

RELATIONSHIPS AMONG CRIME ANALYSIS, ACCOUNTABILITY, AND  
INNOVATIVE POLICING STRATEGIES: RESULTS FROM A NATIONAL SURVEY

by

Justin James Smith

A Thesis Submitted to the Faculty of  
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by

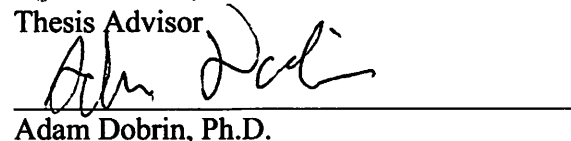
Justin J. Smith

This thesis was prepared under the direction of the candidate's thesis advisor, Dr. Rachel Santos, School of Criminology and Criminal Justice, and has been approved by the members of his supervisory committee. It was submitted to the faculty of the College for Design and Social Inquiry and was accepted in partial fulfillment of the requirements for the degree of Master of Science.

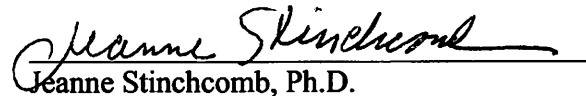
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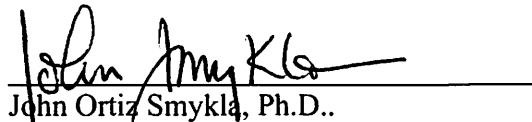
Rachel Santos, Ph.D.  
Thesis Advisor



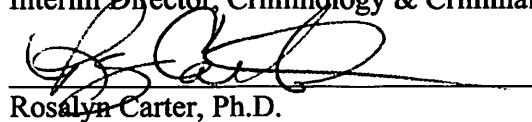
Adam Dobrin, Ph.D.



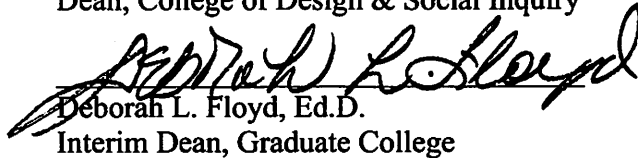
Jeanne Stinchcomb, Ph.D.



John Ortiz Smykla, Ph.D.  
Interim Director, Criminology & Criminal Justice



Rosalyn Carter, Ph.D.  
Dean, College of Design & Social Inquiry



Deborah L. Floyd, Ed.D.  
Interim Dean, Graduate College

10/31/2014  
Date

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## ABSTRACT

Author: Justin Smith  
Title: Relationships Among Crime Analysis, Accountability, and Innovative Policing Strategies: Results From a National Survey  
Institution: Florida Atlantic University  
Thesis Advisor: Dr. Rachel Santos  
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Over the years, innovations such as community-oriented policing, problem-oriented policing, and hot spots policing have enabled the police to make substantial crime control and reduction gains. However, empirical research has shown that police occasionally misuse these strategies in practice. One possible solution is the co-implementation of these strategies with crime analysis. Yet, little is known about this relationship in practice. Using national survey data collected by the Police Executive Research Forum in 2008 from a sample of over 1,000 United States police agencies this thesis explores this relationship. Results of bivariate analysis between agency commitment to and integration of crime analysis within operations and the use of innovative strategies revealed positive relationships. Additionally, bivariate analysis between agency use of accountability mechanisms and innovative strategies revealed a strong positive relationship. Multivariate regression analysis revealed the use of accountability mechanisms and commitment to crime analysis as strong positive predictors of police agency innovation.

## DEDICATION

I dedicate this thesis to my beautiful, loving and patient wife, Lisa



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## Chapter I: Introduction

### **Background**

The last three decades have been a time of tremendous change and innovation in policing in the United States (US) (Skogan & Frydl, 2004; Weisburd & Braga, 2006a; Weisburd & Eck, 2004). While the history of modern police practice is rife with notable achievements, such as advances in DNA, fingerprinting, forensics, and weaponry (Dempsey & Forst, 2012), perhaps the most impressive innovations are those that enable the police to achieve their primary goals of controlling, reducing, and preventing crime and disorder (Telep & Weisburd, 2012; Weisburd & Braga, 2006a). The national crime rate dropped in the 1990s, and some scholars have attributed the decline to more efficient and effective police tactics (Kelling & Sousa, 2001). This shift toward innovation and best practice is in stark contrast to the traditional ideals of police work that have dominated the profession for more than eighty years (Weisburd & Braga, 2006a; Weisburd & Eck, 2004).

David Weisburd and Anthony Braga (2006a), two notable police scholars, have attributed this unprecedented push toward innovation to a “crisis of confidence in American policing” (p. 4) that emerged during the 1960s and 1970s. This period in American history was wrought with political and social upheavals such as the Civil Rights Movement, protests against the Vietnam War, and youth disobedience that fostered a culture that questioned the legitimacy of authority (Dempsey & Forst, 2012; Weisburd & Braga, 2006a). Several government-appointed investigative bodies, such as

the President's Commission on Law Enforcement and Administration of Justice and the Kerner Commission, highlighted numerous failings of both the criminal justice system and the police (Dempsey & Forst, 2012; Weisburd & Braga, 2006a).

Historically, American police agencies have bound in rigid bureaucracy and relied upon a number of generic, primarily reactive, approaches to solving crime and disorder problems, a toolkit of strategies that has been referred to as the standard model of policing by some scholars (Dempsey & Forst, 2012; Weisburd & Braga, 2006a; Weisburd & Eck, 2004). Among the tactics is highly visible, randomized, vehicular “preventive” patrol implemented throughout an entire jurisdiction to deter potential offenders and allay citizen concerns by making the police visible (Dempsey & Forst, 2012; Weisburd & Braga, 2006a; Weisburd & Eck, 2004). Additionally, being on patrol was thought to enable the police to rapidly respond to citizen calls for service and increase the odds of apprehending offenders at the scene of the crime (Dempsey & Forst, 2012; Weisburd & Braga, 2006a; Weisburd & Eck, 2004).

A number of groundbreaking empirical evaluations conducted during the 1970s challenged many of these long held assumptions about core police practices (Dempsey & Forst, 2012; Weisburd & Braga, 2006a). For example, the Kansas City Preventive Patrol Experiment found that randomized patrol dosage had no effect on crime rates or citizen anxieties (Kelling, Pate, Dieckman, & Brown, 1974). Another study showed that various citizen-based delays in calling the police after an offense was discovered or committed negated any benefit of a rapid response (Spelman & Brown, 1984).

The exposure of such shortcomings coupled with growing concern over public perceptions of police legitimacy led to a number of innovations in police practice

(Weisburd & Braga, 2006a). Early innovations, such as community-oriented policing (COP) and problem-oriented policing (POP), required the police to interact with civilians, other than in times of crisis, to build rapport based on trust and mutual respect; such interaction encouraged citizens to communicate which crime and social problems they wanted the police to address (Goldstein, 1990; Office of Community Oriented Policing Services [COPS Office], 2009; Skogan, 2006). As opposed to using traditional law enforcement based tactics, COP and POP require the police to solve community problems creatively by using their own connections with local government or by exerting influence on third parties who may be in a position to mitigate troubling conditions (COPS Office, 2009; Goldstein, 1990; Skogan, 2006).

During the 1980s, a crucial discovery in the field of environmental criminology led to yet another major breakthrough in policing innovation. Researchers examining calls for service over a one year period in Minneapolis, Minnesota found that about 3 percent of addresses accounted for just over 50 percent of the calls (Sherman, Gartin, & Buerger, 1989). Since then, a significant amount of rigorous research has shown that certain crime prone locations, or “hot spots,” as they came to be known, exhibited lengthy histories of chronic crime and disorder problems (Braga, Papachristos, & Hureau, 2012; Weisburd & Braga, 2006b; Weisburd, Bushway, Lum, & Yang, 2004). Thus, it was reasoned that if the police focused their crime control and reduction efforts on such locations they could greatly impact the overall crime rate (Telep & Weisburd, 2012; Weisburd & Eck, 2004).

Yet another major innovation partially based on criminological theory is focused deterrence, also known as “pulling levers” (Braga & Weisburd, 2012; Kennedy, 2006;

Telep & Weisburd, 2012). Focused deterrence approaches are based on concepts from early criminological theory, specifically the idea that offenders will refrain from certain behaviors if they perceive the potential costs of engaging in them outweigh whatever benefits may be derived by committing the offense itself (Braga & Weisburd, 2012). First utilized in Boston, Massachusetts during the mid-1990s to curb incidents of gang-related youth homicide (Braga, Kennedy, Waring, & Piehl, 2001), focused deterrence targets very specific criminal acts and offenders (Kennedy, 2006). It follows a basic framework of first identifying a serious crime problem and the most prolific offenders engaging in it, then seeking cooperation from police officers, probation and parole officers, and state or federal prosecutors to establish viable legal sanctions that can be readily applied to the offenders (Kennedy, 2006). Ironically, part of the approach also involves direct or indirect communication with the offenders themselves to warn them that their actions are being monitored, that specific crimes will not be tolerated, and that every possible legal maneuver will be used against them should they continue to engage in the offensive behavior (Kennedy, 2006).

Other innovations have focused on affecting change in the way police agencies conduct business internally so they are better equipped to address external crime and disorder problems. First introduced in the New York City Police Department (NYPD) in 1994 by then Police Commissioner William Bratton, Compstat (short for “compare stats” or “computer statistics”) is a managerial model that flattens and decentralizes the rank structure and extends ultimate decision-making authority to a geographic commander (Police Executive Research Forum [PERF], 2013; Silverman, 2006). In Compstat agencies, or agencies running Compstat-like programs, computerized crime analysis and



mapping are utilized to provide crime counts on a routine basis; the commander must then formulate a plan to reduce crime in their district (PERF, 2013; Silverman, 2006). Finally, in regularly scheduled meetings with their superiors, the commander is held accountable for the success or failure of their crime reduction strategies (PERF, 2013; Silverman, 2006).

A final managerial-based innovation is Intelligence-Led Policing (ILP). First introduced in the United Kingdom (UK), as part of the bigger National Intelligence Model which was an initiative to reduce and prevent crime through increased police agency efficiency (National Crime Intelligence Service, 2000), ILP is a “business model” that prioritizes the use of overt and covert means to gather intelligence on the most prolific to develop proactive responses such as hot spots policing and POP or COP type approaches (Ratcliffe, 2008). Due to its emphasis on intelligence gathering, ILP has been used to target organized crime, street gangs, and more recently, terrorists (Ratcliffe, 2008; Schaible & Sheffield, 2012).

Unlike the standard model of policing, many of these innovative approaches have been subjected to rigorous empirical evaluations and have been shown to be effective in reducing crime and disorder. In the social sciences, the strongest evidence of effectiveness of an intervention is a Campbell Collaboration Systematic Review (Campbell Collaboration, 2014). Campbell reviews have been conducted of COP (e.g. Gill, Weisburd, Telep, Vitter & Bennett, 2014), neighborhood watch, a common facet of COP (e.g., Bennett, Holloway & Farrington, 2008), POP (e.g., Weisburd, Telep, Hinkle & Eck, 2010), hot spots policing (e.g., Braga et al., 2012), and focused deterrence (Braga & Weisburd, 2012). All the reviews have found that these strategies have moderate to

strong positive impacts on crime and disorder problems. Further, additional benefits may be derived from combining strategies. Telep and Weisburd (2012) assert that hot spots policing approaches are more successful when coupled with POP. They also advocate the use of COP strategies in conjunction with more aggressive tactics, such as hot spots policing, to ease citizen concerns and promote police legitimacy.

Thus far, there are no known studies of the effectiveness of police agency managerial strategies such as Compstat and ILP (Santos, 2014). Nonetheless, some scholars have associated declining crime rates in New York and other jurisdictions in the US (Anderson, 2001; Jang, Hoover, & Joo, 2010; Silverman, 2006) and abroad (Chilvers & Weatherburn, 2004) with Compstat adoption. Moreover, police scholars David Weisburd and John Eck (2004) argued in their seminal work on police effectiveness, as well as in an updated version authored by Cody Telep and David Weisburd (2012), that the most effective policing strategies are those that are highly focused on prolific offenders as well as criminogenic locations, the former being the focus of ILP.

Unfortunately, past research also suggests that police officers cannot do it alone (Braga & Weisburd, 2006; Cordner & Biebel, 2005; Scott, 2000). Reflecting on the integration of problem solving in police practice 20 years after its inception, police scholar Michael Scott (2000) suggests that police officers frequently poorly define problems, lack the time, resources, and skills to conduct research, and will not use problem solving unless they are held accountable for doing so. Scott's points were demonstrated when an early 2000s study conducted at a San Diego police department renowned for their stated commitment to innovative strategizing revealed that the majority of officers engaged in narrow-scope problem solving and haphazardly

implemented traditional law enforcement-based responses to resolve issues as opposed to finding more creative solutions (Cordner & Biebel, 2005). Other research shows that the police occasionally misidentify hot spot locations; such findings suggest that resources are not being deployed effectively in to areas where they are needed most (Bichler & Gaines, 2005; McLaughlin, Johnson, Bowers, Birks, & Pease, 2007; Ratcliffe & McCullagh, 2001).

One possible solution to the problems inherent in the deployment of innovative policing tactics is the supplementation of their use with crime analysis (Santos, 2014). Crime analysis is the data-driven study of reported crime and disorder incidents to identify patterns and trends that the police can proactively address in order to make greater crime control gains (Santos, 2013). It is a crucial innovation that has become increasingly popular over the last several decades due in large part to advancements in computer technology (Santos, 2014; Weisburd & Lum, 2005). In a recently released paper, police scholar Rachel Santos (2014) contends that crime analysis should be endemic to effective and empirically tested innovative policing strategies such as COP, POP, hot spots policing, and focused deterrence. Additionally, she asserts that crime analysis should also be inexorably linked to, as yet, untested innovations such as Compstat, and ILP (Santos, 2014).

### **Problem Statement**

The link between innovative policing strategies and crime analysis is critical to understand, yet little is known about it in practice. A positive relationship should exist in that an agency that is committed to innovative policing strategies such as COP, POP, and hot spots policing should also be committed to crime analysis because their combined use

would reduce operational bottlenecks and result in greater crime control gains. For instance, it would be conducive for a police agency to invest a great deal of resources (e.g., personnel, time, and money) in to a crime analysis capacity if the agency frequently engaged in hot spots policing. Conversely, a police agency may be shortchanging its efforts if it engaged in hot spots policing, yet did not have or use spatial analysis. If it can be demonstrated that a positive relationship exists, then one can surmise that the police are operating with an advantage. On the other hand, if the relationship is negative it may suggest a disconnection between the tactical advantages afforded by analysis in problem-solving initiatives and the realities of field operations. In spite of these facts, the relationship between innovative policing strategies and crime analysis remains largely under-explored in the policing literature.

A nearly identical question could be posed regarding the relationship between the use of innovative policing strategies and the level of integration of crime analysis within agency operations. Whereas an agency may claim to be committed to crime analysis, the actual integration of analysis within agency operations could be quite different. For example, consider the case study mentioned earlier of the police department in San Diego that was renowned for its creative problem-solving approaches. Yet, the study found that the agency inadequately defined problems and relied upon standard model tactics with some frequency (Cordner & Biebel, 2005). Hypothetically, a positive relationship should exist between the use of innovative policing strategies and the integration of crime analysis within agency operations. To consider the opposing view, a commitment to innovation yet a low level of integration of analytical functions within agency operations would suggest that the analysis results are not being utilized to drive the innovative

tactics in practice. At best, this would suggest that the benefits of analysis are not being used to their fullest potential. At worst, it may suggest a scenario reminiscent of the problems observed in San Diego.

Another piece of the puzzle is the relationship between innovative policing strategies and accountability mechanisms within an agency. Compstat facilitates a number of changes in an agency and chief among them is the required regular use of crime analysis to provide crime counts and descriptive crime maps of specific geographic areas (PERF, 2013; Silverman, 2006). While the primary purpose of the counts is to have a baseline and outcome measures by which to hold geographic commanders accountable for reducing crime, a crucial inter-related facet of Compstat is its promotion of the use of innovative policing tactics, such as COP, POP, and hot spots policing, to facilitate such reductions (PERF, 2013; Silverman, 2006; Weisburd, Mastrofski, McNally, Greenspan, & Willis, 2003). As the accountability mechanism seeks to ensure that commanders seriously address crime, in essence, it encourages them to engage in creative problem-solving (PERF, 2013; Silverman, 2006; Weisburd, et al., 2003). However, there is a paucity of recent empirical research available about this relationship, yet the link is critical, because investment in Compstat-like programs on the basis of their promotion of innovation may be shortsighted if such programs in fact do not promote more effective and efficient strategizing.

### **Thesis Goal**

The goal of the current work is to shed light on the relationship between innovative policing strategies and crime analysis as well as accountability practices within police agencies. To achieve this end, this study examines data from a survey that

was disseminated to over 1,000 police agencies in 2008 by the Police Executive Research Forum (PERF). Using the agency as the unit of analysis, the goal of the survey was to solicit questions from the senior patrol commander and the crime analyst to represent the practices and perceptions of the agency surrounding the current use of crime analysis in patrol operations (Taylor & Boba, 2011; Santos & Taylor, 2014). Because many of the questions address innovative policing tactics, the end-use of crime analysis products, and various accountability mechanisms many of them can be used to represent and examine the relationships among the use of innovative policing strategies, crime analysis, and accountability.

To be clear, this study is concerned with a select number of innovative policing strategies that reduce crime and disorder which represent an obvious departure from traditional standard model policing methods such as preventive patrol and rapid response to calls for service (Dempsey & Forst, 2012; Weisburd & Braga, 2006a; Weisburd & Eck, 2004). Approaches such as COP and POP that promote the use of community partnerships and creative problem-solving to address crime and social problems are innovative (COPS Office, 2009; Goldstein, 1990; Skogan, 2006). Additionally, hot spots policing is considered innovative due to its keen level of focus on criminogenic locations, a drastic departure from randomized preventive patrols (Telep & Weisburd, 2012; Weisburd & Braga, 2006b; Weisburd & Eck, 2004). One final criterion for inclusion in the definition of an innovative policing strategy is effectiveness. Crime reduction innovations have been empirically evaluated and shown to be effective. By this rubric, COP (e.g. Gill et al., 2014; see generally Bennett et al., 2008), POP (e.g., Weisburd et al., 2010), and hot spots policing (e.g., Braga et al., 2012) are considered innovative. While

focused deterrence is innovative, and there is empirical evidence to support its effectiveness (e.g., Weisburd & Braga, 2012), the survey on which this research is based did not include it, and so it cannot be evaluated in this study. Even though managerial models such as Compstat and ILP do represent departures from the standard model of policing, their effectiveness is not known (Santos, 2014), so they are also excluded from the definition.

### **Summary**

Over the years, there have been numerous innovations in policing (Skogan & Frydl, 2004; Weisburd & Braga, 2006a; Weisburd & Eck, 2004). Innovative crime reduction and prevention strategies such as COP, POP, and hot spots policing have changed the way the police react and respond to crime and disorder in the communities they serve (Telep & Weisburd, 2012; Weisburd & Eck, 2004). Many of these strategies have been subject to empirical evaluation and have been shown to be effective (Santos, 2014; Telep & Weisburd, 2012). While the strategies can be effective, police scholars such as Santos (2014) argue they are likely to have a greater impact if coupled with crime analysis.

Past studies of the co-implementation of crime analysis and innovative policing strategies conducted by academic researchers rely heavily upon crime analysis to drive the tactics and therefore do not reflect the realities of every day police use of innovative strategies or analysis products in practice (Santos, 2014). Additionally, little is known about the relationship between innovative policing strategies and a police agency's reliance upon mechanisms that hold staff accountable for crime reduction. The most well-known innovative managerial strategy that attempts to synthesize an accountability

structure is Compstat (PERF, 2013; Silverman, 2006; Weisburd, et al., 2003). As part of the allure of Compstat is its utilization of crime analysis and promotion of innovative problem solving, one might expect a relationship between innovation and accountability (Weisburd, et al., 2003). However, there is a paucity of recent empirical evaluations regarding this relationship. Through the use of survey data, this thesis will attempt to close these gaps.

This thesis is separated into five chapters including this introduction. The second chapter contains a brief literature review that thoroughly explains crime analysis and what is known about its relationship to innovative policing strategies. Through the literature review, gaps in the literature will be revealed that will become the basis for a series of research questions. The third chapter will describe the PERF survey data and the methodology employed to address the research questions. The fourth chapter will present the results of the data analysis. Finally, the fifth chapter will conclude with a discussion of the findings, policy implications, and study limitations.



## Chapter II: Literature Review

### **Introduction**

The purpose of this chapter is to provide a brief definition and overview of crime analysis and how it is intended to assist police operations. The relationship between crime analysis and the innovative policing strategies are also explained to highlight how analysis is crucial to the effectiveness of each strategy. Then, the results of several past studies of crime analysis are discussed to demonstrate what is known about the relationship between analytical functions and innovative policing in practice. Through an evaluation of the literature, gaps in the research are exposed, and the chapter concludes with four research questions that guide this thesis.

### **Crime Analysis Defined**

Before any meaningful discussion of crime analysis can take place, it is essential to define exactly what is meant by the term. A comprehensive, all inclusive, definition of crime analysis is provided by Santos (2013) in her seminal book *Crime Analysis with Crime Mapping*: crime analysis is, “the systematic study of crime and disorder problems as well as other police-related issues — including sociodemographic, spatial, and temporal factors — to assist the police in criminal apprehension, crime and disorder reduction, crime prevention, and evaluation” (p. 2). According to Santos (2013), crime analysts collect, collate, and analyze voluminous amounts of computerized data including calls for service, police reports, census information, offender and victim characteristics, as well as other information obtained from police and county databases. Locations of

crime and disorder incidents as well as accidents are geographically plotted by their date, time, GPS coordinates, and other key characteristics on highly sophisticated and specialized computer software programs, a process known as crime mapping; Crime mapping enables the analyst to identify patterns and trends in crime reporting that may otherwise be indecipherable if such incidents are considered individually (Santos, 2013). The identification and isolation of spatial and temporal relationships can then drive proactive police action and tactical advice is disseminated to the appropriate audience for operationalization (Santos, 2013; Taylor & Boba, 2011).

Santos (2013) describes three primary types of crime analysis used most frequently by police agencies which include tactical crime analysis, strategic crime analysis, and administrative crime analysis. The first is tactical crime analysis which entails analyzing current (i.e., last 2-3 months) crime reports (Santos, 2013). The primary goals of tactical analysis are to identify patterns and trends in crime reporting that can drive proactive responses, identify potential suspects, and assist with case clearance by linking recently solved cases with unsolved cases (Santos, 2013). An example involving tactical analysis and pattern identification would be an analyst examining a list of residential burglaries in a neighborhood and linking some of those incidents together by their locations and times/days when they occurred, the offender's method of entry, and the types of property taken (Santos, 2013; Taylor & Boba, 2011). In practice, once a pattern is identified, an analyst might recommend proactive police strategies to disrupt and hopefully prevent the re-occurrence of the burglaries (Santos, 2013; Taylor & Boba, 2011). Responses may include directed patrol in this neighborhood, police contact with homeowners to inform them of the problem, police contact with known offenders living

or working in the area, or even the deployment of undercover surveillance units in the neighborhood at the peak times during which the incidents are occurring most frequently (Santos, 2013; Taylor & Boba, 2011). Also, if/when an offender is eventually apprehended they may be linked to the earlier offenses based on similarities, thus resulting in the clearance of the unsolved burglaries (Santos, 2013; Taylor & Boba, 2011).

Santos (2013) identifies strategic crime analysis as the study of long-term (i.e., 6 months or longer) crime problems. The primary goals of strategic analysis are to identify problems and evaluate the effectiveness of police responses to them (Santos, 2013). For these reasons, strategic analysis is synonymous with the innovative policing strategy POP and systematic problem-solving (Santos, 2013). To assist police agencies in synthesizing POP within their operations, researchers John Eck and William Spelman (1987) created a four step operational model they dubbed SARA, an acronym for Scanning, Analysis, Response, and Assessment. According to Clarke and Eck (2005), scanning is precisely identifying the crime or problem; analysis is conducting research to understand the problem's origins, root causes, and effects; response is implementing a corrective measure designed to eradicate the problem, and assessment is following up to ensure that the chosen response was effective. Through POP, SARA, and strategic crime analysis police are equipped to solve serious long-term crime and disorder problems (Clarke & Eck, 2005; Eck & Spelman, 1987; Santos, 2013).

A real world example of strategic crime analysis and problem-solving that utilized POP and the SARA process was documented by researchers Baker and Wolfer (2003) during the mid-1990s when a Pennsylvania police department was inundated with calls

for service regarding alcohol and drug abuse, vandalism, and sexual activity at a public park. Scanning and analysis revealed that the offenders were primarily juveniles who accessed the park after hours and consumed alcohol and abused drugs on the premises (Baker & Wolfer, 2003). Several responses were initiated to solve the crime and disorder problems at the park including directed patrols, curfew enforcement, removing a pay phone used to facilitate drug deals, eliciting assistance from local liquor store owners to inhibit the sale of alcohol to minors, contacting city officials to arrange for maintenance to improve the physical environment at the park, and contacting residents and businesses in the vicinity of the park to improve community relations and increase reporting of crime problems (Baker & Wolfer, 2003). An impact evaluation conducted after these and other strategies were implemented revealed a statistically significant decline in reporting and fear of crime at the park among local residents (Baker & Wolfer, 2003).

Lastly, Santos (2013) defines administrative crime analysis. A stark contrast to tactical and strategic analysis, administrative analysis involves presenting the results of crime analysis to specific groups generally outside the realm of the police agency such as police administrators, politicians, city council, community groups, and the news media (Santos, 2013). The purpose of this type of analysis is need-specific but entails the release of important findings regarding a community or city-wide crime problem, dissemination of crime prevention advice, or an alert regarding a time-sensitive crime-related issue, such as the abduction of a child (Santos, 2013).

### **Crime Analysis and Innovative Policing Strategies**

In a recently released paper, Santos (2014) argues that crime analysis is germane to each of the innovative policing strategies, COP, POP, hot spots policing, Compstat,

and ILP, though its role is different in each. As prior Campbell reviews have shown the innovative policing strategies are effective at reducing crime and disorder and other research has shown that the police often bungle the execution of these strategies in practice, understanding how crime analysis can supplement and support their use becomes an important consideration. Thus, the following section briefly describes how analysis benefits each of the innovative policing strategies.

COP relies heavily upon administrative crime analysis (Santos, 2014). Analysts may be tasked with providing crime counts for a website that can be accessed by civilians, or providing crime prevention advice or statistics for a community meeting (Santos, 2014). However, it is worth noting that there has been a growing trend among some agencies to outsource crime count data to companies who then publish it on the Internet for civilian access (Wartell & McEwen, 2001).

According to Santos (2014), strategic and tactical crime analyses are endemic to hot spots policing, POP, and effective problem solving. Crime analysis, and more specifically, crime mapping plays a pivotal role in the identification of hot spots in need of police interdiction (Santos, 2014). In depth analysis and knowledge of a hot spot can also guide a tailored response which is especially crucial in interventions that utilize a combination of hot spots policing and POP approaches (Santos, 2014; Telep & Weisburd, 2012). To that end, crime analysts conduct nearly every step of the SARA process beginning with the identification of crime and disorder problems and researching the relevant characteristics (Santos, 2014). The analyst may then recommend tactical solutions that can be disseminated to and acted upon by patrol officers (Santos, 2014).

Finally, the analyst will conduct an impact evaluation to ascertain if the corrective measures were successful (Santos, 2014).

Crime analysis is also crucial to police agency managerial strategies such as Compstat and ILP (Santos, 2014). In fact, crime analysis is one of the core components of Compstat-like programs, as it is needed for providing up-to-date crime counts and intelligence on the crime and disorder problems facing a district in order to direct responses and evaluate outputs and outcomes (PERF, 2013; Santos, 2014; Silverman, 2006; Weisburd, et al., 2003). To that end, analysis is a crucial part of Compstat's accountability mechanism as it provides the crime counts that are used to assess the performance and impact of the geographic commander's crime control and reduction strategies (PERF, 2013; Santos, 2014; Silverman, 2006; Weisburd, et al., 2003). Under ILP, analysis is key to identifying prolific offenders, deriving solutions to problems, and making a case to police administrators regarding where resources could best be allocated (Ratcliffe, 2008; Santos, 2014).

To summarize, crime analysis enables police agencies to be more effective in their crime control, reduction, and prevention efforts (Santos, 2013). Santos (2014) contends crime analysis is also critical to the effective use of the innovative policing strategies, including Compstat and Compstat-like programs with their accountability mechanisms. Thus, the next section of this chapter details past studies of the relationship between crime analysis, innovative policing strategies, and Compstat-like programs to highlight what is known about the interplay between analysis and the strategies in practice.

## **Empirical Research of Crime Analysis in Practice**

As crime analysis is critical to the effectiveness of the innovative policing strategies as put forth by Santos (2014), it is imperative to know what past research has shown regarding the relationship of crime analysis practices to these strategies. This section will discuss three key areas. First, it will evaluate the research regarding the relationship between crime analysis practices and the use of innovative policing strategies. Research regarding the inter-related issue of the integration of general crime analysis products within agency operations will also be evaluated. Finally, it will evaluate the relationship between reliance upon crime analysis-driven accountability mechanisms, such as Compstat-like programs, and the use of innovative policing strategies. While the previous section focused on definitions and how crime analysis theoretically should supplement each of the strategies, this section will attempt to shed light on what is known about the realities of the use of crime analysis in current police practice, as doing so may reveal areas that could benefit from further study.

Generally, there are few studies that specifically address the relationship between the use of innovative policing strategies and crime analysis. In the late 1990s, a national survey conducted by the Crime Mapping Research Center (CMRC) to investigate the diffusion and prevalence of crime mapping found that while some agencies acknowledged the benefits of the maps for COP activities and hot spot identification, few agencies were engaged in active analysis-driven strategizing at that time (Mamalian & LaVigne, 1999). A narrow scope study conducted around the same by the Police Foundation (2000) that utilized a convenience sample comprised mostly of COPS Office grant recipients (N=51), reported some agencies used crime maps for hot spot

identification, problem solving, or COP, but overall such usage was rare. A large scale national study of crime analysis and mapping adoption and integration carried out by the COPS Office and Department of Justice (DOJ) in 2000 found that agency commitment to COP was not correlated with analytical capabilities, and that most agencies lacked the software necessary for hot spot identification (O'Shea & Nicholls, 2002; see generally O'Shea & Nicholls, 2003). Police scholars Weisburd and Lum (2005) conducted a random survey of 125 agencies in the early 2000s and found that many were using maps to facilitate hot spots policing, a finding they assert is due in part to the accumulation of innovations and empirical research suggesting the effectiveness of the practice. Finally, in a doctoral dissertation that probed the analytical and mapping capabilities of a single police department in Spokane, Washington, Akgul (2007) reported that although the department promoted the use of mapping for hot spots policing and COP projects the majority of police officers did not understand how to use the maps, distrusted them, or did not find them useful in practice.

Collectively, it is hard to make any definitive conclusions about the relationships between innovative policing strategies and crime analysis because most of these findings are dated. The CMRC, Police Foundation, and joint COPS Office and DOJ studies are all 15 years old or older at the time of this writing. Given that crime analysis and mapping rely heavily upon computer technology (Santos, 2013), and that computer technology is constantly changing, it is reasonable to assume that considerable advances have been made over the last decade plus. Of the two remaining studies, Weisburd and Lum's (2005) findings are also a decade old. Akgul's (2007) findings are somewhat more current compared to the others, but his unit of analysis was a single department, thus it is



not generalizable. Moreover, in the majority of these studies, the central focus was not the relationship between the innovative policing strategy and the use of crime analysis, which severely limits the scope of the findings in that regard. Therefore, the current state of the relationship between crime analysis and innovative policing strategies remains unknown.

An inter-related area worthy of examination is the integration of crime analysis within agency operations. If it can be deduced how well data-driven crime analysis products in general are disseminated and operationalized by police agency staff, it may be possible to derive some ideas about how likely the agency is to correctly deploy innovative policing tactics, as innovative strategizing should be synonymous with crime analysis. Again, there are few current studies that consider integration.

The CMRC study (e.g., Mamalian & LaVigne, 1999) and the Police Foundation (2000) study both found relatively low levels of crime analysis integration within police agencies in the late 1990s. More specifically, the CMRC reported that the most common use of the maps was for producing crime counts for the Federal Bureau of Investigation's (FBI) Uniform Crime Reports (UCR), as opposed to strategizing (Mamalian & LaVigne, 1999). The joint COPS Office and DOJ study arrived at similar conclusions, reporting that crime analysts seemed to be engaged in a lot of bean counting (i.e., counting crime incidents) as opposed to using the technology to generate actionable intelligence (O'Shea & Nicholls, 2002; O'Shea & Nicholls, 2003). In a narrow-scope, qualitative investigation of the perceptions of crime analysts and police officers from two UK based police forces, Cope (2004) found that analysis products were frequently requested by command staff and did not reflect the needs of patrol officers, thus the officers found the information

useless in practice. Internet-based survey research conducted in the US regarding analyst perception of line officers' use of analytical products arrived at similar conclusions with many analysts reporting that they did not feel their products were being used in practice (Taylor, Kowalyk & Boba, 2007). Akgul's (2007) single agency case study found that just over half of the officers did not use crime mapping products due to a lack of understanding of how they worked or the benefits they offered. Finally, and perhaps most importantly, using data derived from the same survey as this study Santos and Taylor (2014) found low levels of integration of crime analysis products within patrol operations.

Overall, it is difficult to make generalizations about the current state of crime analysis integration due to the limited number of current studies. As noted earlier, the CMRC, Police Foundation, and joint COPS Office and DOJ studies are all 15 years old, or older. Cope's (2004) study is also somewhat dated at this point, was UK-based, and qualitative, assessing the feelings of analysts and officers in only two police forces, thus the results are not generalizable. Taylor et al.'s (2007) survey only examined the perception of crime analysts on an Internet-based listserv, which raises concerns about generalizability. As noted previously, Akgul's (2007) study focused on a single agency as the unit of analysis and is therefore not generalizable. Of all the studies, the most current and relevant to the current work is Santos and Taylor's (2014) as it utilized the same survey findings as this study. Unfortunately, their study did not focus on police innovations. In fact, none of the studies examined the relationships between crime analysis, integration, and innovative policing strategies together. Thus, the relationship among these concepts remains an unsolved mystery.

In the interest of understanding the promotion of police innovations, it is imperative to know what past research has shown with regard to the relationship between innovative policing strategies and crime analysis driven accountability mechanisms, specifically, Compstat and Compstat-like programs, because a key goal of Compstat is its promotion of the use of innovative tactics to address crime and disorder problems (PERF, 2013; Silverman, 2006; Weisburd et al., 2003). The relationship between innovative strategizing and Compstat adoption has been investigated on a national level at least once (Weisburd et al., 2003). In the late 1990s, Weisburd et al. (2003) studied the diffusion of Compstat-like programs by mailing surveys to a sample of large (i.e., more than 100 officers) and small (i.e., between 50 and 99 officers) police agencies nationwide, though not all of the agencies in their sample had implemented Compstat-like programs. While their study revealed that Compstat agencies were more likely to utilize crime mapping and analysis, few engaged in creative problem-solving (Weisburd et al., 2003). In fact, in Compstat agencies, traditional law enforcement-based responses to problems were still being utilized with the same frequency as they were in non-Compstat agencies (Weisburd et al., 2003). Moreover, Weisburd et al.'s (2003) findings regarding the rationale for adopting a Compstat-like program indicate that the majority of agencies did so to secure and exert better control over field operations. Thus, the researchers concluded that Compstat-like programs actually strengthen the existing bureaucracy within policing agencies and do little to promote innovation (Weisburd, et al., 2003).

Some narrow-scope studies have arrived at similar conclusions that Compstat-like programs do little to encourage innovative strategizing. Willis, Mastrofski, and Kochel (2010) examined the relationship between Compstat-like programs and COP through

field observations at seven different police agencies of varying sizes. They found that the COP and Compstat components operated independently of one another, and that Compstat meetings, during which command staff were held accountable for crime reduction, tended to focus more on serious offenses, as opposed to COP initiatives (Willis et al., 2010). In their probe of the integration of a Compstat-like program within the operations of a police department in Lowell, Massachusetts, Willis, Mastrofski, Weisburd, and Greenspan (2003) found that although the department benefited from the adoption of crime analysis and a greater sense of mission clarification, both components brought about by adoption of Compstat, traditional tactics such as saturation patrol were primarily being used to address crime problems. Thus, the adoption of Compstat did not promote the use of more innovative tactics (Willis et al., 2003) Field research conducted by Dabney (2010) also reinforces this notion of reliance on traditional tactics to address problems, as opposed to more innovative strategizing, as he found that many officers did not understand the tactical and strategic benefits afforded by the Compstat-like program and simply felt compelled to make more arrests, by whatever means necessary, in order to appease their district commanders.

Altogether, it would seem that there is reason for serious concern over whether Compstat-like programs actually promote the use of innovative policing strategies or merely permit the police to continue their reliance upon standard model tactics. It may be hard to make generalizations, however, given the relative age and narrow scope of many of these studies. While Weisburd et al. (2003) used a national sample, their surveying was conducted in the late 1990s and is over 15 years old at the time of this writing. The remainder of the studies discussed here are also too narrowly focused, either using a

single agency as the unit of analysis (e.g., Dabney, 2010; Willis et al., 2003) or multiple agencies (e.g., Willis et al., 2010), yet still not having a large enough sample size to derive any generalizable conclusions. Therefore, the relationships between accountability mechanisms, such as those afforded by Compstat-like programs, and innovative policing strategies remains in question.

Finally, it is worth noting that previous studies have looked at other facets of crime analysis and crime mapping such as factors pertaining to adoption, diffusion, and discontinuation of analysis and mapping programs (e.g., Chamard, 2003; Demir, 2009; Giblin, 2006; Mazeika, 2008; Sever, Garcia, and Tsiandi, 2008); crime analysts' knowledge of criminological theory (e.g., Wartell & Gallagher, 2012); and the effectiveness of crime analysis in case clearance (e.g., Baltaci, 2010; Demir, 2009). Unfortunately, none of these studies specifically address the relationships between innovative policing strategies, crime analysis, and accountability mechanisms.

To summarize, it has been suggested that the empirically supported, thus effective, innovative policing strategies work best when there is co-implementation with crime analysis (Santos, 2014) because prior research has repeatedly shown the police, left to their own devices, are often poor problem-solvers, and are likely to rely upon standard model law enforcement based tactics to address crime and disorder problems (Braga & Weisburd, 2006; Cordner & Biebel, 2005; Scott, 2000). Thus, there should be a positive relationship between use of the innovative policing strategies and the use of crime analysis. While there have been a number of studies of various facets of crime analysis and crime mapping conducted over the last 15-20 years, unfortunately, there are many gaps in the research on the co-implementation of crime analysis with innovative policing

strategies. In fact, in the majority of these studies discussed here, the innovative policing strategies were not the primary focus, and any findings regarding them were secondary considerations. Moreover, most of these studies use problematic sampling techniques (e.g., convenient sampling) or are outdated. Thus, there is a lack of current information about these relationships.

There is also much debate about whether crime analysis driven accountability mechanisms, such as those attributable to Compstat-like programs, actually promote (e.g., Kelling & Sousa, 2001; Silverman, 2006) or inhibit the use of innovative strategizing (e.g., Dabney, 2010; Weisburd et al., 2003; Willis et al., 2003; Willis et al., 2010). Weisburd et al. (2003) examined this relationship in depth and found that adoption of Compstat was not related to the use of innovative policing strategies. A few smaller, narrow-scope studies have reinforced this point (e.g., Dabney, 2010; Willis, et al., 2003; Willis et al., 2010). Yet, there remains a dearth of recent information regarding the relationship between crime analysis, accountability mechanisms, and innovation.

### **The Present Study**

The present work will attempt to fill three gaps identified in the policing and crime analysis research. The first two gaps are somewhat interrelated, but of equal importance. The first consideration is the relationship between police agencies' stated commitment to crime analysis and the use of innovative policing strategies. Stated commitment to crime analysis may be defined as the priority that an agency assigns to the use of analytical functions within their operations. While some studies have covered the use of various innovative policing strategies and crime analysis (e.g., Akgul, 2007; Mamalian & LaVigne, 1999; O'Shea & Nicholls, 2002; see generally O'Shea & Nicholls,

2003; Police Foundation, 2000; Weisburd & Lum, 2005) thus far, none have specifically or recently addressed the relationship between commitment to crime analysis and the use of innovative policing strategies.

The second gap is the relationship between the integration of crime analysis within police agencies' operations and the use of innovative policing strategies. For the purposes of this examination, it is important to distinguish between stated commitment and integration. This is a crucial point because stated commitment measured as a perception of individuals about the agency does not equate to integration measured by the actual level of use in practice. Therefore, this study will look at both stated commitment and integration separately. Although a few studies have looked at the integration of crime analysis within agency operations (e.g., Akgul, 2007; Cope, 2004; Mamalian & LaVigne, 1999; O'Shea & Nicholls, 2002; see generally O'Shea & Nicholls, 2003; Police Foundation, 2000; Santos & Taylor, 2014; Taylor et al., 2007), no study has specifically nor recently examined the relationship between the integration of crime analysis within agency operations and innovative policing strategies together.

Lastly, the third gap is the relationship between police agencies' use of crime analysis-driven accountability mechanisms and the use of innovative policing strategies. Although a few studies have probed the relationship between the use of Compstat and Compstat-like programs with accountability mechanisms and innovative policing strategies (e.g., Dabney, 2010; Weisburd et al., 2003; Willis et al., 2003; Willis et al., 2010) most are dated and/or narrow in depth and scope.

## **Research Questions**

The primary focus of this thesis is the relationship between innovative policing strategies and crime analysis. For the purposes of this study, innovative policing strategies are defined as those that reduce and prevent crime, represent a departure from standard model policing tactics, and have strong empirical support for their effectiveness. The strategies examined here include COP, POP, and hot spots policing. Additionally, this thesis examines the relationship between the innovative policing strategies and the use of crime analysis in conjunction with accountability mechanisms designed to hold police accountable for reducing crime. Four research questions have been devised to address these areas. This next section outlines the research questions and corresponding hypotheses that will be tested in the remainder of this thesis. In Chapter III, the operationalization of these concepts and questions will be discussed.

### **Research Question 1: What is the relationship between police agencies' stated commitment to crime analysis and the use of innovative policing strategies?**

As the literature review has shown, crime analysis is an important innovation that enables the police to operate more efficiently and achieve their primary goals of controlling, reducing, and preventing crime (Santos, 2013; Taylor & Boba, 2011). The co-implementation of crime analysis with the innovative policing strategies (Santos, 2014), is necessary because past research has shown that the police alone are not effective problem-solvers (Braga & Weisburd, 2006; Cordner & Biebel, 2005; Scott, 2000). Thus, policing agencies that claim to be committed to innovative tactics such as COP, POP, and hot spots policing should also be equally committed to crime analysis.



However, the existing literature on this topic is inadequate and does not explain the realities of current practice.

It is important to understand the nature of the relationship between police commitment to crime analysis and commitment to innovative problem solving. Commitment to crime analysis should equate to more use of innovative policing strategies. If there is disconnect between commitment to crime analysis and the use of innovative policing strategies, it is imperative for researchers to know, so further research can be undertaken to explain and ultimately rectify the problem. However, this relationship has yet to be evaluated.

**Research Question 2: What is the relationship between the integration of crime analysis within police agencies' operations and the use of innovative policing strategies?**

A similar argument can be formulated for the second research question with one very important difference. Where the previous question measures the perception of the agency, through stated commitment, this question gets to the heart of operational activities. If crime analysis is used by a wide range of personnel for a wide range of crime reduction activities (i.e., highly integrated), then the agency should be engaging in innovative policing strategies such as COP, POP and hot spots policing. If not, it begs the question, what are they doing?

Past research has documented difficulties in getting police officers to act upon data-driven intelligence in the field (e.g., Akgul, 2007; Cope, 2004; Taylor et al., 2007). Research has also suggested that if left to their own devices police will not routinely engage in effective problem solving (e.g., Braga & Weisburd, 2006; Cordner & Biebel,

2005; Scott, 2000). Finally, research has also shown that some crime analysts did a lot of crime counting as opposed to producing tactical intelligence (e.g., Mamalian & LaVigne, 1999; O'Shea & Nicholls, 2002; see generally O'Shea & Nicholls, 2003). Thus, the relationship between the integration of crime analysis within agencies operations and the use of innovative tactics is a critical one. It would be very costly for police agencies to continue to invest in analytical capabilities with incorrect or non-use as an end result.

**Research Question 3: What is the relationship between police agencies' use of accountability mechanisms and the use of innovative policing strategies?**

The previous question raises a disturbing possibility, that an agency may invest money, resources, and time in to analysis, only to have the results not used in practice. While Compstat has been praised as a great innovation in modern policing (Kelling & Sousa, 2001; Silverman, 2006), it also been damned as an obstacle to innovative problem solving and a throwback to the rigid bureaucracies that have entrenched police agencies for over a century (Weisburd, et al, 2003; Weisburd, Mastrofski, Willis & Greenspan, 2006). Considering the widespread diffusion of Compstat and Compstat-like ideals (PERF, 2013; Weisburd, et al., 2003) the distinction becomes an important one, as investment of agency resources into Compstat-like programs should improve the functioning of an agency by way of increasing its use of innovative tactics, not enabling it to continue doing business as usual. Thus, an identical question could be posed regarding programs, such as Compstat, that utilize crime analysis to promote innovation while enforcing accountability.

**Research Question 4: How are the commitment to crime analysis, the integration of crime analysis within agency operations, and the use of accountability mechanisms predictive of police agencies' use of innovative policing strategies?**

Finally, in this discussion of policing innovation it is important to understand the interplay among each of the concepts: commitment to crime analysis, the integration of crime analysis, and the use of accountability mechanisms. If a police agency is reliant upon aspects of COP, POP, and hot spots policing within its operations, the agency should have a strong crime analysis capability. Additionally, if the agency does have a Compstat-like program or otherwise utilizes an accountability mechanism that is driven by crime analysis, they should be fairly innovative in terms of the strategies that they employ. It would be counterintuitive to hold command staff accountable for crime reduction, yet not give them the proper support for doing so. Moreover, the interplay between all of these concepts, commitment, integration, and accountability is crucial to understand because such knowledge could suggest ways that police agencies could be more cohesive and ultimately more efficient in their operations. At this juncture, however, there exists no recent empirical evaluation of these variables, separately or together. Thus, it is worthwhile to consider the merits and unique contributions of each variable to the level of innovation that a police agency employs.

**Summary**

This chapter began with a definition and brief overview of crime analysis. Crime analysis is an important innovation that enables the police to better achieve their primary goals of controlling, reducing, and preventing crime (Santos, 2013). Moreover, it has been argued that crime analysis is endemic to the successful execution of innovative

policing strategies such as COP, POP, and hot spots policing (Santos, 2014). Crime analysis also plays a role in Compstat-like programs with accountability mechanisms (PERF, 2013; Santos, 2014; Silverman, 2006; Weisburd, et al., 2003).

The second half of the chapter summarized the current literature on crime analysis and crime mapping. Over the years, there have been many empirical evaluations of various facets of crime analysis. Closer examination of past studies revealed several problems. Most of these studies are dated, utilize convenient sampling techniques, or do not focus on the relationship between crime analysis and the innovative policing strategies. Additionally, a review of the literature revealed several gaps, chief among them a lack of current information regarding the current relationship between innovative policing strategies, crime analysis, and accountability mechanisms. These gaps in the research led to the creation of four unique research questions. In Chapter III, the concepts in the research questions will be operationalized via items on the PERF survey, and specific analytic strategies will be proposed to answer each question.

## Chapter III: Data and Analytical Methods

### **Introduction**

The data used in this study come from a national survey conducted in 2008 of over 1,000 US city, county, and state policing agencies by the Police Executive Research Forum (PERF) with funding from the Office of Community Oriented Policing Services (Cooperative Agreement Number 2007-CK-WX-K010)<sup>1</sup>. This chapter begins with an explanation of how the survey data were collected. Next, key variables germane to answering the research questions are isolated and explained in detail. Finally, an analytical strategy for answering the questions is proposed.

### **Data Collection: PERF National Survey**

The purpose of this section is to describe how the data were collected. First, it begins with a brief overview of the original research project that led to the creation of the survey instrument. Next, the survey instrument itself is explained in detail. Lastly, the sampling methods and survey dissemination process is outlined.

The data for this thesis were derived from a survey instrument created and disseminated to a sample of police agencies nationwide by PERF (Taylor & Boba, 2011). The specifics of the PERF project are explained in greater detail in Bruce Taylor's and Rachel Boba's 2011 guidebook, *The Integration of Crime Analysis into Patrol Work: A*

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<sup>1</sup> Permission has been granted by Dr. Bruce Taylor, Principal Investigator of this cooperative agreement as well as PERF.

*Guidebook.* To briefly summarize, the project had two primary goals. The first goal was to establish the current state of the integration of crime analysis within police operations, including how the process of collecting data for analysis has been integrated into patrol. The second goal was the identification of possible impediments to the use of analytical products in patrol work so that practical suggestions for improvement could be made.

The PERF study included four components. First, the national survey instrument disseminated in 2008 to over 1,000 police agencies (to be discussed in more detail below). Second, five separate focus groups were held in 2009 to discuss the use of crime analysis by patrol. The attendees consisted of crime analysts, various police administrative staff, and line-level police officers; all totaled, 21 different agencies were represented in the focus group discussions. Third, a smaller group of practitioners selected from the focus groups were invited to participate in more in-depth discussions of issues raised by the survey results, and the prior focus group discussions. Finally, detailed case evaluations were conducted of four police departments in Alexandria, Virginia; Port St. Lucie, Florida; Jacksonville, Florida; and Mesa, Arizona. The data used in this study was derived from the national survey instrument.

### **Survey Instrument**

The goal of the PERF national survey was to ascertain how police agencies, specifically their patrol divisions, were using crime analysis within their operations and to identify possible obstacles to its implementation and use. The creation of the instrument was based on past research as well as focus group discussions and prior surveys. Two separate instruments were created, one of which was intended to be

answered by the person in charge of crime analysis, and the other was to be answered by the senior patrol commander.

The crime analyst portion of the instrument (hereinafter referred to as “analyst survey”) was to be completed by the person in charge of crime analysis. It contained questions that pertained to how many analysts worked for the agency, whether the analysis function was centralized; the types of analytical products produced, who requested and used analytical products the most; how analysts interacted with patrol, and a myriad of questions regarding the types of information collected for analytical purposes.

The patrol portion of the instrument (hereinafter referred to as “patrol survey”) was to be completed by the senior patrol commander. Creating a survey unique to the patrol division was important, as prior research of crime analysis functions typically elicited feedback from analysts only (Santos & Taylor, 2014). Thus, this provided a rare opportunity to assess the perceptions of patrol command staff regarding the use of crime analysis in practice while at the same time assessing the perceptions of crime analysts working within the same agencies (Santos & Taylor, 2014). Taylor and Boba (2011) addressed the survey to the patrol commander specifically, as it was ascertained that he/she would be in the best position to understand and articulate how analytical products were disseminated to all personnel in the patrol division. The patrol survey contained a number of questions pertaining to agency size, operational activities, primary user groups of analytical products, and how routinely the products were used in practice.

## **Sampling Methods**

To disseminate the survey, a randomized sample was drawn from the 2007 National Directory of Law Enforcement Agencies (NDLEA), a listing of over 15,000 law enforcement agencies nationwide. The NDLEA listings contained detailed information about each agency including key contacts, the population served, the type of agency (e.g., local police department, sheriff's office, tribal, or state agency), the number of officers, and the region of the country where the agency is located. The final sample consisted of 1,023 police agencies, stratified by size, type, and geography. The survey was disseminated via US Mail in multiple waves to ensure higher response rates. The first wave of surveys was mailed on May 8, 2008 to every agency in the sample. Approximately three weeks later, follow-up mailings were sent. Finally, a third wave of surveys was disseminated on June 23, 2008. All of these mailings were followed by reminder letters and faxes to motivate the recipients to complete the survey.

According to Santos and Taylor (2014), all totaled, 564 of the patrol surveys were completed and returned which represents a response rate of 55.1 percent; 567 analyst surveys were completed and returned which represents a response rate of 55.4 percent. Santos and Taylor (2014) noted that these response rates are acceptable, yet low compared to the typical rate of response achieved by PERF. They suggest that perhaps crime analysis was not of great importance to some of the agencies, thus they did not return the surveys. They conducted a bivariate analysis to identify possible differences between respondents and non-respondents on the basis of population size, number of officers, and region of the county; no statistically significant differences were found. The final sample included 89 percent of the agencies having a full time crime analyst on staff



or a staff member who conducted analysis as a secondary responsibility (Santos & Taylor, 2014; Taylor & Boba, 2011).

### **Study Database and Variables**

The raw dataset constructed from the survey responses and ultimately used for the purposes of this thesis consisted of two separate databases. The first database contained the data derived from the analyst survey instrument; the second database contained the data derived from the patrol survey instrument. As the analysis in this thesis will utilize variables and aggregate variables from both datasets, it was necessary to combine both sets of data together to create one master database for analysis. All data analysis for this thesis was conducted using IBM SPSS Statistics version 22.

Each agency that responded to the survey was given a unique case number for identification purposes. Prior to the merging of the databases together, each was sorted numerically by case number. Once this step was complete, a master database was created using the “merge” function in SPSS. Upon completion of the merge, the data were spot checked to ensure that the responses to the analyst and patrol surveys were correctly matched to corresponding agencies via the unique case number identifier. This newly created master database was utilized for the remainder of the statistical procedures described throughout.

Before any meaningful analysis could be conducted, it was necessary to first look for missing data in the newly created database. Missing data occurred when a respondent did not answer a survey question. The merged database began with 594 cases. It was inspected for missing responses. Agencies that did not answer questions germane to the

research questions and hypotheses were then isolated and considered for removal from the database.

Upon closer examination, it became apparent that many of the non-responding agencies in the sample were county jails and therefore did not utilize crime analysis for patrol since they did not have a patrol function. As the primary focus of the current work is crime analysis, it would be counterintuitive to include such agencies, so all agencies whose primary purpose was corrections were removed. There were 89 of these types of agencies. Additional inspection of the data revealed 25 state-level agencies. As this study is concerned with the crime analysis capabilities of local police agencies, it would not be appropriate to include responses from state agencies. Moreover, these state agencies were well above average in terms of the number of personnel employed. Inspection of box plots and scattergrams clearly revealed these agencies as outliers compared to the average agency size, thus the state agencies were removed.

While the merged dataset began with 594 cases, 89 corrections facilities were eliminated, 25 state-level agencies were eliminated, and an additional 119 cases were eliminated due to the respondents not answering key questions. All totaled, 361 agencies were included in the finalized database.

In order to address the research questions, it is necessary to first operationalize broad concepts and terminology such as the use of innovative policing strategies, the stated commitment of an agency to crime analysis, the integration of crime analysis within police agencies' operations, and the use of accountability mechanisms. A number of indexes were created to serve as dependent, independent, and control variables which are all described in the following sections.

## **Dependent Variable**

The dependent variable is an index of an agency's prioritization of innovative policing strategies. While the research questions pertained to the actual use of innovative policing strategies, there were no survey questions that directly measured agency use of such tactics. However, there was a series of questions pertaining to agency prioritization of innovative policing strategies. To be clear, prioritization does not necessarily equate to use, but it was hoped that prioritization would serve as a good proxy for use, as the agencies that indicate some value in the strategy are likely to be using it in some capacity.

To reiterate, innovative policing strategies are those crime and disorder reduction and prevention techniques that represent a departure from standard model tactics and for which there is a high level of empirical support by way of a Campbell systematic review. These strategies include COP, POP, and hot spots policing. This concept was operationalized through a single matrix question on the patrol survey that required the patrol commander to rate, on a 5-point Likert scale, the priority that the agency places on eleven different police actions. The patrol commander was instructed as follows, "Using the following scale, please rate the following components with regard to their importance to your agency's operational activities. Please reserve a "5" (very high priority) to those activities considered to be vital to your operations." The question is illustrated in Figure 1.

	<b>Not a priority at all</b>	<b>Low priority</b>	<b>Somewhat of a priority</b>	<b>High priority</b>	<b>Very high priority</b>
Responding to calls for service and investigating crimes	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Actively encouraging officers to form community partnerships	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Transforming the agency to support officer partnership building and problem-solving (e.g., through decentralization)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Regularly collecting data from citizens about community problems	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Problem-oriented policing	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Hot spot policing	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Intelligence/Information-led Policing (ILP)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
COMPSTAT	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Crime prevention	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Crime analysis	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Crime mapping	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Figure 1. PERF survey question regarding the priority of various actions in police agency activities.

Not all of the items in the matrix are considered “innovations” in policing.

Innovation here is based on the fact that the activity differs from the standard model of policing. Recall that the standard model of policing utilizes generic, generally applied, reactive approaches to solving crime and disorder problems such as preventive patrol rapidly responding to calls for service, and follow-up and investigation of past crimes (Dempsey & Forst, 2012; Weisburd & Braga, 2006a; Weisburd & Eck, 2004). Innovative strategies, then, are problem or offender specific as opposed to generic or generalized approaches, proactive as opposed to reactive, and highly focused as opposed to broad. Additionally, while some of the strategies represented in the survey may be considered innovative, there is a paucity of empirical support regarding their effectiveness. Thus, the dependent variable only includes those items with sufficient evidence to support their

innovative nature and effectiveness (i.e., the strategy was subjected to a Campbell systematic review).

The following is a discussion of each item's exclusion or inclusion into the dependent variable.

- Responding to calls for service and investigating crimes. (Excluded). This is standard model tactic as well as a basic service conducted by all police agencies thus is not considered innovative (Spelman & Brown, 1984).
- Actively encouraging officers to form community partnerships. (Included). This activity represents an innovative departure from standard model tactics in that it is proactive, as well as highly focused on community problems, and improving police and community relations. This strategy is congruent with COP philosophies about encouraging the police to build rapport with civilians and gain trust (COPS Office, 2009; Skogan, 2006). Additionally, there is empirical support for COP's effectiveness (e.g., Gill, et al., 2014).
- Transforming the agency to support officer partnership building and problem-solving (e.g., through decentralization). (Included). This activity represents an innovative departure from standard model tactics in that it is proactive, as well as highly focused on changing the police agency to better address and solve community problems, thereby improving police and community relations. This strategy is congruent with COP and POP philosophies regarding decentralization of power to community policing officers. Creative problem solving is at the heart of problem-oriented policing strategies (COPS Office, 2009; Goldstein, 1990;

Skogan, 2006). Finally, there is empirical support for the effectiveness of COP (e.g., Gill, et al., 2014) and POP (e.g., Weisburd et al, 2010).

- Regularly collecting data from citizens about community problems. (Included). This activity represents an innovative departure from standard model tactics in that it is proactive, improves relations by encouraging communication between the police and citizens, and should enable the police to focus on specific problems. This strategy is congruent with COP philosophy promoting contact with civilians to elicit feedback regarding the crime and social problems they want the police to address (COPS Office, 2009; Skogan, 2006). Again, there is empirical support for COP effectiveness (e.g., Gill, et al., 2014).
- Problem-oriented policing (POP). (Included). POP represents a departure from standard model tactics in that it is often proactive, requires analysis to assess and potentially solve problems, and is highly focused on very specific crime and disorder problems. There is also empirical support for its effectiveness (e.g., Weisburd et al., 2010).
- Hot spot policing. (Included). Although hot spots policing is in some ways analogous to the standard model tactic of preventive patrol, it differs in that it is both proactive and highly focused on the most criminogenic locations in a jurisdiction as opposed to being distributed randomly. There is also empirical support for its effectiveness (e.g., Braga et al., 2012).
- Intelligence-led policing (ILP). (Excluded). Although the ILP police agency managerial model is innovative in its use of crime analysis, problem solving, and high level of focus on targeting prolific offenders, attributes that separate it from

the standard model of policing, it is excluded because its effectiveness is untested (Santos, 2014).

- Compstat. (Excluded). Although the Compstat police agency managerial model is innovative in its use of crime analysis, problem solving, and promotion of creative strategizing, attributes that separate it from the standard model of policing, it is excluded because its effectiveness is untested (Santos, 2014).
- Crime prevention. (Excluded). This activity is too general to measure and could encompass a number of innovative and non-innovative tactics used by police in any approach.
- Crime analysis. (Included). This activity represents a departure from standard model tactics in that it is proactive, uses specialized computer and software technology and methods to generate tactical or strategic intelligence that can be used to reduce and prevent crime, and is highly focused on very specific crime and disorder problems. Although there are no known empirical evaluations of the effectiveness of crime analysis, an attribute that should disqualify it from inclusion, the fact that it is the drive behind other innovative tactics with empirical support such as COP, POP, and hot spots policing, renders it worthy of inclusion (Santos, 2013; Santos, 2014).
- Crime mapping. (Included). This activity is a subset of crime analysis. It does represent a departure from standard model tactics in that it is proactive, uses specialized computer and software technology and methods to generate tactical or strategic intelligence that can be used to reduce and prevent crime, and is highly focused on very specific crime and disorder problems. Although there are no

known empirical evaluations of the effectiveness of crime mapping, an attribute that should disqualify it from inclusion, the fact that it is part of crime analysis, and the drive behind other innovative tactics with empirical support such as COP, POP, and especially hot spots policing, renders it worthy of inclusion (Santos, 2013; Santos, 2014).

In summary, the seven items included in the index are 1) actively encouraging officers to form community partnerships, 2) transforming the agency to support officer partnership building and problem-solving (e.g., through decentralization), 3) regularly collecting data from citizens about community problems, 4) problem-oriented policing (POP), 5) hot spot policing, 6) crime analysis, and 7) crime mapping.

The values for each item range from 1-5 on a Likert scale with a rating of 1 indicating the action is “not a priority at all” and 5 indicating the action is a “very high priority.” To create the index, the responses for each action were summed together to create an “innovation” measure for each agency. The minimum value is 7 (i.e., if the patrol commander rated each action a “1”) and the maximum value is 35 (i.e., if the patrol commander rated each action a “5”).

### **Independent Variables**

In the four research questions, there are three key independent variables that represent concepts that are hypothesized to be associated with innovation. They include 1) stated commitment to crime analysis, 2) integration of crime analysis within police agencies’ operations, and 3) the use of accountability mechanisms. The following is a description of the measure for each variable.



**Stated commitment to crime analysis.** The first independent variable is measured with a single multiple choice question from the patrol survey, “Overall, how does crime analysis fit with the agency's goals and objectives?” The patrol commander was instructed to select only one response among five possible answer choices. The five possible answers are ordinal and represent high to low fit. The answer choices are:

- Crime analysis function is critical to the agency achieving its goals and objectives.
- Crime analysis function is fairly well aligned with agency goals and objectives and is useful (but not critical) to the agency achieving its goals and objectives.
- Crime analysis function is neutral to the agency goals and objectives and neither helps nor hurts the agency's ability to achieve its objectives and goals.
- Crime analysis function is poorly aligned with agency goals and objectives and can sometimes interfere with the agency achieving its goals and objectives.
- Crime analysis function runs counter to the agency goals and objectives and always creates problems for the agency achieving its goals and objectives.

These responses were coded as 5 to 1 with the most positive as 5. A negative response of “runs counter” would be represented by a “1.”

**Integration of crime analysis within police agencies' operations.** The second independent variable is measured using the same index as Santos and Taylor (2014) in their examination of the integration of crime analysis within patrol operations. As this thesis uses data derived from the same survey, and one of the goals is to contrast innovation and integration, the same index will be utilized for the integration measure. Integration was measured by a single matrix question on the patrol survey. The patrol

commander was instructed to answer the question as follows, “Please mark the appropriate boxes to indicate who is/are the primary customer(s) who routinely use(s) that information. Mark all that apply.” The respondent was then presented with a list of various crime analysis products. The exact list is reproduced in Figure 2.

**a. Short-term (i.e., crime activity occurring for no more than four to six months)**

	Is not produced	No one uses	Patrol officers	First-line supervisors	Management	Team of personnel	Other
Analysis determining repeat call locations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Crime patterns (e.g., linked by suspect, MO, time/day, property type)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Crime maps (e.g., clustering of small numbers of incidents)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**b. Mid-term (i.e., crime activity occurring for more than six months)**

	Is not produced	No one uses	Patrol officers	First-line supervisors	Management	Team of personnel	Other
Analysis determining high crime/call locations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analysis determining repeat offenders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analysis determining repeat victims	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analysis determining types of property taken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Crime maps (e.g., hotspot identification)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**c. Long-term (i.e., crime activity occurring for several years)**

	Is not produced	No one uses	Patrol officers	First-line supervisors	Management	Team of personnel	Other
Analysis of citywide problems (e.g., false alarms)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Evaluation of police operational response to a crime problem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Evaluation of a crime prevention response	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 2. PERF survey question regarding the primary user groups of crime analysis products.

Three types of crime analyses are represented in the question: tactical crime analysis, strategic crime analysis, and evaluation-oriented crime analysis. Tactical crime analysis entails addressing short-term crime activity occurring for no more than four to

six months. Tactical crime analysis is represented by three items, 1) analysis determining repeat call locations, 2) crime patterns (e.g., linked by suspect, MO, time/day, property type), and 3) crime maps (e.g., clustering of small numbers of incidents). Strategic crime analysis entails addressing mid-term crime activity occurring for more than six months. Strategic crime analysis is represented by five items: 1) analysis determining high crime/call locations, 2) analysis determining repeat offenders, 3) analysis determining repeat victims, 4) analysis determining types of property taken, and 5) crime maps (e.g., hotspot identification). Lastly, evaluation-oriented crime analysis entails addressing long-term crime activity occurring for several years. Evaluation-oriented crime analysis is represented by three items, 1) analysis of citywide problems (e.g., false alarms), 2) evaluation of police operational response to a crime problem, 3) evaluation of a crime prevention response. All totaled, eleven different analytical products are represented in the question.

The patrol commander was instructed to check a box indicating who the primary customers or users of each product were. There were seven possible options for users, 1) is not produced (i.e., this type of analysis product is not generated by the crime analyst), 2) no one uses (i.e., the analysis product is generated but not used by any of the user groups listed), 3) patrol officers, 4) first-line supervisors, 5) management, 6) team of personnel, and 7) other. Due to the fact that the integration variable is only concerned with the actual use of analytical products, answer choices regarding non-use were excluded from the creation of the variable. Answer choices excluded on the grounds of non-use were, “is not produced,” and “no one uses.” Also, as the integration variable pertains to the use of crime analysis within patrol operations, the following two user

group categories were excluded from the creation of the variable, “team of personnel,” and “other.” The remaining user groups included in the creation of the variable are 1) patrol officers, 2) first-line supervisors, and 3) management.

Integration is measured by assessing among the three user groups, who primarily makes use of eleven different analytical products that represent tactical, strategic, and evaluation-oriented crime analysis. As the patrol commander was instructed to check a box to indicate which user group used each of the eleven products, checked boxes were coded as “1.” Unchecked boxes were coded as “0.” The selection criteria for each analytical product was not mutually exclusive (i.e., if all three user groups, patrol officers, first-line supervisors, and management, utilized crime maps, all three boxes could be checked by the patrol commander and included in the aggregation). Therefore, each of the eleven analytical products could have a minimum of “0” (i.e., none of the user groups made use of the product), and a maximum of “3” (i.e., all three groups, patrol officers, first-line supervisors, and management, used the product). Responses regarding all three groups’ usage of all eleven crime analysis products were aggregated to produce an “integration” measure. The measure ranges from a low of 0 (i.e., no integration because no user groups are using any of the eleven products) to a high of 33 (i.e., total integration because all three user groups are using all eleven products). Note that Santos and Taylor (2014) found that the overall integration level was relatively low with the mean usage of all agencies at 11.67 and a standard deviation of 8.16.

**Use of accountability mechanisms.** This concept was also operationalized as an index using a matrix question on the patrol survey that required the patrol commander to rate, on a 5-point Likert scale, the priority of five different actions pertaining to

accountability. Of the five actions, three pertain to holding different personnel (e.g., officers, first-line supervisors, and management/command staff) accountable for crime reduction and prevention, one pertains to measuring the production and performance of personnel and one pertains to measuring the effectiveness of the agency as a whole in reducing crime and disorder. It should be noted that, as with the innovation variable, the research question pertained to the use of accountability mechanisms, yet there were no specific questions on the survey that measured use, rather the questions measured perception of priority. In this instance then, priority is a proxy for use. The patrol commander was instructed as follows, “Indicate the level of priority your agency places on using crime analysis for informing the following organizational activities listed below. Please reserve a "5" (very high priority) to those activities considered to be vital to your operations.” The question is illustrated in Figure 3.

	<b>Not a priority at all</b>	<b>Low priority</b>	<b>Somewhat of a priority</b>	<b>High priority</b>	<b>Very high priority</b>
To help measure work production/performance of personnel (e.g., field interviews, arrests)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
To help determine whether the agency is effective in reducing crime and disorder	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
To hold officers accountable for crime reduction and prevention	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
To hold first-line supervisors accountable for crime reduction and prevention	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
To hold management/command staff accountable for crime reduction and prevention	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

*Figure 3.* PERF survey question regarding the priority of accountability mechanisms in police agency operations.

The values for each item range from 1-5 on a Likert scale with a rating of 1 indicating the action is “not a priority at all” and 5 indicating the action is a “very high priority.” To create the independent variable, the responses for each action are summed together to create an “accountability” measure for each agency. The minimum value is 5 (i.e., if the patrol commander rated each action a “1”) and the maximum value is 25 (i.e., if the patrol commander rated each action a “5”).

### **Control Variables**

In order to properly assess the relationship between the key independent variables and the dependent variable in a multivariate analysis, it is also necessary to employ a number of control variables. According to Bhattacharjee (2012), control variables are extraneous factors that may affect change on a dependent variable. Such factors, then, need to be controlled for in order to better observe the actual effect of the independent variables on the dependent variable (Bhattacharjee, 2012). In total, three controls were included in this study. The characteristics of each variable are described in detail below.

One obvious and important consideration in selecting a control variable is that of agency size. It would stand to reason that as the size of an agency increases in terms of the number of personnel it employs, so too does the departmental budget and access to resources. Therefore, it is reasonable to assume that crime analysis capabilities may vary greatly among police agencies of different sizes. Thus, it would be appropriate to utilize a control based on agency size.

Past studies have generally found that agencies with 100 or more sworn officers are more likely to be early adopters of innovative technology such as computers (e.g., Mullen, 1996), crime mapping (Chamard, 2003; Mamalian & LaVigne, 1999; Weisburd

& Lum, 2005), and crime analysis (Giblin, 2006). Interestingly, the national study undertaken by the COPS Office and the DOJ found that agency size was not correlated with analysis adoption, yet larger agencies seemed to be engaging in a wider variety of analysis techniques (O'Shea & Nicholls, 2002; O'Shea & Nicholls, 2003). Findings regarding the effect of size seem to remain true, even among smaller agencies. For instance, in looking specifically at agencies employing less than 100 officers, Mazeika (2008) found that size was positively correlated with the adoption of crime mapping. Sever et al. (2008) came to similar conclusions in their study of the analysis and mapping capabilities of smaller police agencies in New Jersey.

Another interrelated consideration is that of the crime rate in the cities where they respondent agencies are located. The findings regarding the effect of crime rates on the adoption and use of crime analysis and other innovations are generally mixed. In his study of the diffusion of computers in police agencies at a time when the technology was not as widespread as it is currently, Mullen (1996) found that agencies located in cities with higher crime rates were more likely to be early adopters of the technology. In looking at the adoption of crime analysis specifically, Giblin (2006) discovered that FBI Index crime rates were not a factor. Conversely, the Police Foundation (2000) study reported that higher FBI Index crime rates were correlated with the adoption of crime mapping, but these findings should be interpreted with some caution due to the fact that the study used a small convenience sample comprised largely of COPS Office grant recipients. Sever et al. (2008) found that FBI Index offenses were positively correlated with time spent on crime analysis activities in their sample of New Jersey agencies. Finally, in the national study conducted by the COPS Office and the DOJ in 2000, it was

reported that crime rates were correlated with the use of higher quality analytic hardware and software, but only in agencies with less than 100 officers (O'Shea & Nicholls, 2002).

To account for the possible effects of agency size and crime rate, a unique rate variable was created to represent the amount of calls for service per officer each agency received in 2007. This was done for two primary reasons. First, to account for possible agency size differences based upon their geographic locations. Second, while the FBI's Index crime rates may have been a stronger, more desirable, control, inspection of the UCR data for 2007 revealed that many of the cities in the PERF database were not represented (i.e., crime rates were not reported to the FBI). Therefore, calls for service were substituted to allow the study to control for some variations in agency business. However, it should be noted that calls for service do not necessarily represent crimes committed or reported.

The variable was computed from responses to two specific questions on the patrol survey. The first question required the patrol commander to input the total number of sworn officers employed by their agency. The second question required the patrol commander to input the total number of citizen and officer generated calls for service received by their agency in 2007. The number of calls for service was then divided by the number of sworn officers to produce a rate of calls for service per officer for the year 2007. For example, an agency that received 50,000 citizen and officer generated calls for service in 2007 and employed 100 sworn officers would have a rate of approximately 500 calls per officer.

The second control variable in the study is the priority of Compstat in regard to its importance in the agency's operational activities. It was decided that Compstat priority



would be an appropriate control given its relationship to crime analysis and the fact that it supposedly promotes innovation and creative problem-solving, yet as discussed in the literature review, opinion is divided as to whether it actually helps or hinders such practices. Additionally, as one of the key independent variables is a measure of accountability and many police agencies have synthesized Compstat's accountability mechanism, it is necessary to distinguish between the two variables in the final multivariate analysis to better isolate the effect of the independent accountability measure on the level of innovation.

This variable was extracted from the same matrix question on the patrol survey that was used to compute the dependent innovation variable. Recall that the question required the patrol commander to rate, on a 5-point Likert scale, the priority of eleven different police actions. The patrol commander was instructed as follows, "Using the following scale, please rate the following components with regard to their importance to your agency's operational activities. Please reserve a "5" (very high priority) to those activities considered to be vital to your operations." Note that although Compstat was one of the eleven police actions in the matrix question used to create the dependent variable, it was excluded from that index because, although innovative, there is no empirical support for Compstat's effectiveness.

Finally, the third control variable is the presence of a primary crime analyst in the police agency. This is key, as, according to Santos (2013), a number of agencies do not employ full time crime analysts, and such responsibilities are often delegated to another employee (e.g., a secretary or administrative assistant) to be completed as a secondary task. Therefore, one might reasonably conclude that more innovative agencies would

have a dedicated full time analyst. Thus, the presence of a primary crime analyst is an appropriate control. This concept was operationalized as a dummy variable (“0” for a primary analyst; “1” for no analyst) via a single question on the analyst survey that required the respondent to indicate if their agency had a full time employee whose primary responsibility was conducting crime analysis.

### **Analytic Strategy**

To briefly reiterate, the dependent (Y) variable in all analyses is the use of innovative policing strategies. There are three independent (X) variables that will first be tested separately, each with the dependent variable, then together with the control variables in a multivariate analysis. The independent variables are commitment to crime analysis, the integration of crime analysis within police agencies’ operations, and the use of accountability mechanisms. Now that each variable has been operationalized through items on the patrol and analyst survey instruments created by PERF, specific analytic strategies can be proposed to address the research questions posed at the end of Chapter II. Therefore, the purpose of this section is to restate the research questions, derive testable hypotheses, and discuss the statistical analysis techniques to be used to answer each question. There are two types of statistical analyses that will be used in this thesis, bivariate correlational analysis and multiple regression. The next section provides a brief discourse on each method.

In their text, *Statistics in Criminal Justice*, David Weisburd and Chester Britt (2007) discuss several types of bivariate correlational analysis. Bivariate correlational analysis is a statistical technique often used in the social sciences to identify and describe the linear relationship shared by two interval or ratio variables (Weisburd & Britt, 2007).

Linear relationships are either positive or negative and if two variables share a positive linear relationship, increase in one variable will equate to increase in the other variable; conversely, if a negative relationship exists, increase in one variable will equate to decrease in the other variable (Weisburd & Britt, 2007). Finally, if the two variables do not share a linear relationship in either direction, the relationship is deemed spurious (Weisburd & Britt, 2007). Despite the knowledge that can be gleaned through bivariate correlational analysis, Weisburd and Britt (2007) caution that correlation does not equal causation (i.e., the tests cannot pinpoint precise cause and effect relationships).

In their discussion of bivariate correlational analysis, Weisburd and Britt (2007) highlight two of the most commonly used tests in criminal justice research, the Pearson correlation coefficient and Spearman's rank-order coefficient. The Spearman rank-order coefficient is typically used for identifying correlations in ordinal data that can be ranked (Weisburd & Britt, 2007). As the data used in this study are interval and ratio level, the Pearson correlation coefficient is the most appropriate test to use (Weisburd & Britt, 2007).

Once a linear relationship between two variables has been established, it is possible to use a simple linear regression equation to predict the amount of change that will occur in one variable as the other variable increases or decreases (Weisburd & Britt, 2007).

As Weisburd and Britt (2007) explain:

By making only a slight change to the equation for Pearson's correlation coefficient, we can construct the regression coefficient  $b$ —a statistic that estimates how much one variable influences another...in developing this measure

we again make a very important assumption about the relationship between the variables examined. We assume that the independent variable (X) influences or predicts the dependent variable (Y). The regression coefficient  $b$  asks how much impact one variable (the independent variable) has on another (the dependent variable). It answers this question not in standardized units, but in the specific units of the variables examined (p. 422).

This simple linear regression equation described by Weisburd and Britt (2007) is useful for predicting change in a dependent variable (Y) upon the introduction of a single independent variable (X). However, multiple regression is a more robust statistical procedure that attempts to predict change in the dependent variable based on the unique contributions of multiple independent variables (Chatterjee & Simonoff, 2013; Weisburd & Britt, 2007). According to Chatterjee and Simonoff (2013), and Weisburd and Britt (2007), in order to achieve accurate predictive power, it is necessary for the researcher to construct a multiple regression model that contains only the key variables hypothesized to affect change in the dependent variable. Once a model is constructed, statistical tests can determine how well the model fits and explains variation observed in the dependent variable, as well as identify the unique contribution of each independent variable to the observed change (Chatterjee & Simonoff, 2013; Weisburd & Britt, 2007).

**Research Question 1: What is the relationship between police agencies' stated commitment to crime analysis and the use of innovative policing strategies?**

As this question pertains to the relationship between two concepts, the stated commitment to crime analysis and the use of innovative policing strategies, a bivariate correlational analysis is appropriate since commitment (X) and the innovation index (Y)

are both continuous interval variables. Before performing the test, it is imperative to develop a testable hypothesis for the research question. Based on literature that suggests there should be a relationship between crime analysis and the use of innovative policing strategies (e.g., Santos, 2014), the hypothesis for research question one is that a positive relationship exists between stated commitment to crime analysis and the use of innovative policing strategies.

**Research Question 2: What is the relationship between the integration of crime analysis within police agencies' operations and the use of innovative policing strategies?**

As this question pertains to the relationship between two concepts, the integration of crime analysis within police agencies' operations and the use of innovative policing strategies, a bivariate correlational analysis is appropriate since the integration index (X) is a continuous ratio variable and the innovation index (Y) is a continuous interval variable. Before performing the test, it is imperative to develop a testable hypothesis for the research question. Santos and Taylor (2014), the original developers of the integration measure, used data derived from the same survey to examine the integration of crime analysis within patrol operations. Their findings suggested that there was low integration of analytical products in patrol operations (Santos & Taylor, 2014). Even though they did not look specifically at integration and the use of innovative policing strategies, the fact that they found low levels of analysis integration within patrol suggests that a positive relationship does exist. In addition, as Santos (2014) suggests there should be a relationship between crime analysis and the use of innovative policing strategies, the hypothesis for research question two is that a positive relationship exists between the

integration of crime analysis within police agencies' operations and the use of innovative policing strategies.

**Research Question 3: What is the relationship between police agencies' use of accountability mechanisms and the use of innovative policing strategies?**

As is the case with the first two research questions, this third question also pertains to the relationship between two concepts, police agencies' use of accountability mechanisms and the use of innovative policing strategies. Again, a bivariate correlational analysis is appropriate since the accountability index (X) and the innovation index (Y) are both continuous interval variables.

Hypothetically, a pure Compstat model should promote the use of innovative problem solving and tactics (PERF, 2013; Silverman, 2006). Compstat itself has even been heralded as a major innovation in policing (Kelling & Sousa, 2001; Silverman, 2006). However, empirical research has shown that there is a disconnect between Compstat ideologies and the realities of fieldwork in that many agencies adopted certain components of the Compstat model, yet continued to rely upon standard model policing tactics to resolve crime and disorder problems (Dabney, 2010; Weisburd et al., 2003; Willis et al, 2003; Willis et al., 2010). In following the findings of empirical research, the hypothesis for research question three is that a negative relationship exists between the use of accountability and the use of innovative policing strategies.

**Research Question 4: How are the commitment to crime analysis, the integration of crime analysis within agency operations, and the use of accountability mechanisms predictive of police agencies' use of innovative policing strategies?**

As this question is examining the ability to predict change in the dependent variable by the inclusion of several independent variables, the most appropriate statistical test is multiple regression analysis. In this instance, a multiple regression model will be utilized to determine how well the independent variables of commitment to crime analysis, integration of crime analysis within agency operations, and the use of accountability mechanisms predict the use of innovative policing strategies. Additionally, the control variables of calls for service per officer in 2007, priority of Compstat, and the presence of a primary crime analyst will be considered as well.

In keeping with the direction of hypotheses derived from the earlier research questions, the following hypotheses have been devised.

Hypothesis 1: Police agencies' stated commitment to crime analysis is predictive of the use of innovative policing strategies.

Hypothesis 2: The integration of crime analysis within police agencies' operations is predictive of the use of innovative policing strategies.

Hypothesis 3: Police agencies' use of accountability mechanisms is not predictive of the use of innovative policing strategies.

### **Summary**

The purpose of this chapter was to first explain the goals of the original PERF research project that led to this study. While the project's original goal was to gain an understanding of the use of crime analysis products by patrol (Taylor & Boba, 2011), there were a number of questions on the national survey that could be utilized to operationalize the concepts under examination in this research. For instance, questions pertaining to the priority of various police actions became the basis for a dependent

variable representing the level of agency innovation. Other questions pertaining to agency commitment to crime analysis, use of analytical products by personnel within the patrol division, and reliance upon analysis-driven accountability mechanisms were also operationalized in to variables. Additionally, three control variables were operationalized via data in the survey. The operationalization of these concepts in to variables permits proper hypothesis tests to be conducted to answer the research questions. The last section of the chapter proposed a specific analytic strategy for addressing each research question. The results of the data analysis are explained in detail in Chapter IV.



## Chapter IV: Data Analysis Results

### **Introduction**

This chapter describes and explains the results of the statistical analyses performed to address the study's four research questions. First, the descriptive statistics for the dependent variable, the innovation measure, are presented. Additionally, descriptive statistics are provided for the three key independent variables — the commitment variable, the integration measure, and the accountability measure — and the three control variables — calls for service per officer in 2007, Compstat priority, and the presence of a primary crime analyst.

Secondly, the chapter includes the results of the bivariate Pearson correlation coefficient tests that were conducted to answer the first three research questions regarding the relationships among agency commitment to crime analysis, integration of crime analysis within operations, accountability mechanisms, and innovation. The third section details the more complex multivariate analysis. It explains the results of a multiple regression analysis in which the dependent innovation variable was regressed against the independent variables of commitment, integration, and accountability, as well as three controls. Finally, the chapter ends with a summary of all the results as they pertain to the level of innovation in police agencies.

### **Descriptive Statistics**

The measures of central tendency, or summary statistics, highlight specific attributes of a data distribution to permit easier simultaneous cross comparisons among

multiple datasets, as well as to indicate what the most average and most frequently reported cases in the dataset are (Bachman & Schutt, 2012). Table 1 provides the minimum, maximum, range, mean, median, and standard deviation for all of the quantitative variables used in this study which include the innovation measure, the commitment variable, the integration measure, the accountability measure, the Compstat priority, and the calls for service per officer in 2007.

Table 1.

*Measures of Central Tendency for Dependent, Independent, and Control Variables*

Variable	Minimum	Maximum	Range	Mean	Median	Standard Deviation
Innovation	11	35	24	25.07	25	5.04
Commitment	2	5	3	4.06	4	.84
Integration	0	33	33	15.71	15	9.97
Accountability	5	25	20	16.05	16	5.06
Compstat	1	5	4	2.76	3	1.42
CFS per officer	6.10	4,411.76	4,405.66	483.58	431.20	372.63

N=361

First, for the agencies in the study the innovation measure, which is the dependent variable, resulted in a minimum of 11, a maximum of 35, with a range of 24. This is interesting in light of the fact that the innovation scoring system permitted a range between 7 and 35, yet no agency scored lower than 11. In addition, the mean (25.07) and the median (25.00) are very close and the standard deviation (5.04) is less than one third of the mean both of which indicate the distribution is not skewed and the values are clustered around the mean, respectively. In fact, 68 percent of the agencies reported an innovation score of between 20.03 and 30.11. Thus, overall, agencies report innovation relatively consistently and if the overall score is converted back to the relative priority scale, the average becomes 3.58 (25.07 divided by 7, the number of variables in the index) which falls between “somewhat of a priority” and “high priority.”

The first independent variable is the commitment measure with a minimum of 2, a maximum of 5, and a range of 3. Although this is a five point scale, none of the agencies reported that crime analysis “runs counter” to achieving agency goals and objectives (value of 1). The median (4) and the mean (4.06) are almost identical. At .84, the standard deviation is less than one third of the mean (1.02) showing that the data are not skewed and the values are clustered around the mean. Assessment of the spread reveals that 68 percent of the agencies fall between 3.22 and 4.9. This would suggest that, in terms of the scale, on average among the agencies in the dataset, the crime analysis function is neutral to fairly well aligned with agency goals and objectives, and neither helps not hurts or is useful (but not critical) to the agency achieving its goals and objectives.

The second independent variable is the integration measure with a minimum of 0, a maximum of 33, and a range of 33. The fact that the range covers all possible values suggests at least one agency in the sample reported no integration of crime analysis within agency operations and conversely at least one agency reported total integration. The median is 15 and the mean is 15.71. Again, these are nearly identical numbers suggesting the data are highly concentrated around the mean. The standard deviation is 9.97. The data are skewed because the standard deviation is more than one third of the mean (5.24). Assessment of the spread reveals that 68 percent of the data fall between 5.74 and 25.68. This wide range suggests a great deal of variance in the data, thus a large amount of variation in the level of integration of crime analysis products within patrol operations.

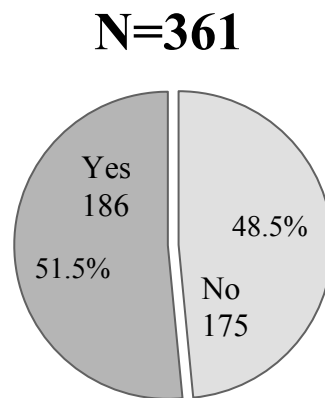
The third independent variable, the accountability measure, resulted in a minimum of 5, a maximum of 25, with a range of 20. The median (16) and mean (16.05) are practically identical, and the standard deviation (5.06) is less than one third of the mean (5.35) which suggests that the data are not skewed. The majority of the values are tightly clustered around the mean in this dataset. Assessment of the spread reveals that 68 percent of the data fall between 10.99 and 21.11. This range suggests minimal variance in the data. If the overall score is converted back to the relative accountability scale, the average becomes 3.21 (16.05 divided by 5, the number of variables in the index) which falls between “somewhat of a priority” and “high priority.”

The first control variable measures the priority the agency places on Compstat and has a minimum of 1 and a maximum of 5, with a range of 4. The median is 3 and the mean is 2.76 with a standard deviation of 1.42. The data are skewed because the standard deviation is larger than one third of the mean (0.92) Assessment of the spread reveals that 68 percent of the data fall between 1.34 and 4.18. This wide range suggests a great deal variance in the data. The variance is further demonstrated when considering these values in terms of the original scale. In that case, Compstat ranges from “Not a Priority at all” to a “high priority.”

The second control variable is the rate of calls for service per officer in 2007 which resulted in a minimum of 6.10, a maximum of 4,411.76 with a range of 4,405.66. The median is 431.20 and the mean is 483.58 with a standard deviation of 372.63. The data are skewed because the standard deviation is more than one third of the mean (161.19). Assessment of the spread reveals that 68 percent of the data fall between 110.95 and 856.21. This wide range suggests a great deal variance in the data. Despite the very

obvious variation in the data, this control is realistic in considering the wide array of agency sizes in existence.

The final control variable was the presence of a primary crime analyst. Figure 4 illustrates that just over half (51.5 percent) of the agencies did have a primary crime analyst.



*Figure 4.* Frequencies and percentages of police agencies with and without a primary crime analyst on staff.

### **Bivariate Pearson Correlation Coefficient Analysis**

The purpose of this section is to explain the results of the bivariate analysis conducted to test relationships between variables in three of the proposed research questions and corresponding hypotheses. The tests will indicate both the direction (i.e., positive, negative, or spurious) and strength of the relationships between the variables in each question. In their text on statistical methods for criminal justice research, Weisburd and Brit (2007) explain that the outcome of a correlation analysis is a coefficient, or  $r$  value, between  $-1$  and  $+1$ . They contend that a negative  $r$  value denotes a negative relationship, and a positive  $r$  value denotes a positive relationship. Additionally, they point out that a  $0$  denotes no relationship between the variables in question (Weisburd &

Britt, 2007). According to Salkind (2012), the strength of the coefficient output may be interpreted as follows:

- Coefficients between +/- .8 to 1.0: very strong relationship.
- Coefficients between +/- .6 to .8: strong relationship.
- Coefficients between +/- .4 to .6: moderate relationship.
- Coefficients between +/- .2 to .4: weak relationship.
- Coefficients between +/- .0 to .2: very weak relationship.

### **Research Question 1 Results**

It was hypothesized that a positive relationship existed between the stated commitment to crime analysis and the use of innovative policing strategies. The Pearson correlation coefficient test between the variables of commitment to crime analysis and innovation resulted in  $r(361) = .655, p < .05$ . Thus, the hypothesis was supported, and the analysis shows that a strong positive relationship exists between police agencies' stated commitment to crime analysis and the use of innovative policing strategies. This finding suggests that as agencies report crime analysis as more important in achieving their goals they also report placing a higher priority on innovative policing strategies.

### **Research Question 2 Results**

It was hypothesized that a positive relationship existed between the integration of crime analysis within police agencies' operations and the use of innovative policing strategies. The Pearson correlation coefficient test between the variables of integration of crime analysis within police agencies' operations and innovation resulted in  $r(361) = .439, p < .05$ . Thus, the hypothesis was supported, and the analysis shows that a moderate positive relationship exists between the integration of crime analysis within police

agencies' operations and the use of innovative policing strategies. This finding suggests that as the level of integration of crime analysis within police agencies' operations increases, they also report placing a higher priority on innovative policing strategies.

### **Research Question 3 Results**

It was hypothesized that a negative relationship existed between police agencies' use of accountability mechanisms and the use of innovative policing strategies. The Pearson correlation coefficient test between the variables of police agencies' use of accountability mechanisms and innovation resulted in  $r(361) = .681, p < .05$ . Although the analysis shows a strong significant relationship exists between police agencies' use of accountability mechanisms and the use of innovative policing strategies, the hypothesis was not supported because the direction of the relationship was opposite (positive) than what was hypothesized. This finding suggests that as the use of accountability mechanisms within an agency increases, they also report placing a higher priority on innovative policing strategies.

### **Multivariate Regression Analysis**

In this analysis, the dependent innovation variable was regressed against the crime analysis commitment variable, integration variable, and the accountability variable, in addition to three control variables: Compstat priority, calls for service per officer in 2007, and the presence of a primary crime analyst. The goal of this analysis is to ascertain how well the independent variables predict the level of innovation, while controlling for Compstat prioritization, agency busyness, and the presence of a primary crime analyst.

## Overview of Multiple Regression Components

Once a linear relationship between two single variables has been established, linear regression can be used to predict the amount of change that will be observed in the dependent variable upon increases or decreases in the frequency of the independent (or predictor) variable (Weisburd & Britt, 2007). However, as Weisburd and Britt (2007) wisely note, in the real world, it is unlikely that relationships are this simplistic (i.e., that a single independent variable can account for all observed change in a dependent variable). Thus, in the social sciences, multiple regression is a more preferred method of statistical analysis as it allows the researcher to assess the influence of numerous independent variables on a single dependent variable at one time (Weisburd & Britt, 2007). Multivariate analysis permits the researcher to introduce multiple predictor variables into an equation, observe the resulting changes in the dependent variable, and accurately record the unique contribution of each predictor to those changes while controlling for extraneous factors (Weisburd & Britt, 2007). Weisburd and Britt (2007) use the term “correctly specified regression model” (p. 463) to refer to a model that is capable of accurately predicting change in a dependent variable based upon the inclusion of relevant independent variables. The equation for the multivariate regression model prescribed by Weisburd and Britt (2007) is as follows:

$$Y = \beta + \beta_1 X_1 + \beta_2 X_2 + \epsilon$$

In the multiple regression equation, Y represents the dependent variable, X1 and X2 represent the independent variables,  $\beta$ ,  $\beta_1$  and  $\beta_2$  represent the coefficients of the independent variables, and  $\epsilon$  represents the difference between the predicted and observed values (Weisburd & Britt, 2007). Given the equation, a model can now be



constructed to predict the level of innovation based upon the key independent and control variables in the study. There are many different methods for building a multiple regression model (e.g., Chatterjee & Simonoff, 2013; Seber & Lee, 2003), though none are ideal for all circumstances. As Weisburd and Britt (2007) note in their discussion of the correctly specified regression model, the selection process is critical because the model's predictive or explanatory power is affected by the interplay of the variables selected for inclusion. As each independent variable adds its own unique contribution to the prediction, addition or removal of a key variable could positively or negatively impact the model's predictive or explanatory power (Brace, Kemp, & Snelgar, 2012; Chatterjee & Simonoff, 2013; Hinton, McMurray, & Brownlow, 2014; Seber & Lee, 2003; Weisburd & Britt, 2007).

In their respective texts on statistical methods in conjunction with SPSS functions, Brace et al. (2012) and Hinton et al. (2014) describe the preferred software-based technique for regression modeling, the stepwise method. Stepwise methods can be automated, and assess each variable individually and together with combinations of other variables in order to arrive at a model with the strongest predictive power (Brace et al., 2012; Hinton et al., 2014). The authors outline three primary stepwise methods, backward elimination, forward selection, and stepwise (Brace et al., 2012; Hinton et al., 2014). Each method is briefly discussed below.

Backward elimination is when all predictor variables are added to the model at once. Then, each variable is individually assessed as to its effect on the variance of the model as a whole. The variable that has the least effect is removed first, and the remaining variables are reassessed. Again, the weakest variable is removed. This process

is repeated until the only variables that remain are those that provide the highest predictive and explanatory power (Brace et al., 2012; Hinton et al., 2014).

Forward selection begins without any predictor variables in the model. Then, one at a time, variables are assessed and added to the model beginning with the variable that has the highest correlation with the dependent variable. Subsequent variables are added based on their partial correlation to the variables already in the model. The process is repeated until the model has achieved optimum predictive and explanatory power. The stepwise method is a combination of the above two methods in which predictor variables are added and/or subtracted from the model based upon their fit with other variables (Brace et al., 2012; Hinton et al., 2014).

For the purposes of this analysis, backward elimination was selected. Backward elimination has an advantage in that the model begins with all possible variables and removes those that do not contribute to the predictive and explanatory power of the model as a whole (Brace et al., 2012; Hinton et al., 2014). Seber and Lee (2003) caution that the forward selection method may result in the creation of a weaker model as the process adds one variable at a time, and stops when the model has achieved the highest power, though not necessarily before all of the predictors have been assessed together.

One additional concern in multiple regression analysis is the problem of multicollinearity. Weisburd and Britt (2007) explain that multicollinearity occurs when certain independent variables are so closely correlated to one another that their combined inclusion in the model could amplify or distort the effect on the dependent variable and render the model unstable. Therefore, multicollinearity should be avoided at all costs (Weisburd & Britt, 2007).

As Hinton et al. (2014) explain, multicollinearity can be diagnosed through inspection of the Pearson correlation coefficients once the multiple regression analysis has been run. Generally, correlations of .8 or higher are considered problematic (Hinton et al., 2014). One additional measure to detect multicollinearity is through inspection of the variance inflation factor (VIF) and Tolerance statistics (Brace et al., 2012). In their discussion of multicollinearity detection in SPSS, Brace et al. (2012) explain that the VIF statistic indicates the strength of the linear relationship between a predictor variable and the dependent variable. They assert that if the strength of any of the relationships exceeds 10, or if the average of all the VIF statistics is substantially larger than 1, the possibility of a multicollinearity issue exists (Brace et al., 2012). Brace et al. (2012) define tolerance as the reciprocal of the VIF statistic. They emphasize that values below .1 are problematic, and values below .2 could potentially be problematic (Brace et al., 2012).

In terms of interpreting the regression output itself, Brace et al. (2012) and Hinton et al. (2014) emphasize inspection of the multiple correlation coefficient and the coefficient of determination; both are measures of fit that permit an assessment of how well the model, with the included predictor variables, is able to predict change in the dependent variable. Second, the analysis of variance (ANOVA) examines the variability that exists in the dependent variable by contrasting the amount of variation that can be explained by the regression model to the amount of variation that remains unexplained (termed the residual). The ANOVA test permits an assessment of how well the model is able to predict change in the dependent variable contrasted to the amount of change that can be explained by chance (Brace et al., 2012; Hinton et al., 2014). Finally, assessment of the unstandardized regression coefficients and their accompanying weights will

indicate how each variable, individually and together, contributed to the prediction (Brace et al., 2012; Hinton et al., 2014). The following terms and definitions, taken from Brace et al.'s (2012) and Hinton et al.'s (2014) respective discussions, are relevant to understanding the concepts illustrated in the model.

- R – the multiple correlation coefficient. R is the Pearson correlation coefficient between the actual values of the dependent variable and the new values predicted by the model. R is useful to assess the overall fit and accuracy of the model in predicting change in the dependent variable. R values range from 0 to 1. The closer the R value is to 1, the higher the predictive power of the model. Conversely, values closer to 0 indicate a poor fit (Brace et al., 2012; Hinton et al., 2014).
- R-square – the coefficient of determination. R-square is a measure of fit that indicates the amount of variance in the sample dependent variable that can be explained by the independent variables included in the model. The value can be multiplied by 100 to derive a percentage (e.g. .81 multiplied by 100 equals 81 percent). The percentage indicates the amount of variance in the sample that is explained by the model (Brace et al., 2012; Hinton et al., 2014).
- Adjusted R square – an estimate of fit that indicates how much of the variance the model could be expected to explain in the population at large, as opposed to just the sample. The purpose of this estimate is to account for bias that could exist in the R-square measure, thus, the value is typically lower than R-square. Like R-square, the value can be multiplied by 100 to derive a

percentage. The percentage indicates the amount of variance in the population that is explained by the model (Brace et al., 2012; Hinton et al., 2014).

- F ratio – an estimate of fit, resulting from the ANOVA test, which contrasts the amount of variance in the dependent variable that is explained by the model to the amount of variance that remains unexplained. The F ratio is accompanied by a significance value so the statistical significance of the model, as a whole, can be assessed (Brace et al., 2012; Hinton et al., 2014).
- B – the unstandardized regression coefficient. B indicates the amount of change that can be expected to occur in the dependent variable when the independent variable changes by 1 increment and all other variables in the model are held constant. Negative B values indicate a negative relationship. Conversely, positive B values indicate a positive relationship (Brace et al., 2012; Hinton et al., 2014).
- Standard Error – an estimate of the variability that exists in the coefficient (Brace et al., 2012; Hinton et al., 2014).
- Beta – the standardized regression coefficient. Beta, or Beta weight, indicates the amount of change that can be expected to occur in the dependent variable, in terms of the standard deviation, when the standard deviation of the independent variable increases by 1 and all other variables in the model are held constant. Negative B values indicate a negative relationship. Conversely, positive B values indicate a positive relationship. Due to the fact that the measure of each variable is standardized, evaluation of the Beta weights

across variables will indicate how each variable uniquely contributed to the predictive power of the model (Brace et al., 2012; Hinton et al., 2014).

- T-value – the results of t-tests performed to determine if the Beta weights were significantly different from 0 (Brace et al., 2012; Hinton et al., 2014). The t-test results are accompanied by their corresponding statistical significance, as reported in the “sig” column to the right of the T-column.

#### **Research Question 4 Results**

Three hypotheses were under examination in the fourth research question. First, it was hypothesized that police agencies’ stated commitment to crime analysis is predictive of the use of innovative policing strategies. Second, it was hypothesized that the integration of crime analysis within police agencies’ operations is predictive of the use of innovative policing strategies. Finally, it was hypothesized that police agencies’ use of accountability mechanisms is not predictive of the use of innovative policing strategies.

For the purposes of detecting possible multicollinearity issues, Table 2 contains the Pearson correlation coefficients for all of the variables in the dataset. Note that none of the coefficients are larger than .8. In fact, the largest correlation is between the innovation and accountability variables at .681. This relationship was the subject of the third research question answered earlier.

Table 2.

*Bivariate Pearson Correlations Among All Dependent, Independent, and Control Variables*

Variables	Innovation	Accountability	Commitment	Compstat	Crime analyst	CFS per officer	Integration
Innovation	----	.681	.655	.589	-.427	.051	.439
Accountability	.681	----	.498	.570	-.295	.009	.400
Commitment	.655	.498	----	.516	-.426	-.037	.428
Compstat	.589	.570	.516	---	-.394	-.089	.277
Crime analyst	-.427	-.295	-.426	-.394	---	.061	-.414
CFS per officer	.051	.009	-.037	-.089	.061	---	-.028
Integration	.439	.400	.428	.277	-.414	-.028	---

N=361

Additional diagnostic tests were performed to detect multicollinearity. Table 3 displays the multicollinearity statistics for the VIF and Tolerance. In terms of the VIF, none of the VIF values exceed 10. Also noteworthy, the mean of all VIF values is 1.50, which is also not problematic. In evaluating tolerance, the lowest predictor variable is Compstat prioritization at .568 which is well above the problematic range below .2. Thus, with multicollinearity ruled out, the multiple regression analysis was performed and the results are displayed and discussed as follows.

Table 3.

*Tolerance and VIF Statistics Among All Dependent, Independent, and Control Variables*

Variables	Tolerance	VIF
(Constant)		
Accountability	.581	1.722
Commitment	.595	1.680
Compstat	.568	1.759
Crime analyst	.716	1.397
CFS per officer	.985	1.015
Integration	.709	1.411

N=361

The multiple regression analysis was performed in SPSS. The dependent variable, the use of innovative policing strategies (innovation), was loaded, as were the three key independent variables, commitment to crime analysis (commitment), integration of crime

analysis within agency operations (integration), and the use of accountability mechanisms (accountability). In addition, the three control variables were also loaded: Compstat priority (Compstat), calls for service per officer in 2007 (CFS per officer), and the presence of a primary crime analyst (crime analyst). All totaled, 6 predictor variables and 1 dependent variable were entered into the model. Interestingly, when the analysis was run, the backward elimination method did not remove any variables, thus only one model was created. Therefore, every variable was necessary to effectively predict change in the dependent variable. Table 4 displays the summary for the single model that was created as a result of the backward elimination method in SPSS.

Table 4.

*Final Multiple Regression Model for Predicting the Level of Police Agency Innovation.*

Variables	B	SE B	Beta	t-value	Sig
(Constant)	9.087	1.015		8.951	.000
Accountability	.371	.042	.373***	8.823	.000
Commitment	1.911	.252	.317***	7.596	.000
Compstat	.577	.151	.163***	3.822	.000
Crime analyst	-.929	.383	-.092**	-2.424	.016
CFS per officer	.001	.000	.081**	2.501	.013
Integration	.037	.019	.073	1.918	.056
R	.796				
R <sup>2</sup>	.633				
Adj. R <sup>2</sup>	.627				
F	101.807				
Sig.	.000				

N = 361, \* p ≤ .05, \*\* p ≤ .01, \*\*\* p ≤ .001

In evaluating the results of the multiple regression analysis displayed in Table 4, it is apparent that the model had an approximate R value of .796. According to Brace et al. (2012), and Hinton et al. (2014), the closer this value is to 1.00, the higher the predictive and explanatory power of the model. Thus, the model is a fairly robust predictor. The predictive power of the model is further evidenced by the results of the ANOVA test and the corresponding F ratio. In this instance, the F ratio is approximately 101.807 and is



statistically significant at the .000 level. This indicates that the model's prediction of changes to the dependent variable was statistically significant and the predictions themselves were more accurate than what would have been expected by chance.

Next, inspection of the R-square and adjusted R-square values indicates the amount of variation in the dependent variable that is explained by the independent variables included in the model. The model accounts for 63.3 percent of the variance in the sample. Evaluation of the adjusted R square value reveals that the model could be expected to account for 62.7 percent of the variance in the population at large. Weisburd and Britt (2007) contend that, in criminal justice research, R-square values rarely exceed 0.40, or 40 percent. Therefore, the model is a very robust predictor.

The regression coefficients indicate how each independent variable individually contributed to the prediction and which were statistically significant in predicting change in the dependent variable. Additionally, it is possible to assess the precise amount of change expected in the dependent variable when each independent variable increases by one increment. These variables are discussed in order of their significance.

In terms of its contribution to the prediction, the independent variable of accountability contributed the most in the model. It has an unstandardized B coefficient of .371 meaning that with all other variables held constant, a 1 increment increase in the measure of accountability, which ranges from 5-25 on an interval scale, equates to a .371 unit increase on the innovation measure, which ranges from 7-35. The independent commitment variable had an unstandardized B coefficient of 1.911, so holding all other variables constant, a 1 increment increase in the measure of commitment, which ranges from 1-5 on an interval scale, equates to a 1.911 unit increase on the innovation measure,

which ranges from 7-35. The control variable of Compstat prioritization resulted in an unstandardized B coefficient of .577, which reveals that, with all other variables held constant, a 1 increment increase in the measure of Compstat prioritization, which ranges from 1-5 on an interval scale, equates to a .577 unit increase on the innovation measure, which ranges from 7-35.

In terms of its contribution to the model, the control variable of the presence of a primary crime analyst merits special consideration, as it was categorical data originally, thus was coded as a dummy variable for analysis. Recall that agencies with a primary crime analyst were coded as “0” and agencies without a primary crime analyst were coded as “1,” and agencies When the regression was run, these two variables were compared against each other; the outcome of the analysis pertains to the variable with the majority cases that was coded as 0 (i.e., 186 agencies with a primary crimes analyst to 175 agencies without a primary crime analyst). Therefore, compared to agencies that do employ a primary crime analyst, agencies that do not employ a primary crime analyst have an unstandardized B coefficient of -.929. This means that when all other variables are held constant, the lack of a primary crime analyst equates to a .929 unit decrease on the innovation measure, which ranges from 7-35.

In terms of the control variable of calls for service per officer in 2007, inspection of the unstandardized B coefficient reveals that, with all other variables held constant, a 1 increment increase in the measure of calls for service per officer, which ranges from 6.10-4,411.76 on an interval scale, equates to a .001 unit increase on the innovation measure, which ranges from 7-35. Lastly, the independent variable of integration contributed the least to the model. Integration resulted in an unstandardized B coefficient

of .037. Thus, holding all other variables constant, a 1 increment increase in the measure of integration, which ranges from 0-33 on an interval scale, equates to a .037 unit increase on the innovation measure, which ranges from 7-35.

Finally, assessment of the Beta weights is crucial, as it indicates which of the variables are the most important in terms of predicting the level of innovation, and it will either support or discredit the specific hypotheses (Weisburd & Britt, 2007) derived in Chapter III. In assessing the Beta weights, the independent variable of accountability is the largest contributor to the model and thus the strongest predictor of the use of innovative policing strategies, (among all six possible predictors) with a Beta weight of .373, and a t-value of 8.823 that was statistically significant at the .000 level. The independent variable of commitment contributed the second most to the model with a standardized Beta coefficient of .317, and a t-value of 7.596 that was statistically significant at the .000 level. In terms of its contribution to the model, the control variable of Compstat prioritization contributed the third most with a standardized Beta coefficient of .163, and a t-value of 3.822 that was also statistically significant at the .000 level. The dummy control variable of a primary crime analyst contributed the fourth most with a standardized Beta coefficient of .092, t-value of 2.424, and was statistically significant at the .01 level. The control variable of calls for service per officer in 2007 contributed the fifth most with a standardized Beta coefficient of .081, t-value of 2.501, and was statistically significant at the .01 level. Lastly, the independent integration variable contributed the least out of the six possible predictors with a standardized B coefficient of .073, t-value of 1.918, and it was not statistically significant at the .05 level.

Turning to the specific hypotheses, the first hypothesis was that police agencies' stated commitment to crime analysis is predictive of the use of innovative policing strategies. In terms of its predictive power, commitment contributed the second most to the model with a Beta weight of .317. Further, the results of the T-test conducted to show if the Beta weight was significantly different from 0 were statistically significant at the .000 level. Thus, the hypothesis was supported and it can be concluded that police agencies' stated commitment to crime analysis is predictive of the use of innovative policing strategies.

The second hypothesis was that integration of crime analysis within police agencies' operations is predictive of the use of innovative policing strategies. In terms of its predictive power, integration contributed the least to the model with a Beta weight of .073. The results of the T-test reveal that its difference from 0 was not statistically significant. Although not statistically significant, the variable was not excluded by the stepwise backward elimination method so it can be concluded that the inclusion of the integration variable was necessary in that it affected the predictive power of the model as a whole in a positive way otherwise, it would have been eliminated from the final model. Thus, the hypothesis was supported, and it can be concluded that the integration of crime analysis within police agencies' operations is predictive of the use of innovative policing strategies.

The final hypothesis was that police agencies' use of accountability mechanisms was not predictive of the use of innovative policing strategies. In the model, accountability contributed the most to the predictive power of the model with a Beta weight of .373, and its contribution was statistically significant at the .000 level.

Therefore, the hypothesis was not supported, because in terms of the variables entered in to the model, accountability contributed the most and is the strongest predictor of the use of innovative policing strategies.

In summary, the results of the multiple regression analysis indicate that, all variables were necessary to predict change in the level of innovation, or the use of innovative policing strategies, and the model was very robust according to social science parameters (Weisburd & Britt, 2007). More specifically, accountability and stated commitment to crime analysis were the most important predictors of the use of innovative policing strategies, contrasted to the next most significant predictor, Compstat prioritization. These findings supported the hypothesis that stated commitment to crime analysis is a predictor of the use of innovative policing strategies. Additionally, the hypothesis concerning the integration of crime analysis within police agencies' operations was also supported, even though its contribution to the model was not statistically significant, its inclusion was necessary to facilitate the prediction. Conversely, the findings did not support the hypothesis that the use of accountability mechanisms was not predictive of the use of innovative policing strategies. On the contrary, out of all the variables entered in to the model, accountability contributed the most to the predictive power.

### **Summary of Findings**

The first research question sought to understand the nature of the relationship between police agencies' commitment to crime analysis and the use of innovative policing strategies. Again, it should be noted that use was measured by way of a question about the relative priority the agency assigned to each innovative strategy. The results of

a bivariate correlational analysis supported the research hypothesis and revealed a strong, positive relationship. These findings suggest that the more committed an agency is to crime analysis, the higher their reported levels of innovation.

The second research question examined the relationship between the level of integration of crime analysis within police agencies' operations and the use of innovative policing strategies. The results of the bivariate correlational analysis supported the research hypothesis and did reveal a moderate, positive relationship. This finding is also important, as it suggests that integration of crime analysis within police agencies' operations does equate to more use of innovative tactics, although the connection here is weaker than stated commitment.

The third research question examined the relationship between police agencies' use of accountability mechanisms and the use of innovative policing strategies. The results of the bivariate correlational analysis did not support the research hypothesis. In fact, the results found the reverse. The use of accountability mechanisms and innovative policing strategies shared a strong positive relationship. This finding suggests that the use of accountability mechanisms to evaluate police performance and hold staff accountable for crime reduction and prevention are related to the use of innovative policing strategies. Interestingly, accountability would prove to have the strongest correlation out of all of the variables tested.

Finally, a multivariate analysis resulted in a single model with all of the predictor variables significant that was robust. The final model accounted for just over 60 percent of the variance in the sample, which is significant, as most models in criminal justice research rarely explain more than 40 percent of the variation in the dependent variable

(Weisburd & Britt, 2007). In terms of individual predictors, assessment of the Beta weights revealed that accountability was the most significant of the six predictors. This disproved an earlier hypothesis that the use of accountability mechanisms was not predictive of the use of innovative policing strategies. Additionally, the hypothesis regarding commitment as a predictor of innovation was supported, as commitment contributed the second most to the model's predictive power. Lastly, the hypothesis regarding the integration of crime analysis within agency operations being predictive of the use of innovative tactics was also supported even though its Beta weight did not reach the level of statistical significance, it was not dropped from the creation of the model, suggesting its inclusion was needed. Thus, the next chapter discusses these findings in more depth, their practical implications, as well as presents limitations and future research.

## Chapter V: Discussion and Conclusion

### **Discussion of the Findings**

This research examined the relationships between policing innovations (i.e., COP, POP, hot spots policing) and agency commitment to and integration of crime analysis within their operations. In addition, the study also investigated the relationship between agency use of accountability mechanisms and the use of innovative policing strategies. The data on which this research is based was unique for two key reasons. Foremost, the data were derived from the first large scale national survey regarding the use of crime analysis within police agency operations conducted in over a decade. Second, the survey method itself was unique in that two views of the same agency were collected, as this had never been done before, and it permitted assessment of each agency's analytical capabilities from two distinctly different vantage points, those of the analyst and of the patrol commander (Santos & Taylor, 2014; Taylor & Boba, 2011). This allowed an examination of several key issues pertaining to the co-implementation of crime analysis with innovative policing strategies as well as the use of crime analysis-driven accountability mechanisms.

The first focus of this study was the relationship between agency stated commitment to crime analysis and the use of innovative policing strategies. The results of the bivariate analysis showed that a strong positive relationship existed between commitment to crime analysis and the use of innovative policing strategies. In other words, when patrol commanders report crime analysis is critical to achieving their



agencies' goals, they also report a higher prioritization of innovative, and empirically supported strategies such as COP, POP, and hot spots policing. Thus, patrol commanders who see the benefit in crime analysis to achieving their agencies' ends also prioritize the use of innovative tactics in their operations. Conversely, since the direction of the relationship as reported by the test was positive, it suggests that patrol commanders, who report that crime analysis is not as important to achieving agency goals, are also likely to deprioritize the use of innovative policing strategies. This finding may provide support for crime analysis itself as a crucial innovation in the police toolkit of crime reduction and prevention strategies.

A second, yet inter-related, focus of the study was the relationship between the integration of crime analysis within agency operations and the use of innovative policing strategies. The results of the bivariate analysis showed a moderate positive relationship between integration and innovation. In other words, the more integrated crime analysis is within the agencies' operations, the higher priority the agency places on innovative strategies. Perhaps not surprisingly, however, the integration measure reached only the moderate level, which suggests that there was a difference between the commitment and integration variables in that the patrol commander respondents were more likely to say that their agency was committed to crime analysis, yet the realities of integration tell a different story in that the actual integration and use of analysis products in practice appeared to be somewhat low.

The finding of low integration contrasted to higher levels of commitment may suggest that not all agencies are taking advantage of the benefits afforded by crime analysis, or may be deploying the innovative tactics in a way that may not be the most

effective. Overall, this finding has different connotations. On one hand, it may suggest that patrol commanders see the benefits in prioritizing innovative policing, yet for reasons unknown, the tactics are simply not being utilized in practice. Conversely, it may suggest that patrol commanders are eager to report on paper that their agencies are innovative, even though they are not truly engaging in effective innovative policing. In either case, this finding illustrates the importance of devising questions to measure actual use, as opposed to perception of use, and might propose a direction for a future research.

A third focus of this study was on the relationship between the use of accountability mechanisms and the use of innovative policing strategies. The results of the bivariate analysis suggested that a strong positive relationship existed between the use of accountability mechanisms and innovative policing strategies. In other words, the more the agency uses accountability mechanisms the higher they prioritize innovative policing strategies. As noted earlier, there is some debate about whether Compstat-like programs with accountability mechanisms promote (Kelling & Sousa, 2001; Silverman, 2006), or hinder the use of innovative policing strategies (Dabney, 2010; Weisburd, et al., 2003; Weisburd et al., 2006; Willis et al., 2003; Willis et al., 2010). It seems that in these agencies, they go hand in hand and are not seen as not being compatible by those agencies that responded.

Lastly, the final, most comprehensive focus brings all these concepts together in a single analysis. The results of the multivariate model showed that all the characteristics were important with accountability and commitment being most significant in predicting the levels of innovation. These findings lend even more support to the previous conclusion regarding the strong positive relationship between the use of accountability

mechanisms and the use of innovative policing strategies because the relationship held in the multivariate model, even while controlling for other factors. These results are counter to prior findings which suggest that programs with accountability mechanisms, such as Compstat, inhibit innovation (Dabney, 2010; Weisburd, et al., 2003; Weisburd et al., 2006; Willis et al., 2003; Willis et al., 2010).

The multivariate analysis also lends further support to the first hypothesis regarding the relationship between stated commitment to crime analysis and the use of innovative policing strategies. Like accountability, stated commitment was shown to be a strong predictor of the level of innovation even while controlling for other factors. This is a new finding that prior research has heretofore not addressed. Both findings have direct implications for improving police practice.

### **Policy Implications**

The findings of this study suggest key policy implications for police practitioners interested in utilizing more innovative tactics in practice. First, it is apparent that police agencies should consider investment in a managerial model that utilizes some form of crime-analysis driven accountability mechanism. Given the elements that comprised the accountability measure used in this study, the adoption of such a model should include mechanisms that permit for a measure of work production and performance of personnel, as well a means to determine the effectiveness of the agency as a whole at reducing and preventing crime. Moreover, the accountability structure should permeate the entire chain of command with accountability mechanisms at all ranks including management and command staff, first-line supervisors, and line-level officers.

The simple recommendation then would be to invest in Compstat or a Compstat-like program. Yet, such a solution may prove too simplistic. Although Compstat-like programs do provide means for measuring personnel performance and evaluating agency effectiveness, the accountability mechanism is not applied evenly across the ranks; rather, it is solely focused on the geographic commander (Taylor & Boba, 2011). Focus group discussions led by PERF with various police personnel revealed that Compstat-programs may be inadequate due to this emphasis on only holding command staff accountable for crime reduction as well as the infrequency of the Compstat meetings during which accountability is actually enforced (Taylor & Boba, 2011). This contention is partially backed up by the findings of this study, which seem to suggest that accountability mechanisms at all ranks would prove more effective in promoting the prioritization of innovative tactics.

One possible solution to the problems of inadequate accountability coverage at all ranks would be investment in another police agency managerial model, specifically, Boba and Santos' (2011) stratified model. First devised as a means to institute problem-solving into police practice, the stratified model uses the existing framework inherent in police organizations to synthesize an accountability system and routinize data collection, analysis, and problem-solving across all levels and ranks (Boba & Santos, 2011). It best fits the recommendations of this study in that it provides means of measuring personnel performance and measuring agency effectiveness and staff at all ranks are held accountable for their actions in meetings that increase in frequency as the chain of command extends downward (Boba & Santos, 2011). Additionally, as the stratified model was originally designed with the intent of routinizing data collection as part of

standard practice to facilitate high quality crime analysis, it provides a further benefit of creating a framework that condones and supports the routine use of crime analysis, a facet which may smooth integration issues (Boba & Santos, 2011).

As agency commitment to crime analysis was determined to be an important correlate to the prioritization of innovative policing by this study, another recommendation may be the promotion of crime analysis as an agency priority. In order for this to occur, crime analysis needs to be seen as the new way of doing business, a concept that should be embraced by every member of the organization from the chief to the line-level officer (Taylor & Boba, 2011). In their guidebook about instituting crime analysis within patrol operations, Taylor and Boba (2011) discuss several ways that messages conducive to crime analysis can be transmitted such as incorporating them within the agency's mission statement, enlisting the involvement of influential, respected staff (e.g., lieutenants and sergeants) to stress key objectives and set good examples by using analysis products themselves, and enabling first-line supervisors to act as positive conduits between crime analysts and line-level officers. Many of these facets are also part of the stratified model, including mission clarification, and the use of staff at various levels, specifically first-line supervisors, to institute change conducive to promoting effective and frequent use of crime analysis products (Boba & Santos, 2011).

Lastly, the findings suggest a focus on the integration of crime analysis with agency operations as a weakness that could benefit from more research. While the findings are positive in the sense that integration is associated with higher prioritization of innovative policing strategies, as discussed the correlation is only moderate. Unfortunately, the finding of a moderate correlation in regard to integration is not that

surprising considering the results of other research which has documented disconnect between the use of crime analysis products in police operations (e.g., Akgul, 2007; Cope, 2004; Santos & Taylor, 2014; Taylor et al., 2007) and similar findings regarding the difficulties inherent in getting police officers engaged in effective problem-solving (e.g., Braga & Weisburd, 2006; Cordner & Biebel, 2005; Scott, 2000). Boba and Santos (2011) assert that a key problem with instituting effective problem-solving initiatives within police agencies is heavy reliance upon line-level police officers to engage in problem-solving on their own; specifically, that line-level officers are likely to misidentify isolated incidents as problems, and that such misidentification leads to poor quality crime analysis. The stratified model then offers a solution to integration issues by establishing procedures to routinize data collection for better crime analysis, permitting better communication and cooperation among the ranks, and reinforcing change through the use of accountability mechanisms (Boba & Santos, 2011).

### **Limitations**

As with any research study, there are always limitations worth noting. First, as the data were derived from self-report surveys, there are always problems associated with this type of research such as deliberate or unintentional over or under reporting (Maxfield & Babbie, 2011). Additionally, as the patrol commander was asked to represent the agency as a whole in responding to the patrol portion of the instrument, it is possible that their own biases and experiences could have influenced their responses to key questions. For example, a patrol commander who is innovative may understand the benefits of crime analysis and empirically supported policing strategies and thus might answer in the affirmative by indicating that crime analysis is critical to achieving his agency's ends,

and likewise he may report that every single one of the innovative strategies is a high priority. Conversely, a patrol commander who lacks such insights may see crime analysis as unimportant, and may prioritize standard model tactics as opposed to more innovative means, thus, his answers would reflect this bias.

Second, it should be noted that the response rate to the original survey was somewhat low (Taylor & Boba, 2011; Santos & Taylor, 2014). As noted in Chapter III, responding agencies and non-responding agencies were compared via a bivariate analysis on the basis of their population size, number of officers, and region of the country, yet no differences were found which may suggest that the findings are generalizable (Taylor & Boba, 2011; Santos & Taylor, 2014). The original researchers contended that perhaps the low response rate was due to the fact that some agencies did not have a vested interest in crime analysis (Taylor & Boba, 2011; Santos & Taylor, 2014).

On that specific point, it is worth noting that 89 percent of responding agencies had either a primary crime analyst on staff or a staff member who conducted crime analysis as a secondary responsibility (Taylor & Boba, 2011). This may confirm the contention that only agencies with interests in crime analysis responded to the survey, thus a “creaming” effect (i.e., those most interested in the subject respond) may account for the overwhelmingly positive results of the study (Weisburd, Lum, & Petrosino, 2001). Unfortunately, if one assumes that creaming did occur, it seriously undermines the study’s external validity and generalizability of the results to the population at large. It cannot be said then, with any degree of certainty, that the respondents to the survey reflect the “typical” police agencies or such agencies’ analytical capabilities, or interest in crime analysis in general.

Another problem is that the survey used in this study was originally designed for a different purpose. The original goal of the project, of which the survey was a component of, was to gain an understanding of the current state of the integration of crime analysis within police operations, and how the data collection process had been integrated in to patrol work (Taylor & Boba, 2011; Santos & Taylor, 2014). A second consideration was the identification of impediments to the integration of crime analysis within agency operations (Taylor & Boba, 2011; Santos & Taylor, 2014). Although the survey did contain questions pertaining to innovative policing strategies and accountability mechanisms, in depth investigation of such topics was not the intent of the original researchers. Thus, the questions and operationalization of such concepts for the purposes of this study is very limited in depth and scope.

An additional serious limitation that occurred as a result of not being able to utilize more specific questions was the large number of aggregate variables used in this study. For instance, the dependent variable, innovation, was aggregated from a matrix question that required the respondent to rate on a 5 point Likert scale the priority their agency placed on eleven different police actions. Of those eleven actions, only seven were used to create the innovation variable (i.e., actively encouraging officers to form community partnerships; transforming the agency to support officer partnership building and problem-solving; regularly collecting data from citizens about community problems; problem-oriented policing; hot spot policing; crime analysis, and crime mapping). By aggregating the variables in this manner, it becomes impossible to tell which of these innovations may be most linked to the other variables that the bivariate and multivariate



analyses revealed positive relationships with (i.e., commitment, integration and accountability).

A similar problem existed with the accountability measure, which was aggregated from a series of five Likert scale questions regarding the priority the agency placed on various accountability mechanisms. Three of the questions pertained to holding different staff members accountable for crime reduction and prevention (i.e., officers, first-line supervisors, command staff), and two pertain to monitoring agency effectiveness. Unfortunately, the aggregation makes the effect of each component unclear. For example, are agencies that truly prioritize accountability holding first-line supervisors accountable for crime reduction, and to what extent are the other groups held accountable?

Finally, it is debatable whether many of the questions used in this study actually got at the heart of actual usage of key variables such as the use of innovative policing strategies and accountability mechanisms. The language used in both of these questions prompted the patrol commander to indicate the priority their agency placed on these tactics, not indicate how frequently they were deployed or in what capacity. Priority may be a good proxy for the subject of use. For instance, if an agency does engage in hot spots policing in practice with some frequency, this may equate to a “high priority” by the perception of the patrol commander. While one might surmise this to be the case, there is no way to be sure without a separate measure of hot spots policing that accounts for frequency, purpose, or other factors that may be relevant to deriving a better approximation of use.

## **Recommendations for Future Research**

There are several recommendations that can be made for future research. First, it may be worthwhile to develop a specific measure for each innovative policing strategy. As noted earlier, the innovation variable was aggregated from several police activities that were best thought to represent innovations in policing. A future study of policing innovations and crime analysis co-implementation may seek to disentangle the aggregate variable by testing each strategy separately. To be even more precise, clear definitions of what constitutes COP, POP, and hot spots policing should also be considered.

Moreover, examining each innovative policing strategy separately in conjunction with crime analysis co-implementation may prove beneficial, as Santos (2014) suggests that crime analysis is more closely affiliated with some innovations more than others. For example, COP is more closely associated with administrative crime analysis (Santos, 2014), which was not examined here. Likewise, hot spots policing is more closely associated with crime mapping (Santos, 2014). Given this study's focus on tactical and strategic analytical functions, it is possible that more aggressive crime reduction and prevention tactics (e.g., POP, hot spots policing) are more closely associated with tactical and strategic applications, the latter is certainly true with regard to POP. This also makes sense when considering that many agencies appear to be using crime analysis for tactical responses in the short term, which may include tactics of relatively short duration such as hot spots policing approaches. Thus, a future study among the interplay between the three primary types of crime analysis and each innovative policing strategy, individually, may yield some interesting results.

An inter-related problem here was that the questions asked about prioritization of these strategies, not actual use. To be sure, a future study of innovation may define a measure of the use of each strategy in agency operations. With a more precise measure of the actual use of each strategy, the extent to which crime analysis is influential in the execution of the strategy could also be measured.

Lastly, the prioritization of the use of accountability mechanisms could also benefit from future study. While this study used another aggregate variable to measure the use of accountability mechanisms, a future study may also seek to disentangle this variable. For instance, three key components of the variable were the use of crime analysis to hold officers, first-line supervisors, and management/command staff accountable for crime reduction and prevention. Comparisons between the level of innovation and each individual group could prove beneficial, especially when the choices of police agency managerial models are concerned. For example, Boba and Santos' (2011) stratified model utilizes accountability mechanisms at all levels. Conversely, Compstat managerial models only hold command staff accountable for crime control gains. A future study could be conducted to evaluate the effect of holding various staff accountable on the level of innovation. While there has been some question about whether Compstat promotes innovation, perhaps a similar question could be asked of the stratified model. In that case, evaluating the effect of holding staff at various levels accountable could be contrasted with the corresponding level of innovation.

### **Conclusion**

Examining the complex relationships between innovative policing strategies, crime analysis, and accountability mechanisms is important for more than just academic

purposes. In recent years, there has been a shift toward implementing evidence-based practice in policing (Welsh, 2006). That is, an emphasis on using high quality, peer reviewed research to assist in policy and decision making, which will ultimately translate to action in the field (Welsh, 2006). Also, given the present economic climate, there has been an increased interest among many government run agencies, including police departments, to do more with less (Santos, 2013; Taylor & Boba, 2011). Thus, it becomes imperative to understand what the police are doing, if what they are doing is effective, and if the greatest crime control gains are being achieved. Conversely, if problems do exist, it is crucial to diagnose them and understand where and why they are occurring so further research can be conducted to rectify them.

Further, it is reasonable to assume that the police will likely continue to innovate. Recently, due in part to advances in computer technology, there has been an interest in integrating predictive analytics in to police work by way of forward-thinking crime prevention strategies, specifically, predictive policing (Santos, 2014). Predictive policing involves the examination of current crime scene locations in an attempt to predict where and when offenders will strike next often through the use of theoretical constructs from other fields (Santos, 2014). For instance, equations used by seismologists to predict the locations and times of earthquake aftershocks after the occurrence of the initial quake have been modified for use in predicting possible hot spots for residential burglaries after the first break in occurs in a neighborhood (Mohler, Short, Brantingham, Schoenberg, & Tita, 2011). Perhaps not surprisingly, crime analysis plays a crucial role in predictive policing and perhaps out of all the innovations that have come about over the years, its connection to predictive policing is the most critical yet (Santos, 2014).

As Telep and Weisburd (2012) remind us, the most successful approaches to crime control and prevention are those that are highly focused. Crime analysis fills this niche nicely. For as relatively young as crime analysis is (the earliest reports of police usage date back to the late 1970s) (Santos, 2013) it has come a long way. General comparisons between the integration of analytic functions nearly two decades ago and the analytical functions of today show marked improvement, that has been likely been assisted by concurrent advancements in computer technology. While crime has and will continue to become more complex over time, so too will police responses by way of crime reduction innovations, and it will likely come as no surprise to find data-driven crime analysis at the heart of new approaches.

## Bibliography

- Akgul, A. (2007). *Implementation of geographic information systems in policing: A case study of the Spokane police department* (Doctoral dissertation). Retrieved from ProQuest, UMI Dissertations Publishing. (3302699)
- Anderson, D.C. (2001). Crime control by the numbers: Compstat yields new lessons for the police-and the replication of a good idea. *Ford Foundation Report, Winter 2001*, 16-21.
- Bachman, R., & Scott, R.K. (2012). *Fundamentals of research in criminology and criminal justice*. Thousand Oaks, CA: Sage.
- Baker, T., & Wolfer, L. (2003). The crime triangle: Alcohol, drug use, and vandalism. *Police Practice and Research, 4*, 47-61.
- Baltaci, H. (2010). *Crime analysis: An empirical analysis of its effectiveness as a crime fighting tool* (Doctoral dissertation). Retrieved from ProQuest, UMI Dissertations Publishing. (3421465)
- Bennett, T., Holloway, K., & Farrington, D. (2008). The effectiveness of neighborhood watch. *Campbell Systematic Reviews*. DOI: 10.4073/csr.2008.18
- Bhattacharjee, A. (2012). *Social science research: Principles, methods and practices*. Tampa, FL: CreateSpace Independent Publishing Platform.

- Bichler, G., & Gaines, L. (2005). An examination of police officers' insights into problem identification and problem solving. *Crime & Delinquency, 51*, 53-74.
- Boba, R. & Santos, R. (2011). *A police organizational model for crime reduction: Institutionalizing problem solving, analysis, and accountability*. Washington DC: Office of Community Oriented Policing Services.
- Brace, N., Kemp, R. & Snelgar, R. (2012). *SPSS for psychologists*. New York, NY: Palgrave Macmillan.
- Braga, A., Kennedy, D., Waring, E., & Piehl, A. (2001). Problem-oriented policing, deterrence, and youth violence: An evaluation of Boston's Operation Ceasefire. *Journal of Research in Crime and Delinquency, 38*, 195-225.
- Braga, A.A., Papachristos, A.V., & Hureau, D.M. (2012). The effects of hot spots policing on crime: An updated systematic review and meta-analysis. *Justice Quarterly, 31*, 633-663.
- Braga, A.A., & Weisburd D. (2006). Problem-oriented policing: The disconnect between principles and practice. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 133-152). New York: Cambridge University Press.
- Braga, A.A. & Weisburd, D.L. (2012). The effects of focused deterrence strategies on crime: A systematic review and meta-analysis of the empirical evidence. *Journal of Research in Crime and Delinquency, 49*, 323-358.

- Campbell Collaboration. (2014). *What is a Campbell Systematic Review?* Retrieved on April 8, 2014 from [http://www.campbellcollaboration.org/what\\_is\\_a\\_systematic\\_review/index.php](http://www.campbellcollaboration.org/what_is_a_systematic_review/index.php)
- Chamard, S.E. (2003). *Innovation-diffusion networks and the adoption and discontinuance of computerized crime mapping by municipal police departments in New Jersey* (Doctoral dissertation). Retrieved from ProQuest, UMI Dissertations Publishing. (3088006)
- Chatterjee, S. & Simonoff, J.S. (2013). *Wiley handbooks in applied statistics: Handbook of regression analysis*. Hoboken, NJ: Wiley.
- Chilvers, M., & Weatherburn, D. (2004). The New South Wales Compstat process: It's impact on crime. *Australian & New Zealand Journal of Criminology*, 37, 22-48.
- Clarke, R.V., & Eck, J.E. (2005). *Crime analysis for problem solvers in 60 small steps*. Washington DC: Office of Community Oriented Policing Services.
- Cordner, G., & Biebel, E.P. (2005). Problem-oriented policing in practice. *Criminology & Public Policy*, 4, 155-180.
- Cope, N. (2004). Intelligence led policing or policing led intelligence: Integrating volume crime analysis into policing. *British Journal of Criminology*, 44, 188-203.
- Dabney, D. (2010). Observations regarding key operational realities in a Compstat model of policing. *Justice Quarterly*, 27, 28-51.



- Demir, S. (2009). *Diffusion of police technology across time and space and the impact of technology use on police effectiveness and its contribution to decision-making*. (Doctoral dissertation). Retrieved from <https://etd.ohiolink.edu/>
- Dempsey, J.S., & Forst, L.S. (2012) *An introduction to policing*. Clifton Park, NY: Delmar.
- Eck, J.E., & Spelman, W. (1987). *Problem solving: Problem-oriented policing in Newport News*. Washington DC: Police Executive Research Forum.
- Giblin, M.J. (2006). Structural elaboration and institutional isomorphism: The case of crime analysis units. *Policing: An International Journal of Police Strategies & Management*, 29, 643-664.
- Gill, C., Weisburd, D., Telep, C.W., Vitter, Z. & Bennett, T. (2014). Community-oriented policing to reduce crime, disorder and fear and to increase satisfaction and legitimacy among citizens: A systematic review. *Journal of Experimental Criminology*, DOI: 10.1007/s11292-014-9210-y.
- Goldstein, H. (1990). *Problem-oriented policing*. New York, NY: McGraw-Hill.
- Hinton, P.R., McMurray, I., Brownlow, C. (2014). *SPSS explained*. Florence, KY: Taylor and Francis.
- Jang, H., Hoover, L., & Joo, H. (2010) An evaluation of Compstat's effect on crime: The Fort Worth experience. *Police Quarterly*, 13, 387-412.

- Kelling, G.L., & Sousa Jr., W.H. (2001). *Do police matter? An analysis of the impact of New York City's police reforms. Civic Report No. 22*. New York, NY: Manhattan Institute for Policy Research.
- Kelling, G.L., Pate, A., Dieckman, D., & Brown, C.E. (1974) *The Kansas City preventative patrol experiment: Technical report*. Washington DC: Police Foundation.
- Kennedy, D.M. (2006). Old wine in new bottles: Policing and the lessons of pulling levers. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 155-177). New York: Cambridge University Press.
- Mamalian, C.A., & LaVigne, N.G. (1999). *The use of computerized crime mapping by law enforcement: Survey results*. Washington DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.
- Maxfield, M. G., & Babbie, E.R.. (2011). *Research methods for criminal justice and criminology*. Belmont, CA: Wadsworth.
- Mazaika, D.M. (2008). *The failure to innovate: A study of the non adoption of computerized crime mapping in American police* (Master's thesis). Retrieved from ProQuest Information and Learning Company. (1453759)
- McLaughlin, L., Johnson, S.D., Bowers, K. J., Birks, D. J., & Pease K. (2006). Police perceptions of the long-and short-term spatial distribution of residential burglary. *International Journal of Police Science & Management*, 9, 99-111.

- Mohler, G.O., Short, M.B., Brantingham, P.J., Schoenberg, F.P., & Tita, G.E. (2011). Self-exciting point process modeling of crime. *Journal of the American Statistical Association, 106*, 100-108.
- Mullen, K. L. (1996). *The computerization of law enforcement: A diffusion of innovation study* (Doctoral dissertation). Retrieved from ProQuest, UMI Dissertations Publishing. (9626240).
- National Criminal Intelligence Service. (2000). *The National Intelligence Model*. London: Author.
- Office of Community Oriented Policing Services. (2009). *Community policing defined*. Washington DC: Author.
- O'Shea, T.C., & Nicholls, K. (2002). *Crime analysis in America*. Washington DC: U.S. Department of Justice, Office of Community Oriented Policing Services.
- O'Shea, T.C., & Nicholls, K. (2003). Police crime analysis: A survey of US police departments with 100 or more sworn personnel. *Police Practice and Research, 4*, 233-250.
- Police Executive Research Forum. (2013). *Compstat: Its origins, evolution, and future in law enforcement agencies*. Washington DC: Author.
- Police Foundation. (2000). *Integrating community policing and computer mapping: Assessing issues and needs among COPS office grantees*. Washington DC: Author.
- Ratcliffe, J. H. (2008) *Intelligence-led policing*. Cullompton, UK: Willan.

- Ratcliffe, J. H., & McCullagh, M. (2001). Chasing ghosts? Police perception of high crime areas. *The British Journal of Criminology*, *41*, 330–341.
- Salkind, N.J. (2012). *Tests & measurement for people who (think they) hate tests & measurement*. Thousand Oaks, CA: Sage.
- Santos, R.B. (2013). *Crime analysis with crime mapping*. Thousand Oaks, CA: Sage.
- Santos, R.B. (2014). The effectiveness of crime analysis for crime reduction: Cure or Diagnosis? *Journal of Contemporary Criminal Justice*, *30*, 147-168.
- Santos, R.B. & Taylor, B.G. (2014). The integration of crime analysis into police patrol work: Results from a national survey of law enforcement agencies. *Policing: an International Journal of Police Strategies & Management*, *37*, pages pending.
- Seber, G.A.F. & Lee, A.J. (2003). *Wiley series in probability and statistics: Linear regression analysis*. Hoboken, NJ: Wiley.
- Schaible, L., & Sheffield, J. (2012). Intelligence-led policing and change in state law enforcement agencies. *Policing: An International Journal of Police Strategies & Management*, *35*, 761-784.
- Scott, M.S. (2000). *Problem-oriented policing: Reflections on the first twenty years*. Washington DC: Office of Community Oriented Policing Services.
- Sever, B., Garcia, V., & Tsiandi, A. (2008). Municipal police departments' attention to crime analysis: Essential or impractical? *Police Practice and Research*, *9*, 323-340.

- Sherman, L.W., Gartin, P.R., & Buerger, M.E. (1989). Hot spots of predatory crime: Routine activities and the criminology of place. *Criminology*, 27, 27-55.
- Silverman, E. (2006). Compstat's innovation. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 267-283). New York: Cambridge University Press.
- Skogan, W.G. (2006). The promise of community policing. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 27-43). New York: Cambridge University Press.
- Skogan, W., & Frydl, K.. (2004). *Fairness and effectiveness in policing: The evidence*. Washington DC: National Academies Press.
- Spelman, W. & Brown, D.K. (1984). *Calling the police: Citizen reporting of serious crime*. Washington DC: US Government Printing Office.
- Taylor, B., Kowalyk, A., & Boba, R. (2007). The integration of crime analysis into law enforcement agencies: An exploratory study into the perceptions of crime analysts. *Police Quarterly*, 10, 154-169.
- Taylor, B., & Boba, R. (2011). *The Integration of crime analysis into patrol work: A guidebook*. Washington DC: Office of Community Oriented Policing Services.
- Telep, C.W., & Weisburd, D. (2012). What is known about the effectiveness of police practices in reducing crime and disorder? *Police Quarterly*, 15, 331-357.
- Wartell, J. & Gallagher, K. (2012) Translating environmental criminology theory into crime analysis practice. *Policing*, 6, 377-387.

- Wartell, J. & McEwen, T. (2001). *Privacy in the information age: A guide for sharing crime maps and spatial data*. Washington DC: U.S. Department of Justice, National Institute of Justice.
- Weisburd, D. & Britt, C. (2007). *Statistics in criminal justice*. New York, NY: Springer.
- Weisburd, D., & Braga, A.A. (2006a). Introduction: Understanding police innovation. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 1-23). New York: Cambridge University Press.
- Weisburd, D., & Braga, A.A. (2006b). Hot spots policing as a model for police innovation. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 225-244). New York: Cambridge University Press.
- Weisburd, D., Bushway, S., Lum, C., & Yang, S. (2004). Trajectories of crime at places: A longitudinal study of street segments in the city of Seattle. *Criminology*, 42, 283-321.
- Weisburd, D., & Eck, J.E. (2004). What can police do to reduce crime, disorder, and fear? *The Annals of the American Academy of Political and Social Science*, 593, 42-65.
- Weisburd, D., & Lum, C. (2005). The diffusion of computerized crime mapping in policing: Linking research and practice. *Police Practice and Research*, 6, 419-434.

- Weisburd, D., Lum, C.M., & Petrosino, A. (2001). Does research design affect study outcomes in criminal justice? *The Annals of the American Academy of Political and Social Science*, 578, 50-70.
- Weisburd, D., Mastrofski, S., McNally, A., Greenspan, R. & Willis, J. (2003). Reforming to preserve: Compstat and strategic problem solving in American policing. *Criminology & Public Policy*, 2, 421-456.
- Weisburd, D., Mastrofski, S. D., Willis, J.J., & Greenspan, R. (2006). Changing everything so that everything can remain the same: Compstat and American policing. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 284–301). New York: Cambridge University Press.
- Weisburd, D., Telep, C.W., Hinkle, J.C., & Eck, J.E. (2010). Is problem-oriented policing effective in reducing crime and disorder? Findings from a Campbell systematic review. *Criminology & Public Policy*, 9, 139-172.
- Welsh, B.C. (2006). Evidence-based policing for crime prevention. In D. Weisburd & A.A. Braga (Eds.), *Police innovation: Contrasting perspectives* (pp. 305-321). New York: Cambridge University Press.
- Willis, J.J., Mastrofski, S.D., & Kochel, T.R. (2010). The co-implementation of Compstat and community policing. *Journal of Criminal Justice*, 38, 969–980.
- Willis, J.J., Mastrofski, S.D., Weisburd, D., & Greenspan, R. (2003). *Compstat and organizational change in the Lowell police department: Challenges and opportunities*. Washington DC: Police Foundation.