Assessment of Data-Driven Deployment by the Memphis Police Department

James "Max" Helms
Research Assistant

Dr. Angela Madden
Research Associate Professor

Maura Joyner
Research Intern

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MESSAGE FROM THE EXECUTIVE DIRECTOR

The Public Safety Institute (PSI) at the University of Memphis is an interdisciplinary part of the University community committed to identifying and advancing best practices in the field of public safety.

In 2016, the Memphis Shelby Crime Commission spearheaded development of a true community-wide five-year plan (2017-21) to reduce crime called Operation: Safe Community. Composed of five key goals and 16 objectives, it centers on evidence-based and evidenced-informed practices, some of which have been advanced previously in this community and some of which have good track records elsewhere.

A key part of the plan is to independently evaluate each objective as it is implemented, including, where possible, these assessments rather than waiting until the end of the five-year plan for a full-scale evaluation. Over the course of the Operation: Safe Community five-year plan, the PSI will be releasing assessments of various plan objectives.

Assessments can include a look at both (1) implementation or process and (2) impact. Through these assessments, determinations can hopefully be made as to what is working, what is not working, and if not, why. (Is it because of inadequate implementation and processes or because what may have worked in another community may not work as well here?)

This assessment deals with a key objective of the plan — data-driven deployment of law enforcement resources, in this case by the Memphis Police Department.

Thanks to the researchers involved in this initial assessment of data-driven deployment — research assistant James "Max" Helms, who took the lead in data analysis and was the driving force in getting the assessment completed; research intern Maura Joyner, who has been a valuable asset to our team; and research associate professor Dr. Angela Madden, who both conducts and oversees PSI-related research. Thanks to the PSI executive assistant Linda Russell, who strives to keep us focused on the challenges at hand and took the lead in finalizing this document. Finally, thank you to the leadership of the Memphis Police Department for its cooperation, without which this assessment would not be possible.

Bill Gibbons, Executive Director
Public Safety Institute

INTRODUCTION

Data-driven policing has been a priority for Memphis Police Department (MPD) for more than 10 years. During the initial Operation: Safe Community Plan 1 (2007–11), MPD expanded its data-driven ability by updating the technology used and increasing its personnel. According to the Real Time Crime Center website, this technology allows MPD "to receive instant information on recent criminal activity in a radius around a crime, existing crime patterns in the neighborhood and a history of people with arrest records who may frequent the area." Successful policing should have good data and intelligence gathering abilities, such as hot spot analysis. Hot spots can help police identify areas of high crime to better prevent and solve crime. The objective of this assessment is to examine if MPD is deploying its resources to the best of its abilities through a data-driven approach.

LITERATURE REVIEW

The Evolution of Data-Driven Policing: Computers in Law Enforcement

Throughout the history of policing, electronic data use has increased as the use of technology has become more common. Computer use by police departments was first implemented in the St. Louis Police Department in the mid-1960s (Colton, 1979). The beginnings of wide-spread technology use by law enforcement can be traced to the Omnibus Crime Control and Safe Streets Act of 1968 (Northrop, Kraemer, & King, 1995). This led to the creation of the Law Enforcement Assistance Administration (LEAA), which contributed approximately $50 million to law enforcement agencies and enabled them to access police technology (Northrop et al., 1995). Surveys conducted in the early and mid-1970s showed that implementation of police technology was slower than anticipated (Colton, 1979).

Police use of technology became more common during a crime spike in the 1960s and 70s when a "demand gap" emerged, and it was evident that traditional policing techniques were not getting the job done (Ratcliffe, 2016). In the 1970s, technology use within law enforcement agencies markedly improved, most notably in data entry and management (Ratcliffe, 2016). Managing crime data more effectively allowed for the creation of a "strategic picture of crime" (Ratcliffe, 2016, p. 2). The demand gap led to "greater calls on the police for effectiveness and efficiency" (Ratcliffe, 2016, p. 2). The public wanted more professionalism from the police, with increased access to information. While the factors listed above helped increase data management technology within departments, rising levels of organized crime that ignored jurisdiction and state lines meant that police departments needed a better way to collaborate with each other.

Crime Mapping

Crime maps were noted as early as 1829 in France and were known as choropleth maps (Chamard, 2016). Chamard defined these as "maps that display quantities of things in areas." More specifically, choropleth maps divided geographical areas into multisided figures called polygons, which are then shaded depending on the value of the variable being displayed." Election maps are a modern example of choropleth maps. During the 1900s, sociologists at the University of Chicago mapped the homes of delinquent children using another type of map called a point map. These maps used dots or points to mark geographical points of interest and were completed without the aid of computers, which took hours of work. Crime mapping in a true sense did not appear until the ability to run crime mapping programs on desktop computers.

Before mapping programs became widely available, police departments used a basic pushpins and paper technique. These maps allowed for elementary detection of clustered activity but lacked the ability for more advanced analysis that incorporated other factors, such as time of the offense. Even with the availability of computers, digitizing crime maps was still a significant undertaking. Due to the labor involved, many police departments couldn't afford to computerize their maps. A study conducted in the late 1990s showed that larger departments were much more likely to have a computerized crime mapping system than their smaller counterparts (Charmard, 2016).

Crime mapping has advanced with the development of Geographical Information System technology (GIS), which began in planning for the 1970 census and improved from there. As satellite images of Earth became available and the military was able to create a platform for these images to be viewed, GIS technology quickly became useful for gathering intelligence. The ease of attaining computer hardware that came with a reduction in price in the 1980s combined with improved computer systems and more advanced software has had a positive impact on the widespread use of GIS technology. However, early use of GIS crime mapping was met with several setbacks, such as organizational problems, information sharing issues, technical problems and geocoding problems. These problems have not entirely disappeared, and new problems have emerged over time (Chainey & Ratcliffe, 2013).

CompStat, short for "Compare Statistics," is a program introduced in New York City in 1994. The idea for CompStat stemmed from failures in traditional policing (Weisburd, Mastrofski, McNally, Greenspan, & Willis, 2002). To counter these failures, data-driven decision making was emphasized. CompStat was intended to be an organizational device that used crime information to target crime reduction. This organizational tool allowed agencies to more effectively use their data, and its emergence was followed by an impressive decrease in crime.

Current Technology

Police use of technology has grown and changed over the years. Crime mapping has moved from merely describing where crimes have happened to be a predictive tool for preventive measures. Current technologies can gather data on police activity, indicate where crime reduction projects are in place, detail crime incidents and more (Chainey & Ratcliffe, 2013). Data is used in police briefings as indicators of where future crimes may occur and in targeting crime hot spots. Data gathered on crimes can also be applied to analysis of crime reduction projects in areas where those have been deployed (Chainey & Ratcliffe, 2013). Many other policing technologies employed today have not always been readily available, including "wiretapping, fingerprints, DNA research, database coupling, data mining and profiling, camera surveillance and network analyses" (Custers, 2012, p.62). Other methods of computerized data collection that are less known are also in use now, such as 3D crime scene imaging and through-the-wall radar technology (Solar, 2015). Technology is integrated into police officers' everyday lives via use of body cameras. This video footage can be used in court as evidence (Solar, 2015).

According to Willis, Koper, & Lum (2018), 60 percent of all large police departments currently use license plate readers (LPRs), high-speed cameras that can read and instantly analyze license plates. The LPR stores pictures of the plates and compares them to a database of plates of interest to law enforcement. These could be the plates of stolen vehicles or plates connected to known criminals. Along with the plate information itself, data such as the date, time, description of the vehicle and the location of the vehicle are available to officers to aid in investigations.

Another technology currently being used by law enforcement is gunshot detection devices (GSDs). GSDs were developed in the mid-1990s and work by triangulating multiple sensors that can detect sound waves produced by a gunshot. Systems generally require three or more sensors to detect the sound wave for optimal accuracy. Data gathered from these sensors is then sent to law enforcement with the location and an identification of the noise (whether it was an actual gunshot or another sound, like vehicle backfire). Previously, gunshots were reported mainly through citizen reports which can be inaccurate. With the innovation of GSD technology, law enforcement is hoping to "increase the perceived risk of firing a weapon," mainly through more rapid dispatch and response times and to reduce gun crime overall (Choi, Librett, & Collins, 2014, p.51).

The Use of Data in Policing

According to Lum, Koper and Willis, "Technology has become a major source of expenditure and innovation in law enforcement and is assumed to hold great potential for enhancing police work" (2016, p.135). Police departments use data from this technology in many ways. For example, crime mapping data is used to "locate crime and traffic crash hot spots, thus enabling law enforcement officials to target these areas with highly visible traffic enforcement" (Hardy, 2010, p.1). Data is not only collected, but is also analyzed. Analyses are used to inform decisions on "local partnerships; strategic operations; information sharing and outreach; monitoring, evaluating and adjusting operations; and measuring outcomes" (Hardy, 2010, p.2). All the data gathered by police can then be used to increase proactive measures. In Chicago, for example, the police department currently focuses on a "heat list" of offenders that risk analysis programs have shown to be possible future risks (Joh, 2014). Even Homeland Security is employing computer systems into their preventive measures with their systems filtering out potentially threatening words (Joh, 2014).

In New York, the NYPD has developed a Domain Awareness System that links data gathered from several computerized systems such as CCTV footage and LPR technology (Joh, 2014). New York has been active in data-driven policing since 1990s with CompStat, the system that allowed them to use pinpointed crime maps to target specific areas and more efficiently allocate resources based on the maps. This system led to significant decreases in crime rates (Hyunseok, Hoover, & Joo, 2010).

"Real-Time Crime Centers" (RTCCs), such as the one within MPD, are a great example of how high-end police technology interacts with data-driven policies. The software employed at the Memphis RTCC can receive instant updates on criminal activity, identify crime patterns and monitor high-risk offenders. The RTCC uses Blue C.R.U.S.H. (Crime Reduction Using Statistical History) data gathered on hot spot crimes including time of day, day of the week and location to better allocate resources to those hot spots. Additionally, a wall of LCD monitors that display live feeds from areas of interest (such as the locations of GSD and LPR technologies) aids in providing real-time responses.

Research with the Mesa Police Department in Arizona showed how data-gathering technology like LPRs can influence police efficiency and resource allocation and illustrated the effectiveness of those technologies on reducing hot spot crimes. Specifically, Mesa police were interested in whether these technologies could reduce auto theft and increase the recovery of stolen vehicles and the apprehension of thieves. The department deployed an auto theft unit of four officers in various types of cars all outfitted with LPRs. Each camera was linked to state-level data on stolen vehicles and other vehicles of interest, with a small amount of warrant information being linked as well. After methodically sweeping hot spots for 30 weeks, results of the study showed that the LPR patrol unit was more likely than other patrol units to recover stolen vehicles and to apprehend auto thieves. However, the

LPR unit was only nominally more likely to make arrests for auto theft. Only four auto theft or stolen plates arrests were made, with the remainder being for unrelated crimes, either observed or based on warrants. The patrols saw a two-week time frame during which auto thefts and reports of drug activity were reduced. However, a sustained reduction in actual auto theft was not realized. Based on these results, Mesa concluded that, while LPR cameras may not be cost effective for hot spot crime patrols, a specialized unit may be able to impact a targeted offense, at least in the short term. In addition, while increasing scanned license plates may lead to more matches with the database of auto theft information, it is best to deploy a manual patrol unit as well (Koper, Taylor, & Woods, 2013).

Conclusion

Technology use by police departments began in the 1960s with computers cautiously being integrated into departments that could afford them, with many tasks still being done by hand. Crime maps did not consist of the advanced information we have access to today, but pushpins on a map on the wall. As computer technology became more advanced and more affordable, many cities saw the positive impacts of becoming more computerized, starting with their data management systems. This eventually led to data analysis being done to meet growing demands for police professionalism and accountability. New York City set the standard in the 1990s by implementing CompStat and using its data to more efficiently and effectively allocate its resources to higher crime areas and focus on high risk offenders. This standard led to other cities implementing similar programs that helped bring their crime statistics down. In time, law enforcement has implemented increasingly advanced systems that allow them to analyze even more detailed aspects of crime, such as the Blue C.R.U.S.H. data that can focus on the time of day and day of the week crimes are occurring. The data is often used in RTCCs that monitor these hot spot areas to inform management decisions on more effective and efficient allocation of resources.

METHODS

The Public Safety Institute (PSI) attended MPD's weekly Tracking for Responsibility, Accountability and Credibility (TRAC) meetings on a weekly basis for several months. This allowed us to examine how the data that MPD collects was used and how each precinct handled this data. Second, in order to better understand the selection of hot spots, MPD provided data of Blue C.R.U.S.H. offenses within all precincts for 2017. The data for the analysis below was pulled from the Blue C.R.U.S.H. crime data for each precinct provided by MPD and data from the TRAC PowerPoints prepared by each precinct.

ANALYSIS AND RESULTS

Cameras (both Mobile Blue C.R.U.S.H. and Pole-Mounted)

Two main factors push the use of mobile Blue C.R.U.S.H. cameras. One factor is major events that happen around the city. Any event that may have a high attendance of citizens can lead to Blue C.R.U.S.H. cameras placed around the event. The other factor is by request of a precinct colonel. Some colonels may choose to place these cameras around high-crime areas such as malls and parks.

Pole-mounted Blue C.R.U.S.H cameras can originate from several sources. MPD installs some cameras based upon need and funding available to purchase cameras. The Memphis City Council created the Sentinel Camera Program to provide Blue C.R.U.S.H. cameras to neighborhoods. Under the Sentinel Camera Program, each of the city's seven council districts gets 10 cameras. The Memphis City Council members receive crime data from the Memphis Police Department's Crime Analysis Unit. They then select where to place the cameras in their districts. Citizens or businesses can also purchase these cameras for their neighborhoods and then donate them to the Memphis Police Department. License plate reader(s) or gunshot recognition devices can be added to any of the cameras at an additional cost.

License Plate Readers (both Mobile and Pole-Mounted) and Gunshot Detectors (Pole-Mounted)

While MPD had several gunshot detectors, their number increased after being awarded the Technology Innovation for Public Safety (TIPS) grant in October 2016. Through this grant, MPD was able to add an additional 30 license plate readers and 10 gunshot detectors. MPD contracted with the University of Memphis to handle the research component. In order to determine the location of the pole-mounted license plate readers and gunshot detectors, calls for service relating to shots fired for 2015 were pulled and geocoded at the census tract, precinct and block levels. The top 50 blocks were then pulled, and 20 were selected. From these 20, 10 were randomly chosen for the experimental group, and 10 for the control areas. This study is still ongoing.

TRAC Meetings

An important area that was examined to help determine the use of data-driven deployment was MPD's weekly TRAC meetings. Max Helms, research assistant for the Public Safety Institute, attended these meetings for several weeks to better understand what data MPD currently uses and how they are used.

Weekly TRAC Meeting Process

The weekly TRAC meetings usually include the presence of MPD command staff, precinct colonels and members of different agencies (such as the District Attorney's Office, the MPD Academy, etc.). Prior to January 2018, these meetings were in a format referred to now as "TRAC 1." After the MPD command staff gave updates on the previous week, each precinct commander would give a report on his or her precinct through a PowerPoint presentation.

Starting in January 2018 under the leadership of director Michael Rallings, MPD made a change that was referred to as "TRAC 2, Round 1." During this transition, a precinct was notified before the meeting that it would be giving a presentation. After the command staff members gave their updates, the chosen precinct would give its PowerPoint presentation and answer any questions from the command staff. In March 2018, "TRAC 2, Round 2" began. On Monday prior to the week's TRAC meeting, all MPD chiefs review all nine precincts crime reports, and one precinct is chosen to undergo the full review. After the precinct gives its update, precinct representatives are questioned about designated Blue C.R.U.S.H. crimes. Blue C.R.U.S.H. crimes include robbery (business and individual), aggravated assault, burglary (residential, business and non-residential), auto theft and theft from a motor vehicle. Several factors are taken into consideration during the review. The command staff evaluates and notes how the precinct representatives meet expectations in the categories of preparation, engagement, knowledge of crime and receptiveness. The command staff notes any other comments it may have in response to questions posed. Other questions that may be asked include:

- How many lieutenants do you have on each shift?
- How many sergeants are in your General Investigation Bureau (GIB)? How many total investigators are in GIB?
- How many PIIs, or officers, are assigned to your precinct?
- How many officers are on task forces? What hours do they work?
- How many details did you run last week? Areas? Focus?
- How many outside units (TACT, OCU, Traffic, etc.) assisted last week?

Task forces are officers who are assigned to specific tasks. For example, the Organized Crime Unit uses multi-jurisdictional task forces to help target attacks on illegal drug trafficking operations. Precinct colonels will also assign details within their precinct. These details place officers within the hot spots of their precinct to help reduce the crime in these areas. Precinct leaders may also use outside units to help assist with specific crimes. Some of these outside units include the TACT Unit which assists with various emergencies, the Organized Crime Unit for drugs and gangs, and the Traffic Unit.

The precinct colonel and officers of his or her choice answer these questions from the command staff to the best of their abilities. MPD's Real Time Crime Center then collects and keeps the evaluation sheets submitted by each member of the command staff in order to keep a record of the precinct's responses.

TRAC Meeting PowerPoints

These PowerPoints cover a wide range of data that would be helpful for any precinct commander to know. Besides the Blue C.R.U.S.H. offenses, larcenies are also a major focus of these PowerPoints. Larcenies make up a major part of the total crime within Memphis. These PowerPoints include:

- The number of guns reported stolen/recovered
- The trend of Blue C.R.U.S.H. offenses by week and four-week comparisons
- Budgeting
- Hot spots
- General Investigation Bureau arrests and clearances
- Officer weekly productivity
- Larceny reports and offenses
- Larceny hot times and hot days

Accountability

TRAC 2, Round 2 meetings usually last more than three hours. In an effort to hold precinct colonels and their staffs accountable, the questioning by the MPD command staff can be intense and very specific as to cases, incidents and patterns. Sometimes possible solutions to particular matters are discussed, considered and decided. Precinct colonels and their staffs are expected to be prepared and to follow up where weaknesses are identified.

The process appears to be an effective, intensive tool of accountability. Precincts are being held to a higher standard under the new process compared to the previous process under TRAC 1. Each reporting precinct is expected to explain what it did or did not do, and the reasoning behind its actions in response to specific challenges.

Hot Spot Analysis

To determine whether MPD is being data-driven when using its resources, the PSI examined changes in crime within chosen hot spots in each precinct. MPD crime analysts provide each precinct colonel a general map of his or her precinct that maps reported crimes within that precinct during the prior four weeks. The precinct colonel and his or her staff then determine which areas are considered hot spots.

An analysis was conducted for calendar year 2017 to determine whether identifying an area as a hot spot appeared to have any impact on the number of reported Blue C.R.U.S.H. crimes the week after that area was identified. TRAC 2 was not implemented until 2018. Another assessment will be conducted after 2018 on crime data in designated hot spot areas under TRAC 2.

Charts 1-9 below show the increase or decrease within each precinct's hot spots the week after those hot spots were selected. Chart 10, titled MPD – All Stations, represents the average increase or decrease within all hot spots across all nine precincts.

On each of the charts, the numbers from 1 to 52 on the bottom axis represent the weeks of the year. For example, Week 1 is Jan. 2-8 2017. This was chosen since it was the first full week of 2017. The percentages represent the decrease (negative/blue) or increase (positive/red) of Blue C.R.U.S.H. crimes within the chosen hot spots one week after they were considered hot spots. For example, in the Old Allen precinct, sixteen Blue C.R.U.S.H. crimes were reported from Jan. 2-8, 2017 (Week 1). During Week 2, Jan. 9-15, 2017, only eight Blue C.R.U.S.H. crimes were reported within those areas, thus showing a 50 percent decrease in crimes in those selected hot spots.

Chart 1: Old Allen Station % Change in Prior Week Hot Spot Crime by Week
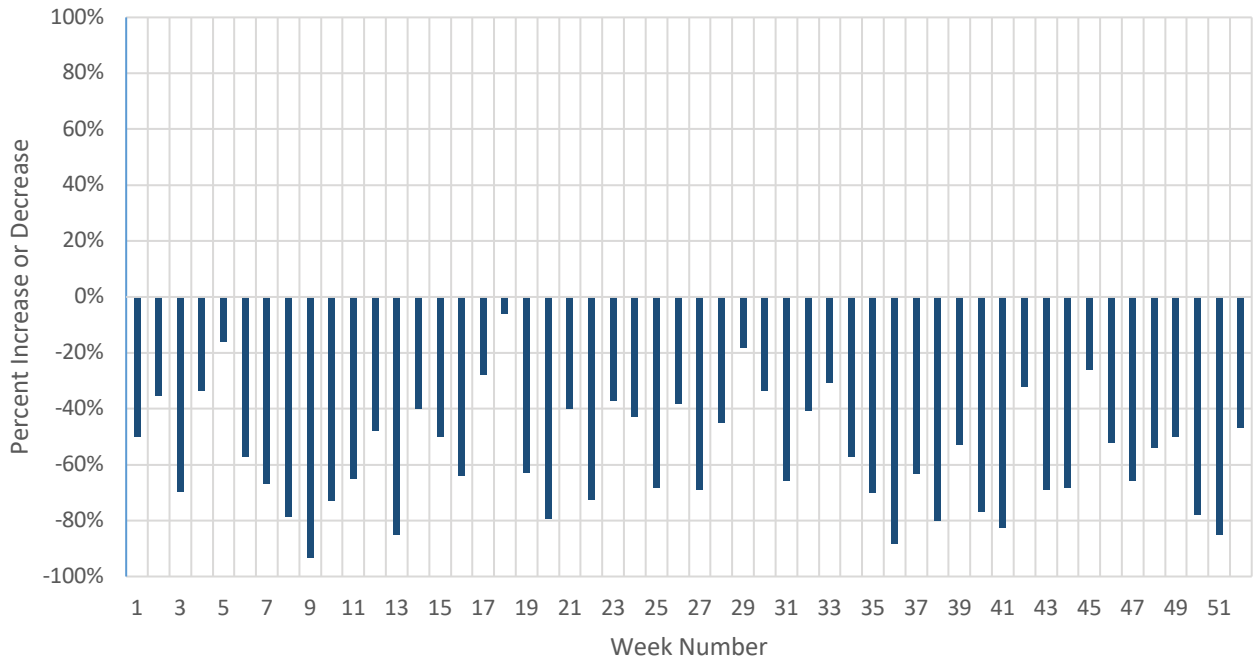

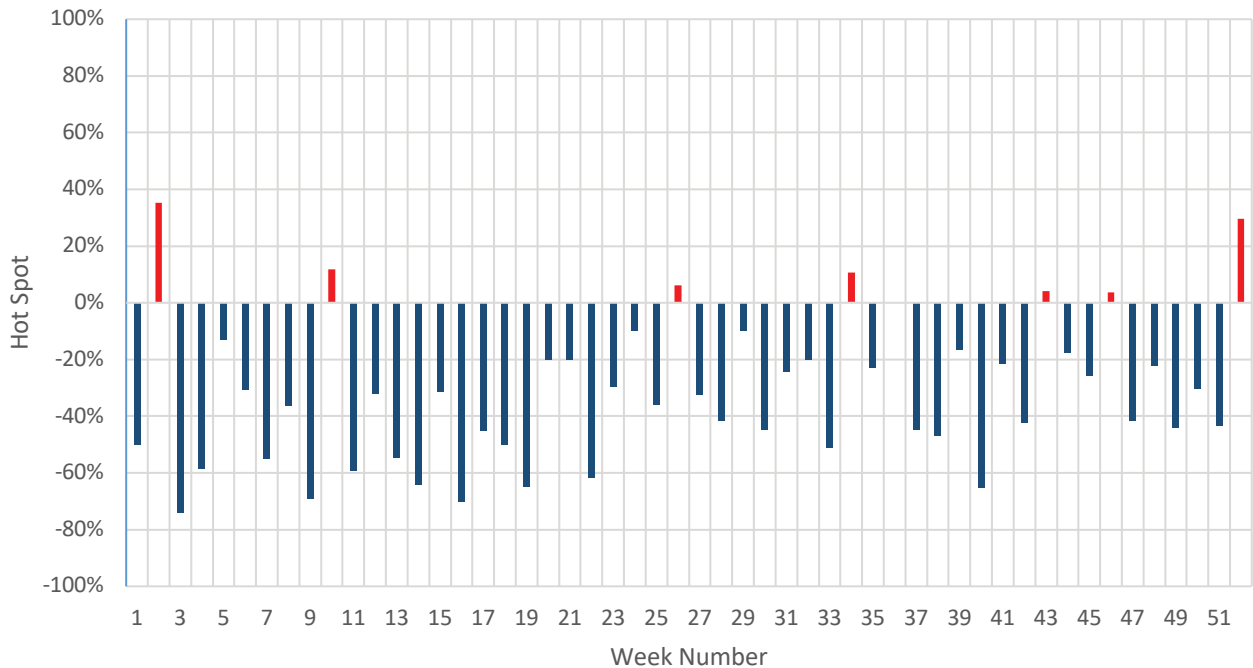Chart 2: Raines Station % Change in Prior Week Hot Spot Crime by Week

Chart 3: Mt. Moriah Station % Change in Prior Week Hot Spot Crime by Week
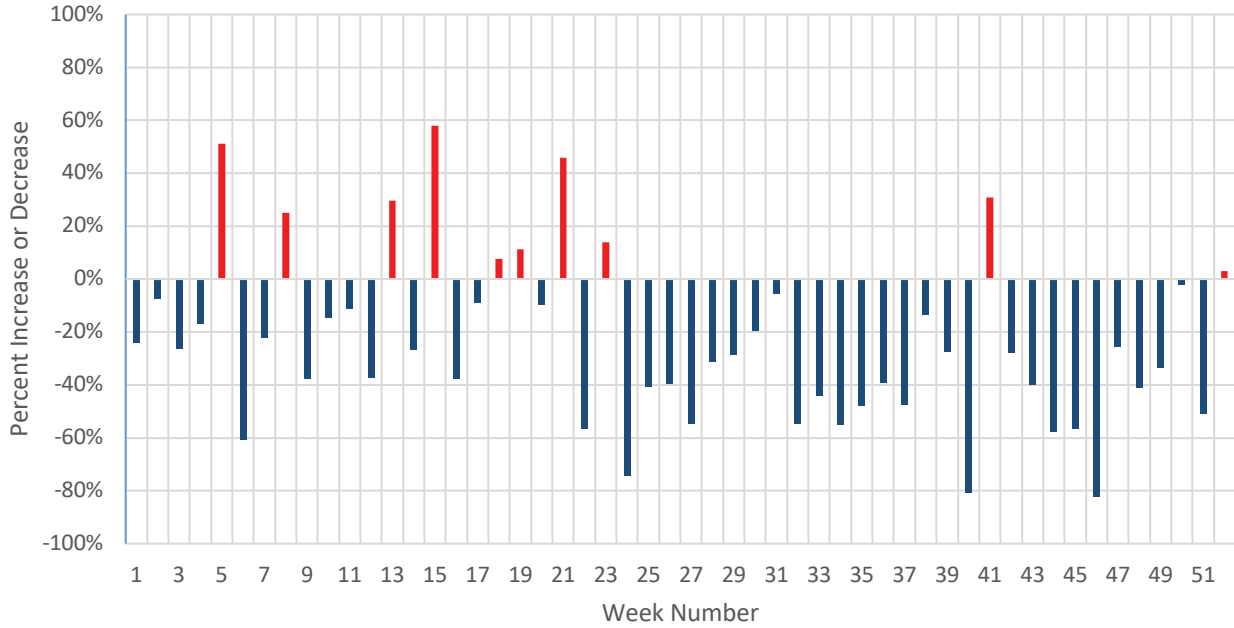

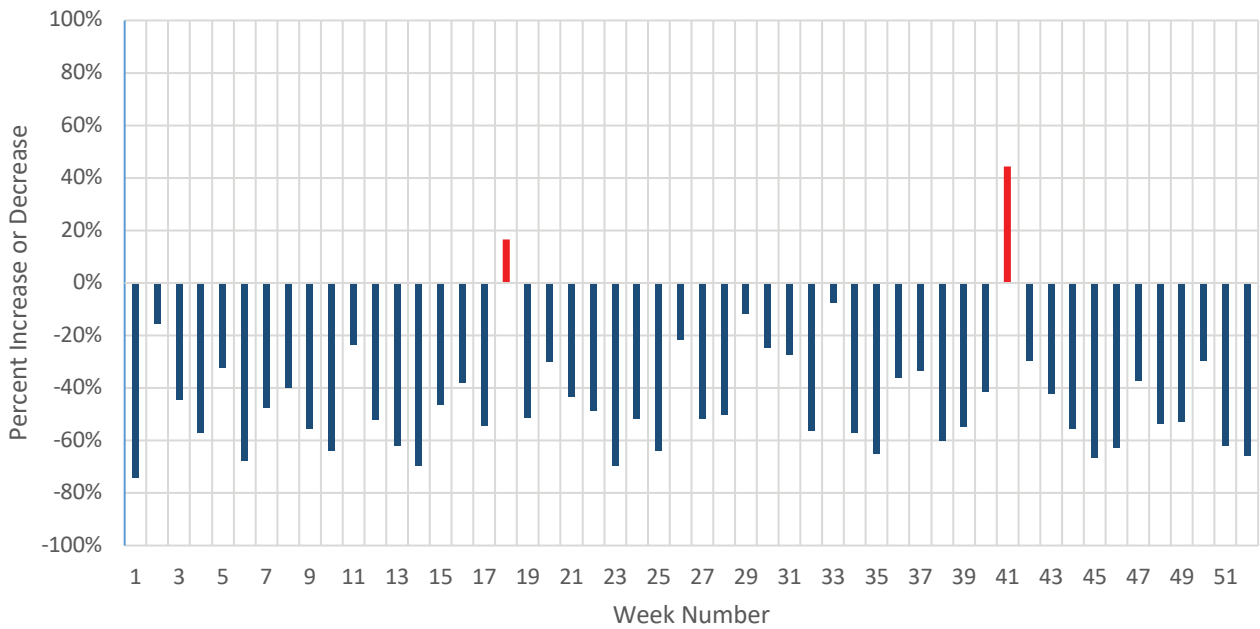Chart 4: Crump Station % Change in Prior Week Hot Spot Crime by Week

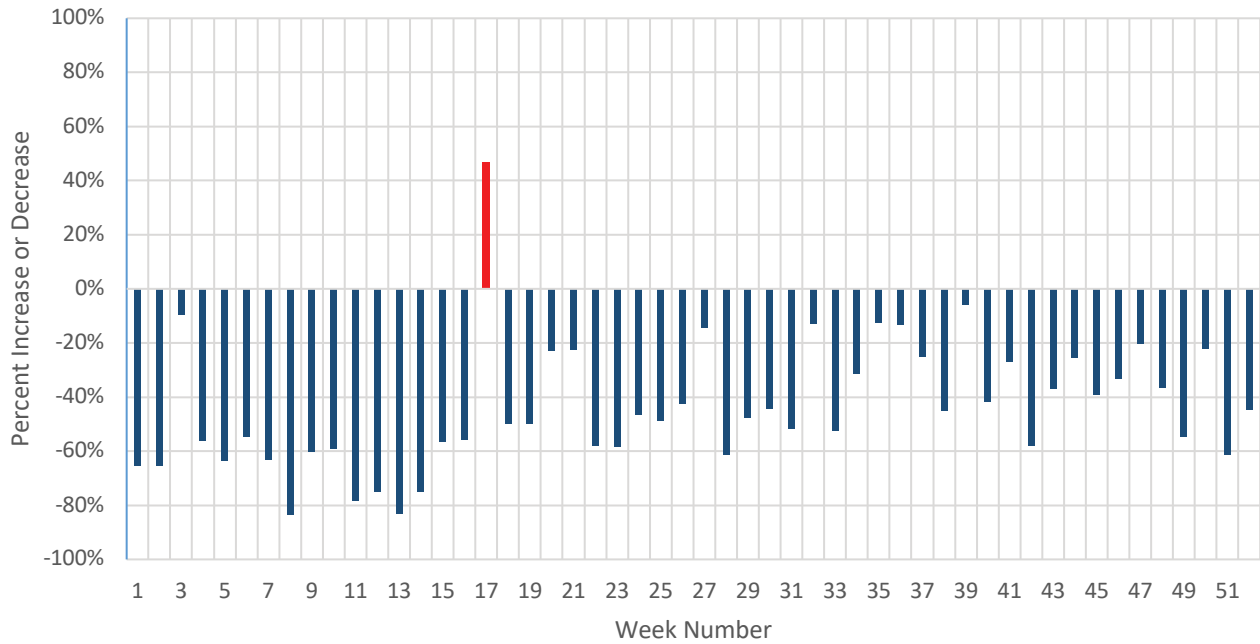Chart 5: Tillman Station % Change in Prior Week Hot Spot Crime by Week

Chart 6: North Main Station % Change in Prior Week Hot Spot Crime by Week
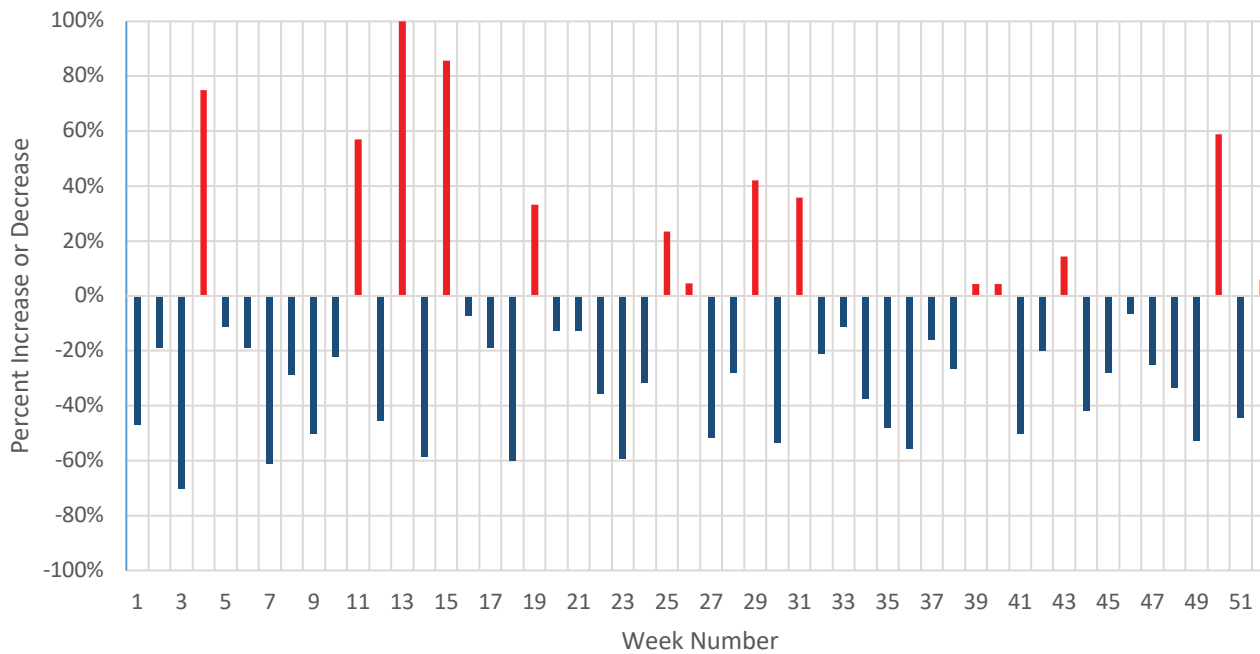
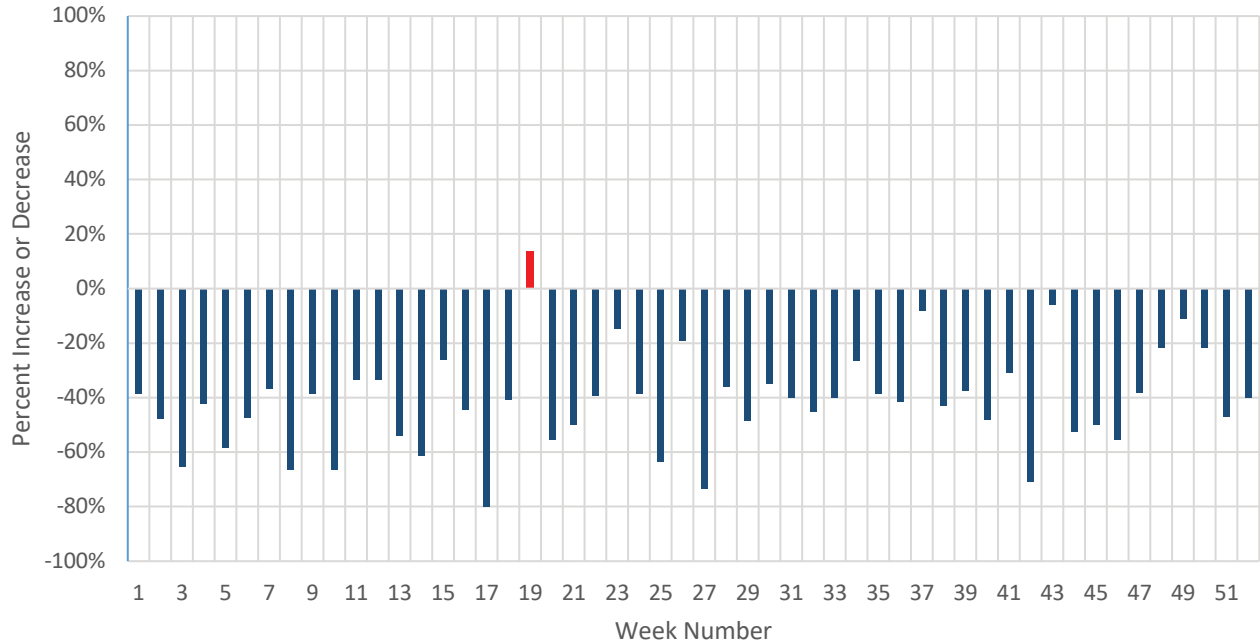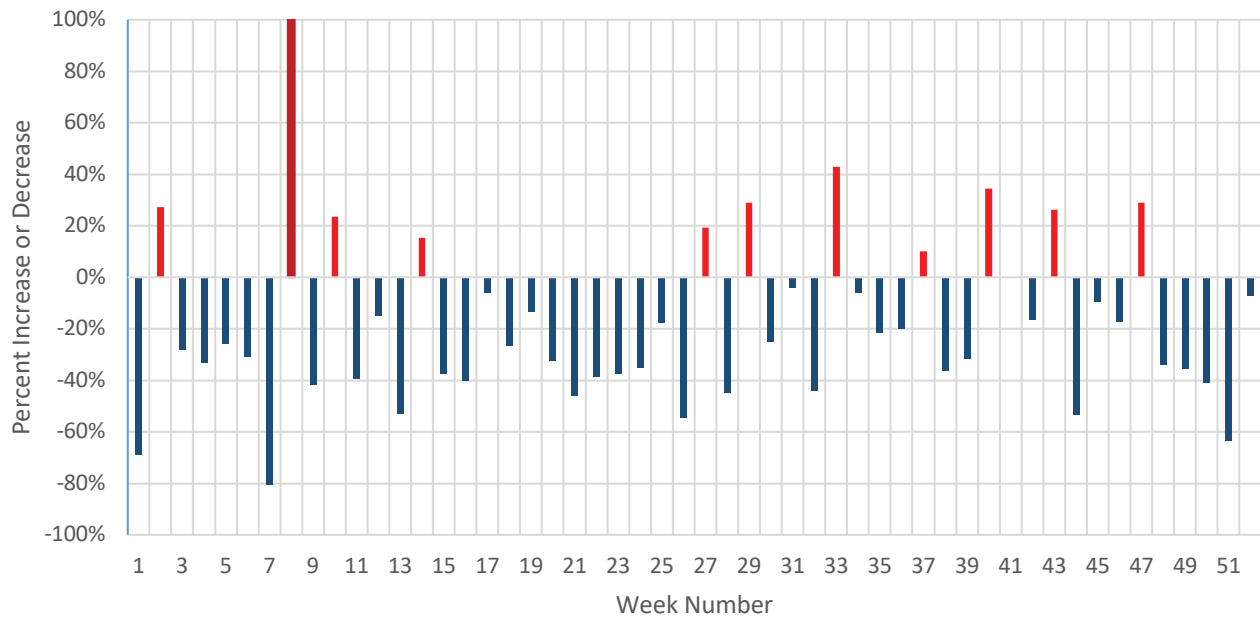Chart 7: Airways Station % Change in Prior Week Hot Spot Crime by Week

Chart 8: Appling Farms Station % Change in Prior Week Hot Spot Crime by Week

Note – Week 8 has a darker line due the increase being higher than 100%.

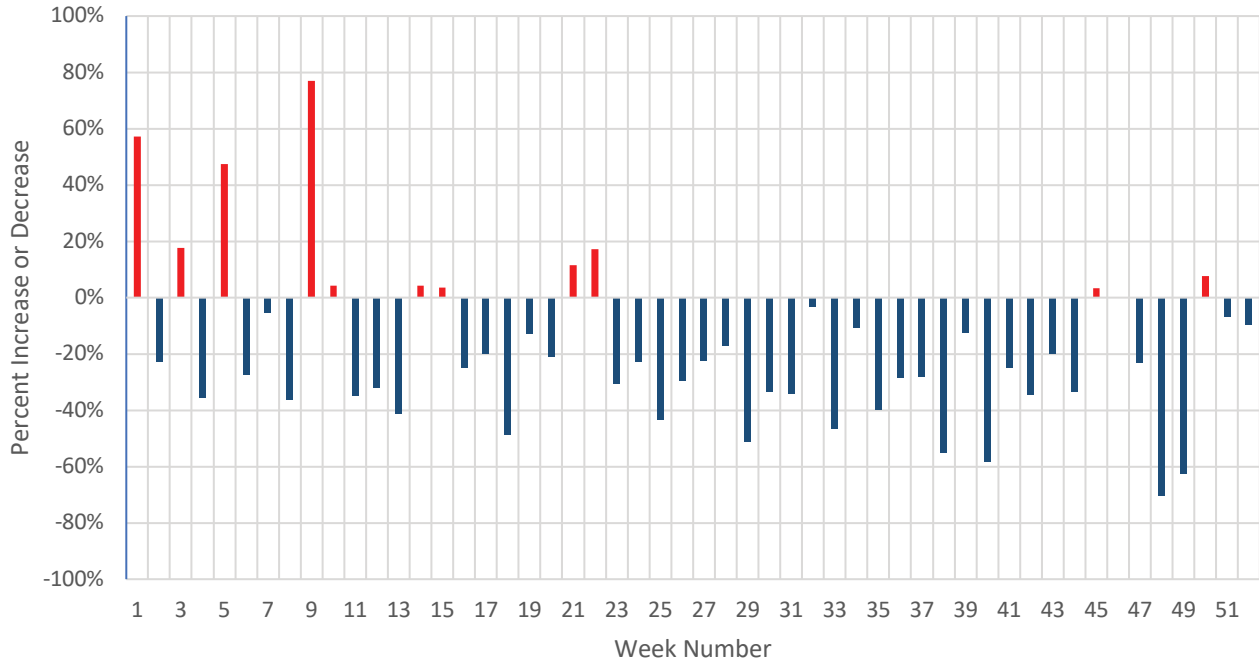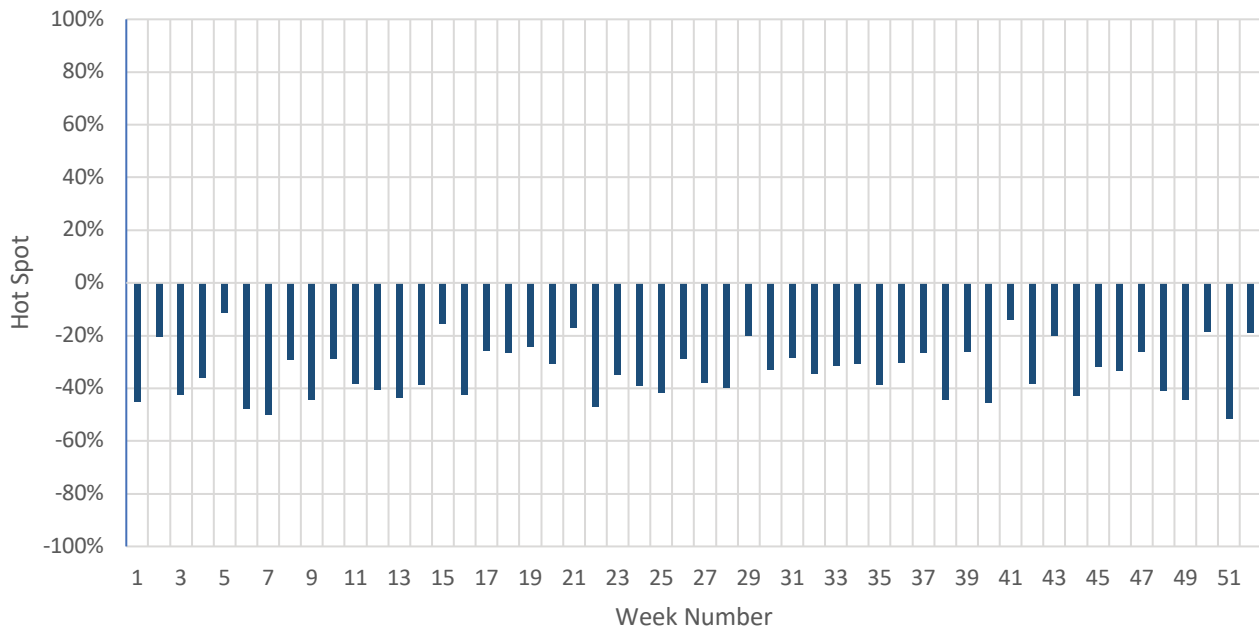Chart 9: Ridgeway Station % Change in Prior Week Hot Spot Crime by Week

Chart 10: MPD - All Stations % Change in Prior Week Hot Spot Crime by Week

The following two tables graphically depict the percentage change in Blue C.R.U.S.H. crimes. Table 1 depicts the percentage of weeks that reported Blue C.R.U.S.H. crimes either decreased or increased in the designated hot spots, along with the average percentage change of these crimes for 2017.

Table 2 depicts the weekly average number of crimes in the hot spots the week of being designated, the average numbers of crimes the week after, and the weekly change average. These data were pulled from each precinct's respective TRAC Blue C.R.U.S.H. PowerPoints. The PSI obtained the number of reported Blue C.R.U.S.H. crimes in hot spots each week from the PowerPoints, then compared those numbers to numbers in the next week's PowerPoints.

Table 1: Reported Blue C.R.U.S.H. Crimes - Percentage of Weeks Reporting Decrease/Increase in Hot Spot Areas and Average Percentage Change for Year 2017

Precinct	% Decrease	% Increase	Yearly Avg.
Old Allen	100.00%	0.00%	-55.74%
Raines	84.62%	13.46%	-31.59%
Mt. Moriah	80.77%	19.23%	-23.87%
Crump	96.15%	3.85%	-44.11%
Tillman	98.08%	1.92%	-43.73%
North Main	73.08%	26.92%	-14.86%
Airways	98.08%	1.92%	-41.46%
Appling Farms	76.92%	21.15%	-17.03%
Ridgeway	76.92%	21.15%	-18.56%
MPD	100.00%	0.00%	-33.34%

Note - Raines, Appling Farms, & Ridgeway do not equal 100% due to 1 week being 0% change.

Table 2: Weekly Average of Reported Blue C.R.U.S.H. Crimes in Hotspot & Weekly Change

Precinct	Week of Avg.	Week After Avg.	Weekly Change Avg.
Old Allen	23.92	10.79	-13.13
Raines	31.12	21.00	-10.12
Mt. Moriah	41.10	31.00	10.10
Crump	30.73	17.06	-13.67
Tillman	34.83	19.98	-14.85
North Main	18.81	14.71	-4.10
Airways	23.58	13.79	-9.79
Appling Farms	37.42	29.25	-8.17
Ridgeway	30.00	23.08	-6.92
MPD	30.17	20.07	-10.09

CONCLUSIONS AND RECOMMENDATIONS

Based on data analysis, reviewing the TRAC process, and numerous interviews with MPD officials, the PSI provides the following conclusions:

1. MPD command staff, and the precinct colonels and their staff, are very data-driven in their deployment of resources. The use of this data-driven deployment has been beneficial to the precincts and does have an immediate impact on the level of crime within identified precinct hot spots.

2. During 2017, reported Blue C.R.U.S.H. crimes decreased within precinct hot spots at least 73 percent of the time. One precinct (Old Allen) had a decrease 100 percent of the time, three precincts (Crump, Tillman and Airways) had a decrease more than 90 percent of the time, and two others (Raines and Mt. Moriah) more than 80 percent of the time. Overall, crime decreased within MPD hot spots 100 percent of the time over all 52 weeks in 2017.

3. Weekly averages of reported Blue C.R.U.S.H. crimes in designated hot spots decreased in every precinct the following week. Tillman had the highest average decrease at -14.85 crimes. Old Allen and Crump both had decreases of more than 13 crimes (-13.13 and -13.67, respectively). Raines and Mt. Moriah both had decreases of more than 10 crimes (-10.12 and -10.10, respectively). Overall, the average number of crimes decreased by more than 10 during the weeks after the hot spots were identified.

   This average decline does not account for factors such as crime displacement (crime decreasing in one area because it moves to another area). Also, analyses conducted in this initial assessment are not as sophisticated and thorough as the final analyses, which will evaluate for statistically significant changes. However, this preliminary inquiry does seem to indicate that MPD's approach to targeting certain crimes in specific areas is having an impact on those crimes, at least in the short term. It is possible that, in the absence of factors such as personnel shortages and major events (such as protests) pulling resources within a precinct, the impact could have been even greater.

The PSI has developed the following four recommendations:

1. Predictive Models
   Allocation of resources based on identification of a hot spot is a reactive model to combat crime numbers. The precinct commanders examine all crimes that have happened within a four-week period. It could be beneficial if MPD used more of a predictive model in an attempt to determine where crime may happen next. Such a predictive analytics model would be a massive undertaking for MPD and the RTCC, but it could have a more significant impact on crime.

2. Hot Spot Boundaries
   Currently, crime analysts create the maps for each precinct that show where crimes are occurring, and the precinct commanders determine the hot spot boundaries. Crime analysts could convert these crimes into a weighted sample and develop a heat map. This heat map could be used as a tool for precinct commanders to narrow down their hot spot boundaries. Several of the weeks during which precincts experienced increases in hot spot crimes could have been the result of the hot spot being too broad. Providing more narrow hot spots would give officers a more precise area on which to focus.

3. Traffic Accidents/Enforcement
   It is widely known that MPD is understaffed, which means that current officers are having to do the work of multiple officers. Some officers get tied up on other issues (such as traffic accidents and traffic violations) and cannot respond to calls. Analyzing traffic accidents might allow MPD to recommend better layouts for certain intersections where traffic accidents are high. Certain additions may include resources such as traffic cameras or deterring signage. Australia, for example, posts multiple signs that state "red light speed camera ahead" and include the speed limits next to them. If officers spend less time working accidents or enforcing traffic laws, they would have more time to focus on more serious crimes.

   In addition, MPD should continue to seek assistance from other law enforcement agencies such as the Tennessee Highway Patrol and the Shelby County Sheriff's Department, freeing up more MPD officers' time to focus on crime deterrence within precincts.

4. Further Training for Crime Analysts

MPD should focus on giving additional training for their crime analysts. Currently, it appears that these analysts do not perform any in-depth analysis of the crimes for the precincts. Currently, they provide each precinct colonel with a map and raw numbers of reported Blue C.R.U.S.H. crimes within his or her precinct. It would be beneficial for not only the RTCC but MPD as a whole if the crime analysts were given further training in order to perform a deeper analysis of these crimes.

LIMITATIONS

Data analyses may have been impacted by the change of PowerPoint layouts later in the 2017 year. Some precincts did not include the "Last Week Hot Spots" section that states how many crimes happened in those areas. In some weeks, some precincts did not include the previous week's hot spots. To address these omissions, data were provided by MPD and manually counted to determine the percentage change in reported Blue C.R.U.S.H. crimes within those impacted hot spots.

This assessment did not analyze the data to determine the degree to which crime reductions in hot spot areas were sustainable over time given MPD's current resources. In addition, the assessment focused on calendar year 2017, before TRAC 2 was implemented.

In 2019, the Public Safety Institute plans to conduct an assessment that includes an examination of the TRAC 2 process implemented in 2018 and whether crime reductions in hot spot areas are sustained over time.

REFERENCES

Colton, K.W. (1979). The Impact and Use of Computer Technology by the Police. *Communications of the ACM, 22*(1), 10-20.

Chainey, S., & Ratcliffe, J. (2013). GIS and Crime Mapping. Chichester, West Sussex, England: Wiley.

Chamard, S. (2006). The History of Crime Mapping and its use by American Police Departments. *The Justice Center: University of Alaska Anchorage, Alaska Justice Forum, 23*(3), 1-8.

Choi, K.-S., Librett, M., & Collins, T. J. (2014). An Empirical Evaluation: Gunshot Detection System and Its Effectiveness on Police Practices. *Police Practice & Research, 15*(1), 48-61.

Custers, B. (2012). Technology in policing: Experiences, Obstacles and Police Needs. *Computer Law & Security Review, 28*(1), 62-68.

Hardy, E. (2010). Data-Driven policing: How Geographic Analysis Can Reduce Social Harm. *Geography & Public Safety, 2*(3), 1-2.

Hyunseok, J., Hoover, L. T., & Joo H.-J. (2010). An Evaluation of Compstat's Effect on Crime: The Fort Worth Experience. *Police Quarterly, 13*(4), 387-412.

Joh, E. E. (2014). Policing by numbers: Big Data and the Fourth Amendment. *Washington Law Review*. *89*(1), 35-68.

Koper, C. S., Taylor, B. G., & Woods, D. J. (2013). A Randomized Test of Initial and Residual Deterrence From Directed Patrols and Use of License Plate Readers At Crime Hot Spots. *Journal of Experimental Criminology, 9*(2), 213-244.

Lum, C., Koper, C. S., Willis, J. (2016). Understanding the Limits of Technology's Impact on Police Effectiveness. *Police Quarterly, 20*(2), 135-163.

Memphis PD Initiatives. (n.d.). Retrieved from https://www.memphispolice.org/initiatives.asp

Memphis Police Real Time Crime Center. (n.d.). Retrieved from http://www.planar.com/case-studies/project/ memphis-police-real-time-crime-center/#installprofile

Northrop, A., Kraemer, K.L., King, J.L. (1995). Police Use of Computers. *Journal of Criminal Justice, 23*(3), 259-275.

Ratcliffe, J.H. (2016). Intelligence led Policing. In Wortley, R, Mazerolle, L., and Rombouts, S. (Eds), Environmental Criminology and Crime Analysis (1-18).

Real Time Crime Center. (n.d.). Retrieved September 27, 2018, from https://www.memphispolice.org/rtcc.asp

Solar, P.J. (2015, December). How Technology is Changing in Law Enforcement. Police: The Law Enforcement Magazine. Retrieved from http://www.policemag.com/blog/technology/story/ 2015/12/how-technology-is-changing-law-enforcement.aspx.

Weisburd, D., Mastrofski, S.D., McNally, A.M., Greenspan, R., Willis, J.J. (2002). Reforming to Preserve: Compstat and Strategic Problem Solving in American Policing. *Criminology & Public Policy, 2*(3), 421-456.

Willis, J.J., Koper, C. & Lum, C. (2018) The Adaptation of License-Plate Readers for Investigative Purposes: Police Technology and Innovation Re-invention. *Justice Quarterly, 35*(4), 614-638.

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