PATROL SHIFT STAFFING LEVELS AND COMMUNITY CRIME RATES: ANALYZING THE IMPACT OF REDUCED PER-SHIFT STAFFING LEVELS ON REPORTED CRIME RATES

A Thesis by

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The following faculty members have examined the final copy of this thesis for form and content, and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Arts.

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DEDICATION

To the men and women of Law Enforcement, who stand ready in the night.

Here's to us. And who is like us?

Damn Few

ABSTRACT

The purpose of this case study was to test the hypothesis: Police staffing deployment levels inversely affect reported crime rates. There is a growing body of research that looks at the issue of police staffing levels and their relationship to reported crime. The findings are conflicting, with some showing a moderate negative correlation. These studies use panel data from several large agencies and tend to center on the relationship of crime rates to the total number of officers employed for a given period. This method could lead to errors due to the varying structures of law enforcement agencies across the nation, which utilizes non-sworn staff.

A longitudinal study was designed and implemented to examine the effect of actual fielded staff on reported crime rates. This study examined 5 years of daily patrol staffing levels for a medium size agency in south central Kansas, and compared it to the annual reported crime during the same period. The results of various statistical models showed a significantly high negative correlation between the mean number of officers on daily patrol and the amount of crime reported. The correlation was further analyzed to determine if there was the presence, and if so the direction of predictive causality. A Granger Causality Test was applied to this data and in 3 of 4 lags an there was an indications a likelihood that low staffing deployment levels caused an increase in crime. The same test was performed reversing the hypothesis and each of the 4 lags indicated a strong likelihood that reported crime did not affect shift deployment levels.

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to all who have made this thesis possible. First to the men and women of the Newton Police Department who were willing to take on the task of completing thousands of Daily Activity Reports and Shift Staffing Reports which provided the data for this study. To Susan Hammen of Bair Analytics / Lexis Nexis, who saw in me the potential to excel, and encouraged me to seek growth through higher education. To Kristen Brewer, who has given freely of her time and talents to assist me in many professional challenges, which sough to deter me from completing this thesis. To Dr. Beeson, who has been a teacher, mentor, and friend throughout this process. To my best friend Jason Reynolds who has been a source support personally, professionally, and academically, always when I needed it most. And finally to my wife, who has endured all of the struggles leading to this day, and after 25 years, is still by my side.

"In the words of the old saying, every society gets the kind of criminal it deserves. What is equally true is that every community gets the kind of law enforcement it insists on."

- Robert Kennedy
United States Attorney General

Statement to the Permanent Subcommittee on Investigations of the Senate Government Operations Committee
September 25, 1963

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Chapter 1

Introduction

Police staffing levels are commonly a vexing topic for public safety administrators. There is always the quest to balance the scales between public safety, and the cost to provide that service. Since the economic downturn of 2008, many agencies have experienced a reduction in their staffing levels due to factors such as attrition, hiring freezes, furloughs, and layoffs. While struggling to maintain this balance, the question begs to be asked, "What effect is the reduction of staff having on community crime rates?" A popular notion is police force staffing levels change in accordance with increased criminal activity. Research conducted by Liska, Lawrence, & Benson (1981) finds crime rates have minimal to no impact on police staffing levels. In fact, rather than relying on measurable need for law enforcement services, police staffing levels are most determinable by the previous years staffing level.

Previous research has centered on analyzing the relationship of the number of sworn personnel to the community's reported crime rate. While this data is readily available as human resource records and crime rates tend to be maintained in most jurisdictions, the flaw in this type of approach is law enforcement agencies follow multiple staffing models with regard to how duties are performed by sworn and non-sworn personnel. Some agencies utilize non-sworn employees to conduct many of the daily tasks, which are performed by sworn personnel at other agencies. To compare the reported crime rates based on the

number of sworn personnel is not the most consistent measure of the effectiveness of staffing levels with regard to the public's perception of being apprehended.

While each member of the overall law enforcement team has a role to play in agency's ability to identify and apprehend offenders, it would be difficult to imagine an offender takes into consideration the quality of the evidence room staff, and data entry personnel. Due to their making the majority of an agency, and their access to the public, most citizen contact with law enforcement professionals is with the Patrol Officer. Therefore it is reasonable to assume if fluctuations in police staffing do indeed have an effect on reported crime rates pursuant to the rational choice theory, then the number of officers fielded in the patrol division would be the most influential factor

Previous research does not examine is how the number of patrol officers who are fielded on a daily basis impacts the overall reported crime rate. It might be easy to compare allotted numbers in the patrol division, where most duties are performed by sworn personnel, however even this method is subjected to the inaccuracies created by the variance of non-sworn personnel being utilized, as well as the lack of staffing caused by factors such as attrition, injury/ sick leave, vacations, and training obligations.

It is unlikely a criminal knows the day to day staffing levels of the police department where he commits crime, let alone factors them into his decision making rationale. However, if the agency routinely staffs its patrol division in a manner which both predictable and ineffectual, yielding a low pattern of presence, this could lead to a reduced perception of

apprehension and increased criminality. Ultimately if crime rates are connected to the perception of apprehension in accordance with Rational Choice Theory, then we must examine the actual number of sworn officers fielded during each shift, every day, over the course of time. This examination will yield a pattern of presence promulgated by an agency due to its staffing.

The following pages document a 5-year study of the daily staffing allocation for the patrol division of a moderate sized mid-western city, and how the daily staffing changes affected reported community crime rates. The selected community has a rural buffer of at least 20 miles to the nearest medium to large city, thereby negating the external affect on the perception of apprehension for those who choose to commit crime.

Chapter 2

Literature Review

The members of society have a vested interest in lowering the occurrence of crime / disorder. Incidents of victimization bring with them both a personal and an economic impact to a given community. While there are many theories explaining potential causes of criminality, and any treatment applied through a developmental / life-course criminological lens would have to be seen as a long-term movement toward prevention through the mitigation of influencing variables which impact epigenetic plasticity, or the removal of criminogenic commodities. Short-term prevention treatments, or Crime Deterrence methods, are used in a tactical manner and their effectiveness requires study. Deterrence, or the threat of punishment, first relies on the premise of the offender being detected and apprehended. Classical Criminologists Beccaria and Bentham would argue the likelihood of being apprehended far outweighs the severity of the punishment, with its relevance as a crime control measure. They further argue any punishment, which exceeds the level needed for deterrence, is cruel and ineffective.

Prior work in this area has led to often-conflicting results, and brought up potential sociological phenomena, which can alter how crime is reported as staffing levels change. Several studies using panel data to compare total agency size vs. the occurrence of crime have cast doubt on the notion of variance in law enforcement's staffing and the overall impact on community crime rates, the seminal of which is "Crime and Punishment: An Economic Approach" (Becker 1968). Becker who uses an examines crime control through a cost /

benefit to society lens, argues while large changes in police staffing levels can have an effect on crime rates, the overall cost has to be compared to the cost to society of the crimes which are being deterred. He states in some instances the view of law enforcement officers being an active deterrent to criminal activity is set aside in favor of increased punishment to serve in this manner.

"…an increased probability of conviction obviously absorbs public and private resources in the form of more policemen, judges, juries, and so forth. Consequentially a "compensated" reduction in this probability obviously reduces expenditures on combating crime, and, since the expected punishment is unchanged, there is no "obvious" offsetting increase in either the amount of damages or the cost of punishments. The result can easily be continuous political pressure to keep police and other expenditures relatively low and to compensate by meting out strong punishments to those convicted." - Becker

If the social costs of criminal behavior outweigh the potential profit, people tend to make the rational choice to avoid engaging in crime. Cesar Beccaria would argue it is not the severity of the punishment, but rather the likelihood of being apprehended, and facing eventual punishment (even those less severe that do not seek retribution).

Many governing bodies, in an effort to reduce crime while still cutting operational costs have turned to increased penalties. Policies such as "Three Strikes" laws, and mandatory minimum sentences are referred to as the Punitive Justice Model, and founded in General Deterrence Theory. This model is based on the notion that crime is a rational act and offenders weigh the likelihood of being detected, apprehended, convicted, and the intensity of the punishment before committing a crime. Proponents of this crime control policy follow Becker's lead by determining that costs can be cut in the areas of prevention, detection, and conviction, if the severity of the punishment is sufficiently high enough to offset them. Since

adopting this model crime rates in the United States has been in a state of decline. There is argument as to contributing factors, but what is indisputable is our nation has one of the highest incarceration rates in the world, and the suppressive effect on crime may have more to do with incapacitation of offenders through incarceration (Marvel & Moody 1994), rather than a deterrent effect on individual choices.

Proponents of the Restorative Justice Model submit the resources used in the process of trial and incarceration are more effectively spent on increasing the level of enforcement (number of law enforcement officers per shift), thereby increasing the probability of apprehension in addition to other crime control measures. They argue it is the fear of apprehension (if followed by timely punishment, in accordance with Rational Choice Theory, which is the most influential leg in Rational Choice theory. Another effect of increased law enforcement presence as seen through the lens of developmental / life course criminology, is the opportunity through increased community contact, to identify circumstances contributing to criminal behavior as well as what interventions may be useful.

It is difficult to draw a conclusion from studies using panel data, as there are also unseen variables. One such variable is the possibility of increased staffing leading to the detection of more crime, thereby altering the measured effectiveness (Wornall &Kovandzic 2010; Swimmer 1974). Another observed phenomenon, which makes the effectiveness of additional police officers harder to measure, is "Reporting Bias" (Levitt, 1998). Levitt argues the confidence of a community regarding the solvability of a crime rises as the agency increases their staff; therefore they are more willing to report crimes, which have occurred.

His study found an expected increase of 5 index crimes per officer added, which would not have been reported previously.

This constant desire for agencies to find just the right amount of policing to be efficient with regard to capital outlay, led to a study of the crime rates of 29 police departments in an effort to develop a Goldilocks approach to staffing (Guffey 2009). Guffey determined police officer rates of 20 or fewer per 10,000 citizens spread officers too thin. Rates above 40 officers per 10,000 citizens appeared to be inefficient, and rates of 50+ officers per 10,000 citizens were clearly inefficient as crime rates did not drop in relation to the increased officers. Guffey determined the optimum ratio of officers to citizens was in the range of 30-40 officers per 10,000 citizens.

Other researchers (Levitt, 1998; Marvel & Moody, 1996, Guffey et all 2010) have found a significant negative correlation between the number of officers employed and the amount of reported crime. Marvel & Moody found for each officer hired, the employing agency showed a reduction of 24 part 1 crimes (.02 homicides, .1 rapes, 1.8 robberies, 5.3 burglaries, 12.5 larcenies, and 4.5 auto thefts). The cost to society for each of these prevented crimes can be calculated thereby helping to answer the cost effectiveness question presented by Becker.

This case study seeks to control for the aforementioned factors, and measure police effectiveness in a new way. In each study this author has read, one fatal flaw has been observed. The data analyzed only looks for correlation between reported crime and the number of sworn officers employed for the same time period. The assumption is each officer has the same deterrent effect. The studies do not take into account the distribution of

administrative personnel, sworn officers performing functions, which are staffed with non-sworn personnel in other agencies, or non-working time due to illness, injury, training, or vacation. When these factors are taken into account it becomes apparent that comparing reported crime rates with the number of officers employed is simply not sufficient to draw a meaningful correlation. A more accurate picture of the effectiveness of police officers in a deterrent role could be developed when reported crime rates are compared with shift deployment rates. This method provides us with an accurate measurement of the daily enforcement treatment a community receives.

Chapter 3

Research Methods

Rationale:

This study examined staffing data from a medium sized city in South Central Kansas. Previous studies looked for correlation between the total numbers of sworn officers employed and reported crime rates. While every member of the department contributes to the overall prevention of crime, investigators only deal with crimes, which have occurred, and administration facilitates the operations of the other divisions. The distribution and activity levels of each of these portions of an agency vary between agencies. This study focused on the patrol division, as the researcher believes it has the most contact with the community and arguably the most effectiveness in creating a sense of prescience of apprehension. This longitudinal study of the patrol division over a period of 5 years created a daily measurement of the number of officer's deployed on patrol or away on vacation leave, training, or sick / injury leave. The data was recorded on a pre-printed index card at the beginning of each shift by the shift supervisor, and turned in to the office manager for entry into a spreadsheet. An officer had to complete at least half of their shift to be counted.

Socio-Geographic Information

The municipal research partner is a city with a population of 19,254 residents. The partner serves as the County Seat and encompasses an area of 14.27 square miles. The City's population has increased 11.8% between 2000 and 2010. The population is relatively young with a median age

of 36.8 years (as compared to 42.9 years for the State of Kansas). The community has a diverse socioeconomic makeup with a median household income of $44,463, and 13.9% of its population living below the poverty level. Located 17 miles away from a major urban metro area, and bisected by Interstate an interstate and US Highway, the city's Police Department experiences an additional commuter population in addition to its residents. There are three area colleges, which also impact the services of the police department.

Causes of Fielded Staff Variance

The city uses a rotating 12-hour schedule with 4 shifts. While a squad is targeted to staff with five members fielded, which is considered fully staffed for a shift, only 29.4% of the time was the agency able to meet this goal. The city's four patrol squads operate at Targeted Minimum Staffing levels (4 officers) 51.2% of the time. The members of the patrol division are forced to work with Emergency Minimum Staffing levels (3 officers) 19.4% of the time. These shortages are caused by several factors. Among these are Illness / Injury Leave, FMLA Leave, Vacation Leave, Training requirements, Court Appearances, and Attrition.

Leave

Like every employer, the City Police Department cannot predict use of leave due to illness or injury; however, there are certain factors, which increase the potential for the use of this leave. The nature of Law Enforcement exposes officers to varying weather and temperature conditions, places officers in close personal contact with citizens who may be contagious, and due to the non-standard

sleep pattern (night shift), compromises officers immune systems. The potential for injury to officers is high due to their being sedentary for many hours, then having to exert maximal physical effort quickly without the ability to plan or prepare. The physical encounters are often in the form of physical combat with another person, leading to a high risk of injury.

A form of leave, which has become more common and used to be recorded under sick leave, is the use of FMLA leave when a child joins the officer's family. Since the law enforcement profession traditionally attracts new members in their young 20's, there is a high chance for the officer to begin growing a family. Federal law requires the City to allow the officer to take up to 12 weeks of leave without penalty. In addition to the previously mentioned types of leave, Vacation Leave is an employee benefit, which allows a new officer to build leave throughout the year, which equates to two weeks of time the shift will be short staffed. As the officer increases his tenure, vacation leave available also increases to a maximum level, which equates to four weeks a shift will be short staffed.

Training

All police officers in the State of Kansas are required to obtain a minimum of 40 hours of annual in-service training to maintain their license. Several officers require many times the minimum number of training hours due to specialty positions they hold. Officers partnered with K-9's, Members of the SWAT team, Drug Recognition Experts, Department Use of Force Instructors, and Department Firearms Instructors are just a few of those who require far in excess of the minimum number of training hours. In an effort to minimize overtime costs, these training hours

occur during the officer's scheduled shift or the officer is given in-lieu of time off during the same pay period. Either way, each training day represents a day the officer's squad is operating short of personnel. The cost in time is high, but having a well-trained department provides a better service to our community, secures criminal convictions, and lessens civil liability.

Occasionally officers become engaged in an investigation, which leads to prosecution on federal charges or in other jurisdictions. Officers who are under subpoena are lawfully required to be present as a witness at these proceedings, which may extend over several days. While these events are not common, they do represent additional staffing shortages. This time away has to be recorded and subtracted from the effectiveness of crime prevention in accordance with Rational Choice Theory.

Attrition and Retraining of Officers

The most common and long-term factor affecting staffing levels is attrition. During the last 15 years, very rarely has the City Police Department been fully staffed as a whole. As each year passes senior officers draw nearer to retirement, and other officers seek employment elsewhere. Due to the extensive application process and training requirements, when an officer leaves, the ramifications are felt for at least a year. The advertising process and application acceptance period typically extends to six weeks. The testing and interview process, background investigation, polygraph testing, and physical exam add an additional four weeks at a minimum. Once an offer of employment is made, there is usually a two to three week delay before the new officer begins employment. The officer is then required to attend a 14-week basic training program at the Kansas

Law Enforcement Training Center, and returns to complete an additional 14-week field-training program before the officer is able to fill vacancies in the patrol schedule. The new officer typically requires an increased level of supervision for at least another year, extending the impact on the shift's resources. The 38-week hiring process represents the minimum typical period, but in reality, the process usually takes 45-50 weeks. By this time, the Police Department traditionally has lost another member or two and the process begins again. This lag in officer effectiveness will not show up if a researcher is only comparing employment data, which is a snapshot of the agency on a particular day, not a measurement of the effectiveness of, nor the ability to deploy an officer in an official capacity.

As of the time of this study the City Police Department had one unfilled, sworn position. An additional sworn officer has submitted his notice of a pending resignation. The current openings represented 6% of the department's sworn officers. In addition to these known openings, six sworn members of the Newton Police Department (approximately 18%) will be eligible to retire with benefits within the next 5 years, and an additional five will be eligible to retire with benefits within the next 10 years (an additional 15%). In total, the Newton Police Department could reasonably expect a turnover of 39% of its sworn employees within the next 10 years, placing a sizeable burden on the patrol division.

Reported Cases

The total number of cases reported to or by officers in a calendar year were first used to determine correlation, but once further evaluation was made the cases generated by the Warrant /

Bailiff were removed. While this choice actually lowered the R-value, the researcher felt is was a sound decision as many of the Warrant Officer cases were generated as an administrative function due to self-reporting to court once a warrant was issued. Arguably the deterrent factor of the warrant may be better classified in a study of the effectiveness of the court system. The cases generated through the warrants do not impact, nor reflect the variance in demand on patrol. All future reference to "Reported Cases" will be the total cases minus the Warrant / Bailiff cases.

Data Analysis

The first stage of this study was to determine if there was a base correlation between the numbers of sworn officers employed, the number of full time employees, and the rate of reported crime. Data from the 2012 version of Crime in the United States, which compiles the Federal Bureau of Investigation – Unified Crime Reports (UCR), was used for the initial observation. The researcher compared the partner city to the remaining top 25 cities in Kansas by population (the partner city scored among these 25) for the relationship of Part 1 violent crimes. The dark figure of crime (crimes which have occurred but have not been reported) is an unknown variable, which can invalidate a study. The researcher chose to use Part 1 violent crimes as the inherent severity causes a higher level of reporting frequency. There are those who choose not to report violent victimization such as a rape, however there is no reason to believe there would be a significant change in reporting frequency across the state.

Upon examining 2012's data, the partner city ranked #23 in order of population (figure 1), and if crime were distributed randomly and evenly should not change significantly when normalized by other variables. When the aggregate number of violent crimes was examined, the

partner city moved to #12 (figure 2). When comparing the amount of violent crime by the population, the partner city moves to #8 on the list (3). If compared to the rates of reported crime by full time officer, and by employee we learn the partner city moved to #5 (Figure 4) and #3 on the list respectfully (Figure 5). The initial evaluation showed the partner agency might have a high incidence of criminality, which could be related to the relatively low number of sworn officers and full time staff.

Rank	City	Population	Total Full Time Police Employees	Sworn Employees	Non-Sworn Employees	Part 1 Violent Crimes	Part 1 Property Crimes
1	Wichita	386,409	821	642	179	2869	21070
2	Overland Park*	177,085	287	240	47	285	4079
3	Kansas City	147,201	433	353	80	877	7538
4	Topeka	128,843	353	290	63	772	6841
5	Olathe*	128,560	189	163	26	191	2480
6	Lawrence	89,180	184	151	33	370	3997
7	Shawnee	63,542	111	88	23	85	1060
8	Lenexa	49,222	129	87	42	58	944
9	Salina	48,155	107	76	31	161	2353
10	Hutchinson	42,357	96	66	30	262	2519
11	Leavenworth	35,857	82	58	24	248	1163
12	Leawood	32,554	82	59	23	18	460
13	Dodge City	28,064	61	45	16	101	1053
14	Garden City	27,017	92	59	33	115	764
15	Emporia*	25,099	63	41	22	57	831
16	Junction City	24,138	66	44	22	162	621
17	Derby*	22,393	52	42	10	24	522
18	Prairie Village	21,906	59	46	13	13	243
19	Liberal	20,968	50	34	16	67	576
20	Hays	20,823	51	33	18	98	621
21	Pittsburg	20,380	59	40	19		
22	Gardner	19,532	28	25	3	35	343
23	Newton	19,328	37	32	5	108	672
24	Great Bend	16,174	35	30	5	95	725
25	McPherson	13,249	36	30	6	32	590

Figure 1 – Ranked by Population

Rank	City	Population	Total Full Time Police Employees	Sworn Employees	Non-Sworn Employees	Part 1 Violent Crimes	Part 1 Property Crimes
1	Wichita	386,409	821	642	179	2869	21070
2	Kansas City	147,201	433	353	80	877	7538
3	Topeka	128,843	353	290	63	772	6841
4	Lawrence	89,180	184	151	33	370	3997
5	Overland Park*	177,085	287	240	47	285	4079
6	Hutchinson	42,357	96	66	30	262	2519
7	Leavenworth	35,857	82	58	24	248	1163
8	Olathe*	128,560	189	163	26	191	2480
9	Junction City	24,138	66	44	22	162	621
10	Salina	48,155	107	76	31	161	2353
11	Garden City	27,017	92	59	33	115	764
12	Newton	19,328	37	32	5	108	672
13	Dodge City	28,064	61	45	16	101	1053
14	Hays	20,823	51	33	18	98	621
15	Great Bend	16,174	35	30	5	95	725
16	Shawnee	63,542	111	88	23	85	1060
17	Liberal	20,968	50	34	16	67	576
18	Lenexa	49,222	129	87	42	58	944
19	Emporia*	25,099	63	41	22	57	831
20	Gardner	19,532	28	25	3	35	343
21	McPherson	13,249	36	30	6	32	590
22	Derby*	22,393	52	42	10	24	522
23	Leawood	32,554	82	59	23	18	460
24	Prairie Village	21,906	59	46	13	13	243
25	Pittsburg	20,380	59	40	19		

Figure 2 – Ranked by Total Part 1 Violent Crime

Rank	City	Population	Total Full Time Police Employees	Sworn Employees	Non-Sworn Employees	Part 1 Violent Crimes	Part 1 Property Crimes
1	Wichita	386,409	2.12	1.66	0.46	7.42	54.53
2	Leavenworth	35,857	2.29	1.62	0.67	6.92	32.43
3	Junction City	24,138	2.73	1.82	0.91	6.71	25.73
4	Hutchinson	42,357	2.27	1.56	0.71	6.19	59.47
5	Topeka	128,843	2.74	2.25	0.49	5.99	53.10
6	Kansas City	147,201	2.94	2.40	0.54	5.96	51.21
7	Great Bend	16,174	2.16	1.85	0.31	5.87	44.83
8	Newton	19,328	1.91	1.66	0.26	5.59	34.77
9	Hays	20,823	2.45	1.58	0.86	4.71	29.82
10	Garden City	27,017	3.41	2.18	1.22	4.26	28.28
11	Lawrence	89,180	2.06	1.69	0.37	4.15	44.82
12	Dodge City	28,064	2.17	1.60	0.57	3.60	37.52
13	Salina	48,155	2.22	1.58	0.64	3.34	48.86
14	Liberal	20,968	2.38	1.62	0.76	3.20	27.47
15	McPherson	13,249	2.72	2.26	0.45	2.42	44.53
16	Emporia	25,099	2.51	1.63	0.88	2.27	33.11
17	Gardner	19,532	1.43	1.28	0.15	1.79	17.56
18	Overland Park	177,085	1.62	1.36	0.27	1.61	23.03
19	Olathe	128,560	1.47	1.27	0.20	1.49	19.29
20	Shawnee	63,542	1.75	1.38	0.36	1.34	16.68
21	Lenexa	49,222	2.62	1.77	0.85	1.18	19.18
22	Derby	22,393	2.32	1.88	0.45	1.07	23.31
23	Prairie Village	21,906	2.69	2.10	0.59	0.59	11.09
24	Leawood	32,554	2.52	1.81	0.71	0.55	14.13
25	Pittsburg	20,380	2.89	1.96	0.93	0.00	0.00

Figure 3 - Ranked by Per Capita Violent Crime

Rank	City	Population	Total Full Time Police Employees	Sworn Employees	Non-Sworn Employees	Part 1 Violent Crimes per officer	Part 1 Property Crimes per officer
1	Wichita	386409	821	642	179	4.47	32.82
2	Leavenworth	35857	82	58	24	4.28	20.05
3	Hutchinson	42357	96	66	30	3.97	38.17
4	Junction City	24138	66	44	22	3.68	14.11
5	Newton	19328	37	32	5	3.38	21.00
6	Great Bend	16174	35	30	5	3.17	24.17
7	Hays	20823	51	33	18	2.97	18.82
8	Topeka	128843	353	290	63	2.66	23.59
9	Kansas City	147201	433	353	80	2.48	21.35
10	Lawrence	89180	184	151	33	2.45	26.47
11	Dodge City	28064	61	45	16	2.24	23.40
12	Salina	48155	107	76	31	2.12	30.96
13	Liberal	20968	50	34	16	1.97	16.94
14	Garden City	27017	92	59	33	1.95	12.95
15	Gardner	19532	28	25	3	1.40	13.72
16	Emporia*	25099	63	41	22	1.39	20.27
17	Overland Park*	177085	287	240	47	1.19	17.00
18	Olathe*	128560	189	163	26	1.17	15.21
19	McPherson	13249	36	30	6	1.07	19.67
20	Shawnee	63542	111	88	23	0.97	12.05
21	Lenexa	49222	129	87	42	0.67	10.85
22	Derby*	22393	52	42	10	0.57	12.43
23	Leawood	32554	82	59	23	0.31	7.80
24	Prairie Village	21906	59	46	13	0.28	5.28
25	Pittsburg	20380	59	40	19	0.00	0.00

Figure 4 - Ranked by Sworn Officer / Violent Crime

Rank	City	Population	Total Full Time Police Employees	Sworn Employees	Non-Sworn Employees	Part 1 Violent Crimes per officer	Part 1 Property Crimes per officer
1	Wichita	386409	821	642	179	4.47	32.82
2	Leavenworth	35857	82	58	24	4.28	20.05
3	Hutchinson	42357	96	66	30	3.97	38.17
4	Junction City	24138	66	44	22	3.68	14.11
5	Newton	19328	37	32	5	3.38	21.00
6	Great Bend	16174	35	30	5	3.17	24.17
7	Hays	20823	51	33	18	2.97	18.82
8	Topeka	128843	353	290	63	2.66	23.59
9	Kansas City	147201	433	353	80	2.48	21.35
10	Lawrence	89180	184	151	33	2.45	26.47
11	Dodge City	28064	61	45	16	2.24	23.40
12	Salina	48155	107	76	31	2.12	30.96
13	Liberal	20968	50	34	16	1.97	16.94
14	Garden City	27017	92	59	33	1.95	12.95
15	Gardner	19532	28	25	3	1.40	13.72
16	Emporia*	25099	63	41	22	1.39	20.27
17	Overland Park*	177085	287	240	47	1.19	17.00
18	Olathe*	128560	189	163	26	1.17	15.21
19	McPherson	13249	36	30	6	1.07	19.67
20	Shawnee	63542	111	88	23	0.97	12.05
21	Lenexa	49222	129	87	42	0.67	10.85
22	Derby*	22393	52	42	10	0.57	12.43
23	Leawood	32554	82	59	23	0.31	7.80
24	Prairie Village	21906	59	46	13	0.28	5.28
25	Pittsburg	20380	59	40	19	0.00	0.00

Figure 5 - Ranked by Full Time Employee / Violent Crime

Examining this data indicates the number of sworn officers in relationship to population and occurrence of crime is relatively low as compared to agencies in the area. This made the partnering agency a prime candidate for evaluation of how staff was fielded in the patrol division, and determine of there was a correlation to the number of officers and the city's high crime rate. Initially the researcher examined the manner in which officers were fielded and determine if pattern existed. Shift staffing cards were used to determine the mean fielded officers per year, and examine if there was a relationship to the number of reported cases. At the beginning of each shift, the supervisor completes a card documenting who is working, and what beat they are assigned to. If an officer leaves prior to completing 6 hours (1/2 of a shift) their position is to be removed from the card. This allows the mean number of officers per any given time period, per shift to be determined.

Agency Staffing Approach

The minimum staffing approach currently being used by the City Police Department is based on the presumed minimum officers being fielded to adequately respond to expected call volumes. This approach relies on Command Staff determining a set number of officers who will always be available to work on a given shift. If circumstances cause staffing to fall below this level, additional officers will be called in and paid at an overtime rate or transferred from another shift for a temporary duty assignment. The City Police Department Patrol Division is currently organized in the following manner.

The Patrol Division is commanded by a Lieutenant and comprised of 20 sworn personnel divided into four squads. Each squad is composed of three patrol officers and supervised by a Sergeant, assisted by a Corporal. Each squad is deployed for a 12-hour shift seven days out of each two-week (14-day) period, providing for 24 hour a day police coverage. Mean staffing numbers are drawn from the four squads, not inclusive of the Lieutenant.

Periodically a shift will be short staffed due to attrition, illness, injury, or the officer being off for training purposes. The varying staffing levels are categorized into one of three areas. In each area the breakdown of the number of officers is listed. Each breakdown addresses the percentage the shift is short, as well as the types of calls "experienced" and the number of each type of call, which can be responded to simultaneously.

Optimum Staffing:

This level indicates a Squad comprised of a full complement of officers: three patrol officers, a Corporal, and a Sergeant. When staffed at this level a Squad can respond to the following number of calls at one time:

1) 4 non-priority calls (minor reports which are not "In-progress"); or
2) 1-2 priority calls ("In-progress" criminal calls, or motor vehicle accidents); or
3) 1 major call (High level crime, Disturbance with multiple people, Severe Injury Accident)

Targeted Minimum Staffing:

This level indicates a squad when 20% short (one position). This level of staffing is not desirable during levels of high-anticipated call loads. When staffed at this level a Squad can respond to the following number of calls at one time:

1) 3 non-priority calls; or
2) 1 priority call + 1 non-priority call; or
3) 1 major call (Initial response - additional assets may be called in if needed)

Emergency Minimum Staffing:

This level indicates a squad when 40% short (two positions). This level of staffing is not desirable, and only to be employed when necessary. When staffed at this level a Squad can respond to the following number of calls at one time:

1) 2 non-priority calls; or
2) 1 priority call; or
3) 1 major call (Initial Response - additional assets will be needed immediately)

Figures 6 and 7 depict the percentages of time a shift has been staffed at each of the aforementioned levels by day shift (6:00 am – 6:00 pm) and night shift (6:00 pm – 6:00 am). Occurrences where the shifts were optimally staffed are color coded green. Occurrences where the shifts were able to meet the targeted minimum staffing are color coded yellow. Occurrences where the shifts were operating at emergency levels are color coded red.

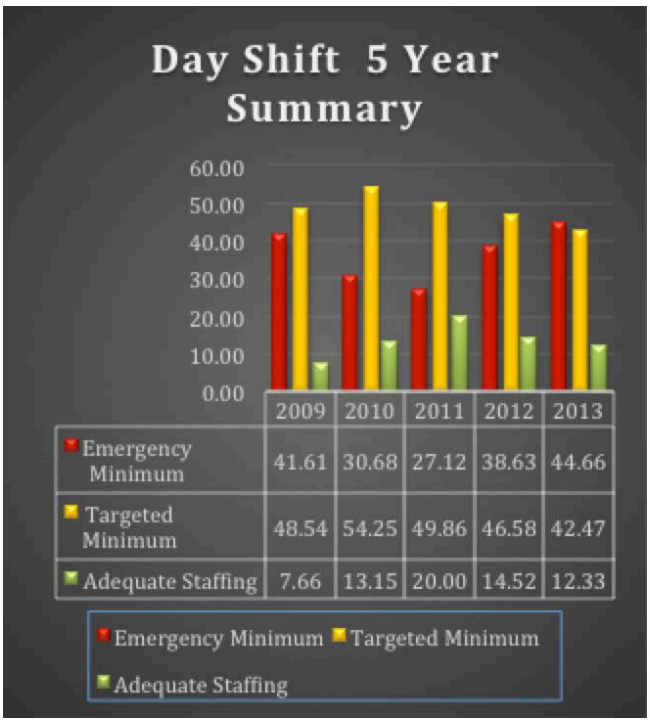

Figure 6 – Day Shift Staffing Summary

Figure 7 – Night Shift Staffing Summary

Shift Relief Factor

The challenges to adequately staff a given shift for the City Police Department is evident when we examine the amount of time an officer has to allocate to non-patrol activities. A common equation in the Human Resources field is the Shift Relief Factor. This is a method to determine the total number of employees required to guarantee sufficient employee levels to fill critical staffing requirements. The equation works by determining the number of shifts or shift length to be worked in a given year (hours x days). The number is then divided by the annual shift length, then subtracted by the number of hours an employee is expected to be unavailable for work. This will result in a number of employees needed to

guarantee each critical position is filled. Usually this results in one employee plus a fraction of an additional employee to cover unavailable time.

365 (days) x Shift Length / [365 x Shift Length – Total Time off (annually)]

An examination of the City Police Department Patrol Division time off needs resulted in the following values.

Each officer is required to attend a quarterly training session, which results in four 12-hour shifts being missed due to in-lieu of time. 48 hours x 20 patrol officers = 960 hours of time away from the shift.

Members of the Emergency Response Team train 12 hours a month and the members are required to take in-lieu of time away from their assigned shift. There are four members of the patrol division assigned to ERT. 12 hours x 12 months x 4 members = 576 hours of time away from the shift.

Officers who are assigned a K-9 partner receive one 12-hour training day per pay period (26 annually) and this time is on a scheduled workday, or in-lieu of time is taken from another shift. In addition, each K-9 handler has to attend an annual weeklong certification, which is also required to be time away from the shift. However, the additional 12 hour training day is part of this week. 12 hours x 25 pay periods x 2 officers = 600 hours. Training week = 42 hours x 2 officers = 84 hours. (Total K-9 training time, 684 hours away from the shift).

Officers earn vacation and sick leave time at differing rates per pay period. Sick leave is earned at 4 hours per pay period (26) for a total potential leave time of 104 hours*. Vacation time earned depends on an officer's seniority and ranges from 96 hours for a new officer to 156 hours for an officer with 15+ years of service. The average time in service for the Newton Police Department Patrol Division is 10.05 years, which would provide for 124 hours of vacation annually. (104 + 124 vacation hours x 20 officers = 4,560 hours).

In order to gain a representation of expected time an officer is away from their shift, the total hours of expected leave were divided by the total number of patrol officers. This was then added to the total number of hours away from work due to days off. The City Police Department works with four rotating 12-hour shifts. Each officer is off-duty an equal amount of time they are on duty. For each 14-day pay period, an officer is assigned to seven 12-hour shifts. No additional time off is given for holidays. (12 hours x 7 days in each 14 day pay period x 26 pay periods = 2,184 hours).

960 + 576 + 684 + 4,560 = 6,780 / 20 = 339 + 2,184 = 2,523 average hours an officer is expected to be away from an assigned shift.

365 x 12 hours / (365 x 12 hours – 2,523)
4,380 / 1,857
2.36 = 7.08 officers / shift

Figure 8 – Shift Relief Factor for 3 critical positions

This equation, as shown in figure 8, indicates the City Police Department would require 2.3 officers per critical staffing position to ensure proper personnel were available to fill these positions without relying on recalling officers from other shifts. The practice of recalling off

duty officers is not desirable as it poses risks due to the employee not having adequate sleep for a 12-hour shift and is also more taxing on the department's budget as the employee will be paid at an overtime rate.

The City Police Department has a stated minimum staffing of three officers for each of the 12-hour shifts. Using this equation a shift would have to be comprised of 7 officers (3 x 2.36 = 7.08 officers) to provide adequate staffing to ensure the critical positions were covered.

These numbers do not take into account the attrition and retraining time as discussed above. The City Police Department utilizes a linear promotion process to fill all open positions. The patrol division is the first step to other offices. Vacancies in other offices are filled through promotions from patrol; therefore we can safely assume any retirement or resignation will directly affect patrol staffing. The equation is preformed again considering one perpetually open position (figure 9) and with two perpetually open positions (figure 3.10). The results of these equations are shown below.

One Perpetual Open Position
365 x 12 / [365 x 12 – (2,523+219)]
4.380 / (4,380 – 2,742)
4,380 / 1,638
2.67 = 8.01 officers / shift

Figure 9 - Shift Relief Factor Equation for One Perpetual Open Position

Two Perpetual Open Positions
365 x 12 / [365 x 12 – (2,525+438)]
4.380 / (4,380 –2,961)
4,380 / 1,419
3.09 = 9.27 officers / shift

Figure 10 - Shift Relief Factor Equation for two perpetual open positions

Annual Cases:

The partner agency experienced a record number of reported crimes in 2013. While the frequency of reported crimes varies from year to year, a trend analysis indicates during the last 10 years the trend has steadily increased. A polynomial trend line demonstrates the agency was progressing toward a lowering of reported crimes until 2008 at which point the trend has shifted toward a sharp increase in reported crimes. Unfortunately staffing data is not available prior to 2009. It should be noted again that the numbers used in this study do not include cases generated by the Warrant /Bailiff as shift staffing levels do not affect the quantity of warrants served by the Warrant Officer.

Figure 11 - Annual Case Trend W/O Bailiff

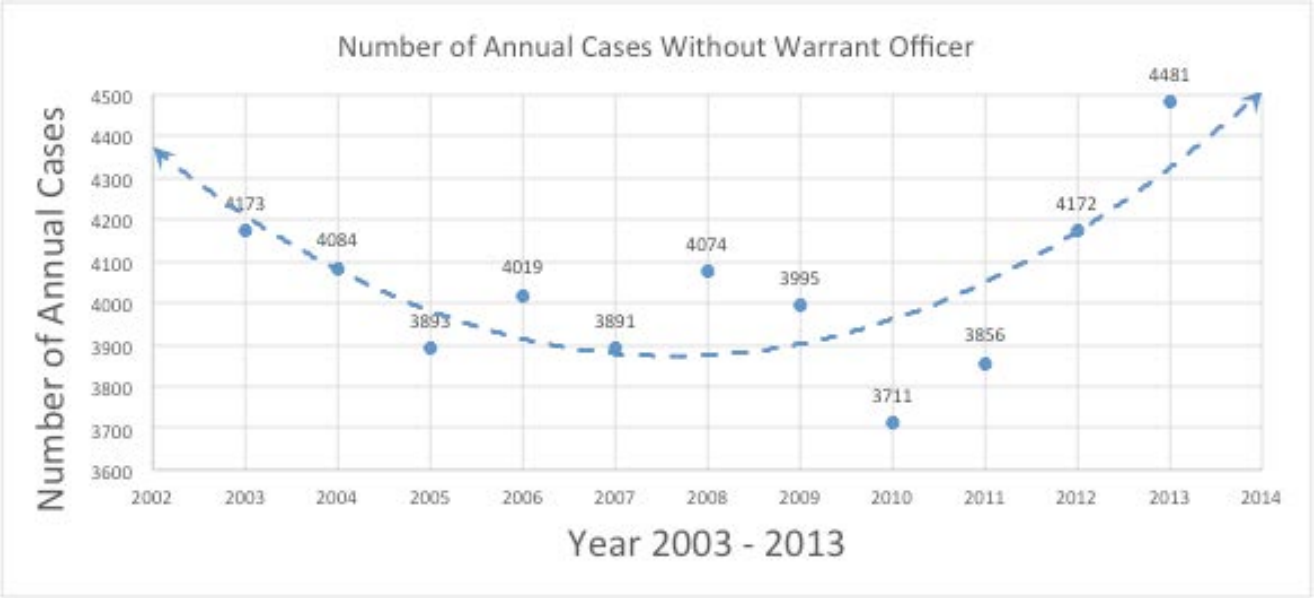

Figure 12 - Polynomial Trend Line for Reported Cases

The City Police Department has collected data with regard to staffing by shift since 2009. The average annual shift staffing level was determined first by finding the grand annual mean, and then compared with the reported caseload. (Figure 14) The two sets of values were analyzed utilizing the Pearson's Product-Moment Correlation Coefficient equation.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2]\,[n(\sum y^2) - (\sum y)^2]}}$$

Figure 13 - Pearson's Product R Equation

The above equation measures the relationship between two sets of variables. The measurement ranges from +1 (indicating a perfect positive correlation), through 0 (indicating no correlation), to -1(indicating a perfect negative correlation). When the average staffing level was determined for each of the last five years, then correlated with the reported crimes

yielded a coefficient of correlation of (-.8951), indicating a very high negative correlation (figure 15). We know over the last five years, when staffing decreases, reported cases increase. The two are strongly correlated. The next step was to determine the coefficient of determination (r^2), which yielded a result of (.8012), indicating 80.12% of the change in reported criminal cases can be explained by how the change in staffing affects it. This isn't to say this is a test of a causal relationship, but rather something about the variance of staffing is having a measurable effect on the reported occurrence of crime. The remaining fluctuation (19.88%) is due to other unrelated variables.

Newton Police Department Cases Assigned by Month														Total without Warrant Officer	
	January	February	March	April	May	June	July	August	September	October	November	December	Total	W/O	Total Patrol
2014	372	373	382	410	424	362	397	426	373	347	407	399	4672	277	4395
2013	345	337	429	372	381	442	382	391	397	469	385	460	4790	309	4481
2012	359	275	389	410	411	335	418	409	382	417	329	317	4451	279	4172
2011	349	332	355	363	325	379	390	404	357	354	341	287	4236	380	3856
2010	325	303	374	352	360	347	359	362	344	320	349	310	4105	394	3711
2009	389	342	333	412	350	387	378	390	402	382	314	335	4414	419	3995
2008	374	346	331	341	412	401	464	413	386	364	372	336	4540	467	4073
2007	366	342	357	344	373	371	464	380	419	393	315	340	4464	573	3891
2006	444	351	427	400	370	389	405	451	371	403	310	337	4658	639	4019
2005	277	318	333	337	348	385	348	409	399	401	394	374	4323	430	3893
2004	369	309	396	357	360	376	384	380	400	377	336	352	4396	312	4084
2003	300	311	374	380	384	424	405	414	372	389	354	359	4466	293	4173
Average	355.75	328.25	373.333	369.82	370.36	385.09	399.7273	400.27	384.454545	388.0909	345.363636	346.0909091	4440.273		

Figure 14 - Annual Department Case Load By Month

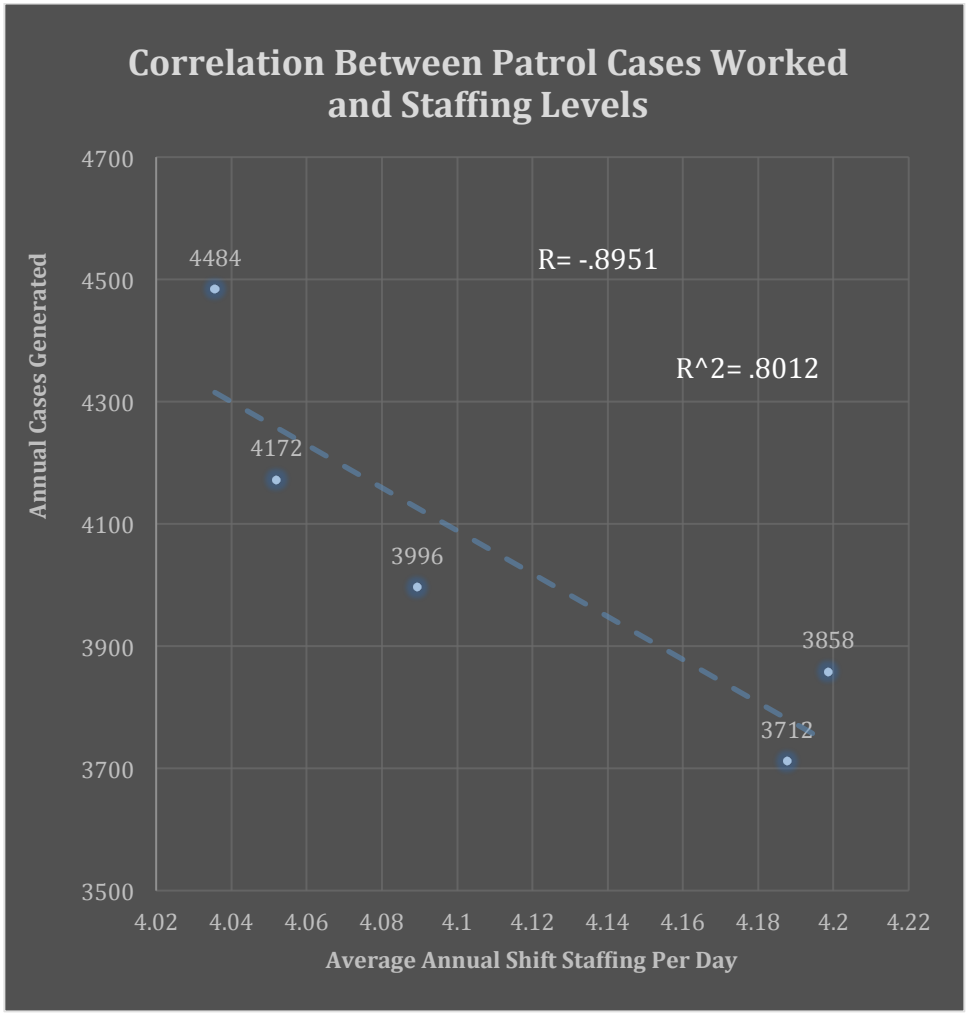

Figure 15 Regression Analysis Results

Lag Analysis:

While the analysis indicated a very high negative correlation for the 5 years being studied, there are some limitations to the value of this work. The sample size when analyzed by year is very small, and the time frame being calculated on a calendar year basis (January 1st – December 31st of each year) is also quite arbitrary. The analysis could have been completed April 1 –March 31st for example, and doing so may have uncovered offsetting outlying values in the dataset.

In order address these limitations, the data was parsed into monthly sections, and the corresponding mean value of staffed officers was determined. The timeframe of a month was selected based on the phenomenon of reporting delay. Victims may be delayed in the reporting of a crime, be unable to report it, or be unaware of their own victimization for several days, and may not be accurate with the reported time of occurrence. This makes any meaningful analysis of daily officer impact on crime impossible as there is too much variability from day to day to determine the effectiveness of the number of officer's fielded. The researcher however believes the amount of reporting delay from month to month to be less than significant, and consistent enough for this analysis. Because crimes are affected by seasonal changes, work schedules, school terms, etc. it is important to maintain a 12-month evaluation period. The months had to be consecutive to account for reporting delay from the previous month. Each month's reported number of crimes and mean number of officer's deployed were recorded and placed into a one month rotating lag. This method created "hypothetical years" of data, which were summed to create annual totals. If the presence of counteracting outliers in either caseload, or staffing had been present, their effect should be demonstrated with this lag analysis. The results of this analysis confirmed the correlation to a very high degree of significance (See figures 16, 17, and 18) The direct negative correlation can also be viewed by as a time series graph depicting the relationship between reported crimes and mean officer deployment in Figure 19.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.622549
R Square	0.387567
Adjusted R Square	0.376012
Standard Error	223.7459
Observations	55

alpha = .05

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1679093.107	1679093.107	33.54011703	3.88072E-07
Residual	53	2653298.275	50062.23161		
Total	54	4332391.382			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	11789.23	1333.123256	8.843317201	5.15942E-12	9115.325186	14463.13845	9115.325186	14463.13845
X Variable 1	-1872.75	323.3690593	-5.791382998	3.88072E-07	-2521.350268	-1224.157876	-2521.350268	-1224.157876

.0000754421120198

Figure 16 - EXCEL Summary Output

Model Summary and Parameter Estimates

Dependent Variable: VAR00001

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.388	33.540	1	53	.000	11789.232	-1872.754

The independent variable is VAR00002.

Figure 17 - Summary Output from SPSS

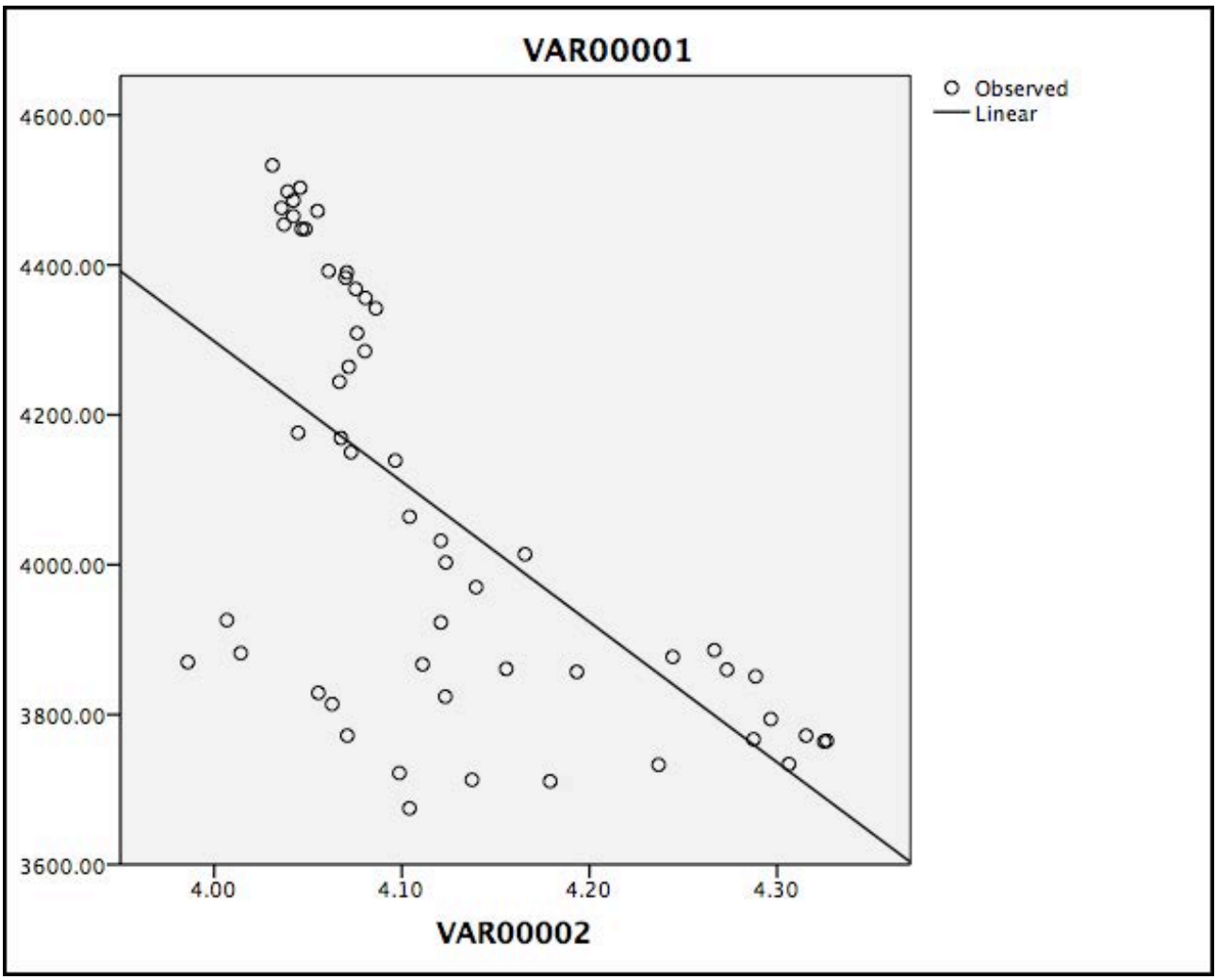

Figure 18 - Lagged Regression Analysis

Figure 19 - Granger Time Series Output

By utilizing the lag analysis method a moderate correlation of .6225 is still observed, with a coefficient of determination of .3875, and a significance level of .0000003872. The interpretation of this result would indicate to a very high level of certainty that approximately 38.76% of the variance in reported crime is directly affected by the change in fielded staffing levels.

While we know the previous data has shown a high negative correlation between fielded staffing levels and reported crime, we do not know which direction the causal relationship may run. Are the changes in crime rates a result in the variance of fielded staffing levels, or are staffing levels adjusted as a result of reported crimes? These two hypotheses were tested using a Granger Causality Test. This form of hypothesis testing evaluates data sets in a timeline to determine if one series is useful in predicting another. This method assumes if there is a cause / effect relationship, the cause has to precede the effect and should be measurable. Being cautious of the *Post Hoc Ergo Propter Hoc* fallacy, it must be noted this method is to determine predictive causality, and not true causality.

Granger Hypothesis 1 Testing

Null: Shift Staff Deployment rates do not granger cause an increase in annual police reports.

Alternate: Shift Staff Deployment rates do granger cause an increase in annual police reports

Off: Equals the annual per shift mean staffing level

CR: Equals the annual number of police reports generated by the patrol division.

Lag 2

```
> grangertest (Off~CR, order=2, data=M.Off.Shift)
Model 1: Off ~ Lags(Off, 1:2) + Lags(CR, 1:2)
Model 2: Off ~ Lags(Off, 1:2)
  Res.Df Df                F  Pr(>F)
1     48
2     50 -2 4.412   0.01742 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Lag 3

```
> grangertest (Off~CR, order=3, data=M.Off.Shift)
Granger causality test

Model 1: Off ~ Lags(Off, 1:3) + Lags(CR, 1:3)
Model 2: Off ~ Lags(Off, 1:3)
  Res.Df Df                F  Pr(>F)
1     45
2     48 -3 2.2991          0.09017 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Lag 4

```
> grangertest (Off~CR, order=4, data=M.Off.Shift)
Granger causality test

Model 1: Off ~ Lags(Off, 1:4) + Lags(CR, 1:4)
Model 2: Off ~ Lags(Off, 1:4)
  Res.Df Df                F  Pr(>F)
1     42
2     46 -4 2.8361          0.03606 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Lag 5

```
> grangertest (Off~CR, order=5, data=M.Off.Shift)
Granger causality test

Model 1: Off ~ Lags(Off, 1:5) + Lags(CR, 1:5)
Model 2: Off ~ Lags(Off, 1:5)
Res.Df Df                F  Pr(>F)
1     39
2     44 -5 2.8798          0.02628 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Granger Hypothesis 1 Test Conclusion:

The granger causality test data demonstrates Pr(>f) values of .01742 (Lag 2), .09017 (Lag 3), .03606 (Lag 4), and .02628 (Lag 5). We are able to reject the null hypothesis in Lag 2, Lag 4, and Lag 5. Exclusive of other external variables, we could conclude the per shift officer staffing level not only has an effect on police reports in the short term, as demonstrated in previous analysis, but also two, four, and 5 years removed.

Granger Hypothesis 2 Testing

Null: The number of annual police reports does not granger cause an increase in Shift Staff Deployment.

Alternate: The number of annual police reports does granger cause an increase in Shift Staff Deployment

Off: Equals the annual per shift mean staffing level

CR: Equals the annual number of police reports generated by the patrol division.

Lag 2

```
>  grangertest (CR~Off, order=2, data=M.Off.Shift)
Granger causality test

Model 1: CR ~ Lags(CR, 1:2) + Lags(Off, 1:2)
Model 2: CR ~ Lags(CR, 1:2)
  Res.Df Df              F Pr(>F)
1     48
2     50 -2 1.0579          0.3551
```

Lag 3

```
> grangertest (CR~Off, order=3, data=M.Off.Shift)
Granger causality test

Model 1: CR ~ Lags(CR, 1:3) + Lags(Off, 1:3)
Model 2: CR ~ Lags(CR, 1:3)
  Res.Df Df              F Pr(>F)
1     45
2     48 -3 0.7146          0.5485
```

Lag 4

```
> grangertest (CR~Off, order=4, data=M.Off.Shift)
Granger causality test

Model 1: CR ~ Lags(CR, 1:4) + Lags(Off, 1:4)
Model 2: CR ~ Lags(CR, 1:4)
  Res.Df Df              F Pr(>F)
1     42
2     46 -4 1.1728          0.3365
```

Lag 5

```
> grangertest (CR~Off, order=5, data=M.Off.Shift)
Granger causality test

Model 1: CR ~ Lags(CR, 1:5) + Lags(Off, 1:5)
Model 2: CR ~ Lags(CR, 1:5)
  Res.Df Df              F Pr(>F)
1     39
2     44 -5 0.9675          0.4495
```

Granger Hypothesis 2 Test Conclusion:

The granger causality test data demonstrates Pr(>f) values of .3551 (Lag 2), .5485 (Lag 3), .3365 (Lag 4), and .4495 (Lag 5). We are unable to reject the null hypothesis in any lag examined. Exclusive of other external variables, we could conclude the increase in annual police reports does not cause a change in per shift officer staffing levels.

Chapter 4

Research Conclusion and Recommendations

This research which focuses on shift deployment levels and their relationship to reported crime rates opens a new avenue for exploring the effectiveness of law enforcement staffing as it relates to crime prevention. Society has a vested interest in mitigating the effects of crime, in both quantifiable costs and qualifiable effects on victims. Considerable effort has been spent on identifying causative factors and developing actionable programs to reduce the occurrence of crime / victimization.

While arguments continue as to the most cost effective means to achieve this goal, several conclusions can be drawn from this case study. Previous methods used to compare the effectiveness of police staffing levels in relationship to reported crime rates made the assumption each agency utilizes sworn-officers vs. non-sworn staff in a similar fashion, and deploys sworn-officers in the field consistently. The error of this method is that it assigns a virtual crime prevention value per officer, which is overly generalized.

This study employed an original approach of evaluating reported crimes in relationship to actual fielded staff in a patrol division. It is the researcher's belief this method yields a more accurate measurement of the effectiveness of law enforcement intervention as a crime prevention measure. The results of this study would lead to the conclusion the

systemic understaffing of the city's patrol division has contributed to a significant portion of the increase in reported crime rates, and by extension an actionable method to reduce the number of reported crimes would be to employ and field staff in accordance with the shift relief factor findings.

The comparative analysis of medium to large agencies in the same state demonstrates a wide range of Sworn vs. Non-Sworn staffing utilization and highlights the need for a more universal measure of law enforcement impact with regard to crime rates. The municipal research partner was observed to have a very low number of both sworn and non-sworn staff per capita, and a high rate of violent crime by both sworn and non-sworn full time employees.

Upon evaluating the agency structure with regard to the patrol division per shift staffing needs, and contrasting those needs to actual deployment rates we were able to determine a significant failure to routinely meet this need. If those who support the notion of the Punitive Justice System's reliance on severity of punishment being a plausible crime control model, the variability of fielded staff would have minimal effect on the rate at which crimes are reported. An analysis of the grand mean fielded staff levels for each year and how it relates to the reported crime rate was conducted and a high level of correlation (.8951) was found. This correlation informed us that during periods when the agency fields the lowest number of staff, the number of reported criminal cases tends to be higher, and as the percentages of fielded staff increase, the number of reported criminal cases declines. This finding is contrary to the notion of increasing criminal report rates due to more officers

detecting more crimes. (Wornall &Kovandzic 2010; Swimmer 1974). The case study found a very significant increase in reported crime as less officers were available.

A rotational lag analysis was employed to control for small sample size and hidden contrasting outliers. The resulting 55 years of hypothetical sample data was analyzed using a regression analysis and found to have a moderate correlation .6225, with a coefficient of determination of .3875. This analysis would indicate that approximately 38.75% of the variability of crime and victimization from the sample low, to the sample high was directly attributable to the fielding of sworn-officers to an extremely high significance at a rate of .00000038872. The T-statistic of 8.84331721 indicates

Prior to the conclusion that fielded staffing rates were the driving factor of the change in reported crimes, a causal relationship in the other direction had to be ruled out. A two way Granger causality test was performed which indicated findings to support the causal relationship of variance in fielded staff influencing reported crime rates, but did not support the variance in reported crime rates influencing the number of fielded staff. When evaluating predictive causation with regard to fielded staffing rates and their effect on reported crimes, the granger causality test data demonstrates Pr(>f) values below the .05 threshold in three of the four years [.01742 (Lag 2), .09017 (Lag 3), .03606 (Lag 4), and .02628 (Lag 5)]. The reverse analysis was performed to rule out a predictive causal relationship in the other direction and the Pr(>f) values were found to be will in excess of the .05 threshold and consisted of [.3551 (Lag 2), .5485 (Lag 3), .3365 (Lag 4), and .4495 (Lag 5)].

Several methods have been used to evaluate the data derived from this case study. The results from each method are consistent with one another. The various methods to evaluate the data all indicate that a large portion of the increase in reported crimes has been a result of a decreased number of officers fielded during daily patrol shifts. As previously mentioned Guffey (2009) determined police officer rates of 20 or fewer per 10,000 citizens spread officers too thin. Rates above 40 officers per 10,000 citizens appeared to be inefficient, and rates of 50+ officers per 10,000 citizens were clearly inefficient as crime rates did not drop in relation to the increased officers. Guffey determined the optimum ratio of officers to citizens was in the range of 30-40 officers per 10,000 citizens. These figures indicate the City Police Department is staffed well below the level indicated by Guffey as "spreading officers too thin". The authorized size of the agency during the time of this data collection was 32 Sworn and 6 non-sworn full time positions. In order to attain the "efficient" ratio, The City Police Department would require a police staff of 60-80 officers. The current study supports these findings, and it appears if the agency were to increase the quantity of it's patrol staff allowing for a higher number of fielded officers over a long enough period of time, the result should be a lowering of reported crimes.

While the results of this study are significant, and may show a new path for the evaluation of law enforcement staffing as a crime control measure, there are limiting factors, which should be considered. The information from this case study is a snapshot in time based on a single agency's data. This agency has it's own internal policing culture, and serves a community with an equally unique need and level of social services in place. While random sampling typically shows underreporting of allocated time, the analysis does rely on

numerous individual officers tracking daily activity over several years, and therefore could suffer from measurement errors.

Further research into this area by utilizing data from other jurisdictions should be performed. While this study indicates significant results for the area studied, at this time findings should not be viewed as applicable to the population as a whole. This project does define a process for future studies, and could indicate the usefulness of applying a micro-sociological approach to determine the effectiveness of varied staffing levels on reported crime rates in specified regions.

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