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I, Davin Hall,
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This work and its defense approved by:

Chair: Dr. Lin Liu
Dr. Colleen McTague
Dr. Kevin Raleigh

Cops and Robbers in Cincinnati: a spatial modeling approach for examining the effects of aggressive policing

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By

Davin Hall

B.A. University of Cincinnati, 2005
B.S. University of Cincinnati, 2005

Committee Chair: Dr. Lin Liu

Abstract

Aggressive policing tactics have been frequently examined in crime prevention studies, both in their effectiveness at reducing crime as well as possible problems of displacement of crime. This study examines robberies in the city of Cincinnati following a major increase of arrests for minor offenses in a small neighborhood of the city. A modified version of the Weighted Displacement Quotient test (WDQ), termed the Spatio-Temporal Weighted Displacement Quotient (STWDQ), is used to determine possible displacement of crime or a diffusion of benefits. Directly surrounding the treatment area, a diffusion of benefits is found to be taking place; however, at a greater distance from the treatment area, displacement of crime has occurred. For the overall study area, the displaced crime out-weighs the decreases in robberies within the treatment area and its immediate neighboring areas. Future study is required to clarify the relationship between the observed increases in crime and police actions.

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Introduction

Beginning in early 2006, the Cincinnati Police Department initiated the militaristic-sounding “Operation Vortex” – an aggressive patrol unit designed to reduce crime through high numbers of arrests. The Vortex Unit was first used to target the Over-the-Rhine neighborhood of Cincinnati, a low-income, high-crime area within the city. Earlier that same year, a number of deputies from the Hamilton County Sheriff’s Office were authorized to patrol the Over-the-Rhine neighborhood in an attempt to control the crime problem. Initial police reports of the success of these programs touted falling crime rates in the area, and stressed the importance and value of the patrol unit. Later that same year, the city decided to make the Vortex Unit a permanent feature of the Cincinnati Police, based on its successes in Over-the-Rhine. However, public complaints began to arise from neighborhoods throughout the rest of the city, as citizens argued that crime had increased around their homes (Wagner, 2006). Aggressive policing tactics have been a hotly debated topic, not only in regards to the effectiveness of aggressive policing, but also in terms of displacement of crime.

Many crime displacement studies have found that not only is crime not displaced, but also that often a diffusion of benefits occurs, where crime rates in surrounding areas drop, following a successful crime prevention strategy; the complaints of the citizens of the city seemed to suggest otherwise. This paper began with the intention of testing whether or not displacement was occurring throughout the city, and if it may be a result of the aggressive policing tactics of the Cincinnati Police Department. Research studies that have tested for displacement of crime have often utilized relatively small buffer regions when examining increases in crime, due to the notion that offenders only commit crimes in areas close to where they live and are with which they are familiar. Based on offender mobility studies and the

distance people are willing to travel to commit crimes (e.g. Van Koppen and Jansen, 1998), buffer regions that consist of only one or two city blocks (e.g. Green, 1995) may not be large enough to adequately consider displacement of crime.

Future study of displacement of crime from a particular area will need to consider a number of issues, such as accessibility and number of attractive targets. Another concern is distance from the treatment area; this paper seeks to determine the effect of this distance on crime displacement. Distance decay aspects of target selection have been shown in past research (Van Koppen & Keijser, 1997), suggesting that offenders are only willing to travel a certain distance to commit crimes. This concept may also be present in displacement of crime, where displaced crime only travels a certain distance.

Aggressive policing sounds perhaps more threatening than it actually is. Some people equate the term with police brutality; however this is not the case. Aggressive policing has also been called zero-tolerance policing and pro-active policing (depending on how positive or negative one wishes to present the term), and essentially implies that no transgression of the law, however seemingly insignificant, will go unpunished. The basic idea stems from the broken windows theory of crime which suggests that one small civil disorder can lead to more serious crime.

Aggressive policing tactics have often been criticized for failing to address underlying social causes of crime or for potentially damaging societal side-effects that result from the mass processing of large numbers of citizens (Sherman, 1993). However, these complaints have been often countered with results of specific studies showing significant reductions in crime, as well as evidence that the positive effects of the police actions have spread to the immediate surrounding areas. These results have enabled police forces to gain funding in support of these

aggressive tactics, as is the case in Cincinnati. If it is shown though, that these actions merely push crime to a new location, new consideration will have to be paid in evaluating whether or not these programs are worth the costs, both in terms of the money and resources devoted to them, and the problematic societal concerns that have been raised.

In addition to the problem of immediate displacement of crime, long-term effects of aggressive policing have often been questioned as potentially creating societal unrest or becoming ineffectual after the initial treatment (Eck & Maguire, 2006); it is possible that a police action that specifically targets a single area will alienate the population of that area towards the police and to the city in general (Sherman, 1993). This alienation could potentially generate increased levels of criminal activity in a population that previously was not criminogenic. Additionally, increased police action will inevitably result in a greater number of innocent people being arrested; this can limit their ability to find or maintain a legitimate job. These feelings of resentment towards the police are not limited to only those who are being targeted by the police, but could also be felt by the residents of the neighborhoods where crime increases as a result of displacement. Negative theoretical side-effects of aggressive policing aside, many studies have shown significant reductions in crime, lending support for these types of tactics. In the city of Cincinnati, robbery declined by an overwhelming 48% in Over-the-Rhine from 2005 to 2006. However, these successful decreases in crime rates in the area are tempered by significant increases in crime in surrounding neighborhoods, a statistical aberration from previous years.

This study tests for displacement of crime from the Over-the-Rhine through Cincinnati. Bowers and Johnson (2003) developed a specific test for displacement, what they termed the Weighted Displacement Quotient test (WDQ). This test is discussed and modified in order to create a more accurate picture of crime displacement in Cincinnati. Specific tests for the

immediate area surrounding Over-the-Rhine, as well as a larger buffer area were conducted, with the assumption that a diffusion of benefits would be seen in the immediate area, while displacement of crime would occur on a larger scale. These tests were conducted in order to determine several questions; first, is the aggressive policing in the Over-the-Rhine area effective at reducing crime; second, does this aggressive policing benefit the surrounding area; and finally, does this aggressive policing benefit the rest of the city. In addition to testing for displacement, a series of regression models analyzing the relationship between changes in robberies and distance was constructed, comparing the changes in crime over several years. This model was designed to determine what effect, if any, distance had on displacement or a diffusion of benefits of crime following the aggressive police activity.

Literature Review

Aggressive Policing

One of the most famous and important articles written on the effectiveness of policing and policing strategies was “Broken Windows” by Wilson and Kelling (1982). This article introduces the concept of broken windows to the public. Wilson and Kelling’s argument stems from the statement that one broken window in a building left unfixed will lead to the dilapidation of the entire building. People will believe, based on the first, unfixed broken window that no one cares about the building, and this will be a signal to them to continue breaking windows and subsequently destroy the property. This idea is anchored strongly within social control theory, arguing that people exercise control over their actions until it is not unacceptable to resort to wanton destruction. Taking this concept, Wilson and Kelling apply it to communities, and argue that a community can turn into an “inhospitable and frightening jungle” beginning simply with

the abandonment of a piece of property. A chain reaction begins that turns minor social disorder into delinquent behavior. This in turn affects people's behavior, causing them to become disengaged from the neighborhood in which they live. All of this leads to an increase in the likelihood that violent crime will occur, according to Wilson and Kelling. To combat this phenomenon, Wilson and Kelling argue that some types of legal behavior should be policed. A single vagrant causes no harm initially, but left untended will send the message to more homeless and undesirables that this area does not care if they stay there. This is a link in the chain to serious crimes, and preventing this single vagrant from loitering, even though he or she is doing nothing illegal, will preserve the stability of the neighborhood. To this end, Wilson and Kelling state that police officers should protect communities, not just individuals, by removing those elements of a community that will eventually destroy it.

The argument that aggressive policing of minor disorder reduces serious crime has been tested in a number of different studies. Wilson and Boland (1978) attempted to test his broken windows theory of crime. This study found that there was a significant, negative relationship between Wilson and Boland's measure of aggressive policing – number of traffic citations issued – and reduced rates of robberies among 35 U.S. cities. Sampson and Cohen (1988) expanded on Wilson and Boland's research, studying whether or not cities with high numbers of arrests for disorderly conduct have lower rates of robberies. Sampson and Cohen found that across 171 U.S. cities a significant negative correlation existed between arrest rates for disorderly conduct and rates of reported robbery. Whitaker *et al* (1985) used observations from 7200 hours of police ride-alongs to determine that high amounts of suspicious stops made by police officers resulted in lower rates of robbery. However, Whitaker *et al* also stress that a style of policing which used high numbers of suspicious stops as a crime preventative, could potentially damage

the relationship between citizens and police, as people could feel that their rights were being infringed upon. MacDonald (2002) found that among 164 U.S. cities, high rates of arrests for disorderly conduct and driving under the influence, as well as a high number of officers per residents, were significantly negatively correlated with rates of robberies.

These past studies used cross-sectional methods to argue that police stations with aggressive policing tactics resulted in decreased rates of robberies in their cities; studies have also incorporated interrupted time-series designs in order to test this hypothesis. Novak, Hartman, and Holsinger (1999) followed a four week plan by police to increase their presence and activity in a 10 by 12 block section of a single community that had been experiencing crime problems. During this plan, police were instructed to make arrests for open containers of alcohol, there was an increase in the number of officers assigned to the area, and police cars were present on street corners at select times of night. Novak *et al* found, however, that there was no significant reduction in robberies following this police action. In a similar study, Weiss and Freels (1996) worked with a police department to institute a change in policing style and then measure its effects. This treatment involved officers increasing the number of traffic stops between 6PM and midnight, and to make the stops in a highly visible location. Similar to the Novak *et al* experiment, Weiss and Freels did not find a significant relationship between the increased number of traffic stops and a reduction in robberies. These results call into question the effectiveness of aggressive policing at all in reducing crime. However, even considering that aggressive policing does actually produce a decline in crime in an area, there are several strong problems that have been studied in association with aggressive policing.

Implications for Police Aggression

The idea of “broken windows policing” has been highly supported and critiqued by a number of researchers. Herbert and Brown (2006) criticize the broken windows theory of policing as legitimizing and contributing to the expanding social divide between social and economic classes. Isolating and separating Wilson and Kelling’s “undesirables” creates an “us versus them” mentality which causes the deepening rift between the affluent and the poor. Davis (1992) furthers this idea, talking about this phenomenon occurring in Los Angeles and comments on the separation between rich and poor that is already taking place. This idea is also examined by Boddy (1992) as he examines elevated walkways in the city. In both texts, the authors argue that architectural, cultural, and legalistic enforcements are creating a vicious circle of poverty and crime within the city. While both authors argue that the privatization of public space is occurring to keep unwanted people out of sight, Davis in particular is critical of the Los Angeles Police Department and the aggressive extremes that it has gone to in the name of order maintenance, including a police operation that resulted in over 1400 arrests for primarily curfew violations and delinquent parking tickets (1992). This separation of classes that the authors argue is occurring is only important (to most people) if it is creating more problems than it is solving.

Benson (2002) summarizes John Hagan’s crime theory of capital disinvestment, and the concept of hyper-ghettos. Hagan argued that intense pockets of poverty can form and breed criminal activity. These pockets become “deviant services centers” where criminal items and activities (e.g. drugs, prostitution) can be obtained by the general public. Both Davis and Boddy argue that poor individuals within a city are being isolated in this regard and forming clusters of high-poverty areas. These arguments center on the idea that not only is this style of policing

ineffective, but that it can also theoretically create a basis for increased crime in the future. This concept is also addressed in the issue of the fairness of the police.

An important issue when examining policing strategies is whether or not the strategy is being implemented fairly. Jackson and Carroll (1981) examine whether police spend more money in areas of greater racial presence or unrest. The authors found that racial composition and level of mobilization were significantly positively correlated with police expenditures. This leads the authors to argue that police funding at least, if not police actions, are driven by minority groups who pose a threat to the dominant group, and that the police actions are to maintain the status quo. If individuals feel they are being treated unfairly, as could result from heightened police action simply because of greater racial heterogeneity in a community, then the crime prevention measures could be counter-productive. Sherman (1993) argues that offenders who feel they have been treated unfairly by the criminal justice system will respond with defiance and continue to commit crime, sometimes even increasing their criminal behavior. This behavior is not limited to the individual but also to groups who will respond with defiance if they feel their community is being threatened. Neighborhoods within Cincinnati provide a sense of social solidarity – you can buy bumper stickers that advertise your neighborhood (e.g. “I *heart* Northside”). If people within a neighborhood perceive that their neighborhood is being targeted, and that they believe that this activity is unfair, then the police actions could have the opposite intended effect.

Mixed Results

A large amount of research has been done on aggressive policing tactics, and a consensus has yet to be reached. One of the most famous (and often pointed to) examples of aggressive

policing is the city of New York, and former New York City police commissioner William Bratton writes about how his tough style of policing cleaned up the city (1998). However, in a study of San Francisco crime rates, Macallair (2002) found similar reductions in crime occurred as had been seen in New York, despite San Francisco police not adopting any aggressive policing tactics. A similar study is taken up by Ouimet (2004), who examines the crime drop of the 1990s in both the United States and Canada. While proponents of aggressive policing cited it as a reason for the decline of crime in the U.S., Canada saw a similar crime drop without adopting aggressive policing tactics. Visher and Weisburd (1997) argue that for a policing strategy to be effective, it must be highly focused. Aggressive policing tactics that merely increase the number of arrests over a large area, without a specific target, would not fall into this category. Broad aggressive policing strategies, then, would not be effective at reducing crime, according to Visher and Weisburd (1997).

A common complaint of aggressive policing is that it does not address the source of the problem; Sherman *et al* determined that police raids had little long-term effects on crime in the areas where the raids took place: “Like aspirin for arthritis, the painkiller does nothing to remedy the underlying condition” (1995). Langworthy (1989) analyzed police stings, arguing that not only was this aggressive method not effective at reducing crime, but it also may have increased crime in the area. In a replication of Wilson and Boland’s 1978 study, Jacob and Rich (1980-81) found positive correlations for aggressive policing and crime rates, as opposed to the negative correlations reported by Wilson and Boland (1978).

Several studies have summarized past research findings, including Sherman (1996) who argues that “broken windows policing” or “zero tolerance policing” shows consistent support of crime reductions. However, Sherman also cautions against implementing these tactics, since

large numbers of arrests could potentially lead to a state of defiance that could increase rates of reoffending among those who had been arrested. Eck and Maguire (2006), again looking at multiple studies of aggressive policing, argue that aggressive policing tactics have not conclusively been shown to reduce serious crimes, and also that these tactics have resulted in an increase in the harassment of minorities. Not enough research has been conducted on the long-term effects of aggressive policing, and Eck and Maguire conclude by stating that declines in crime that result from aggressive policing may only be temporary, if the public feels that they are being treated unjustly.

Offender Motivation and Mobility

Several studies have examined how offenders choose their targets, and how far they will travel in order to commit a crime. Wright and Decker (1993) conduct interviews with robbers in order to acquire a more complete picture of offender motivation, which would allow for a better idea in forming robbery prevention strategies. Wright and Decker found that a “street culture” was very present in the robbers they interviewed, a fast and hard lifestyle where money was spent on drugs and gambling. Offenders robbed when they ran out of cash in order to continue this street lifestyle, because the payoff was immediate; a legitimate job would not pay as quickly and was harder to keep. In order to combat this motivation, Wright and Decker argued that situational crime prevention techniques would do nothing to reduce overall crime, and that at best would only reduce crime for the specific area that was being targeted. Because of the unique motivation driving robbers, simply making a single area less accessible would only cause robbers to look for a new area. Wright and Decker stated that, short of a massive societal restructuring, job creation was the most likely means to effectively reduce robbery. Wright and

Decker also argue that increased incapacitation of robbers could also prove problematic, since, not only does this ignore their original motivation, but the prison culture strengthens and enforces the street culture that drove robbers to offend in the first place.

A key issue here is how far offenders are willing to travel. Hesselning (1982) found that most crimes within the inner city were not committed by people who lived within the inner city neighborhoods, nor even in areas surrounding the inner city. This suggests that offenders travel further to commit crimes in the inner city as opposed to residential crimes. In the case of the current study, offenders who had previously been traveling to Over-the-Rhine to commit robberies may simply avoid the area after having perceived it to have a higher police presence due to the increase in arrests. Additionally, the distance that offenders travel varies depending on a number of other factors, such as the type of crime being committed, and even the gender, age and race of the offender (Van Koppen & Jansen, 1998). Older offenders traveled further than young offenders (4.98 miles on average compared to 2.02 miles), whites traveled further than blacks (6.67 miles compared to 2.29) (Nichols, 1980, as quoted in Van Koppen and Jansen). Van Koppen and Jansen, based on 524 robbers, found that offenders in the Netherlands traveled a median distance of 2.17 miles to commit robberies (the average distance was heavily skewed by several large outliers and was over 11 miles). For the current study, it is important to note that this means that not only would displaced offenders potentially be traveling this far from the study area, but that they also traveled this far to the study area before they were displaced. If the displaced crime was committed in a new area, closer to their home, then this displaced crime could easily be several miles away from Over-the-Rhine. To put it another way, if an offender traveled two miles to commit a robbery in Over-the-Rhine, he/she might travel two miles in the

opposite direction if that the perceived police presence was too much of a threat in Over-the-Rhine.

Displacement and the WDQ

Tests for displacement have often been stymied by the lack of any actual specific test for displacement; however, several studies have examined crime rates surrounding treatment areas. Often, studies have found no displacement (Weisburd *et al*, 2006) or a diffusion of benefits occurring (Green, 1995; Weisburd & Green, 1995) where crime decreases in the surrounding area. Some studies assume displacement occurs, but argue that this is a positive effect (Zimmer, 1990). This is based on Barr and Pease's argument that displaced crime results in a "more equitable pattern of victimization" (abstract, 1990). This assumes that when crime is displaced, it is displaced evenly through an area, although this is almost certainly never the case.

The WDQ was introduced by Bowers and Johnson in their article "Measuring the Geographical Displacement and Diffusion of Benefits Effects of Crime Prevention Activity" (2003); the test was designed to study not only whether displacement occurred based on the effects of a treatment, but also to compare the effects of displacement against the effects of the treatment. The WDQ examines three separate areas; a treatment area (A), a buffer area (B), and a control area (C). The control area can either be an extended buffer or it can be a completely separate region. In addition to the three areas, the WDQ requires "before" (subscript 0) and "after" (subscript 1) time periods to measure changes in the rates of crimes in each area. The formula for the WDQ is as follows:

$$\frac{(B_1 / C_1) - (B_0 / C_0)}{(A_1 / C_1) - (A_0 / C_0)}$$

In this formula, A is equal to the crime rate in the treatment region B is equal to the crime rate in the buffer region, and C is equal to the crime rate in the control region. The numerator in this formula determines whether or not displacement of crime or a diffusion of benefits is occurring, while the denominator is a measure of success for the treatment itself. If the numerator is negative, this is indicative of displacement of crime occurring; if the numerator is positive, it suggests that a diffusion of benefits is occurring. If the success measure is negative then this is an indication that the treatment achieved a reduction in crimes, whereas if this number is positive it shows that the treatment was unsuccessful. The WDQ allows, then, for the comparison of changes in crime rates between the buffer area and the treatment area. If a large increase in crime were seen in the buffer region, but no major change was seen in the treatment region, then the WDQ would not show a strong amount of displacement.

The result of the WDQ itself is either a negative or positive number, indicating displacement of crime or diffusion of benefits, respectively. Table 1 shows how the results of the WDQ can be interpreted (Bowers & Johnson, 2003). If the WDQ result is 0, then this is an indication that the treatment showed no displacement or diffusion. As the WDQ result moves away from zero, this indicates whether displacement of crime or a diffusion of benefits is occurring; negative numbers show that displacement is occurring, where positive numbers indicate a diffusion of benefits. If the WDQ shows a result of 0.5, this means that a diffusion of benefits occurred, equal to half of the direct effects of the treatment. A result of -1 indicates that all of the direct effects of the treatment were displaced to the buffer region. In the event that displacement of crime occurs, this allows for the researcher to determine whether or not the effects of displacement were equal to the effects of the treatment. If, for example, a

displacement of crime occurs that is not equal to the effects of the treatment, it may be decided to continue with the treatment; if the effects of displacement are equal to or greater than the positive effects of the treatment then the treatment should probably be discontinued.

Table 1 – Interpretation of the Weighted Displacement Quotient

For example, consider three areas – A, B, and C – where each area has a crime rate of 100 in the “before” time period. Following an intervention, the crime rate changes to 50 in area A, 75 in area B, but with no change in area C (crime rate equal to 100) – see Table 2.

Table 2 – WDQ Example

	Time 1	Time 0
A	50	100
B	75	100
C	100	100

The WDQ would then be calculated as follows:

$$\frac{(75/100) - (100/100)}{(50/100) - (100/100)} = \frac{0.75 - 1}{0.5 - 1} = \frac{-0.25}{-0.5} = 0.5$$

The result of $WDQ = 0.5$ indicates that a diffusion of benefits is occurring such that half of the positive effects seen in the treatment region are occurring in the buffer area.

Bowers and Johnson (2003) suggest a test for significance for the numerator and denominator, however, as they state, the sample size used to determine these significance measures was relatively small ($n = 21$). Bowers and Johnson suggest that a result of the denominator (which is the measure of the success of the treatment) of equal to or less than -0.035 indicates that the treatment was successful. If this success measure is greater than -0.035 then it was not successful. For the numerator (which shows the extent of displacement or diffusion of benefits), if the result is less than -0.035 then this is indicative of significant diffusion of benefits; likewise, if the numerator results are greater than $+0.035$, then this is indicative of significant displacement of crime.

Summary of Literature

The degree to which policing affects crime has yet to be fully realized; the degree to which a particular brand of policing affects crime is even more unclear. In the case of aggressive policing, studies have revealed mixed results of every sort – cases where policing raised crime, cases where policing lowered crime, and cases where there was no apparent effect. Following an increase in popularity of aggressive policing for its apparent role in the decline of crime in New York City, many agencies and many researchers have been attempting to discern its effects. Researchers have argued that the long-term consequences of aggressive policing may be extremely damaging to the city and to the public, and that these consequences are not being considered by police agencies. As police increase their presence and activity within a community, the people within that community can become separated from the rest of the city,

disenfranchised with the police or both. Policies where large numbers of young adults are arrested for minor offenses can lead to feelings of defiance, and also limit the future possibilities for the arrested - a criminal record can severely limit potential job opportunities. Advocates argue that this kind of disorder policing reduces serious crime and cleans up neighborhoods. The high arrest rates discourage minor crimes, which instills a greater sense of community within people, which encourages them to respect their neighbors and their neighborhood to a higher degree. The term aggressive policing itself has been called into question as well; social scientists have debated its exact meaning and the best way to measure it in research studies. Police expenditure, police force size, and number of arrests have all been used to quantify police aggression. Some of the major studies examining police aggression are also frequently limited to observing differences between cities. Even though a neighborhood effect is in place for both crime rates and police behavior, many studies have failed to take this into account.

Methodology

Data gathering and processing

Data for this study were obtained from the Cincinnati Police Department, and included a total of four years of data for crimes and arrests (2003-2006). Only data for the months of July and August were used for each month. Operation Vortex was initiated in early 2006, so this allowed for the effects of the program to be examined, without worrying about the months when the program was not in place. Robberies and aggravated robberies were selected as the crime type; possession of open flask and possession of drug paraphernalia were selected as the arrest type. It was not possible to determine the type of robberies that were being committed (e.g. commercial robbery or street robbery). Crime data for Cincinnati includes an address for both

crimes and arrests, and these crimes and arrests were geocoded onto a street network of Cincinnati using ArcMap. A small percentage of the crime and arrest data (5%) was forced to be removed, due to being unable to verify the exact address of where the address took place during the geocoding process. Of the geocoded arrests, an additional 14% were forced to be removed, as the arrests were reported as taking place at the district stations, rather than at a particular address on the street. This made it impossible to determine where the arrest took place, since all these arrests were geocoded at the district police stations. Since a district station was within the study area, if these arrests were included in the analysis, it would have greatly skewed the number of arrests that occurred within the study area (making it seem much higher than it actually is). As it is, the number of arrests is therefore slightly lower than reality; it is still interesting, then, to note the high numbers of arrests even after this data reduction.

In order to analyze the effects of distance, as well as create the distance buffers required for the WDQ tests, driving distance buffers were generated using the Network Analyst function of ArcMap. Street data were obtained from the Cincinnati Area GIS (CAGIS) database, and a street network was constructed using their parameters. In order to determine the number of crimes and arrests within each buffer and within each neighborhood, spatial joins were conducted in ArcMap.

The current study uses data from 2003 through 2006; the study areas are indicated in Figure 5. The treatment area (region A) was determined based on the spread of arrests for possession of open flask and possession of drug paraphernalia. These arrests were geocoded in ArcMap and the results are shown in Figure 6. From this treatment area, buffers of two miles (region B) and four miles (region D) were determined based on a street network of Cincinnati.

This study began as a result of the increased attention paid to the Cincinnati Police following the start of Operation Vortex, as well as the Hamilton County deputies. In Cincinnati, the number of arrests for minor disorder increased dramatically following the start of Operation Vortex. For this study, two specific minor offenses were selected: possession of open flask (of alcohol) and possession of drug paraphernalia. A series of seven one-mile buffers were created around the study area in order to analyze the relationship between distance from the area and changes in arrests and crimes. The change in the number of these arrests is illustrated in Figure 1. As can be seen, a large spike in arrests is seen from 2005 to 2006 in the Over-the-Rhine neighborhood, which quickly dissipates once one moves beyond a single mile.

This increase in arrests in Over-the-Rhine was coupled with a large decrease in the number of robberies. However, the changes in robberies throughout the city were much more dynamic than the changes in arrests for minor disorder, which were primarily limited to the Over-the-Rhine area. Figure 2 shows these changes in robberies, again moving away from Over-the-Rhine. As can be seen, there is a large decrease in robberies from 2005 to 2006 in Over-the-Rhine, and this decrease in crime extends beyond the boundaries of Over-the-Rhine itself. However, three and four miles away from the Over-the-Rhine neighborhood, there are increases of robberies. What is unique about this analysis is that it suggests that both a diffusion of benefits occurs (as is predicted and suggested by the literature) *as well as* a displacement of crime. There is a pivotal distance where the diffusion of benefits effects ceases to occur, and crime is displaced.

However, while it was assumed that this large rise of arrests from 2005 to 2006 was a unique event, this was not the case. Figure 1 also shows the changes in arrests from 2003 to

2004, and 2004 to 2005. As can be seen, there is an even larger increase in arrests from 2004 to 2005. The large increase from 2005 to 2006 is still important, since it is adding on to the large increase seen from 2004 to 2005, however this still shows that aggressive policing began in this area a year before Operation Vortex or the Sheriff Deputies arrived, and again, this change is highly focused, limited solely to a single mile from the study area.

Figure 1 – Changes in arrests in July and August from 2003 to 2006, compared to distance from Over-the-Rhine

Despite the large increase in arrests for possession of open flask and possession of drug paraphernalia seen in 2005, the number of robberies does not decrease any more than they did from 2003 to 2004, when there had been no drastic increase in arrests, as can be seen in Figure 2. This is quite a bit different from the changes in robberies from 2005 to 2006, where a massive decrease occurred. Crimes do, however, increase several miles away from the study area from 2004 to 2005, as well as from 2005 to 2006.

Figure 2 – Changes in robbery in July and August from 2003 to 2006, compared to distance from Over-the-Rhine

STWDQ

For the current study, the study regions for the WDQ were restructured to provide the most complete picture of crime trends in Cincinnati; namely, a modified version of the WDQ, which was dubbed the Spatio-Temporal WDQ (STWDQ), was used to attempt to control for potential spatial problems. The modification to the WDQ consisted of replacing the control region; instead of a more distant area, the same area was used, but from a different year. In the original WDQ, both the buffer area and the treatment area are controlled by area C. In the STWDQ, the buffer area is controlled by the buffer area from a previous time period, while the treatment area is controlled by the treatment area from the same previous time period. This update requires a larger amount of data; however it does not rely on a potentially related area to control for crime displacement. If crime displacement does occur on a large scale and does spread to the control region, then the WDQ is corrupted.

In the previous WDQ formula, the “before” and “after” time periods were designated with subscripts 0 and 1, respectively. Since the STWDQ essentially incorporates two “before” and two “after” time periods, this notation is no longer sufficient. The updated formula uses the years from which the data was gathered for the subscripts. An example of the formula is as follows:

$$\frac{(B_{06} / B_{04}) - (B_{05} / B_{03})}{(A_{06} / A_{04}) - (A_{05} / A_{03})}$$

With this modification comes the added benefit of using crime rates or absolute numbers of crimes. In the updated formula, A_{06} is equal to the number of crimes committed in the treatment area in 2006, while A_{05} is equal to the number of crimes committed in the treatment area in 2005. Likewise, B_{06} is equal to the number of crimes committed in the buffer region in 2006, while B_{05} is equal to the number of crimes committed in the buffer region in 2005. In this example, the changes in crime from 2005 to 2006 are compared against the changes in crime from 2003 to 2004.

Since many previous studies had shown effects of a diffusion of benefits, including Bowers and Johnson’s uses of the WDQ in their article (2003), it was assumed that there was both an area that saw a diffusion of benefits (area B), as well as an area that saw effects of displacement of crime (area D). In order to determine these effects, STWDQs were run comparing area A with areas B and D, as well as the combination of the two (area Z). Additionally, assuming that a diffusion of benefits was occurring, it is important to determine if those diffusion effects are being displaced as well (displacement of diffusion of benefits), and STWDQs were run using the combined regions A and B (area X) as the treatment region.

Previous crime studies that have suggested a diffusion of benefits from their treatment programs seem to assume that the crime vanishes altogether; this seems problematic at best, considering offender motivations. If the treatment does not address these motivations, then there is a possibility that the crime will simply move to a new area.

Figure 5 – Cincinnati STWDQ Study Regions

Figure 6 – Arrests for Minor Disorder in Cincinnati

Figure 7 – Reported Robberies in Cincinnati

In order to determine the number of robberies that occurred within each area, all robberies for the months of July and August in the years 2003 through 2006 were geocoded in ArcMap. A count field was then created for each region; these results are shown in Table 3. An example of the geocoded robberies for 2006 is seen in Figure 7.

Table 4 groups the STWDQ tests into three main categories depending on the time period they examined. STWDQ 1 examines the changes in robbery from 2005 to 2006 is examined, using 2003 to 2004 as the control time period. STWDQ 2 examines the changes from 2005 to 2006 again, but this time using 2004 to 2005 as the control. Because of the large increase in arrests in the study area from 2004 to 2005, STWDQ 3 examines the changes in robberies from 2004 to 2005, using 2003 to 2004 as the control.

Based on these time periods, four different buffer regions were analyzed to determine the extent of displacement and diffusion of robberies in Cincinnati. The first set of STWDQs examines crime displacement or diffusion in the B buffer region; this test assumes that diffusion will occur within this immediate area. The next set examines area D, and assumes that displacement will occur. The third set of STWDQs looks at the total buffer area, defined as the Z area, and assumes that, overall, displacement will occur. The last set combines the treatment area and the two-mile buffer region in order to determine if the assumed diffusion of benefits effects are themselves being displaced.

Table 3 – Robberies by year for study regions

	2003	2004	2005	2006
A	120	118	107	56
B	74	65	69	55
D	153	123	140	180

X	194	183	176	111
Z	227	188	209	235

Table 4 –STWDQ tests run

	STWDQ 1 03-04/05-06	STWDQ 2 04-05/05-06	STWDQ 3 03-04/04-05
Two-mile buffer	$\frac{(B_{06}/B_{04}) - (B_{05}/B_{03})}{(A_{06}/A_{04}) - (A_{05}/A_{03})}$	$\frac{(B_{06}/B_{05}) - (B_{05}/B_{04})}{(A_{06}/A_{05}) - (A_{05}/A_{04})}$	$\frac{(B_{05}/B_{04}) - (B_{04}/B_{03})}{(A_{05}/A_{04}) - (A_{04}/A_{03})}$
Four-mile buffer	$\frac{(D_{06}/D_{04}) - (D_{05}/D_{03})}{(A_{06}/A_{04}) - (A_{05}/A_{03})}$	$\frac{(D_{06}/D_{05}) - (D_{05}/D_{04})}{(A_{06}/A_{05}) - (A_{05}/A_{04})}$	$\frac{(D_{05}/D_{04}) - (D_{04}/D_{03})}{(A_{05}/A_{04}) - (A_{04}/A_{03})}$
Combination buffer	$\frac{(Z_{06}/Z_{04}) - (Z_{05}/Z_{03})}{(A_{06}/A_{04}) - (A_{05}/A_{03})}$	$\frac{(Z_{06}/Z_{05}) - (Z_{05}/Z_{04})}{(A_{06}/A_{045}) - (A_{05}/A_{04})}$	$\frac{(Z_{05}/Z_{04}) - (Z_{04}/Z_{03})}{(A_{05}/A_{04}) - (A_{04}/A_{03})}$
Combination treatment area	$\frac{(D_{06}/D_{04}) - (D_{05}/D_{03})}{(X_{06}/X_{04}) - (X_{05}/X_{03})}$	$\frac{(D_{06}/D_{05}) - (D_{05}/D_{04})}{(X_{06}/X_{05}) - (X_{05}/X_{04})}$	$\frac{(D_{05}/D_{04}) - (D_{04}/D_{03})}{(X_{05}/X_{04}) - (X_{04}/X_{03})}$

This combination of tests allows for the analysis of displacement on several different scales and at several different time periods. Because the STWDQ is, in essence, measuring police strategies in a specific study area against each other, this allows for direct comparison between annual changes in police behavior in the Over-the-Rhine area. For example, in the STWDQ 1 set, the aggressive policing tactics observed from 2005 to 2006 are compared against the policing tactics from 2003 to 2004. Additionally, STWDQ results from the immediate area can be compared against the displacement or diffusion in the larger buffer region to determine if both displacement and diffusion are occurring.

Regression Model

Finally, a regression model was created in order to examine the effects of distance and aggressive policing on changes in crime. The units of analysis for the model were individual neighborhoods whose centers fell within the four-mile buffer that had previously been established for the WDQ and STWDQ. Figure 8 indicates which neighborhoods were included in the regression model; these neighborhoods were obtained from the Cincinnati Area Geographical Information System database. The dependent variable examined was the changes in the number of robberies from 2005 to 2006; the independent variables were the changes in the arrests for possession of open flask and possession of drug paraphernalia, as well as the sigmoid function of travel time from each neighborhood centroid to the Over-the-Rhine centroid. This travel time, based on street length and speed limit, was calculated using Network Analyst in ArcMap. The model was run for both the changes in crime from 2005 to 2006 as well as the changes from 2003 to 2004 and 2004 to 2005. The '03-'04 and '04-'05 models were run in order to determine if displacement or diffusion of crime was occurring at any other time.

Figure 8 – Neighborhoods included in regression model

The equation for the regression models is as follows:

$$C_{1-0} = k + (sig)T_{s-j} + A_{1-0} + \epsilon$$

Where C_{1-0} is equal to changes in crime (the crime in the “after” time period (1) minus the crime in the “before” time period (0)), k is equal to the coefficient, $(sig)T_{s-j}$ is equal to the travel time from Over-the-Rhine (s) to each neighborhood centroid (j) transformed using a sigmoid function, A_{1-0} is the change in arrests for possession of an open flask or possession of drug paraphernalia, and ϵ is equal to the error. This model does not include several variables that have been present in past research, such as neighborhood stability, unemployment rate, percent nonwhite population, or age. This was done primarily because of the concern that displacement of crime

from Over-the-Rhine may be occurring because the population demographics are changing due to gentrification and revitalization of the area in general. These developmental changes (for example, see 3CDC) may have significantly altered the population make-up of the city. If this is the case, then U.S. census data from 2000 would not be representative and could lead to misleading or incorrect results.

The regression model examined the effects of distance, in addition to the changes in arrests for possession of open flask and possession of drug paraphernalia, on the changes in robberies. As in the WDQ and STWDQ tests, the changes in robbery were determined based on the differences between the July and August months of 2005 to the July and August months of 2006. Spatial joins in ArcMap were again used to count the number of robberies and arrests in each neighborhood for 2005 and 2006.

Results

The results for the twelve STWDQ tests are shown in Table 5; almost all the results were as had been predicted prior to the study; the success of the treatment, each instance of displacement, and each instance of a diffusion of benefits is significant according to the significance parameters established by Bowers and Johnson (2003).

Table 5 – STWDQ results

	STWDQ 1 03-04/05-06	STWDQ 2 04-05/05-06	STWDQ 3 03-04/04-05
Two-mile buffer	0.21	0.69	-2.39
Four-mile buffer	-1.31	-0.39	-4.37

Combination buffer	-0.79	-0.03	-3.7
Combination treatment area	-1.82	-0.45	N/A

The first set of STWDQ 1 compares the aggressive policing tactics employed from 2005 to 2006 with the non-aggressive policing style from 2003 to 2004. As was predicted, a diffusion of benefits was seen in the immediate area, with a large amount of displacement (-1.31) occurring further into the city. The overall effect shows displacement that is almost equal to the effects of the treatment (-0.79). Based on Bowers and Johnson's interpretation of the WDQ results (2003), this would suggest that there is no net benefit to aggressive policing at this scale. When one considers the diffusion of benefits as part of the treatment program (i.e. when one tests for displacement of the diffusion of benefits), a huge amount of displacement is observed.

The second set of STWDQ 2 compares the policing strategies from 2005 to 2006 against those of 2004 to 2005. The same pattern of displacement and diffusion is observed as had been seen in the STWDQ 1 tests, however, the amount of a diffusion of benefits in the immediate area is larger, and the amount of displacement of crime is smaller. In the combination buffer area, the amount of displacement is almost non-existent. However, this is essentially comparing two instances of aggressive policing. Since the large increase in arrests for minor disorder was observed from 2004 to 2005, this is indicative of an aggressive policing style. What can be said of the policing strategy from 2005 to 2006 is that, perhaps, the additional increases in arrests (i.e. more aggressive aggressive policing) had a greater influence on robberies.

The third set of STWDQ 3 compares the aggressive policing tactics employed from 2004 to 2005 with the non-aggressive policing style from 2003 to 2004. This is the only instance where there is no diffusion of benefits observed in the immediate surrounding area. Additionally, the effects of displacement of crime, which are present in every test, are massive. No STWDQ was run for the combination treatment area and immediate buffer area, since there was no diffusion of benefits in the immediate buffer region. The large STWDQ results are probably due to the relatively little change in robbery within the treatment area from 2004 to 2005, coupled with increases in crime in the surrounding area. Comparing these results with the STWDQ 1 set, it shows a large improvement from 2005 to 2006 as compared to 2004 to 2005, at least within the study area. The amount of displacement shown in the STWDQ 1 set, while still present, has greatly been reduced from the STWDQ 3 set. This can be attributed to the large reduction of robberies in the study area from 2005 to 2006, which was not seen from 2004 to 2005.

Most importantly, the results show the combination of a diffusion of benefits as well as that of displacement of crime occurring following the increase in arrests. This is a crucial realization, because it calls into question the results of other displacement studies that did not include an extended buffer area. The common finding of displacement studies has been that of a diffusion of benefits; however, if this diffusion of benefits occurs simultaneously with a displacement of crime, and if the effects of diffusion are also being displaced, then the potential for skewed results becomes problematic. The findings of the current study agree with past literature that has shown this diffusion of benefits, yet the addition of the extended buffer shows a more complete picture; that of displacement.

The three regression models tested the effects of distance from the treatment area, to further explore whether or not displacement was occurring. The first regression model acted as a control, and examined the changes in robberies from 2003 to 2004; the second regression model examined the changes from 2004 to 2005; and the third examined the changes from 2005 to 2006. The sigmoid function of travel time and the changes in arrests for possession of open flask and possession of drug paraphernalia were used as the independent variables for both the regression models. Figure 9 shows a choropleth map of the changes in robberies from 2005 to 2006. As it appears on the map, there is a large decrease in crime in Over-the-Rhine and the surrounding area (with the exception of the neighborhoods directly north of Over-the-Rhine), while there is an increase of crime on the periphery. The two neighborhoods that show increases of robberies that are directly north of Over-the-Rhine contain the University of Cincinnati, and are home to a large number of university students.

Figure 9 – Changes in robberies from 2005 to 2006 by neighborhood

Figure 10 shows the movement of robberies throughout the city over a four year period. As can be seen in 2005 robberies remained highly clustered in Over-the-Rhine, but in 2006 they began to disperse throughout the city. The 2003-2004 regression model showed an R^2 of 0.102, showing that there was no relationship between travel time from the treatment area and the changes in robberies; similarly the 2004-2005 regression model showed an R^2 of 0.137, again indicating no significant relationship between travel time and changes in robberies. The 2005-2006 regression model, however, showed an R^2 of 0.666, and was significant at the 0.01 level. Table 6 shows the regression model results. Graph 6 shows the differing relationships of distance and changes of robberies from 2003 to 2004 as compared to the changes from 2005 to

2006. This suggests that the treatment was not effective at reducing overall crime, and merely moved crime out of the treatment area and into the surrounding region. Following Operation Vortex's initiation into Over-the-Rhine, crime in the surrounding area increased as crime in Over-the-Rhine decreased. Distance played an important factor in determining where crime would arise following Operation Vortex. Because this relationship was only seen in the changes of robberies from 2005 to 2006, it may be that this relationship occurs not as a result of aggressive policing tactics, since aggressive policing was present from 2004 to 2005; a delayed effect of the aggressive policing may also be responsible for these results. There is obviously not a continuous movement of crime out of Over-the-Rhine, but following the large decrease of crime there, robberies did move out away from that neighborhood. This suggests the importance of considering distance in predicting where increases of crime may occur following displacement.

Figure 10 – Cincinnati robberies in July and August for the years 2005 and 2006

Table 6 – Regression Model Results

Model 1	R	R Square
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	0.32	0.102			
	B	Std. Error	Beta	t	Sig.
(Constant)	-4.799	4.168		-1.151	0.261
Travel Time	4.559	6.527	0.133	0.699	0.491
Arrest change	-0.093	0.062	-0.285	-1.501	0.146

Model 2	R	R Square			
	0.37	0.137			
	B	Std. Error	Beta	t	Sig.
(Constant)	-7.052	5.585		-1.263	0.218
Travel Time	12.086	8.402	0.462	1.438	0.163
Arrest change	0.009	0.025	0.121	0.376	0.71

Model 3	R	R Square			
	0.816	0.666			
	B	Std. Error	Beta	t	Sig.
(Constant)	-41.773	8.492		-4.919	0.000
Travel Time	64.316	13.203	1.075	4.871	0.000
Arrest change	0.035	0.024	0.325	1.472	0.154

Figure 11 shows the residuals of the Model 3 regression test; crime is higher than expected in the neighborhoods of East Price Hill, while crime is lower than expected in Corryville. If offender populations are being displaced from Over-the-Rhine through gentrification, the west side of Cincinnati may be where they are moving to, which would explain the higher than expected results in East Price Hill. The results may also be due to random chance. A Moran's I test showed no spatial autocorrelation among the residuals; the Moran's index and the expected index were both equal at -0.04.

Figure 11 – Residual map of regression model 3

WDQ vs. STWDQ

An initial problem with the WDQ is its reliance on crime rates, as opposed to actual number of crimes. In the case of Cincinnati, the treatment region has a population of about 15,000 people according to U.S. Census data, while the Z region (the combined buffer region) has a population of roughly 135,000 (citation here). Examining changes in robbery from 2005 to 2006, one sees a decline from about 100 crimes in 2005 to roughly 50 in 2006. In 2005, the Z region had around 200 robberies committed. For the WDQ to yield a result of -1 (absolute displacement), an increase of 450 robberies would have to be observed in the Z region in 2006.

A larger issue for the WDQ is based on the Modifiable Areal Unit Problem – different results will be yielded when different sized study areas are used. This is most important when it comes to identifying a control region. If crime displacement is more widespread than is previously considered in previous criminology studies, then the control region is in danger of being corrupted by displaced or diffused crime. The notion that crime will only be displaced to the immediate surrounding area ignores issues of offender motivation and mobility, leading to the possibility that crime is displaced to a larger area. The selection of a buffer region to test for displacement is less problematic in regards to the MAUP issue, however the problem still exists. It is impossible to know the extent to which crime is displaced, how far afield offenders will go to commit crime. If the buffer is drawn too small, it will miss potential displaced crime; if it is drawn too large, the results will be tempered by the “wash-out” effect, discussed by Bowers and Johnson (2003) – that is, the effects of displacement will be lost in the bigger picture. While the WDQ has to contend with both the problem of deciding a buffer region as well as a control region, the STWDQ has only the worry of deciding on a suitable buffer region. The control region is temporally separate from the crime treatment, making it impossible for crime to be

displaced to it; no unknown displacement or diffusion can corrupt the control area in the STWDQ. Selecting a control region for the WDQ is doubly problematic, since the control must be far enough away so that it is not corrupted by the displacement or diffusion, but also close enough so that it is still a meaningful control; using Chicago as a control for a neighborhood in Cincinnati would not make much sense, since the cities are quite different from one another. If crime displacement is far-reaching, then a suitable control region – one which is separate from any displacement or diffusion effects, but is still relevant to be used as a control – may not exist.

In a sense, the STWDQ is not testing for displacement against a control area, but rather against a different police strategy – whatever strategy was being employed during the previous time period. In this sense, the STWDQ allows for a direct comparison of police strategies to determine which method was more effective, and whether or not the new treatment displaces or diffuses crime based on the previous police behavior. The WDQ assumes that police behavior in the control region is constant from the before time frame to the after time frame, while the STWDQ needs no such assumption since it is actually comparing police strategies.

Discussion

Aggressive policing of minor offenses has often been thought to be the solution to preventing more serious crime from occurring. Many tests of the effectiveness of aggressive policing have yielded mixed results, however there have been several success stories of aggressive policing reducing crime in a targeted area; Cincinnati also fits this description. Tests for displacement have also yielded positive results, with many studies finding that not only did displacement of crime not occur, but that crime in the immediate surrounding area decreased as a

result of the treatment; this is also the case in Cincinnati. However, what many studies have failed to do is consider a wider range of where displacement could be occurring.

Aggressive policing does not address any offender motivations for committing a crime; it merely makes an area less accessible for an offender to commit a crime in that particular area. When considering offender motivation and mobility, it seems possible that an offender could change where they committed their offenses, up to several miles from the original target area. Studies of offender mobility show that they are willing to travel several miles on average to arrive at a location to offend at (Van Koppen & Jansen, 1998), and most importantly, that offenders will travel further to commit crimes in a downtown area, such as Over-the-Rhine and the Central Business District of Cincinnati (Hesseling, 1982). These target-rich environments are very appealing to offenders until an aggressive police program is enforced; at this point, the offenders do not decide to give up their life of crime, but merely look for new places to commit crime. Offenders who travel greater distances to commit crimes in Over-the-Rhine specifically who are displaced will already live several miles away from Over-the-Rhine to begin with. If they continue to commit crimes, and if they commit these crimes close to where they live, then the result will be an increase of crime away from the Over-the-Rhine area.

The results of this study show that on a large scale, displacement of crime is occurring from the center of the city. This coincides with a large increase of arrests for minor offenses, such as possession of open flask or possession of drug paraphernalia, within a small area primarily in the Over-the-Rhine neighborhood. However, the police actions in Cincinnati do not appear to have reduced crime in the city as a whole. Long-term effects of this style of policing are thought to include a disassociation of the city and of the police by residents living within the targeted areas. Cincinnati police may only be damaging their relations with their citizens by

continuing on the present course, not only to those people living in Over-the-Rhine, but also people living in the surrounding areas who have seen their crime rates increase and believe it to be a result of police behavior, whether or not this is even true.

Based on the findings from the STWDQ tests and the regression models, it appears that robberies have only recently begun to be displaced from Over-the-Rhine, but that aggressive policing may be unrelated to this issue (although perhaps indirectly related) or that a delayed effect is occurring. There was no large reduction in crime in Over-the-Rhine until 2006; however, aggressive policing was taking place in 2005. An increase of crime was observed in the areas surrounding Over-the-Rhine from 2004 to 2005, and a larger increase was seen again from 2005 to 2006. It is possible that there is no relationship between the decrease in crime seen in Over-the-Rhine in 2006, and the increases in crime observed in the surrounding area at that same time. The reasons for the increase of crime seen in 2005 may have continued and become more exacerbated, or even been added to by a small amount of displacement from Over-the-Rhine.

Future study is required to better understand the changes of crime in Cincinnati. The city of Cincinnati has chosen to continue its use of the Vortex Unit, allowing for a unique opportunity to study a dynamic aggressive patrol unit. City and police officials state that the Vortex Unit will cycle throughout the city, wherever there are increases in crime. What remains to be seen is whether the reductions of crime observed following the introduction of Operation Vortex will be seen again in new neighborhoods. This will help determine whether or not Operation Vortex actually caused the decline in crime in Over-the-Rhine, or whether this was merely coincidental. Additionally, it will be extremely important to observe what happens to Over-the-Rhine (and the additional neighborhoods) when the Vortex unit moves out of the neighborhood. The changes in

arrests as well as changes in crime are extremely important to determine the effectiveness of aggressive policing. If Operation Vortex is, in fact, the cause of the decline in crime, will there be a “whack-a-mole” effect, where crime returns to a neighborhood once the Vortex unit has left?

Conclusion

While this study began with the assumption that aggressive policing had only recently arrived to Cincinnati, it turned out that this was not the case. Cincinnati police began aggressive policing style tactics well before Operation Vortex or the introduction of Hamilton County Sheriff deputies. It is unclear whether these actions had a large impact on robberies in the city. While it seems probable that crime displacement from Over-the-Rhine to the surrounding area is occurring, it is not clear at present what is causing this exodus. Potential causes include police actions, public perception of the police, or gentrification of the area causing population (as well as offender) displacement. In addition to this displacement, there is also a diffusion of benefits occurring from the decreases in crime in the study area; the immediate surrounding area is also seeing reductions of robberies. Because the cause of these changes is unknown, it is also not possible to predict whether or not these changes will remain permanent. If the reductions of crime are due to population displacement, then it is possible that Over-the-Rhine will continue to have reduced crime rates. If the reductions are due to aggressive police behavior, then it is possible that crime could return if the police move to a new neighborhood, or that societal unrest could increase as a result of overly aggressive policing.

While many studies have examined displacement, a reliable measure for displacement has not always been available. While the WDQ provided some measure of displacement or

diffusion of benefits, it was not without some flaws. These issues included the problem of the control area being corrupted by large-scale displacement. The STWDQ allows for researchers to examine police strategies in an area directly against previous police strategies of the same area to determine how well the new tactics perform. This allows for researchers to determine whether or not to continue pursuing the current policing strategy or to revert back to the previous methods (or to find a new solution).

In Cincinnati, the STWDQ tests revealed that following the adoption of aggressive policing tactics, crime in Over-the-Rhine declined, but crime in the surrounding areas increased. In the immediate area surrounding Over-the-Rhine, a diffusion of benefits was observed, keeping in agreement with previous displacement studies (citations here). However, beyond this diffusion of benefits area, large amounts of displacement were observed, suggesting that both a diffusion of benefits and displacement of crime occur. When examining whether or not the diffusion of benefits themselves are displaced, there is even larger amounts of displacement, above and beyond the decreases in crime both in the treatment area as well as from the diffusion of benefits. These effects are most pronounced when examining the changes in robbery from 2004 to 2006 as compared to 2003 to 2004. Considering that the Cincinnati Police appear to have adopted aggressive policing from 2004 to 2005 and continued this style of policing to 2006, the displacement of crime that has occurred within this time frame is especially problematic.

The results of the regression models support the conclusion that displacement of crime did occur from 2005 to 2006, and that this probably was not the result of aggressive policing. Although Cincinnati police were employing aggressive tactics in Over-the-Rhine from 2004 to 2005, there was no relationship between increases in crime and travel time from Over-the-Rhine.

It is the recommendation of this study that the aggressive policing be halted and that the policing strategy maintained from 2003 to 2004 be reinforced. Either the Cincinnati Police are responsible for the crime displacement (however this could be unrelated due to the relatively minor changes in crime in Over-the-Rhine from 2004 to 2005), or some other variable is causing the displacement. In either case, the aggressive style of policing is an added cost to the city, both in terms of budget costs and potential societal problems.

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