



Strengthening Core Understanding of Physical Activity for Individuals who Experience Gender-Based Violence: A Scoping Review Approach



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Executive Summary

About the Project

Physical activity (PA) is a key mechanism for promoting positive mental health. This may be of particular importance to people who have experienced high levels of trauma and violence, with regular engagement in PA being associated with decreased depression, anxiety, sleep disturbances, and other health conditions associated with post-traumatic stress disorder (PTSD). However, despite the effective and low-cost potential of PA-centred interventions, it remains a very low priority within health promotion efforts targeted for individuals who experience(d) gender-based violence (GBV). Support to create accessible and appropriate PA programming is all-the-more pressing to understand, particularly since COVID-19 has created a de facto "shadow pandemic" with a notable global upsurge in GBV and a resulting strain on community programming for victims of GBV.

As such, we conducted three scoping reviews to develop a nuanced, interdisciplinary understanding of past and current research initiatives related to GBV and PA. These diverse, yet interrelated, reviews were address through three objectives:

- (1) Examine PA interventions for individuals who have experienced GBV with a focus on the last decade in the Canadian context.
- (2) Understand how noticeably neglected groups, such as pregnant individuals who experience(d) GBV, are included/excluded from specific research and/or programmatic interventions leveraging the therapeutic potential of PA.
- (3) Understand how geographic information system (GIS) mapping is and/or can be used to assess the relationship between PA and experiences of GBV.

Key Findings

Gender-Based Violence and Physical Activity Interventions

There is limited research (n = 5) in the Canadian context leveraging PA interventions as an adjunctive support for individuals who have experienced GBV.

Current evidence illustrates the importance of taking a trauma- and violence-informed approach to PA (TVIPA) programming. All five studies employed community-based, participatory approaches in at least one aspect of the intervention; specifically, all studies worked with agencies, programs, or stakeholders based in the community of interest, in

either program advisory or development capacities. Social workers, support workers, and/or trauma therapists were present during the PA delivery across all studies, while 80% employed some iteration of trauma-informed training to coaches/staff prior to the intervention.

Broadly, all studies saw improvement in physical and mental health outcomes; evidence of trauma symptoms being alleviated by TVIPA. PA, especially when designed and delivered in a trauma informed way, has the potential to strengthen social connectedness and lead to positive mental health outcomes among equity-owed, self-identified women and gender-diverse people.

Physical Activity, Gender-Based Violence, and Pregnant Bodies

Review of the literature reveals a robust case for further research with/for pregnant individuals with experiences of trauma, PTSD, and physical activity to address a sex and gender gap in research and explore the potential to interrupt intergenerational cycles of trauma.

We quickly found there were **no studies with human subjects** that met our inclusion criteria; rather, we found a singular animal model study. This finding reveals a significant gap in research on the potential impacts of PA on trauma and PTSD symptomology in pregnancy.



Geographic Information Systems and Gender-Based Violence

From our review, there is clear momentum with the use of spatial approaches to understand GBV; however, no studies directly integrating PA were found. As such, a more general scoping review on the use of GIS to examine trends in GBV was conducted, with a total of 43 studies included in full-text analysis.

The majority of studies were conducted in urban or suburban centres (n = 28, 65%) and dominantly depended (n = 30, 70%) on institutional data sources (e.g. hospitals and police data), which hold major caveats when it comes to structural and systemic barriers to SGBV data collection, such as stigma in and/or fear of reporting and historic distrust in institutional services. There is an opportunity to leverage GIS and spatial approaches to better understand relationships between PA-levels, availability of health promotion services (e.g. PA) and environmental/neighbourhood factors.

Policy Implications

Gender-Based Violence and Physical Activity Interventions

- Increased federal, provincial, and municipal funding and support for novel GBV and PA research, including: (1) conducting a randomized-control trials (RCT) for population-relevant data, (2) discovering innovative ways of conducting RCTs, or similar research models, with a trauma-informed lens.
- Providing funds directly to the relevant communities for: (1) the evaluation/delivery of community organizations offering PA programming to equity-owed groups; and (2) integration of TVIPA programming into GBV support services.
- Promoting multi-sectoral advancements in TVIPA training and education, and provision of services for accessible and equitable PA programming such as childcare, transportation, and free programming.

Physical Activity, Gender-Based Violence, and Pregnant Bodies

- There is urgency to fund and advocate for PA research with pregnant individuals who have experiences of trauma and/or PTSD to develop evidence-based practices to protect them through research, not from research. Such benefits may decrease the risk of intergenerational transmission of trauma, thus enhancing the quality of life of pregnant individuals as well as their families.

Geographic Information Systems and Gender-Based Violence

- As GIS is increasingly employed in GBV research, funding should prioritize mixed-methods, innovative research models to (1) account for structural/systemic barriers to data collection for those who have experienced GBV and (2) integrate community-identified insights into spatio-spatial analysis of GBV risk.

Please note, the scoping reviews presented in this report have been submitted to peer-reviewed journals for publication. As such, some of the material from this report may be published elsewhere.

Strengthening the Case for Trauma- and Violence-Informed Physical Activity for Pregnant Women: A Review

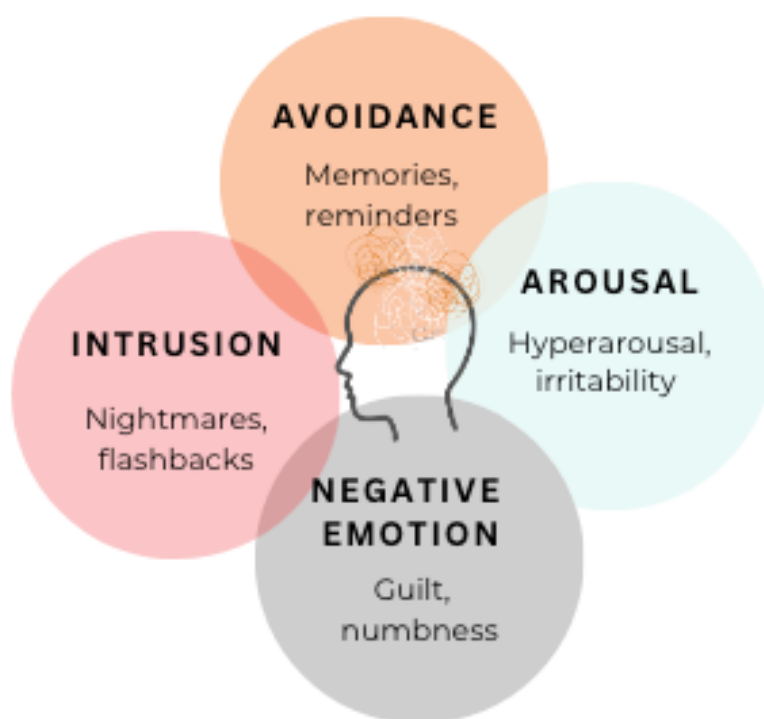
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BACKGROUND: THE ISSUE

Trauma exposures are highly prevalent with a reported 76% of Canadians experiencing at least one traumatic event during their lifetime.^{1,2} In terms of the translation of this trauma exposure into psychopathology, an estimated 9.2% of Canadians will experience post-traumatic stress disorder (PTSD) during their lifetime.³ PTSD is defined in the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) by four symptom clusters: 1) the incidence of intrusive, recurring memories of trauma; 2) avoidance of trauma-related stimuli; 3) changes in mood or cognition, contributing to negative emotions or experiences of numbness; 4) hypervigilance and other changes in reactivity and arousal.⁴ The updated characterization of PTSD specifies dissociative and delayed subtypes of PTSD as well as diagnostic criteria specifically for children ages six and under.⁵

Among those exposed to trauma, women¹ have been shown to have a significantly higher rate of PTSD.⁶⁻⁸ The prevalence of trauma exposure within Canadian populations is mirrored on a global level, where one study found that roughly 70% of participants had experienced at least one trauma.⁹ This same global study found that rape and sexual assault presented as the types of trauma associated with the greatest risk for development of PTSD, a finding that has been supported in other



Adapted from Figure 13-1 in Jorge, R.E. (2015). Posttraumatic Stress Disorder. *CONTINUUM: Lifelong Learning in Neurology*, 21, 789-805.

¹We use the terms women/female throughout to accurately reflect research findings from other scholars. For the purposes of this review, we use the terms “pregnant people” and “pregnant individuals” to be inclusive of diverse gender identities and to focus on individuals with a uterus.

studies of trauma.^{7,8} Trauma related to intimate partner sexual violence represented almost half of the collected responses; sexual violence more broadly is also a type of trauma that women appear to be more likely to experience than men.^{8,9}

The lived experiences of women with trauma and PTSD, and the multifaceted effects of these experiences, extend beyond the individual level. Trauma has been shown to have intergenerational impacts through a variety of mechanisms, which include the dysregulation of the stress response and a potential maternal-fetal pathway.¹⁰ Investigating these pathways in the context of the neurobiology of women during pregnancy could give a more complete physiological profile of women who are impacted by trauma. Equally as important, this greater understanding of the distinct physiological environment that affects pregnant women impacted by trauma and/or PTSD could contribute to more tailored therapeutic approaches. This would be a highly beneficial development since of those who receive treatment for PTSD, only approximately 60% are responsive to interventions, with only a third of patients recovering completely from the disorder.¹¹

Many current trauma treatments use psychological or pharmacological methods, however, there is growing evidence of the benefits of physical activity as an adjunctive treatment.¹²⁻¹⁴ Current research in animal models has shown neuroendocrine benefits of exercise interventions for PTSD; these types of interventions have been identified as having impacts on cortisol, a key component of the stress response pathway, which in turn could provide a potential avenue to address the dysregulated cortisol levels associated with this disorder.^{13,15,16} Similar research among human participants appears to be scarce from the extensive literature review performed by the authors of this article prior to initiation of this project. Of the work that does focus on the effects of exercise on cortisol, studies tend to focus on outcomes in athletes or in association with factors like age rather than PTSD status.^{17,18} In narrowing down the target population to pregnant women, the available evidence of the

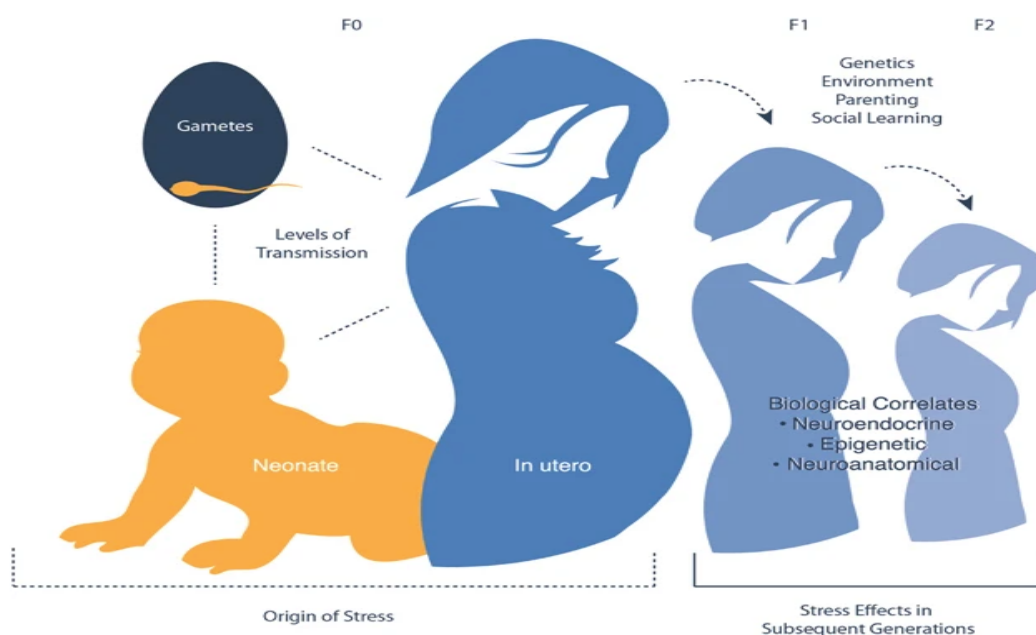


Figure 1, Bowers, M., Yehuda, R. Intergenerational Transmission of Stress in Humans. *Neuropsychopharmacol* 41, 232–244 (2016). <https://doi.org/10.1038/npp.2015.247>

impacts, including the potential benefits, of exercise for people affected by trauma and/or PTSD becomes increasingly limited.

This more focused scope of research is merited since pregnancy has been argued as a particularly meaningful intervention point to break the cycle of intergenerational trauma, suggesting that improvements to the personal health of women affected by trauma may also have benefits for their children.¹⁹ Antidepressants, which have been suggested as a first-line pharmacological treatment for PTSD, appear to be safe for both mother and child, yet this is an understudied population and there have been documented concerns of inconsistent or lower quality methodologies in existing studies.^{20,21} As a result, this evidence remains preliminary. As Shivakumar and colleagues²² note, typical treatments for PTSD, such as psychotropic medications more broadly, lack conclusive evidence in regards to safety during pregnancy. We will not provide further review on the safety of taking medications while pregnant since this is beyond the scope of this study, and our expertise; instead, we examine the effects of physical activity during pregnancy as an adjunctive treatment for PTSD.

Aforementioned, there is a dearth of literature specifically examining physical activity and PTSD for pregnant women. While the current literature is limited, there is evidence to suggest, in separate works, both that 1) exercise may decrease cortisol levels among pregnant women^{23,24}; and 2) there are heightened levels of cortisol among pregnant women impacted by trauma.^{25,26} Based on these findings, it appears that there may be benefits of exercise for pregnant women affected by trauma via impacts on cortisol levels, yet as this study shows this relationship has yet to be directly assessed. The mechanism for these changes in the physiology of pregnant women impacted by trauma and the physiological impacts of physical activity remain unclear. In a proof-of-concept study on physical activity for PTSD in women veterans of child-bearing age (but not pregnant) researchers assessed the safety, feasibility, and efficacy of a 12-week brisk walking program.²⁷ The researchers reported PTSD symptoms improved significantly and suggested that moderate intensity aerobic exercise may be a promising intervention for this population. Despite this gap in knowledge, the reviewed findings demonstrate the benefits that physical activity can have for pregnant individuals affected by trauma as well as the implications of these impacts in terms of better-informed treatment plans and the interruption of the cycle of intergenerational trauma.

This review aims to explore and document the existing literature related to the effects of physical activity interventions for pregnant people affected by trauma and/or PTSD. In taking this focused approach, the goals of this scoping review are to analyze the existing research for pregnant individuals as well as identifying an important gap in the current evidence base.

METHODS

Search Strategy

The methods employed in this scoping review were guided by Arksey and O'Malley's methodological framework²⁸, with recommendations by Levac, Colquhoun, and O'Brien.²⁹ To inform the compilation of relevant search terms (Figure 1), and subsequently develop a

formal search strategy, researchers posed the following research question: “What existing literature has directly assessed the effects of physical activity during pregnancy as an adjunctive support designed for individuals with experiences of PTSD or trauma?” A total of four databases were searched, including: Scopus, PsychINFO, CINAHL, and PubMed. Additionally, in the data charting stage, all included sources underwent reference list screening to ensure all potential includes were accounted for prior to analysis. Once all searches were complete, all identified sources were uploaded to Zotero Reference Manager and subsequently imported to Covidence, an online systematic review management software.³⁰

Selection Criteria for Inclusion and Exclusion

During the initial stage of screening, a minimum of two screeners reviewed all titles and abstracts (T-A), considering the following T-A inclusion criteria: 1) Does this study address psychological trauma or other stress-related disorders?; 2) Is this study about PA?; 3) Is this study conducted in pregnant individuals? For this review, authors used the definition of trauma outlined by the Centre for Addiction and Mental Health (CAMH) when considering inclusion criteria.³¹ Any studies focused on “physical” trauma were excluded at the T-A screening phase. Conflicts were resolved through group discussion between authors. Remaining studies were included in the full text (F-T) screening process.

Consistent with Arksey and O'Malley's screening framework, the following question was used to inform F-T eligibility: does the study employ PA to *address* or *support* pregnant people with past trauma or PTSD *during* pregnancy? For the purposes of this study, following these criteria meant that the article had to directly analyze the relationship between physical activity and trauma or PTSD in pregnant individuals; as an example, this approach excluded studies which include measures of physical activity and trauma or PTSD, but in relation to a third variable rather than to each other. Conflicts were collaboratively resolved by all authors.

Data Charting and Analysis

Data charting was conducted by authors MSP and SH. An excel spreadsheet was purposefully designed to synthesize the following information from all included studies: 1) author information, title, and publication information; 2) type of participants (i.e. animal vs. human), trauma and/or PTSD metrics as well as physical activity intervention or measure used, reason for exclusion, if applicable. Frequency statistics were manually performed on all extracted data to better address the outcomes outlined by this scoping review.

Following the completion of the initial data charting, the authors further categorized the excluded articles based on reason for exclusion. This additional analysis was performed in light of the extremely limited number of articles that met the inclusion criteria, as will be presented in the following section. Articles were categorized based on the primary reason for exclusion, with an understanding that there were studies that had multiple overlapping reasons for exclusion. Shared characteristics among the excluded studies were also analyzed and quantified in order to identify trends within the existing, albeit adjacent to the topic of interest, literature. All authors reviewed these additional analyses to ensure agreement and accuracy of interpretation.

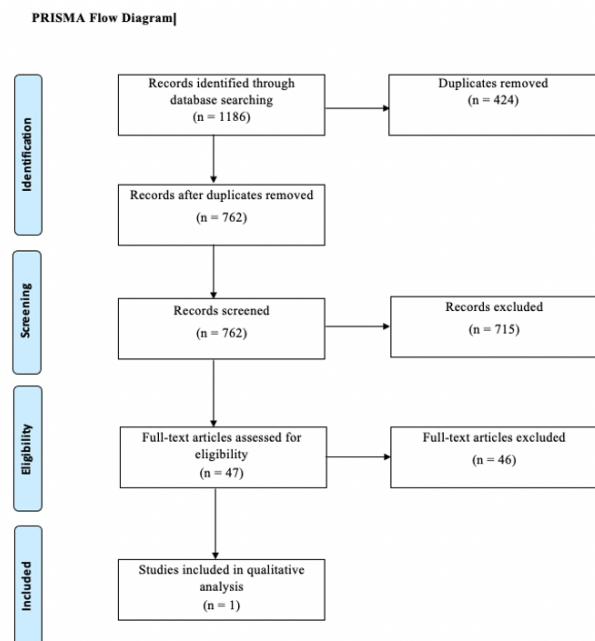
RESULTS

Search

Based on four databases, our initial search yielded 1169 articles. Following de-duplication (n = 424), a total of 762 articles were screened using T-A criteria. To ensure inter-rater reliability, all authors participated in a T-A pilot and a kappa score of 0.95 (95% confidence interval (CI): 0.91,1.00) was achieved. T-A screening results in the exclusion 715 articles, leaving 47 for F-T review. Following a F-T pilot test (kappa score of 0.87 [95% CI: 0.74, 0.99]) F-T screening resulted in a single study (n = 1) for qualitative analysis (Figure 2).

Description of Included Study

Disappointingly, the only study which met our inclusion criteria involved an animal model of PTSD. In this study, treadmill exercise was found to significantly decrease anxiety-like responses in pregnant rats that had undergone PTSD induction via predator exposure.³² The animal subjects in the intervention group ran on a treadmill for 30 minutes daily from day 7 of pregnancy until delivery. The anxiety-like responses were measured postpartum in the rats after a 3-week period during which the rats and their offspring were undisturbed. The authors describe the use of an elevated plus maze test to measure anxiety-like behavior, with reduced anxiety-like behavior being represented by decreased time spent in the closed arms of the maze. This study found that the PTSD-induced group that did not participate in exercise during pregnancy exhibited significantly more time spent in the closed arms while the PTSD-induced exercise group spent significantly less time in these arms. The reported percentage of time spent in the closed arms was identified as similar between the control group and the PTSD-induced exercise group. Additionally, the control exercise group exhibited the lowest amount of time spent in the closed arms, further supporting the anxiolytic impacts of exercise generally in addition to the specific effects related to alleviation of PTSD behaviors. The authors also analyzed the biochemical effects of exercise relating to serotonergic and nitric oxide as well as levels of neuronal activity in the hypothalamus and



locus ceruleus, areas which play a role in the stress response axis and autonomic functions such as arousal, mood, and pain, respectively.³³ These biochemical and neuronal activity impacts are beyond the scope of this review yet are important to note since these findings represent an important contribution to the neurobiological understanding of trauma and PTSD in pregnant rats.

Characteristics of Excluded Studies

Due to the dearth of data available for analysis, the major reasons for exclusion of studies from this scoping review are presented. The inclusion of these data is meant to expand on the presented insights of the current state of this area of literature. Among the excluded studies, 37% (n = 17) could not be included due to lack of specific trauma or PTSD measure; 20% (n = 9) were removed due to a study population of postpartum women or a study population without reported outcomes solely for pregnant women; 41% (n=19) of articles did not directly measure the impacts of a physical activity intervention on trauma and/or PTSD; finally, 2% (n=1) of articles had no physical activity intervention. Within these categories, there were more specific shared characteristics of the analyzed articles. 17% (n=8) of articles discussed physical activity in the context of impacts on mental health generally or effects on psychological distress, depression, or anxiety. Many articles were non-interventional, with this subcategory representing 24% (n=11) of the screened full-text articles. Finally, a subset of articles focused on outcomes not related to maternal mental health, such as gestational hypertension³⁴ or inflammation.³⁵ This subset made up 15% (n=7) of the reviewed studies.

IMPLICATIONS

The inclusion of a singular study in the final analysis of this scoping review clearly reveals a massive gap in literature related to this population. While the data available for analysis were extremely limited, the nature of the included study does reveal some insights. The included study, which was published in 2013, was conducted in animal models.³² The lack of complementary human studies on this topic reflects the need for further translational research among pregnant individuals who have experienced trauma and/or PTSD. Additionally, the included study only measured anxiety-like behaviors postpartum in the animal subjects. This may reveal opportunities for future work at the animal model level as well as among human participants. On a practical note, while the predator stress model of PTSD has been identified as having numerous strengths as a biological model, the use of a wider variety of stress exposure models in future work may also enhance the validity of subsequent findings.³⁶ As mentioned previously there are separate findings related to the effects of physical activity^{24,37} as well as trauma and PTSD^{25,26} on cortisol levels during pregnancy, yet these factors have not been directly connected in animal or human research. Thus, while the included study found significant reductions in anxiety-like behaviors postpartum, it is still unknown whether exercise has these same benefits during pregnancy. The opposing impacts of physical activity and trauma on cortisol during pregnancy suggests a physiological mechanism by which exercise may benefit this population. However, until the psychosocial and neurobiological impacts of physical activity for pregnant people affected by trauma and PTSD are studied, the exact nature of this relationship will remain unclear. These effects are relevant to the discussion around intergenerational trauma transmission as well

as the well-being of the pregnant person. Prenatal stress and specifically elevated maternal cortisol levels have been identified as having a substantial impact on fetal cortisol levels which may be a sign of altered stress response axis functioning related to maternal exposure to trauma.³⁷ Maternal PTSD has been associated with altered cortisol levels among children as well, further strengthening the evidence for a physiological transmission of the effects of trauma.²⁵ These findings show the challenges that mothers impacted by trauma face, while also demonstrating an opportunity for interventions to have intergenerational benefits.

Although the excluded articles did not directly address the target population and relevant outcomes, many of these studies included evidence supporting the possible benefits of an exercise intervention for pregnant individuals affected by trauma. The relationship between physical and mental health was highlighted in one study, where gestational hypertension was associated with a significantly higher frequency of experienced traumatic events.³⁴ This same study found that physical activity during the third trimester correlated with a greater incidence of hypertension, suggesting that if exercise programs are to be implemented there must be adequate safety considerations and guidelines for participants and respective physical activity interventions. Another study focused on the prevalence of traumatic birth experiences rather than prior trauma.³⁸ Researchers found that lack of engagement in regular exercise during pregnancy was a predictor of traumatic birth experiences. These findings may indicate a role for physical activity programming as having preventive benefits as well as serving as an intervention for prior experiences of trauma and/or current PTSD diagnosis.

Finally, an excluded study recognized trauma exposure as a significant barrier to accessing health programming, including physical activity interventions.³⁹ The study included a focus on barriers to participation in prenatal yoga classes and measured trauma exposure via the Adverse Childhood Experience (ACE) questionnaire. These findings align with literature related to the accessibility of physical activity generally for women affected by trauma. Physical activity can be challenging for anyone to engage in after experiencing trauma due to a sensitivity or fear of symptoms of hyperarousal, such as elevated heart and breathing rates, that can occur both during exercise and after experiencing trauma.⁴⁰ In addition to being more likely to develop PTSD overall, a recent scoping review found that females are more likely to experience these types of symptoms compared to their male counterparts.⁴¹

Gender differences embedded in the culture around exercise research further exacerbates accessibility/feasibility issues for women. Females diagnosed with PTSD are both less likely to exercise and are less represented in health promotion research than their male counterparts.⁴² Moderate-to-vigorous physical activity (MVPA) in particular has been identified as having benefits in terms of reducing PTSD symptomology, including hyperarousal responses, yet studies assessing the effects of MVPA tend to use samples of only men or mixed gender samples.⁴¹ The latter case of a mixed gender sample may appear to be an improvement, however, some women with experiences of trauma may be less likely to participate in this type of MVPA programming due to feeling unsafe.⁴³

Gender-based discrimination, bias, and paternalistic systems impact the lived experience of women and gender diverse individuals, and influence exclusion from research. Such gender bias is evident in research data gaps that persist across almost all research areas.⁴⁴ These

gaps lead to evidence-based medicine and interventions that are not as effective for women, and increases the likelihood of adverse outcomes for women compared to men.⁴⁵ There is clearly a knowledge gap related to the effects of physical activity for pregnant women living with PTSD and experiences of trauma as evidenced by the results of this review; we were unable to locate any publications with empirical data related to pregnant human participants in this area. It is widely accepted that pregnant women are considered a ‘vulnerable’ group which excludes them from taking part in clinical studies and they are often excluded from statistical analysis⁴⁶ which perpetuates the knowledge and research gaps for this population. Many researchers, and ethical review boards “regard pregnancy as a near-automatic cause for exclusion, regardless of the costs of exclusion or the likelihood of the risks of participation”.^{47(p.5)} While it is important to protect ‘vulnerable’ populations, such decisions may be grounded in paternalistic practices that inadvertently heighten risks for women due to a lack of scientific evidence.⁴⁵ Documented advocacy for the inclusion of pregnant women in research can be seen in work from over two decades ago.⁴⁸ However, these populations continue to be underrepresented in vital studies such as those investigating the impacts of COVID-19^{49,50}, cardiovascular disease^{51,52}, HIV⁵³ and physical activity and sport research.^{51,54} Clearly, the “protection by exclusion mentality” is prevalent across many research areas.^{51(p.2)} This exclusion occurs despite the availability of evidence related to the challenges and potential approaches to involving pregnant women in studies.^{51,55-57} The exclusion of pregnant women from research has led to this population referred to as “therapeutic orphans” because there are so few evidence-based treatments.^{45(p.29)} Our findings add to the growing literature on the ways in which female bodies are excluded from research, specifically pregnant bodies, and adds to calls to action for research agendas that centre the needs of pregnant individuals to advance evidence-based research outcomes for this population. These sex and gender research gaps reinforce the necessity for, and importance of, the proposed expansion of appropriate research with this population.

While there is advocacy for further research with pregnant people, given our focus on trauma and PTSD, we argue the necessity of trauma- and violence-informed approaches to research and interventions. Researchers have demonstrated the effectiveness of trauma- and violence-informed approaches have the potential to improve access and experiences in human service contexts in various settings such as healthcare/emergency rooms⁵⁸, intimate partner violence interventions⁵⁹, educational settings⁶⁰, and recently physical activity.⁶¹⁻⁶³ Traumatic experiences have been cited as being an obstacle to participation in exercise for pregnant and parenting individuals who have experienced trauma.⁶¹ Therefore, consideration for the implementation of physical activity interventions would benefit from a trauma-and violence-informed physical activity (TVIPA) approach.^{62,63} Succinctly, this means that interventions must account for the effects of systemic, structural and interpersonal violence - and the intersections of these- in the development, implementation, and delivery of interventions.⁶² A TVIPA approach has the potential to improve the accessibility of exercise interventions for pregnant individuals affected by trauma and PTSD. The nature of this type of approach is one that centralizes sensitivity to the vulnerabilities of trauma survivors and adapts the delivery of programming to avoid participants’ re-traumatization^{42,62}; this may be

of particular importance for research that includes biological measures of physical activity or trauma.⁴¹

CONCLUSIONS

There are obvious opportunities for further research related to physical activity interventions for pregnant individuals affected by trauma and/or PTSD. While we sought to provide evidence of the effectiveness of physical activity as an intervention for pregnant individuals, we quickly found there were **no** studies with human subjects that met our inclusion criteria. These findings reiterate the problematic nature of excluding pregnant individuals from research. Making the physiological benefits of physical activity accessible may allow participants to experience reduced PTSD symptoms, and these types of interventions may also reinforce social bonds and empower self-care and confidence, which in turn can aid recovery and strengthen individuals' and communities' abilities to cope with past, current, or future traumatic experiences.⁶⁵ There is urgency to support physical activity research with pregnant individuals who have experiences of trauma and/or PTSD to develop evidence-based practices to protect them through research, not from research. Such benefits may decrease the risk of intergenerational transmission of trauma, thus enhancing the quality of life of pregnant individuals as well as their families.

Moving Forward: Conclusions and Recommendations

- Physical activity interventions for pregnant individuals affected by trauma and/or PTSD is urgently needed to inform evidence-based practices to protect pregnant individuals through research, rather than excluding them.
- The lack of studies with human subjects in this area needs to be acknowledged and addressed. Researchers should be encouraged to design and carry out studies that specifically include pregnant individuals and meet inclusion criteria to provide evidence of the effectiveness of physical activity as an intervention.
- It is critical to ensure that PA interventions are inclusive, safe, and tailored to the unique needs of pregnant individuals, in order to examine if physical activity can reduce PTSD symptoms and promote overall well-being for pregnant individuals.
- Interventions should be designed such that they not only focus on the physiological benefits of physical activity but also reinforce social bonds, empower self-care, and build confidence. These interventions can aid recovery, strengthen individuals' and communities' abilities to cope with traumatic experiences, and potentially decrease the risk of intergenerational transmission of trauma.

Physical Activity Interventions to Support Individuals who have Experienced Gender-Based Violence: A Scoping Review

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BACKGROUND: THE ISSUE

Gender-Based Violence

Gender-based violence (GBV) encapsulates the crimes, threats, abuse, discrimination, and physical violence motivated by actual and/or perceived gender identity/expression of the victims, which are disproportionately women, girls, and gender diverse people.⁶⁶ In addition to gender, other social determinants of health which may increase one's risk of experiencing GBV include geographical location (e.g., northern, rural, and remote communities), disability status, race, culture, immigrant status, Indigenous (First Nations, Inuit, Métis) identity, and young age.⁶⁶ The intensified rates of GBV among these populations are significant in that stigmatization and marginalizing circumstances often act as barriers to accessing the support and services they need.⁶⁷⁻⁶⁹ This deep rooted, systemic issue was exacerbated by the COVID-19 pandemic, in which notable increases in GBV have emerged, all while support services for the victims have become more difficult to access.⁶⁹ This "Shadow Pandemic"⁶⁹, caused by several compounding factors such as income insecurity, isolation with abusers, and deserted public spaces, has raised concerns for the safety and wellbeing of women, girls, and gender-diverse people worldwide.⁷⁰

There are numerous negative physical, emotional, and mental health consequences of GBV.⁷¹ Long-term mental health consequences of GBV and lack of social support can include anxiety, depression, and post-traumatic stress disorder (PTSD), each of which have been identified as risk-factors for chronic disease and poor physical health outcomes.⁷² In addition, survivors of family- or intimate partner-violence may experience unique challenges pertaining to economic burden, relationships, social isolation, and substance abuse.⁷¹ Such negative outcomes contribute to ongoing marginalization at the individual and population levels, such as intergenerational trauma can arise through patterns of violence across families and communities.⁷³⁻⁷⁵ Hence, devoting resources to trauma- and violence-informed GBV-focused support models are of utmost importance, to support the safety, health, and wellbeing of current and future generations worldwide. The need for trauma- and violence-informed services is even more pertinent given the implications of the COVID-19 pandemic, that exacerbated barriers for low-SES, visible minority, and gender-diverse populations to access services.^{69-70,76}

Physical Activity and Mental Health

The Canadian 24-hour movement guidelines recommend that adults participate in 150 minutes of moderate to vigorous physical activity per week to achieve optimal health benefits.⁹¹ Research has also demonstrated the positive and protective effects that regular physical activity can have on mental health outcomes amongst various populations.^{78,80,92-95} Specifically, these studies have examined the relationship between physical activity and subsequent symptoms of depression, post-traumatic stress disorder (PTSD), suicidal behaviour, and overall suicide risk.^{78,80,92-95} Ghose et al. found a negative relationship between regular participation in physical activity and suicidal ideation and suicidal attempts among older adults (≥ 50 years) in low and middle income countries. Additionally, Davidson et al. observed that through decreasing depressive symptoms and improving sleep, physical activity was associated with a reduction in the risk of suicide amongst a sample of military veterans. It should be noted that much of the existing research is cross-sectional and retrospective in nature and has not employed physical activity interventions to establish the relationship between physical activity and mental health. However, Rosenbaum et al. conducted a randomised control trial in which adults with a diagnosis of PTSD participated in a 12-week physical activity intervention focussed on resistance training and walking. They found that participants had a statistically significant reduction in symptoms of PTSD and depression when augmenting standard care with the physical activity intervention (Rosenbaum et al., 2015).

Mechanisms that explain the relationship between physical activity and mental health could be physiological, psychological and/or social in nature.⁸⁰ The act of exercising releases biochemical components including endorphins, neurotransmitters and mitochondria and reduces systemic inflammation, all of which is known to be beneficial to mental health (Mikkelsen et al., 2017). Participating in physical activity, especially team activities, has also been shown to act as a protective factor against anxious and depressive symptoms by strengthening social networks (Doré et al., 2016). Still, other studies relate physical activity to improved sleep patterns and behaviours, thereby increasing psychological well-being (93; Rosenbaum et al., 2015). Physical activity has the potential to be an accessible, cost-effective and community-based way in which individuals can improve and protect their mental health⁷⁸, however the COVID-19 pandemic has exacerbated existing structural barriers and inequities that prevent equity-owed populations from accessing physical activity programming and resources.⁸⁷

Trauma- and Violence-Informed Physical Activity

One underexplored avenue to support individuals who have experienced GBV is trauma- and violence-informed physical activity (TVIPA). TVIPA is an approach to programming that aims to foster a safe and supportive environment through focussing on four key tenets: trauma awareness, safety and trustworthiness, opportunity for choice, collaboration, and connection, and employing a strengths-based and capacity building approach.⁹⁶ However, there has been limited research conducted on the relationship between PA and mental health outcomes in the Canadian context, particularly with equity-owed groups.

Physical activity is a valuable resource for the promotion of positive overall health and has been shown to improve symptoms/outcomes in conditions associated with GBV experience, namely post-traumatic stress disorder (PTSD), anxiety, depression, suicidal behaviour, and sleep disturbances.⁷⁷⁻⁸⁰ These benefits highlight the potential of physical activity for healing and have driven the development of TVIPA; an approach characterized by its emphasis on understanding the intersecting effects of systemic, structural, and interpersonal violence, as they relate to physical activity access and delivery.⁸¹ Despite the robust evidence which supports physical activity as a coping tool for victims of GBV, marginalizing circumstances continue to inhibit access to participation.⁸²⁻⁸⁵ The COVID-19 pandemic has exacerbated rates of both physical inactivity and GBV worldwide.⁸⁶⁻⁸⁷ Hence, the need for TVIPA services is more critical than ever; however, the research on this topic in the context of Canadian populations remains limited⁸¹, especially in relation to physical activity and GBV.⁸⁸ At its core, TVIPA program development and delivery is inherently context- and population-specific⁸¹. It is, therefore, necessary for Canadian TVIPA research and program development to be built upon and invested in, in order to increase access, uptake, adherence of evidence-based TVIPA programs for GBV survivors.

Objectives

Examine physical activity interventions for individuals who have experienced GBV with a focus on the last decade in the Canadian context. Specifically, better understand:

1. the **types of programming** available (e.g. yoga, walking, boxing)
2. the **target audience** (e.g. families, women, men, gender-diverse individuals)
3. the use of **trauma informed approaches** (understand if tenets of trauma- and violence-informed practice are adapted and assess if intervention is targeted at individual level behaviour, organizational structures, and/or policies)

METHODS

Search Strategy

The methodology of this scoping review is based on Arksey and O'Malley's²⁸ five stage framework, with recommendations by Levac et al.²⁹ We drafted the following objectives to guide our search and literature review: 1) to examine the current literature, 2) determine the best strategies and 3) formulate recommendations to advance PA practices for individuals who have experienced GBV. Based on these objectives, a list of search terms relevant to GBV and PA was compiled and used to search a total of seven academic databases including Scopus, Medline (Clarivate), CINAHL (Ebscohost), PsychInfo (Proquest), Gender Studies Database (Ebscohost), Sociological Abstracts (Proquest), and Dissertations and Theses Global (Proquest). Once the sources were identified from the search, they were uploaded into

Endnote Reference Manager and then to Covidence, a systematic review management software.

Selection Criteria for Inclusion and Exclusion

A pilot title-abstract screening was completed on 65 sources by four authors, based on the following questions: 1) Is this study about women or gendered people who have experienced violence?; 2) Is this study about physical activity as an intervention?; 3) Does this study occur in a Canadian context? Additionally, only articles published in 2012 and onwards, underwent screening. The pilot T-A screening achieved an 89.9% overall agreement and a free-marginal Kappa score 0.85, after which AL and LM proceeded with the T-A screening. All sources that met the inclusion criteria proceeded to full text (F-T) screening and any conflicts between these two authors' decisions were resolved by FD and MSP. Full-text studies that met the following criteria were included in the final scoping review: 1) involved self-identified women or gendered people who have experienced violence, 2) used physical activity as an intervention, 3) took place in Canada and 4) PA was used as a support for individuals who have experienced violence.

Data Charting and Analysis

AL and LM completed data charting on Covidence using a spreadsheet to collect the following information: title, authors, study location, geographic location, study aims, study design, start and end date of the study, funding sources, population descriptions, inclusion and exclusion criteria, number of participants, methods of recruitment, considerations of GBV, PA descriptors (type, duration, frequency, location, group/individual, online/in-person, facilitators present, additional program components and supports), measures, participatory approaches, TVI approaches, key outcomes and specific recommendations.



RESULTS

Geographic Location

Four of the papers specified a geographic location and took place in an inner-city urban setting in either Toronto, Ontario (60%, n = 3) or Vancouver, British Columbia (20%, n = 1). The final study (10%, n = 1) was conducted in five middle-schools in British Columbia but did not specify their locations. The study that was conducted in Vancouver, specified that the study took place in the Downtown Eastside, the lowest income neighbourhood in Canada. Furthermore, all studies included in this review were run in collaboration with community

organizations and agencies, many of which had pre-established connections with participants.

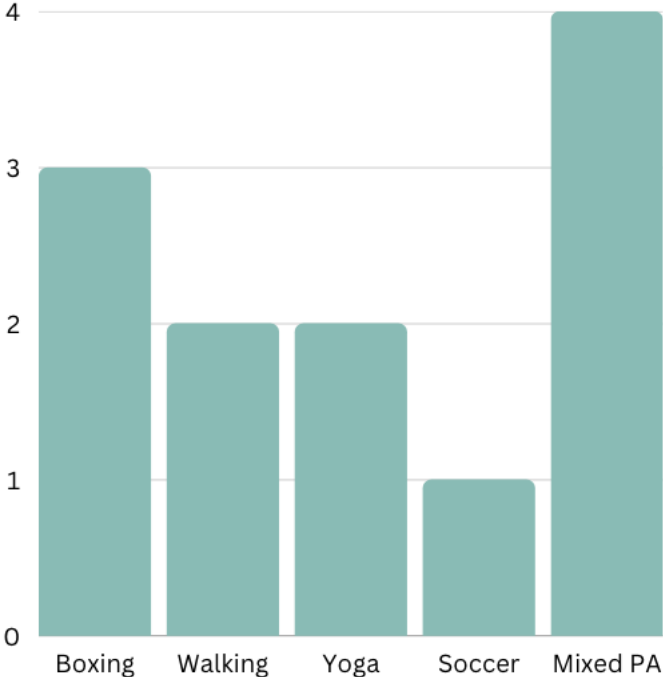
PA Interventions

The five studies used a variety of physical activity interventions including non-contact boxing (60%, n=3), dance (60%, n=3) walking (40%, n=2), hiking (40%, n=2), yoga (40%, n=2) and soccer (20%, n=1). All physical activity interventions were conducted in-person and in a group that ranged from 4 - 40 participants per session. Of the studies, 40% (n=2) employed only one type of physical activity while 60% (n=4) employed multiple types of physical activity throughout the duration of the intervention.

Most studies (80%, n=4) had physical activity interventions that lasted between 9 and 14 weeks, while a single study's (20%, n=1) intervention spanned approximately four years. The frequency of the intervention was either one time per week (80%, n=4) or two times per week (20%, n=1) and each session lasted between 45-120 minutes. If the activity required (i.e. boxing, dancing), the intervention was offered at a studio in the community (60%, n=3) however other activities were offered in middle schools (e.g. classroom, gymnasium, school grounds; 20%, n=1) or in the local neighbourhood (20%, n=1).

A variety of facilitators and professional support were present during the physical activity interventions. In all the included studies (100%, n=5) a trained researcher(s) and instructor(s)/coach(es) were present during the sessions, while some also had social workers (40%, n=2) and trauma therapists (20%, n=1) available to participants.

Additional supports were offered to participants during the physical activity interventions and commonly included healthy food and beverages (80%, n= 4) , transit tokens or other transportation (100%, n=5), childcare (60%, n=3), workout clothing and footwear (60%, n=3) and a food bank on site (20%, n=1). Furthermore, all programs had components in addition to the physical activity intervention such as check-ins and discussions on relevant topics (40%, n=2), journal writing (20%, n=1), painting (20%, n=1), grounding and visualization activates (20%, n=1), and programming that continued to be offered after the research period (40%, n=2). One study (20%) also specified that participants could access information on housing, counselling, parental, legal, and income support if they desired.



Measures of Effectiveness

Of the five articles included in this review, 40% (n=2) utilized a mixed methods approach (a combination of surveys and interviews) while 40% (n=2) used only interviews and 20% (n=1) used only surveys. All studies that employed surveys (n=3) measured mental health outcomes while 2 studies also measured social (e.g. financial stability, social support, interpersonal relationships) and physical health outcomes. Only one study (20%) utilized a scale that measured trauma directly (Trauma Symptom Checklist for Children (TSCC)). All surveys were completed before the onset of the intervention at baseline and again after its completion. Semi-structured individual interviews were conducted in 4 (80%) of the studies and had open-ended questions that focused largely on the enjoyability and effectiveness of the program while asking participants about their personal experiences with the intervention. Additionally, a single study (20%, n=1) specified that researchers asked participants how the program could better support the population of interest in the future.

Aim of Study

All studies (n = 5) sought to understand and evaluate TVIPA as an intervention in the context of women and/or gendered individuals who have experienced trauma. Specifically, two of the six papers sought to evaluate the same program, namely the Shape Your Life (SYL) non-contact boxing program based in Toronto. 80% of the articles (n = 4) were presented as experimental papers, either describing past research or in the case of one study, describing an experimental research protocol. Conversely, 20% of the articles (n = 1) chose an alternative, visual arts-based approach to illustrate the subjective experiences of the participants accessing the TVIPA services to help cope with their trauma.

Start Date / End Date of Study

One of the two SYL non-contact boxing studies described the experimental steps in their research reports, however, as the interventions remain the same, they will be considered the same for the intervention time frame. As such, 80% of the interventions (n = 4) were conducted within the years 2016-2020, with the mean duration being 3 years (± 1 year). One study described a <1-year duration pilot test, followed by a research protocol, which was not completed.

Study Funding Sources

100% of the studies (n = 5) were funded by government organizations; specifically, 40% (n = 2) by the Public Health Agency of Canada, 20% (n = 1) by the Social Sciences and Humanities Research Council of Canada, 20% (n = 1) by the Michael Smith Foundation for Health Research, and 20% (n = 1) by the Banting Research Foundation.

Population Description

Across all six studies, the age range was between 11-66, with 40% (n = 2) of studies concerning youth (ages 11-17), exclusively.

100% of studies (n = 5) included participants identifying as Canadian women, girls, and/or transgender people, who have experienced (n = 4), or who are at risk of experiencing (n = 1) abuse and/or violence.

One study focused primarily on pregnant or parenting people within five months postpartum. Another study included youth in a more general sense, thus capturing data from both girls and boys with a history/risk of trauma.

When reporting gender versus sex, 100% of studies (n = 5) utilized the word “women” when referring to self-identifying women, 20% of studies (n = 1) utilized the word “female” at least once when referring to assigned female at birth (AFAB) adult participants, and 40% (n = 2) of studies referred to their AFAB youth participants as “girls”.

Inclusion Criteria

All studies required the participants to have lived experience with trauma and/or violence, which was assumed via study-specific factors, as detailed in the How is GBV Considered/Defined section. Furthermore, all studies were limited to distinct geographical regions, hence participants had to be residents of and/or access the services/amenities of particular regions, as elaborated on in the Location section.

Though one study included data from assigned male at birth (AMAB) boy participants, all studies had to include data from women and/or gender-diverse people.

60% of studies (n = 3) required the participants to be 18 years or older, or 16 years old, if legally emancipated. The two studies (33%) about the SYL non-contact boxing program required that participants be woman-identified survivors of violence aged 18 years or older and members of the SYL program. One of the studies required the participants to be mothers and/or parenting people, including pregnant people or birthing parents within five years postpartum. 40% of studies (n = 2) required the participants to be youth, which ranged from ages 11-17.

Exclusion Criteria

Any studies without specific data on self-identifying women, girls, or gender-diverse people were excluded. Exclusion criteria differed by study objective. 20% of studies (n = 1) excluded participants who were not pregnant or within five years postpartum. 40% of studies (n = 2) excluded participants who were not youth. 20% of studies (n = 1) excluded participants who had already taken part in the pilot study. 60% of studies (n = 3) excluded non-emancipated minors, that is people under the age of 18, unless over the age of 16 and legally emancipated.

Total Number of Participants

One paper simply described a study protocol; hence it did not occur and will therefore be excluded from the participant analysis. In addition, the two SYL non-contact boxing studies described the same group of participants; as such, they will be combined for the participant analysis. Therefore, a total of three study sample groups are to be examined from the five studies. The mean number of participants across all studies was 73.33 (± 19.77), with a range of 56 to 101 participants.

Method of Recruitment of Participants

Community-based recruitment as a broad category was an essential measure for every study, however, the specific measures differed between them. The two SYL studies recruited participants via the SYL participant waiting list database, the current program list, and/or through posters at agencies and community groups designed for survivors of violence in Toronto. One of the six studies relied on both recruitment posters and snowball sampling. Both studies involving youth relied on adult guidance and/or trauma therapists to determine youth eligibility before their determined recruitment.

How is GBV Considered/Defined

One notable similarity across all of the studies is the intentional decision to not ask participants directly about their trauma/histories of violence. Prior to recruitment, each study made educated assumptions about their participants' histories based on social determinants of health and/or prior knowledge.

The two SYL non-contact boxing studies pulled their participants from two main sources, namely their program waiting list and respondents from the program advertisement posters found at services for those who have experienced GBV. As such, their participants would have self-identified as survivors of GBV due to their interest in the program and attendance at community resources of the same nature.

One of the youth studies involved guidance counsellors, who had prior knowledge of their students, within the recruitment process. Students were selected based on perceived eligibility in the study due to risk factors for violence and trauma, including home life and/or socioeconomic status (SES). Similarly, the second youth study recruited participants deemed "at-risk" due to socioeconomic status and/or built environment.

One study pulled participants from a high-risk neighbourhood, where the experience of trauma, GBV, and precarious living is experienced at disproportionately high levels. Thus, as members of the community, it was assumed that the participants would have been survivors of GBV.

Participatory Approaches (e.g., CBPR, working with community advisory board, co-developing intervention)

All of the studies utilized community-based, participatory approaches in at least one aspect of the intervention. Notably, 100% of the studies worked with agencies, programs, or stakeholders based in the community of interest, in either program advisory or development capacities.

60% of the interventions (n = 3), including both SYL studies, used community advisory boards/committees, which oversaw and evaluated the program/intervention throughout its duration. In addition, 60% of the studies (n = 3) involved current and/or past members in the development of the intervention programs.

Trauma- and Violence-Informed Approaches

In terms of facilitation professionals, social workers and/or trauma therapists were present during the delivery of every PA intervention across all studies. For 80% of interventions (n = 4),

including both SYL studies, facilitators and coaches/staff were given TVIPA, trauma, and/or LGBTQ+ community training before the commencement of the study, so that they could effectively interact with their participants.

A key facet of every program was open communication between researchers and participants. 40% of studies (n = 2) used participant feedback to inform the activities delivered as the intervention, either in the form of physical activity type or physical activity level suited for each participant. One study reported regularly sharing their findings with participants and community partners throughout the duration of the intervention. 60% of studies (n = 3) engaged in debriefing activities for the participants, either written or orally, following the intervention.

Program environment and connection were highlighted in every study, such as both SYL studies describing the boxing studio's bright, clutter-free space, which emphasize the importance of built environments on coping.

Key Outcomes

The key outcomes being explored across all studies were within the context of health, healing, and well-being. Broadly, all studies saw improvement in physical and mental health; evidence of trauma symptoms being alleviated by TVIPA. These findings were equal across all populations studied, which include pregnant or parenting women, at-risk AFAB youth and adolescents, and women or gendered people, who have experienced trauma.

60% of studies (n = 3) observed that social support was improved among participants, who are at risk of experiencing social isolation. One study, namely one of the SYL studies, also cited improvements in indicators such as quality of life, personal and interpersonal agency, resilience, and self-esteem.

It is of note that one study was designed as a protocol only, hence its key outcomes were suggested, and not directly measured. In addition, one study is still too early in its stages to form significant conclusions, though the preliminary results are promising and are in line with the findings from other studies.

Specific Recommendations

40% of studies (n=2) emphasized the importance of population context within the development and facilitation of TVIPA programs, with one study suggesting the implementation of such programs in a wider, more diverse range of community contexts.

According to two studies, TVIPA programs should expand the types of physical activity delivered within these contexts to accommodate the various abilities, needs, and preferences of their participants. By diversifying the types of physical activity delivered, one study suggested that the spread of participants who would be interested and able to participate in such programs would grow.

40% of studies (n = 2) suggested the great potential of TVIPA as a complement to traditional trauma therapies (e.g., talk therapy).

One arts-based study on the SYL non-contact boxing program demonstrated an alternative model of knowledge dissemination, which may resonate more deeply with the viewers and participants. Therefore, offering a possible avenue for conducting and presenting future TVIPA research.

IMPLICATIONS

Trauma- and violence- informed approaches to physical activity and mental health

Traumatic experiences, such as GBV, are linked to an increased likelihood of later mental health diagnoses such as PTSD, anxiety disorders, depression⁹⁷, schizophrenia and/or bipolar disorder.⁹⁸⁻¹⁰⁰ There is also an association between participation in regular physical activity and positive mental health outcomes.^{8,80,92-95} Despite these understandings, there has been limited research conducted on the relationship between TVIPA interventions and mental health outcomes. Aforementioned, TVIPA programming aims to foster a safe and supportive environment by implementing four key tenets: 1) trauma awareness, 2) choice and collaboration, 3) safety and 4) a strengths based and capacity building approach.⁹⁶ Scholars have recently called for a better understanding of how TVIPA approaches could be used to improve physical activity opportunities and programming, and subsequently physical and mental health outcomes, for individuals who have experienced GBV.^{65,81,81,96}

Some studies included in this review addressed this research gap by measuring mental health related outcomes before, during and after the implementation of TVIPA programming including anxiety levels¹⁰¹, self-compassion¹⁰² self-esteem, and resilience.¹⁰³ Lampum et al.¹⁰⁴ found that youth who participated in a 10-week trauma-informed dance intervention experienced improved symptoms of anxiety and depression. Similarly, Gammage et al.¹⁰³ found that after the implementation of a 14-week TVI boxing program, participants experienced statistically significant improvements in mental health (as measured by the Short-Form General Health Survey¹⁰⁵, self-esteem, resilience and agency. This is novel research in the Canadian context, however the findings are consistent with comparable studies that have been conducted in other countries. Researchers in rural Montana, U.S.A, implemented a virtual trauma-informed yoga intervention for adolescents and found that participants in the experimental group experienced reduced levels of anxiety and depression after the intervention, compared to the control group.¹⁰⁷ Additionally, the study found that participants in the treatment had significantly lower levels of cortisol, a biological indicator of stress, compared to the control group post-intervention.¹⁰⁷

A wide variety of physical activity types were implemented in the included studies such as walking, dancing, and boxing. However, future studies should consider physical activity type in the TVI context in an effort to better understand whether the mechanisms connecting TVIPA approaches and positive mental health outcomes are social, physiological, and/or psychological in nature. Considerations could include both the biomechanical features of the physical activity (i.e. anaerobic versus aerobic exercise, strength versus cardio etc.) and the components of the program delivery (self-led versus instructor led, outdoor versus indoor setting, individual versus team physical activity activities etc.) Ultimately, more research is

needed to better understand the relationship between TVIPA approaches and mental health outcomes, especially amongst equity-owed groups.

Gaps in studying the effects of physical activity on mental health outcomes in equity-owed populations

The positive effects of PA on mental health are well-documented, however, the current scope of the literature fails to capture data on equity-owed populations. For instance, women and gender-diverse people who identify as mothers, pregnant or postpartum parents, members of the disabled community, 2SLGBTQIA+, immigrants, Indigenous (First Nations, Inuit, or Métis), and/or adolescents; demographics with statistically higher rates of GBV, discrimination, and isolation.⁶⁶ As such, the lived experiences of those experiencing marginalization are different from those of the captured sample groups; hence, the currently documented mental health outcomes of PA may not be generalizable. Similarly, the recommended physical activities/interventions for mental health may not be accessible for all, as unique financial, cultural, geographical, and systemic barriers have been shown to exclude these underrepresented populations from participating.⁸²⁻⁸⁵

The capacity to adapt and conform to the unique needs of a community are values which the TVIPA approach firmly grounds itself in, and which require thorough pre-investigation and planning.⁸¹ Hence, the lack of programming and support is a direct reflection of the gap in evidence- and community-based research on PA and mental health for equity-owed populations in Canada.

COVID-19 and the Increased Need for TVIPA

The COVID-19 pandemic, which led to dozens of nationwide and provincewide lockdowns in Canada, has exacerbated pre-existing issues relating to GBV.⁸⁶ This, as a multicausal problem, was heavily driven by mass trauma coupled with increased rates of isolation and closures of supportive services.^{86,87}

Inability to cope with the unforeseen levels of stress and isolation was a major factor in the increased substance abuse rates (e.g. alcoholism) during this time.¹⁰⁷ These substance abuse rates, which, in addition to more time isolated at home, have contributed to the epidemic of family violence (FV), intimate partner violence (IPV), and domestic violence (DV), issues which disproportionately target women and gender-diverse people.^{69,108,109} Furthermore, with in-person, lower-wage jobs being unable to shift to an online environment, sources of stress such as reduced income, unemployment, precarious employment, and difficulty accessing childcare hit low-SES populations the hardest.¹⁰⁹ In addition, pre-existing comorbidities associated with lifestyle and social determinants of health (e.g. poverty, crowded housing) made low-SES populations more vulnerable to contracting COVID-19 and being hospitalized due to serious infection.¹⁰⁹

The Canadian government responded to the closures of in-person coping tools and non-essential services by increasing public health messaging surrounding the benefits of PA and time spent outdoors (Moore). However, these recommendations, with the hope of improving Canadians' physical and mental health, were not successful for everyone (Moore). Accessing green space and/or safe outdoor areas for exercise was challenging in many urban, densely

populated, and low-income residential communities, an issue which existed pre-COVID and has grown in awareness during this time (Heredia). Exercise and time spent outdoors have been shown to have significant positive impacts on the health and wellness of people of all ages, especially in regards to stress relief and depression (Moore). Hence, the lack of accessibility to PA and outdoor space is a direct obstacle to the well-being of equity-owned communities and has contributed to the challenges of coping experienced by these groups during the pandemic.⁸⁷

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Moving Forward: Conclusions and Recommendations

Positive mental health outcomes associated with physical activity may benefit survivors of GBV who are at a higher risk of isolation, PTSD, depression, and anxiety.

There is potential for survivors to build confidence, reclaim bodily autonomy, and connect with fellow survivors through physical activity and create supportive communities.

The development of TVIPA programming may create accessible programs for survivors of GBV and/or other equity-owned community members including those who experience discrimination, stigma, low socioeconomic status (SES), and PTSD.

Community-based, participatory, and trauma-informed approaches are particularly impactful for conducting physical activity research/implementing programming for those who have experienced trauma.

Increased federal, provincial, and municipal funding and support for novel GBV and physical activity research, including: (1) conducting a randomized-control trials (RCT) for population-relevant data, (2) discovering innovative ways of conducting RCTs, or similar research models, utilizing a trauma- and violence-informed lens.

Exploring the Use of Geographic Methods to Understand Sexual- and Gender-based Violence: A Scoping Review

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BACKGROUND: THE ISSUE

Spatial Analysis of Geographic Patterns of SGBV

While individual and relational factors have been historically referenced to identify SGBV risk factors¹¹²⁻¹¹³, spatial epidemiology and use of geographic methods are being increasingly recognized as legitimate tools to better understand the contextual elements related to heightened SGBV vulnerability.¹¹³⁻¹¹⁵ The innovative use of GIS, which stores, analyses, and visualises geocoded data using points, lines, or areas, or reference features⁹⁰ has the potential to 'map community patterns of [SGBV], researchers, practitioners, and policymakers can collaborate to strengthen community efforts to prevent and respond to [SGBV]'.^{116, p.5} Specifically, GIS may be especially beneficial to identify areas with high SGBV prevalence to inform tailored SGBV prevention and response programs, conduct proximity analysis from an incident to perpetrator and/or victims homes to model and predict relevant factors, and spatially assess needs-based service availability/delivery gaps. In the context of spatial distributions of SGBV, findings from a significant body of research have indicated associations between built environments and violence against women perpetrated in public domains, with higher levels of assault being associated with underdeveloped infrastructure (e.g., vacant fields, buildings, and public streets)¹¹⁷, narrow paths and restricted pedestrian mobility¹¹⁵ and construction sites, parks, and spaces with poor lighting or physical barricades.¹¹⁸ Further, data visualization and mapping of SGBV incidence has been used as an important tool to model contextual risk factors and vulnerabilities across geographic regions, particularly when household socioeconomic and demographic variables can be aggregated at the neighbourhood level.

Current spatial modelling practice for SGBV aim to visualise population- and community-specific features (i.e. we are able to recognize where they live, thrive, where their violence occurs, and if these features differ), identify features of the surroundings that may influence the occurrence of violence (i.e. public vs private, the built environment), and capture temporal changes that may be affecting a potentially migratory or season dependant population (i.e. the implementation of spatio-temporal analysis). As the momentum for spatial frameworks of SGBV builds in the research space, there is a critical opportunity to understand the context, capacity, and methodological approaches to identify key research

gaps and inform future research practice for more inclusive and community-specific SGBV research.

Objectives

Systematically explore available academic literature employing geographic methods to understand patterns of SGBV. Specifically, this scoping review aims to synthesize:

1. the context in which **spatial approaches** are being used to understand SGBV (i.e. objectives)
2. the **study characteristics**
3. the respective **methods and data sources** used.

While specific analysis was performed for studies in the Canadian context (results presented below), an initial search of the literature indicated very limited studies in Canada. Further, because this study was focused on research parameters (i.e. objectives, methods, and data sources), we felt a global context would be appropriate and enhance the impact of the study.

METHODS

Search Strategy

Aligning with Arksey and O'Malley's methodological framework²⁸ and the aforementioned review question, we developed two key lists of relevant search terms related to 1) sexual- and gender-based violence, and 2) geographic methods of inquiry. To ensure the contribution of this work would be novel, a preliminary, limited search of PubMed, PsycINFO, and Scopus was undertaken to identify current or underway systematic reviews or scoping reviews on the given topic. Following a consultation with a Health Sciences Librarian at Carleton University and review expert, we developed key search strings used to systematically search a total of six databases: Gender Studies, PsychINFO, Scopus, PudMed, Cochrane, and Campbell. Across all databases, Boolean operators were used to broaden our search such that it captured all studies falling within our inclusion criteria.

Screening

Once all searches were complete, all identified citations were collated in Zotero Reference Manager and then uploaded in RIS format to *Covidence*, an online systematic review management software offered by Cochrane (Covidence). Covidence allows for initial deduplication to account for similarities across databases.

Screening was completed by two authors (MSP and TM) and included two phases, title-abstract screening and full-text screening. All conflicts were discussed between both authors until a unanimous decision was made. The title-abstract screening was guided by the following questions: 1) Is this study about SGBV? 2) Does this study employ a spatial approach

to examining SGBV? If both questions were answered 'yes', articles were moved to full-text screening phase.

Studies were considered eligible if they: (1) employed spatial analysis techniques to understand patterns of SGBV; (2) were conducted with adults and/or adolescents (>12 years of age) populations. Studies were excluded if they were: (1) grey literature, documents published in non-English languages, theses, protocols, conceptual papers, policy documents, editorials, abstracts; (2) non-peer reviewed publications; (3) evaluating child maltreatment/abuse or community violence (e.g. gun violence, gang violence, etc.); and (4) only assessing non-physical neighbourhood characteristics (i.e. exclusively neighbourhood-level factors being assessed).

Secondary screening methods were also used to ensure no available articles meeting the inclusion criteria were missed. Indeed, once the initial full-text screening was complete, we conducted a title-level screening of all bibliographies. Additionally, any review articles (e.g. scoping reviews, systematic reviews, meta-analyses) were screened for respective articles that potentially met our full-text criteria.

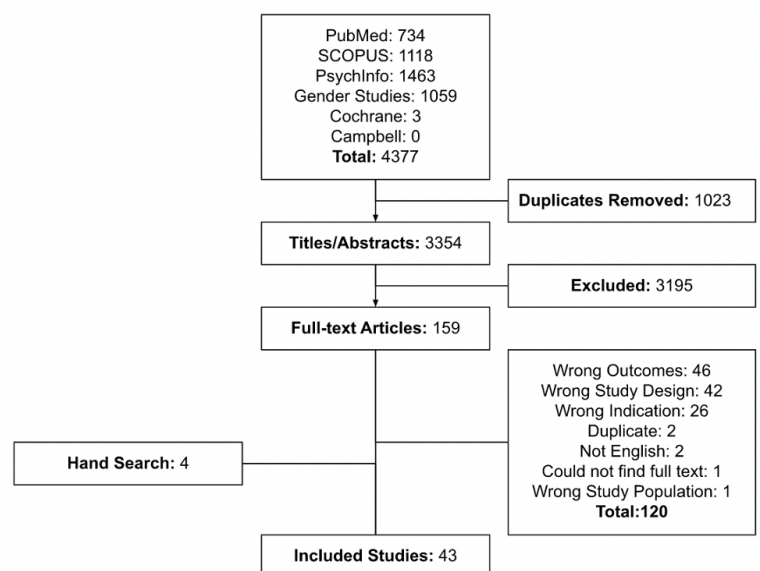
Data Extraction

To conduct data extraction, the Covidence Data Extraction sheet was adapted such that the charted elements from each included study best reflected the objectives of the scoping review. Specifically, extraction data included: author names, title, year of publication, study location, study characteristics, study methods, study objectives, interventions, spatial analysis techniques, spatial features explored, spatial setting, type of violence, outcomes, participant characteristics, recruitment method/data source, baseline characteristics collected. MSP and TM independently extracted data from all studies following full-text review to ensure validity and optimise the inclusion of all relevant details. Any disagreements or inconsistencies were collectively resolved and all data was finalised for descriptive analysis.

RESULTS

Search

Based on the initial search, we extracted 4377 articles across six databases. Following de-duplication, 1023 articles were removed, leaving 3354 to undergo title-abstract screening. Title-abstract screening was completed by two authors following a pilot screen that yielded a 100.0% level of agreement, with a kappa score of 1.00. The kappa score is a statistical metric used to assess inter-rater reliability (McHugh, 2012); in the case of scoping reviews, it can signify whether the criterion for screening is well-understood



across screeners. F-T screening eliminated 159 articles, leaving 39 remaining (Figure 1). Secondary screening methods (e.g. reference screening) results in 7 additional studies, resulting in a total of 46 articles for data extraction and analysis. Importantly, while 46 articles met criteria, two of these were reporting on the same study; as such, a total of 44 studies were included in the final data analysis phase.

Study Parameters

Study Dates

Considering study dates, the vast majority (n = 36, 81.8%) were completed in the last decades (i.e. 2013 and later), while the last two years (i.e. 2021 and 2022) produced a quarter of all studies (n = 11, 25.0%). Importantly, while the earliest studies (n = 2, 4.9%) were completed in 2006, earlier data was used in many studies. Specifically, half of studies (n = 22, 50.0%) used data from greater than five years before the study completion date. A notable number of studies (n = 17, 38.6%) included data that spanned over five years or more, while five studies (n = 5, 11.4%) included data across ten years or more.

Study Objectives

The overwhelming majority of studies (n = 38, 86.3%) aimed to understand spatial and contextual patterns of [SGBV]. Of these, five studies (11.3%) aimed to identify patterns by leveraging perpetrator perspectives, while 27 (61.3%) depend on data related to victims. Further, six studies (13.6%) aimed to understand if SA services are in the best location for those that need it, and one aimed to develop a web GIS-based application to identify unsafe areas for women.

Study Characteristics

Location of Study

Studies included in this review were predominantly situated in the United States (n = 20, 46.5%). Four studies (9.3%) were located in Mexico, three (6.9%) in Canada, three (6.9%) in Sweden, three (6.9%) in India, two (6.8%) in Spain, two (4.7%) in New Zealand, two (4.7%) based in Brazil, one (2.3%) in the UK, one (2.3%) in Uganda, and one (2.3%) in South Africa.

The studies included in this review were predominantly situated in the United States (n = 20, 45.4%). Otherwise, there was some notable geographic spread, with five studies (11.4%) located in Mexico, three (6.8%) in Canada, three (6.8%) in Sweden, three (6.8%) in India, three

Canadian Context



Studies in the Canadian context represented ~7% of included studies (n = 3)

Studies took place in **Ottawa, Ontario and the Gatineau Region of Québec, Vancouver, British Columbia, and Québec** (province-level analysis).



Two studies focused on **sexual violence**, while the third covered sexual and physical assault

Two studies used **hospital/clinical** patient records, and one used both **police data** and **semi-structured interviews**



Geolocation was used in all studies, and **spatiotemporal** analysis (e.g. time of day/week) were employed in two studies

(6.8%) in Spain, two (4.5%) in New Zealand, two (4.5%) based in Brazil, one (2.2%) in the UK, one (2.2%) in Uganda, and one (2.2%) in South Africa.

Participant Descriptors

When considering the relationship to SGBV, over half (n = 23, 51.2%) presented some form of descriptive variables of the study participants (i.e. outside of neighbourhood-level descriptors). Of these, participants included victims and/or survivors of some form of SGBV (n = 18, 78.3%) exclusively perpetrators (n = 3, 13.0%), and both victims and perpetrators in the same study (n = 3, 13.0%). Of the five studies examining perpetrator demographics, the majority (n = 3, 60.0%) only included those considered serial sexual offenders, operationally defined across studies as an offender who has committed two or more SAs or sex-related crimes. Further, four of all included studies (9.1%) relied on data from national surveys that specifically collected information on participant experiences with IPV, whereby individuals participating consented to SGBV-related data being analysed for research purposes.

21 studies did not include descriptors specific to SGBV participants. 9 studies (20.5%) used area descriptors (e.g. census data, district-level data, national multi-wave survey data) to conduct a broader analysis on neighbourhood-level factors, but did not present study participant descriptors specific to incidence of SGBV. Three studies employed analysis on non-human variables, such that demographics were not included; specifically, these included a study leveraging GIS to develop a 'safest path' app, and two studies assessing respective proximities healthcare/SGBV resources. The remaining studies (n = 8, 18.2%) worked with human subjects, but did not collect or incorporate demographics into analysis.

Sociodemographic characteristics.

A breadth of sociodemographic descriptors were included across studies, such as age, ethnicity, race, relationship between perpetrator and victim, nature of the assault, sex, gender, household make-up, education, income/housing status, etc.; of the studies that included participant descriptors (n = 23, 52.3%), age (n = 13, 56.5%) was the most commonly presented sociodemographic factor. Most studies focused on women or female victims (n = 19, 43.2%). One study (2.3%) looked exclusively at female perpetrators and male victims and seven studies (15.9%) explicitly reported being mixed-sex/gender victims.

Sexual- and Gender-based Violence.

Over half of the studies identified incidences of SA or rape (n = 23, 52.3%), followed by intimate partner violence or domestic violence (DV) (n = 19, 43.2%), physical assault (n = 14, 31.8%), and femicide/homicide (n = 14, 31.8%). Notably, almost all studies examining femicide or homicide were focused on intimate partner deaths (n = 12, 85.7%).

Spatial Characteristics

Settings.

The geographic area of focus varied widely, including municipalities (n = 28, 63.6%), regions or counties (n = 3, 6.8%), states or provinces (n = 6, 13.6%), and pan-national (n = 7, 15.9%). Relatedly, studies honed-in on a variety of settlement types (i.e. rural, urban, suburban). Most studies were situated in an urban setting (n = 29, 65.9%), while six studies (13.6%) focused on rural communities or conducted rural-specific analysis, two studies (4.9%) included suburban areas, and 13 (31.7%) did not include interpretation of settlement-specific analysis.

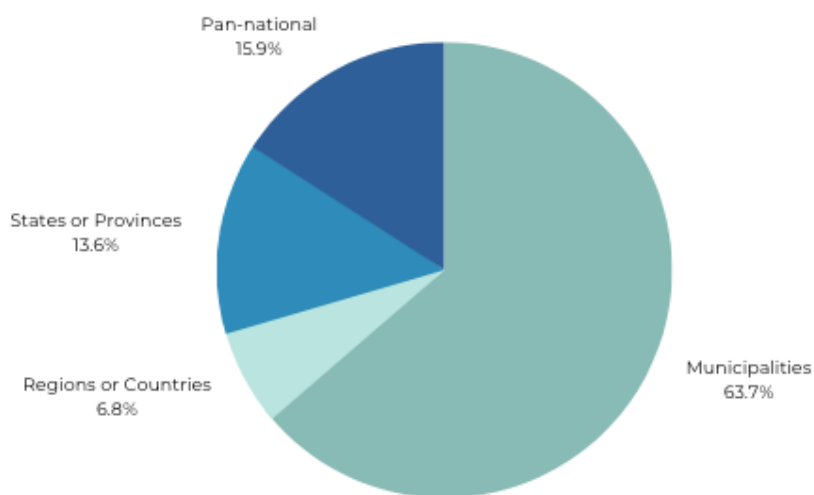
Approaches.

GIS represented the most frequently used spatial analysis tool (n = 33, 75.0%), with employment ranging in nature, from hotspot analysis, to service availability visualization, to app development. Spatiotemporal and other space-time models were used in 31.8% of studies (n = 14); of these, six studies collected temporal-specific variables such as time of day, day of the week, and month of the year. Further, 20.9% of studies (n = 9) used proximity analysis; specifically, four studies focused on the proximity to neighbourhood features, three measured distance to healthcare/SGBV-related services, and two analysed distances from perpetrator and/or victims home to the location of violence or site of arrest, respectively. A quarter of studies (n = 11, 25.0%) employed hot spot analysis, while five (11.4%) conducted density analyses.

Features.

The majority of studies (n = 30, 68.2%) identified and analysed the locations of the violent incident. Of the 17 studies (38.6%) that focused exclusively on locations of violence, analysis was restricted to SGBV occurrence in a given geographic boundary. Further, 16 studies (36.3%) considered the *presence* of neighbourhood features in their spatial analysis. Specifically, this included five studies (11.3%) that measured the presence of physical disorder as a non-human spatial variable in the context of understanding patterns of SGBV in an urban environment, and 11 studies (25.0%) that assessed the presence of 'risky' spaces/places in the area of interest, such as alcohol outlets (n = 7), educational institutions (n = 1), forested areas (n = 2), and public transit environments and features surrounding metro train in systems in the context of SGBV (n = 4). Specific to support services, six studies (13.6%) reported the location of healthcare services in relation to incidence of SGBV, including 'specialised service types' for survivors of SGBV (n = 4) and hospitals (n = 2).

Settlement Types across Studies



Methods Employed

Data Sources

'Institutional data' (i.e. data from corrections/police departments or healthcare facilities) accounted for the majority of SGBV data sources (n = 30, 68.2%). Indeed, 61.4% (n = 27) of studies used some form of corrections or police data; of these, the majority (n = 24, 88.9) were police reports, one was based on emergency phone calls, one included cases associated with legal protection orders, and one based on medical examiner reports. Two studies supplemented police data with information from a state-specific coalition against DV. Three studies used hospital reports of rape, IPV, or violent trauma suspected to be SGBV to emergency departments. Of the 12 studies that did not depend on institutionalised data, three relied on newspapers and online articles to identify potential cases of SGBV, four used specific SGBV data from multi-wave national surveys, three sourced SGBV data through community-based recruitment, two considered SGBV data in relation to nearby resources/healthcare centres (i.e. publicly available service location data), and one pulled #metoo data from twitter.

Data Collection & Analysis

Most studies relied on quantitative data for analysis of SGBV (n = 37, 84.1%), which involved district- and institution-specific data access protocols; specifically, 31 studies (70.5%) exclusively used quantitative analysis, while five studies took a mixed-methods approach. Indeed, eight studies (18.2%), employed qualitative data collection methods; of these studies, only two relied solely on a qualitative approach. Further, seven studies (15.9%) qualitatively reviewed and coded respective written data sources; specifically, four studies (9.1%) reviewed the details of police records, phone calls, or hospital records to assess if the reported incident would be included in their study analysis. Similarly, three studies (6.8%) qualitatively screened through newspapers or other online resources to identify potential cases of violence based on the reported details in the article. Four studies (9.1%) conducted interviews with participants. Specifically, two studies (4.5%) interviewed perpetrators of SAs to collect information like the perpetrators motivation to conduct the crime and their planning process, while two studies (4.5%) interviewed victims of SA survivors and staff members in a hospital setting. Finally, 3 studies (6.8%) employed participatory or 'sketch' mapping, whereby participants were engaged in drawing or manually marking areas considered unsafe or associated with high levels of violence from a community-level perspective. One of these studies paired participatory mapping and other qualitative methods such as focus groups and skit acting; one used participatory mapping processes to systematically identify hotspots of dating violence in a school setting, and the final study used it in conjunction with GIS and quantitative data analysis.

Participant involvement in this review was limited, with 81.8% (n = 36) of studies employing some method of indirect data collection. Specifically, 68.1% studies (n = 30) exclusively used data sets considered to be 'non-human' data sources accessed through records of public media sources (i.e. via government or institutional bodies, newspapers, social media). Three studies (6.8%) relied on partnerships with hospitals to collect data on suspected SGBV cases but did not have any interaction with the participants themselves. Four studies (9.1%)

reached out to respondents to respective national surveys to use SGBV-related responses, but participant involvement was limited to consent procedures and data collection remained indirect/retrospective. Of the studies relying on participant involvement for data collection, three studies (6.8%) partnered with public schools to conduct research; three (6.8%) used community recruitment methods, whereby data was collected directly from participants, and two studies (4.5%) were recruited through partnerships with corrections/police departments.

IMPLICATIONS

Through a systematic search and analysis of the available academic literature, this research sought to explore (1) the avenues in which spatial approaches are being used to understand SGBV (i.e. objectives), (2) the study characteristics, and (3) the respective methods and data sources employed. In doing so, key patterns, gaps, and opportunities for future research have emerged.

Study Parameters

There is clear momentum with the use of spatial approaches to understand trends in SGBV. This is consistent with trends in the use of GIS and spatial approaches applied in public health domains, which begun with a focus on disease surveillance and risk analysis in the late 20th century and steadily gained traction with community health profiling, health promotion, and health access and planning.^{119,120} The notable gap between data set timeframes and study completion dates reveal some important limitations, such as relying on institutional (i.e. government, hospital, police) data sources. While some studies were published after the COVID-19 pandemic (i.e. later than 2020), none employed data collected during or after this time; importantly, this is likely a reflection of the data collection challenges imposed during the pandemic, as well as off-cycle SGBV data collection. As new cycles of study data are released, spatial approaches may be even more critical to examine how global crises, impact rates of SGBV across regions as well as access to support services. Spatial approaches may be a feasible and impactful way to assess the magnitude of space-time trends of SGBV attributed to pandemic-related public health measures. Given the inevitable time lapses between institutionalised data collection and release, exploring alternative ways to fill these data gaps may be particularly important for timely responses to SGBV crises on a community-, region-, national-, or in the case of COVID-19, global-level.

Study Objectives

As reflected by the objectives in the majority of studies, using locational information of SGBV incidents can be a critical mechanism for visualising spatial distribution of SGBV. Geographic occurrences of SGBV cases, most commonly captured by ambulance geolocation¹²¹ or police data¹²², can encompass critical locational information for emergency response teams¹¹⁴ and identify highly affected neighbourhoods. When considering the location of an incident, the reporting of public and private spaces is an important distinction. Within private domains, the relative distance between the home of the survivor and the location of the incident may be of particular interest. Muldoon and colleagues¹¹⁴ reported that 'community-based stakeholders found residential information to be the most informative as it is survivor-

focused and brings attention to neighbourhoods that may be experiencing heightened levels of violence but are not identifiable through crime and urgent care sources.' (p.8826).

Considering risk of SGBV in public domains, several studies took a two-fold approach, considering density of SGBV incidence in conjunction with density and/or proximity to spatial features. This approach highlights how key contextual elements and geographic patterns can be associated with increased risk of SGBV, such as the density of entertainment districts or alcohol outlets, green space or forested areas, commercial parking lots, and public transit systems; however, in doing so, it is important to uncertainties in terms of directionality and potential confounding neighbourhood factors. Interestingly, in a study by Taylor et al.¹²³ examining dating violence in New York City, location-based analysis was considered in a setting-specific environment. Specifically, this study used interviews and participatory mapping exercises with a cohort of adolescent girls to identify hot spots of problematic areas in 30 different Middle Schools, which were subsequently leveraged to address dating violence through tailored, built environment-related intervention. Drawing on the popularly employed social disorganisation theory, public disorder is commonly leveraged as a mechanism to evaluate ecological risk factors such as concentrated disadvantage,¹²⁴⁻¹²⁶ translating to environmental factors like graffiti, vacant or abandoned houses, vandalised or run-down buildings, presence of trash, and vacant parking lots¹²⁵. Of note, Royo and colleagues¹¹⁵ followed-up their heat map analysis with site visits, using observational methods to identify potentially risky aspects of the built environment in high-incidence areas. Research analysing trends of SGBV in relation to structural and compositional neighbourhood-level indicators may be critical to inform upstream SGBV prevention efforts when considering municipal planning, built environment, and patterns of urbanisation.^{114-115,117}

While the locational studies are an excellent way to gain neighbourhood-specific information on incidence and risk, they can also be leveraged to generate innovative strategies to address SGBV. Of importance, GIS and spatial analysis may be a feasible and impactful complement to the traditional community safety audits, understood as a participatory tool that uses visual observation to identify community-specific SGBV risks, response and prevention mechanisms, and relevant service gaps for SGBV survivors. Used in conjunction, strategies for risk mitigation can be space- and community-specific by combining mixed-method incidence and neighbourhood feature data.

The use of GIS is becoming an increasingly popular tool to understand service access in public health domains.¹²⁷ Approaches vary widely, including but not limited to analysing proximity (e.g. driving time, physical [cartesian] distance) between user homes to respective service points, modelling clinic and/or hospital deprivation scores¹²⁷, weighted evaluation of health service usage and/or availability (e.g. sociodemographic considerations), relocation to specialised services (e.g. shelters) as a process of forced migration⁹⁰ and transportation-based accessibility.¹²⁸ For survivors of SGBV, experiences of victim-blaming and stigmatization are the primary documented barrier to accessing care, resulting in low service utilization, undocumented cases, and untreated injury.¹²⁹ In contrast, the provision of 'specialised' SGBV services, which have deep roots in grassroots women's health organisations¹³⁰⁻¹³¹, promotes service utilisation by culturally situated models of care. Thus, indicators for a diversity of service types may be of particular importance when considering density of services in an

area; for example, while a local authority may be considered a 'hotspot' for hospitals or clinics, there may be a gap in availability of specialised SGBV services, such as shelters. With this said, the significant risk associated with using GIS and spatial approaches to identify service-related trends should not go unacknowledged. Unlike geolocating other healthcare services for visualisation and spatial analysis, releasing locational information of SGBV services may pose a serious risk to those accessing anonymous support. Anonymity, security, and confidentiality are central to the provision of SGBV services, with victims often seeking services under precarious and unsafe conditions, making the exposure of safe spaces a mechanism for further harm to the individual, others accessing the service, and service providers. Further, feminist geographers assert the robust and historical politicisation and power struggle of spaces related to female sexual and reproductive health and safety, such as abortion clinics, women's shelters, and hospitals^{132,133}; in turn, we must recognize and carefully navigate a risk-benefit approach in the ways in which we use information related to these spaces and those who access them.¹³⁴ In the context of spatial research, this translates to best and safest practice when geovisualization services are available. Precautionary geovisualization strategies for sensitive data can be taken through smoothed service density surfaces, data transformation techniques (i.e. shifted or 'detangled' maps that transform precision), or through small area centroid analysis. In the case of developing and presenting data secure maps, one promising method to keep pathing information sensitive to confidential information is to use the closest block centroid of the starting and ending points.¹³⁵ In the case of SGBV service access, paths can be presented using these approximate locations without specific housing/shelter locations being revealed.

Several studies relied on perpetrator perspectives to understand SGBV risk factors- while research funding and support with this population might be controversial, it has been highlighted as a promising avenue for prevention.¹³⁶ In an effort to visualise 'specialised' services, Coy and colleagues⁹⁰ included perpetrator programs in their analysis of service availability and access. Dovetailing spatial research on SGBV with that surrounding toxic masculine spaces, access to prevention or therapy programs, and considerations of neighbourhood demographics (e.g. criminological variables, neighbourhood-level access to education, social supports, and gendered programming¹³⁷) may paint a more holistic picture of opportunities for SGBV prevention and policy.

Study Settings

The majority of studies were focused on urban and/or suburban areas, which may in part align with research focused on neighbourhood-level influences of SGBV.^{112-113,116} While census data is often used to provide richer context for community-level influences of SGBV¹¹²⁻¹¹³ the concept of a 'neighbourhood' may hold less value in a rural context (Rine et al 2012). While rural settings are still understudied, this review validates the body of research is questioning rural-specific links between place-related contextual factors, SGBV risk, service availability, and/or the ability to flee violent situations in rural settings.^{112,132,137} Those living in rural and remote areas may face a myriad of individual-, community-, and system-level barriers to safety, such as lack of safe and affordable transportation options, limited childcare services, ties to the home and community, limited access to phone and internet, barriers to maintaining the confidentiality of reports of abuse (e.g. personal relationships with police,

doctors, judges, etc.), and social, cultural, and psychological isolation, economic dependence, acceptance/availability of firearms, and an overall scarcity of support services.^{138,139} Of importance, there are notable limitations with data collection in rural and remote areas, starting with the recognition that data collection tools and methods have been historically designed with and for urban or suburban populations.¹⁴⁰ Alongside questions about validity and reliability of data collection procedures in a rural setting,¹⁴¹ other significant caveats for rural GIS include ambiguous, unidentified, or the employment of crude urban versus rural dichotomies for statistical measures of rurality¹⁴², supports/resources not being tied to known geographic coordinates, environmental obstacles such as weather, infrastructure, internet/connectivity bandwidth¹⁴³, locating appropriate target groups, and diverse cultural considerations.¹⁴²

While GIS analysis most commonly relies on large data sets, community-based recruitment methods may be particularly conducive and feasible in rural communities. This is demonstrated by Ohurira and colleagues¹⁴⁴, whereby a two-stage community cluster analysis was conducted to gather a representative sample of villages in rural southwestern Uganda. In this study, approximately 50 individuals in each village were approached, asked about their experience regarding IPV, alcohol in their family and alcohol selling in the area. This included identifying the individuals who sell alcohol, the types of alcohol being produced, and the observed consumers of the alcohol. Indeed, in caveat-heavy data collection contexts such as rural settings, complementing GIS analysis with qualitative and/or community-based methods is a promising methodology to for triangulating varying forms of evidence, recruitment, and analysis.¹⁴⁵

Participant Descriptions

Participant descriptions, for both the perpetrators and the victims, are a critical component of developing in depth understanding of community-specific risk factors of SGBV. Only half of the papers reviewed presented sociodemographic information on the specific participants, and for those that do present the information, it remains limited. A large number of studies took a neighbourhood-level approach, incorporating national, district, or census-level data to make assertions about community-level influences such as socioeconomic indices, unemployment, race/ethnicity, educational levels, female- or male-headed households, physical disorder, concentrated disadvantage, and crime.

Conceptual frameworks like social disorganisation theory and social are popular grounders for studies evaluating community- and neighbourhood-level influences on SGBV; however, they may construct a falsely linear or causative narrative in terms of neighbourhood-level influences on SGBV.¹¹⁶ Further, while the use of census (or equivalent) data is widely used to make inferences about neighbourhood-level influences on SGBV, participant-specific socio-demographic data can enhance our understanding of community-specific risk for SGBV. Recognizing the mixed findings on neighbourhood effects on SGBV ^{112-113,146}, the use of an intersectional approach to conduct spatial analysis (e.g. GIS) holds promise for recognizing intersecting macro- and micro-level variables having systemic influence on rates of SGBV.¹¹⁶

Moving forward, there should be a push to develop trauma-informed avenues for collecting demographic data and conducting intersectional GIS, a practice that prioritises trauma

awareness and understanding, safety and trust, choice and collaboration, and a strengths-based approach in service provision.¹⁴⁷ This further highlights the importance of engaging in collaborative research partnerships with SGBV service providers to design community-tailored responses.

Data Collection and Sources

SGBV is a complex research area, with a myriad of structural inequities driving the potential exclusion of community members from research endeavours.¹⁴⁸ Cited reasons for this include being socially isolated, disenfranchisement and risk for greater harm through the disclosure of their experience, and a lack of labelling of their experience as abuse.^{149,150} Given the globally ubiquitous incidence of SGBV, cultural, sociopolitical, and geographic considerations are imperative when considering limitations for population-specific data collection and analysis. Structural and systemic differences may limit the applicability, representation and/or accuracy of large-scale surveys or datasets. One factor to consider are diverse cultural understandings and/or acceptance of SGBV and the impact on reporting. Wani et al¹⁵¹ provides a critical example of the importance of conducting a spatio-temporal analysis of braid chopping in Kashmir Valley, India. This may not be reported as SGBV in other parts of the world, yet, given the significance of women's braids in Indian culture and the parallel timing of this analysis with increased rapes and SAs in the area, it demonstrates the importance of considering both regionally- and culturally-specific acts of gendered violence. The notion extends to community-specific reporting trends in the Global North, with Williams and colleagues¹⁵² explicitly stating that the 'Miami-Dade patchwork of incorporated cities and cultural variation in IPV reporting are logistical challenges, but this approach presents a significant opportunity to identify and target underserved areas for IPV screening and capacity building' (p 1666). Taken together, while multilateral organisations, institutions, and researchers move toward broader definitions of SGBV (e.g. acts of violence encapsulating emotional, religious, verbal, financial, and psychological abuse), it is important to recognize how the notion of accounting for community-specific definitions of SGBV can simultaneously translate into more narrow understandings of what is considered SGBV. Specifically, in many sociocultural, political, and geographic contexts, SGBV may be understood primarily as acts of violence perpetrated physically (i.e. sexual, verbal, and or/physical abuse), which may be reflected in reporting (and thus, research data sources) despite institutional acceptance of more all-encompassing definitions.

SGBV data collection methods are deeply challenged by other structural barriers, such as police corruption/mistrust in authority, systemic racism and discrimination in healthcare systems, SGBV-related stigma engrained in support services, and inadequate community outreach by data collection agencies. With this, it is important to question who is being included in these datasets, and in turn, whether policies and programs are tailored for those at highest risk. Most research on the spatial patterns of violence most commonly rely on crime and police data related to location and perpetrator history, ambulance dispatch records on the geolocation of the sustained injury, and hospital emergency room admissions data. For instance, researchers examining health care utilisation following violent events most commonly use emergency department admissions records as the primary source of data.^{153,154} However, these data only encapsulate a minor proportion of violent events and are

biased toward severe injuries requiring medical attention.¹¹⁴ While emergency departments can be a good source of data for examining the spatial epidemiology of SGBV.^{86,114}, the rates of SGBV survivors seeking medical care remain extremely low, thus highlighting the potential for quantitative data collection methods to be augmented with community-relevant local knowledge.

Participatory Mapping

Several studies employed a mixed methods approach to understand the community-specific, spatio-spatial realities of SGBV and experiences of safety. Participatory mapping, which combines digital cartography (i.e., GIS analysis) with participatory methods (e.g., narratives, photographs, sketch maps, video images, and semi-structured interviews), has been recognized by researchers and human rights organisations as an important tool for understanding experiences of safety for women in public spaces.⁸⁹ The value of this participatory data may extend beyond the simple description of spatial variables given the data originates from stakeholder involvement and ensures the legitimacy and utility of the research process and outcomes for stakeholders. There are some SGBV organisations implementing grassroots mapping efforts, whereby community members are able to anonymously 'pin' the location in their area where they experienced violence. This initiative was 'specifically designed to provide a safe method for survivors to report experiences of sexual violence – without having to talk to the police, describe what happened in detail, or even give your name' (ANOVA n.d.). This approach could be a useful avenue for capturing community-level understanding of high-risk areas in a community. even give your name' (ANOVA n.d.). This approach could be a useful avenue for capturing community-level understanding of high-risk areas in a community.

Moving Forward: Conclusions and Recommendations

Recognizing the exponential growth in using spatial frameworks to understand GBV, researchers and policymakers should further explore these frameworks to gain insights into the patterns and dynamics of GBV.

A range of approaches within spatial frameworks should be employed, including visualizing spatial distribution of GBV patterns, analyzing service availability and density, examining geographic relocation patterns, and participatory mapping.

We must acknowledge the paradox in relying on institutions that can perpetuate systemic and structural violence for GBV data; as such, opportunities to combine intersectional, mixed-methods, and participatory approaches with mainstream spatial research strategies should be explored.

It is critical to recognize and address systemic issues that affect GBV data collection, such as stigma, fear of reporting, low service utilization, and insufficient community data outreach.

Knowledge Mobilization Activities

COMMUNITY SHARING ACTIVITIES

- An article will be submitted to *The Conversation Canada*, “an independent and online source of news and views, from the academic and research community, delivered direct to the public”. *The Conversation* aims to published high quality, thought-provoking written pieces that spark public discourse and conversation.
- For each scoping review, we will produce a one-page infographic that includes main findings and policy implications in clear, plain language. Infographics will be posted on the HWERG website and shared widely on social media.
- Scoping reviews will be presented at academic conferences, departmental research seminars, and integrated as “case studies” for undergraduate and graduate courses.

JOURNAL ARTICLES

- Each scoping review to relevant and high-impact, peer-reviewed journal with the hopes of publishing our findings to the wider scientific community.
- Journals will be chosen thoughtfully, and studies will be submitted within 2-months of the granting end-date to ensure all included articles are as up-to-date as possible.

SOCIAL MEDIA

- All relevant materials from the grant will be shared through the HWERG research group website and Twitter accounts.

Figures

Table 1. Summary of Data Collection and Methods

| Author (Year) | Data Source | GIS Methods | Spatial/Temporal Focus |
|----------------|--|--|--|
| Balemba (2013) | Police Records and semi-structured interviews | Spatiotemporal | Locations of violence (LOV); Temporal measures - night/day, weekend/weekday |
| Barbosa (2019) | Police Records | Hot Spot; Spatiotemporal; Density analysis | LOV; locations of healthcare services; temporal (time of day) |
| Bench (2022) | Police Records | Driving Distance | LOV |
| Beyer (2013) | Police Records | Geocoding | LOV; presence of neighbourhood features; urban-rural; public-private space; area based concentrated disadvantage index; area based residential instability index |
| Bogen (2021) | Tweets with the hashtag #MeToo | Hotspot | Location of Tweet regarding #MeToo |
| Bunch (2018) | Police Records and Census Area based information | Hotspot | LOV; presence of neighbourhood features |
| Ceccato (2017) | Police Records and Metro system assault reports | Geocoding | LOV; Features of metro station Features of neighbourhood (e.g. public roads, greenspace, socioeconomics, bars/restaurants/schools, etc.) Time of day Day of the week |
| Ceccato (2019) | Police Records | Hot Spot; Density analysis | LOV Accessibility - presence of subway station Anonymity - close to city centre, forest, industrial area Opportunity - close to educational institutions, alcohol outlets |

| | | | |
|----------------------------------|--|--|--|
| <p>Ceccato (2020)</p> | <p>Hospital/Clinic Records (No Patient Interaction)</p> | <p>Spatiotemporal; Visualisation tools (VISUAL-TimePACts)</p> | <p>Locations of violence; presence of neighbourhood features Place type - private, street, forested, interstitial, other outdoor, private transport, public transport, indoor public</p> |
| <p>Chang (2015)</p> | <p>Multi-wave National Survey</p> | <p>Geocoding</p> | <p>Neighbourhood characteristics - neighbourhood physical disorder</p> |
| <p>Coy (2011)</p> | <p>Community based support service records and police records</p> | <p>Geocoding; driving distance; migration patterns</p> | <p>Locations of healthcare services</p> |
| <p>Cunradi (2011)</p> | <p>Police Records (IPV police calls/crime reports)</p> | <p>Bayesian space-time model</p> | <p>Proximity to neighbourhood features - alcohol outlets including bars, off premises outlets, restaurants</p> |
| <p>Datta (2020)</p> | <p>Community Recruitment</p> | <p>Participatory Mapping; Proximity</p> | <p>LOV; proximity to neighbourhood features; presence of neighbourhood features; Other: areas where women feel safe or feel fear of potential violence</p> |
| <p>deBarros (2021)</p> | <p>Police Records</p> | <p>Proximity; Spatiotemporal</p> | <p>LOV; presence of neighbourhood features; month of occurrence; day of the week</p> |
| <p>DePrince (2014)</p> | <p>Police Records</p> | <p>Geolocating</p> | <p>LOV</p> |
| <p>Fox (2006)</p> | <p>National Survey of Families and Households Survey Respondents</p> | <p>Hot Spot</p> | <p>LOV</p> |
| <p>Frye (2008)</p> | <p>Police Records (medical examiner data)</p> | <p>Geolocating</p> | <p>Physical disorder</p> |
| <p>Gracia (2014)</p> | <p>Police Records</p> | <p>Risk modelling presentation by census blocks</p> | <p>LOV; presence of neighbourhood features</p> |
| <p>Gracia et al., 2015</p> | <p>Police Records</p> | <p>Risk modelling presentation by census blocks</p> | <p>LOV; presence of neighbourhood features</p> |
| <p>Hernandez 2021</p> | <p>Police Records and local News Crime Information</p> | <p>Spatiotemporal</p> | <p>LOV; month; day of week</p> |
| <p>Hetling & Zhang, 2010</p> | <p>Police Records and Connecticut Coalition Against DV</p> | <p>Spatiotemporal; Incidence, spatial autocorrelation, proximity</p> | <p>LOV; location of healthcare services (DV agency)</p> |

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| Iritani (2013) | School-Based National Survey | Density Analysis | Presence of neighbourhood features - alcohol outlets |
| Jain (2019) | Police Records | Spatiotemporal; predictive modelling; Pathing Index | LOV; area total (sq km); longitude; latitude |
| Juraska (2014) | Indian health service and tribal operated hospital databases | Proximity | Proximity to healthcare services - SA response teams and SA examination services |
| Kelling (2021) | Police Records | Proximity | LOV |
| Lundrigan (2006) | Police Records | Spatiotemporal; drive time | LOV; location of offenders home; distance between offence locations |
| Lundrigan (2010) | Police Records | Proximity | LOV; location of offenders home; distance between offence locations Day of the week/Time of day Area type land use Deprivation score |
| Moreira (2021) | Police Records and Mobility data from the cities Destination Survey | Proximity; Spatiotemporal | LOV; presence of neighbourhood features; Other: presence of metro train features, demographic context of violence Station features - near bus stop, commercial area, parking lot, green space, |
| Moroskoski (2022) | Police Records | Spatiotemporal | LOV |
| Muldoon (2021) | Hospital/Clinic Records (No Patient Interaction) and Census information | Geolocation | LOV |
| Ohurira (2022) | Community Recruitment | Proximity; neighbourhood density | Location of homes; Community - alcohol outlet |
| Peek-Asa (2011) | Clinic Patient Survey Completion (Interaction with participant) | Proximity | Locations of healthcare services Housing rurality |
| Ponton III (2018) | Newspaper Articles | Geolocation | LOV |
| Royo (2020) | National Household Survey | Density analysis (heat maps) and site visits | LOV; site-specific follow-up of high risk areas (i.e. built environment) |
| Serra (2022) | Hospital/Clinic Records (No Patient Interaction) | Spatiotemporal; Incidence, prevalence, risk ratios by neighbourhoods | LOV |

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| Snowden (2016) | Hospital/Clinic Records (No Patient Interaction) | Geolocation | LOV; neighbourhood features - alcohol outlets |
| Stansfield (2019) | Hospital/Clinic Records (No Patient Interaction) | Hot Spot | LOV |
| Stoler (2020) | Hospital/Clinic Records (No Patient Interaction) and Hospital Staff Interviews | Hot Spot; Spatiotemporal; Density analysis, Kernel density | LOV; Neighbourhood feature - SA services |
| Taylor (2015) | School/ Community Partnership | Participatory Mapping; Hot Spot | Building features/areas |
| Varjavandi (2017) | School/ Community Partnership | Participatory Mapping | presence of neighbourhood features |
| Walker (2014) | Hospital/Clinic Records (No Patient Interaction) | Hot Spot; Spatiotemporal | Time of day, day of the week |
| Wani (2020) | Newspaper Articles | Hot Spot; Spatiotemporal | LOV |
| Wani (2021) | Police Records | Hot Spot; Spatiotemporal | LOV |
| Williams (2018) | Hospital/Clinic Records (No Patient Interaction) and Police Records | Spatiotemporal | Locations of healthcare services; Location of Arrests |

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