficial on a number of fronts, from reducing the amount of police time and resources consumed by responding to PwPMI to eliminating the fear and discomfort that some PwPMI have reported when interacting with police (Marcus & Stergiopoulos, 2022; Yousif, 2022).

Crucially, what is seldomly discussed about CIT, co-response teams, and even the emerging civilian-based response efforts is that they are all *reactive* in nature. While not inherently detrimental, they are, in effect, deployed to an individual who has already reached crisis. Therefore, they are attempting to address a situation that, arguably, could have been prevented had a timelier intervention taken place. Within a policing context, such reactive efforts fall under what is commonly referred to as the 'traditional' model of policing in which *random patrol*, *rapid response*, and *reactive investigations* dominated day-to-day policing operations (Sherman, 2013; White & Weisburd, 2017). However, while present day policing—at least when it comes to the policing of criminal activity— still engages in rapid response and reactive investigations as needed, the profession has progressed away from random patrol toward more data-informed, proactive approaches which may in turn mitigate or even eliminate the need for reactive responses to crime and subsequent investigations.

1.2.4 Proactive, Place-Based Policing and the Criminology of Place

One example of data-informed, proactive policing approaches is the practice of place-based, hot spot policing. In short, this practice depends on knowledge of where crime issues occur within a jurisdiction, to which policing resources can be directed with the goal of preventing crime before it occurs (Sherman & Weisburd, 1995; Weisburd, 2008). In fact, the literature on hot spots policing in particular has amassed a considerable number of high quality, experimental studies which show that directing police resources into hot spots of crime—even for as little as 15 minutes at a time during periods of the day when the hot spot is most criminally active—can lead to reductions in crime and disorder with no displacement to nearby areas (Braga, 2001; Braga et al., 2012a, 2012b, 2019a, 2019b; Braga & Weisburd, 2020; Koper, 1995; Telep et al., 2014; Telep & Weisburd, 2012; Weisburd, 2008). Another practice that is closely related to hot spots

policing is that of problem-oriented policing. Depending on the 'problem' at hand, practical applications of problem-oriented policing may similarly focus on redirecting resources to crime hot spots, but with the added objective of addressing problems at their source (Eck & Spelman, 1987; Goldstein, 1979). In fact, studies on hot spots policing that apply a problem-oriented approach have shown to be *more effective* at reducing crime and disorder than other applications of hot spots policing that merely call for an increased police presence in a high-crime area (Braga et al., 2019a, 2019b). In either case, however, one of the most important elements of both hot spots policing and problem-oriented policing is not only that both approaches have a considerable evidence base that substantiates their use as an effective means of reducing crime and disorder in targeted areas, but there is also a considerable body of literature which has documented the spatial patterns of crime that give hot spots policing and problem-oriented policing the foundation upon which they operate.

Investigations into the spatial patterns of crime began in the early-to-mid 1800s through the work of Quetelet (1831) and Guerry (1832) who examined crime concentration across large administrative areas in France. The focus then shifted to the concentration of crime across neighbourhoods upon the emergence of the Chicago School approximately a century later (e.g., Shaw & McKay, 1942), and shifted again toward micro-geographic units of analysis—also known as 'micro-places'—in the 1980s which include: individual buildings or addresses, street block faces, street intersections, and/or street segments (Eck & Weisburd, 1995; Weisburd, Bruinsma, et al., 2009). This most recent shift to micro-geographic units of analysis, in particular, proliferated a new area of study, coined by Sherman and colleagues (1989) as the *Criminology of Place* and has developed a robust body of literature about the spatial patterns of crime.

Both cross-sectional (e.g., Andresen & Linning, 2012; Boivin & Melo, 2019; Sherman et al., 1989; Weisburd & Amram, 2014; Weisburd & Mazerolle, 2000) and longitudinal studies (e.g., Curman et al., 2015; Gill et al., 2017; Schnell & McManus, 2020; Vandeviver & Steenbeek, 2019; Weisburd et al., 2004; Weisburd, Morris, et al., 2009) studies on the concentration of crime have all discovered a striking degree of concentration across micro-places. Sherman and colleagues (1989), for instance, found

that 50% of all calls for service in Minneapolis, Minnesota over a one-year term were concentrated at just 3% of addresses in the city, whereas Boivin and de Melo (2019) found that 50% of crime in 2016 in Toronto and Montreal, Canada was concentrated at just 3.7% and 4.5% of street segments, respectively. Longitudinal studies, however, enabled scholars to discover that the degree of crime concentration across a small proportion of street segments was not isolated to any one particular year, but rather remained stable over time. Weisburd and colleagues (2004), for example, examined 14 years of crime in Seattle, Washington and found that crime was concentrated between 4% and 5% of street segments in any given year. More recent work by Vandeviver and Steenbeek (2019) similarly found that 50% of all residential burglaries in Antwerp, Belgium over a 12-year period were concentrated at approximately 2% of street segments in any given year. This literature ultimately inspired and lent much support to Weisburd's (2015, p. 138) *Law of Crime Concentration* that states, "For a defined measure of crime at a specific micro-geographic unit, the concentration of crime will fall within a narrow bandwidth of percentages for a defined cumulative proportion of crime." Moreover, beyond temporal stability in the degree of crime concentration at street segments, longitudinal investigations have also discovered that crime is spatially stable as well, with crime largely occurring at the same places over time (e.g., Andresen, Curman, et al., 2017; Andresen, Linning, et al., 2017; Braga et al., 2010; Curman et al., 2015; Gill et al., 2017; Hibdon et al., 2017; Hodgkinson et al., 2016; Schnell & McManus, 2020; Weisburd et al., 2004).

Ultimately, the research literature on crime and place has developed a robust understanding around the concentration and spatial stability of crime to adequately inform proactive, place-based policing efforts that target 'hot spots' of criminal activity (Gill et al., 2017; Lee et al., 2017; Schnell & McManus, 2020; Sherman et al., 1989; Sherman & Weisburd, 1995; Weisburd et al., 2004). Studies on police activity, however, show that only 20% to 30% of all calls for service concern issues that are criminal in nature, with the remaining 70% to 80% of calls involving a breadth of non-criminal, social issues—such as interactions with PwPMI (Lum et al., 2021; Wuschke et al., 2017). Accordingly, some scholars have recently drawn from the *Criminology of Place* and the demonstrated success of place-based, crime-focused policing strategies to argue for a

reimagining of how the police operationalize their responses to PwPMI in the community which, as White and colleagues (2019) argue, have to-date largely failed to consider the utility of knowledge on *where* PwPMI calls for service occur to inform their deployment.

Scholars, such as Coleman and Cotton (2016), argue that police efforts—in addition to responding to PwPMI in crisis—should also be proactively deployed, focusing their efforts on root causes that may lead some PwPMI to come into contact with the police. Other work by Wood and Watson (2017) as well as White and colleagues (2019) echoes this sentiment and further argues that *place* is a critical area of opportunity for such proactive deployment in that the geography of *where* interactions between police and PwPMI occur could be used to inform targeted, proactive efforts (see also Wood & Beierschmitt, 2014). This, however, is not to say that that there do not already exist practices involving PwPMI that are 'proactive' in nature. For instance, certain deployments of co-response teams do operate in a proactive capacity, but their focus is not on *place* and instead have their attention on following up with PwPMI who recently had an interaction with the police and/or PwPMI who are known to police as 'frequent fliers' (see e.g., Koziarski et al., 2021; Morabito & Savage, 2021). Work by White and Weisburd (2017), on the other hand, documents the first attempt at a proactive co-response team deployment in Baltimore, Maryland whose focus was on *place*. This co-response team, however, was proactively deployed into hot spots of crime with high levels of self-reported mental health problems, as opposed to hot spots of PwPMI calls for service (White & Weisburd, 2017). As such, although 'proactive' efforts to PwPMI exist in practice and have been documented in the literature, proactive place-based efforts whose deployment is specifically informed through the spatial patterns of PwPMI calls for service have yet to materialize.

Importantly, there are many hypothesized benefits that may stem from the proactive deployment of both police and even non-police resources into hot spots of PwPMI calls for service. Overall, proactive deployment into these areas can enable for the identification of individuals who may be approaching crisis and therefore directing them to hospital or a community-based mental health service before they reach crisis and require a police response (White et al., 2019; White & Goldberg, 2018; White &

Weisburd, 2017). In doing so, it could not only put the individual on a more fruitful path of mental health care and treatment, but it would lessen the footprint of the police in the lives of PwPMI. Further, from the policing perspective, both CITs and co-response teams endure a number of deployment-related challenges which therefore limit the number of PwPMI they reach in their communities. With CIT, for example, a lack of resources and officer availability can be a financial deterrent for some police services to send officers to the 40-hour CIT training program (Bratina et al., 2021; Seo & Kruis, 2022; Skubby et al., 2013). On the other hand, co-response teams are also often deployed on a limited scale due to staffing and funding restrictions, with many jurisdictions only having one or two teams that do not cover an entire 24-hour period (Iacobucci, 2014; Koziarski et al., 2021). Schulenberg (2016) also documents that due to their limited deployment, co-response teams may be reserved for calls where an individual has reached a certain 'threshold' in their crisis. As such, deploying either CITs or co-response teams in a proactive capacity with a focus on where PwPMI calls for service concentrate, police services can mitigate the effects of limited resourcing through efficient deployment and instead enable CIT and co-response team resources to have greater reach to the individuals they are intended to assist. Most importantly, in doing so, this would not only reduce the number of PwPMI calls for service and therefore the need for frontline officers with less training to address these situations, but a proactive deployment of CIT and co-response teams would also enable for more PwPMI to interact with efforts that have been shown to reduce use of force and criminalization of PwPMI while increasing PwPMI referrals to community-based care and engagement with treatment.

Outside of the policing context, if jurisdictions deploy non-police, civilian-based response teams to PwPMI, efforts should similarly be made to deploy them in a proactive capacity with a focus on where PwPMI calls for police service have historically concentrated instead of the reactive approach that many pilot programs are currently planning (Dee & Pyne, 2022; Yousif, 2022). In doing so, they could similarly intervene in situations where an individual appears to be approaching crisis and thus reduce the number of PwPMI these civilian-based responses themselves come into contact with in a reactive capacity.

Beyond the concentration of PwPMI calls for service alone, attempts at investigating possible theoretical frameworks that seek to explain *why* PwPMI calls occur where they do could also be of immense benefit to both police and non-police stakeholders who employ proactive, place-based efforts to PwPMI in their communities. This is because, in addition to targeting areas *where* PwPMI calls for service concentrate, they may in tandem seek to develop and execute means through which they address theoretical reasons for *why* PwPMI calls for service occur where they do, thus adding an additional mechanism through which crises may be proactively averted.

1.2.5 PwPMI Calls for Service: Spatial Patterns and Theoretical Perspectives

There is great promise in the proactive deployment of both police and non-police resources into areas where interactions between the police and PwPMI concentrate, along with understanding theoretical possibilities for why these calls occur where they do. And although the *Criminology of Place* has almost exclusively focused on understanding the spatial patterns of crime and crime-related issues, some scholars have shifted their attention toward understanding the spatial patterns of PwPMI calls for service. While this body of literature is certainly in its infancy, it does suggest at least preliminary support toward the feasibility of the aforementioned proactive place-based efforts.

Motivated by the work of Sherman and colleagues (1989) which served as the impetus for the *Criminology of Place*, Biebel and Cordner (2003) found that 33% of all PwPMI calls for service made throughout 1995 in Lexington, Kentucky occurred at just 70 addresses in the city. Research that followed over a decade later in a number of North American jurisdictions found that 50% of PwPMI calls for police service were concentrated on between 0.30% and 3% of all street segments (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018). Studies have, however, identified that while PwPMI calls for service are considerably concentrated at street segments, they are dispersed within that concentration. In other words, PwPMI calls for service tend to cluster in multiple hot spots that are spread out across a jurisdiction (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018). One Canadian study that, on the other hand, drew upon larger spatial units akin to United

States census blocks found that while 50% of PwPMI calls for service were more dispersed across Statistics Canada dissemination areas relative to street segments, calls were still nonetheless considerably concentrated within 11.10% of dissemination areas (Vaughan et al., 2019).

Moreover, studies on the spatial patterns of PwPMI calls for service have also discovered that these calls are not only more concentrated than crime (Hodgkinson & Andresen, 2019; Vaughan et al., 2016), but that they occur in different areas than crime as well (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018). One notable exception to this, however, is violent crime which tends to co-locate with PwPMI calls for service (Hodgkinson & Andresen, 2019; White et al., 2019; White & Goldberg, 2018). White and colleagues (2019), for instance, found that calls for service related to violence and drugs on a particular street segment increased the likelihood of a PwPMI call for service occurring on the same segment. As such, should efforts be made to proactively deploy non-police resources into areas of PwPMI call concentration, caution should be exercised if a co-location of violence and PwPMI calls for service is identified. In some cases, this co-location may mean that the use of co-response teams in a proactive capacity, and not civilian-based efforts, may be the most optimal approach given that the police half of the co-response team possesses use of force options should unrelated violence occur while proactive activities are being conducted.

Beyond the growing evidence on the spatial patterns of PwPMI calls for service, few scholars have explored theoretical frameworks that could potentially explain why PwPMI calls occur where they do. To-date, scholars have tested three plausible frameworks which, at times, yield inconsistent results. Vaughan and colleagues (2016), for example, drew upon opportunity theories of crime (see Brantingham & Brantingham, 1993; Cohen & Felson, 1979; Cornish & Clarke, 1987) to argue that due to their mental illness, PwPMI may frequent locations such as hospitals, pharmacies, and mental health services, and as such, more PwPMI calls may occur around such places. While they identified a spatial overlap between PwPMI calls for service and their places of interest (Vaughan et al., 2016), work that followed in a different jurisdiction similarly examined whether places such as service providers, pharmacies, and schools increased the likelihood of a

PwPMI call for service occurring on the same street segment and found that schools were the only place that increased the likelihood of PwPMI calls for service (White et al., 2019).

Alternatively, others have examined the effect that social cohesion and social capital have on the location of PwPMI calls for service. Indeed, scholarship dating back to the work of Durkheim (1897) has consistently shown the negative effects that social isolation can have on one's psychological well-being (see also Kawachi & Berkman, 2001; Mair et al., 2008), with more recent studies on social capital—often operationalized in the literature through measures of trust, social participation, and/or community involvement—showing that low social capital is associated with deteriorated psychological well-being, while high social capital has protective effects against negative mental health symptoms (Araya et al., 2006; Bassett & Moore, 2013; Langille et al., 2012; Takagi et al., 2013). Accordingly, drawing upon these theoretical frameworks to explore the location of PwPMI calls for service, it has been found that high levels of social cohesion, trust, and community involvement on a street segment decreased the likelihood of a PwPMI call occurring on said segment (White et al., 2019). White and colleagues (2019) hypothesized that this was the case because community members may have stronger relationships on segments with high social cohesion, trust, and community involvement, and as such, individuals may also be more open to discussing their mental health with others, which in turn leads to community members intervening before one's mental health issues rise to the level of requiring police involvement.

The third and final theoretical framework previously used in an attempt to explain the spatial patterns of PwPMI calls for service is social disorganization theory. This theoretical framework, originally put forth by Chicago School sociologists Shaw and McKay (1942), posits that areas characterized by low socioeconomic status, high ethnic and/or racial heterogeneity, high residential mobility, family disruption, and urbanization are socially disorganized and thus may lack adequate social ties between community members, resulting in an environment in which crime and delinquency are left unaddressed (see also Sampson & Groves, 1989). Beyond its criminological applications, social disorganization theory has also been widely used by sociologists and

epidemiologists to help explain how particular neighbourhood characteristics and the resulting lack of social cohesion and social support can negatively impact one's mental health. In the first application of the theory to this context, Faris and Dunham (1939) found that a disproportionate number of individuals institutionalized in mental health facilities in Chicago, Illinois originated from socially disorganized neighbourhoods (see also Ku et al., 2020; Melnychuk et al., 2009). More recent scholarship has similarly identified that neighbourhoods with high disadvantage (i.e., households on public assistance, single-parent households, high unemployment), residential mobility, high ethnic/racial diversity, and low socioeconomic status had higher rates of psychotic disorders (Silver et al., 2002; Veling et al., 2015).

While social disorganization does appear to be associated with increased levels of mental illness, the lack of social ties and social support within socially disorganized communities may have a double effect. That is, the lack of social ties and social support in socially disorganized communities may not only negatively affect one's mental health, but the absence of these social factors may also contribute to community members not intervening before one reaches crisis. Indeed, as Watson and colleagues (2008) argue, access to mental health treatment is facilitated through social networks and community ties. As such, in socially disorganized communities wherein these ties are weaker and/or non-existent, community members may be less willing to intervene when an individual is exhibiting overt symptoms of mental illness, thus leaving them to escalate toward a potential crisis and police involvement (Krishan et al., 2014; Watson et al., 2008). Work by Vaughan and colleagues (2018) recognized this link between social disorganization and the potential for increased PwPMI calls for service in socially disorganized communities. Accordingly, they calculated areas across four jurisdictions that have a disproportionate share of PwPMI calls for service relative to all calls for service—otherwise known as spatial specialization—and examined whether social disorganization theory could explain the exhibited spatial patterns in PwPMI calls for service. They found no association between socially disorganized area and the spatial specialization of PwPMI calls for service (Vaughan et al., 2018).

1.3   Current Study

While the evidence on the spatial patterns of PwPMI calls for service suggests that these calls do indeed concentrate in space, there remain crucial gaps in our understanding to adequately inform proactive deployment of both police and non-police resources into such areas of concentration. Furthermore, while diverse theoretical perspectives have similarly been applied in an attempt to understand why PwPMI calls for service occur where they do, theoretical investigations in this area have been sparse and few have been replicated outside of their original inquiry. As mentioned previously, developing a theoretical basis upon which to understand why PwPMI calls for service occur where they do can be especially instructive for both police and non-police proactive place-based efforts. In doing so, it could be an additional area of opportunity to address core problems that push certain PwPMI into interactions with police in particular places. Accordingly, in the present dissertation, I draw upon seven years of calls for service data from the Barrie Police Service in Barrie, Ontario, Canada to address a number of gaps in this body of literature, each of which are outlined below.

First, while existing empirical evidence does show that PwPMI calls for service concentrate in space, most of our understanding of this phenomenon stems from the same, or multiple adjacent jurisdictions in British Columbia, Canada (see Vaughan et al., 2016, 2018, 2019). The present dissertation, therefore, not only seeks to investigate the concentration of PwPMI calls for service in a new jurisdictional context, but does so in a small city which has: that has the smallest land area of all jurisdictions featured in previous work (Vaughan et al., 2016, 2019; White & Goldberg, 2018), the fewest number of dissemination areas (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019, see 2018 for exception), as well as the fewest number of street segments (Hodgkinson & Andresen, 2019).

Small cities, in particular, tend to endure with having fewer mental health resources, social services, employment services, and housing opportunities than larger cities (Beimers & Gatlin, 2011; Belanger & Stone, 2008; Forchuk et al., 2010; Schiff et al., 2015; Skubby et al., 2013; Yang et al., 2018). Consequently, this scarcity of resources in smaller cities may not only push some PwPMI into coming into contact with police, but it

may affect the concentration of PwPMI calls for service in that calls may concentrate around the few resources that are available. Moreover, small-city characteristics, such as smaller land areas and/or fewer street segments effectively limit the extent to which PwPMI calls for service can be dispersed in the first place, thus possibly contributing to a more pronounced concentration. Accordingly, in Chapter 2, *Examining the Spatial Concentration of Mental Health Calls for Police Service in a Small City*, I attempt to answer the following research question: (1) to what extent do PwPMI calls for police service concentrate within the context of a small city (if at all)?

In Chapter 3, *The Spatial (In)Stability of Mental Health Calls for Police Service*, I seek to answer two research questions on the spatial characteristics of PwPMI calls for service that have not been explored previously: (1) does the concentration of PwPMI calls for service fall within a narrow bandwidth of spatial units over time (i.e., is the proportion of spatial units that account for a defined proportion of PwPMI calls for service stable over time)?; and (2) are PwPMI calls for service spatially stable or do they occur in different parts of a jurisdiction over time? Indeed, as described earlier, the concentration of crime not only falls within a narrow, stable bandwidth of spatial units—such as street segments—over time (see e.g., Weisburd, 2015), but crime itself also largely appears to be spatially stable and occurs in the same places over time (see e.g., Andresen, Linning, et al., 2017; Curman et al., 2015; Gill et al., 2017; Vandeviver & Steenbeek, 2019; Weisburd et al., 2004). The existing literature on PwPMI call for service concentrations, however, has either been cross-sectional in nature with only one year under investigation (Biebel & Cordner, 2003; Hodgkinson & Andresen, 2019; Vaughan et al., 2016; White & Goldberg, 2018) or combined multiple years of PwPMI call data (Vaughan et al., 2018, 2019). As such, scholars have yet to explore the stability of PwPMI call concentrations over time, as well as the spatial stability of these calls, with a longitudinal dataset. Doing so is especially critical with respect to proactive, place-based strategies. This is because, as some scholars have argued within the literature on the spatial patterns of crime, while the concentration of crime may be pronounced, crime itself may be spatially instable thus leading to proactive, place-based efforts 'chasing dots on a map' (Andresen, Linning, et al., 2017; Levin et al., 2017; Weisburd et al., 2004; Wheeler et al., 2016). This same issue

may undoubtedly be a concern for proactive, place-based efforts to PwPMI. As such, this dissertation seeks to shed light on this issue.

In Chapter 4, *Spatial Specialization of Mental Health Calls for Police Service: A Test of Social Disorganization Theory*, I seek to answer the final research question of the present dissertation: is there an association between the spatial specialization of PwPMI calls for service and the tenets of social disorganization theory? More specifically, given that the sparse theoretical investigations in this body of literature have yet to be replicated, I seek to replicate the work of Vaughan and colleagues (2018) to shed light on whether social disorganization theory is indeed not suitable for explaining the spatial patterns of PwPMI calls for service or whether their null findings were merely a function of their particular study jurisdictions. If it is the latter, then this dissertation would be the first to generate evidence not only on the utility of the social disorganization framework to understand the location of PwPMI calls for service, but would give practitioners engaged in proactive, place-based efforts a preliminary understanding around what may be driving PwPMI calls for service to occur where they do. If, on the other hand, this dissertation confirms the null findings of the original investigation, then that would indicate that efforts may be better put to use if other theoretical frameworks were examined in the future.

Finally, in Chapter 5, I summarize the key findings of this dissertation, further elaborate on the implications of the findings for informing the deployment of both police and non-police resources to assist PwPMI, as well as discuss future areas of research.

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Chapter 2

2 Examining the Spatial Concentration of Mental Health Calls for Police Service in a Small City[2]

In light of multiple social and systemic reasons, the police have increasingly come into contact with persons with perceived mental illness (PwPMI)[3]—a population that is more likely to be criminalized and have force used against them during interactions with police (Fisher et al., 2011; Livingston, 2016; Markowitz, 2011; Morabito et al., 2017). In an effort to prevent these issues, select police services have deployed specialized responses to PwPMI, but often do so on a limited scale due to funding limitations and other challenges, thus restricting their full potential (Iacobucci, 2014; Koziarski et al., 2020). However, to make efficient use of these responses, some have argued that these efforts should instead be proactively deployed, focusing on hot spots of PwPMI calls for police service (Coleman & Cotton, 2016; White & Weisburd, 2017; Wood & Watson, 2017). In doing so, PwPMI may be proactively directed toward mental health supports before reaching crisis, thus not only enhancing mental health care for that individual, but also preventing future police calls for service.

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[2] This is a pre-copyedited, author-produced version of an article accepted for publication in *Policing: A Journal of Policy and Practice*, following peer review. The version of record, Koziarski, J. (2021). Examining the Spatial Concentration of Mental Health Calls for Police Service in a Small City. *Policing: A Journal of Policy and Practice*, is available online at: https://doi.org/10.1093/police/paaa093. OnlineFirst: December 2020.

[3] The literature on mental health-related police interactions employs a variety of terms to refer to such interactions, with 'persons with mental illness'—often shortened to 'PMI' or 'PwMI'—being among the most frequently used terms (Frederick et al., 2018). Within police data, however, mental health calls are often coded as such by responding officers due to a perception or belief—on behalf of the officer, bystanders, etc.—that mental health-related issues *may* be present, as opposed to a *certainty* that they are present. Therefore, as Frederick and colleagues (2018) note, among other issues, the broad use of 'PMI' (and related) terms may lead to validity-related issues in the literature, unless researchers are certain that the data are comprised of people living with a diagnosed mental illness or explicit steps are taken to sample individuals who have a diagnosis. Empirical efforts that, on the other hand, rely on officer-generated data should instead employ terms that reflect officers' uncertainty of whether mental illness is present. Since this is the case for the present work, this study employs the term 'persons with perceived mental illness' (PwPMI) to reflect uncertainty.

Proactive efforts are not new to police practice. Place-based policing efforts, such as hot spots policing and problem-oriented policing, have long leveraged knowledge around where crime problems concentrate, subsequently deploying resources into these areas to target and successfully address said crime problems (Braga et al., 2019b, 2019a; Weisburd et al., 2019). However, while these crime-focused proactive efforts are situated within a robust based of evidence on crime concentration (Lee et al., 2017), the spatial concentration of PwPMI calls has only recently received scholarly attention. As such, little is still known about the concentration of these calls to adequately inform similar proactive efforts for PwPMI.

The current study seeks to contribute to the existing literature on PwPMI call concentration by not only drawing upon new methods and introducing a new measure of concentration, but also by examining the concentration of these calls within a new jurisdictional context that is smaller in land area than jurisdictions found in previous work, and has fewer spatial units—namely, street segments and dissemination areas. Examining PwPMI call concentration within this jurisdiction will reveal new knowledge about this phenomenon, which could result in vital practical implications for proactive police efforts into PwPMI call hot spots, in addition to setting the stage for subsequent spatial research on PwPMI calls in small cities.

2.1   Literature Review

2.1.1   Overview of Police-PwPMI Interactions

Calls for police service involving PwPMI comprise a significant proportion of services' yearly call loads (Livingston, 2016), with some jurisdictions recording approximately a 10% annual increase in these calls (Vaughan & Andresen, 2018). While the deinstitutionalization of individuals living with mental illness and the subsequent lack of mental health supports is frequently cited as the reason for the rise in police-PwPMI interactions (Coleman & Cotton, 2016; Frederick et al., 2018), other factors, such as strict civil commitment criteria, homelessness, poverty, and intolerance of social disorder—among other reasons—all contribute as well (Borum et al., 1997; Canada et al., 2010; Lamb & Weinberger, 1998; Markowitz, 2011; Schulenberg, 2016; Teplin, 1984). By

consequence, the police have been tasked with the role of *Streetcorner Psychiatrist* whereby they act as gatekeepers to both the criminal justice and mental health systems (Iacobucci, 2014; Teplin & Pruett, 1992).

Despite interactions with PwPMI long being part of the policing profession (Bittner, 1967), and officers usually receiving some degree of mental health training (Coleman & Cotton, 2010; Cotton & Coleman, 2008), officers at times feel ill-prepared for interactions with PwPMI (Wells & Schafer, 2006). These interactions, however, can occur for any number of reasons beyond crisis, such as being casual/informal in nature, as victims of crime, by reporting crime, and as witnesses to a crime, among other reasons (Livingston et al., 2014). Although the nature in which PwPMI come into contact with police are certainly diverse, interactions with PwPMI have not only been found to take between 20 to 50 minutes longer than those not involving PwPMI (Charette et al., 2014; Schulenberg, 2016), but they also consume approximately 90% more resources (Charette et al., 2014; see also Vaughan & Andresen, 2018).

Further, police officers hold a significant amount of discretion when it comes to how they opt to conclude interactions with PwPMI. That is, they can choose to address an interaction through 'official' avenues, such as transport to hospital or arrest; or through 'unofficial' avenues, such as referral to a community-based mental health service or leaving them where/as they were (Bittner, 1967; Teplin & Pruett, 1992). While previous research suggests that interactions most often conclude with no action on behalf of the officer (Brink et al., 2011; Charette et al., 2011; Teplin & Pruett, 1992; Watson & Wood, 2017), numerous factors can affect officer decision-making. For instance, arrest or transport to hospital can consume a significant proportion of officer time (Charette et al., 2011), as such, some officers may opt for—or are encouraged by supervisors or co-workers to opt for—quick, informal conclusions to move onto the next call in the queue (Schulenberg, 2016). Moreover, in jurisdictions where there are few mental health resources, some officers may be forced to conclude that the individual's best chance of receiving mental health care is through the criminal justice system, therefore arresting—or 'mercy booking'—them to provide them with this care (Lamb & Weinberger, 1998).

While arrests are a rare outcome for police-PwPMI interactions (Charette et al., 2011, 2014; Shore & Lavoie, 2018), research has shown that PwPMI have a higher probably of arrest than non-PwPMI (Boyce et al., 2015; Lamb & Weinberger, 1998; Teplin, 1984; Teplin & Pruett, 1992), even when the severity of an offence is equal (Charette et al., 2014). This holds true across various crime categories, especially disorder-related crime for which PwPMI are four-to-five times more likely to be arrested (Fisher et al., 2011; Schulenberg, 2016).

Beyond criminalization, PwPMI are also more likely to experience police use of force. More specifically, previous research has not only found that use of force is indeed higher against PwPMI, but that those experiencing comorbidity—that is, both mental health and substance use issues—were found to be even more likely to experience police use of force (Morabito et al., 2017). Although police use of force is generally a rare occurrence, the higher likelihood of force against those experience comorbidity is certainly a cause for concern given that alcohol and/or drug use is present in approximately 25% to 50% of PwPMI interactions with police (Charette et al., 2011; Schulenberg, 2016; Shore & Lavoie, 2018).

2.1.2   Improving Police-PwPMI Interactions

In recognizing the above issues and wanting to prevent them, police services in a number of jurisdictions have taken initiative in developing more robust responses to PwPMI. Efforts broadly referred to as 'co-response teams', for example, are commonly comprised of an officer and mental health practitioner who work together on shift and respond to PwPMI calls at the request of frontline officers, or an on-call mental health practitioner who also responds to calls on request (Iacobucci, 2014; Koziarski et al., 2020; Shapiro et al., 2015). Co-response teams are not only meant to filter PwPMI away from the criminal justice system (Munetz & Griffin, 2006), but they are also intended to improve interactions between PwPMI and police on a more general level (Shapiro et al., 2015).

Although evidence on co-response teams suggest that they are associated with decreases in use of force, involuntary apprehensions under mental health legislation, unnecessary hospital transfers, time spent at PwPMI calls, and costs associated with PwPMI calls, as

well as increases in referrals to community-based resources, PwPMI satisfaction when interacting with the police, and PwPMI engagement with outpatient services (Blais et al., 2020; Fahim et al., 2016; Kirst et al., 2015; Kisely et al., 2010; Lamanna et al., 2018; Semple et al., 2020), some co-response teams endure numerous challenges that hider their ability to achieve these successes, such as lack of funding or understaffing (Koziarski et al., 2020). As a result, most mental health calls for service are still addressed by frontline officers, who are arguably less capable at addressing PwPMI calls than co-response teams (Iacobucci, 2014).

Some scholars, however, have recently begun conceptualizing what the 'next wave' of police responses to PwPMI should look like, including those of co-response teams (Coleman & Cotton, 2016; Wood & Beierschmitt, 2014; Wood & Watson, 2017). Currently, co-response teams operate within the 'traditional' model of policing: that is, reacting and responding to calls for service (White & Weisburd, 2017). Coleman and Cotton (2016), however, argue that co-response teams should—in addition to responding to crises—be proactively deployed, focusing on the root causes that may lead to PwPMI interactions with police. Wood and Watson (2017) see *place* as a critical area of opportunity for such proactive deployment, in that the geography of *where* these interactions concentrate could be used to inform targeted, proactive co-response team efforts. In this way, co-response teams can be situated in areas where they are needed the most, as opposed to reacting to calls.

Proactive, place-based efforts are not new to the policing profession. For example, hot spots policing and problem-oriented policing both leverage knowledge around where crime problems concentrate, subsequently deploying resources into these areas to either deter criminal activity or to address problems at the source with significant success (Braga et al., 2019a, 2019b; Weisburd et al., 2019). Drawing from these crime-focused proactive efforts, White and Weisburd (2017) describe the first known attempt at proactive deployment of a co-response team in Baltimore, Maryland. While this proactive co-response team pilot project was deployed to aid those with mental health issues residing within crime hot spots (White & Weisburd, 2017), identical efforts that are instead focused on hot spots of PwPMI calls for service could result in numerous

benefits, such as more efficient deployment of scarce resources, increased reach of co-response teams to PwPMI, prevention of mental health crises, and proactive diversion to mental health resources. These benefits, in turn, could not only put some PwPMI on a more fruitful path of mental health care, but they could also prevent future calls for police service.

While place-based, crime-focused policing strategies are situated within mounds of empirical research which consistently shows that crime concentrates in a small number of places (Lee et al., 2017)—leading Weisburd (2015) to posit a *Law of Crime Concentration*—the spatial concentrations of PwPMI calls for service have only recently received scholarly attention and thus are not relatively well known to adequately inform attempts at proactive place-based co-response team deployment.

2.1.3   Spatial Concentration of Police-PwPMI Calls for Service

In using street segments as the unit of spatial analysis—that is, both sides of the street from intersection-to-intersection (Eck & Weisburd, 1995)—previous research on the concentration of PwPMI calls for service has found that 50% of calls occur on a very small proportion of segments: between 0.30% and 3% (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018). This same work as also found that, although PwPMI calls are highly concentrated, the calls are dispersed within that concentration. In other words, PwPMI calls for service tend to cluster in multiple hot spots that are spread out across the jurisdiction (Hodgkinson & Andresen, 2019; Vaughan et al., 2016; White & Goldberg, 2018). Further, PwPMI calls for service have also been found to be highly concentrated at larger spatial units (Vaughan et al., 2019).

While this early body of work has been instrumental in forming a preliminary understanding around the spatial concentration of PwPMI calls for service, additional research is certainly needed to further our understanding. This is especially pertinent given that most existing research draws on data from the same, or multiple adjacent, jurisdiction(s) in the Canadian province of British Columbia (Vaughan et al., 2016, 2018, 2019). Therefore, additional work is not only required to examine the concentration of

PwPMI calls within new jurisdictional contexts, but especially in contexts that may generate new and unique patterns of spatial concentration, such small cities.

Research shows that smaller, less population-dense communities tend to have fewer mental health resources relative to larger cities, if any at all. More specifically, smaller communities tend to have fewer psychiatric beds and psychiatric facilities, understaffed hospitals, and a lack of specialized mental health staff (Canadian Institute for Health Information, 2019; Forchuck et al., 2010; Skubby et al., 2013; Yang et al., 2018). Beyond mental health, smaller communities also tend to have fewer resources for other services, such as social services, employment, and housing (Beimers & Gatlin, 2011; Belanger & Stone, 2008; Waegemakers Schiff et al., 2015), some of which are perceived as addressing foundational issues that certain PwPMI may need to resolve before being able to focus on their mental health (Koziarski et al., 2020)[4]. Taken together, the scarcity of these resources not only exacerbates the issues discussed earlier and contributes to the police having a more predominant role in mental health within smaller communities (Durbin et al., 2010; Forchuck et al., 2010), but it also may affect the spatial patterns of PwPMI calls within these communities as well.

The work of Vaughan and colleagues (2016) suggests that there may be an association between places that may be frequented by PwPMI, such as social or mental health services, and the concentration of PwPMI calls (see also Hodgkinson & Andresen, 2019). However, since there are fewer of these resources in smaller communities, and thus fewer places around which PwPMI calls may concentrate, the concentration of these calls may be more pronounced in smaller cities. This concentration may also be further influenced through other small city characteristics, such as a smaller land area—which may be disproportionately residential—and/or fewer street segments. These factors effectively limit the extent to which resources and PwPMI calls for police service can be dispersed

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[4] While the work cited here largely discusses service disparities between urban and rural areas, the implications for small cities are nonetheless clear: they have fewer services and resources relative to large urban centers.

throughout a small city, thus likely contributing to a greater concentration of such calls in these contexts.

Given that PwPMI call concentration has yet to be examined within a small city, the purpose of the current, exploratory study is to develop an empirical and practical understanding around the spatial concentration of these calls within such a context: Barrie, Ontario, Canada. Doing so will not only reveal new evidence as it pertains to the concentration of PwPMI calls within small cities which can be used to inform proactive police practice, but this evidence can also be used to guide subsequent empirical or theoretical efforts that seek to understand the specific and/or unique factors that may contribute to PwPMI call concentration within smaller cities.

2.2   Data and Methods

2.2.1   Study Jurisdiction & Data

Barrie is a 99km^2 city—nearly one-third (32km^2) of which is residential land use—that is situated approximately 100km north of the City of Toronto and sits on the western coast of Lake Simcoe in Central Ontario. As per the 2016 census, the population of Barrie is approximately 197,000 with a population density of 219 per km^2 (Statistics Canada, 2017). Data for this study were extracted from the computer-aided dispatch system (CAD) of the Barrie Police Service and include all calls made to the service for the six-year period of January 1, 2014 through December 31, 2019 ($N = 363,961$). Each incident in the data was accompanied by the date and time the respective call was made, the incident-type as reported by the caller, the incident-type as found by the officer(s), as well as CAD-generated XY-coordinates.

For the purpose of the current study, a subset of these data was created in which only calls for service were included if the 'incident-type as found' field was set to *Mental Health*. In other words, this subset contains all calls for service for the six-year period in which the responding officer(s) perceived mental health as being the primary nature of

the call[5]. In total, this subset includes 3,262 calls for service, thus comprising 0.89% of all calls made to the Barrie Police Service between 2014 and 2019. This finding is within the 0.50% to 3.48% range of previous work (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2018; White & Goldberg, 2018).

2.2.2   Units of Spatial Analysis

The current study employs two units of spatial analysis. The first are street segments which consist of both sides the street from intersection-to-intersection (Eck & Weisburd, 1995). Street segments have become an immensely popular unit of analysis in spatial criminology not only because they are instructive for identifying high degrees of spatial concentration that would otherwise not be revealed through larger spatial units (Schnell et al., 2017), but also because of their practical utility in that problem segments can be identified with high precision thus informing police practitioners where additional resources may be needed down to the exact segment. With respect to the study jurisdiction, the City of Barrie has 2,975 street segments.

The second unit of spatial analysis are Statistics Canada dissemination areas. As per Statistics Canada (2018):

> A dissemination area is a small, relatively stable geographic unit composed of one or more adjacent dissemination blocks with an average population of 400 to 700 persons based on data from the previous Census of Population Program. It is the smallest standard geographic area for which all census data are disseminated.

While the objectives of the current study could sufficiently be achieved through street segments alone, their small size makes it difficult to generate visualizations where differences between spatial units are to be highlighted (such as those that will stem from the analyses below). Therefore, dissemination areas are employed because they are still a relatively small unit that can identify spatial concentrations with a high degree of

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[5] This is in contrast to some previous work on the spatial concentration of PwPMI calls in the Canadian context which drew upon incidents in which provincial mental health legislation was applied (e.g., Vaughan et al., 2016, 2018, 2019). The data drawn upon for the present study does not reveal how a PwPMI call concluded, either through application of mental health legislation or otherwise.

precision, but are also large enough to generate meaningful visualizations (Hodgkinson & Andresen, 2019). An added benefit of employing dissemination areas along side street segments is that it will highlight how the concentration of PwPMI calls can vary based on the spatial unit. With respect to the study jurisdiction there are 243 dissemination areas within the City of Barrie as of the 2016 Census.

Relative to jurisdictions in previous research on the spatial concentration of PwPMI calls, Barrie is the smallest jurisdiction based on land area (Vaughan et al., 2016, 2019; White & Goldberg, 2018), has the fewest number of dissemination areas (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; see 2018 for excpetion), and the fewest number of street segments (Hodgkinson & Andresen, 2019).

2.2.3   Kernel Density Estimation

Kernel Density Estimation (KDE) is used to generate an exploratory visualization of where PwPMI calls cluster within the study jurisdiction. KDE is a popular method of identifying areas of concentration by generating a smooth risk surface across points on a map (Chainey & Ratcliffe, 2005). The generated risk surface is commonly visualized through a heat map; however, the resulting visualizations can vary depending on two parameters: grid cell size and search radius (or bandwidth). The latter of the two is arguably most influential on the results because it determines the size of hot spots, whereby smaller search radii generate small hot spots and larger radii generate large hot spots (Chainey & Ratcliffe, 2005). For the current study, the grid cell size is set to 73m and the search radius is set to 421m. Nearest Neighbour Analysis—which measures the distance of each point to its nearest neighbour—was used to inform the selection of these parameters; however, varying the parameters did not impact the results.

2.2.4   Concentrations at Spatial Units

In line with previous research on the spatial concentration of PwPMI calls for service (e.g., Hodgkinson & Andresen, 2019; Vaughan et al., 2016), three measures of concentration will be calculated at both the street segment and dissemination area level: (1) the percentage of spatial units that have any PwPMI calls for service; (2) the

percentage of spatial units that account for 50% of calls; and (3) the percentage of spatial units with any calls that account for 50% of calls[6].

In addition to calculating these measures, the degree of concentration for both spatial units will be additionally reported and summarized with Lorenz curves and Gini coefficients. Historically, the former has largely been used to visualize income inequality, whereas the latter summarizes the degree of inequality with a single number between 0 (perfect equality) and 1 (perfect inequality) that is calculated as a ratio of the area between the Lorenz curve and the line of perfect equality to the area above the line of perfect equality (Bernaso & Steenbeek, 2017). Bernasco and Steenbeek (2017) argue that, to-date, the literature on crime concentration has lacked a single, universal measure of 'concentration', therefore complicating efforts to compare the degree of concentration across areas, temporal periods, or crime types. They argue that Lorenz curves and Gini coefficients can fill this gap (Bernasco & Steenbeek, 2017). However, because methods in the PwPMI call concentration literature have been heavily influenced by those in the crime concentration literature, the lack of a single measure of concentration is also an issue. Therefore, although this is the first paper on PwPMI call concentration to present Lorenz curves and Gini coefficients, the aim is that by doing so, work that follows will also adopt these measures to facilitate a more standardized method of comparing concentration across study jurisdictions. All Lorenz curves and Gini coefficients for the present study are generated though the *lorenzgini* package for the R statistical programming environment (Steenbeek & Bernasco, 2018).

2.2.5 Moran's *I*

Finally, along with generating an understanding around the degree of concentration of PwPMI calls for service in a small city, it is also pertinent to know whether these

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[6] Approximately 50 (1.5%) of the 3,262 PwPMI calls were situated at street segment intersections. Upon closer examination of these calls it was noted that: (1) most intersections at which calls were located only had a single call; and (2) many segments which converged at these intersections had zero calls. Given that a majority of these points could be offset to any one of the converging segments to arrive at the same conclusion—that is, a street segment with one PwPMI call—it was, therefore, decided to manually offset these points to intersecting segments in a counterclockwise sequence following the four cardinal directions (North, West, South, East).

concentrations are clustered or dispersed across the study jurisdiction. To assess this, the current study employs Moran's *I* to test for spatial autocorrelation between units of analysis. Simply put, Moran's *I* tests whether or not street segments or dissemination areas with high or low counts of PwPMI calls for service are situated next to other street segments or dissemination areas with similarly high or low PwPMI call counts (Moran, 1950; Tobler, 1970). The degree of clustering is indicated through the Moran's Index which ranges from -1 to +1: the former indicates perfect dispersion, whereas the latter indicates perfect clustering. A value of 0 indicates that spatial units are dispersed across the jurisdiction at random, with no clustering or dispersion pattern[7].

Because Moran's *I* generates one statistic for the entire study area—also referred to as Global Moran's *I*—the current study also employs Local Moran's *I* (Anselin, 1995). Local Moran's *I* identifies which *specific* spatial units with high counts of PwPMI calls are next to other units with similarly high counts (High-High), as well as units with low counts that are next to other low-count units (Low-Low). These areas indicate clustering, whereas high units next to low units (High-Low) and low units next to high units (Low-High) are indications of dispersion. Both Global and Local Moran's *I* are executed with a first-order Queen's contiguity weights matrix and 999 permutations.

2.3 Results

Figure 1 displays the results of the KDE, which provides an exploratory visualization of where PwPMI calls for service cluster within Barrie. As is immediately evident in the figure, there are two PwPMI call hot spots. The first, larger hot spot is situated within the downtown core where there is a concentration of social and mental health services. The second, smaller hot spot situated in the north-east corner of the city is at the local hospital.

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[7] Given that the expected value of Moran's *I* is calculated as -1/(N-1), the true value for random dispersion is slightly negative.

Figure 1. Kernel Density Surface of PwPMI Calls for Service

N

Kernel Density
Low Density
High Density

0   1   2   4 Kilometers
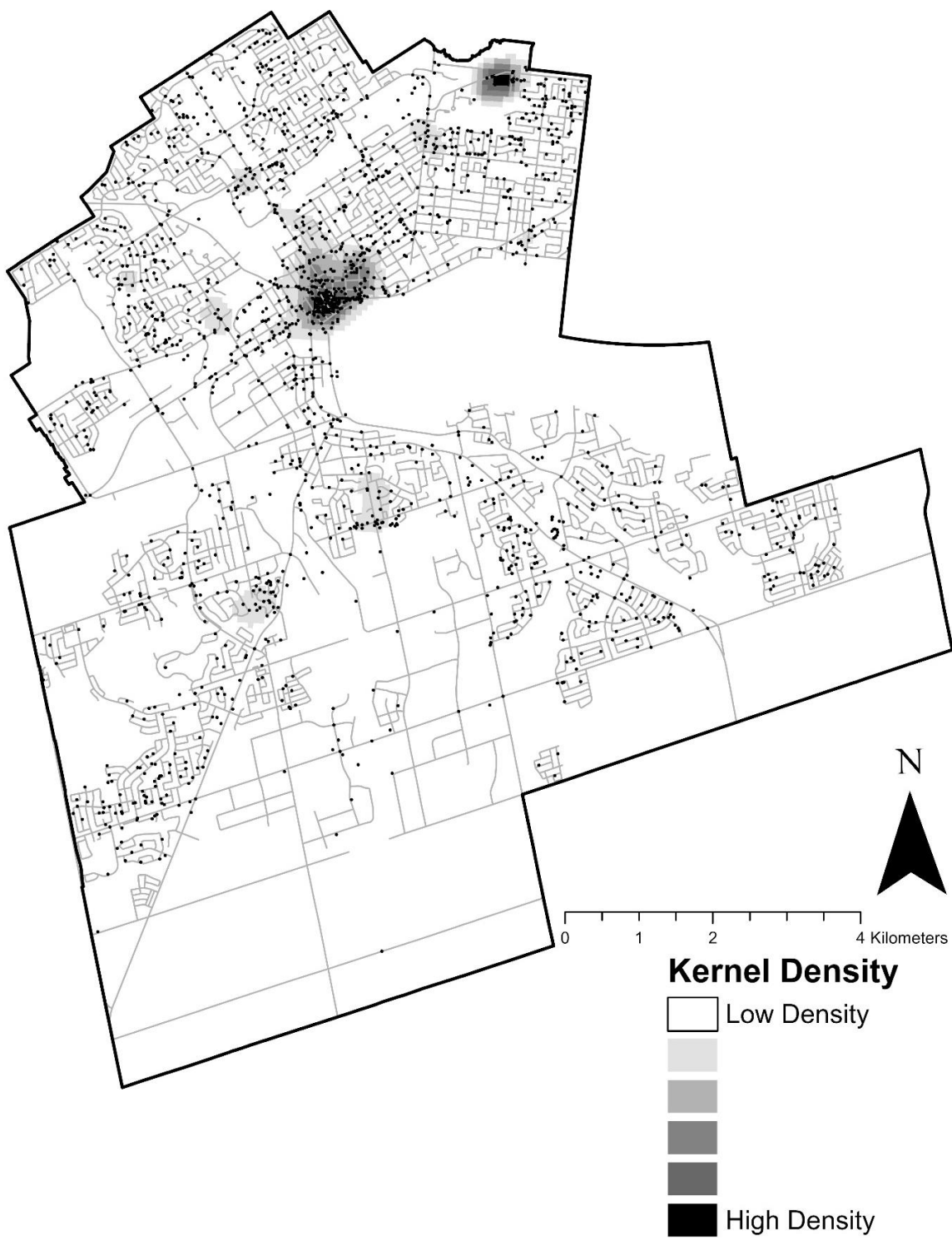
Table 1. Percent Spatial Units Accounting for 100% and 50% of PwPMI Calls for Service

Unit Type	(a) *N* Units	(b) Percent Units with Any Calls	(c) Percent Units Accounting for 50% of Calls	(d) Percent Units with Any Calls Accounting for 50% of Calls
Dissemination Areas	243	98.35	13.17	13.39
Street Segments	2,975	33.68	4.17	12.38

Next, a series of calculations are performed to examine the degree of PwPMI call concentration at dissemination areas and street segments within Barrie. When considering all PwPMI calls, Table 1, column b, reveals that almost all dissemination areas (98%) had at least one PwPMI call; however, at street segments, this figure drops down to just 34%. In other words, 66% of street segments did not have a single PwPMI call for service between 2014 and 2019. Further, when considering the percent of units required to account for 50% of calls, column c indicates that there is a high degree of concentration at both units: only 13% of dissemination areas and 4% of street segments are required to account for 50% of PwPMI calls.

Lorenz curves are employed to further visualize the concentration at dissemination areas (Figure 2) and street segments (Figure 3), as well as to provide an additional measure of concentration via their respective Gini coefficients. The results confirm that not only are PwPMI calls for service highly concentrated, but the concentration is more pronounced at street segments. Recall that the Gini coefficient ranges from 0 (perfect equality) to 1 (perfect inequality). For dissemination areas, the Gini coefficient was found to be near the middle of the range: 0.57. As displayed in Figure 2, while there is an unequal distribution of PwPMI calls across dissemination areas, almost all dissemination areas have at least one PwPMI call. This is confirmed through the moderate coefficient, as well as the Lorenz curve nearly approaching 100% of calls at 100% of dissemination areas in the top-right corner. At street segments, on the other hand, the Gini coefficient was found to be much higher, indicating higher concentration: 0.84. In Figure 3, this extremely

unequal distribution of PwPMI calls is indicative of the fact that the Lorenz curve reaches 100% of calls and plateaus at only 34% of street segments (see also Table 1, column b).

Figure 2. Lorenz Curve and Gini Coefficient for PwPMI Call Concentration in Dissemination Areas
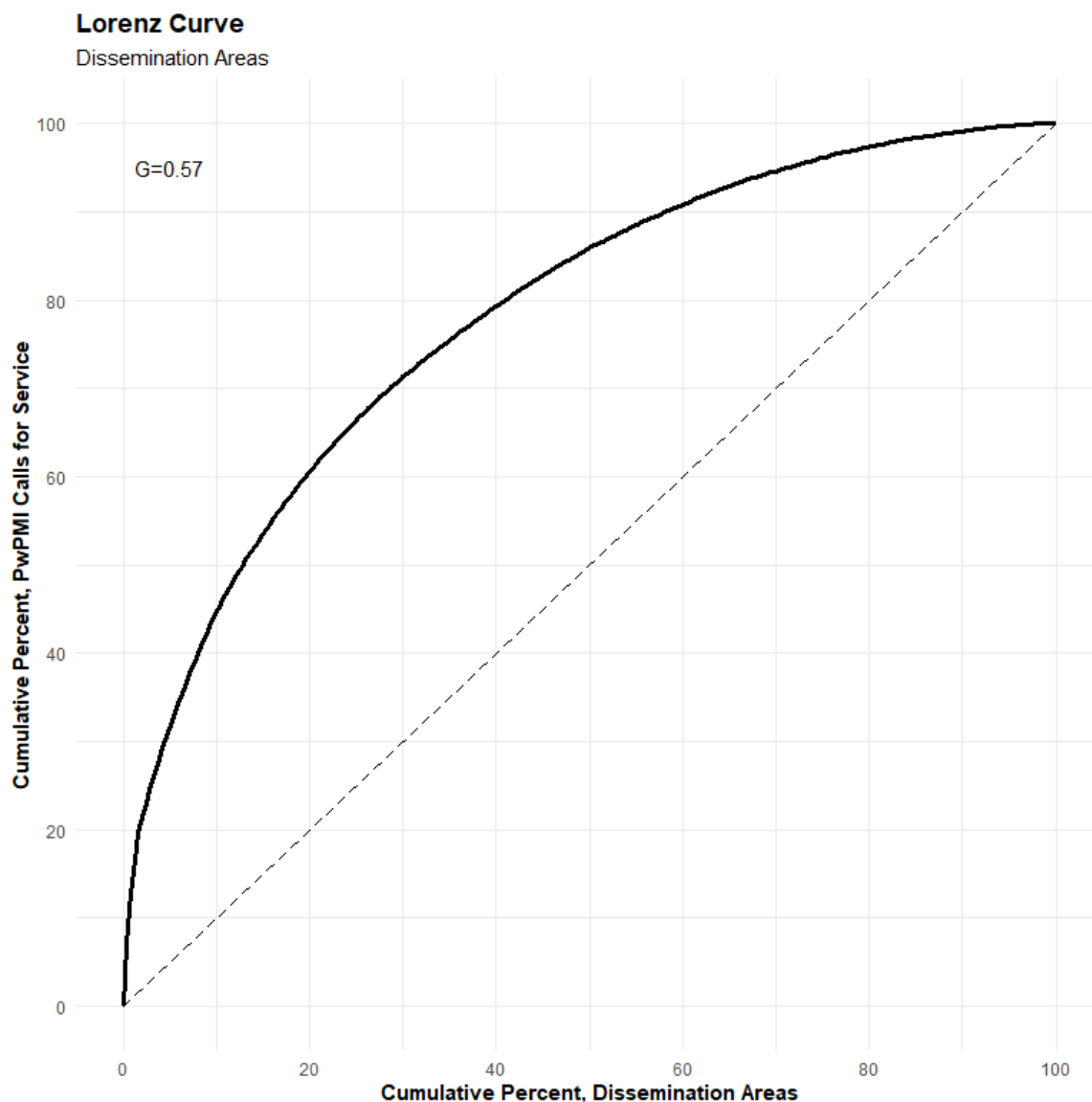
Thus far, it is clear that PwPMI calls are highly concentrated in Barrie, but are these concentrations clustered or dispersed across the city? Findings in Table 1, column d, suggests that it is the latter. More specifically, relative to column c where dissemination areas and street segments with zero PwPMI calls are *included* in the calculation, they are *excluded* for these same calculations in column d. While the percentage between these

two columns is essentially the same for dissemination areas, there is an 8% increase for street segments. This indicates that although there is a high degree of PwPMI call concentration at the street segment level, the calls are dispersed within that concentration. The presence of clustering or dispersion was further examined through Global Moran's *I*. At the dissemination area level, Moran's Index is 0.24 ($z = 7.01$, *p* <0.001) and at street segments it is 0.08 ($z = 8.80$, *p* <0.001). Although both indices are positive and statistically significant, thus indicating the presence of some dissemination areas and street segments clustering next to others with similar PwPMI call counts, the degree of clustering is quite low. In other words, PwPMI call concentrations across both dissemination areas and street segments are more so randomly dispersed, especially at street segments.

Figure 3. Lorenz Curve and Gini Coefficient for PwPMI Call Concentration at Street Segments
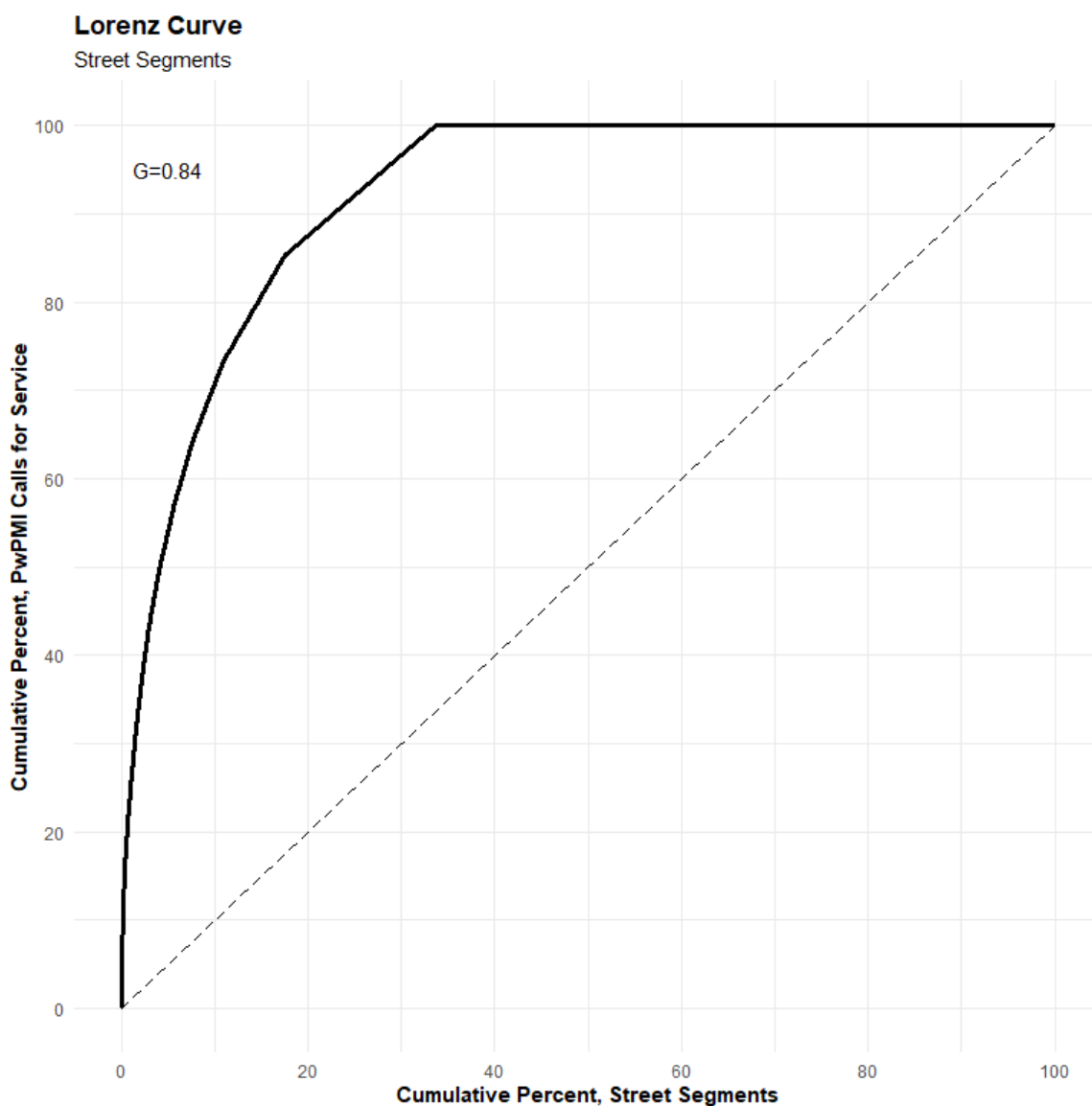
Figure 4. Global and Local Moran's *I* for PwPMI Calls for Service, Dissemination Areas

N

Local Moran's I

High-High

High-Low

Low-High

Low-Low

Not Significant

0   1   2   4 Kilometers

Global Moran's I = 0.24 (z = 7.01, p <0.001)
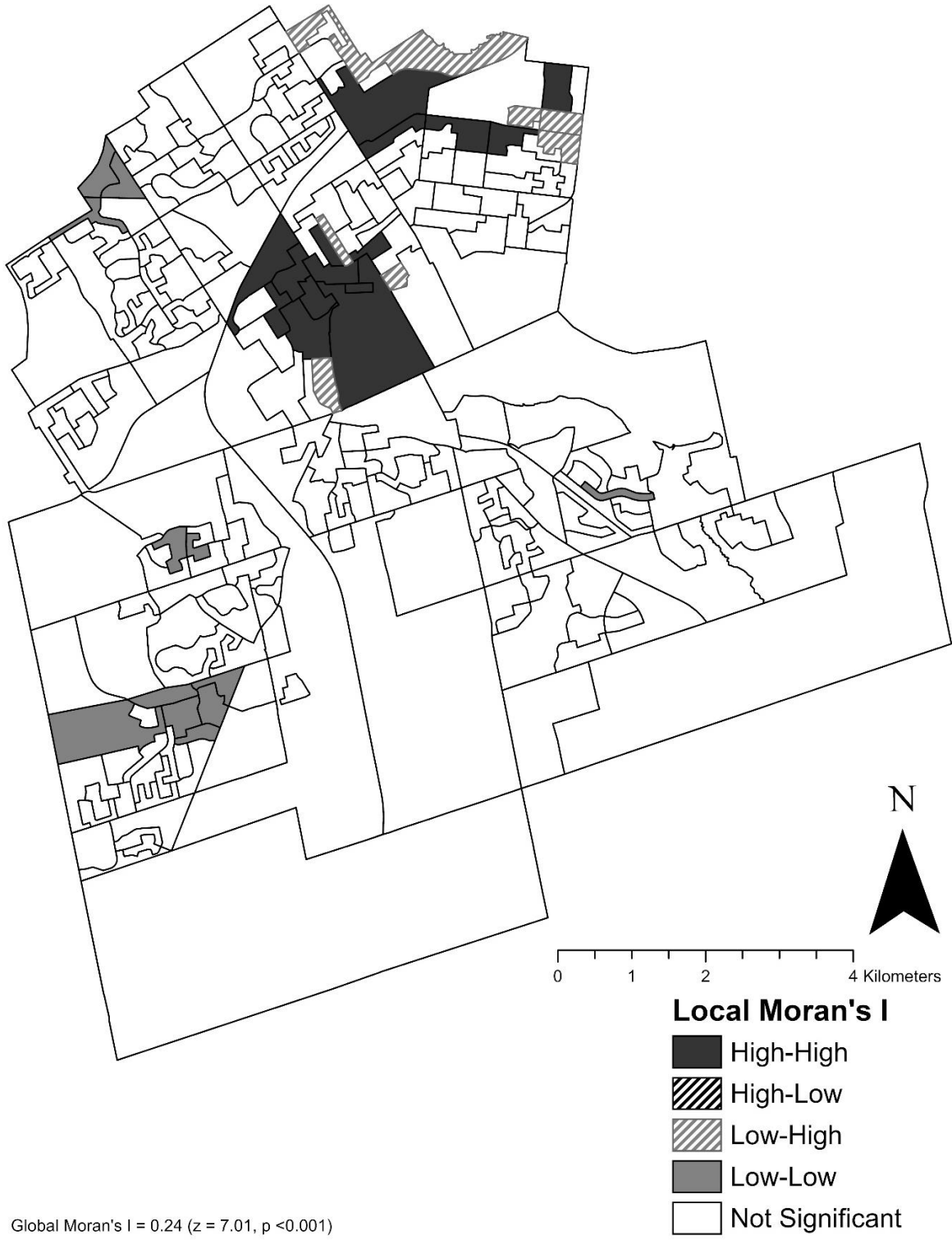
At the local level, Figure 4 displays the results of Local Moran's *I* at dissemination areas. Recall that unlike Global Moran's *I*, Local Moran's *I* identifies the *specific* dissemination areas that contribute to clustering or dispersion at the global level. Immediately evident is that, similar to the KDE results, there is a cluster of dissemination areas in the downtown core of the city that are situated adjacent to dissemination areas with similarly high PwPMI call counts (i.e., High-High). Further, again in the north-east corner of the city, there is a cluster of High-High dissemination areas, as well as some Low-High outliers (i.e., low call count dissemination areas situated next to dissemination areas with high counts). Moreover, in the north-west and south-west of the city there are some Low-Low clusters (i.e., low call count dissemination situated next to dissemination areas with similarly low counts). Notably, however, there are no High-Low clusters (i.e., high call count dissemination areas situated next to dissemination areas with low counts), and, for the most part, many dissemination areas across the study jurisdiction exhibit non-statistically significant clustering or dispersion, thus driving the low Moran's Indices.

2.4   Discussion and Conclusion

The purpose of the current, exploratory study was to develop an empirical and practical understanding around the degree to which PwPMI calls for police service concentrate in a small city context. While this body of literature is certainly in its infancy, the current study builds on previous research by introducing a new measure of concentration, employing local spatial methods and—as mentioned—having an explicit focus on examining PwPMI call concentration within the context of a small city: Barrie, Ontario, Canada.

Exploratory KDE revealed two areas of call concentration within the city. One is in the downtown core where there is a concentration of various social and mental health services; the other is at the local hospital. While the current study did not explicitly explore the role of place, previous research suggests that there may be an association between locations that may be frequented by PwPMI and the concentration of PwPMI calls for service (Hodgkinson & Andresen, 2019; Vaughan et al., 2016). However, to-date, these associations have either been made through visualizing these locations over KDE results (Vaughan et al., 2016) or through the author's personal knowledge of the

study jurisdiction (as is also the case here) (Hodgkinson & Andresen, 2019). Therefore, it is imperative that future research not only examine the association between place and concentrations of PwPMI calls for service—particularly within small city contexts—but to do so through more robust methods.

Further analyses at the dissemination area level revealed that nearly all dissemination areas had at least one PwPMI call for service, but that 50% of calls were concentrated in only 13% of dissemination areas, which is similar to that of previous work (Vaughan et al., 2019). Street segments, however, revealed an even higher degree of concentration. More specifically, it was found that 50% of PwPMI calls were concentrated on only 4% of street segments. When compared to that of dissemination areas, the finer degree of concentration found at street segments only further supports the use of this spatial unit to help guide place-based police practice with a high degree of precision.

Although 4% of segments accounting for 50% of calls is similar to that of previous work, it is also the *least* concentrated. As mentioned, earlier studies have found that 50% of PwPMI calls are attributed to between 0.30% and 3% of segments (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018). The small number of street segments in Barrie likely contributes to this finding. With only 2,975 street segments, there are already fewer segments on which calls can concentrate to begin with. Therefore, for each additional segment that is required to account for 50% of calls, calls will appear to be more dispersed in jurisdictions with fewer segments relative to jurisdictions which have a higher number of segments. Relatedly, others have also emphasized that caution must be used when interpreting concentration as *50% of events are attributed to X% of street segments*. This is because this measure includes *all* street segments in the jurisdiction as part of the calculation as opposed to only those where a call occurred, therefore making the concentration appear more significant than it truly is (Bernasco & Steenbeek, 2017). Excluding street segments with no PwPMI calls for service instead revealed that 50% of calls are concentrated on 12% of segments. Relative to previous research providing this measure, Barrie has the highest degree of PwPMI call

concentration with previous work ranging between 14% and 44% of segments with calls (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019)[8]. However, because not all research provides a measure that excludes spatial units without any calls (e.g., White & Goldberg, 2018), and because there is a lack of standardization when it comes to presenting results of PwPMI call concentration, future research must consider employing Lorenz curves and Gini coefficients in order to facilitate comparisons between jurisdictions through a standardized measure that can also take into consideration when there are many units with no calls (see Bernasco & Steenbeek, 2017).

Measures that exclude units with no events also allude to the degree of call dispersion. The current study sought to examine this further through additional analyses. More specifically, at the street segment level, and similar to that of White and Goldberg (2018), Global Moran's I revealed some degree of street segment clustering next to other segments with similar counts of PwPMI calls, but that for the most part, segments appeared randomly dispersed throughout the jurisdiction. Dissemination areas revealed relatively the same results; however, their larger size also provided an opportunity to examine Moran's I at the local level. Doing so revealed numerous dissemination areas with high PwPMI call counts situated next to other dissemination areas with similar counts. Further, there were some low count areas identified next to high count areas, as well as some clustering of Low-Low areas.

Ultimately, while the current study was conducted in a new, unique jurisdictional context, as well as introduced new methods and a new measure of concentration to the existing literature on PwPMI call concentration, the findings confirm those of previous work: PwPMI calls for police service concentrate in a disproportionality small number of places. However, in the small city of Barrie, Ontario, Canada, it was revealed that PwPMI calls are less dispersed relative to larger jurisdictions in previous research. While additional work is certainly needed in this area, especially empirical and theoretical efforts that seek to understand what specific or unique factors may contribute to PwPMI

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[8] Hodgkinson and Andresen (2019) also include street intersections in their analyses, which likely contributed to 44% of their spatial units with events being required to account for 50% of PwPMI calls.

call concentration within small (and large) cities, this small, but growing body of evidence is increasingly building support for co-response teams to be reconfigured into a proactive, hot spot policing-like practice (Coleman & Cotton, 2016; White & Weisburd, 2017). As mentioned earlier, efforts such as hot spots policing and problem-oriented policing have long leveraged knowledge around the spatial concentration of crime to *successfully* deter criminal activity or to target issues at their source, both in a proactive manner. Along the same vein, co-response teams could leverage knowledge around PwPMI call concentration, target these areas through proactive outreach, and direct those who may appear to be struggling with their mental health toward mental health resources *before* a call for service is generated. In doing so, many individuals could be placed on a more fruitful path of mental health care, while also reducing PwPMI calls for police service. This is a unique and untapped area of empirical research and police practice that must be explored further.

2.4.1   Limitations

As with all empirical work, the present study is not without limitations. First, as others have also noted (e.g., Hodgkinson & Andresen, 2019; Shore & Lavoie, 2018; Vaughan et al., 2016), calls for police service are commonly classified based on what the *primary* nature of the call was. Consequently, this method of call classification masks other, secondary components of each call. Therefore, while the present study drew upon 3,262 calls for police service where *Mental Health* was selected as the primary nature, it is very plausible to assume that there may have been many additional calls for service involving PwPMI that were not accounted for because the primary nature was selected as something else by the responding officer(s).

A second, but related limitation is that the determination of whether a call for service is mental health-related is up to the perception of responding officer(s) (Bittner, 1967; Bohrman et al., 2018; Hodgkinson & Andresen, 2019; Schulenberg, 2016; Shore & Lavoie, 2018; Vaughan et al., 2016; White & Goldberg, 2018). While police officers commonly receive at least some degree of mental health training, they are not trained mental health practitioners who are qualified at forming mental health diagnoses. Signs of substance use, for example, are commonly misinterpreted by police officers as

symptoms of mental illness (Bohrman et al., 2018). As a result, it is plausible to presume that some calls for service that were classified as *Mental Health* in the provided CAD data were in response to individuals who do not have a diagnosed or diagnosable mental illness.

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Chapter 3

3 The Spatial (In)Stability of Mental Health Calls for Police Service

Scholars have had a long, enduring interest in examining the concentration of crime and have done so at ever finer spatial units of analysis. Early work in this area by the likes of Quetelet (1831) and Guerry (1832) examined the unequal distribution of crime in France at large administrative areas. Approximately a century later, the Chicago School shifted the focus toward examining crime concentration across neighbourhoods (e.g., Shaw & McKay, 1942). Then, in the 1980s, the focus shifted once again toward examining the concentration of crime at micro-geographic units of analysis—also known as 'micro-places'—such as individual buildings or addresses, street block faces, street intersections, and/or street segments (Weisburd, Bruinsma, et al., 2009). This gradual shift toward *place* as the unit of analysis in examining the concentration of crime has proliferated a new area of study within spatial criminology known as the *Criminology of Place* (Sherman et al., 1989). And as police data collection practices improved with the emergence of technological sophistication, scholars have since been able to push beyond cross-sectional analyses on spatial crime patterns into longitudinal investigations showing not only that the proportion of spatial units that account for a defined proportion of crime falls within narrow bandwidth, thus revealing that crime concentrations are stable over time, but also that longitudinal trajectories of crime are spatially stable as well, indicating that crime largely occurs in the same places over time (Andresen, Curman, et al., 2017; Andresen & Malleson, 2011; Braga et al., 2011; Gill et al., 2017; Hibdon et al., 2017; Hodgkinson & Andresen, 2019a; Melo et al., 2015; Schnell & McManus, 2020; Vandeviver & Steenbeek, 2019; Weisburd et al., 2004; Weisburd, Morris, et al., 2009; Weisburd, 2015; Wheeler et al., 2016). This body of evidence has ultimately provided immense empirical backing for crime-focused, place-based police practices in areas of crime concentration that have been found to be successful at reducing crime and disorder (Braga et al., 2019a, 2019b; Hinkle et al., 2020).

Recently, however, scholars have drawn from the *Criminology of Place* and the success of crime-focused place-based policing strategies in an attempt to reimagine police responses to other issues under the police mandate, such as calls for service involving persons with perceived mental illness (PwPMI)[9]. More specifically, some have argued that instead of responding to PwPMI calls in a reactive manner, efforts should instead be proactive with a focus on the places in which these calls concentrate (Coleman & Cotton, 2016; Koziarski, 2021a; White & Weisburd, 2017; Wood & Watson, 2017). Doing so may be particularly helpful for efforts such as Crisis Intervention Teams (CIT) and co-response teams which have been found to reduce use of force and criminalization of PwPMI (e.g., Blais et al., 2020; Morabito et al., 2017; Semple et al., 2021; Watson, Owens, et al., 2021), but whose reach to this population has been stifled due to a number of deployment-related barriers (Bratina et al., 2021; Iacobucci, 2014; Koziarski et al., 2021; Seo & Kruis, 2022; Skubby et al., 2013).

Focusing on areas of PwPMI call concentration, however, may not only improve the reach of CITs and co-response teams to PwPMI in their communities through efficient resource deployment, but through proactive diversion of individuals to mental health services who may be approaching crisis, they may also prevent said crisis from occurring and thus future PwPMI calls for service (Koziarski, 2021a; White & Weisburd, 2017). Indeed, such benefits may be obtainable through emergent, non-police efforts to PwPMI as well. More specifically, due in part to the Defund the Police movement, many North American jurisdictions are currently piloting civilian-based responses to PwPMI that do not involve police (Dee & Pyne, 2022; Yousif, 2022). However, should their deployment instead be proactive and place-based—and not reactive, as many pilot programs are

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[9] The literature on mental health-related police interactions employs a variety of terms to refer to such interactions, with 'persons with mental illness'—often shortened to 'PMI'—being among the most frequently used terms (Frederick et al., 2018). Within police data, however, mental health calls are often coded as such by responding officers due to a perception or belief that mental health-related issues *may* be present, as opposed to a *certainty* that they are present. Therefore, as Frederick and colleagues (2018) note, the broad use of 'PMI' (and related) terms may lead to validity-related issues, unless researchers are certain that the data are comprised of people living with a diagnosed mental illness. Empirical efforts that, on the other hand, rely on officer-generated data should instead employ terms that reflect officers' uncertainty of whether mental illness is present. Since this is the case for the present work, this study employs the term 'persons with perceived mental illness' (PwPMI).

currently structured—they may similarly intervene before PwPMI reach crisis and thus even reduce the number of calls for service that civilian-based efforts would themselves need to attend to.

While the evidence on PwPMI call concentration does show that a large proportion of said calls are concentrated in a few number of places (Biebel & Cordner, 2003; Hodgkinson & Andresen, 2019b; Koziarski, 2021a; Vaughan et al., 2016; White & Goldberg, 2018)—thus indicating support for proactive, place-based efforts to PwPMI— the small number of studies in this area to-date have all been cross-sectional in nature. We, therefore, do not know whether concentrations of PwPMI calls for service fall within a stable, narrow bandwidth of spatial units, nor whether this call-type is spatially stable. Spatial stability, in particular, is vital when considering place-based practices as redirecting resources to areas of concentration *solely* on the basis that a concentration is present runs the risk that these efforts may end up 'chasing dots on a map' if PwPMI calls are found to be spatially instable (Andresen, Linning, et al., 2017; Levin et al., 2017; Weisburd et al., 2004; Wheeler et al., 2016).

The purpose of the present study is to conduct the first longitudinal examination on PwPMI calls for police service, with a focus on: (1) whether the proportion of spatial units that account for a defined proportion of PwPMI calls falls within narrow bandwidth, indicating that concentrations of PwPMI calls are stable over time; and (2) whether PwPMI calls are spatially stable. Doing so will reveal new and important knowledge on the spatial patterns of PwPMI calls for service which will result in vital practical implications for proactive, place-based police and non-police efforts to PwPMI.

3.1 Literature Review

3.1.1 The Criminology of Place

The first pioneering study of crime concentration at micro-geographic units—which Sherman and colleagues (1989) coined as the *Criminology of Place*—found that 50% of all calls for service in Minneapolis, Minnesota over a one-year period were concentrated at just 3% of all addresses in the city. Other cross-sectional studies that emerged in the following decades similarly showed a high degree of crime concentration at micro-

geographic units. Weisburd and Amram (2014), for example, found that 50% of crime in 2010 in Tel Aviv, Israel was concentrated on just 4.5% of street segments, whereas Bovin and de Melo (2019) similarly found that 50% of crime in 2016 in Toronto and Montreal, Canada was concentrated on 3.7% and 4.5% of street segments, respectively. Cross-sectional studies that examined the concentration of disaggregated crime-types found even stronger degrees of concentration than aggregated crime categories (e.g., Andresen & Linning, 2012; Boivin & Melo, 2019; Sherman et al., 1989; Weisburd & Mazerolle, 2000).

Longitudinal studies at micro-geographic units, on the other hand, have also found high degrees of crime concentration, however, their longitudinal nature have enabled scholars to discover two additionally important properties of crime at *place*. The first is that the concentration of crime at micro-geographic units is stable over time, falling within a narrow bandwidth of street segments. More specifically, Weisburd and colleagues (2004)—in the first longitudinal study in this area—found that 14 years of crime in Seattle, Washington was concentrated on between 4% and 5% of street segments in any given year. Studies that followed which examined over a decade of crime in a number of North American jurisdictions have all similarly found that the degree of crime concentration remains stable, falling within a narrow bandwidth of street segments over time (Curman et al., 2015; Gill et al., 2017; Schnell & McManus, 2020). Indeed, longitudinal studies examining disaggregated crime-types have yielded similar findings. For instance, Weisburd et al. (2009) found that 50% of juvenile crime in Seattle over a 14-year period was found on less than 1% of street segments in any given year, whereas Vandeviver and Steenbeek (2019) found that 50% of all residential burglaries in Antwerp, Belgium over a 12-year period were concentrated at approximately 2% of street segments per year (see also Andresen, Curman, et al., 2017; Andresen, Linning, et al., 2017; Andresen & Malleson, 2011; Braga et al., 2010, 2011; Hibdon et al., 2017; Levin et al., 2017; Melo et al., 2015). This body of literature has ultimately provided immense support for Weisburd's (2015, p. 138) *Law of Crime Concentration* which states that, "For a defined measure of crime at a specific micro-geographic unit, the concentration of crime will fall within a narrow bandwidth of percentages for a defined cumulative proportion of crime."

The second property that has emerged from longitudinal studies of crime at micro-geographic units is that crime is also moderately-to-highly spatially stable. In other words: crime largely occurs in the same places over time. Drawing on Group-Based Trajectory Modeling (GBTM) to uncover the longitudinal, developmental trajectories of crime at street segments, Weisburd and colleagues (2004) discovered that crime is remarkably spatially stable in Seattle, with 84% of street segments found in the stable trajectory. Subsequent studies drawing on GBTM were conducted in many jurisdictions, all of which yielded relatively similar findings (Curman et al., 2015; Gill et al., 2017; Schnell & McManus, 2020; Wheeler et al., 2016). Indeed, once again, studies investigating disaggregated crime-types—either through GBTM (Hibdon et al., 2017; Weisburd, Morris, et al., 2009) or other methods (Andresen, Curman, et al., 2017; Andresen, Linning, et al., 2017; Braga et al., 2011; Hodgkinson et al., 2016; Vandeviver & Steenbeek, 2019)—have similarly found that specific crimes are spatially stable as well. For instance, using a Spatial Point Pattern Test that assesses for similarity between point patterns, Hodgkinson et al. (2016) find that automotive theft in Vancouver, Canada over an 11-year period was moderately stable, with approximately 70% of street segments exhibiting spatial stability.

Taken together, the *Criminology of Place* has developed a robust body of evidence regarding the concentration of crime at micro-geographic units, the stability of these concentrations over time within a narrow bandwidth of spatial units, as well as the spatial stability of crime. In doing so, it provides immense empirical justification for place-based policing strategies that target so-called 'hot spots' of chronic criminal activity (Gill et al., 2017; Schnell & McManus, 2020; Sherman et al., 1989; Sherman & Weisburd, 1995; Weisburd et al., 2004). Studies on initiatives such as hot spots policing or problem-oriented policing that focus on areas of crime concentration—including crime concentrations at micro-geographic units—have shown to be effective at reducing crime and disorder (Braga et al., 2019a, 2019b; Hinkle et al., 2020). Studies on police activity, however, show that only 20% to 30% of all calls for service concern issues that are of a criminal nature (Wuschke et al., 2017). It may come to no surprise, then, that the robust findings on crime concentration and place-based policing strategies have inspired scholars to consider how knowledge around the concentration of the remaining 70% to

80% of police activity can be leveraged in order to develop and inform place-based policing strategies in response to these remaining issues under the police mandate. One such area that has recently received this attention are police responses to PwPMI.

3.1.2 PwPMI Calls for Service and the Criminology of Place

PwPMI calls for service comprise approximately 1% of police services' yearly call loads (Livingston, 2016), and are known to not only be longer in duration, but also utilize more resources than non-PwPMI calls (Charette et al., 2014; Schulenberg, 2016). Vaughan and Andresen (2018), for example, found that in British Columbia, Canada the number of hours devoted to responding to PwPMI, as well as the costs incurred during these responses, increased significantly each year between 2009 and 2015. And although this police role as *Streetcorner Psychiatrist* (Teplin & Pruett, 1992) appears to be a more prominent part of the contemporary police mandate, studies show that officers receive little training on mental health (Bittner, 1967; Fiske et al., 2020; Lorey & Fegert, 2021; Richmond & Gibbs, 2020), feel ill-prepared during interactions with PwPMI (Wells & Schafer, 2006), and/or feel anxious during interactions with PwPMI (Wittmann et al., 2020).

Furthermore, studies also show that although use of force occurs in fewer than 1% of all police interactions (Baldwin et al., 2018), PwPMI disproportionately experience use of force (Laniyonu & Goff, 2021; Yang et al., 2018), and particularly so when co-occurring issues are present, such as mental illness and substance use (Morabito et al., 2017). Arrest is a similarly rare occurrence when it comes to PwPMI calls (Charette et al., 2011, 2014; Shore & Lavoie, 2018), however, PwPMI have a higher probability of arrest (Charette et al., 2014; Compton et al., 2022; Lamb & Weinberger, 1998; Teplin, 1984; Teplin & Pruett, 1992) and especially so for disorder-related offences (Charette et al., 2011, 2014; Fisher et al., 2011; Schulenberg, 2016).

In an attempt to mitigate issues around use of force and criminalization—and to improve interactions between the police and PwPMI more generally—police services have attempted to reform how they respond to PwPMI by innovating specialized responses that focus on improving interactions between the police and PwPMI and their respective

outcomes. Crisis Intervention Teams (CIT), for example, involve a multisectoral partnership between police, hospitals, psychiatric facilities, community-based mental health services, and families of PwPMI with the objective of improving interactions between police and PwPMI, transferring PwPMI to the appropriate care, and establishing networks of support for early intervention (Dupont et al., 2007; Watson et al., 2017). While there is a dearth of evidence on subject, agency, and community-level outcomes, studies on officer-level impacts suggest that the 40-hour mental health training program that officers participate in as part of CIT can lead to improved attitudes toward PwPMI (Compton et al., 2014a; Ellis, 2014; Wells & Schafer, 2006), choosing referral to community-based services or hospital over arrest (Compton et al., 2014b; Franz & Borum, 2011; Steadman et al., 2000; Watson, Owens, et al., 2021), and less use of force (Compton et al., 2011; Morabito et al., 2012, 2017), among other effects.

Beyond CIT, police services have also established efforts broadly referred to as 'co-response teams' which are commonly comprised of a specially trained police officer working together with a mental health practitioner who then respond to PwPMI calls as a team (Koziarski et al., 2021; Shapiro et al., 2015). The evidence on co-response teams similarly suggests promising results in that they may reduce use of force incidents, arrests, costs associated with PwPMI calls, and time spent at PwPMI calls, while also increasing referrals to community-based mental health services, PwPMI engagement with outpatient services, and PwPMI satisfaction when interacting with the police (Blais et al., 2020; Fahim et al., 2016; Kirst et al., 2015; Kisely et al., 2010; Lamanna et al., 2018; Semple et al., 2021).

Outside of a policing context, recent discussions have also emerged in a number of North American jurisdictions to remove the police as primary responders to PwPMI through the development and deployment of civilian-based responses. This particular call for reform originates from the murder of George Floyd by the Minneapolis Police Department and the subsequent Defund the Police movement which broadly sought to reimagine how policing and public safety is conducted, which in part questioned the role of the police in responding to PwPMI (Cummins, 2022; Koziarski & Huey, 2021; Lum et al., 2021). While most of our limited empirical knowledge on civilian-based responses is currently

contained within unpublished grey literature that has not been scrutinized by peer-review (Marcus & Stergiopoulos, 2022), a number of North American jurisdictions are currently conducting pilot programs for these programs with the goal of reducing the footprint of the police in the lives of PwPMI (Dee & Pyne, 2022; Watson, Pope, et al., 2021; Yousif, 2022).

The problem with CIT, co-response teams, and even emergent civilian-based responses to PwPMI, however, is that they are deployed to be *reactive* in nature, responding to a crisis that could have arguably been prevented had a timelier intervention taken place. Beyond reactivity, literature on both CIT and co-response teams has identified a number of deployment-related barriers that, in effect, limit the reach that both of these response efforts have even in their reactive capacity. CITs, for example, can endure lack of resources and officer availability in some jurisdictions, both of which can act as a financial deterrent for sending officers to the 40-hour mental health training program (Bratina et al., 2021; Seo & Kruis, 2022; Skubby et al., 2013); whereas co-response teams have been found to endure underfunding and understaffing issues (Iacobucci, 2014; Koziarski et al., 2021). Indeed, in some jurisdictions, co-response teams have even been instructed to refrain from responding to some PwPMI calls altogether because the individual in question may not be in "enough crisis" (Schulenberg, 2016, p. 473).

Recently, however, scholars have drawn from the *Criminology of Place* and success of crime-focused place-based policing strategies to reimagine how police responses can be operationalized in practice—thoughts which can be extended to the deployment of emergent non-police responses as well. More specifically, Wood and Watson (2017) note that *place* is critical area that must be considered when innovating the future of police responses to PwPMI, which, they argue, should be proactive and targeted in areas where interactions between the police and PwPMI concentrate (see also Coleman & Cotton, 2016; White et al., 2019; Wood & Beierschmitt, 2014). White and Weisburd (2017), with a specific focus on co-response teams, similarly critique the reactive deployment of these efforts and instead make the case that co-response teams should be proactive in nature, akin to hot spot policing efforts that have been successful in addressing crime in areas of crime concentration at micro-geographic units. In doing so, CITs, co-response teams, and

even civilian-based efforts may not only have an increased reach to PwPMI in their communities in spite of the operational limitations faced, but they may also prevent mental health crises from occurring and thus future PwPMI calls for service, and—above all—may put PwPMI on a more fruitful path of mental health care and treatment (Koziarski, 2021a; White & Weisburd, 2017).

Emerging literature on the concentrations and spatial patterns of PwPMI calls for service does suggest at least preliminary support toward the feasibility of proactive, place-based efforts to PwPMI. More specifically, motived by the work of Sherman and colleagues (1989), Biebel and Cordner (2003) found that 33% of all PwPMI calls for service made throughout 1995 in Lexington, Kentucky occurred at just 70 addresses in the city. Research that followed over a decade later in a number of North American jurisdictions found that 50% of PwPMI calls for police service were concentrated on between 0.30-4.17% of all street segments (Hodgkinson & Andresen, 2019b; Koziarski, 2021a; Vaughan et al., 2016; White & Goldberg, 2018). Canadian studies that, on the other hand, drew upon larger spatial units akin to United States Census blocks found that while 50% of PwPMI calls for service were more dispersed across Statistics Canada dissemination areas relative to street segments, calls were still nonetheless considerably concentrated within 11.10% to 13.17% of areas (Koziarski, 2021a; Vaughan et al., 2019).

3.2 Current Study

By focusing their limited resources on areas of PwPMI call concentration, it is certainly plausible that proactive, place-based police and non-police efforts will have a much greater reach to PwPMI within their communities due to the considerable proportion of calls that occur within few places. However, scholars have previously written within the context of crime concentration that concentrations *alone* may be insufficient to justify re-directing resources toward place-based efforts. This is because while the degree of concentration may be profound, crime may be spatially instable over time, thus resulting in place-based efforts 'chasing dots on a map' (Andresen, Linning, et al., 2017; Levin et al., 2017; Weisburd et al., 2004; Wheeler et al., 2016). This very same issue may also be present when one considers PwPMI calls for service. However, to-date, unlike the longitudinal studies within the *Criminology of Place* that have examined the temporal

stability of crime concentrations, as well as the spatial stability of crime, the existing literature on PwPMI call concentrations has largely either been cross-sectional in nature with only one year of calls under examination (Biebel & Cordner, 2003; Hodgkinson & Andresen, 2019b; Vaughan et al., 2016; White & Goldberg, 2018) or draws upon multiple years of PwPMI call data that were then aggregated to provide only one measure of concentration for the entire data period (Koziarski, 2021a; Vaughan et al., 2018, 2019). As such, unlike crime-focused place-based policing strategies which can be informed by a large body of evidence showing not only that bandwidths of crime concentrations are temporally stable, but that crime is spatially stable as well, scholars have yet to examine whether these spatial properties also exist for PwPMI calls for service. Filling this gap in the literature is paramount toward not only informing potential proactive, place-based efforts as to whether PwPMI call concentrations remain concentrated to a similar degree year-over-year, but—most crucially—whether these calls occur in the same place over time. If so, it would provide even further empirical support toward the re-deployment of both police and non-police resources as proactive, place-based efforts.

3.3   Data and Methods

3.3.1   Data

Data for the present study are provided by the Barrie Police Service. This organization serves the City of Barrie located approximately 100km north of the City of Toronto in Ontario, Canada. As of the 2016 Census, Barrie has a population of 197,000 and a population density of 219 per km^2 (Statistics Canada, 2017). Barrie is also largely suburban in nature with nearly one-third of its total land area—99 km^2—zoned for residential land use.

For the purpose of this study, all calls for service made to the Barrie Police for the seven-year period of January 1, 2014, through December 31, 2020 ($N = 424,271$) were extracted from the service's computer-aided dispatch (CAD) system. Each incident in the data was accompanied by the date and time the respective call for service was made, the incident-type as reported by the caller, the incident-type as found by the responding officer(s), and CAD-generated *XY*-coordinates. A subset of these data was subsequently created in

which only calls for service were included if the 'incident-type as found' field was set to *Mental Health*. In doing so, this study draws upon a subset that contains 3,977 calls for service made to the Barrie Police Service during the seven-year period in which the responding officer(s) perceived mental health as being the primary nature of the call. These data were additionally disaggregated at the yearly level to facilitate the present analysis.

As shown in Figure 5, the Barrie Police Service received a relatively stable frequency of PwPMI calls for service between 2014 and 2019, which subsequently peaked in 2020 with 715 calls. Indeed, this peak coincides with the Coronavirus Disease 2019 (COVID-

Figure 5. PwPMI Calls for Service Per Year, 2014-2020

PwPMI Calls for Service Per Year
January 1, 2014 - December 31, 2020
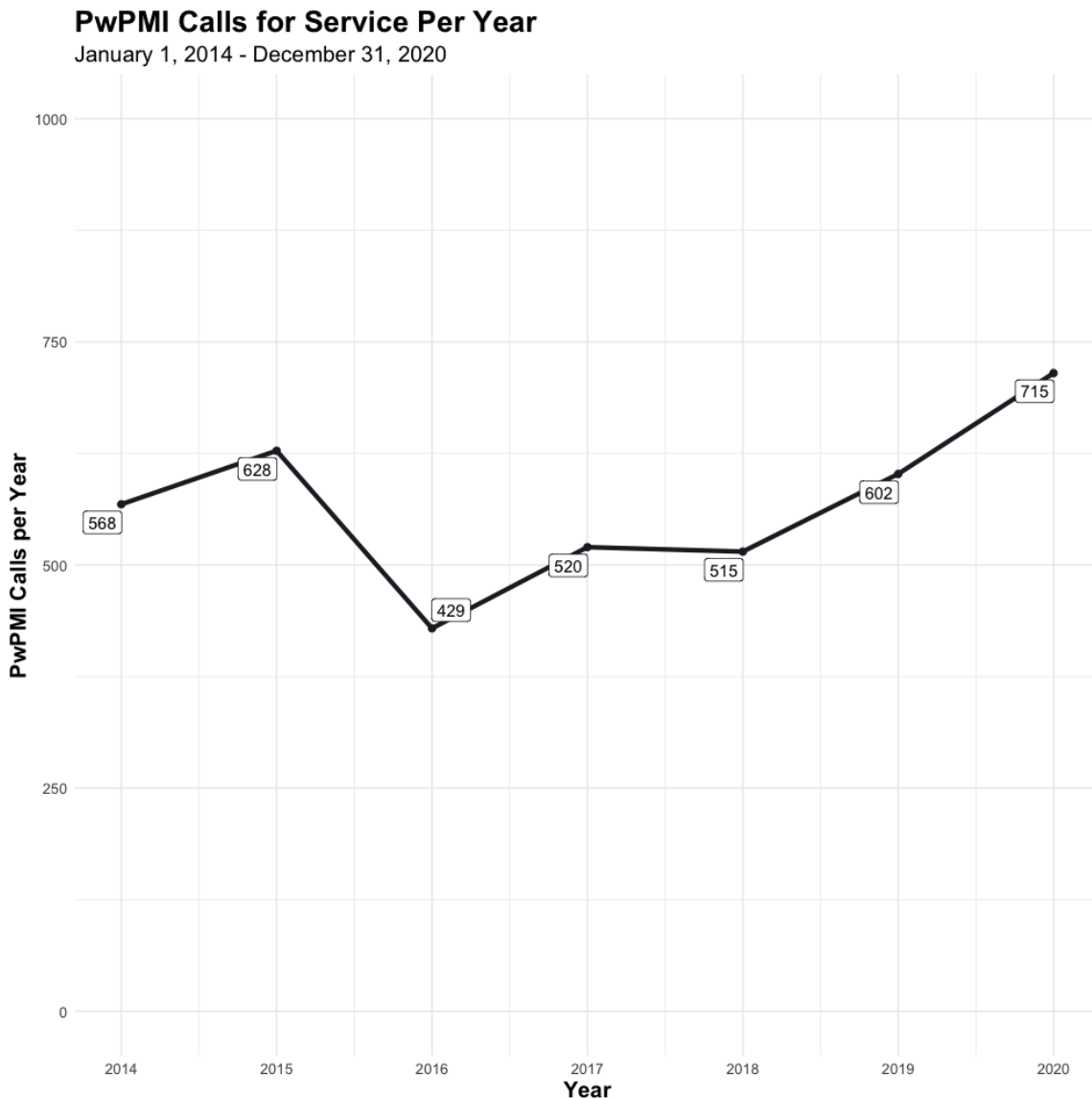
19) pandemic and the enactment of various public health measures to prevent the spread of the virus—such as lockdowns, quarantines, and physical distancing—which have been found to be associated with higher rates of depression, stress, and/or anxiety (see e.g., Holman et al., 2020; Proto & Quintana-Domeque, 2021; Vindegaard & Benros, 2020; Zajacova et al., 2020). While there have been few inquiries into the effect of the pandemic on PwPMI calls for service, research on this topic specifically from the Barrie context suggests that the pandemic did indeed have an impact on PwPMI calls for service in the jurisdiction, increasing by 22% relative to what would have been expected had the pandemic not occurred (Koziarski, 2021b). As such, although the specific purpose of the present study is not to examine the impact of the COVID-19 pandemic on the spatial patterns of PwPMI calls for service, the inclusion of call data from 2020 will afford the opportunity to do so.

3.3.2   Units of Spatial Analysis

The present study employs two units of spatial analysis. The first are street segments, which as defined by Weisburd and colleagues (2004, p. 290) are, "the two block faces on both sides of a street between two intersections." Indeed, street segments have become an immensely popular unit of spatial analysis in the *Criminology of Place*, particularly as studies have shown that larger units—such as neighbourhoods—may mask the spatial heterogeneity of crime found within them (Andresen & Malleson, 2011; Groff et al., 2010; Sherman et al., 1989). Street segments also possess a considerable degree of utility from a practical perspective in that areas of concentration can be identified with a high degree of precision, thus providing practitioners with the knowledge of *exactly* where resources need to be re-directed. Since the focus of the present study is to inform future place-based efforts that assist PwPMI, street segments are the ideal unit of spatial analysis through which to inform such efforts. With respect to the present study jurisdiction, the City of Barrie has 2,975 street segments.

The second unit of spatial analysis for this study are dissemination areas. As per Statistics Canada (2018):

A dissemination area is a small, relatively stable geographic unit composed of one or more adjacent dissemination blocks with an average population of 400 to 700 persons based on data from the previous Census of Population Program. It is the smallest standard geographic area for which all census data are disseminated.

Although these units are certainly larger than micro-geographic units, previous literature that has examined the spatial stability of crime at both street segments and dissemination areas has shown that crime is more spatially stable over time at street segments than dissemination areas (Andresen & Malleson, 2011; Hodgkinson & Andresen, 2019a). It is therefore worthwhile to examine whether the same holds true when considering the spatial stability of PwPMI calls for service at dissemination areas relative to street segments. With respect to the study jurisdiction, there are 243 dissemination area within the City of Barrie as of the 2016 Census.

3.3.3 Yearly Concentrations at Spatial Units

In order to examine the temporal stability of PwPMI call concentrations at both street segments and dissemination areas, three measures of concentration are calculated for both units of analysis for each year in the data: (1) the percentage of spatial units that have any PwPMI calls for service; (2) the percentage of spatial units that account for 50% of calls; and (3) the percentage of spatial units with any calls that account for 50% of calls. These three measures are in-line with those used in previous research on PwPMI call concentrations (e.g., Hodgkinson & Andresen, 2019b; Koziarski, 2021a; Vaughan et al., 2016).

As an added measure, Gini coefficients will also be calculated for both units of analysis for each year in the data. Historically, Gini coefficients have largely been used as a means to summarize the degree of income inequality with a single number that ranges between 0 (perfect equality) and 1 (perfect inequality). However, recently, Bernasco and Steenbeek (2017) have critiqued the literature on crime concentration in that it has lacked a single, universal measure of concentration which therefore has stifled opportunities to compare concentration across areas, temporal periods, or crime-types. In light of this, they not only make the case that Gini coefficients can fill this gap in the literature, but also introduce the generalized Gini coefficient which prevents overestimating the degree

of concentration when the number of events is smaller than the number of spatial units (Bernasco & Steenbeek, 2017). The aim for including Gini coefficients as a measure of concentration is to facilitate the current comparison of PwPMI call concentrations from year-to-year within the Barrie context. Accordingly, since there are fewer PwPMI calls for service in Barrie in any given year than there are street segments, generalized Gini coefficients are calculated for street segments whereas standard Gini coefficients are calculated for dissemination areas[10]. All Gini coefficients are calculated though the *lorenzgini* package for the R statistical programming environment (Steenbeek & Bernasco, 2018).

3.3.4   Spatial Point Pattern Test

Finally, to measure the spatial stability of PwPMI calls for police service over time, this study employs a nonparametric Spatial Point Pattern Test (SPPT) developed by Andresen (2009, 2016). The SPPT is area-based and examines the degree of similarity between two point patterns for each individual spatial unit, which in turn can be used to identify the stability of a point pattern over time. Indeed, use of the SPPT to examine the spatial stability of PwPMI calls for service is a departure from much of the literature in the *Criminology of Place* which has largely used GBTM (e.g., Curman et al., 2015; Gill et al., 2017; Hibdon et al., 2017; Schnell & McManus, 2020; Weisburd et al., 2004; Weisburd, Morris, et al., 2009; Wheeler et al., 2016). However, as Andresen and colleagues (2017) point out, trajectories of crime that are identified as 'stable' through GBTM are only *assumed* to be spatially stable when in fact there may be a small degree of variation within the trajectories themselves, which may therefore amount to meaningful changes in spatial patterns over longer temporal periods. Others have also pointed out that the group-based nature of GBTM does not allow for the examination of spatial stability at individual spatial units (Hibdon et al., 2017). In light of these considerations, the SPPT is used here as it is a more specific investigation into the

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[10] Although Lorenz curves are not presented in this Chapter, a Gini coefficient is calculated as a ratio of the area between the Lorenz curve and the line of perfect equality to the area above the line of perfect equality. Generalized Gini coefficients are calculated in a similar manner, but with the line of maximal equality (Bernaso & Steenbeek, 2017).

stability of PwPMI calls over time than would be afforded through GBTM, and because the test allows for investigating stability at both the global and local levels (Andresen, Linning, et al., 2017).

Considering the focus of the present study, the execution of the SPPT is as follows:

1. Select a point pattern to be classified as the 'base' dataset (e.g., 2014 PwPMI calls for service) and a second to be classified as the 'test' dataset (e.g., 2015 PwPMI calls for service);
2. Randomly sample—with replacement—both datasets, calculating the percentage of PwPMI calls for service within each individual spatial unit (i.e., dissemination area/street segment);
3. Repeat the previous step 200 times via Monte Carlo simulation to produce 95% confidence intervals for each individual dissemination area/street segment and for each dataset;
4. If the confidence intervals from each dataset overlap for a given dissemination area/street segment, the two point patterns for said spatial unit are considered to be similar and is thus assigned a local similarity index—local-*S*—of 0. Spatial patterns that, on the other hand, are dissimilar are assigned either a local-*S* of -1 (i.e., base dataset is greater than test) or +1 (i.e., test dataset is greater than base).

From this, a global similarity index—*S*-Index—can also be calculated that provides a single measure of similarity between the two point patterns for the entire study jurisdiction. The *S*-Index ranges between 0 (perfect dissimilarity) and 1 (perfect similarity), and is calculated as follows:

$$S = \frac{\sum_{i=1}^{n} s_i}{n}$$

where s_i is equal to 1 if the two spatial patterns are similar within a particular spatial unit (*i*) or 0 if they are not, and where *n* is the total number of dissemination areas/street segments within the test. The *S*-Index, therefore, measures the percentage of dissemination areas/street segments that exhibited a similar spatial pattern between the two datasets. A rule-of-thumb has emerged throughout previous applications of the SPPT whereby an *S*-Index of 0.80 is considered as the threshold for similarity (Andresen, 2009,

2016). The full bootstrap version[11] of the SPPT is employed for the present study through the *sppt* package for the R statistical programming environment (Steenbeek et al., 2020).

Given the pairwise nature of the test, each consecutive year of PwPMI calls for service will serve as both 'base' and 'test' datasets for a total of 21 pairwise comparisons per spatial unit of analysis. However, while such pairwise tests may be instructive for comparing the similarity in spatial patterns between all years in the data period, they alone are limited in their ability to measure spatial stability over time. More specifically, as Andresen and colleagues (2017) explain, even though the *S*-Index may, for example, be 0.90 or higher for each consecutive pairwise comparison—therefore *suggesting* the presence of spatial stability over time—there may be enough spatial change in the remaining ~10% of non-similar spatial units that the *true* spatial similarity in the final pairwise comparison may be low in spite of an *S*-Index that suggests otherwise. For this reason, they introduce three new *S*-Indices that extends the SPPT into a longitudinal application, all of which will be calculated here through narrowing in on six pairwise comparisons: 2014-2015, 2015-2016, 2016-2017, 2017-2018, 2018-2019, 2019-2020.

3.3.4.1 Longitudinal Global SPPT

The first longitudinal *S*-Index, $S_{Absolute}$, is a calculation of the percentage of spatial units that exhibit absolute spatial stability. That is, if the local-*S* is 0 across all six pairwise

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[11] A new version of the SPPT has recently been made available that allows one to examine the difference in proportions between two spatial patterns (see Wheeler et al., 2018 for full details regarding recent changes to the SPPT). This difference in proportions test also addresses two limitations of earlier versions of the SPPT: (1) the arbitrary choice of which dataset serves as the 'base' dataset and which as the 'test' dataset that can ultimately affect the *S*-Index if the sample size in the latter is smaller/larger than the former; and (2) the influence of spatial units with no events. While the first limitation is not an issue for the present study as the bootstrap version of the SPPT samples *both* datasets (not just the 'test' dataset), the second limitation is still present in that a spatial unit with no events in the 'test' dataset will always generate a confidence interval from 0% to 0% and thus always conclude that the spatial patterns are dissimilar for that particular unit, even if the number of events in the 'base' dataset is very small, but not zero. The difference in proportions version of the SPPT instead generates a confidence interval of 0% to 3% for units that have zero events in the 'test' dataset, thus preventing the overestimation of dissimilarity between the two point patterns. Initial analyses for the present study were conducted using both bootstrap and proportion difference versions of the SPPT (the latter of which with and without correction for multiple comparisons) and the results were found to be extremely similar. And since the purpose of the present study is to simply examine the spatial stability of PwPMI calls for service over time and not the difference in proportions, the bootstrap version of the SPPT was determined to be the most appropriate.

comparisons, the spatial stability for this particular unit is considered 'absolute'. The second longitudinal S-Index, S_{Zero}, is calculated in the same manner, but includes spatial units which have found a 'new' stability. For example, if a spatial unit had the following local-S' for the six pairwise comparisons—0, 0, 0, -1, 0, 0—it has found a new stability after the decrease in the fourth pairwise test and would therefore be included in this S-Index[12]. The third and final longitudinal S-Index, S_{Sum}, is a calculation of the percentage of spatial units that are similar in most pairwise comparisons. That is, with six pairwise tests under consideration, a spatial unit would require a local-S of 0 in four or more of the comparisons. The purpose of the S_{Sum}, as Andresen and colleagues (2017) explain, is to not 'punish' a particular spatial unit for being dissimilar when it is in fact similar for a majority of the study period.

3.3.4.2   Longitudinal Local SPPT

As Vandeviver and Steenbeek (2019) point out, while Andresen and colleagues' (2017) extension of the SPPT is instructive toward examining the stability of spatial patterns at the global level over time, summarizing multiple pairwise comparisons into a single measure strips some of the capabilities that are offered through the traditional pairwise applications of the test, namely the ability to examine local stability of individual spatial units. As such, the present analysis follows Vandeviver and Steenbeek (2019) in calculating two additional measures that will shed light on the stability of PwPMI calls for service at the local level: a local similarity sum score and a volatility score.

Again, considering the six pairwise comparisons above, the local similarity sum score is the sum of the local-S' for each individual dissemination area and street segment. With six pairwise comparisons, the sum score can range from -6 to +6 with negative values indicating a net decrease in PwPMI calls for service for that particular spatial unit over

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[12] Spatial units were *excluded* in the calculation of the S_{Zero} if: (1) the local-S changed more than once as that would more so be characterized as a volatile spatial unit and thus instable; and (2) if the 'new' stability was found in either of the two final pairwise comparisons. For example, a spatial unit with local-S'—0, 0, 0, 0, -1, 0—found its 'new' stability in the final pairwise comparison, however as the end of the data period has been reached, it is not possible to know—at least for the time being—whether or not the next local-S is 0 and thus *truly* stable or simply stable for the final pairwise comparison.

the study period, and positive values indicating a net increase. A sum score of 0 may suggest stability in PwPMI calls for said unit, but it may also mask volatility in the local-*S*' that ultimately sum to 0. To prevent this, and to understand the broader spatial volatility of PwPMI calls at both dissemination areas and street segments, a volatility score is calculated as a measure for the total number of times a spatial unit experienced a change in its local-*S* during the study period.

Table 2. Percent Dissemination Areas Accounting for 100% and 50% of PwPMI Calls for Service, Per Year

(a) Year	(b) *N* PwPMI Calls	(c) *N* Units with Any Calls	(d) Percent Units with Any Calls	(e) Percent Units Accounting for 50% of Calls	(f) Percent Units with Any Calls Accounting for 50% of Calls
2014	568	164	67.49%	11.11%	16.46%
2015	628	173	71.19%	10.29%	14.45%
2016	429	157	64.61%	11.11%	17.20%
2017	520	152	62.55%	9.47%	15.13%
2018	515	160	65.84%	10.70%	16.25%
2019	602	164	67.49%	10.29%	15.24%
2020	715	183	75.31%	13.17%	17.49%

3.4   Results

3.4.1   Temporal Stability of PwPMI Call for Service Concentrations

Table 2 presents the proportion of dissemination areas in the City of Barrie that account for 100% and 50% of PwPMI calls for service in each year of the data period. Concerning the former, Table 2, column d, shows that PwPMI calls are rather dispersed across dissemination areas with 62.55% to 75.31% of units required to account for all calls in a given year. Interestingly, although the proportion of units remains relatively stable year-over-year for this measure, calls are most dispersed across dissemination areas in 2020—during the COVID-19 pandemic—than in any previous year.

When considering the proportion of dissemination areas required to account for 50% of calls, presented in Table 2, column e, it is clear that the degree of concentration becomes much stronger with 9.47% to 13.17% of dissemination areas. And, similar to all calls, while the proportion is relatively stable year-over-year, 2020 exhibited an increase in the proportion of dissemination areas required to account for half of calls. Within these yearly concentrations, however, Table 2, column f, shows that PwPMI call concentrations are slightly dispersed with 14.45% to 17.49% of dissemination areas with any calls required to account for 50% of calls, with 2020 once again being most dispersed.

Table 3. Percent Street Segments Accounting for 100% and 50% of PwPMI Calls for Service, Per Year

(a) Year	(b) N PwPMI Calls	(c) N Units with Any Calls	(d) Percent Units with Any Calls	(e) Percent Units Accounting for 50% of Calls	(f) Percent Units with Any Calls Accounting for 50% of Calls
2014	568	337	11.33%	2.69%	23.74%
2015	628	345	11.60%	2.32%	20.00%
2016	429	282	9.48%	2.29%	24.11%
2017	520	310	10.42%	2.29%	21.94%
2018	515	296	9.95%	2.45%	24.66%
2019	602	343	11.53%	2.59%	22.45%
2020	715	375	12.61%	2.49%	19.73%

Annual concentrations at street segments, on the other hand, are considerably more pronounced than across dissemination areas. As displayed in Table 3, column d, 100% of PwPMI calls for service occur on between 9.48% and 12.61% of street segments in any given year. Once again, all PwPMI calls in 2020 are more dispersed across street segments than in previous years. However, when considering the proportion of segments required to account for 50% of all calls, as shown in Table 3, column e, it is clear that PwPMI call concentrations are remarkably stable, falling within a very narrow bandwidth of spatial units. That is, half of PwPMI calls for service are concentrated on just 2.29% to 2.69% of street segments in any given year. Further, while half of all calls are more dispersed across dissemination areas in 2020 relative to previous years, this does not

appear to be the case at the street segment level. In fact, 50% of PwPMI calls were *more* concentrated at street segments in 2020 than the year before and to a similar degree relative to the year before that. These concentrations, however, are rather dispersed—

Figure 6. Gini Coefficients, Dissemination Areas and Street Segments, PwPMI Calls for Service, 2014-2020

Gini Coefficients
Dissemination Areas and Street Segments, PwPMI Calls for Service, 2014-2020

Generalized Gini Coefficients are presented for Street Segments.
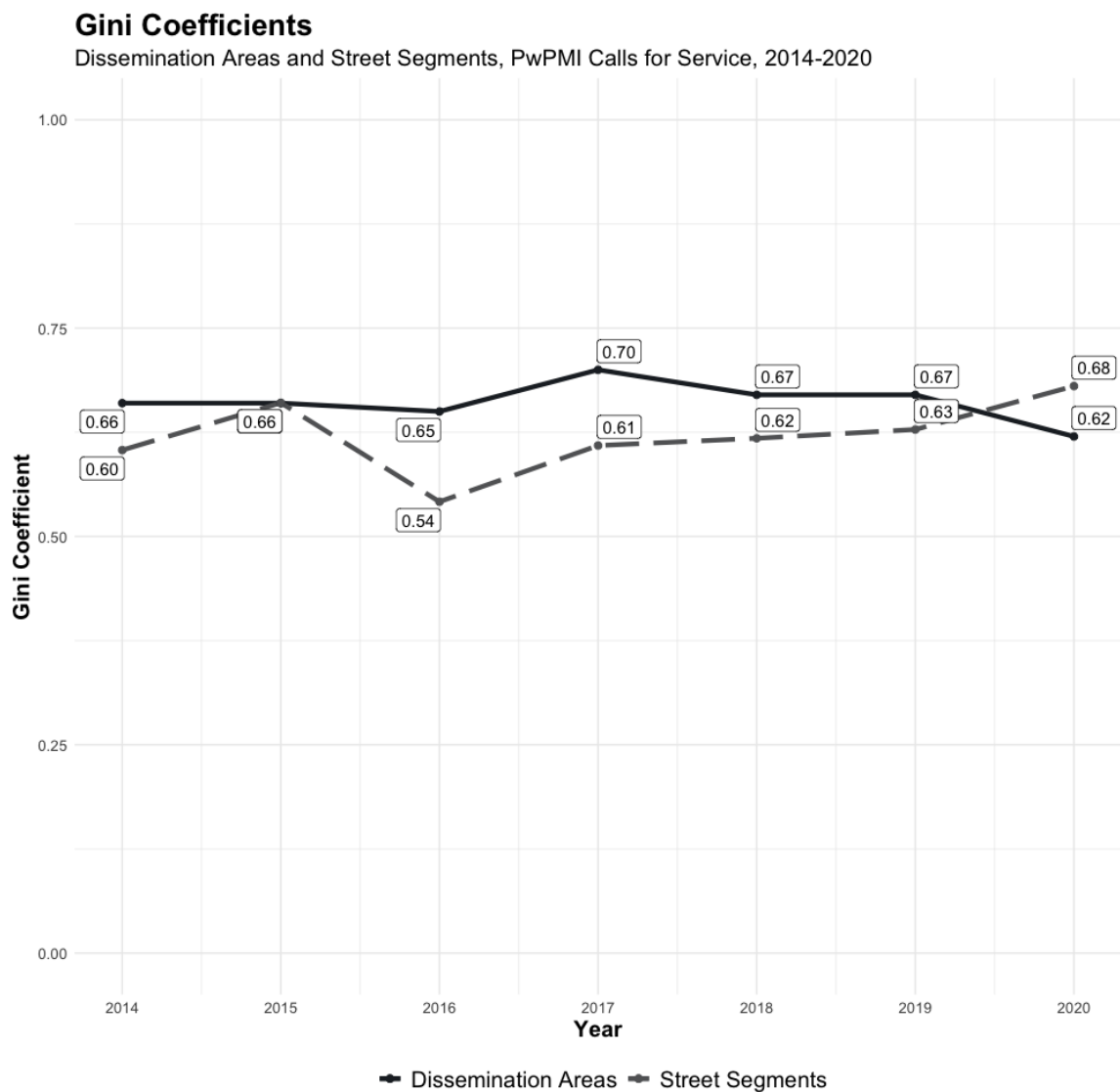
more so than at dissemination areas—with 19.73% to 24.66% of street segments with any calls required to account for 50% of PwPMI calls in a given year (Table 3, column f). And although this bandwidth of concentration is relatively stable year-over-year, 50% of calls are—interestingly—*least* dispersed in 2020 across street segments with any calls at 19.73%.

In sum, it is clear that concentrations of PwPMI calls for service are temporally stable at both dissemination areas and street segments, falling within a narrow bandwidth of spatial units. This is further confirmed through annual Gini coefficients displayed in Figure 6. That is, Gini coefficients for dissemination areas are in a stable range from 0.62 to 0.70 annually; whereas generalized Gini coefficients for street segments—which are corrected to only consider the segments on which PwPMI calls occurred in a given year—are similarly stable from 0.54 to 0.68.

3.4.2   Spatial Stability of PwPMI Calls for Service

Thus far, it has been established that concentrations of PwPMI calls for service are temporally stable, falling withing a narrow bandwidth of spatial units. But are PwPMI calls for service spatially stable as well? Table 4 presents results of pairwise S-Indices for PwPMI calls for service at dissemination areas. Focusing on the top right half of the table, it is immediately clear that PwPMI calls for service are remarkably stable across all 21 pairwise comparisons at dissemination areas. More specifically, with exception to three S-Indices, all indices are greater than 0.90. However, the three outlying indices are only marginally below 0.90. These three outlying indices are also all compared against 2020, which, as discussed above, was the year in which PwPMI calls for service were most dispersed across dissemination areas.

Table 4. Standard and Robust Pairwise S-Indices, Dissemination Areas

	2014	2015	2016	2017	2018	2019	2020
2014		0.934	0.951	0.922	0.947	0.918	0.897
2015	0.924		0.942	0.942	0.934	0.926	0.905
2016	0.941	0.931		0.955	0.951	0.942	0.930
2017	0.906	0.931	0.944		0.967	0.926	0.868
2018	0.937	0.924	0.939	0.960		0.951	0.930
2019	0.905	0.914	0.930	0.911	0.939		0.877
2020	0.884	0.894	0.920	0.849	0.919	0.859	

Standard S-Indices are presented in the top triangle; Robust S-Indices in the bottom triangle

Similarity through S-Indices, however, may be overestimated in the event that there are many spatial units with no PwPMI calls for service in both 'base' and 'test' datasets. This is because the SPPT concludes that units with no events in either dataset are similar, thus inflating the index. To prevent this overestimation, results for *robust S*-Indices that

exclude such units are presented in the bottom left of Table 4. While indices drop slightly, all—with exception to four—pairwise comparisons still have an *S*-Index of 0.90 or greater. The four comparisons that are less than 0.90 are still well above the threshold of similarity and, again, are all compared against 2020. Taken together, through either the *S*-Index or *robust S*-Index, pairwise comparisons suggest that PwPMI calls for service are remarkably stable across dissemination areas.

Table 5. Standard and Robust Pairwise *S*-Indices, Street Segments

	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
2014		0.996	0.997	0.995	0.994	0.994	0.994
2015	0.976		0.996	0.995	0.994	0.991	0.988
2016	0.982	0.979		0.996	0.997	0.994	0.990
2017	0.970	0.970	0.975		0.994	0.991	0.990
2018	0.963	0.966	0.983	0.964		0.994	0.990
2019	0.970	0.952	0.965	0.950	0.966		0.991
2020	0.970	0.941	0.944	0.947	0.944	0.954	

Standard *S*-Indices are presented in the top triangle; Robust *S*-Indices in the bottom triangle

Shifting the attention to the finer unit of analysis, the top right half of Table 5 presents pairwise *S*-Indices at street segments. Once again, it is immediately clear that PwPMI calls for service are remarkably stable across all pairwise comparisons at this unit of analysis. However, the indices are notably stronger at street segments relative to dissemination areas, with all but one pairwise comparison having an *S*-Index of 0.99. Given that an *S*-Index of 1 indicates perfect similarity, almost all pairwise comparisons are near-perfect, thus suggesting near-perfect year-over-year spatial stability. The sole pairwise comparison that is less than 0.99 is only marginally so, and, once again, compared against 2020. Robust indices on the other hand, which are displayed in the bottom left half of Table 5, are indeed not as strong, but remain well above 0.90 and are stronger than *robust S*-Indices at dissemination areas. Once again, either through the *S*-Index or *robust S*-Index, pairwise comparisons suggest that PwPMI calls for service are remarkably stable across street segments, and even more than what was exhibited across dissemination areas.

Importantly, as discussed earlier, while pairwise comparisons are indeed instructive at exploring spatial stability, they alone are insufficient. As such, Table 6 presents both

Table 6. Standard and Robust Longitudinal *S*-Indices, Dissemination Areas and Street Segments

	All Spatial Units			Non-Zero Spatial Units				
	S_{Absolute}	S_{Zero}	S_{Sum}	S_{Absolute}	S_{Zero}	S_{Sum}	*n*	*%*
Dissemination Areas	0.745	0.819	0.979	0.743	0.817	0.979	241	99.18%
Street Segments	0.976	0.984	0.999	0.937	0.956	0.996	1,118	37.58%

standard and *robust S*-Indices for the longitudinal extension of the SPPT. Considering all dissemination areas, the S_{Absolute} suggests that PwPMI calls for service fall short of the 0.80 similarity threshold, which is in stark contrast to the results of the pairwise tests presented in Table 4, thus highlighting the importance of not over relying on pairwise SPPT applications for examinations of spatial stability. Although, that said, with nearly three-quarters of dissemination areas exhibiting 'absolute' spatial stability over the study period, this is not something to be ignored. Spatial stability, however, does increase when also considering dissemination areas which have found a 'new' stability (S_{Zero}: 0.819) as well as those which are similar in most pairwise comparisons (S_{Sum}: 0.979). The robust indices, on the other hand, which only consider dissemination areas that experienced at least one PwPMI call during the study period, remain relatively unchanged as all but two dissemination areas experienced at least one PwPMI call.

Table 7. Longitudinal Local Sum and Volatility Scores, Dissemination Areas

		Volatility Score				Total	
		0	**1**	**2**	**3**	**n**	**%**
Sum Score	**-2**			2		2	0.83%
	-1		16		1	17	7.05%
	0	179		15		194	80.50%
	1		22		4	26	10.79%
	2			2		2	0.83%
Total	**n**	179	38	19	5	241	
	%	74.27%	15.77%	7.88%	2.07%		100%

Spatial stability across individual dissemination areas with at least one PwPMI call during the study period is further explored in Table 7. More specifically, approximately 75% of dissemination areas experienced a sum and volatility score of 0. Notably, however, few dissemination areas are volatile in nature, with even fewer exhibiting net

increases or decreases over the study period. This in turn suggests that PwPMI calls for service are not only spatially stable across dissemination areas, but that the *concentrations* of these calls are spatially stable as well.

Returning to Table 6, longitudinal spatial stability at street segments, on the other hand, is far more pronounced relative to dissemination areas. More specifically, when considering all street segments, the $S_{Absolute}$ suggests that PwPMI calls for service are remarkably spatially stable. Unsurprisingly, the indices only get stronger when including street segments that have found a 'new' stability, as well as those that are similar in most pairwise comparisons. When considering street segments that experienced at least one PwPMI call during the study period, however, the robust indices are weaker, but only marginally so. The stability of individual segments with at least one PwPMI call is further explored in Table 8. Indeed, an overwhelming majority of street segments have a sum and volatility score of 0, with only a very small proportion of segments exhibiting volatility as well as net increases/decreases. Overall, at the local level, it appears that PwPMI calls for service experience not only less spatial volatility at street segments than across dissemination areas, but also fewer net increases/decreases in PwPMI calls. Crucially, this suggests that PwPMI calls are not only remarkably spatially stable at street segments, but that the concentrations of these calls are spatially stable as well.

Table 8. Longitudinal Local Sum and Volatility Scores, Street Segments

		Volatility Score				Total	
		0	**1**	**2**	**3**	**n**	**%**
Sum Score	**-2**					0	0.00%
	-1		20		1	21	1.88%
	0	1,048		21		1,069	95.62%
	1		25	1	2	28	2.50%
	2					0	0.00%
Total	**n**	1,048	45	22	3	1,118	
	%	93.74%	4.03%	1.97%	0.27%		100%

3.5   Discussion and Conclusion

In light of recent discussions where scholars have posited drawing from the *Criminology of Place* and crime-focused place-based policing strategies in order to reimagine responses to PwPMI as proactive place-based efforts (Coleman & Cotton, 2016; Koziarski, 2021a; White & Weisburd, 2017; Wood & Watson, 2017), the purpose of the present study was to inform these potential efforts by conducting the first longitudinal examination into not only whether the proportion of spatial units that account for a defined proportion of PwPMI calls for service falls withing a stable, narrow bandwidth, but also whether these calls are spatially stable. Doing so builds on existing cross-sectional literature that has shown PwPMI calls to be immensely concentrated across a small proportion of places (Biebel & Cordner, 2003; Hodgkinson & Andresen, 2019b; Koziarski, 2021a; Vaughan et al., 2016; White & Goldberg, 2018), and may provide operational assurances to both police and non-police practitioners that proactive place-based efforts to PwPMI are practically efficient in that they are not 'chasing' call concentrations that are spatially instable.

With respect to the temporal stability of PwPMI call for service concentrations, the present study found these concentrations—at both dissemination areas and street segments—to indeed be temporally stable. Concentrations at street segments in particular were found not only to be more pronounced than across dissemination areas thus confirming the findings of previous research (Koziarski, 2021a; Vaughan et al., 2019), but also remarkably stable over the seven-year study period with 50% of PwPMI calls for service falling within an incredibly narrow bandwidth of street segments: 2.29% to 2.69%. This particular finding adds to the broader *Criminology of Place* in that akin to crime-related issues such as juvenile crime (Weisburd, Morris, et al., 2009), gun violence (Braga et al., 2010), property crime (Andresen, Linning, et al., 2017), or drug activity (Hibdon et al., 2017), PwPMI call for service concentrations are, too, temporally stable. Importantly, these findings also possess implications for Weisburd's (2015) *Law of Crime Concentration* in that crime does not appear to be the only issue under the broader police mandate that adheres to the principals of this law. Indeed, earlier cross-sectional work on the concentrations of PwPMI calls for service hinted at the broader applicability

of the *Law of Crime Concentration* beyond crime itself (Hodgkinson & Andresen, 2019b; Vaughan et al., 2016; White & Goldberg, 2018), but the present findings lend further support to this idea in that PwPMI calls are not only concentrated, but that concentration falls within a narrow bandwidth as stipulated by the law. As such, while the *Criminology of Place*—and indeed the broader sub-field of spatial criminology—has almost exclusively focused on the spatial patterns of crime (Andresen & Hodgkinson, 2019), further spatial work is most certainly needed on a much broader array of issues that fall under the police mandate. In doing so, knowledge around the concentration of these other issues can be obtained, and the broader applicability of the *Law of Crime Concentration* can be evaluated. From this, as argued herein, there may also be opportunities to posit proactive place-based efforts to these other non-crime-related issues that otherwise generally receive a reactive response from the police or other stakeholders.

Moreover, in terms of the spatial stability of PwPMI calls for service, the SPPT revealed that—across both dissemination areas and street segments—PwPMI calls exhibited remarkable spatial stability with every pairwise *S*-Index being well above the 0.80 similarity threshold. Notably, similar to how the concentration of PwPMI calls for service was found to be more pronounced at street segments than dissemination areas, the pairwise indices revealed that PwPMI calls were also more spatially stable across street segments. This finding is in line with those of Andresen and Malleson (2011) who found that several crime-types—such as assault, burglary, robbery, and theft—were more spatially stable at street segments in Vancouver than across dissemination areas, as well as those of Hodgkinson and Andresen (2019a) who similarly found greater spatial stability of residential burglary at street segments, also in Vancouver, relative to dissemination areas.

The longitudinal application of the SPPT, on the other hand, revealed a much starker difference in the spatial stability of PwPMI calls for service across dissemination areas relative to street segments than what was found in the pairwise tests. That is, whereas the pairwise indices for dissemination areas suggested a strong degree of spatial stability that was relatively in line to the stability exhibited at street segments, the longitudinal *S*-Indices instead revealed a much weaker degree of PwPMI call stability across

dissemination areas relative to street segments, with one of the indices failing to reach the similarity threshold. Though moderately stable, this difference in findings between pairwise and longitudinal indices at dissemination areas reaffirms the need for caution when attempting to infer spatial stability through pairwise indices alone (Andresen, Linning, et al., 2017). PwPMI calls for service at street segments, however, were found to be remarkably stable through the longitudinal application of the SPPT, with approximately 94% of segments exhibiting absolute spatial stability throughout the entire seven-year study period. Further, local longitudinal analyses revealed that PwPMI calls for service across individual dissemination areas and street segments exhibited very little volatility over the study period, and even fewer net increases or decreases. This ultimately points to the fact that PwPMI calls for service are not only remarkably spatially stable, but that the *concentrations* of these calls are spatially stable as well.

While it is outside of the purview of the present study to determine what may be contributing to this immense degree of spatial stability, it is important to note that relative to jurisdictions in previous research that have examined PwPMI call concentration, Barrie has the fewest number of street segments and dissemination areas (Hodgkinson & Andresen, 2019b; Vaughan et al., 2016, 2019), as well as the smallest total land area. This, in turn, means that there are simply fewer places in Barrie where PwPMI calls for service can occur, let alone concentrate. As a result, it may indeed be that the remarkable degree of spatial stability found here—particularly at street segments—is driven, or at the very least influenced by the fewer number of places at which PwPMI calls could possibly occur. Future research on the stability of PwPMI calls for service and their concentrations is certainly needed in other jurisdictions of various sizes in order to ascertain whether these calls are indeed spatially stable, or whether the findings here are simply a function of the study jurisdiction's characteristics (Vaughan et al., 2016, 2019; White & Goldberg, 2018).

On a different note, given the inclusion of calls for service data through 2020, the present findings provide the opportunity for a brief discussion into the possible impact of the COVID-19 pandemic on the spatial patterns of PwPMI calls for service. Indeed, as discussed earlier, the pandemic spurred on a whole host of public health measures in an

attempt to prevent the spread of the COVID-19 virus, such lockdowns, quarantines, and physical distancing (Holman et al., 2020; Proto & Quintana-Domeque, 2021; Vindegaard & Benros, 2020; Zajacova et al., 2020). By their very nature, these public health measures affected the daily routines of many people around the globe, which in turn, would suggest the possibility of PwPMI calls for service occurring in different places than they would have pre-pandemic. The findings here, however, do not support such a notion. More specifically, while PwPMI calls for service were found to be most dispersed across dissemination areas and street segments in 2020 relative to previous years, all pairwise *S*-Indices indicated high degrees of similarity between the 2020 point pattern and each of the previous years in the study period. Similarity, unsurprisingly, was found to be much stronger at street segments. As such, while previous research has shown that PwPMI calls for service increased in Barrie during the COVID-19 pandemic relative to what would have been expected had the pandemic not occurred (Koziarski, 2021b), the findings here suggest that an overwhelming majority of these calls occurred in the very same place as in previous years. More research is certainly needed that not only conducts a more direct investigation into the effect of the pandemic on the spatial patterns of PwPMI calls for service, but the reasons as to why PwPMI calls appear to occur in the same place year-over-year, even during a pandemic.

3.5.1 Practical Implications

Altogether, the findings of the present study generate vital practical implications for the deployment of both police and non-police resources to PwPMI. That is, with PwPMI call for service concentrations not only falling within a narrow bandwidth of spatial units that is temporally stable, but—more importantly—PwPMI calls for service being spatially stable, this study lends even further empirical support toward the deployment of proactive place-based efforts to PwPMI.

Indeed, the literature on CITs and co-response teams suggests that both response types have a number of beneficial impacts through their interactions with PwPMI, such as reduced use of force and reduced criminalization of PwPMI (Blais et al., 2020; Morabito et al., 2017; Semple et al., 2021; Watson, Owens, et al., 2021). Civilian-based efforts on the other hand, though lacking empirical evidence on their impacts due to the infancy of

these responses, are similarly posited to generate benefits for PwPMI, particularly with respect to minimizing the footprint that the police have in the lives of some PwPMI (Dee & Pyne, 2022; Marcus & Stergiopoulos, 2022; Watson, Pope, et al., 2021; Yousif, 2022). However, as discussed earlier, these efforts are not only reactive in nature and thus focus their scarce resources on issues that could have arguably been prevented through timelier invention (Coleman & Cotton, 2016; White et al., 2019; White & Goldberg, 2018; White & Weisburd, 2017; Wood & Beierschmitt, 2014; Wood & Watson, 2017), but—at least in the case of CITs and co-response teams—endure a number of deployment related barriers that limit their reach to PwPMI (Bratina et al., 2021; Iacobucci, 2014; Koziarski et al., 2021; Seo & Kruis, 2022; Skubby et al., 2013). As such, should any of these efforts be re-deployed as proactive place-based efforts with a focus on areas of PwPMI call for service concentration—which we now know are spatially stable—it is very plausible that their reach to PwPMI would increase substantially, even in spite of endured deployment barriers. In doing so, proactive place-based efforts would not only have the potential of preventing mental health crises from even occurring in the first place, but by consequence, it would reduce the number of PwPMI calls for service that either police-based or civilian-based responses receive as well.

Caution, however, should be exercised if civilian-based efforts are deployed in a proactive, place-based capacity as suggested here. That is, while studies on the spatial patterns of PwPMI calls for service have discovered that these calls largely occur in different areas than crime (Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018), one notable exception to this is violent crime, which has been found to co-locate with PwPMI calls (Hodgkinson & Andresen, 2019; White et al., 2019; White & Goldberg, 2018). White and colleagues (2019), for instance, found that calls for service related to violence and drugs on a particular street segment increased the likelihood of a PwPMI call for service occurring on the same segment. As such, should efforts be made to proactively deploy non-police resources into areas of PwPMI call concentration, caution should be exercised if a co-location of violence and PwPMI calls for service is identified. In some cases, this co-location may mean that the use of co-response teams in a proactive capacity, and not civilian-based efforts, may be the most

optimal approach given that the police half of the co-response team possesses use of force options should unrelated violence occur while proactive activities are being conducted.

On a final note, while these implications may apply to any jurisdiction in which the above responses are already deployed in practice, they are especially pertinent for the current study jurisdiction of Barrie, Ontario, Canada. This is not only because the evidence generated herein stems from this jurisdiction and thus is in a position to immediately inform practice, but because the Barrie Police Service already deploys variations of the aforementioned response types and is currently in the planning process of deploying other alternatives in the future. More specifically, the Barrie Police Service currently deploys a Crisis Outreach and Support Team (COAST) which is comprised of a specially trained non-uniformed officer and a mental health practitioner from the Canadian Mental Health Association (CMHA) who attend low-risk calls for service involving PwPMI at the request of frontline officers and conduct follow ups with PwPMI who have previously interacted with Barrie Police officers (Barrie Police Service, 2021). In addition to COAST, the Barrie Police Service is also currently conducting a pilot project involving a Mobile Crisis Response Team (MCRT) which similarly pairs a specially trained police officer (who in this case is in police uniform) with a CMHA mental health practitioner, but whose mandate it is to be the first responders to PwPMI calls for service, largely irrespective of risk level (Barrie Police Service, 2022). Early discussions have also been had between the Barrie Police Service and other stakeholders to develop a co-response team-like deployment that involves a pairing of a CMHA mental health practitioner and a paramedic (Johnston, 2022). Although the existing and emerging deployment of co-response teams in the Barrie context is in-line with how these efforts are deployed in other jurisdictions (see e.g., Koziarski et al., 2021)—(1) responding to PwPMI already in crisis; and/or (2) following up with individuals who have previously interacted with members of the Barrie Police Service—work is currently on-going between myself and the Barrie Police Service to leverage the present findings, along with the broader body of literature on the spatial patterns of PwPMI calls for service, to inform deployment of co-response teams efforts in the Barrie context.

3.5.2   Limitations

Although these findings will indeed be immensely helpful toward informing the future of police responses to PwPMI, the present study is not without limitations. First and foremost, this study relies on officer-generated data. While not an issue in and of itself, police officers are not trained mental health practitioners and thus may misinterpret symptoms of other conditions as indications that a mental health component is present at a call and subsequently code said call as a *Mental Health* call. Work by Bohrman and colleagues (2018), for instance, found that it is not uncommon for police officers to misinterpret symptoms of substance use as symptoms of mental illness. It is, therefore, plausible that some calls included in the current study were for calls that the responding officer(s) perceived as being a PwPMI call, but in fact were for another issue altogether.

Second, calls for service data are commonly classified on the basis of what the *primary* issue of a call was (Hodgkinson & Andresen, 2019b; Langton et al., 2021; Shore & Lavoie, 2018; Vaughan et al., 2016). This data management practice consequently masks secondary, potentially important components of each call. As such, while the present study drew upon a sample of calls for service data where *Mental Health* was perceived as the primary nature of the call by the responding officer(s), it is possible that the present study only drew upon a fraction of calls for service that involved PwPMI over the seven-year study period. Indeed, emerging research has shown that PwPMI may be involved in as many as five-to-ten times more calls for service than the *Mental Health* call code alone lets on (see e.g., Koziarski et al., 2022; Langton et al., 2021). It is therefore imperative that future work not only replicate the present study, but also conducts further examinations into whether the temporal and spatial stability of PwPMI call for service concentrations is affected by including a much broader net of calls that involve PwPMI.

Finally, relative to many previous longitudinal studies in the *Criminology of Place* which were able to draw upon a decade or more of crime data (e.g., Braga et al., 2011; Curman et al., 2015; Vandeviver & Steenbeek, 2019; Weisburd et al., 2004), the data period for the present study is notably shorter at only seven years. Unfortunately, however, CAD data retention policies at the Barrie Police Service meant that 2014 was the earliest accessible year in the CAD system at the time the present data was acquired. Providing

data availability, future research should also strive to examine the temporal and spatial stability of PwPMI call for service concentrations across longer temporal periods in order to ascertain whether the present findings hold.

3.6   References

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Chapter 4

4 Spatial Specialization of Mental Health Calls for Police Service: A Test of Social Disorganization Theory

Although the police have long been tasked with being the *de facto* first responders to persons with perceived mental illness (PwPMI)[13], evidence suggests that this role is becoming not only ever-more pronounced (Koziarski, 2021b; Vaughan & Andresen, 2018), but also a considerable drain on scarce resourcing (Charette et al., 2014; Schulenberg, 2016). Recently, however, scholars have posited a more efficient use of resources devoted to responding to PwPMI: instead of *reacting* to PwPMI calls for service, the police and mental health practitioners should be *proactive* in their approach, focusing on areas where PwPMI calls concentrate spatially (Koziarski, 2021a; Koziarski, 2022; White et al., 2019; White & Goldberg, 2018; White & Weisburd, 2017; Wood & Beierschmitt, 2014; Wood & Watson, 2017). Beyond the benefit of operational efficiencies, focusing resources on where PwPMI calls for service concentrate is also posited to enable police and mental health practitioners to have a greater reach to PwPMI in their communities, allow them to intervene before PwPMI reach crisis, and put them on a more fruitful path of mental health care and treatment (Koziarski, 2021a; White et al., 2019; White & Goldberg, 2018; White & Weisburd, 2017).

A small but growing body of literature has developed evidence on the spatial patterns of PwPMI calls for service to substantiate such proactive efforts. More specifically, previous scholarship has not only found these calls to be immensely concentrated across a number of different jurisdictional contexts (Hodgkinson & Andresen, 2019; Koziarski,

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[13] The literature on mental health-related police interactions employs a variety of terms to refer to such interactions, with 'persons with mental illness'—often shortened to 'PMI'—being among the most frequently used terms (Frederick et al., 2018). Within police data, however, mental health calls are often coded as such by responding officers due to a perception or belief that mental health-related issues *may* be present, as opposed to a *certainty* that they are present. Therefore, as Frederick and colleagues (2018) note, the broad use of 'PMI' (and related) terms may lead to validity-related issues, unless researchers are certain that the data are comprised of people living with a diagnosed mental illness. Empirical efforts that, on the other hand, rely on officer-generated data should instead employ terms that reflect officers' uncertainty of whether mental illness is present. Since this is the case for the present work, this study employs the term 'persons with perceived mental illness' (PwPMI).

2021a; Vaughan et al., 2016, 2019; White & Goldberg, 2018), but that the concentrations of PwPMI calls are spatially stable as well (Koziarski, 2022). There have, however, been few theoretical investigations that could help explain why PwPMI calls for service occur where they do. In fact, existing theoretical inquires within the context of PwPMI calls for service are so sparse that not only have few theoretical frameworks ever been tested, but existing investigations have never been replicated to confirm whether the findings hold outside of the original inquiry. This is a crucial gap in knowledge that, should it be addressed, could provide proactive place-based efforts with invaluable understanding behind mechanisms that may drive these calls that could additionally inform their proactive activities.

The present study draws upon Sampson and Groves' (1989) iteration of social disorganization theory to replicate the work of Vaughan and colleagues (2018) who found no association between the theoretical tenets of social disorganization and the spatial specialization of PwPMI calls for service. Replicating this work is not only important on the basis that it is the sole theoretical inquiry drawing upon social disorganization to explain the spatial patterns of PwPMI calls for service and thus should be replicated to confirm its findings, but there has also been sociological and epidemiological literature that has identified a link between social disorganization and higher rates of mental illness (see e.g., Cho, 2022; Faris & Dunham, 1939; Ku et al., 2020; Melnychuk et al., 2009; Silver et al., 2002; Veling et al., 2015). As such, the objective of the present study is to confirm whether the findings of Vaughan et al. (2018) hold elsewhere or whether their null findings were merely a function of their study jurisdictions.

4.1 Literature Review

4.1.1 PwPMI Calls for Service and their Spatial Patterns

In tandem with a multitude of social and systemic factors, a lack of adequate mental health care funding in the post-deinstitutionalization era has shifted the onus onto the police to become the *de facto* response to PwPMI in the community (Coleman & Cotton, 2016; Iacobucci, 2014; Lamb & Weinberger, 1998; Teplin, 1984). Recent evidence

suggests that this police role of *Psychiatrists in Blue* (Menzies, 1987) and *Streetcorner Psychiatrist* (Teplin & Pruett, 1992) has assumed a growing proportion of the contemporary police mandate. That is, while estimates suggest that PwPMI calls for service comprise approximately 1% of services' yearly call loads (Livingston, 2016), recent evidence suggests that PwPMI may be involved in as much as 10% of all calls for service (Koziarski et al., 2022; Langton et al., 2021). Moreover, research by Vaughan and Andresen (2018) observed a nearly 10% year-over-year increase in select municipalities in British Columbia, Canada. Accordingly, they not only found that the number of police hours devoted to PwPMI calls for service increased by 12% per year, but also that the costs incurred by police services for attending these calls increased by an average of 14% annually (Vaughan & Andresen, 2018). Charette and colleagues (2014) similarly found that PwPMI calls last twice as long as non-PwPMI calls and can use up to 90% more resources as well (see also Schulenberg, 2016).

Factors strongly contributing to increases in PwPMI calls for service include issues such as chronic interactions with the same individual(s), which in some cases can amount to hundreds of interactions per year (Akins et al., 2016; Shore & Lavoie, 2018; Willis et al., 2021). Along the same vein, the revolving door of the mental health system often sees officers bringing select PwPMI to hospital for assessment, to only be discharged a short time later due to a shortage of psychiatric beds and other resources (Canada et al., 2010; Shore & Lavoie, 2018). Recent scholarship has also identified that public health emergencies are associated with increases in PwPMI calls as well. More specifically, Koziarski (2021b) examined the effect of the COVID-19 pandemic on PwPMI calls for service in Barrie, Ontario, Canada and found that these calls increased by 22% during the pandemic relative to what would have been expected had the pandemic not occurred.

In any case, it is clear that police services are not only enduring increased calls for service involving PwPMI but are also navigating increasing proportions of their budgets and resources being devoted to these calls as well. Scholars, however, have advanced approaches that the police can draw upon in practice to more efficiently address, and even prevent, PwPMI calls for service from occurring in the future. More specifically, these scholars posit that instead of *reacting* to PwPMI calls for service, the police should

instead be *proactive* in their approach to PwPMI by focusing on areas where PwPMI calls concentrate spatially (Koziarski, 2021a; Koziarski, 2022; White et al., 2019; White & Goldberg, 2018; White & Weisburd, 2017; Wood & Beierschmitt, 2014; Wood & Watson, 2017). White and colleagues (2019), for instance argue that alongside social service providers, the police could target areas of a jurisdiction in which PwPMI calls concentrate to provide proactive care before one reaches the point of crisis that may require police involvement. Koziarski (2021a) similarly argues that doing so would not only put PwPMI on a more productive trajectory when it comes to mental health care and treatment but may enable for a more efficient use existing police interventions when it comes to PwPMI.

There are a number of police efforts that could benefit from such a proactive deployment. For example, Crisis Intervention Teams (CIT) and co-response teams, which see specially trained police officers respond to PwPMI calls for service on their own in the case of CIT or alongside mental health practitioners in the case of co-response teams, have been found to not only mitigate some of the consequences of having the police as primary responders to PwPMI, such as criminalization and increased use of force (Bailey et al., 2021; Blais et al., 2020; Fahim et al., 2016; Kisely et al., 2010; Morabito et al., 2017; Watson, Owens, et al., 2021), but have been found to reduce costs associated with responding to PwPMI as well (e.g., Semple et al., 2021). Yet, despite these benefits, both CIT and co-response teams have been found to endure a number of deployment-related barriers, such as a lack of resources, underfunding, and understaffing (Bratina et al., 2021; Iacobucci, 2014; Koziarski et al., 2021; Schulenberg, 2016; Seo & Kruis, 2022; Skubby et al., 2013). These barriers consequently limit the reach that either of these responses can have to PwPMI in their communities, and in effect, leave PwPMI calls for service to be addressed by frontline officers, who—Iacobucci (2014) argues—are not equipped with effectively handling calls that involve PwPMI.

Outside of a policing context, discussions have also recently emerged in a number of North American jurisdictions that call for the removal of the police as the primary responders to PwPMI, deploying civilian-based responses instead (Dee & Pyne, 2022; Koziarski & Huey, 2021; Watson, Pope, et al., 2021; Yousif, 2022). While the

deployment limitations of these civilian-based efforts are not currently documented in the empirical literature due, in part, to the fact that many civilian-based responses to PwPMI are currently being deployed as pilot projects (Marcus & Stergiopoulos, 2022), these pilots suggest that civilian-based responses to PwPMI will suffer from at least one drawback shared by CIT and co-response teams: *reactivity*. While not inherently detrimental, these efforts are, in effect, focused on responding to an issue that theoretically could have been prevented had a timelier intervention taken place. In contrast, given the evidence on the spatial patterns of PwPMI calls for service, there is reason to believe that deploying CITs, co-response teams, or even emergent civilian-based response teams as proactive, place-based efforts can lead to more efficient use of scarce resources and a greater reach to PwPMI in the community, which in turn may prevent mental health crises before they even occur and thus the number of calls for service that either the police or civilian-based efforts receive to respond in a reactive capacity.

Early work on the spatial concentration of PwPMI calls for service by Biebel and Cordner (2003) found that 33% of all PwPMI calls for service in Lexington, Kentucky in 1995 occurred at just 70 addresses in the city. Research that followed over a decade later in a number of North American jurisdictions also found high degrees of PwPMI call concentration, with 50% of calls being concentrated on between 0.30% and 4.17% of street segments (Hodgkinson & Andresen, 2019; Koziarski, 2021a; Vaughan et al., 2016, 2019; White & Goldberg, 2018). Studies that looked at PwPMI call concentration at larger spatial units (i.e., dissemination areas) similarly identified concentration of these calls, but to a less pronounced degree (Koziarski, 2021a; Vaughan et al., 2019). Perhaps most crucially though, recent work by Koziarski (2022) found that PwPMI calls for service, and their concentrations, are spatially stable over time. As such, redeployment of both police and non-police resources in a proactive capacity that focus on place can be done in an efficient manner, without hesitation that such efforts would be targeting areas in which PwPMI calls concentrated in the past but do not anymore.

4.1.2 Theoretical Perspectives on the Spatial Patterns of PwPMI Calls for Service

While knowledge around the spatial patterns of PwPMI calls for service is instructive for informing practice, to-date, there has been a dearth of theoretical investigations that have sought to shed light on potential reasons why PwPMI calls occur where they do. Indeed, possessing knowledge on not only *where* PwPMI calls for service occur, but also theory around *why* they occur there can help further inform proactive place-based efforts.

Existing theoretical investigations have so-far tested three plausible theoretical frameworks with, at times, inconsistent results. With the first, Vaughan and colleagues (2016) drew upon opportunity theories of crime—routine activity (Cohen & Felson, 1979), rational choice (Cornish & Clarke, 1987), and the geometry of crime (Brantingham & Brantingham, 1993)—to argue that due to their mental illness, PwPMI may frequent locations such as hospitals, pharmacies, and mental health services, and as such, more PwPMI calls may occur around such places. In laying a Kernel Density map of PwPMI call hot spots over the locations of places likely frequented by PwPMI, Vaughan et al. (2016) identified a spatial overlap. In other work, however, White and colleagues (2019) drew upon inferential statistics to examine whether service providers, parks, schools, and pharmacies on a street segment affected the likelihood of a PwPMI call occurring on said segment. Schools were determined to be the only place that increased the likelihood of PwPMI calls for service occurring, with the remining places having no effect (White et al., 2019).

Within their analysis, White and colleagues (2019) also examined whether the degree of social cohesion and social capital on a particular street segment impacted the likelihood of a PwPMI call occurring on said segment. Indeed, scholarship dating back to the work of Durkheim (1897) has consistently shown the negative effects that social isolation can have on one's psychological well-being (see also Kawachi & Berkman, 2001; Mair et al., 2008). The recent COVID-19 pandemic has perhaps placed more attention on social isolation than ever before given that large proportions of the general public reported deteriorations in self-reported mental health over the course of the pandemic due, in part, to public health restrictions that caused social isolation (Vigo et al., 2020; Vindegaard &

Benros, 2020; Zajacova et al., 2020). Studies on social capital—often operationalized in the literature through measures of trust, social participation, and/or community involvement—have similarly shown that low social capital is associated with deteriorated psychological well-being, while high social capital has protective effects against negative mental health symptoms (Araya et al., 2006; Bassett & Moore, 2013; Langille et al., 2012; Takagi et al., 2013). Accordingly, White and colleagues (2019) found that high levels of social cohesion, trust, and community involvement on a street segment decreased the likelihood of a PwPMI call occurring on said segment. They concluded that because community members may know one another better on such segments, individuals may also be more open to discussing their mental health struggles with others, which in turn leads to community members intervening before one's mental health issues rise to the level of requiring police involvement (White et al., 2019).

The third and final theoretical framework previously used to explain the spatial patterns of PwPMI calls for service, and the framework that is the focus of the present study, is social disorganization theory. This theoretical framework, originally put forth Shaw and McKay (1942) and later developed further by Sampson and Groves (1989), posits that areas characterized by low socioeconomic status, high ethnic and/or racial heterogeneity, high residential mobility, family disruption, and urbanization are socially disorganized, thus leading to crime and delinquency being left unaddressed. The hypothesis behind this is issues such as population influx and language/cultural barriers contribute to weak social cohesion and a lack of communication, which in turn leads to the community failing "to realize the common values of its residents and to maintain effective social controls" (Sampson & Groves, 1989, p. 777; see also Bursik, 1988).

Social disorganization theory has also been employed by researchers in other disciplines, most notably by sociologists and epidemiologists to explain how certain neighbourhood characteristics and the resulting lack of social cohesion and social support can negatively impact one's mental health (Cho, 2022). Work by Faris and Dunham (1939) in the early 20th century, for example, examined the neighbourhood characteristics of over 30,000 individuals admitted to psychiatric facilities in Chicago, Illinois and found that a disproportionate number of institutionalized individuals originated from socially

disorganized neighbourhoods (see also Ku et al., 2020; Melnychuk et al., 2009). More recent work by Silver and colleagues (2002) similarly found that neighbourhoods that were highly disadvantaged (i.e., households on public assistance, single-parent households, high unemployment) and had high residential mobility were associated with higher rates of schizophrenia and depression, whereas Veling et al. (2015) found that neighbourhoods with low socioeconomic status, high residential mobility, and high ethnic/racial diversity were strongly associated with incidence of psychotic disorders.

While socially disorganization does appear to be associated with increased levels of mental illness, it is important to note that the lack of social ties and social support in such communities not only contributes to these increased levels of mental illness but may equally contribute to community members not intervening before one reaches crisis. Indeed, as Watson and colleagues (2008) point out, access to mental health treatment is often facilitated through social networks and community ties. As such, in socially disorganized communities where these ties are weaker and/or non-existent, community members may be less willing to intervene when an individual is exhibiting overt symptoms, thus leaving them to escalate toward a potential crisis and police involvement (Krishan et al., 2014; Watson et al., 2008). Indeed, work by Vaughan and colleagues (2018) recognized this link between social disorganization and the potential for increased PwPMI calls for service in socially disorganized communities. They calculated location quotients for all dissemination areas across four municipalities in British Columbia, Canada to identify areas that specialize in PwPMI calls for service (i.e., higher proportion of PwPMI calls than all other calls for service) and tested whether the tenets of social disorganization theory could explain location quotient values. Surprisingly, and in spite of the literature linking socially disorganized communities to increased levels of mental illness, Vaughan and colleagues (2018) identified no association between socially disorganization and the spatial patterns of PwPMI calls for service.

4.2 Current Study

To-date, there has been little theoretical underpinning as to why PwPMI calls for service occur in the places they do. However, instead of introducing a new, fourth theoretical framework to the spatial literature on PwPMI calls for service, it is instructive to first

focus efforts on replicating existing work. For as Lowenkamp et al. (2003, p. 353) argue in their replication of Sampson and Groves' (1989) iteration of social disorganization theory:

> Breaking new theoretical and/or empirical ground is perhaps of prime importance, for such efforts potentially push the field to new horizons. Nevertheless, the emphasis on innovation over systematic replication has a cost: the inability to build cumulative knowledge and to be able to state with confidence what is, and is not, known

Accordingly, the present study seeks to replicate the work of Vaughan et al. (2018, p. 1164) in a new jurisdictional context to examine whether community structural characteristics as hypothesized through social disorganization theory do indeed "have significant limitations in aiding in the understanding of the spatial aspects" of PwPMI calls for service or whether their findings were simply a function of the social and economic context of their studied jurisdictions (see also Shen & Andresen, 2021).

In terms of proactive place-based practice, it is instructive to understand how (if at all) social disorganization affects the spatial patterns of PwPMI calls for service. Indeed, as Watson and colleagues (2008) argue within the context of police efforts, given that informal mental health interventions may be less likely in socially disorganized communities due to the lack of social ties and social support, police interventions might be maximized in such communities given increased opportunities for formal interventions. As such, proactive place-based efforts, as discussed earlier, may have an important role to play in socially disorganized communities when it comes to preventing PwPMI calls for service.

4.3   Data and Methods

4.3.1   Study Context

The context for the present study is the City of Barrie. Barrie is a municipality in the Canadian Province of Ontario, located north of the City of Toronto and on the eastern shore of Lake Simcoe. Barrie has a land area of 99 km²—approximately one-third of which is zoned for residential land use—and, as per the 2016 Canadian Census, Barrie

has a population density of 219 people per square kilometer and a total population of 197,000 (Statistics Canada, 2017).

4.3.2   Data and Spatial Units of Analysis

The present study draws upon data from two sources. The first is the computer-aided dispatch (CAD) system of the Barrie Police Service—the police organization which serves the City of Barrie. These data include all calls for service made to the Barrie Police between January 1, 2014, through December 31, 2020. A total of 424,271 calls for service were made during this seven-year period. Each call in the data file was accompanied by the date and time the respective call for service was made, the incident-type as reported by the caller, the incident-type as found by the responding officer(s), and CAD-generated *XY*-coordinates.

To facilitate the present analysis, these CAD data were used to create a second dataset in which calls for service were included if the 'incident-type as found' field was set to *Mental Health*. In doing so, this second dataset isolates 3,977 calls for service made to the Barrie Police Service from 2014 through 2020 in which the responding officer(s) perceived mental health as being the primary nature of the call in question.

The second data source for the current study are drawn from the 2016 Canadian Census, administered by Statistics Canada. The purpose of this second source is to draw upon data that can be operationalized as theoretical constructs for social disorganization theory, as proposed by Sampson and Groves (1989). Given the objective of the present study is to replicate the work of Vaughan and colleagues (2018), attempts were made to operationalize the five concepts as closely as possible to the original work. However, minor changes were made to how certain concepts were operationalized for the present study, all of which were informed by more recent applications of social disorganization theory in the Canadian context (e.g., Hodgkinson et al., 2022; Shen & Andresen, 2021). For instance, Vaughan and colleagues (2018) partially operationalized the concept of *Socioeconomic Status* through number of renters whereas the present study uses number of renters to partially operationalize *Residential Mobility* instead. Furthermore, the present operationalization of *Ethnic Heterogeneity* features the additions of percentage of

Table 9. Descriptive Statistics for Social Disorganization Variables, 2016 Canadian Census, Dissemination Areas

Theoretical Concept	Independent Variable	Mean	*SD*	Minimum	Maximum
Residential Mobility	Number of Persons Moved into DA 1-year Before Census	85.86	77.48	0	805
	Number of Renters	62.16	65.64	0	360
Ethnic Heterogeneity	Percentage of Visible Minorities	8.72	6.06	0	30.83
	Percentage of New Immigrants (2011-2016)	1.07	1.59	0	10
	Percentage of Total Immigrants	12.51	5.39	3	43.56
	Percentage of Those with Aboriginal Identity	3.97	2.96	0	14.49
Socioeconomic Status	Number of Residents with Post-Secondary Education	240.12	198.39	30	2560
	Unemployment Rate (%)	7.74	3.99	0	22.20
	Median House Value ($)	$361,458.20	$93,048.11	$159,903.00	$698,610.00
	Median Family Income ($)	$89,771.87	$22,370.16	$31,104.00	$168,192.00
	Median Monthly Rent ($)	$763.93	$671.12	$563.00	$2,017.00
	Percentage of Households Under Major Repair	5.20	4.94	0	25
	Percentage of DA Income from Government Assistance	12.71	5.40	4.80	36.30
	Percentage of DA at or Under Low Income Cut-Off	7.85	5.61	1	34.20
Urbanization	Population Density per Square Kilometer	3206.37	1639.12	8.70	9379
	Percentage of Condominiums	7.24	17.68	0	95.59
	Percentage of Apartments	14.94	25.79	0	100
Family Disruption	Percentage of Single Parent Dwellings	21.78	9.29	0	56.25

total immigrants and percentage of those with Aboriginal identity, the latter of which is particularly important for the Canadian context; *Socioeconomic Status* features several important additions that strengthen the operationalization of this concept, such as median monthly rent, percentage of households under major repair, percentage of dissemination area income from government assistance, and percentage of dissemination area at or under low-income cut-off; and *Urbanization* has the addition of percentage of apartments. And finally, the concept of *Family Disruption* is operationalized the same as in Vaughan and colleagues (2018).

Altogether, the present study operationalizes the five concepts of social disorganization theory as follows: *Residential Mobility* is operationalized through the number of individuals who moved into an area one-year before the Census and the number of renters. *Ethnic Heterogeneity* is operationalized by the percentage of visible minorities, percentage of new immigrants that have landed in the dissemination area within five years before the Census, percentage of total immigrants, and percentage of those with Aboriginal identity. Eight variables are used to operationalize *Socioeconomic Status*: number of residents with post-secondary education, unemployment rate, median house value, median family income, median monthly rent, percentage of households under major repair, percentage of dissemination area income from government assistance, and percentage of dissemination area residents that are at or under the low-income cut-off. *Urbanization* is operationalized through population density per square kilometer, percentage of condominiums, and percentage of apartments. Finally, *Family Disruption* is operationalized through the percentage of single parent dwellings (see Table 9 for descriptive statistics).

These Census variables were extracted for analysis using the *cancensus* package for the R statistical programming environment (von Bergmann et al., 2021) and were appended to dissemination areas. As per Statistics Canada (2018):

> A dissemination area is a small, relatively stable geographic unit composed of one or more adjacent dissemination blocks with an average population of 400 to 700 persons based on data from the previous Census of Population Program. It is the smallest standard geographic area for which all census data are disseminated.

Beyond the current focus of replicating Vaughan et al. (2018)—who also did their analysis across dissemination areas—given that previous literature has shown PwPMI calls for service to not only concentrate across dissemination areas (Koziarski, 2021a; Vaughan et al., 2019), but remain spatially stable across dissemination areas over time (Koziarski, 2022), it is instructive to continue drawing upon this spatial unit for the present analysis. With respect to the study jurisdiction, there are 243 dissemination area within the City of Barrie as of the 2016 Canadian Census.

Table 10. Calls for Service and PwPMI Calls at Dissemination Areas, 2014-2020

	Mean	*SD*	Min.	Max.
Number of Calls for Service	1745.97	2987.26	150	22503
Percent of all Calls for Service	0.41	0.70	0.03	5.30
Number of PwPMI Calls for Service	16.37	26.70	0	263
Percent of PwPMI Calls for Service	0.41	0.67	0	6.61

To facilitate the present analysis, spatial joins were performed in which the number of all calls for service made in a given dissemination area, as well as the number of PwPMI calls for service made in a given dissemination area, where appended to their respective spatial unit. As show in Table 10, the mean number of all calls for service across Barrie's dissemination areas for the seven-year study period is 1,745.97 (*SD* = 2,987.26). The range of all calls for service across dissemination areas is from 150 to 22,503. For PwPMI calls for service, on the other hand, the mean of these particular calls for service across dissemination areas is 16 (*SD* = 26.70), with a range from 0 to 263.

4.3.3　Method

In testing the association between social disorganization theory and the spatial patterns of PwPMI calls for service, Vaughan and colleagues (2018) opted to calculate and employ location quotients as a measure through which to capture the spatial patterns of PwPMI calls across their study jurisdictions. More specifically, location quotients are a geographic measure of specialization that is identified by comparing the percentage of a particular event/activity that falls within a spatial unit, relative to the percentage of all events/activities that fall within that same spatial unit (Miller et al., 1991). In other words, the location quotient is a ratio that measures the over- and under-representation of a

particular phenomenon within a spatial unit. Traditionally, the location quotient has long been used in the field of economics to geographically measure phenomena such as industrial specialization, but—outside of Vaughan et al.'s (2018) work on PwPMI calls for service—has sparingly been used in criminological research to understand the spatial specialization of crime (Andresen, 2007, 2018). The location quotient is calculated as follows:

$$LQ = \frac{C_{in}/C_{tn}}{\sum_{n=1}^{N} C_{in}/\sum_{n=1}^{N} C_{tn}},$$

where C_{in} is the count of PwPMI calls i in dissemination area n, C_{tn} is the count of all calls for service in dissemination area n, and N is the total number of dissemination areas. This study draws upon the location quotient classifications originally proposed by Miller et al. (1991) to interpret over- or under-representation of PwPMI calls for service across Barrie dissemination areas:

- \> 1.30 is a very over-represented area
- 1.11 to 1.30 is moderately over-represented
- 0.91 to 1.10 is averagely represented
- 0.70 to 0.90 is under-represented
- 0.00 to 0.69 is a very under-represented area

In line with Vaughan et al. (2018), the location quotient for each dissemination area was appended to its respective area in order to fulfill the objective of the present study. A regression model was estimated in which the location quotients served as the dependent variable, while the Census variables serving as proxies for tenets of social disorganization theory acted as predictor variables.

Given the spatial nature of the present data, caution must be exercised when conducting inferential analyses, such as regression. The reason for this is the possibility of observations in one area being similar to, or even influenced by, observations in neighbouring areas—otherwise referred to as spatial autocorrelation (Anselin, 2005; Weisburd et al., 2022). In the event that spatial autocorrelation is present, it violates one of the core assumptions of regression modeling: independence of observations. There are, however, two alternatives that one may utilize should social autocorrelation be present.
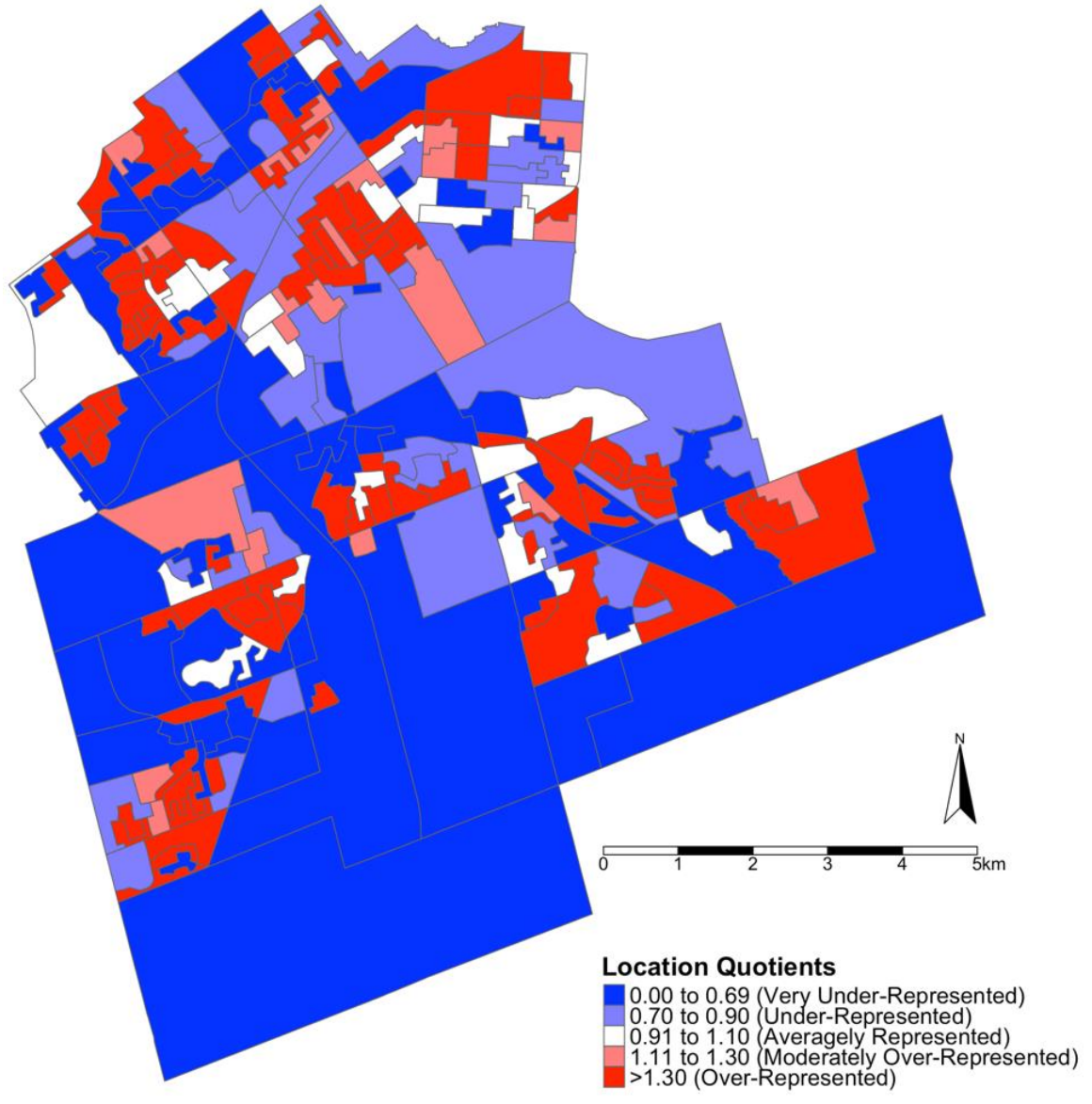
The first is a spatial lag model, which adjusts the model accordingly in the event that the dependent variable is influenced by neighbouring areas; whereas the second alternative is a spatial error model, which is estimated when regression residuals are autocorrelated (Anselin, 2005; Weisburd et al., 2022).

For the present study, regression diagnostics and subsequent model estimation were conducted using *GeoDa*. Anselin's (2005) spatial regression decision process informed model selection for the present study. More specifically, an ordinary least squares (OLS) regression was first estimated with a first-order Queens Continuity matrix to test for spatial autocorrelation. The results of the regression diagnostics revealed that Moran's *I*, Lag Lagrange Multiplier, and the Error Lagrange Multiplier were all non-statistically significant, thus suggesting that there is no spatial autocorrelation in the data and pointing to an OLS regression as the most suitable model. The lack of spatial autocorrelation was additionally verified through additional Moran's *I* analyses whereby both the dependent variable—location quotients—and regression residuals did not exhibit spatial autocorrelation, thus confirming OLS as the most appropriate model for the present study[14].

Once the type of model was determined, regression diagnostics were also conducted to ensure the model does not violate core regression assumptions (i.e., linearity, normality, homogeneity of variance, multicollinearity, and outliers). All assumptions were held, with exception to the assumption of normality. This violation was found to have occurred due to large residuals in 14 dissemination areas with exceptionally high location quotients. As this violation of normality was influenced by spatial patterns exhibited in only ~6% of dissemination areas and because there were no influential outliers identified through regression diagnostics, a decision was made to proceed with the regression analysis despite violating the normality assumption.

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[14] Importantly, these spatial autocorrelation results differ from those presented in Chapter 2. In that Chapter, Moran's *I* analyses were conducted on the frequency of PwPMI calls for service across spatial units. In the present Chapter, Moran's *I* analyses are conducted on the location quotients and regression residuals, which is why the results differ.

Figure 7. PwPMI Call Location Quotients Per Dissemination Area, Barrie, Ontario

Location Quotients
- 0.00 to 0.69 (Very Under-Represented)
- 0.70 to 0.90 (Under-Represented)
- 0.91 to 1.10 (Averagely Represented)
- 1.11 to 1.30 (Moderately Over-Represented)
- >1.30 (Over-Represented)

4.4 Results

Figure 7 displays the location quotients of PwPMI calls for service across dissemination in Barrie. Immediately evident from the figure is that PwPMI calls are either under-represented or over-represented, with few dissemination areas having an average representation. Most of Barrie's land area also appears to largely have an under-representation of PwPMI calls for service, with many dissemination area clusters dispersed throughout the city in which PwPMI calls are either moderately over-

represented or over-represented, thus indicating PwPMI call specialization in these areas. Moreover, although the spatial specialization of PwPMI calls for service across dissemination areas *does not* mean that these calls are also spatially concentrated in these same areas, a visual inspection of PwPMI call concentrations in the Barrie context from previous research does suggest there appears to be some overlap between where PwPMI calls concentrate and specialize in Barrie (see Koziarski, 2021a)[15].

Table 11. PwPMI Call Location Quotients at Dissemination Areas, 2014-2020

Mean	*SD*	Min.	Max.	% LQ: 0-0.69	% LQ: 0.70-0.90	% LQ: 0.91-1.10	% LQ: 1.11-1.30	% LQ: >1.30
1.27	0.91	0	5.96	25.93	16.05	11.11	8.64	38.27

Table 11 additionally describes the location quotients of PwPMI calls for service across Barrie dissemination areas. More specifically, the location quotient mean is 1.27 (*SD* = 0.91), thus suggesting that, on average, PwPMI calls for service are moderately over-represented across Barrie's dissemination areas. Also, as displayed in Figure 7, Table 11 appears to confirm a relatively equal split between under-represented and over-represented dissemination areas, though leaning slightly in the direction of the latter. That is, 41.98% of Barrie's dissemination areas have a location quotient of <0.90, whereas 46.91% have a location quotient of >1.11. The remaining 11.11% have an average representation of PwPMI calls for service.

With respect to the main study objective, inferential results from the OLS model are presented in Table 12. Immediately evident from the table is that social disorganization does not appear to explain the spatial pattern of PwPMI calls for service in the Barrie context. The model's R-Squared is 0.131, leaving over 86% of the location quotient variance unexplained by the model. The only statistically significant variable is population density per square kilometer (p = <0.001).

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[15] This is not the case for all dissemination areas in which PwPMI calls for service concentrate. As an example, of the 30 dissemination areas with the highest PwPMI call counts for the seven-year study period, PwPMI calls are very under-represented in five of these dissemination areas, under-represented in another five, and averagely represented in one.

Table 12. Ordinary Least Squares (OLS) Regression Results

Theoretical Concept	Independent Variable	Coefficient	Standard Error	t-Statistic
Residential Mobility	Number of Persons Moved into DA 1-year Before Census	0.001	0.001	0.840
	Number of Renters	0.001	0.002	0.071
Ethnic Heterogeneity	Percentage of Visible Minorities	0.008	0.013	0.623
	Percentage of New Immigrants (2011-2016)	-0.019	0.041	-0.461
	Percentage of Total Immigrants	-0.008	0.015	-0.541
	Percentage of Those with Aboriginal Identity	0.009	0.021	0.434
Socioeconomic Status	Number of Residents with Post-Secondary Education	-0.001	0.001	-1.051
	Unemployment Rate (%)	-0.011	0.017	-0.680
	Median House Value ($)	0.001	0.001	1.399
	Median Family Income ($)	0.001	0.001	0.059
	Median Monthly Rent ($)	-0.001	0.001	-1.694
	Percentage of Households Under Major Repair	0.001	0.014	0.103
	Percentage of DA Income from Government Assistance	0.010	0.025	0.415
	Percentage of DA at or Under Low Income Cut-Off	-0.002	0.019	-0.094
Urbanization	Population Density per Square Kilometer	0.001	0.001	4.221***
	Percentage of Condominiums	-0.001	0.005	-0.397
	Percentage of Apartments	-0.002	0.006	-0.293
Family Disruption	Percentage of Single Parent Dwellings	0.008	0.011	0.697

R-Squared	0.131	
Log Likelihood	-294.77	
*p<0.05 **p<0.01 ***p<0.001		

4.5   Discussion and Conclusion

The purpose of the present study was to replicate the work of Vaughan et al. (2018) to test whether their null findings on the association between social disorganization theory and the spatial specialization of PwPMI calls for service indeed translated to another jurisdictional context or whether their findings were merely a function of the social and economic backcloth of their four study jurisdictions. Given the established link between social disorganization and deteriorated psychological well-being (Faris & Dunham, 1939; Silver et al., 2002; Veling et al., 2015), as well as the potential of weak and/or non-existent social ties and social support in such neighbourhoods to push individuals towards crisis and subsequent police involvement (Krishan et al., 2014; Watson et al., 2008), it was worth replicating the work of Vaughan and colleagues (2018) to confirm their findings. In line with what they uncovered, the present study also did not identify an association between the spatial specialization of PwPMI calls for service and the tenets of social disorganization theory: residential mobility, ethnic heterogeneity, socioeconomic status, urbanization, and family disruption. Interestingly, Vaughan and colleagues (2018) had no less than two statistically significant variables for each of their four study municipalities, whereas in the present study context, only one variable was statistically significant—population density—which served as a partial proxy for urbanization. In other words, the present study jurisdiction fared worse in using social disorganization theory to explain the spatial patterns of PwPMI calls for service.

Had this analysis found—contrary to Vaughan at al. (2018)—support between the tenets of social disorganization theory and the spatial patterns of PwPMI calls for service, it would have given practitioners a preliminary understanding behind social factors that may be contributing to the location of PwPMI calls for service and thus would have enabled proactive place-based efforts to focus on mitigating some of these factors. This, however, was not the case.

Do the findings of the present study ultimately put a 'nail in the coffin' of drawing upon social disorganization theory to explain the spatial patterns of PwPMI calls? Possibly. Across both the present study and that of Vaughan et al.'s (2018), social disorganization

theory was tested across five jurisdictions, all of which did not exhibit an association—even partially. As such, the utility of social disorganization theory in explaining the spatial patterns of PwPMI calls for service appears bleak. However, there are more optimal ways in which scholars should consider this association in the future. For example, as Vaughan and colleagues (2018) themselves point out, dissemination areas—though small and only containing between 400 and 700 residents—are still quite large spatial units. As such, they argue that there may be a considerable degree of street-to-street variability in social disorganization even within dissemination areas themselves, which may be contributing to the null findings (Vaughan et al., 2018). Indeed, previous research—even scholarship drawing upon data from the present study jurisdiction—has found that although PwPMI calls for service are immensely concentrated at smaller spatial units such as street segments, there appears to be little-to-no spatial autocorrelation of PwPMI calls for service at street segments (Koziarski, 2021a; White & Goldberg, 2018). In other words: the frequency of PwPMI calls for service on one street segment is often different than the frequency on adjacent segments. Accordingly, should social disorganization exhibit a similar degree of street-to-street heterogeneity, it is instructive to extend the present work to the micro-geographic level. Unfortunately, dissemination areas are the finest spatial scale at which Statistics Canada disseminates Census data to protect the privacy of individual respondents, so such analyses at finer scales were not able to be done for the present study. Nonetheless, future work should consider collecting primary data and testing the association between social disorganization and PwPMI calls for service at the street segment level.

Future research should also consider other avenues for theory testing when it comes to PwPMI calls for service. Certainly, social disorganization theory—at least at larger spatial scales—does not seem too promising at the moment, however, there are other theoretical frameworks that are worthy of further investigation and replication. White and colleagues' (2019) work, for example, comes to mind here. Although they found that street segments with high social cohesion, trust, and community involvement decreased the likelihood of a PwPMI call occurring on said segment (White et al., 2019), these findings have not been replicated elsewhere. As such, future work should strongly consider testing the effect of social cohesion and social capital on PwPMI calls for

service, and particularly at micro-geographic units of analysis. Future work should also consider the effect of place under the guise of opportunity theories, especially given the mixed findings that have been identified through this perspective (Vaughan et al., 2016; White et al., 2019).

4.5.1   Limitations

Although the present study was instructive in building our understanding around the effect of social disorganization on PwPMI calls for service (or rather, lack thereof), it is important to acknowledge its limitations. First, as alluded to earlier, the level of geography at which the present study was conducted was limited to the smallest spatial unit at which Census data are disseminated in Canada. Therefore, it is possible that there is an association between social disorganization and the spatial patterns of PwPMI calls for service at finer spatial scales, but it was not possible to explore this relationship herein.

Second, the present study did not have access to individual-level data for each of the PwPMI who came into contact with the Barrie Police Service during the seven-year data period. This, therefore, precluded the possibility of multi-level modeling whereby individual-level data could be used as control variables in an analysis. A related limitation is the calls for service data itself. Police officers, though trained on how to identify an individual with mental illness, are not professionals in the mental health field and may therefore misinterpret what they see as symptoms of mental illness. Work by Bohrman and colleagues (2018), for instance, suggests that it is not uncommon for police officers to misinterpret symptoms of substance use disorder for symptoms of mental illness. As such, the calls for service data drawn upon for the present study may include people who do not have a mental illness or may exclude others if the officers misinterpreted the situation in front of them. Furthermore, recent scholarship has identified that PwPMI may be involved in as many as ten times more police calls for service than the PwPMI call classification lets on (Koziarski et al., 2022; Langton et al., 2021). Given the present research solely draws upon calls for service in which officers perceived mental illness to be the primary nature of the call, it is very likely that the

present study considers only a small fraction of the total calls for service received by the Barrie Police Service between 2014 and 2020 that involved PwPMI.

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Chapter 5

5   Conclusion

An underfunded mental health system in the post-deinstitutionalization era, coupled with strict civil commitment criteria, homelessness, poverty, intolerance of social disorder, and an all-encompassing police mandate, among other issues, have contributed to the police becoming the primary responders to people with perceived mental illness (PwPMI) (Borum et al., 1997; Canada et al., 2010; Koziarski & Huey, 2021; Lamb & Weinberger, 1998; Markowitz, 2011; Schulenberg, 2016; Teplin, 1984). Unsurprisingly, having the police—who are neither mental health professionals, nor whose primary mandate deals with mental health—in the role of *Psychiatrists in Blue* (Menzies, 1987) and *Streetcorner Psychiatrists* (Teplin & Pruett, 1992) has contributed to PwPMI disproportionately experiencing criminalization (Charette et al., 2014; Compton et al., 2022; Fisher et al., 2011; Lamb & Weinberger, 1998; Schulenberg, 2016; Teplin, 1984; Teplin & Pruett, 1992), use of force (Laniyonu & Goff, 2021; Morabito et al., 2017; Service, 2022; Yang et al., 2018), and—in rare cases—deadly use of force (Dubé, 2016; Hall, 2014; Iacobucci, 2014; McNeilly, 2017).

In an attempt to address these issues, the police (e.g., Dupont et al., 2007; Huey, Andersen, et al., 2021; Iacobucci, 2014; Marcus & Stergiopoulos, 2022) and—within the last year—the community (e.g., Dee & Pyne, 2022; Felson et al., 2020; Watson et al., 2021; Yousif, 2022) have adopted a number of reform efforts that either try to improve how the police respond to PwPMI and the respective outcomes from these interactions by way of Crisis Intervention Teams (CIT) and co-response teams, or they seek to remove the police from this role altogether via the deployment of civilian-based responses to PwPMI instead. While the existing evidence on some of these efforts suggests that they are achieving some of their intended objectives (see e.g., Huey, Andersen, et al., 2021; Marcus & Stergiopoulos, 2022), they are largely deployed in a *reactive* capacity. That is, they are tasked with responding to an individual who has already reached crisis and are therefore attempting to address a situation that could have been prevented had a timelier intervention taken place. On top of reactivity, evidence suggests that many of these efforts endure deployment-related barriers, such as underfunding and understaffing,

which in effect limits the reach that these responses have to PwPMI in their communities (Bratina et al., 2021; Iacobucci, 2014; Koziarski et al., 2021; Seo & Kruis, 2022; Skubby et al., 2013).

Drawing upon previous scholarship (see Coleman & Cotton, 2016; Goldberg et al., 2019; White et al., 2019; White & Weisburd, 2017; Wood & Beierschmitt, 2014; Wood & Watson, 2017), this dissertation argued that reactive efforts focused on PwPMI should instead be deployed proactively, with a focus on where interactions between police and PwPMI concentrate spatially. In doing so, not only would both police and mental health practitioners be able to proactively identify PwPMI approaching crisis and therefore direct them to a hospital or community-based service before a call for service is made to the police (White et al., 2019; White & Goldberg, 2018; White & Weisburd, 2017), but it would enable for existing efforts to be efficiently deployed and mitigate their endured deployment-related barriers, thus having a greater reach to PwPMI in their community. Unfortunately, while other place-based practices within the realm of policing, such as hot spots policing and problem-oriented policing, are supported by nearly a century of literature on the spatial patterns of crime (Weisburd et al., 2009), there has been a dearth of both empirical and theoretical inquiries into the spatial patterns of police interactions with PwPMI to adequately inform the proposed proactive efforts. As such, the present dissertation drew upon seven years (2014-2020) of PwPMI calls for service data from the Barrie Police Service in Barrie, Ontario, Canada to answer the following research questions:

1. To what extent do PwPMI calls for police service concentrate within the context of a small city (if at all)?
2. Does the concentration of PwPMI calls for service fall within a narrow bandwidth of spatial units over time (i.e., is the proportion of spatial units that account for a particular proportion of PwPMI calls for service stable over time)?
3. Are PwPMI calls for service spatially stable or do they occur in different parts of a jurisdiction over time?
4. Is there an association between the spatial specialization of PwPMI calls for service and the tenets of social disorganization theory?

In Chapter 2, *Examining the Spatial Concentration of Mental Health Calls for Police Service in a Small City*, I built upon existing literature which shows that PwPMI calls for

service concentrate in a few number of places (Biebel & Cordner, 2003; Hodgkinson & Andresen, 2019; Vaughan et al., 2016, 2019; White & Goldberg, 2018) by examining this phenomenon within a context not previously explored: a small city. Small cities are unique in that they not only have fewer resources for mental health, employment, and housing, but they have a smaller land area and/or fewer spatial units, all of which may affect the concentration of PwPMI calls for service. Using dissemination areas and street segments as the units of spatial analysis, it was determined that 50% of PwPMI calls for service were concentrated in 13% of dissemination areas and 4% of street segments. While this degree of concentration was found to be similar across dissemination areas relative to that of previous research done in larger jurisdictions, the degree of concentration at street segments was found to be *less* concentrated. While initially surprising, this finding was eventually attributed to the small number of street segments within the Barrie context. With only 2,975 street segments, there are fewer segments on which PwPMI calls for service can concentrate relative to jurisdictions with more street segments. As such, with each additional segment required to account for 50% of PwPMI calls for service, it will make calls appear more dispersed in within a jurisdiction with fewer street segments, as was the case in Chapter 2. However, in excluding street segments with no PwPMI calls for service and recalculating this measure of concentration, it was found that 50% of calls were concentrated on just 12% of street segments, which is the *most* concentrated relative to jurisdictions in previous research where this measure was provided. In any case, irrespective of the magnitude of concentration relative to other jurisdictions, the findings of Chapter 2 confirmed that a large proportion of PwPMI calls for service occur in a few number of places, which was additionally verified through the use of Gini coefficients—proposed by Bernasco and Steenbeek (2017) as a universal measure of concentration that can allow for easy cross-jurisdiction comparison and was the first use of this measure in this body of literature. Additionally, areas of concentration—at both dissemination areas and street segments—were found to be dispersed, even within the context of a small city. In other words, despite the smaller geographical context, dissemination areas and street segments with high frequencies of PwPMI calls for service were *not* likely to be adjacent to other dissemination areas and street segments with similarly high call frequencies.

In Chapter 3, *The Spatial (In)Stability of Mental Health Calls for Police Service*, I sought to extend the literature on spatial patterns of PwPMI calls for service, which has to-date been cross-sectional in nature, by conducting a longitudinal analysis into: (1) whether concentration of PwPMI calls for service across dissemination areas and street segments fell within a narrow, stable bandwidth of spatial units over time; and (2) whether PwPMI calls for service were spatially stable. Over the seven-year data period, it was found that the concentration of PwPMI calls for service did indeed fall within a stable, narrow bandwidth of spatial units: 50% of PwPMI calls for service fell within 9.47% to 13.17% of dissemination areas in any given year and on 2.29% to 2.69% of street segments. Concentration was additionally measured through yearly Gini coefficients and was also found to be stable, similarly falling within a narrow bandwidth: 0.62 to 0.70 for dissemination areas and 0.54 to 0.68 for street segments. In terms of spatial stability, PwPMI calls for service were discovered to be spatially stable across both dissemination areas and street segments, and especially so across the latter. More specifically, global spatial point pattern analyses revealed that 94% of street segments exhibited absolute spatial stability—that is, stable from year-to-year over the seven-year data period— whereas local analyses identified very little volatility across individual street segments. From this, it was concluded that PwPMI calls for service are not only remarkably spatially stable within the Barrie context, but that the *concentrations* of these calls for service are spatially stable as well. These spatial patterns even held during the COVID-19 pandemic, which contributed to a 22% increase in PwPMI calls for service during 2020 specifically in the Barrie context (Koziarski, 2021).

Finally, in Chapter 4, *Spatial Specialization of Mental Health Calls for Police Service: A Test of Social Disorganization Theory*, I sought to replicate the work of Vaughan and colleagues (2018) to test the utility of social disorganization theory in explaining the spatial patterns of PwPMI calls for service. Importantly, Vaughan and colleagues (2018) are the only ones to test social disorganization theory in this regard, as such it was important to examine whether or not their null findings held in a different jurisdictional context. Ultimately, the present replication confirmed their findings, similarly finding that social disorganization theory may be limited in aiding our understanding of the spatial patterns of PwPMI calls for service.

5.1   Practical Implications

There are a number of practical implications that can be derived from the results of the present dissertation. Perhaps most importantly, the findings from Chapters 2 and 3—which present evidence pertaining to the immense spatial concentration of PwPMI calls for service and the spatial stability of these calls over time, respectively—provide empirical justification for arguments made by myself and others to deploy efforts focused on PwPMI in a proactive, place-based capacity (see Coleman & Cotton, 2016; Goldberg et al., 2019; White et al., 2019; White & Weisburd, 2017; Wood & Beierschmitt, 2014; Wood & Watson, 2017). Existing police deployments of CITs and co-response teams, for example, have largely been in a reactive capacity. With the former, CIT-trained officers are commonly assigned to other duties while on-shift, but among their colleagues are tasked with being the first responders to PwPMI calls for service (Dupont et al., 2007; Steadman et al., 2001); whereas co-response teams are either deployed as a secondary, back-up response that steps into the scene at the request of frontline officers or—depending on the jurisdiction and situational context of a call—are the first responders to PwPMI (Koziarski et al., 2021). In any case, however, these police-led efforts are responding to PwPMI who have already reached crisis. On top of this, as mentioned, both of these responses have been documented to endure deployment-related barriers, which in turn limits the reach that they have to PwPMI in their communities.

What the evidence from this dissertation suggests is that should CIT and co-response teams focus their efforts on the small proportion of places in which PwPMI calls for service concentrate, they have the opportunity to reach more PwPMI in their communities—in a proactive capacity—to then intercept individuals who may be approaching crisis and direct them to community-based mental health services or other resources *before* they reach crisis. In doing so, there is not only great potential to put such PwPMI on a more fruitful path of mental health care and treatment, but also in reducing the footprint of the police in the lives of PwPMI. This is because, in deploying resources in a more efficient manner and acting proactively, it can reduce the likelihood of a crisis-related call for police service being made later that—due to limited CIT and co-response team resourcing—may be attended by a regular, frontline officer thus opening the

possibility for issues such as criminalization and use of force to be perpetuated further. Crucially, findings from Chapter 3 suggest that should these proactive efforts focus on places where PwPMI calls for service concentrate, practitioners can rest assured that their scarce resources will be efficiently put to use as areas of concentration are spatially stable and thus will not result in practitioners 'chasing' areas of concentration.

To be clear: this is not to suggest that proactive efforts focused on PwPMI do not already exist in practice. In fact, the objective of some co-response team deployments is to conduct proactive follow-up with PwPMI who have recently come into contact with the police, or PwPMI who are so-called 'frequent fliers' and come into contact with police regularly (Koziarski et al., 2021; Morabito & Savage, 2021). However, these efforts, though framed as being proactive, are in fact still reactive. This is because an interaction—or multiple interactions—with police are required in order for the 'proactive' work to begin. Additionally, the focus of these efforts is on the *individual* and not *places* where PwPMI calls for service concentrate. By instead shifting focus onto the latter, even in part, it opens the realm of possibility for these co-response team efforts to assist multiple individuals with a single visit to a given place.

Outside of a policing context, the murder of George Floyd and the subsequent Defund the Police movement have led to calls to remove the police as the primary responders to PwPMI (Cummins, 2022; Koziarski & Huey, 2021; Lum et al., 2021; Watson et al., 2021). This has led to the development of pilot programs across a number of North American jurisdictions in which civilian-based teams will respond to PwPMI, with police being available on-call to assist should they be needed (Dee & Pyne, 2022; Watson et al., 2021; Yousif, 2022). The available information on these emerging pilot programs suggest that civilian-based efforts will, as with CIT and co-response teams, be reactive in nature and focus their resources on responding to PwPMI already in crisis. Accordingly, these civilian-based efforts would also benefit from the findings of this dissertation in that shifting their focus, at least in part, onto places where PwPMI calls for service concentrate, they can not only have a greater reach to PwPMI in their communities, but their proactive efforts can prevent crises from occurring and therefore reduce the number

of PwPMI calls that civilian-based efforts, or their local police counterparts, would need to attend in a reactive capacity.

Although the empirical evidence on civilian-based efforts is currently limited to unpublished grey literature (Marcus & Stergiopoulos, 2022), it is likely that the emerging pilot programs will initiate a quickly-developing body of literature on civilian-based responses to PwPMI. Indeed, this literature within the disciplines of psychiatry and policing has already begun to emerge. Although there has been support for the development of these responses by some scholars in the former discipline (e.g., Watson et al., 2021), policing scholars have instead brought to light some difficulties that may arise for civilian-based responses. For instance, the work of Ratcliffe (2021), as well as Lum and colleagues (2021), shows that some calls for service involving PwPMI may involve multiple issues that would require a police response. Accordingly, other work has found that PwPMI can be involved in up to 10% of all calls for service, 90% of which were initially received by police for a reason beyond PwPMI involvement alone (Koziarski et al., 2022; Langton et al., 2021; Mitchell et al., 2022). Consequently, these analyses may cast doubt over how and when civilian-based responses to PwPMI may even be dispatched. However, an additional consideration that has not been discussed in the literature on civilian-based responses is the spatial co-location of PwPMI calls for service and calls for service pertaining to violent crime. For instance, work by Hodgkinson and Andresen (2019) identified that PwPMI calls for service and calls for service related to violence shared a similar spatial pattern within their study jurisdiction, whereas White and colleagues (2019) found that the presence of calls for service pertaining to violent crime on a particular street segment increased the likelihood of a PwPMI call occurring on that same segment. Due to the dearth of research on the spatial patterns of PwPMI calls for service, scholars have yet to discern why this co-location of calls exist. Nonetheless, caution should be exercised for civilian-based efforts should they engage in proactive, place-based efforts, as argued for here.

Beyond knowledge on the concentration and spatial stability of PwPMI calls for service and how this knowledge can help inform the deployment of efforts focused on PwPMI, theoretical gaps in our understanding remain as to *why* PwPMI calls for service occur

where they do. Had the analyses in Chapter 4 found—contrary to Vaughan at al. (2018)—support between the tenets of social disorganization theory and the spatial patterns of PwPMI calls for service, it would have given practitioners a preliminary understanding behind social factors that may be contributing to the location of PwPMI calls for service and thus would have enabled proactive place-based efforts to focus on mitigating some of these factors. Unfortunately, this was not the case as no association between social disorganization theory and the spatial patterns of PwPMI calls for service was found. There are, however, other theoretical frameworks that are worthy of additional inquiry and may in turn inform practitioners about social and even place-based factors that may be contributing to where PwPMI calls for service occur. These will be discussed in greater length below.

5.1.1   Barrie-Specific Implications

In addition to the above practical implications that are intended to be applied broadly to any jurisdiction with a CIT, co-response team, and/or civilian-based response team, it is also pertinent to briefly discuss the direct practical implications that this dissertation may hold for the study jurisdiction. This is not only because the evidence generated herein stems from this jurisdiction and thus is in a position to immediately inform practice, but because the Barrie Police Service already deploys versions of the aforementioned response types and is in the planning process of deploying other alternatives in the future. More specifically, the Barrie Police Service currently deploys a Crisis Outreach and Support Team (COAST) which is comprised of a specially trained non-uniformed officer and a mental health practitioner from the Canadian Mental Health Association (CMHA) who attend low-risk calls for service involving PwPMI at the request of frontline officers and conduct follow ups with PwPMI who have previously interacted with Barrie Police officers (Barrie Police Service, 2021). In addition to COAST, the Barrie Police Service is currently engaging in a pilot project for a Mobile Crisis Response Team (MCRT) which similarly pairs a specially trained police officer (who, in this case, is in police uniform) with a CMHA mental health practitioner, but whose mandate it is to be the first responders to PwPMI calls for service, largely irrespective of risk level (Barrie Police Service, 2022). Early discussions have also been had between the Barrie Police Service

and CMHA to remove them from being the primary responders to PwPMI entirely. To achieve this, work is on-going to develop a co-response team-like deployment that involves a pairing of a CMHA mental health practitioner and a paramedic (Johnston, 2022). Although the existing and planned deployments of co-response teams in the Barrie context is in-line with how these efforts are deployed in other jurisdictions (see e.g., Koziarski et al., 2021)—(1) responding to PwPMI already in crisis; and/or (2) following up with individuals who have previously interacted with members of the Barrie Police Service—work is currently on-going between myself and the Barrie Police Service to leverage findings of the present dissertation, along with the broader body of literature on the spatial patterns of PwPMI calls for service, to inform deployment of co-response teams efforts in the Barrie context.

5.2   Limitations and Future Research

While producing results that may be immensely instructive for practitioners both inside and outside of policing contexts, it is important to acknowledge a number of this dissertation's limitations. First and foremost, all three studies rely, either in whole or in part, on calls for service data, which are commonly classified on the primary nature of a given call. This process usually involves the 911 call-taker or dispatcher entering the primary nature based on information that is received from the person making the call, and then is later updated by the responding officer(s) through what they observed while on scene (Ratcliffe, 2021; Simpson, 2020). The problem with classifying calls for service solely on the basis of what the primary nature is that it masks other, secondary components of each call (Hodgkinson & Andresen, 2019; Shore & Lavoie, 2018; Vaughan et al., 2016). As such, a call for service that may, in fact, involve PwPMI may never be reported or logged within the call data as involving PwPMI because their involvement was not deemed to be the primary nature of the call. Indeed, as alluded to above, this issue has recently been explored by scholars who, ignoring call classification and instead examining officer notes appended to calls for service, identified that there may be as much as 10 times more PwPMI calls for service than the call classification categories suggest (Koziarski et al., 2022; Langton et al., 2021; Mitchell et al., 2022). Consequently, given that the present dissertation drew upon a subset of calls for service

where Barrie Police officers selected *Mental Health* as the primary call classification within their computer-aided dispatch (CAD) system, it is likely that the analyses done herein draw upon a fraction of the true number of PwPMI calls for service received by the Barrie Police Service between 2014 and 2020. Future research on the spatial patterns of PwPMI calls for service should therefore consider inquiring officer call notes and other qualitative call data to uncover the true number of calls for service that involve PwPMI before conducting their analyses. Doing so would also allow for equally important avenues of analyses: examining whether PwPMI calls for service identified through examining qualitative call data occur in similar or different locations to PwPMI calls identified through call classification alone. Moreover, it would also be pertinent to use such data to replicate the analyses of the present dissertation to identify whether degrees of PwPMI call concentration remain the same as well as whether calls in these data are spatially stable.

A second, but closely related limitation is that the determination of whether a call for service should or should not fall under the *Mental Health* call classification is up to the perception of responding officer(s) (Bittner, 1967; Bohrman et al., 2018; Hodgkinson & Andresen, 2019; Schulenberg, 2016; Shore & Lavoie, 2018; Vaughan et al., 2016; White & Goldberg, 2018). As described in-length in Chapter 1, police officers—though receiving some level of mental health training—are not mental health experts and thus may misinterpret behaviours that they witness at the scene of an interaction. Symptoms of substance use, for example, have been found to be misinterpreted by some officers as symptoms of mental illness (Bohrman et al., 2018). As such, it is plausible that PwPMI included in the present dissertation by way of the *Mental Health* call classification that is entered by responding officers may include individuals who were incorrectly perceived to have a mental illness.

Third, given the spatial nature of this dissertation and the two different spatial units of analysis employed—dissemination areas and street segments—the findings presented herein strongly suggest that spatial analyses of PwPMI calls for service are not immune to the modifiable areal unit problem (MAUP). In short, the MAUP refers to the issue of results being dependent on the selected units of spatial analysis and levels of data

aggregation (Openshaw, 1984). For instance, as shown in Chapters 2 and 3, while PwPMI calls for service were found to be concentrated across dissemination areas in Barrie, concentrations at street segments were even more pronounced. Thus, had this dissertation only employed dissemination areas (or larger units), it would have failed to uncover the true degree to which PwPMI calls for service are concentrated within the Barrie context. Analyses in Chapter 4 may also be affected by the MAUP in that support for the association between social disorganization theory and the spatial patterns of PwPMI calls for service may indeed be present when other spatial units of analyses are employed. The current analysis in Chapter 4 was limited to the dissemination area-level because that is the smallest unit at which Canadian Census data are disseminated due to privacy considerations. There may, however, be a considerable degree of variability in social disorganization at units finer than dissemination areas, such as street segments (Vaughan et al., 2018). As such, although both Chapter 4 and the findings of Vaughan et al. (2018) find no support for an association between social disorganization theory and the spatial patterns of PwPMI calls for service, future research should consider exploring this association at street segments. This avenue of theoretical inquiry could indeed be fruitful, especially given that findings from Chapter 2 and elsewhere (see e.g., White & Goldberg, 2018) indicate that there is considerable street-to-street variability for PwPMI calls for service.

Beyond social disorganization, future research should also consider testing other theoretical frameworks that have been previously examined in the literature but have yet to be replicated or tested through rigorous methods. For example, work by White and colleagues (2019) drew upon social capital and social cohesion theories to find that street segments with high social cohesion, trust, and community involvement decreased the likelihood of a PwPMI call for service occurring on the same segment, but there is a need to replicate this work elsewhere to corroborate the utility of these theories in explaining the location of PwPMI calls. Contrastingly, other scholars have drawn upon opportunity theories of crime to argue that these calls may instead cluster around places that may be frequented by PwPMI due to their mental illness, such as mental health services, pharmacies, and hospitals, among other places (Vaughan et al., 2016). Although existing scholarship does suggest that there may be a relationship here (see White et al., 2019 for

exception), it has either been tested by laying a map of PwPMI call hot spots over a map that displays the location of such places (Vaughan et al., 2016) or it has merely been suggested by authors due to their personal knowledge of their study jurisdiction (Hodgkinson & Andresen, 2019). Indeed, I made a similar claim in Chapter 2 due to my own knowledge of the Barrie context when I discovered that the two hot spots identified through Kernel Density Estimation overlapped with: (1) Barrie's downtown core where there is a concentration of social and mental health services; and (2) the hospital. As such, future research should consider this relationship between particular places and PwPMI calls for service, but through more rigorous methods.

In terms of other study-specific limitations, CAD policies at the Barrie Police Service limits the length of time that calls for service data are retained, meaning 2014 was the earliest year of CAD data that was obtainable when work on this dissertation began. As such, the longitudinal analyses presented in Chapter 3 pale in comparison to studies on the spatial stability of crime where, for example, some scholars have been able to draw upon a decade or more of crime data (see e.g., Braga et al., 2011; Curman et al., 2015; Vandeviver & Steenbeek, 2019; Weisburd et al., 2004). Future research on the spatial stability of PwPMI calls for service should not only therefore seek to replicate the findings from Chapter 3 which has been the only inquiry into the spatial stability of these calls to-date, but it should also consider drawing upon longer temporal periods to examine whether stability wavers when a decade or more of data is under consideration.

While the present dissertation focused on producing evidence related to the spatial patterns of PwPMI calls for service with the goal of informing the use of proactive, place-based efforts to PwPMI generally, an area of future research opportunity also exists in which scholars examine the spatial patterns of PwPMI from different racialized communities to in turn inform proactive place-based efforts that are simultaneously culturally appropriate for the individual subject to the interaction. Historically, police services have seldomly collected race- and ethnicity-based data (Huey, Ferguson, et al., 2021), so little is known about how and why PwPMI from different racialized communities come into contact with police, what occurred during these interactions, as well as what the outcomes of their interactions were. An additional complication with the

collection of these data is that most PwPMI calls for service are resolved informally, with no action being taken by responding officers (Bittner, 1967; Charette et al., 2011; Shore & Lavoie, 2018; Teplin & Pruett, 1992; Watson & Wood, 2017). While indeed positive, informal conclusions mean there is little need for officers to document any more information than what they observed when they arrived on scene and that they left the individual as they were (Koziarski et al., 2022). This flexibility in what does or does not get documented for such calls means that some may document the individual's perceived race/ethnicity, whereas others will not, thus contributing to gaps in our understanding related to PwPMI from racialized communities and their interactions with police. Nonetheless, the limited scholarship in this area suggests that those who are Indigenous are more likely to interact with the police in the context of a mental health-related situation (David & Mitchell, 2021), whereas PwPMI from the Black community are more likely to be arrested (Compton et al., 2022) and experience use of force (Toronto Police Service, 2022) during interactions with police. Accordingly, should police improve their race-based data collection practices, the analyses of the present dissertation may be replicated to inform the deployment of proactive place-based efforts that seek to specifically assist PwPMI from racialized communities with the aim of mitigating or eliminating these emerging disparities.

On a final note, practitioners from both the policing and mental health fields should work on developing proactive place-based efforts to PwPMI in their communities and evaluating the impacts of such efforts. Indeed, as I and a number of my colleagues have argued (see Coleman & Cotton, 2016; Goldberg et al., 2019; White et al., 2019; White & Weisburd, 2017; Wood & Beierschmitt, 2014; Wood & Watson, 2017), proactive place-based efforts to PwPMI have great potential to increase practitioners' reach to PwPMI in their communities through efficient resource deployment, enable practitioners to intervene before someone reaches crisis, reduce the footprint of the police in the lives of PwPMI, and put them on a more fruitful path of mental health care and treatment. To-date, however, there has not been a single documented proactive deployment of either police or mental health resources into areas where PwPMI calls for service concentrate. Until such a deployment occurs, these proposed benefits are merely theoretical and largely drawn from the success of crime-focused place-based efforts (Braga et al., 2012b,

2012a, 2019a, 2019b; Braga & Weisburd, 2020; Koper, 1995; Telep et al., 2014; Weisburd, 2008). As such, it is vital that pilot programs are implemented and these outcomes are rigorously measured.

5.3 Concluding Thoughts

Due to a host of factors, the police have long been the primary responders to PwPMI in the community. Having the police in this role, however, has contributed to a number of issues, such as criminalization and disproportionate use of force against PwPMI. In response, both the police and communities have developed a myriad of response efforts that seek to get specially trained police officers and/or mental health practitioners to the scene of a PwPMI in crisis. Unfortunately, these efforts are reactive in nature, tasked with responding to a situation that is already in progress and which could have arguably been prevented had a timelier intervention taken place. Accordingly, this dissertation argued for the re-deployment of such efforts in a proactive capacity, with a focus on where PwPMI calls for service concentrate and thus produced evidence on the spatial patterns of these calls to give this argument an empirical backing.

Although the theoretical investigation of this dissertation failed to shed light on why PwPMI calls for service occur where they do, findings show that these calls are not only highly concentrated—even within the context of a small city—but they are spatially stable as well, even throughout the recent COVID-19 pandemic. As such, in targeting areas of PwPMI call concentration through proactive place-based deployment, there is a very promising opportunity for police and mental health practitioners to have a greater reach to PwPMI in their community through more efficient resource deployment, intervene when PwPMI appear to be approaching crisis, reduce the footprint of the police in the lives of PwPMI, and put them on a more fruitful path of mental health care and treatment. In light of these benefits, practitioners should strongly consider employing proactive place-based efforts to PwPMI in their communities and testing whether the assertions of this dissertation hold.

5.4   References

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