On Selecting Crimes for Hot Spot Evaluations

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Abstract

Hot spot policing is a strategy whereby patrols target areas with a disproportionate amount of crime. This strategy has been shown to be effective in reducing crime in high density areas. There is disagreement, however, about the effectiveness of hot spot policing for particular crime types.

Crime types have been shown to influence the results of interventions, but there is currently no standard practice for selecting crime types for analysis. Here we survey the current literature in order to evaluate police response, crime measurement, and crime type selection.

We describe various factors in hot spot policing experiments that should be considered in relation to one another and suggest that policing departments ought to establish clear experimental aims prior to implementing a hot spot strategy. We also suggest that police response should appropriately reflect the established experimental goals, and that crime types should be chosen dependent on the type of police response chosen. Once crime types are chosen, a metric of criminal activity can be chosen based on the crimes being targeted. We conclude by describing three key considerations for hot spot policing interventions: (1) adequate collection of pre-treatment crime levels is essential for an accurate representation of an areas' level of crime and the types of crime problems in a given area; (2) selected crime types should reflect the chosen patrol's effectiveness; and (3) crime measurement metrices should correlate with its corresponding experimental aims, police response and selected crime types.

Introduction

In the late 1980s, criminologists developed an interest in the relationship between crime and place (Weisburd 2015). Research suggests that the environmental composition of an area is more predictive of crime rates than residential demographics of an area (Andresen & Malleson, 2011; Braga & Weisburd, 2010; Eck & Weisburd, 1995; Piza & O'Hara, 2012). Over time, advancement in technological techniques has allowed researchers to demonstrate existence of high crime clusters within small geographic areas, such as block faces, intersections, street segments and specific addresses (Piza & O'Hara, 2012; Weisburd, 2015; Weisburd & Amram, 2012).

A study by Sherman, Gartin, and Buerger (1989), for example, found that just 3.5 percent of the Minneapolis' addresses accounted for over 50 percent of calls for service in a one-year period. Similarly, a study by Pierce, Spaar and Briggs (1988) found that 50 percent of emergency calls for service came from only 3.6 percent of addresses in Boston, Massachusetts.

Furthermore, crime rates remain stable over time, such that high density crime areas report similar levels of crime for ten years or more (Weisburd et al. 2004). This phenomenon has since been coined 'criminology of place' (Sherman, Gartin & Buerger, 1989, p. 49). These findings acted as a catalyst for implementation of evidence based policing strategies such as hot spot policing (HSP), across the United States of America and the United Kingdom (Sherman & Weisburd, 1995; Weisburd, 2015).

HSP is a strategy whereby police patrol target small geographic areas, in an effort to reduce crime in high crime clusters known as hot spots (Sherman & Weisburd, 1995). HSP is grounded in two theoretical frameworks; routine activities theory and deterrence theory. Routine activities theory proposes that crime occurs when motivated individuals and suitable targets converge in time and space, in the absence of capable guardians (Cohen & Felson, 1979). In this case, capable guardians refer to police officers who possess an ability to prevent crime and are motivated to do so (Cox, 2015; Simpson & Hipp, 2017). Importantly, police officers' capacity to influence crime is dependent on the crime occurring in a time and place in which police officers' can adequately respond to it. As such, HSP initatives should determine whether utilised types of police patrol are suitable for a given location and whether the type of police patrol has an effect on chosen crime types (Simpson & Hipp, 2017). In order for suitability of a given location to be determined, empirical evidence must suggest a high density of crime within a given hot spot.

Deterrence theory proposes three key elements; certainty of apprehension, severity of punishment and celerity or swiftness in being caught and punished (Kleck, 2016). Similar to rational choice theory, an individual will rationally weigh up costs and benefits of committing a crime and act accordingly (Nagin, 2013; Sherman et al. 2014; Simpson & Hipp, 2017). Importantly, deterrence theory posits "the certainty of punishment has greater deterrent value than severity of punishment" (Koper, 1995, p. 649).

Both routine activities theory and deterrence theory need to be considered in relation to how a given patrol type will influence criminal activity, and the effectiveness of that given patrol type within a hot spot. Deterrence theory proposes that visual cues to police presence has a deterrent effect on public *perceptions* of police presence. Therefore, hot spots should be small enough such that presence of a patrol car or uniformed police officer can be seen by any individual in the same hot spot. Additionally, visual cues also influence an individual's perception of the likelihood of punishment, thus HSP strategies should select crime types which are influenced by visual cues of police patrols (Koper, 1995).

HSP strategies have been shown to be effective in reducing crime in high density areas (Braga, Papachristos & Hureau, 2014). Despite empirical support for the effectiveness of HSP on crime reduction, little is known about how various factors of HSP experiments such as type of police patrol and crime measurement metrics influences crime reduction. Crime levels are measured via multiple metrices, including but not limited to: publicly generated calls for service, police generated incidents and reported crime. These metrices influence experimental results and interpretations, and as such, must be considered in relation to their corresponding chosen crime types.

Furthermore, little is known about crime types that are selected for inclusion and exclusion in analyses, as a standardised method does not exist. Many of the early studies conducted in the U.S., use classifications such as 'hard' or 'soft' crimes (Koper, 1995; Sherman & Weisburd, 1995). 'Hard' crime is classified as a serious crime which is violent in nature. Conversely non-violent crimes are termed 'soft' crimes and are usually related to disorder (Sherman & Weisburd, 1995; Telep et al. 2014). A similar classification known as Part 1 and Part 2 crimes are also utilised across the literature (Telep et al. 2014). Part 1 crimes refers to serious crimes such as robbery, auto theft, burglary and aggravated assault and Part 2 refers to soft crime, such as public intoxication or public nuisance (Telep et al. 2014).

In contrast, 'street level crime' is often used as a classification. Street level crime refers to crime that patrol officers are able to deter in the public domain, such as anti-social behaviour, vehicle theft, robbery and graffiti (Arial, Weinborn & Sherman, 2016). An ongoing experiment by the Western Australia Police Force is targeting street level crime in Perth CBD.

Police officer's predictions of the most common 'street-level' crime types to occur in Perth CBD were collected. As a result of these predictions, a list of crime types was created by Senior Sergeant Simon Williams and subsequently used in analyses (WA Police, 2018).

Additionally, 'violent' crime is often a specific target of hot spot policing strategies (Braga et al.1999; Groff et al. 2015; Ratcliffe et al. 2011; Simpson & Hipp, 2017; Taylor, Koper & Woods, 2011). Experimental aims are determined by analysing the types of crime problems in a given area. If spatial analysis determines that a high density of violent crime exists in a given area, a policing department will thus target violent crime via HSP strategies. Therefore, only violent crime types are included in crime analyses. For example, HSP strategies which target violent crime often include crime types such as criminal homicide, aggravated assault and robbery.

Despite a number of these classifications being similar in nature, the principle area of difference lies in the sub classifications of crime categories. In addition, hot spot policing experiments have been conducted throughout the United States and the United Kingdom which operate through different legal systems and subsequent classifications of crime severity.

Therefore, we will survey the current literature to evaluate the types of police patrols employed in HSP initiatives, crime measurement metrices and crime type selection. We will propose that the aforementioned factors should be considered in relation to one another. Lastly, we will make recommendations as to how HSP strategies should be implemented by considering how HSP policing interventions are most effective.

Police Response

Type of Police Response

A large portion of HSP literature is dedicated to investigating the effectiveness of specific types of police patrol on crime levels. Several prominent studies investigated the effectiveness of foot patrol on crime reduction (Ariel, Weinborn & Sherman, 2016; Hutt et al. 2017; Novak et al. 2016; Piza & O'Hara, 2012; Ratcliffe et al. 2011). Conversely, multiple patrol tactics have been utilised in an effort to reduce crime, such as foot and car patrol (Cox 2015; Koper, 1995; Sherman & Weisburd, 1995) or foot, bicycle and car patrol (Williams, 2015). However, a significant gap in the literature exists regarding justification for why specific patrol types are chosen, and how specific patrol tactics influence specific types of crime (Haberman, 2017).

Patrol Dosage and Schedule

Previous HSP experiments differ largely in regard to the duration, frequency and measurement of police dosage. A ground-breaking study by Koper (1995) reanalysed the 1989 Minneapolis HSP experimental data and identified the 'Koper curve'. The Koper curve principle refers to the phenomenon in which patrol times of 14 to 16 minutes produced optimal results on crime and disorder reduction. Interestingly, Koper observed diminishing returns effects when patrol times were longer than 16 minutes.

The Koper curve finding subsequently informed future HSP experiments, with numerous studies utilising a patrol time of 12 to 15 minutes per day (Ariel et al. 2016; Hutt et al. 2017; Novak et al. 2016; Telep et al. 2014; Williams, 2015). Alternatively, some studies implemented patrol times with no restrictions, which saw police officers determine time spent at hot spots (Sherman & Weisburd, 1995). In contrast, studies which utilised a problem-oriented policing strategy in conjunction with an HSP strategy, implemented patrol times of as long as 16 hours per day (Groff et al. 2015; Ratcliffe et al. 2011; Taylor et al. 2011). In addition, the schedule and number of visits by police patrols differed across the literature, ranging from a singular and longer patrol per day (Groff et al. 2015; Ratcliffe et al. 2011; Sherman & Weisburd, 1995;

Taylor et al. 2011) to multiple patrols per day (Ariel et al. 2016; Cox 2015; Hutt et al. 2017; Novak et al. 2016; Telep et al. 2014; Williams, 2015).

Multiple methods are utilised to measure patrol dosage across the literature. Police logs or reports are commonly used to measure both length and schedule of patrol dosage (Braga et al. 1999; Groff et al. 2015; Novak et al. 2016; Sherman & Weisburd, 1995). Police logs are often used in conjunction with systematic observations by trained researchers (Braga & Bond, 2008; Ratcliffe et al. 2011; Sherman & Weisburd, 1995) and field interviews with civilians (Taylor et al. 2011). Technological advancements such as GPS trackers (Ariel et al. 2016; Cox, 2015; Hutt et al. 2017; Williams, 2015) or call signs (D1HOT) (Telep et al. 2014) have been used to measure police dosage in more recent studies.

There are several advantages and disadvantages of how patrol schedules and duration are measured. A significant disadvantage of using police logs as a crime metric results in an increased likelihood of inaccuracy in relation to 'observed' crime levels. Systematic observations by trained researchers are often used to provide a more complete assessment of crime, particularly when social and physical disorder are being targeted (Braga & Bond, 2008; Ratcliffe et al. 2011; Sherman & Weisburd, 1995). However, high costs are associated with both training and utilising individuals in HSP experiments (Sherman & Weisburd, 1995). Currently, use of police patrol data from GPS trackers is the most favoured form of measuring patrol dosage and length due to its construct validity compared to traditional methods (Hutt et al. 2017).

Intervention Length

The experimental purpose of any HSP experiment influences how factors such as police dosage and schedule are chosen. Likewise, length of policing interventions varies for this reason. A large number of studies implemented HSP strategies over a time period of a year (Ariel et al. 2016; Braga & Bond, 2008; Haberman, 2017; Koper, 1995; Piza & O'Hara, 2012; Sherman & Weisburd, 1995). However, many of the studies implemented experiments under alternative timeframes.

How Crime is Measured

Effectiveness of an HSP experiment is predicated on an observed reduction in crime as a direct result of an HSP intervention. Therefore, evaluating exactly how crime data is collected and analysed is necessary, especially given that most of the literature differs on these processes. An early and influential study by Sherman and Weisburd (1995) reported a reduction in hot spot crime levels compared to control by measuring both publicly generated calls for service and systematic observations of crime and disorder. Sherman and Weisburd created a precedent of using publicly generated calls for service as outcome variables of crime reduction (Telep et al. 2014; Williams, 2015). Across the literature, publicly generated calls for service are often used as an outcome variable because a reduction in this metric suggests a corresponding reduction in public perception of crime (Ariel et al. 2016).

Often, publicly generated calls for service are measured in conjunction with other outcome measures such as researcher observations (Braga & Bond, 2008) or crime incident reports (Ariel et al. 2016; Braga et al. 1999). Additional outcome measures of crime reduction are calls for service which are both publicly and internally generated (Novak et al. 2016), crime incident reports (Groff et al. 2015; Haberman, 2017; Hutt et al. 2017; Piza & O'Hara, 2012; Taylor et al. 2011) or a combination of calls for service and crime incident reports (Simpson & Hipp, 2017). Field observations, field interviews and harm measures are also used as an outcome measure of observed crime and disorder (Cox, 2015; Groff et al. 2015; Koper, 1995; Ratcliffe et al. 2011). A summary of this information and the main findings can be found in Table 1.

Table 1: Summary of prominent literature on HSP, including type of police response, how crime was measured, primary aim and main findings.

Author	Type of Police Response	Crime Measurement	Primary Aim	Main Findings
Ariel et al (2016)	Foot patrol	Publicly generated calls for service, crime incident reports, harm measures	Evaluate the impact of police community support workers on crime levels in hot spots compared to traditional police patrol.	Crime reduction was evaluated in terms of whether a 'hard' threat of immediate physical arrest by a police officer or 'soft 'patrols by civilian police staff influenced crime levels. Crime reduction effects were evident, regardless of 'hard' or 'soft' intervention. An association between regular patrols and lower crime counts and lower harm outcomes were found.
Braga & Bond (2008)	Problem-oriented policing	Publicly generated calls for service, systematic observations	Reduce incidence of social and physical disorder crimes in Massachusetts hot spots.	Non-significant reductions were observed for all calls for service for crime and disorder. Analysis of systematic observations observed no crime displacement effect. A mediation analysis revealed that situational prevention policing strategies were the most effective at preventing crime.
Braga et al (1999)	Problem-oriented policing	Publicly generated calls for service, incident reports	Reduce the number of urban violent crime problems in New Jersey hot spots.	Reductions in crime and disorder at violent hot spots was evident. Total number of criminal incidents and publicly generated calls for service were significantly reduced in treatment hot spots.
Cox (2015)	Car and foot patrol	Crime incident reports, harm measures	Reduce crime levels in rural hot spots by implementing police patrol teams.	Despite a statistically significant increase of patrol in treatment locations compared to control, no statistically significant effects were found for crime harm reductions in treatment locations compared to control locations.
Groff et al (2015)	Foot patrol, problem-oriented and offender-focused policing,	Interviews, field observations, crime incident reports	Reduce violent crime in Philadelphia hot spots between a 12-14 week period.	Treatment areas which received offender focused strategies saw a 42% reduction in violent crime. However, hot spots which received problem-oriented policing and foot patrol did not demonstrate any significant reductions in violent crime.
Haberman (2017)	N/A	Crime incident reports	Investigate crime type and hot spot relationships using spatial analyses and retrospective data.	Crime incident data was analysed, and 11 different types of crime were selected for analyses. Results indicate minimal overlap between hot spots of different crime types.
Hutt et al (2017)	Foot patrol	Crime incident reports	Evaluate effectiveness of foot patrol in micro hot spots.	Patrols of 10-20 minutes significantly reduced crime rates in micro hot spots. Additionally, patrols of less than 10 minutes and more than 20 minutes were ineffective in reducing crime.
Koper (1995)	Car and foot patrol	Field observations	Reanalyse the Minneapolis HSP experiment data collected to determine optimal patrol length.	Longer patrol dosages improve residual deterrence of crime and disorder. Patrol stops must reach a threshold of 10 minutes to be effective and the optimal length of patrol is 14 to 15 minutes. A patrol longer than 15 minutes has a diminishing returns effect on improving residual deterrence.
Novak et al (2016)	Foot patrol	All calls for service, crime incident reports	Investigate the effectiveness of foot patrol on violent crime hot spots in Kansas City, Mexico.	Foot patrol resulted in statistically significant reductions in violent crime counts in treatment hot spots. However, the deterrent effect was short-lived and decayed almost immediately after intervention. There was no evidence for crime displacement.
Piza & O'Hara (2012)	Foot patrol	Crime incident reports	Evaluate foot patrol efficacy in high density crime hot spots over a one-year period.	Results indicate a decrease in total street violence and disaggregate categories of murder, shootings and nondomestic aggravated assault in hot spots. A spatial and temporal displacement effect for robbery was observed.
Ratcliffe et al (2011)	Foot patrol	Crime incident reports, field observations	Reduce violent crime in high crime hot spots by implementing foot patrols in Philadelphia, U.S.	No significant differences in violent crime counts during the operational period in treatment hot spots were observed. However, significant differences were observed when treatment hot spots had a high level of pre-treatment crime counts.
Sherman & Weisburd (1995)	Car and foot patrol	Publicly generated calls for service, observations	Reduce crime levels in hot spots by implementing foot and car patrols in an effort to increase public perception of police presence.	Overall, modest deterrent effects were demonstrated due to an increase in police presence in hot spots. Increases in police patrol resulted in a reduction in total crime calls of 6-13%. In addition, accounts of observed disorder were half as prevalent in intervention hot spots compared to controls.
Simpson & Hipp (2017)	Foot patrol and police stops	Calls for service, crime incident reports	Evaluate long-term, bidirectional relationships between foot patrol and police stops, and calls for service and official crime reports.	Changes in calls for service and crime counts often precede changes in policing strategy, whilst changes in crime counts also follow policing strategies. Therefore, policing strategies should be tailored to a location's previous crime incidents in order for long-term deterrent benefits to be achieved.
Taylor et al (2011)	Problem-oriented and directed-saturation patrol	Calls for service, incident reports, arrest data, field interviews	Target violent crime in Jacksonville, Florida hot spots by employing multiple policing tactics.	Problem-oriented policing was associated with a reduction of 33% in street violence for 90 days following the intervention period. Non-significant reductions were observed for directed-saturation patrol. Crime displacement to areas surrounding hot spots was also observed.
Telep et al (2014)	Car and foot patrol, traffic stops	Calls for service, incident reports	Evaluate police patrol effectiveness for hard and soft crime in hot spots.	Police patrols of 15 mins demonstrated significant overall declines in both calls for service and crime incident reports in treatment hot spots.
Williams (2015)	Foot and bicycle patrol	Publicly generated calls for service	Evaluate whether time spent at hot spots influenced subsequent crime levels.	Reductions in crime levels was associated with shorter, more frequent patrols (between 10 and 15 minute duration).

Importance of Crime Type Selection

Chosen crime metrics have significant implications when evaluating effectiveness of a HSP intervention on a particular subset of crimes (Weisburd, 2015). However, majority of HSP studies differ in both research aim and methodologies in relation to crime type selection. Due to HSP's relatively new experimental area, no standardised methods or procedures exist in terms of how crime types are selected. The following section will cover which crime types were chosen for analyses, with Table 1 outlining their corresponding research methodology, police response and crime measurement techniques.

Included Crime Types

Given that crime types are chosen for analyses in consideration of their corresponding research aim and chosen police response, included crime types across the literature have differed considerably. Crime classifications such as 'hard' and 'soft' crime types are often utilised and thus targeted, across the literature (Koper, 1995). For example, Sherman and Weisburd (1995) aimed to reduce both observed and reported crime in hot spots and as such, both soft and hard crime types were included in analyses. Importantly, Sherman and Weisburd specifically targeted crime types which were theoretically thought to be

deterred by an increased presence of police patrol in hot spots. By the same merit, an experiment conducted by Telep et al. (2014) targeted both hard and soft crime types and included crime types such as burglary, aggravated assault and vandalism.

Numerous studies specifically target violent crime types in hot spots and as such, only violent crime types are included in experimental analyses (Braga et al. 1999; Groff et al. 2015; Novak et al. 2016; Piza & O'Hara, 2012; Ratcliffe et al. 2011). These studies have included crime types such as, but not limited to criminal homicide, aggravated assault, drug offense, murder, nonfatal shootings, property crime and robbery. Additionally, both 'street-level' and 'hard' crime classifications are often utilised together (Williams, 2015).

Several studies use public perceptions of crime as an outcome measure to indicate effectiveness of HSP interventions (Ariel et al. 2016; Braga & Bond, 2008; Simpson & Hipp, 2017). For example, a study by Braga and Bond (2008) specifically targeted high crime and disorder hot spots in Massachusetts. As such, crime types associated with both physical and social disorder, and a small number of miscellaneous crimes were chosen for inclusion and measured via publicly generated calls for service.

A study by Haberman (2017) utilised a particularly novel approach to investigate the relationship between crime type and hot spots. Retrospective spatial analysis was used to investigate how crime types overlap across hot spots, specifically whether hot spots consist of predominately one crime type or multi-crime hot spots. A large number of crime types were included in analyses such as personal violence and crimes against property. Interestingly, results found minimal overlap between hot spots of different crime types and few intersections were classified as a hot spot with multiple crime types. These findings suggest that crime selection in conjunction with research aim is an important preliminary process, which should take place before a hot spot policing strategy is implemented.

Excluded Crime Types

Selected crime types are often chosen dependent on the type of crime problems being targeted and the type of patrol utilised. Similarly, crime types are excluded from analyses for similar reasons. For example, violent crimes which involve an intimate/domestic relationship between the victim and perpetrator are often excluded from crime count analyses. This is due to their likelihood to occur indoors and as such; police patrols are less likely to have a deterrent effect on its occurrence (Cox, 2015; Piza & O'Hara, 2012; Taylor et al. 2011; Telep et al. 2014). Domestic violence is only included in crime counts when incidents occurred outside a private residence and thus, are likely to be influenced by police presence (Cox, 2015). Nonetheless, domestic violence incidents may not be a suitable crime target for HSP strategies because its management may necessitate unique, individualised policing solutions (Haberman, 2017).

Minor forms of crime are excluded from crime counts when a HSP experiments' primary focus is on reduction of violent crime specifically (Taylor et al. 2011). In some cases, rape and murder are excluded from analyses due to their infrequent nature and thus, deemed unlikely to be prevented by police patrol due to majority of cases occurring in private premises (Ratcliffe et al. 2011; Simpson & Hipp, 2017). In addition, some categories of aggravated assaults such as violence against a student by a school employee, fights between students on school property or violence against a police officer are excluded from HSP analyses (Piza & O'Hara, 2012; Ratcliffe et al. 2011). In addition, crime counts collected from police stations, schools and hospitals are not included in HSP analyses due to the confounding effect it has on overall crime counts (Cox, 2015).

A technique often used to identify which crime types should be excluded is the idea that some crime incidents are 'outputs' of an experimental intervention rather than treatment outcomes (Ariel et al. 2016; Williams, 2015). A crime is classified as an 'output' of an intervention when chances of its occurrence specifically increase due to police presence and community engagement on the part of the police officer (Arial et al. 2016; Williams, 2015). For example, drug possession arrests such as stop-and-search, are often excluded because its' occurrence is a direct result of a policing intervention and thus, is a treatment 'output' (Cox, 2015; Williams, 2015). In some cases, all crime counts from police generated arrest data and police generated calls for service are not included in crime counts because they are not deemed a true representation of treatment effects (Williams, 2015).

Overall, much of the literature has differed significantly on how crime types are selected for analyses. However, two key themes emerged. Firstly, crime type selection is largely dependent on experimental aims. For example, a popular research aim was to evaluate the effectiveness of HSP strategies in high violent areas (Braga et al. 1999; Novak et al. 2016; Piza & O'Hara, 2012; Ratcliffe et al. 2011; Taylor et al. 2011). Therefore, only violent crime types were included in subsequent analyses. Secondly, crime types selection is predicated on deterrence theory and the likelihood of police influence on the occurrence of a particular crime type. For example, crime types such as domestic violence were excluded from analyses because their occurrence was unlikely to be prevented by an increased police patrol (Cox, 2015; Piza & O'Hara, 2012; Taylor et al. 2011; Telep et al. 2014).

Lastly, proposed effectiveness of HSP strategies has varied across the, literature. However, mixed results in the literature may be due to the absence of a standardised methodology or procedure (Haberman, 2017). Therefore, HSP's effectiveness on particular crime types remains unclear.

Discussion

Overall Quality

Overall, our evaluation of the literature suggests that HSP interventions significantly reduce crime levels at hot spots. Most importantly, we found that experimental aims largely influence the type of patrol utilised, which further influences how crime types are selected for analyses. However, the literature differs widely in implementation and following interpretation of HSP interventions.

A significant trend observed across the literature was the large discrepancy between which patrol types were employed. A large portion of HSP experiments implemented foot patrols, with mixed results on crime reduction (Ariel et al. 2016; Hutt et al. 2017; Novak et al. 2016; Piza & O'Hara, 2012; Ratcliffe et al. 2011).

Some studies implemented multiple policing strategies such as problem-oriented policing intervention, directed-saturation patrol and offender focused policing (Braga & Bond, 2008; Braga et al. 1999; Groff et al. 2015; Taylor et al. 2011). Additionally, patrol schedule and number of visits by police patrol differed greatly across the literature, from a longer and singular patrol per day (Groff et al. 2015; Ratcliffe et al. 2011; Sherman & Weisburd, 1995; Taylor et al. 2011) to multiple patrols per day (Ariel et al. 2016; Cox, 2015; Hutt et al. 2017; Novak et al. 2016; Telep et al. 2014; Williams, 2015).

Evidently, measurement of patrol dosage and schedule also varied widely across the literature. Inadequate measurement of patrol dosage and schedule results in a discrepancy between planned and actual police patrol, which has serious implications on outcomes of HSP experiments (Hutt et al. 2017; Sherman & Weisburd, 1995). Discrepancies arise when inaccurate measurement techniques are used, such as police logs. These discrepancies often result in an underpowered study, which reduces the likelihood of finding a significant result. In addition, underpowered experiments increase the chance of a type II error.

Experimental design in HSP literature also differs somewhat, however, majority of studies utilise a randomised controlled trial experimental design (RCT). Length of intervention periods of HSP strategies at hot spots differed across the literature. However, numerous studies implemented policing strategies over a one-year period with some success (Ariel et al. 2016; Braga & Bond, 2008; Haberman, 2017; Koper, 1995; Piza & O'Hara, 2012; Sherman & Weisburd, 1995).

A major conclusion which can be drawn from the literature is the idea that 'effectiveness' of HSP strategies on crime reduction is largely dependent on how crime is measured. Publicly generated calls for service are often used as an outcome variable because HSP strategies have the greatest impact on their occurrence and therefore, reduction (Sherman & Weisburd, 1995; Telep et al. 2014; Williams, 2015). Other utilised metrices included all calls for service and crime incident reports (Cox, 2015; Ariel et al. 2016; Braga & Bond, 2008; Braga et al. 1999; Groff et al. 2015; Haberman, 2017; Hutt et al. 2017; Novak et al. 2016; Piza & O'Hara, 2012; Simpson & Hipp, 2017; Taylor et al, 2011).

Lastly, why specific crime types were chosen for analyses presented a significant discrepancy in the literature. The process of measuring crime is largely dependent on crime types selected for analyses. For example, if a study is targeting social and physical disorder in hot spots, researchers would most likely use publically generated calls for service to measure these constructs (Braga & Bond, 2008). Thus far, no collaborative or comprehensive approach has been offered in relation to how crime types are selected, and why particular crime types are included or excluded from analyses. This lack of a standardised method for this process results in police departments and researchers selecting crime types which align with their given research aims.

Despite some differences across the literature, some similarities presented themselves in relation to how crime types are selected for analyses. These similarities are largely dependent on the experimental aim of a study. For example, if a study is targeting violent crime in hot spots, only violent crime types will be included in the analyses (Braga et al. 1999). Crime types should also be considered in terms of whether their occurrence is a consequence of the policing strategy, and thus, an 'output' or whether their occurrence is a true treatment outcome (Cox, 2015; Williams, 2015).

A significant strength of the HSP literature is the use of RCTs. RCTs are considered the gold standard in experimental designs because they allow police agencies and researchers to evaluate systematic differences in treatment groups compared to control group differences (Sherman, 2013). In addition, random allocation of groups allows researchers to adequately evaluate the effectiveness of an intervention (Sherman, 2013). In the context of HSP, the use of randomised controlled trials is especially important as it allows researchers to demonstrate the effectiveness of HSP strategies on crime levels. Many studies utilised this experimental design in an effort to demonstrate systematic changes in crime levels due to HSP interventions (Ariel et al. 2016; Braga & Bond, 2008; Braga et al. 1999; Cox, 2015; Groff et al. 2015; Ratcliffe et al. 2011; Sherman & Weisburd, 1995; Taylor et al. 2011; Telep et al. 2014; Williams, 2015).

Overall, the literature differs significantly across many facets. However, the experimental rationale was largely similar across studies. All HSP experiments are grounded in environmental criminology theories such as routine activities theory and deterrence theory. These theoretical frameworks provide a basis for HSP experiments, which results in similar research rationales across the literature. Contingent on routine activities and deterrence theory, all HSP experiments aim to reduce crime with the use of targeted police patrol at high crime hot spots. However, significant differences in utilised methods and their subsequent limitations exist. These limitations will be further discussed in the proceeding section.

Limitations

In regard to police visibility, two similar, but distinct limitations exist. Firstly, there is a lack of knowledge surrounding the effectiveness of particular patrol types on particular crime types. For example, the use of foot patrol has been cautioned due to its' inability to deter all crime types, specifically crime types which occur inside a private premise such as domestic violence related crimes (Ariel et al. 2016; Cox, 2015; Taylor et al. 2011; Telep et al. 2014). Accordingly, these crime types should not be included in HSP experiments which utilise foot patrol. In addition, foot patrol has a decreased ability to adequately respond to these types of crimes due to speed limitations (Ratcliffe et al. 2011).

Secondly, the use of particular types of patrol are largely ineffective in large hot spot areas. For example, the use of foot patrol in large hot spots is ineffective due to Police Officers' decreased visibility, and thus, does not increase the public perception of police presence (Cox, 2015; Groff et al. 2015). When foot patrols are utilised in large hot spot areas, deterrence theory is not being taken into account and thus, policing intervention has no effect on the public perception's regarding certainty of apprehension.

A third limitation is differing methods in collecting crime level data across studies. Crime statistics can be gathered via publicly generated calls for service, all calls for service, crime incident reports, researcher observations of crime and disorder, field interviews with officers and crime harm indices. How crime data is gathered has significant implications for how crime reduction is interpreted. Use of all calls for service can often inflate crime statistics because multiple calls can be recorded for a singular crime incident (Haberman, 2017). In contrast, use of crime incident reports can result in lower crime statistics due to low clearance rates in most police departments (Haberman, 2017). Subsequently, the use of crime incident reports as a measurement of crime levels increases the chance of a type II error.

A fourth limitation is a lack of HSP research being conducted in Australia. Majority of the prominent HSP experiments have been conducted in the United States of America and the United Kingdom. Although these places are relatively similar to Australia in terms of demographics, they largely differ in population density. HSP is predicated on the idea of high density clusters of crime in small areas, and it is unknown whether similar HSP experiments would be as effective in Australia (Weisburd & Telep, 2014). Therefore, the results from these experiments may not be applicable to Australia.

Lastly, little is known about the relationship between crime types and HSP. Therefore, the fifth limitation is a lack of evidence for multi-crime hot spots (Haberman, 2017; National Institute of Justice, 2012). Much of the HSP literature is grounded in the assumption that crime clusters consist multiple crime types within a given hot spot. However, Haberman (2017) found that at least 60% of hot spot intersections in Philadelphia, U.S., were singular crime hot spots. Similarly, not all crime types occur in an equal distribution across space and time. This has significant implications for how HSP experiments have been implemented thus far. For example, aggregate levels of crime might be used as an indication of crime levels in a group of hot spots. This method doesn't take into account the distribution of crime types within the hot spots and as such, one particular type of patrol may not be effective in all hot spots. For example, a hot spot which has a high level of assault may benefit from foot patrol, whereas a hot spot which has a high level of domestic violence incidents may not benefit from foot patrol due to its' unlikelihood to deter its occurrence (Ratcliffe et al. 2011).

Recommendations

Having surveyed pertinent findings from HSP's current literature, we suggest several recommendations for future HSP experiments. Firstly, we suggest that adequate collection of pre-treatment crime levels is essential for an accurate representation of an areas' level of crime and the types of crime problems in a given area. Sherman et al (2014) suggests that crime data must be collected for at least one year prior to a HSP intervention. Data collected from a time period less than a year does not truly represent an areas' crime problems. Therefore, using data from a time period less than a year falsely informs researchers and policing departments of the types of crime problems in a given area.

Further, chosen patrol types should be considered when selecting crime types to optimise effectiveness of HSP interventions. As previously mentioned, use of specific patrol types are more effective for particular crime types. Therefore, researchers and policing departments need to consider how their chosen type of patrol influences crime in its given hot spot.

Figure 1. Relationships between facets of HSP experiments

For example, several studies utilised visible foot patrol in violent hot spots in an effort to reduce crime. Foot patrol is often utilised due to its' predicted ability to deter violent crime types. Similarly, some studies utilised multiple types of police patrol such as foot patrol in conjunction with problem-oriented policing strategies, car patrol and bike patrol.

Thirdly, we propose that how crime is measured needs to be considered in conjunction with an experiment's research aim, chosen patrol types and chosen crime types. Many studies used publicly generated calls for service as a metric for criminal activity because Police Departments were targeting street level crime, and subsequent public perception of crime (Ariel et al. 2016; Braga & Bond, 2008; Braga et al. 1999; Telep et al. 2014; Williams, 2015). For example, a citizen is more likely to observe an assault or theft of a motor vehicle due to their occurrence in public spaces. Therefore, publicly generated calls for service represent public perception of crime, and a subsequent decrease in this measurement would indicate a decreased public perception of crime. In addition, internally generated calls for service or crime incident reports should be treated as treatment 'outputs' rather than treatment outcomes (Williams, 2015, p. 36).

In summation, in order for a HSP strategy to be effective, factors such as experimental aims, police response, crime measurement and selected crimes types, should be considered in relation to one another. Policing departments and research teams must establish research goals and targets prior to deciding on police response, as these research goals should determine the type of response suitable to an experiments' aims. Once research goals and police response are established, these factors should inform the types of crime included and excluded from analyses. Additionally, chosen crime types should be reflected by the way in which crime data is measured. In addition, these factors should be considered in conjunction with routine activities theory and deterrence theory.

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