MATHEMATICAL METHODS IN THE SOCIAL SCIENCES
HOUSTON TEXAS POLICE DEPARTMENT PROJECT ON OFFICER-INVOLVED SHOOTING

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Executive Summary

The overall goal of this research was to investigate Officer-Involved Shooting (OIS) incidents relevant to the Houston Police Department, and the relationships between its likelihood and pre-scene and on-scene factors, as well as relationships amongst the factors. The primary goal of the study was to mine data and identify significant pre-scene and on-scene factors that substantially affected the likelihood of Officer-Involved Shooting incidents. The secondary goal of this study was to identify factors that meaningfully impacted the significant on-scene factors, in particular ones related to officer's behavior prior to gun use, that were highly correlated with likelihood of Officer-Involved Shooting. The study's third goal was to focus on investigating specific relationships amongst selected pre-scene and on-scene factors, as well as between these factors and likelihood of Officer-Involved Shooting incidents. For example, the team found that junior officers were more likely to find themselves in use-of-force situations, but were also seemingly more likely to use the CED instead. This might be a result of junior officers assimilating better with CED, which is a relatively newer technology. The treatment group included 195 incidents that escalated into Officer-Involved Shooting incidents, while the control group included 108 incidents where firearm use was also permitted, but did not escalate into Officer-Involved Shooting incidents. Specifically, in these incidents within the control group, officers chose to use Conducted Energy Devices (CEDs) or Tasers instead.

Over the course of six months, the team performed extensive data mining and collating, leading to a data set with 303 observations, and 269 variables. In the primary analysis, the team was able to identify several meaningful relationships between pre-scene and on-scene variables and likelihood of Officer-Involved Shooting incidents. To achieve the secondary goal, the team isolated significant on-scene factors and analyzed their relationships with pre-scene and preceding on-scene factors. Last but not least, the team ran focused regressions for selected pre-scene and on-scene

factors and data points and learnt about specific relationships of interest. The key takeaways are as follows:

Primary Analysis

- Officers responding to Critical Incident Training (CIT)-designated situations were 82 percent less likely to use their guns as compare to non-CIT situations
- Officers approaching with gun drawn were 37.0 percent more likely to use their guns than when approaching without gun drawn
- When officers knew that the suspect had a weapon, they were 19.6 percent more likely to use a gun than when they did not know that suspect had a weapon. However, if these officers also knew that the suspect's weapon was a knife, they were 46.6 percent less likely to use a gun than when they knew the suspect had a weapon, but did not know it was a knife.
- Cases with one officer unit, including cases where backup was expected, were 23.9 percent more likely than two or more officer units to result in Officer-Involved Shooting
- Giving verbal commands resulted in a 10.1 percent decrease in likelihood of Officer-Involved Shooting as compared to not giving verbal command, except in cases where officers communicated with suspects, in which case it had no effect
- Incidents involving vehicles were 17.9 percent more likely to result in Officer-Involved Shooting than incidents not involving vehicles
- Suspects displaying aggressive stance (including pointing weapon at officers or others), and using weapon increased the likelihood of Officer-Involved Shooting by 35.1 percent and 22.4 percent, as compared to when suspect did not display aggressive stance and did not use weapon respectively

- Incidents in the Spring and Summer were 12.8 percent and 12.0 percent more likely respectively to escalate into Officer-Involved Shooting incidents respectively, as compared to Fall incidents; Winter incidents were not significantly different from Fall incidents

Secondary Analysis

- Cases where officers knew beforehand about a vehicle pursuit were 49.3 percent more likely to involve officer approaching with gun drawn as compared to cases where officers did not know beforehand about a vehicle pursuit
- Cases involving traffic stops were 46.7 percent more likely to involve officer approaching with gun drawn as compared to those not involving traffic stops
- Cases where officers knew the suspect had a weapon were 24.8 percent more likely to involve officer approaching with gun drawn as compared to those where officers did not know suspect had a weapon
- Burglary and disturbance crimes were 34.7 percent and 32.8 percent more likely to involve officer approaching with gun drawn respectively, while evade and resist arrest crimes were 44.0 percent less likely to involve officer approaching with gun drawn, in comparison to other types of crimes, i.e. assist officer, barricaded suspect, and warrants, that were not significant
- Initial encounters with officer issuing tickets, interviewing suspects, and suspect initiating encounter were 57.7 percent, 49.7 percent, 49.2 percent less likely to involve officers approaching with gun drawn, in comparison to other insignificant miscellaneous initial encounters

- Assault crimes were 55.5 percent less likely to involve officers giving verbal commands as compared to other insignificant types of crime, such as barricaded suspect, and stolen vehicle.
- Self-initiated incidents were 44.0 percent less likely to involve officers giving verbal commands as compared to dispatch incidents
- For each extra year of service in the force, officers would be 0.5 percent more likely to give verbal commands
- When cover was possible for suspects, officers were 14.9 percent more likely to give verbal commands than when cover was not possible
- Incidents with building searches were 7.2 percent more likely to involve officers giving verbal commands as compared to insignificant miscellaneous initial encounters

Focus Analysis

- More senior officers, specifically with seniority of more than five years, were 22.7 percent more likely than junior officers (seniority of less than five years) to shoot when they approach with gun drawn
- "Get out of the vehicle" resulted in 38.5 percent increase in OIS as compared to not giving command "Get out of the vehicle" in likelihood of suspect attacking officer
- "Drop the weapon" resulted in 20.1 percent decrease in OIS as compared to not giving command "Drop the weapon" in likelihood of suspect attacking officer
- When concealment was possible for officer, the likelihood of suspect attacking officer decreased by 40.5 percent as compared to when concealment was not possible for officer

- An increase in average priority number for previous calls for service decreased the likelihood of OIS by 3.9 percent (per unit increase), when restricting the regression to only officers on duty

Chapter 1: Introduction

Officer-Involved Shooting (OIS) incidents are one of the most scrutinized parts of any police officer's career. This paper will look at these incidents through the lens of an econometrician to help improve use of deadly force policy. The hope with this project is to provide an analysis of these types of OIS cases, along with cases in which an officer used a TASER Conducted Energy Devices (CED), for the Houston Police Department (HPD).

OIS incidents, while infrequent, are troubling to any police department because of the obvious human danger, the inevitable ensuing public critique, and the possible costly litigation. There have been multiple studies carried out in the name of detecting how dangerous these events are, how damaging they are for the public trust of a police department, and the amount of taxpayer dollars that are spent on lawyer fees and financial penalties. This project hopes to identify any predetermining factors that can influence an officer's decisions to shoot or not to shoot. It will explore officer characteristics that make an officer more or less likely to shoot. The actionable results would indicate whether test scores, previous exposure to stressful calls, or other factors could determine the probability of an officer-involved shooting, hoping to positively shape the department's requirements, training, and policies.

The report contains a statistical profiling of every closed HPD OIS case from 2005-2013, which amounts to 205 investigative files. In comparison, the analysis will examine 114 CED cases in which an officer could have fired his or her gun under HPD use of force policy, but did not. The HPD has provided multiple questions and key concerns for the thesis team to address in its research. Actionable research is a key theme within these questions, hopefully leading to meaningful results for the HPD. These questions are:

- What was the officer's call history for that shift prior to being involved in the shooting incident?
- What type of information about the event did the officer have before arriving at the location?
- What type of verbal exchanges (if any) occurred between the officer and the suspect who was shot at?
- How did the issue of "cover and concealment" affect the status of the scene?
- What physical actions were taken by the suspect prior to the discharge of the officer's firearm?
- What reactions did the officer take in response to the suspect's actions?
- What type of tactical training did each officer have prior to being involved in the shooting incident?
- What was the qualification status for the last five years prior to the officer's involvement in the shooting incident?

The Houston Police Department has provided the research team detailed reports on all of these OIS cases, along with the 114 CED cases, and the analysts have used statistical methods to find any meaningful patterns within the data. The thesis team worked with the entire population of OIS and CED data, but with a selective focus on only the largest sets of patterns. Also provided with the case reports are the 24-hour call history for each involved officer leading up to an OIS event, and the overall class standing of an officer within his or her graduating class. These data, compiled with the OIS reports, allowed the team to analyze what precursors to the shootings, if any, result in a statistically significant number of OIS or CED cases. Specifically, the HPD is interested if there are determining factors previous to situations with police

involvement that, given similar protocol, will influence the decisions officers make in an OIS. These components could include the time, manner and setting of officer involvement and escalation to use of deadly force. Also, the paper will examine the decision to use deadly force (i.e. firearms) instead of less than lethal force, and if there are physical and cognitive factors outside of an immediate situation that would correlate with different actions from officers. With the results, the Houston Police Department will be able to critically examine rules surrounding their use of force policy, and make alterations that will ultimately save lives.

The thesis team has also spent the past year gleaning background knowledge on Officer-Involved Shootings, to gain a basis for understanding the legal framework pertaining to these types of incidents. The Houston Police Department helped the thesis team prepare even further by imparting their use of deadly force policy, and by allowing the members of the team to undergo use of deadly force simulation training. After the simulation, the training officers asked some simple questions about the scene of the shooting, and it was evident how duress can blur one's perception. This may be one of the reasons the Portland [OR] Police Bureau initiated contemporaneous interviews after investigating OIS policy, and finding that over time, accidental and deliberate contamination of the account will taint the integrity of interviews (Police Assessment Resource Center, 2003). The Houston Police Department wishes to shed an alternative light on OIS incidents, combating the common mainstream stories that accentuate police blunders, because it knows how stressful it is for an officer involved in such a dangerous scenario. The investigations into shootings are handled seriously, and police departments often devote a full investigative team to a shooting incident (Trompetter et al. 2011).

While previous OIS reports for cities exist, different cities face different circumstances and challenges. Through this research, the thesis team hopes to find actionable results that will

lead to lower numbers of OIS cases in Houston and translatable results for other cities. This report could potentially be shared widely with contacts in other police departments, providing relevant information that affects use-of-force training and protocols. Hopefully, the enhancement of policy behind the use of deadly force could have practical effects in the near future, leading to increased safety of both officers and suspects during these potentially fatal encounters.

Chapter 2: Literature Review

In conducting the literature review, the team found that a large amount of academic articles and journal articles have been written about Officer-Involved Shooting incidents and CED incidents. Amongst the documentation, one fact stood out: the tremendous significance and impact that use of deadly force incidents have on the police department, both for the morale of the officers involved, and the public image of the organization. Hence, it is imperative that police department seek to reduce such incidents.

The best way to reduce OIS and CED incidents is to understand their characteristics. These characteristics can be divided into pre-scene and on-scene categories. An example of a pre-scene factor is officer characteristics, while an example of an on-scene cause is the number of officers on scene. The extensive literature on OIS and CED use have uncovered most of these characteristics and allowed the team to understand their relationships with the likelihood of gun or CED use. However, there is a need for this study because there is a lack of study on the effects of pre-scene conditions on both the probability of gun use and the likely on-scene causes of gun use. Second, the conditions for HPD OIS and CED cases could be different from that of other police departments, and hence to better understand the significant reasons for gun use in the HPD, there is a need to conduct this study within the context of HPD conditions.

Officer-Involved Shootings

A previous study by the Las Vegas Metropolitan Police Department confirmed the hazardous nature of OIS incidents, finding that 47 percent of the time they resulted in fatalities for either the officer or the suspect (Stewart, James, Fachner, King, and Rickman 2012). Reducing injuries and fatalities is the number one concern with use of deadly force policy that all

Houston policemen learn, amongst other externalities that accompany the improvement of policy.

Furthermore, the court cases that typically follow OIS incidents result in litigation fees and settlements, which hurt the pockets of the police department, and ultimately taxpayers. Cutting down the number of OIS cases within a police department could possibly save millions of taxpayer dollars. The direct and indirect costs associated with these types of lengthy lawsuits cut deep into the publicly funded municipal budget.

The most notable of these cases was *Tennessee vs. Garner*, in which the U.S. Supreme Court ruled in favor of the plaintiff, whose son was fleeing the police, but not putting others, including the officer, in immediate danger (1985). The officer named in the civil suit had shot 15 year old Edward Garner as he fled from the scene of a burglary; even though the officer was relatively sure Garner was unarmed. Garner was found to have been stealing ten dollars and a purse from the house, and was climbing a fence when shot in the back of the head. On appeal, the court ruled that an officer killing a fleeing victim is unconstitutional. The impact of the *Tennessee vs. Garner* case was profound and significantly redefined the boundaries within which police may use deadly force. This redefinition and impact could also be seen in the HPD Use of Force policy issued on January 4, 2008, where an officer is prohibited from "fir[ing] at fleeing suspects who do not represent an imminent threat to life of the officer or another".

The frequency of OIS incidents also affects something that is much harder to quantify: the public's trust in their police department. In a 2012 survey of residents of Portland, Oregon, the Criminal Justice Policy Research Institute found that 25 percent of citizens grossly overestimated the number of Officer-Involved Shootings during the previous year, and less than 1 percent of the population estimated the five-year trend of OIS incidents commensurate with the

data (Stewart et al. 2012). With the pervasiveness of surveillance cameras and camera phones, the gravity of these OIS incidents can turn a city against its police department with a simple out-of-context 10-second clip. The best way to avoid these potential viral episodes of public outcry is to limit the number of Officer-Involved Shootings.

Much research has been conducted on the traumatic effects that Officer-Involved Shootings have on police officers' emotional states. For example, Thomas J. Aveni declares that "the nature of police shootings elicits considerable emotion, as well as ample [doses] of misinformation" (Aveni, 2003, p. 1). Indeed, due to this reason, officers involved in gun use are usually required to take a break from field work until declared emotionally ready for field deployment.

On the other hand, literature review has revealed that little or no study has thoroughly examined the inverse relationship: the effects of officers' emotional states in influencing Officer-Involved Shootings. While on-scene conditions directly affect the likelihood of gun use, it is worth studying the impact of pre-scene conditions, such as officers' emotional states, as well because they also play a role in determining the context and the scene leading up to the eventual gun use.

A fair amount of empirical analysis has been conducted over the past decade on police use of force. The most important characteristics can be categorized into three areas, with the first being suspect characteristics, which are most frequently studied. Under this category, race and ethnicity have drawn the most attention. However, most studies have shown that race and ethnicity do not place an important role in determining whether an officer used force. For example, "Engel et al. (2000) estimated nine models and race/ethnicity was not statistically significant in any of the analyses. Similarly, Phillips and Smith's (2000) findings of no

race/ethnicity effect were consistent across two models" (Klahm & Tillyer, 2010, p. 218). At the same time, some mixed reports have found evidence that race does matter in certain situations. For example, Garner et. al. found that African Americans were more likely to be subjected to use of force by officers in situations of compliance. Yet, race and ethnicity did not play a significant role in situations of resistance (Garner et al., 2002).

Other mixed studies have found that suspect race and ethnicity become statistically insignificant once neighborhood context is factored into the regression (Terrill, W., & Reisig, 2003). Their work builds on Werthman and Piliavin's (1967) ecological contamination hypothesis, which states that officers tend to associate certain geographical areas as bad neighborhoods from past experiences. Terrill and Reisig (2003) predict that since most suspects are likely to live in high crime neighborhoods, they are more likely to be victims of contextual distortions, and experience a greater use of force. Another perspective to this issue is that it may be possible that some suspects experience harsher treatment not because police are racially biased but because these neighborhoods appear more threatening. Finally, other studies have found a clear racial bias in whether to shoot or not. In their studies, Correll, Park, Judd, and Wittenbrink conducted video simulation of OIS incidents and found a "clear disposition to shoot black targets more readily than whites" (Correll, Park, Judd, Wittenbrink, p. 1115, 2007). In terms of gender, most research demonstrates that male suspects have a higher chance of experiencing use of force against them. For age, though most reports indicate that older suspects experience a lower use of force, there are mixed reports that show that "being older only reduced the likelihood of physical force when the encounter involved a female officer" (Klahm & Tillyer, 2010). The other important factors are demeanor, social class, and intoxication. In a video simulation study (Aveni, 2008), the researcher found that police are more likely to shoot when

the suspect is younger. In terms of dress, the officer was less likely to shoot when the suspect was in business clothes as opposed to "punk dress" or street clothes such as hooded sweatshirts, blue jeans, or leather jackets.

The second category is encounter characteristics, which are not directly linked to the suspect. The crucial factors are presence of weapon, proactive contact on officer's part, resistance, whether an arrest is made, presence of other officers or citizens, and conflict. Michael D. White studied shootings of armed suspects during two different periods in Philadelphia, 1970-1978 and 1987-1992, and found that three variables persisted as significant situational predictors of an OIS incident: an officer responding to a call about a man with a gun, an incident involving a robbery, and an officer searching the scene or approaching the suspect. Not surprisingly, White found that it was increasingly likely that an officer used deadly force when he knew the suspect also had the ability to use deadly force prior to the confrontation. White did conclude that once an officer engaged the suspect, the probability of deadly force decreased, presumably as the officer could talk the suspect down or the suspect lost his confidence in an escape. In the later time period, White found that an OIS was more likely to take place if the incident was officer initiated instead of an officer responding to a radio call (White, 2002).

Aveni's simulated OIS study (2008) also studied how a suspects' reaction to the officer's verbal command affected the decision of an officer to use deadly force. He applied an acting quotient to the reactions of all the actor suspects in the simulated crime scenes, which served as a score based on how threatening their movements were. The actors were also given three reactions to the officer's command: shoot, surrender with object in hand, and surrender without object in hand. This object could be a gun, a flashlight, a cell phone, or a wallet. He found that officers were more likely to shoot in scenarios in which the suspect had a higher acting quotient,

i.e. more threatening movements, than a lower acting quotient. Aveni also showed that officers are more likely to shoot if the suspect's reaction is shoot than if the suspects reaction is surrender, but also more likely to shoot if the suspect's reaction is surrender without object in hand than surrender with object in hand (Aveni, 2008). Part of this phenomenon can be attributed to the high acting quotient of the suspect in these ambiguously unarmed scenarios. Aveni concluded that in these scenarios the officer decided to shoot before the suspect surrendered with empty hands, and the reaction to seeing the open palms of the suspect is, naturally, too slow to stop the trigger finger.

The last category is officer characteristics, which are increasingly receiving more attention. The most significant factors are race/ethnicity, gender, age, experience, training (specifically officers' exposure to counter-stereotypical information), and education. While some studies have shown that officer characteristics have no effect on the likelihood of an OIS (Aveni, 2008), others have found varying results. Officer characteristics such as age, sex, education, race, and previous shootings were found to be deterministic of OIS events in one study (McElvain et al, 2008). McElvain et al (2008) used a multivariate analysis to prove that younger police officers were more likely to be involved in a shooting than older officers, male officers more likely than female officers, non-college educated more likely than college educated, white officers more likely than Hispanic officers, Hispanic officers as likely as African American officers, and in particular, officers who were previously involved in an OIS much more likely to shoot than officers not previously involved. McElvain et al warned that some of these results might not be due to the proneness to shoot of the officer, but the probability that officers with those characteristics are more likely to be on duty in more dangerous neighborhoods. For example, officers with higher seniority, and thus likely older, may have the opportunity to

choose assignments in more quiet neighborhoods, leaving the most junior officers to work the most crime ridden areas. This does not necessarily mean that if the more senior officers were working the more dangerous assignments that they would not be just as prone to use deadly force.

Contrary to the previous example, in terms of race, other reports have consistently found that race "did not influence the likelihood of an officer using a verbal command, physical restraint, chemical spray, non-lethal weapon, or firearm" (Klahm & Tillyer, 2010). Indeed, through an extensive compilation and summarization of current findings, Klahm and Tillyer came to the conclusion that few characteristics of the suspect, encounter, and officer are significant in influencing use of force by law enforcers. Most studies find mixed results for most characteristics that are often inconclusive. However, Correll, Park, Judd and Wittenbrink (2007) found that training and exposure to counter-stereotypical information, especially about African-American citizens, have a significant influence in reducing racial bias in shooting simulations.

Tasers/Conducted Energy Devices

Since this project will also include analysis of cases in which officers used Conducted Energy Devices (CED), even though the use of deadly force was justified, it is important to examine literature relevant to police use of CEDs. Research into the use of CEDs, while a much newer topic in police work than OIS, has gained considerable depth over the last couple of decades. While guns have played a large role in the American police presence for many decades, CEDs have much more recently entered law enforcement arsenals. Departments began expanding the use of CEDs in the early 2000s with the development of the M26 and X26 models from Taser International, which provided compact handheld units capable of delivering

temporarily debilitating electrical current to suspects (Cronin and Ederheimer, 2006). "Many law enforcement leaders touted the devices, citing them as an effective less-lethal option" (Cronin and Ederheimer, p.3). Therefore, much of the initial focus by researchers has been on measuring immediate safety outcomes for officers and citizens upon the introduction of CEDs by a department.

One study compared injury outcomes for officers and suspects across a cohort of police departments that had introduced CEDs against a group of departments matched in key factors, such as size and crime rates, but did not provide officers with CEDs. There was observable negative correlation between the introduction of CEDs and nonfatal injuries for officers and suspects. These findings contributed to the stated view that "CEDs … allow officers to control suspects from a distance without engaging in the hand-to-hand struggles that typically cause injuries (Taylor et al. p.69).

Another study compared injury outcomes from the Taser M26 to other non-lethal weapon options available to police and found "the Taser M26 carries a lower injury rate to officers and subjects than both empty-handed physical skills, CS spray and batons" (Jenkinson, Neeson and Bleetman 2006). Some research suggests that these improved safety outcomes are only observed in certain instances though. Paoline, Terrill and Ingram asserted that CED use correlates with lower injury risk only compared to hand-to-hand confrontations. In fact, they found that when the CED is used in tandem with another weapon there is a much higher probability of injury to the officer (Paoline, Terrill, Ingram, 2012).

Unfortunately, these studies have not included much inquiry into an individual officer's decision to use a CED over a firearm, which would be of interest since this project will examine cases where use of either would be justified.

Additionally, a significant area of research on CEDs regards the health effects of a CED on its target. The literature indicates that a large majority of citizens hit with CEDs suffer minor or no lasting injury. Over 99 percent of the recorded uses by police in a 2009 study held to this standard (Bozeman, 2009). However, a relatively small number of serious injuries and fatalities have occurred following CED usage, garnering academic attention. Much of that attention has come as a result of work by human rights groups. A 2006 study by Amnesty International reported the circumstances of 152 deaths linked to application of CED (Amnesty International, 2006). The report found many instances of multiple shocks from CEDs that (according to the report) contributed to a state of "Excited Delirium" that was instrumental in the related deaths. This state of "excited delirium" is often associated with drug use or mental illness, which also played a contributing role in a large number of the deaths. More recent estimates place the number of CED-related deaths in the United States at over 500 since 2001 (Trimel, 2012).

In summary, the foundations of use-of-force dynamics have been laid down by Supreme Court cases like *Tennessee v. Garner*. While there is inadequate academic material regarding factors leading to Officer-Involved Shooting cases, there is extensive research into factors at the scene like officer and suspect characteristics, as well as encounter characteristics. The field of CED research is growing quickly and much attention is being paid to variability in officer and suspect injuries while using CEDs in police work.

Chapter 3: Use of Force Policy

All Houston police officers are expected to abide by the Use of Force policies. The two policies of interests, being those currently in use by HPD, are the "Use of Force" policy issued on January 4, 2008 and "Conducted Energy Devices" policy issued on October 10, 2012.[1] The former describes policies and boundaries regarding general use of force, including use of deadly force like fire arm, while the latter describes policies and boundaries regarding use of CED. Public influences, such as lawsuits and interest parties, have tremendous impact in shaping the police use of force policy. For example, the *Tennessee vs. Garner* case mentioned above has affected policy about use of deadly force. Specifically, officers are not to fire at fleeing suspects who do not represent an imminent threat to life of the officer or another, amongst other use of force guidelines.

One would expect the requirements for firearm use to be more stringent than CED use, i.e. the requirements for CED use should be a subset of the requirements for firearm use. In this chapter, instead of summarizing the specific policies for firearm use and CED use separately, the team presents them in two categories: similarities and differences.

The main similarities in requirements are:

- Before carrying or using a CED or firearm, officer must have current model-specific certification.
- Give a warning to suspect prior to activating CED or firing gun, unless doing so would place others at risk.
- Shall not display CED or firearm in an unprofessional or unsafe manner.
- Constantly assess the situation and adjust use of force accordingly.

[1] Some of the cases included fall before these policies were issued, but the relevant information of the policies was largely unchanged within the context of the project.

- Unless exigent circumstances exist, CED or firearm should not be used:
    - Just to protect property against destruction or damage
    - Against passively resisting subjects
    - Against handcuffed subjects
    - Against subjects known to be mentally ill
    - Against pregnant subjects, elderly, or visibly frail subjects, or on young children
    - If fleeing is sole justification for use
    - On a subject who is in a location where a fall may cause substantial injury or death
    - Against a subject who is only verbally non-compliant
- Not to be discharged from moving vehicle or at moving vehicle or its occupants.
- Notify dispatcher immediately after CED or firearm discharge, including accidental discharge. And write detailed report.

The main differences in requirements are:

- Use of firearm is limited to circumstances in which officers reasonably believe it is necessary to protect themselves or others from imminent threat of serious bodily injury or death; CED use does not require this more stringent requirement.
- No more than one officer activating CED against a suspect at a time; gun use policy does not restrict number of officers firing at suspect to only one.
- Duty to seek cover when confronted with possibility of injury from moving or fleeing vehicle; make every effort to safely remove themselves from path of the vehicle and reassess the threat before firing gun; the officer may fire at the vehicle only if evasive

maneuvers by the officer or another person is impossible. In contrast, CED use on vehicle is prohibited.

Further, the team noted that the firearm use of force policy is written in a more detailed manner, with efforts made to point out the subtle differences in use of deadly force such as a firearm and use of non-deadly force such as CED. For example, an additional requirement for use of deadly force is that it is "limited to circumstances in which officers reasonably believe it is necessary to protect themselves or others from imminent threat of serious bodily injury or death", which is not present in CED use of force policy. In addition, while both use of force policies specify the need to constantly reassess the situation before and after each weapon deployment, the firearm use of force policy emphasizes such a need more. For example, it places the requirement for officers to "constantly assess the situation and adjust use of force accordingly" at the start of the policy, as opposed to the middle of the policy, which is the case in the CED use of force policy.

Lastly, it is important to note that our data set consists of incidents where officers were justified in using firearm, i.e. the more stringent requirements of firearm use were met in every case coded by the team. In the OIS cases, officers opted for the firearm option while in the CED cases, officers chose to use the CED instead.

Chapter 4: Methodology

Stage 1: Raw Data Mining

The HPD supplied case reports for 114 CED and 205 OIS incidents from 2005 until 2013. These cases were scanned in PDF format, and organized by incident numbers. The PDF files were comprehensive and contained scene summaries, offense reports, scene diagrams, officer statements, witness statements, and many various appendices. To ensure accuracy, the research team scoured these reports, and coded each case in two stages. First, each report was looked over by two researchers, and coded into the variables provided by HPD. The variables provided were altered and defined after the group convened to discuss each factor's importance and frequency. A complete list and explanation for each coded variable can be found in Appendix A1.

While the coding of some variables was straightforward, others required judgment calls. For example, the number of officers at the scene was coded as either one officer present with no backup en route, one officer present with backup on its way, or multiple officers (two or more) present at the time the weapon was discharged. The most useful parts of each report were the officer witness statements provided with every OIS case, which explained the incident from the shooter's point of view. Weather conditions, visibility, language barriers, and premise could each be found in the report under its respective section. The research team decided to code officer's approach as whether the officer who fired his weapon approached with or without his gun drawn. Paired with each incident report were the call data for the incident, and a training record for each shooting officer. The call data was paramount for looking up variables such as priority number of the call at dispatch, timing characteristics of the incident, crime type, and previous calls for the officer. The training report allowed the research team to gather information about the officer characteristics, including tenure, age, gender, and assignment.

Once all of the cases had been coded twice, the research team met to compare the two separate sets of coding for each variable on each case report. When conflicting codes arose, this allowed the research team to revisit the incident report and ensure consistent results. This also led to a solid standardization of definitions for coding and sparked discussion for the future cleaning of data. During the process of data mining, a small number of case files were empty, redacted, unreadable, or contained insufficient information for inclusion in the project. This led to the elimination of certain incidents, reducing our data set to 195 OIS incidents and 108 CED incidents. These eliminations did not seem to have any systematic correspondence to the collected variables so the project sampling should still hold.

Stage 2: Cleaning Up Data for Stata Upload

The next stage after mining the raw data for both OIS and CED incidents from investigative case files, officer training records, and call data was to prepare the manual inputs and convert them into a Stata-friendly format. The first step was to convert qualitative inputs into statistical data by creating categories and assigning a category to each descriptive input. For example, for the variable "What types of de-escalation efforts were made", the team found a few recurring de-escalation techniques, such as 'verbal commands' and 'intermediate weapon'. To assign categories, the paper will employ dummy variables, where 1 means yes, 0 means no. For the de-escalation efforts variable, dummy variables were created for the common qualitative inputs that the team found, i.e. 'verbal commands', 'intermediate weapon' etc., and coded accordingly. At the same time, string variables that captured mutually exclusive categories were also created so as to facilitate tabulations in the later chapters.

The second step was to compile the raw data, which have been mined individually and verified in pairs, into a master Excel spreadsheet that removed duplicates, since each team member looked at two thirds of the case files. After compiling, the team needed to clean and proofread the data by removing input errors, standardizing the formatting, and making other essential changes to ensure that the Excel document can be uploaded to Stata. The final spreadsheet will have the case incident numbers in the first column, and variable names in the first row. The final data set consists of 195 OIS incidents and 108 CED incidents for a total of 303 observations, and 269 variables. A variable list with detailed descriptions of each variable, and a sample entry, showing how one incident was fully coded, is presented in Appendix A2.

Stage 3: Statistical Analysis

Upon completion of data compiling and cleaning, the data analysis portion of the project began. The compiled data contains 269 variables, subdivided into Stage One and Stage Two variables. Stage one variables generally function to indicate circumstances for the officers before they became involved with the OIS or CED incident. These include whether the officer was on or off duty, their assigned division in HPD and what type of encounter brought them into the incident. Stage Two variables are designed to describe the immediate circumstances directly leading to and causing the officer to use their duty weapon or CED, e.g., did the officer use verbal commands in the encounter, did the suspect have a weapon or was a vehicle involved in the incident. The dataset primarily consists of dummy variables for different aspects of the Stage One or Stage Two situations.

The analysis was done using statistical and regression analysis in Stata. The initial portion of this work came via a simple tabulation of characterizing variables for the pools of OIS

cases and CED cases. This provided a baseline for the analysis and was executed by summarizing and tabulating variables in Stata. The resulting tabulations were graphed and displayed trends along several dimensions of the data. Beyond the information directly provided, these results informed choice of explanatory variables and interpretations of results during the regression analysis.

The next step involved running regressions while controlling for large numbers of variables in order to identify potentially significant areas to pursue further. Of course, identifying causation using information from the literature review and acquired knowledge from reading the cases was essential in sifting through the regression results. The regression analysis employed logit models because of the reliance on binary variables so the results will provide non-linear, probabilistic effects of explanatory variables as opposed to linear effects. The choice of the logit model and its functionality are more fully explained in Chapter 6.

The primary models used in this analysis regressed "ois" on different sets of explanatory variables. The first modeled an officer's likelihood to shoot against a selection of Stage One variables as a means of identifying pre-scene factors that could affect an officer's behavior or preparation when approaching an incident. The second set of explanatory variables included both pre-scene and on-scene variables in order to control for circumstances happening at the scene. This provides a deeper context for the results of the first regression. It will show how pre-scene factors play a role in cases that unfold in similar ways, or where officers are facing similar circumstances at the scene. These regressions should be able to identify both Stage One and Stage Two variables that significantly impacted the likelihood of firearm use by HPD officers.

The secondary models, while inspired by some results from the primary analysis, seek to examine how different factors of use-of-force incidents affect specific officer actions. A highly

intuitive result, supported by the data, was that officers who approached a suspect with their gun drawn would be more likely to use their gun in that incident. Therefore, a model in the secondary stage of analysis regresses an officer's likelihood to approach with their gun drawn on several Stage One and Stage Two variables that could plausibly affect the officer's action. Therefore, more focus was placed on pre-scene variables and the officer's initial encounter with the suspect which could affect the way in which the officer approached. Another model examined potential reasons that an officer would or would not give verbal commands during an incident. Similar criteria dictated the choice of explanatory variables for this regression.

The final set of more focused analyses sought to investigate more specific relationships between using different dependent variables. These models were designed in response to some of the questions posed by HPD Executive Assistant Chief Oettmeier in his description of the scope of the project; questions not specifically answered through the Primary and Secondary analysis. These models were built using a slightly different method, first identifying the relationship in question, then adding control variables that could potentially clarify the results. The inclusion of interaction terms can isolate different levels of effects across groups and give more nuanced results to the posed questions. In total, these tabulations, graphs and regressions provided ample material to investigate and, from which, to draw conclusions.

Chapter 5: Data Description and Summary

The universe of data for situations in which officers used their firearm, or in which they could have but opted to use a controlled electronic device instead is relatively small in respect to the number of variables that were coded per observation. This study has an n of 303 cases, 195 of which are OIS and 108 CED, and there are 269 variables coded for the most complete cases. Appendices B1 and B2 have a breakdown of the data by type of crime, and coded for pre-scene and on scene factors. The data were collected over eight years, specifically from 2005 to 2013[2], during which CED was phased in to Houston Police Department use. A detailed presentation of time elapsed data can be found on the next page in Table 1. At first glance, the numbers show that officers used their firearms more often than their CEDs when put in a situation in which deadly force was permitted. This variable description and analysis is an attempt to shed light on some pertinent factors of deadly force use to try to explain this discrepancy.

Table 1 allows some basic analysis of a few noteworthy years; the maximum amount of OIS cases occurred in 2012 and 2010 had the lowest amount of OIS cases of any year with complete data. The table also displays the deadly nature of assaults and robberies, making up more than one-third of all the OIS cases in the period studied. Instances of assault produced an average of 4.75 OIS cases per year across the span of the study, while robberies averaged about 3.63 OIS cases per year. In 2013, assaults led to an abnormally high usage of deadly force, with the thesis team recording 13 OIS cases in the most dangerous year studied. Both robberies and assaults each only led to one OIS case in 2013. Additionally, cases that involved burglary, a crime categorized as a property crime rather than a violent crime, resulted in a relatively large amount of officer involved shootings.

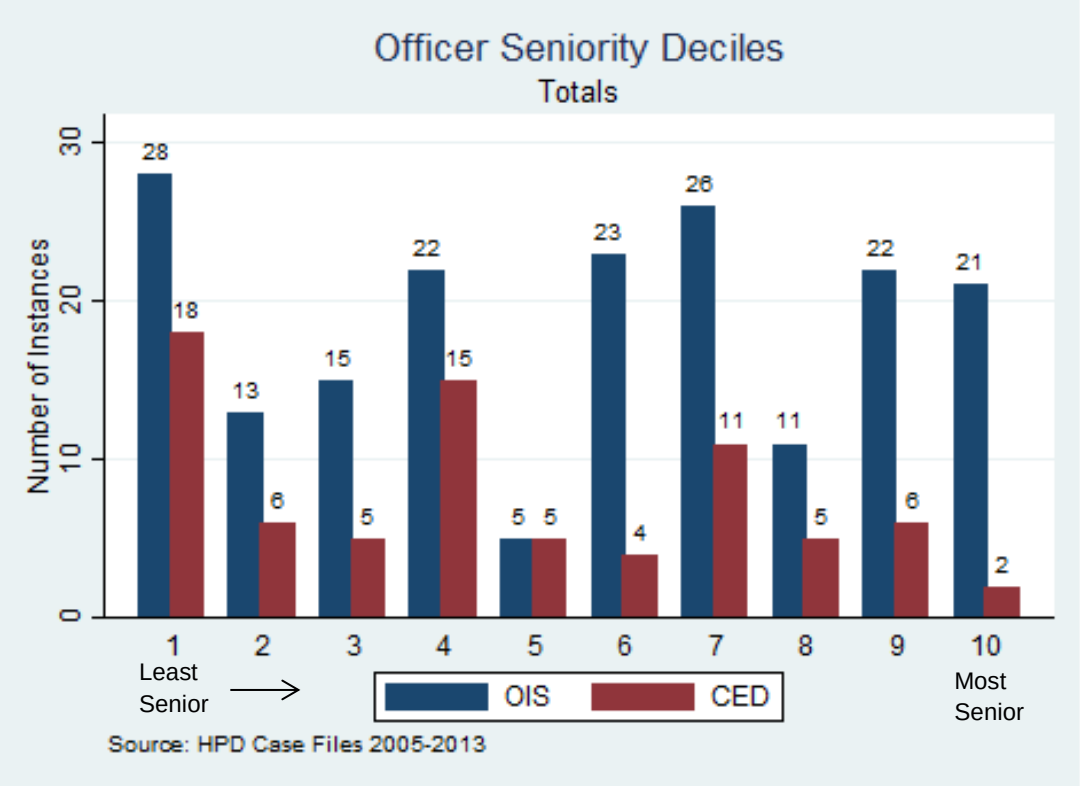
[2] The dataset includes partial data for the years 2005 to 2013. The first case occurs April 8, 2005 and the last, August 20, 2013.

Table 1: ***Number of OIS by Year and Crime Type***

	Year									
Crime	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
assault	2	5	3	3	3	3	5	13	1	38
assist off	0	0	0	0	0	0	0	0	0	0
barricaded susp	0	1	0	2	0	0	0	0	0	3
burglary	3	4	3	4	4	2	2	2	2	26
cit	1	0	0	0	0	1	1	0	0	3
disturbance	1	5	1	1	4	1	2	4	1	20
evade resist arrest	0	1	2	3	1	0	1	1	0	9
misc	2	1	1	1	0	0	0	1	0	6
narcotics	2	1	4	2	3	1	2	2	2	19
robbery	2	5	2	3	7	4	1	4	1	29
stolen veh	1	1	1	1	0	0	1	2	0	7
suspicious pers veh	2	2	0	2	4	0	3	1	3	17
traffic violation	1	1	2	1	0	2	4	2	1	14
warrants	0	1	0	1	0	0	1	0	1	4
Total	17	28	19	24	26	14	23	32	12	195

The team first examined seniority of the officer involved, and age of said officer. Seniority was looked at in deciles and in age brackets. When separated into deciles, Figure 1 shows that officers in the least experienced decile faced the highest absolute number of OIS cases, but also faced the highest absolute number of CED cases. This could be a product of new officers being assigned to more dangerous locations or units. The most tenured officers in decile 10 had seven fewer OIS cases than new officers in decile 1, but they also faced only two CED uses. The very high OIS to CED ratio found in the most tenured decile, with a mean seniority of 27.2 years (See Appendix C), might be a product of new technology not assimilating well into the repertoire of more experienced officers. Overall, less senior officers experience a greater amount of situations in which firearm use is justified, but they are more likely than the most tenured officers to use a CED rather than a firearm.

Figure 1: ***Officer Seniority Deciles Total Numbers***



Age was shown to have a similar effect when bracketed by decades. Officers in their 20's and 30's experienced the most deadly force scenarios (Figure 2), but when put in one of these use of force scenarios, they had the lowest probability of using their firearm (Figure 3). The probability here is calculated as (no. OIS)/(no. OIS +no. CED), and this calculation applies to all of the following figures within Chapter 5 unless otherwise noted. There are two general trends shown in this data summary method. First, less senior and younger officers were involved in more scenarios in which an OIS could be used. Second, when presented with a scenario in which an OIS could be used, the less senior and younger officers had a lower probability of using deadly force, or greater probability of using a CED (Figure 4).

Figure 2: ***Officer Age Brackets Total Numbers***

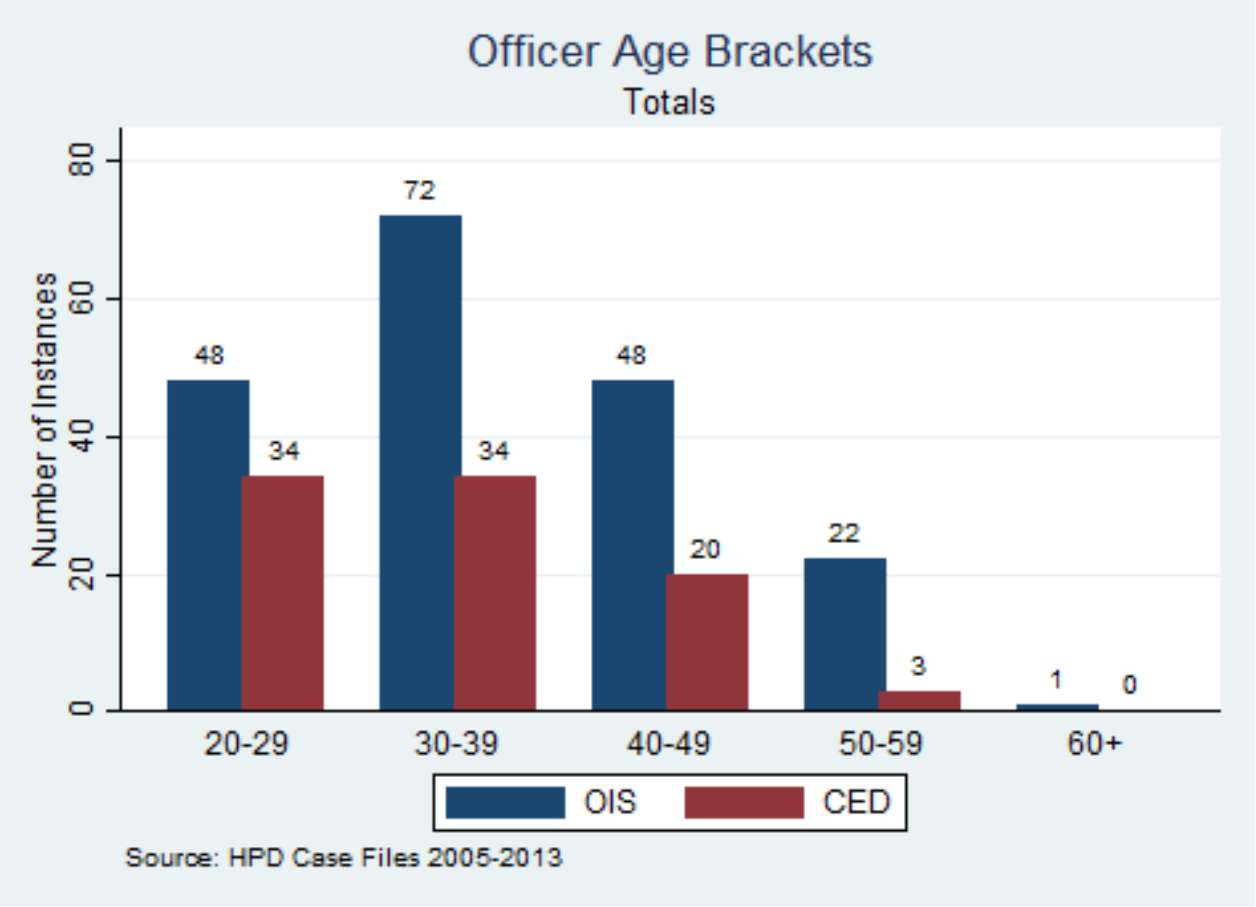


Figure 3: ***Officer Age Brackets Deadly Force Usage***

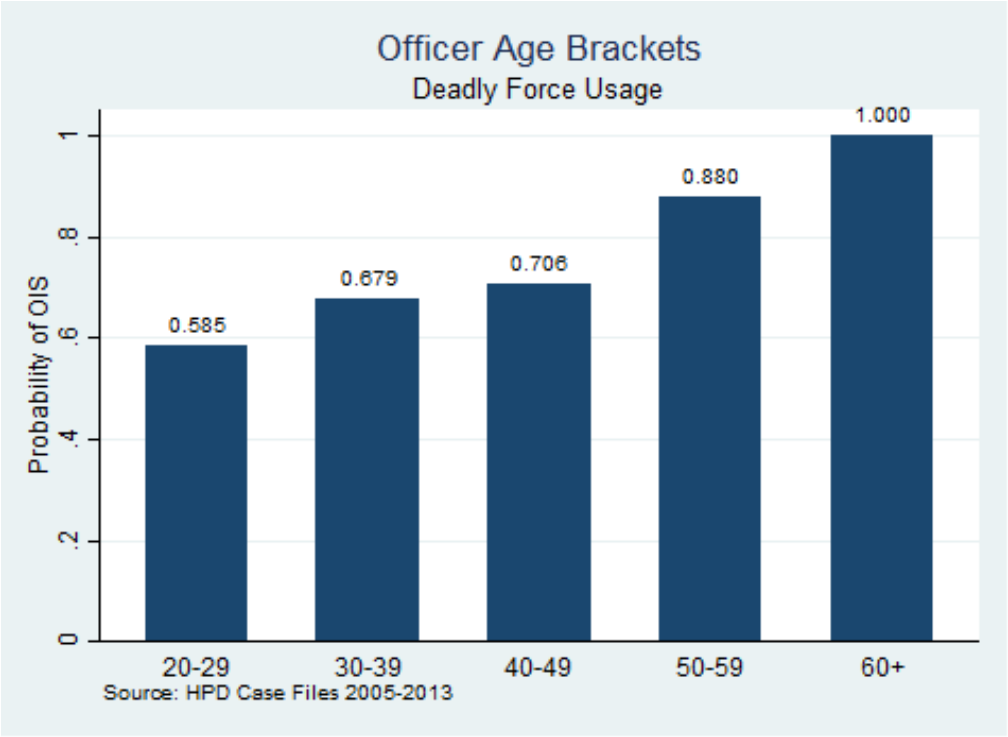
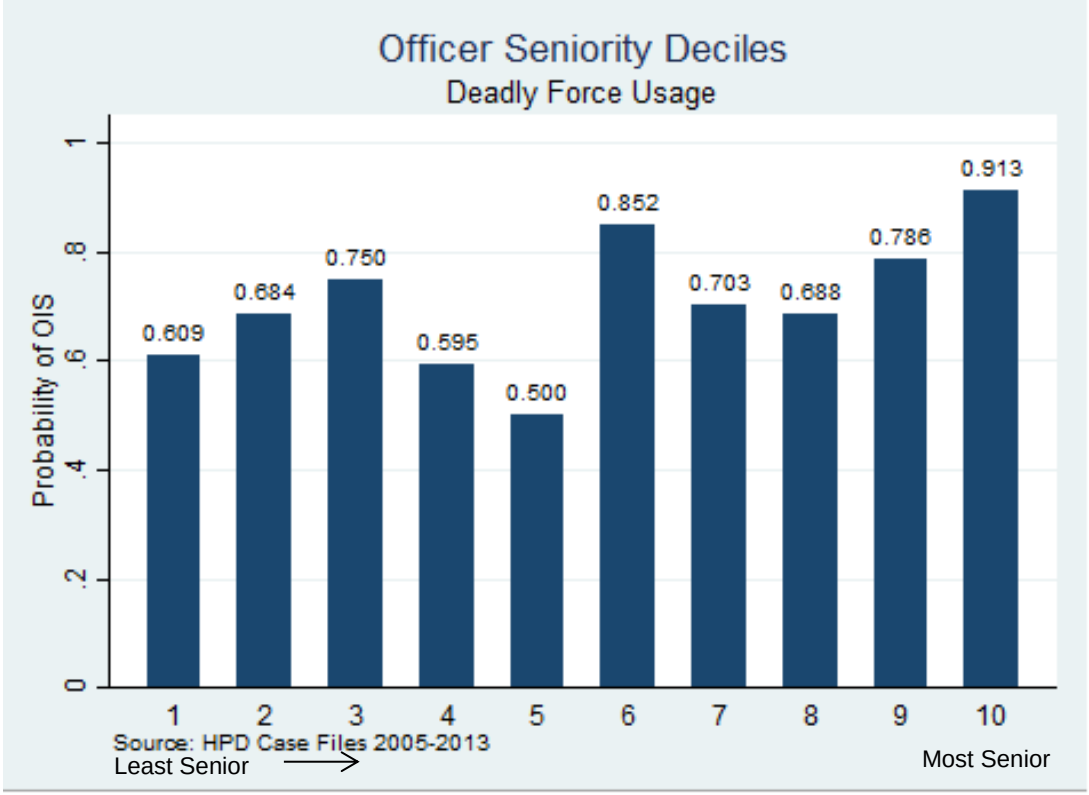


Figure 4: ***Officer Seniority Deciles Deadly Force Usage***



Officer gender analysis shows that male officers were involved in a greater amount of scenarios that warrant the use of deadly force (n=273), while females were only involved in 30 cases (Figure 5). This is undoubtedly telling of the gender ratio within the police department as a whole. When cases were separated into gender, it could be seen that female officers were less likely to use a gun than a CED, with a probability of OIS at about 37 percent (Figure 6). Regression analysis is need to separate this effect from the seniority and age effects, as women officers are also generally younger and less tenured.

Figure 5: ***Officer Gender Total Numbers***

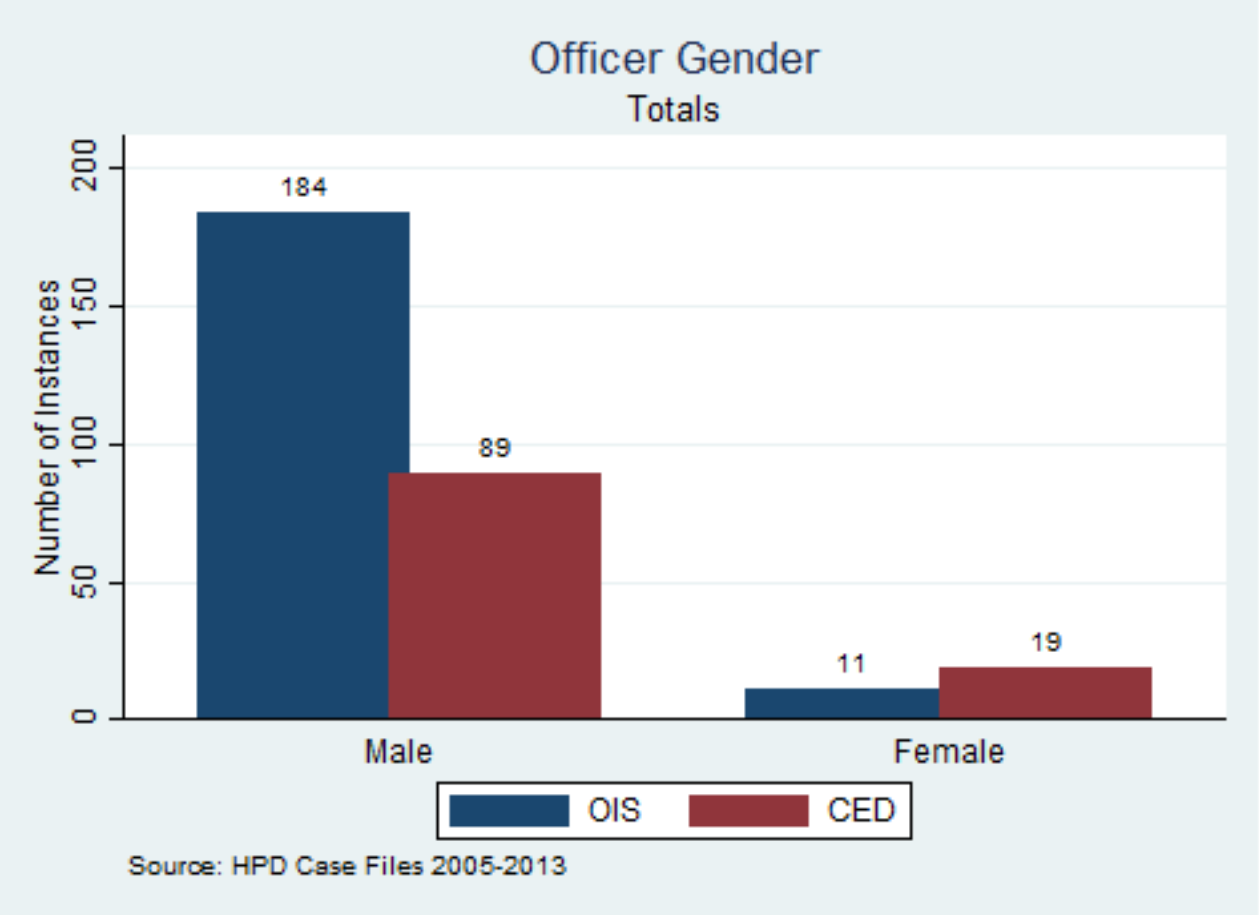
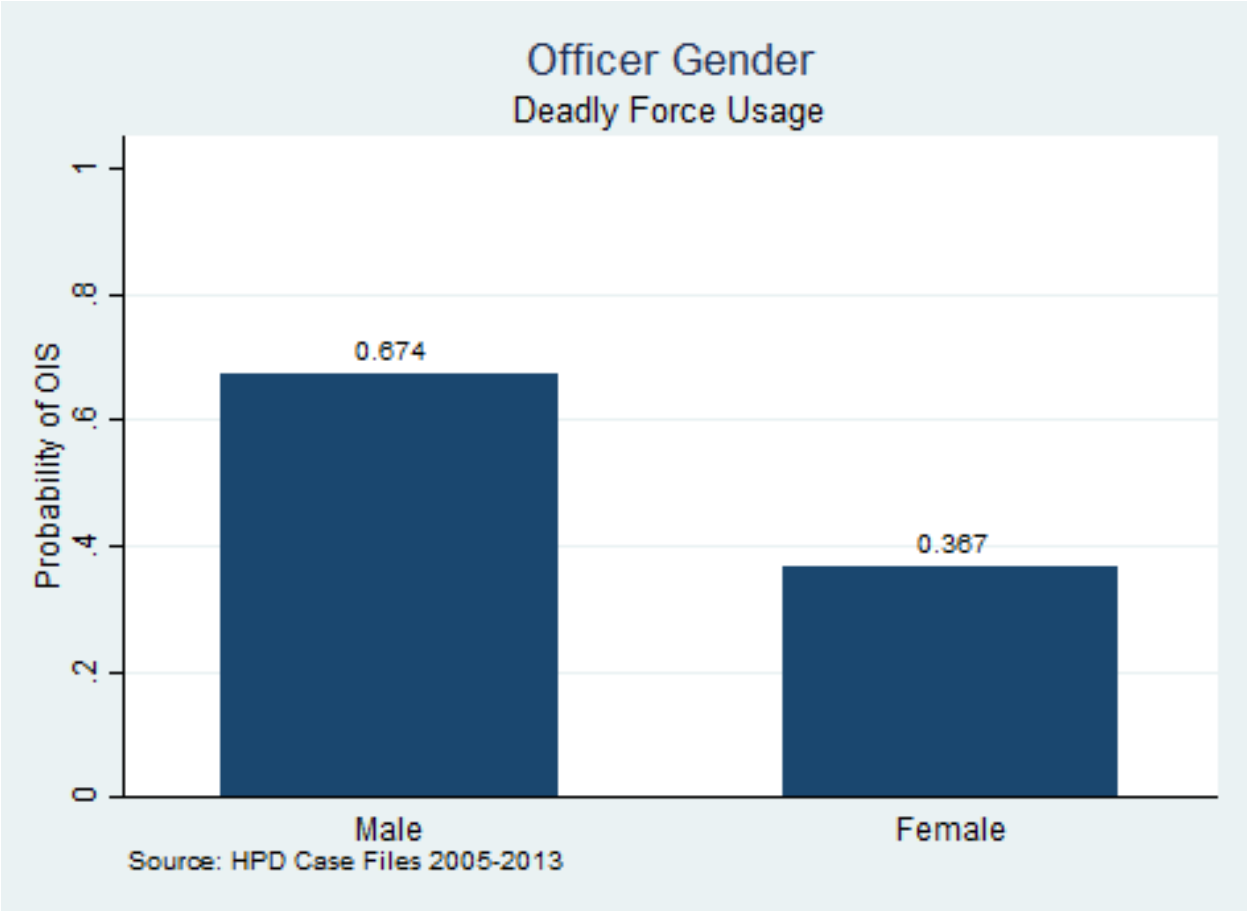


Figure 6: ***Officer Gender Deadly Force Usage***



The data on OIS and CED usage (absolute values) by year can be found in Table 1 (above) and Figure 7, which shows a general decline in the probability of deadly force usage as the CED technology was phased into the HPD. When sorted by weekend and weekday (description found in variable list in Appendix A2), the data show a higher probability of deadly force usage on a weekday rather than a weekend (Figure 8). The total numbers by weekend are not as interesting because weekend only accounted for 36 hours of the week while the weekdays accounted for the other 132 hours (definition of weekend variable can be found on pg. **62**).

Figure 7: ***Yearly Deadly Force Usage***

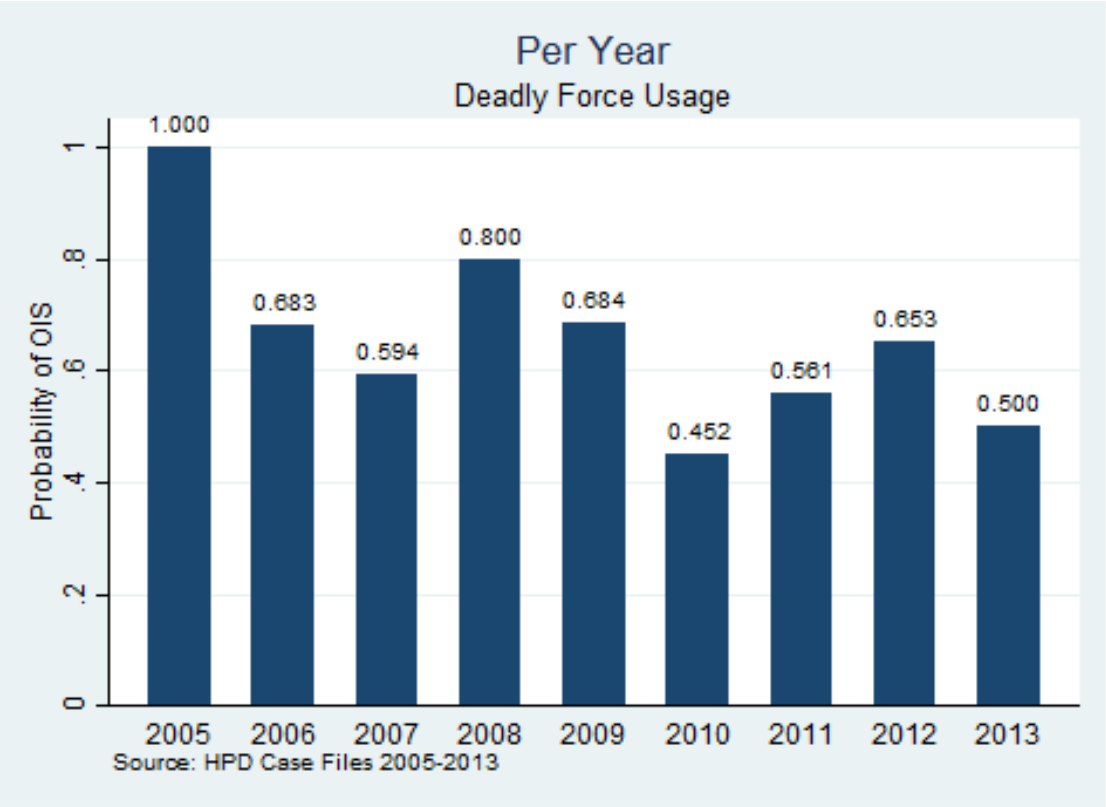
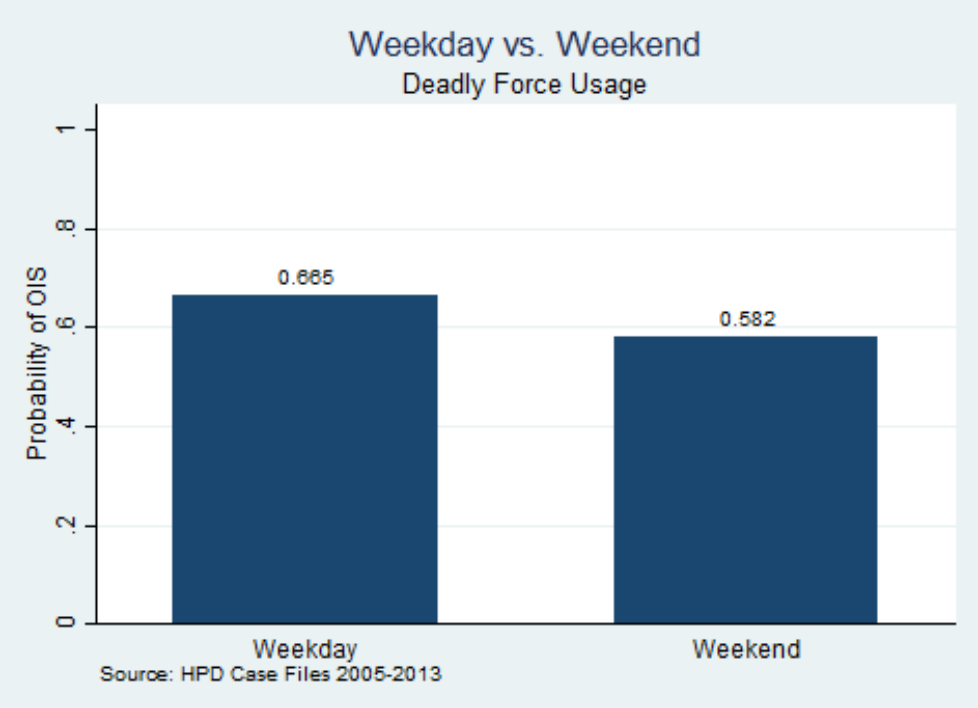


Figure 8: ***Weekend vs. Weekday Deadly Force Usage***



Analyzing by shift of the officer involved, the number of deadly force scenarios is seen to be increasing as shift number increases from 1 to 3 (Figure 9), but the first shift had the greatest probability of deadly force usage when presented with one of these scenarios (Figure 10). The officer shift variable, including start and end times, is described in Appendix A2.

Seasonality is often studied in regards to homicides and crimes, so it is here found to be a variable of interest (end and start dates of each season are explained in Appendix A2). Of the cases examined, the most deadly force scenarios happened during the winter, but the winter was also the season in which the most CED cases occur (Figure 11). The relative lack of a seasonality effect can be attributed to the high year round average temperature in Houston compared to cities like Chicago. The probability of an officer shooting a firearm when faced with one of these scenarios was still the highest in summer, with spring following close behind (Figure 12). This can be attributed to the fact that more people tend to venture out during spring and summer compared to winter and fall, which increases the chances of a life-threatening incident occurring. Further, the hot, humid weather may have the effect of making people more irritable, and hence escalates certain situations that would not have been as affected in winter and fall, into life-threatening incidents.

Figure 9: ***Shift Total Numbers***

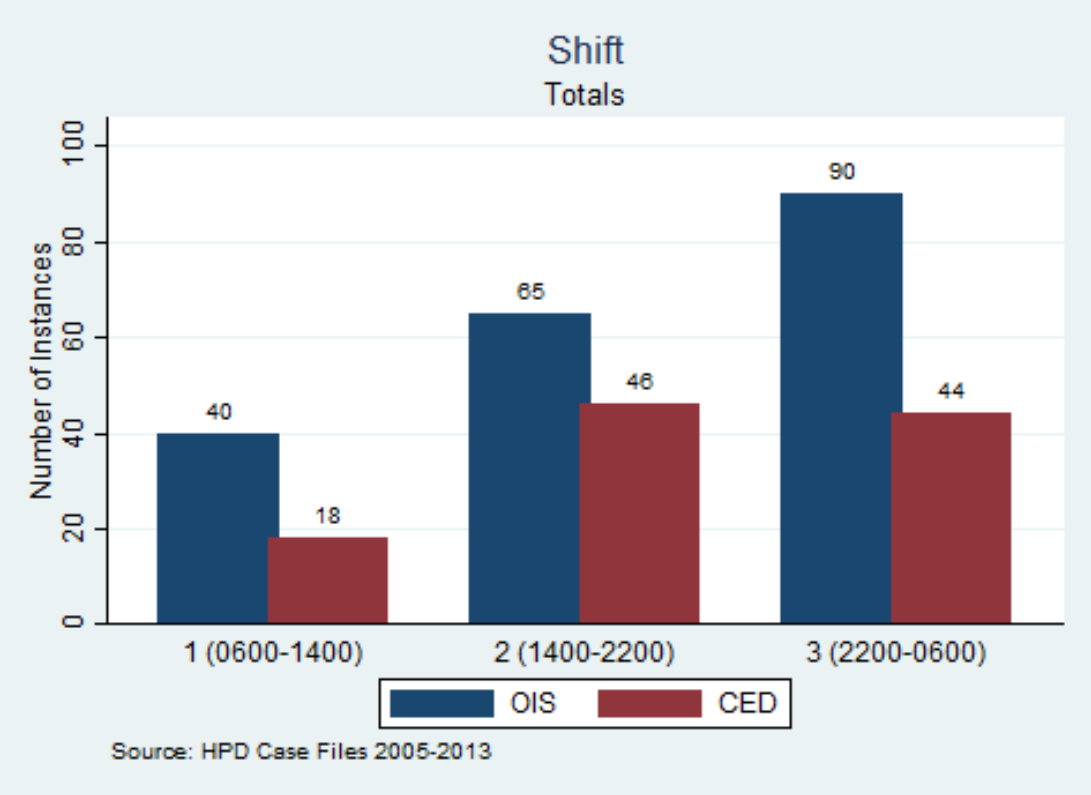


Figure 10: ***Shift Deadly Force Usage***

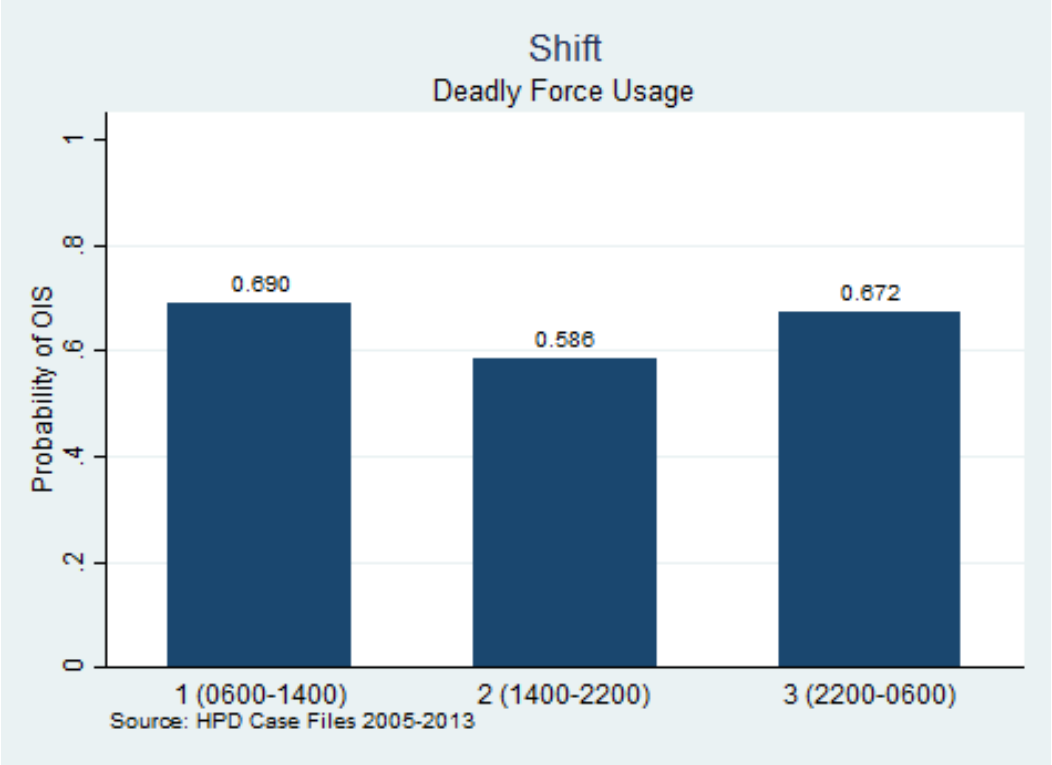


Figure 11: ***Seasonality Total Numbers***

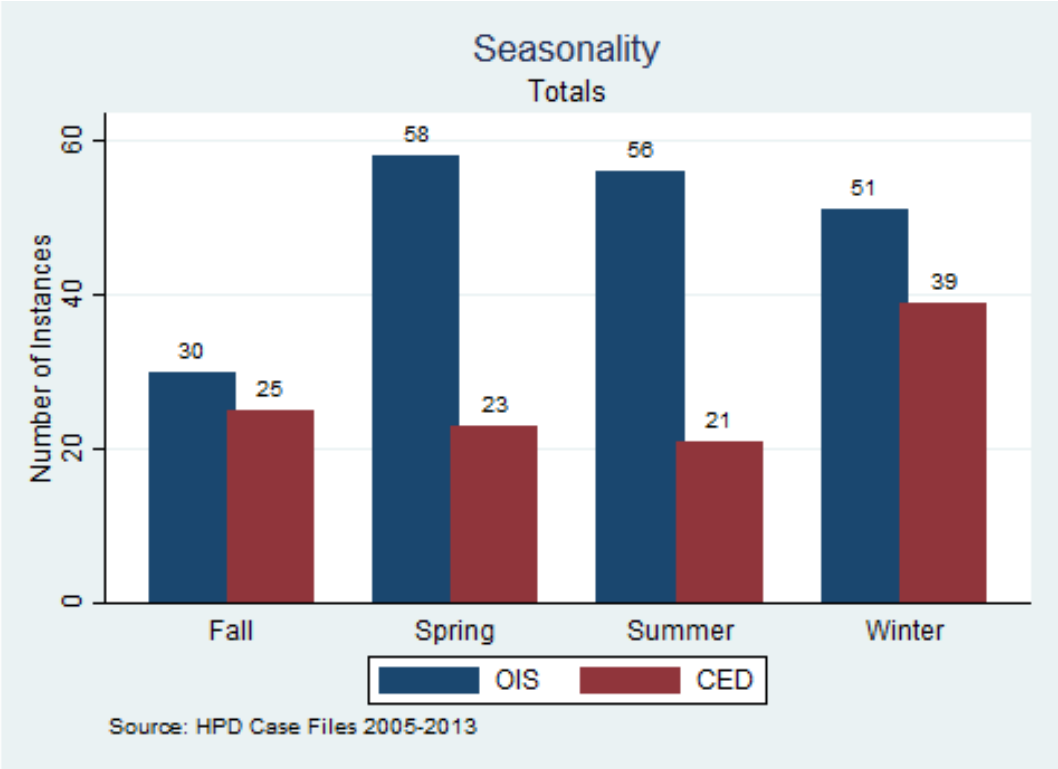
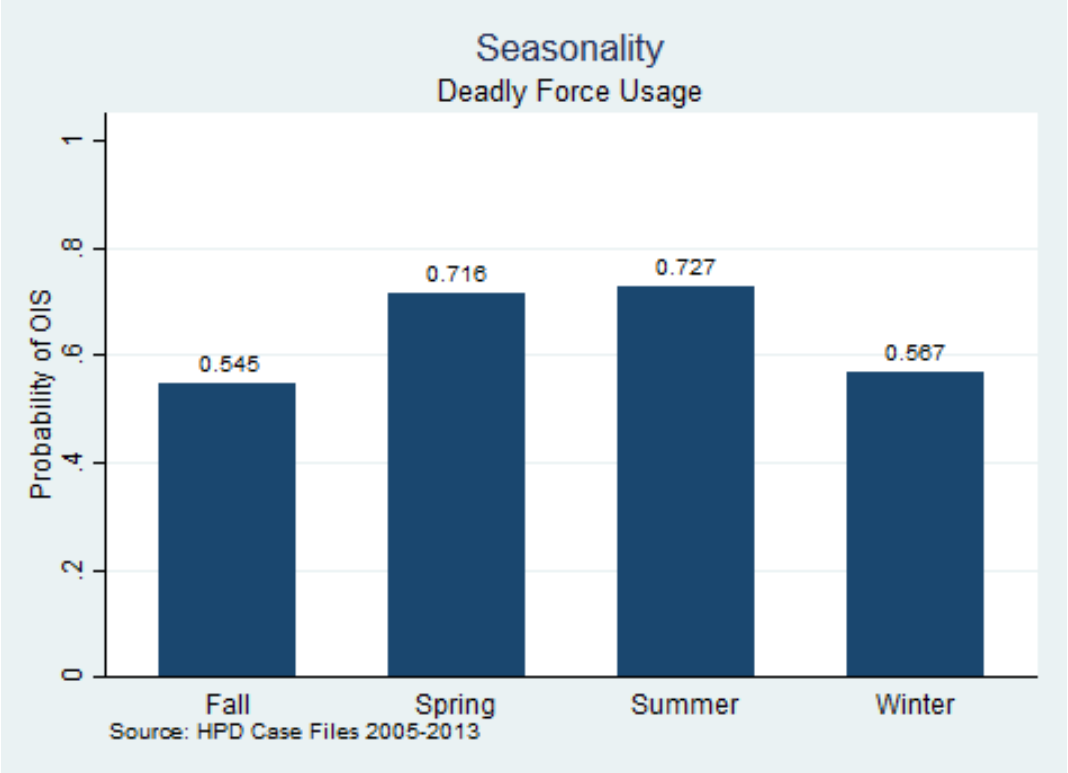


Figure 12: ***Seasonality Deadly Force Usage***



Similar data and variable analysis was also applied to the data across variables based on geolocation of the incident, i.e. by division and district. As seen in Figure 13, divisions that stand out for sheer number of incidents are division 53 and division 55, with 34 and 36 OIS incidents respectively. When examining divisions by probability of using deadly force (Figure 14), these high activity divisions did not stand out as much as division 64, which had 10 OIS cases and only 2 CED cases, or division 52, which attracted attention due to more CED cases than deadly force cases. The same information based on district can be found in Figures 15 and 16, with district 6 being the most incident prone area, and district 18 standing out as the most likely district in which deadly force was used. District 2 was the only district with a probability of using deadly force below 50 percent.

Figure 13: ***Incident Location by Division Total Numbers***

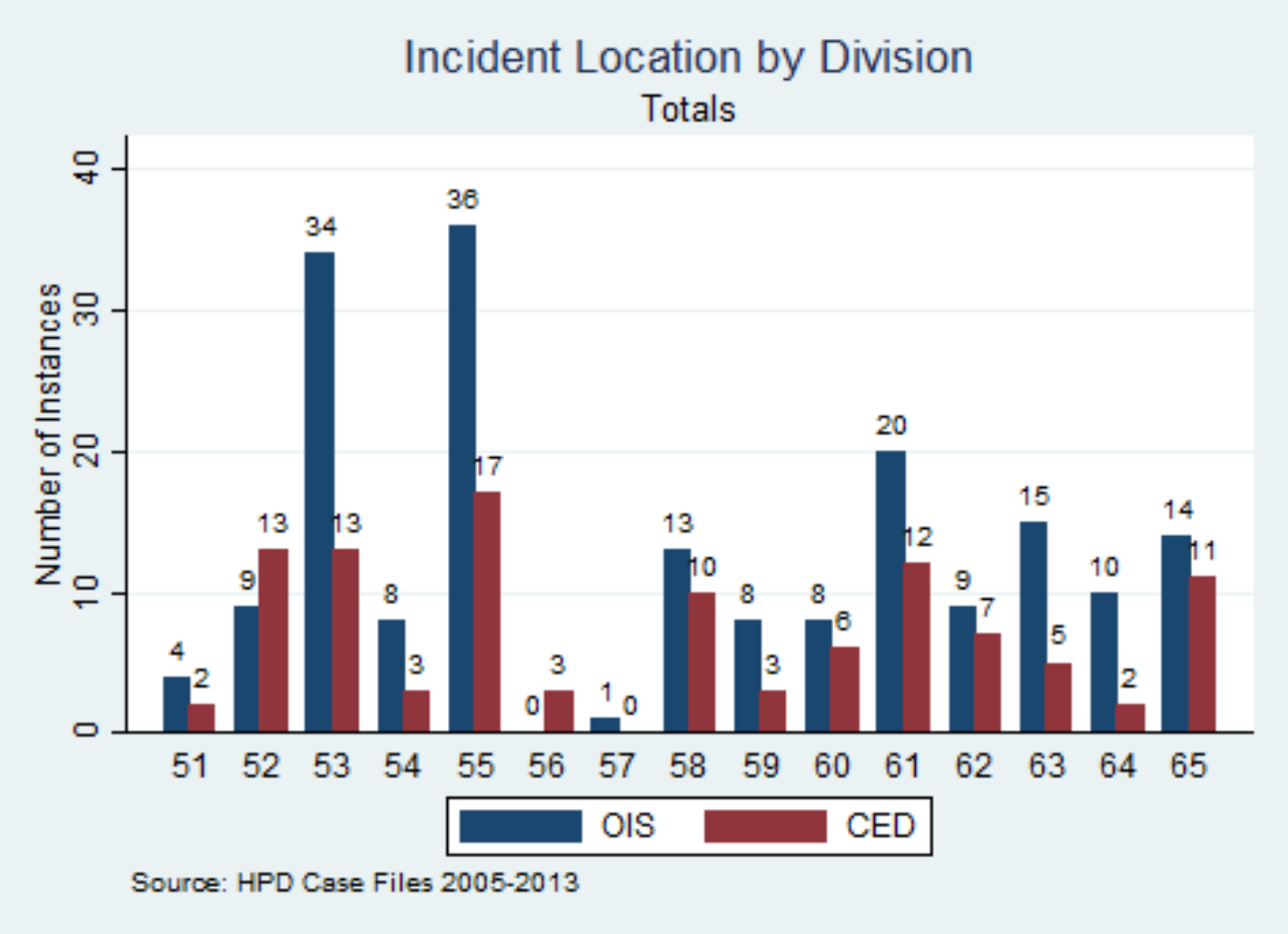


Figure 14: ***Incident Location by Division Deadly Force Usage***

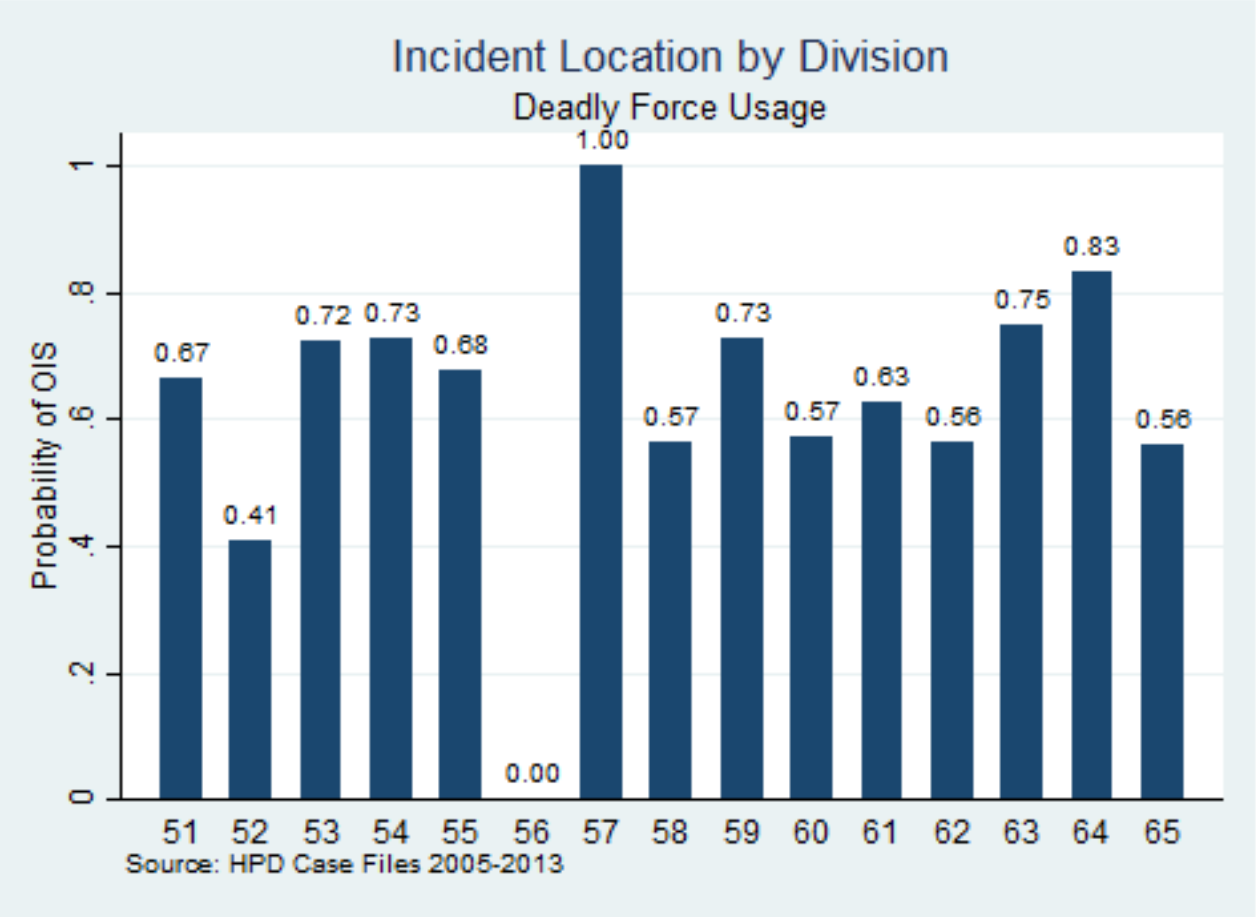


Figure 15: ***Incident Location by District Total Numbers***

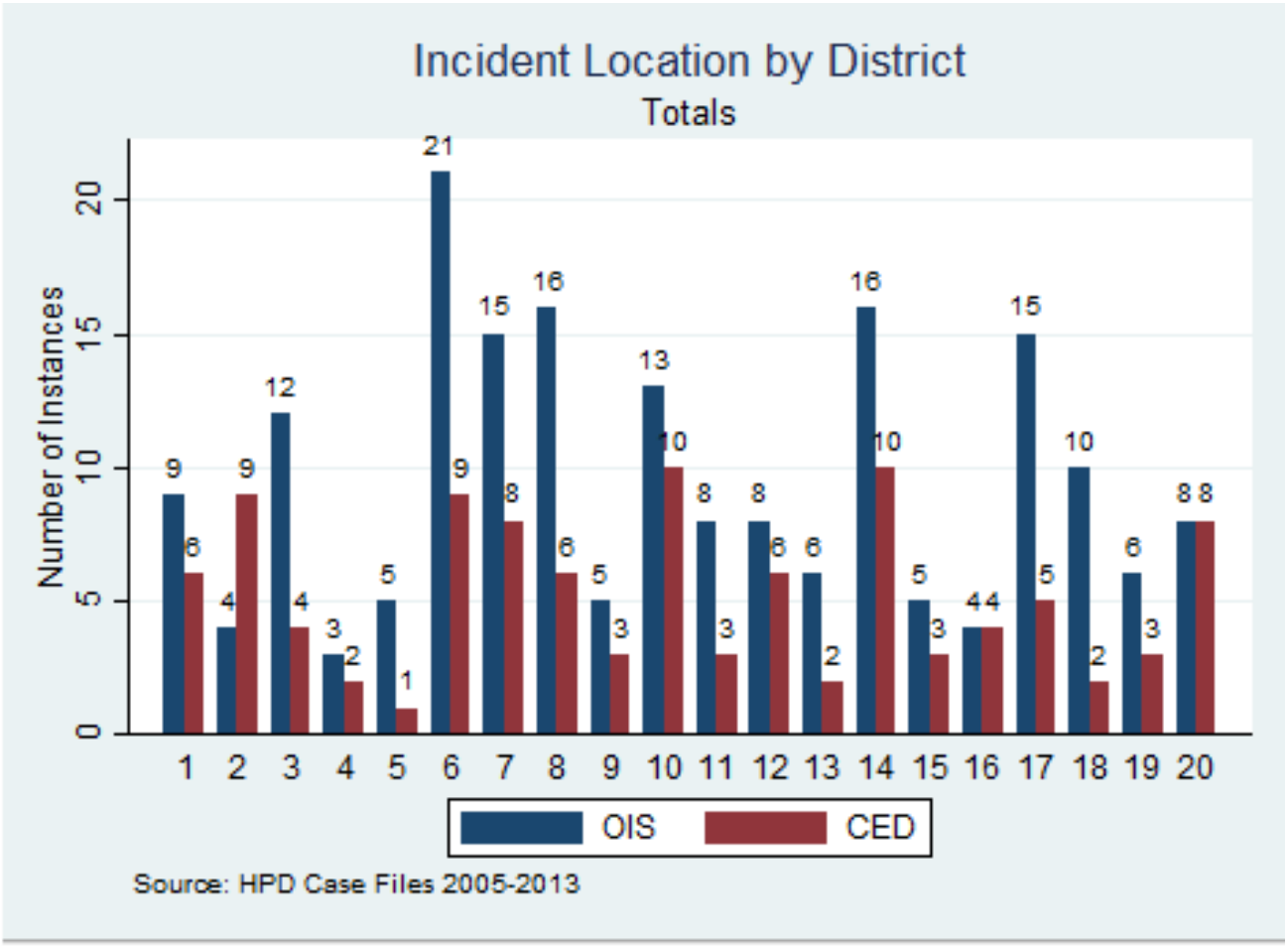
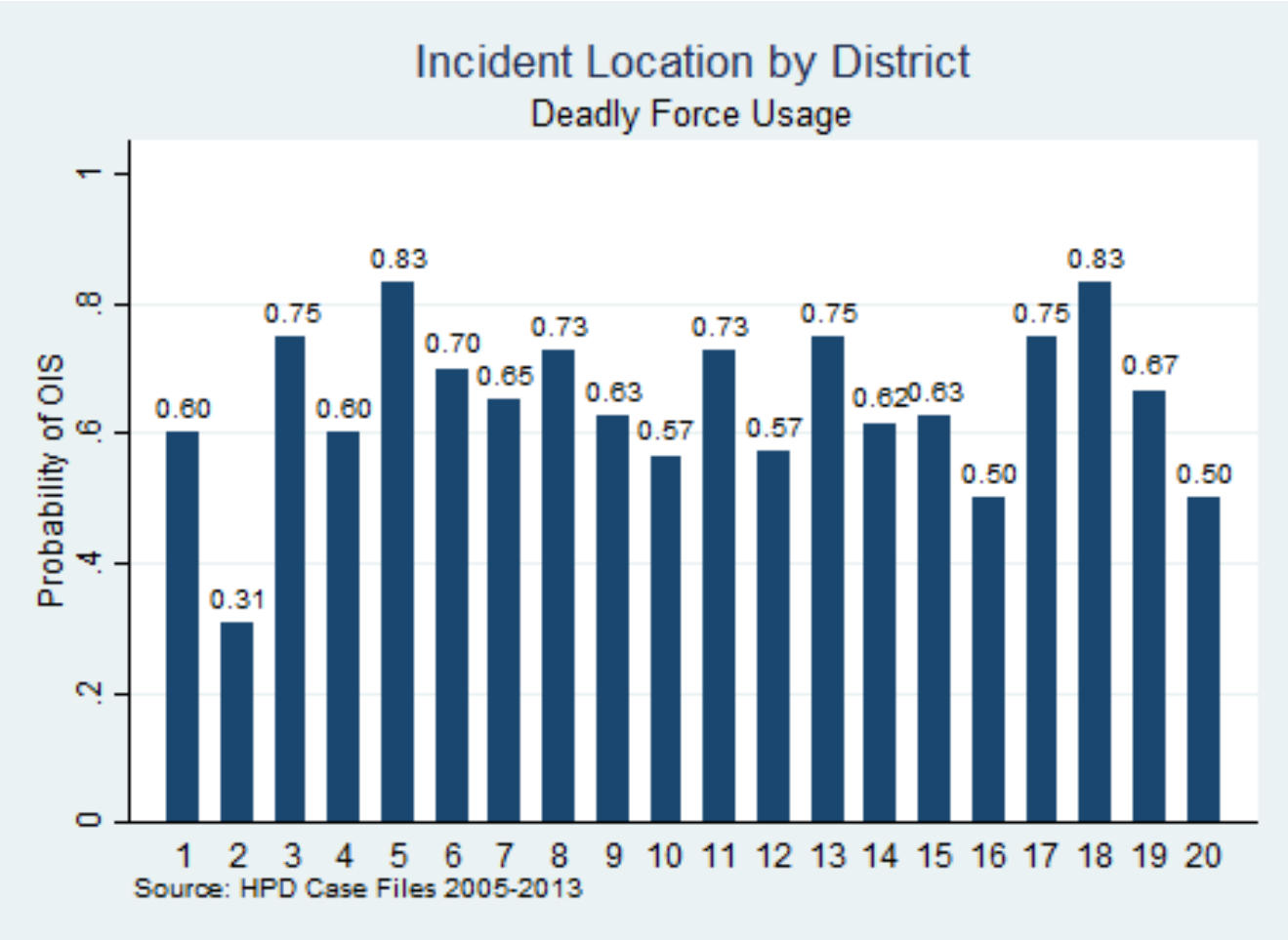


Figure 16: ***Incident Location by District Deadly Force Usage***



Most of the incidents in which use of deadly force was warranted occurred while the officer was on duty (Figure 17). The probability of an officer using a firearm in one of these encounters was much lower on duty, however, compared to being on an extra job or off duty (Figure 18). This relationship could be due to the requirement of officers to carry a CED and a firearm while in uniform. Most officers still wore their uniform when on an extra job, so they were still less likely to use deadly force, while off duty officers had no reported uses of CED. It is probable that officers are more likely to carry their police issued firearm, or a personal firearm, on them while they were off duty, while it is very unlikely they would carry a CED while off duty.

Figure 17: ***Officer Duty Status Total Numbers***

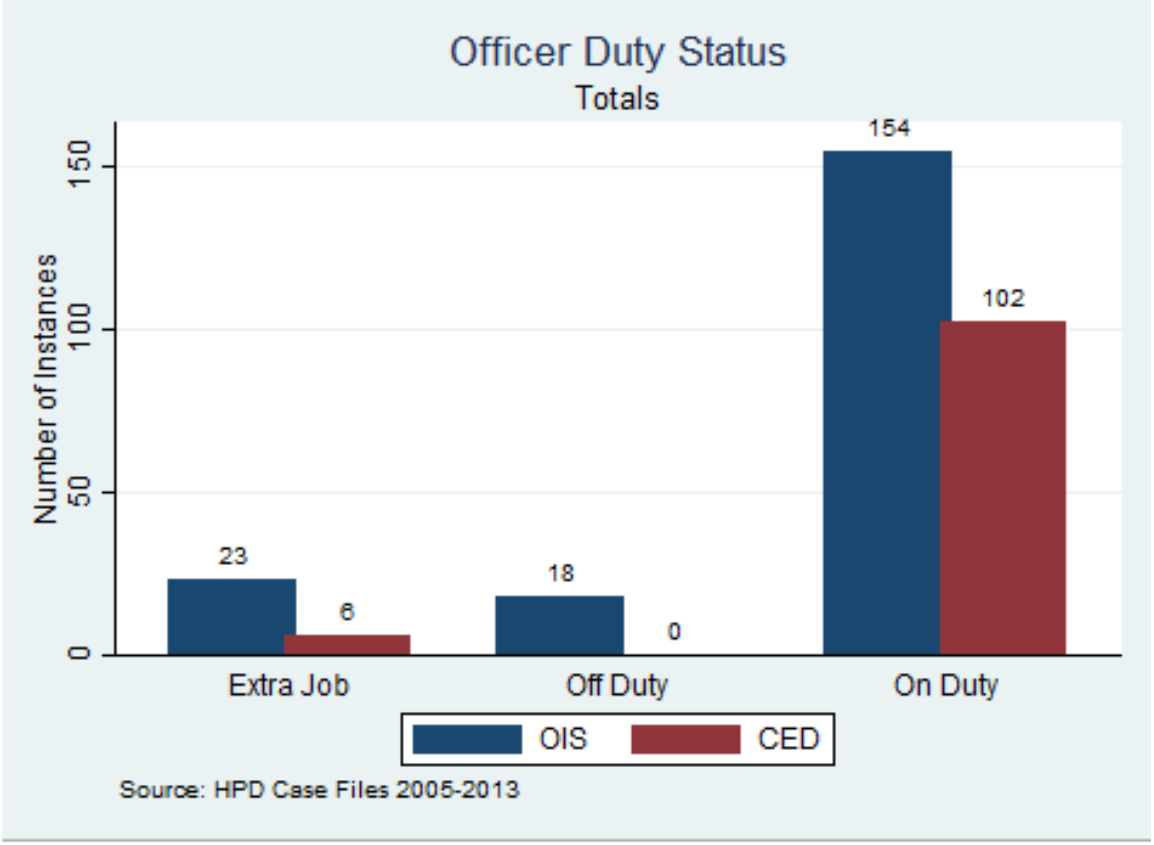
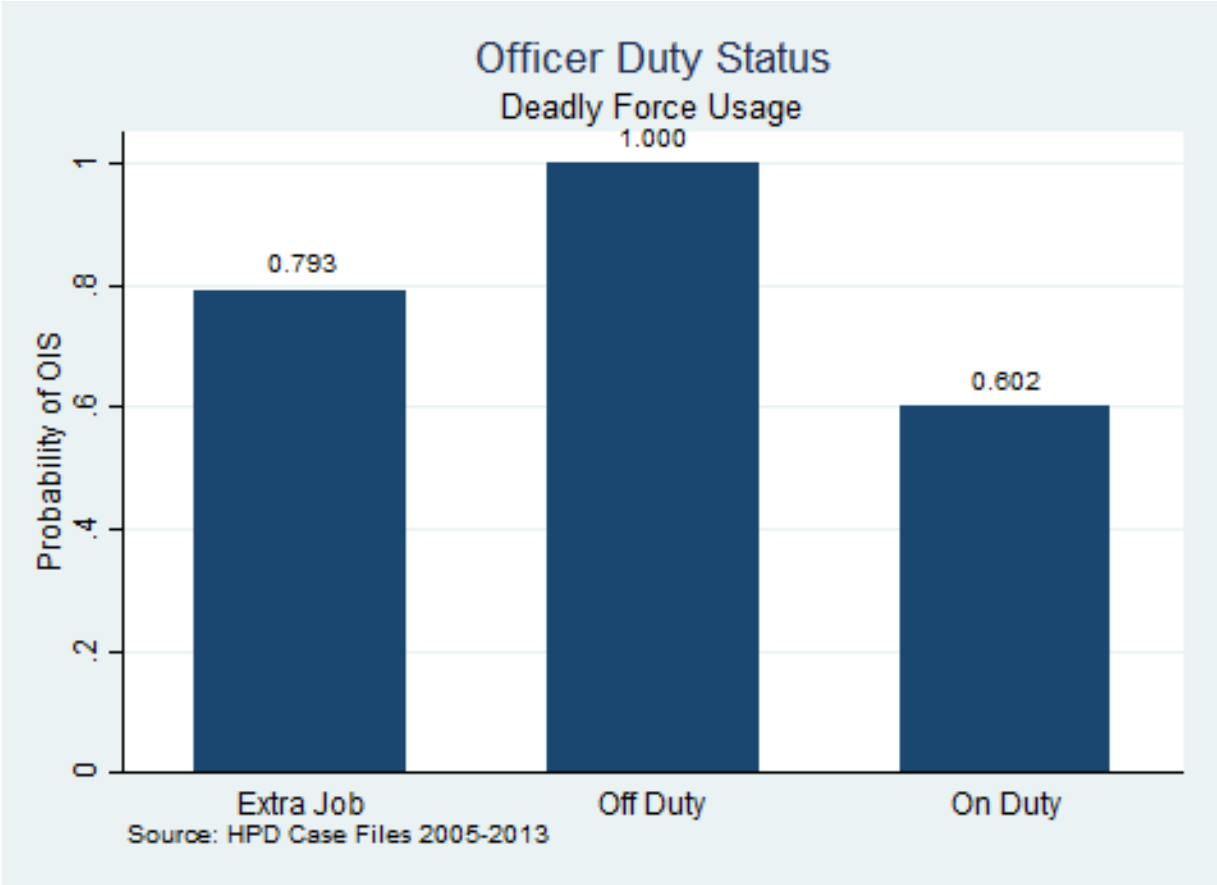


Figure 18: ***Officer Duty Status Deadly Force Usage***



The high instance of OIS usage when an officer isn't on duty merited some further research into a few variables that were previously analyzed, controlling for officers that are on duty. Officer gender graphed under the on-duty conditional can be seen below in Figure 19 and Figure 20. The total number of OIS cases dropped considerably for male officers (39 cases) while the number of CED cases only dropped by 4. The total number of CED and OIS cases for female officers dropped by 2 cases each. The resulting probabilities of OIS usage, seen in Figure 20, dropped for both male (about 4 percent) and female (about 2 percent) officers.

Figure 19: ***Officer Gender Total Numbers if On Duty***

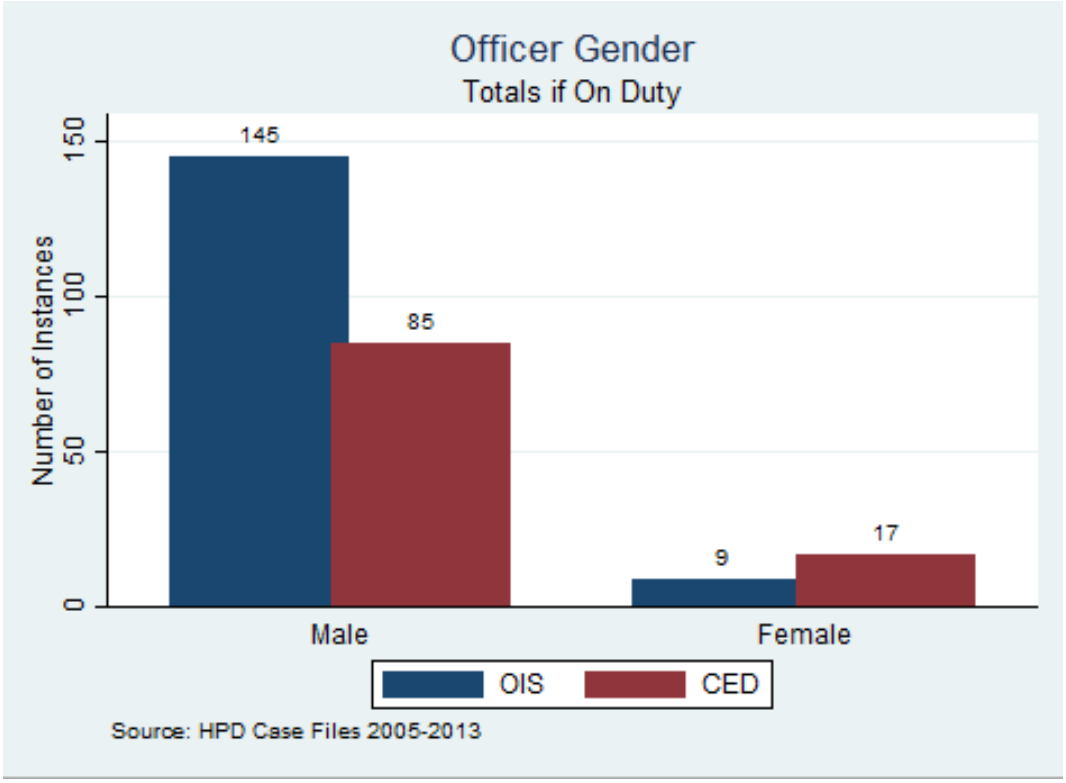
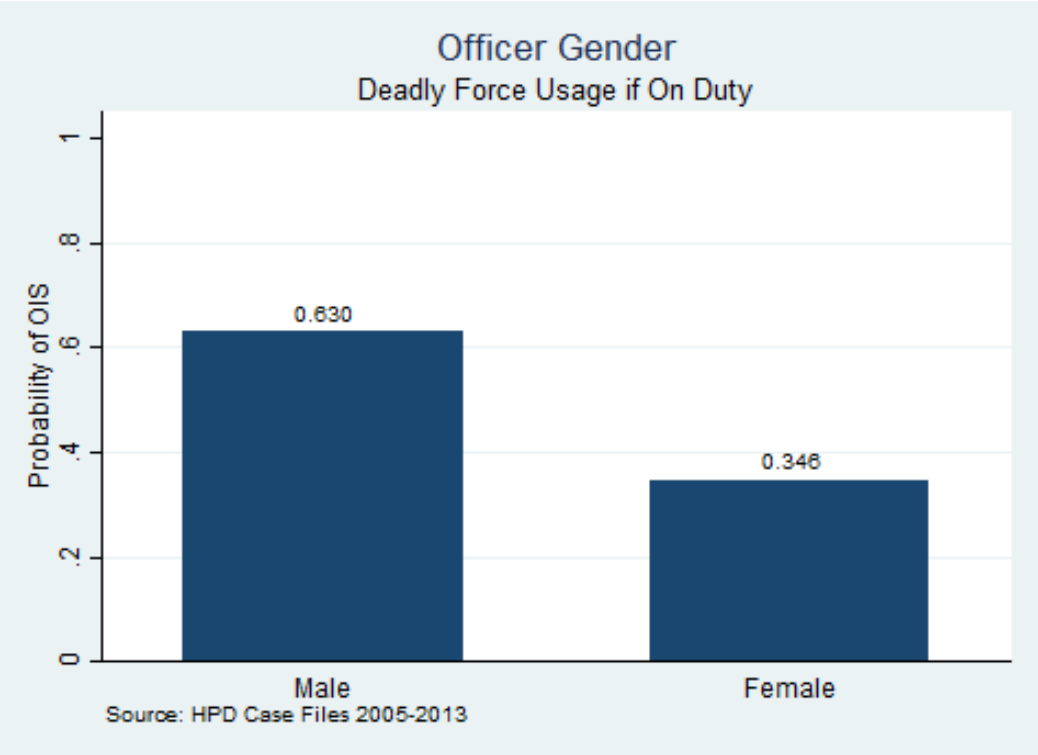
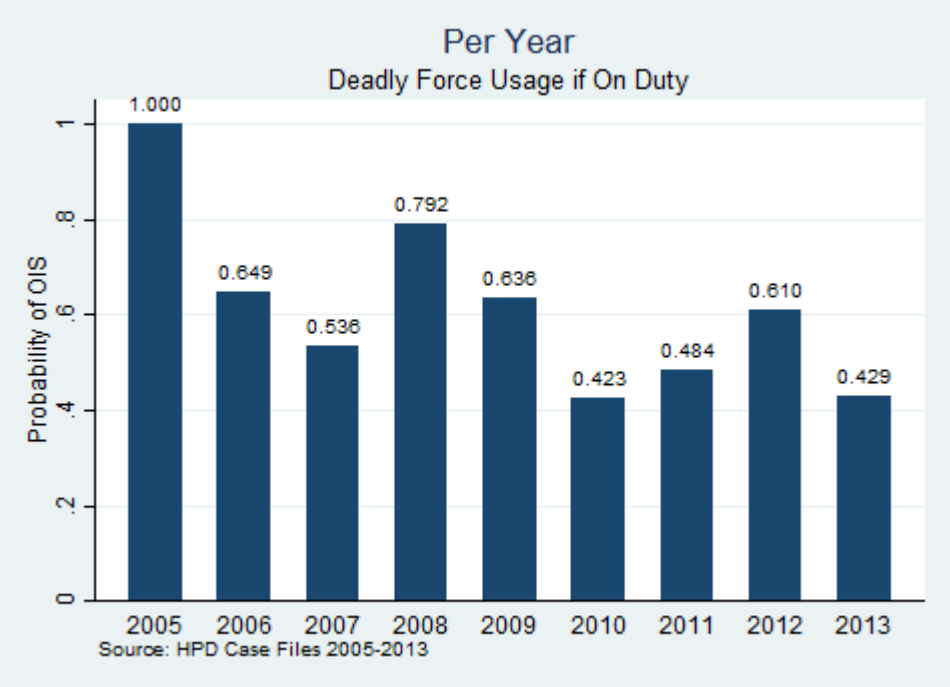


Figure 20: ***Officer Gender Deadly Force Usage if on Duty***



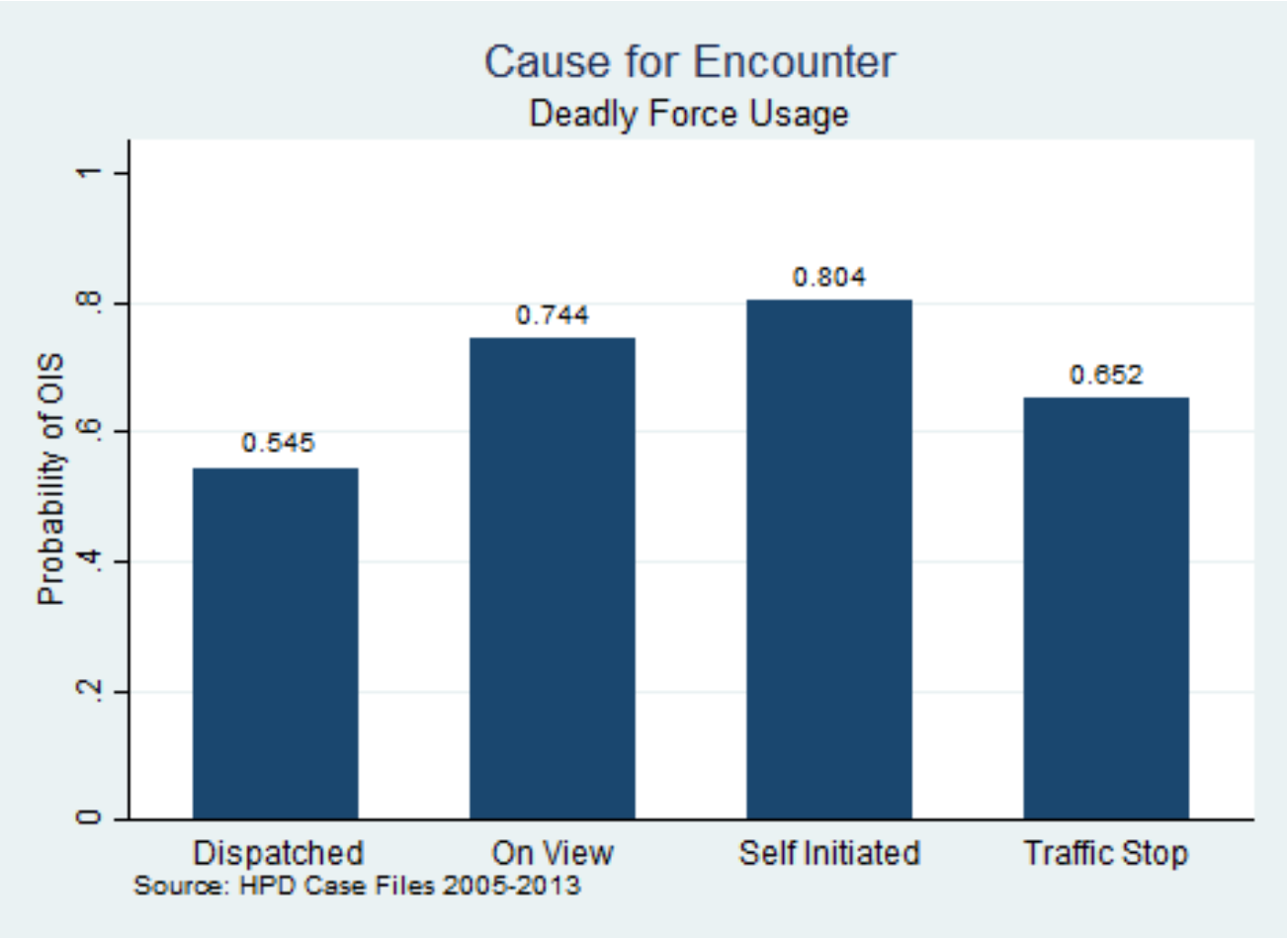
The yearly data was also evaluated while controlling for on duty OIS and CED cases only. The resulting graph (Figure 21) shows that the data displays a very similar trend over time, but with a lower resulting probability of deadly force usage across all years, except 2005. The largest effects of the on duty condition can be seen in the years 2011 and 2013. These two years show a decline in OIS probability of 7.7 percent and 7.1 percent, respectively. Officers off duty or working an extra job within these two years had a relatively larger amount of OIS instances than the rest of the time span analyzed.

Figure 21: ***Year Deadly Force Usage if On Duty***



To delve further into the pre-existing conditions or variables that could increase the likelihood of an OIS event, variable summary analysis was performed on what the officer was doing prior to using either a CED or a firearm. Considering the cause for encounter variable, it is interesting that the highest chance of an officer using his firearm was when the encounter was self-initiated by the officer (Figure 22). This result is probably due to the coding scheme of the study, labeling drug raids as self-initiated.

Figure 22: ***Cause for Encounter Deadly Force Usage***



It is evident from Figure 23 that most deadly force scenarios that an officer encountered occurred when he was dispatched. To understand this result further, the variable for priority number was analyzed for cases in which the call was dispatched (n=120). A lower priority number signifies a more dangerous or serious crime as reported to the dispatch center. While OIS was in greater frequency in general, when the call was dispatched as priority 2 or lower there was a much higher probability of CED usage (Figures 24 and 25). This phenomenon can be explained in two ways. First, calls dispatched as priority 1 were inherently more dangerous and might require deadly force more often. Second, going into the situation the officer was knowledgeable about the gravity of the situation and the likelihood of deadly force becoming necessary. Figure

25 shows the negative relationship between the priority number of a call and the probability of gun use, ignoring the one observation for a priority number of 8 that escalated into an OIS as a single instance anomaly. This outlier illustrates the unpredictability of policing, as the surprised officer went into a traditionally low danger call and found him or herself in a situation that warranted deadly force.

Figure 23: ***Cause for Encounter Total Numbers***

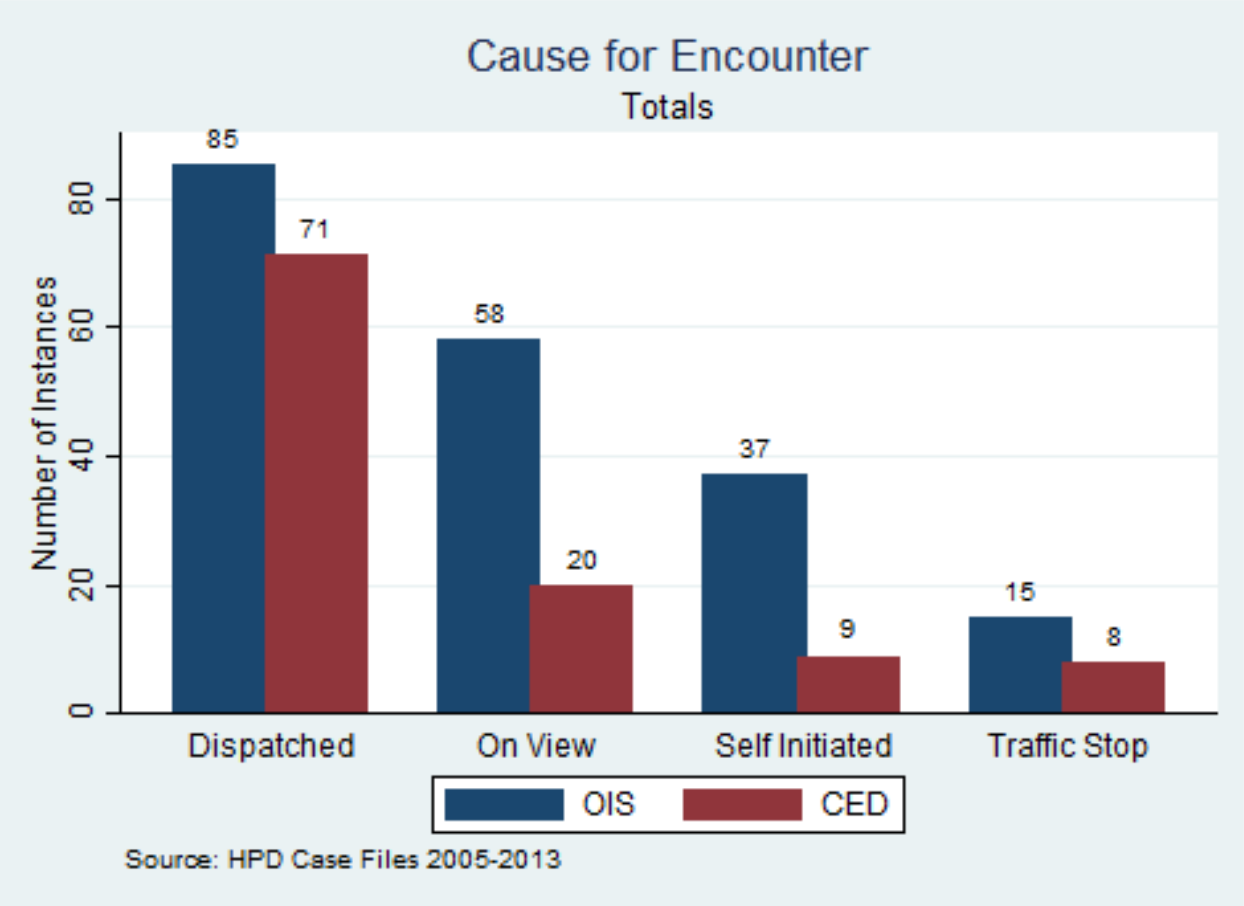


Figure 24: ***Call Priority if Dispatched Total Numbers***

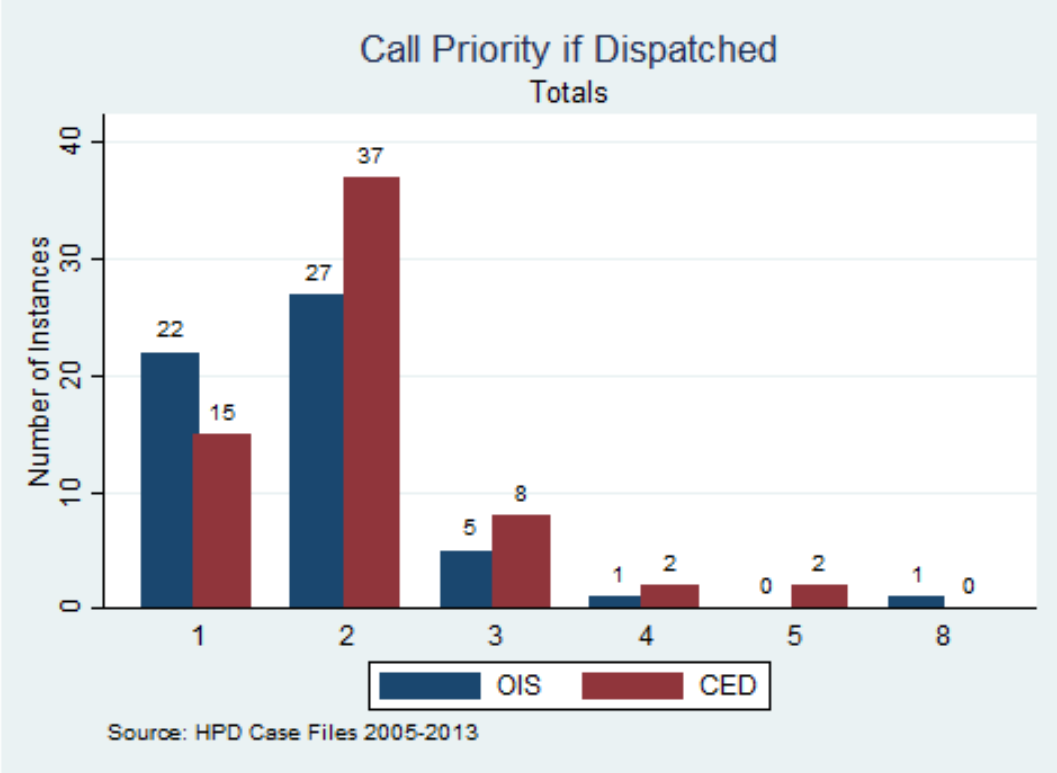
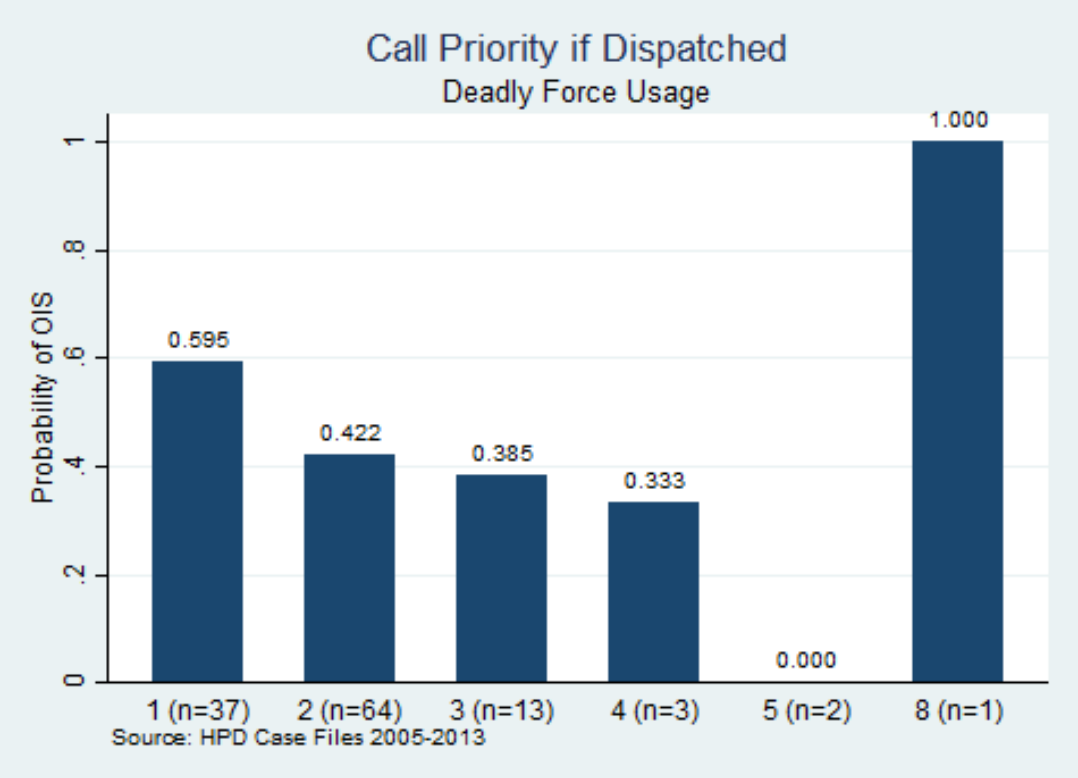


Figure 25: ***Call Priority if Dispatched Deadly Force Usage***



Another variable that the study keys in to is the number of officers at the scene of the shooting. While coding, the cases were partitioned into three different mutually exclusive subsets: one officer unit with no backup unit on the way, one officer unit with backup on the way, and two or more officer unit. This was based solely on what was perceived to accompany a difference in the mindset of the firing officer; whether he thought there would be no help coming, whether he knew help was on the way, or whether he had help on the scene. As seen in Figure 26, two or more officers had the highest number of OIS and CED cases due to a number of factors. Firstly, that universe spans the greatest range of possibilities; any number of officers greater than two. Secondly, situations that were the most severe, would often lead to the dispatch of more officers to that incident. What is more interesting to decode is the relationship between one officer unit and one officer unit with backup on the way. Figure 27 shows that one-officer units were slightly more likely to use deadly force when they perceive that no backup was on the way. The difference was only a 6 percent increase in OIS, so further statistical regression analysis must be taken to determine the significance of such an effect.

Figure 26: ***Number of Officers on Scene Total Numbers***

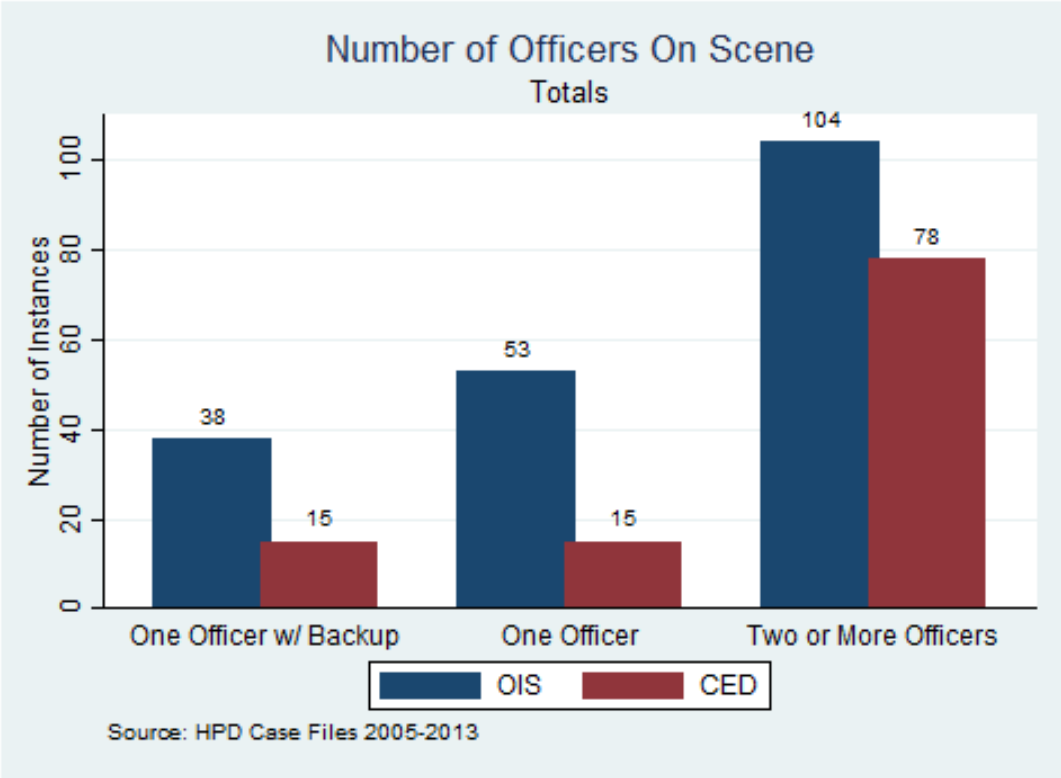
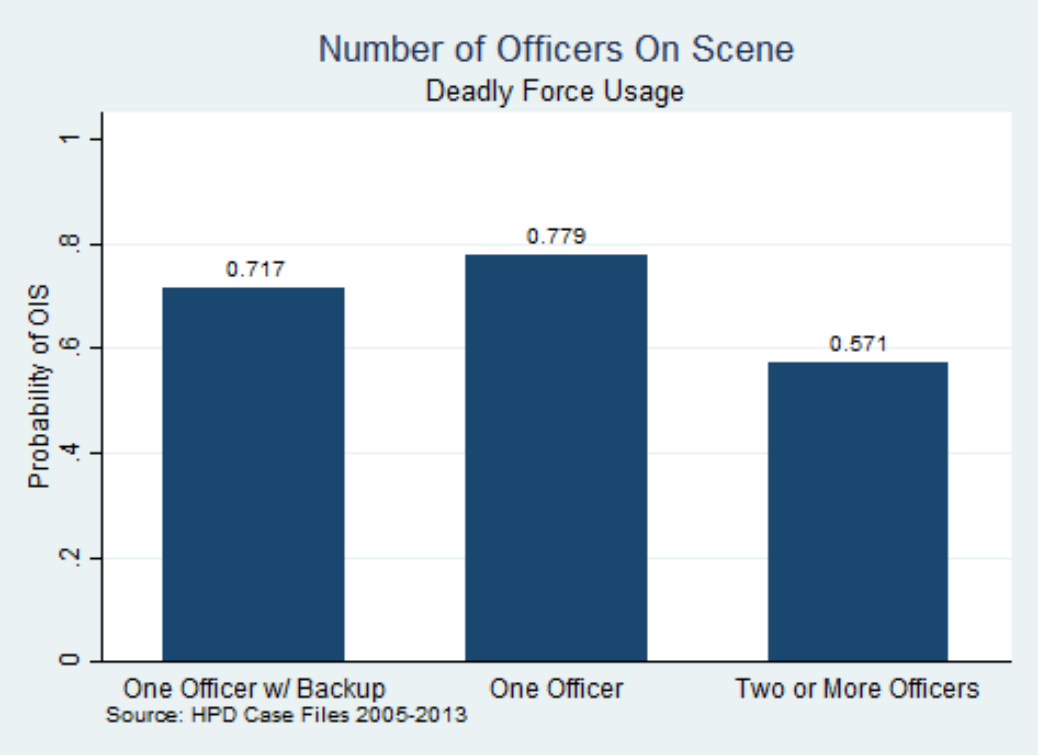


Figure 27: ***Number of Officers on Scene Deadly Force Usage***



When officers on the scene of the OIS or CED was analyzed under the condition that the officer was on duty, it is seen in Figure 28 that the amount of OIS dropped by more than the amount of CED in each data set. The resulting effect on probability of deadly force usage (Figure 29) was greatest for one officer on the scene (5.6 percent) and one officer with backup (5.0 percent).

Figure 28: ***Number of Officers on Scene Total Numbers if On Duty***

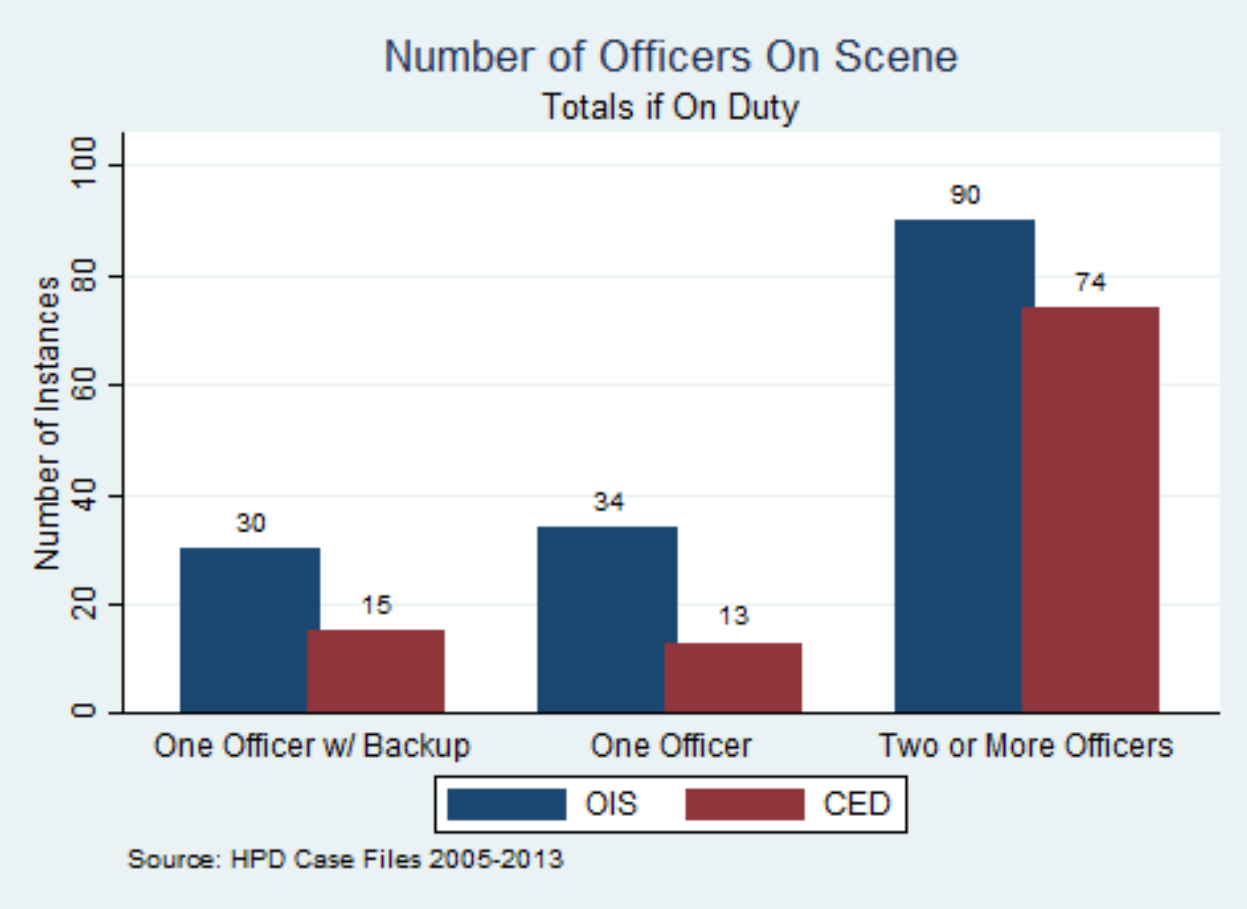
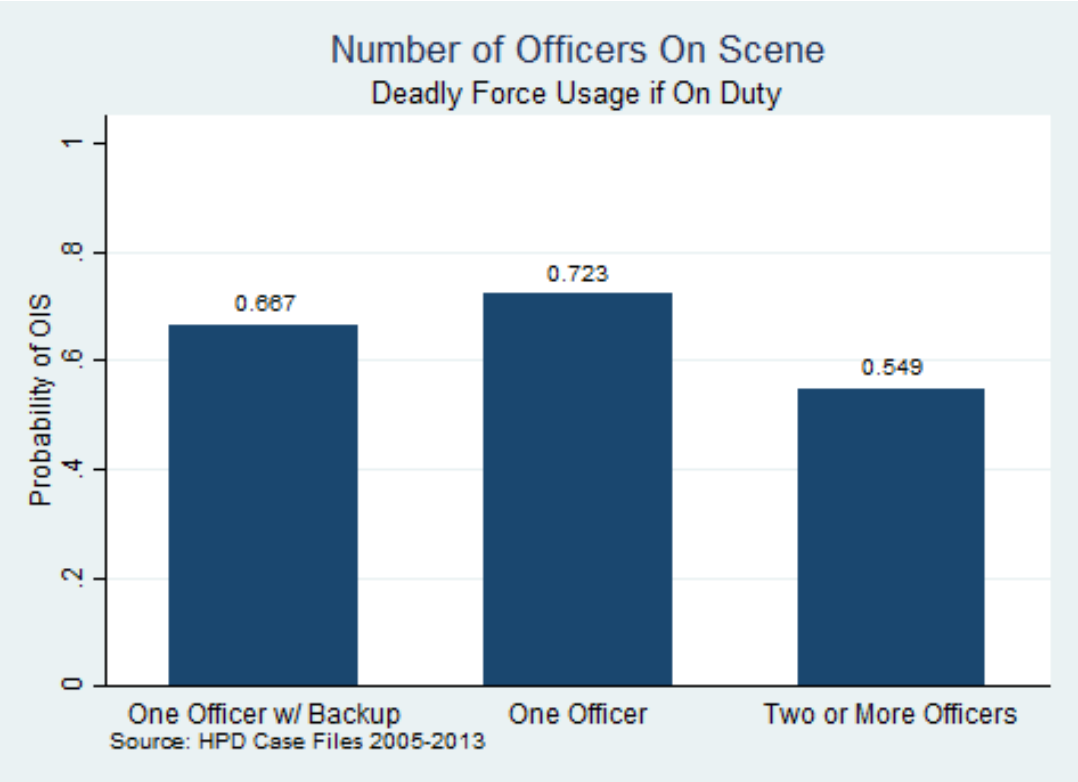


Figure 29: ***Number of Officers on Scene Deadly Force Usage if On Duty***



When the officer knew that a weapon was involved, Figure 30 shows that there was a very slight increase in the probability that an officer used deadly force over a CED. The relationship was categorized for when a weapon was known (n=109) to see if certain weapons signified a greater use of deadly force (Figure 31). Although there were only a few incidents, it was intriguing to find that OIS incidents were more likely when a dog was known as the suspect's weapon, or protection, than when the suspect was known to have a gun (Figure 32). However, the number of cases involving dog as the weapon is small and hence further regression analysis is needed to determine the validity of the statement. When a vehicle was known as the weapon, which was very rare, CEDs were never used, as expected because of their lack of efficacy against a moving vehicle. CED usage was most likely when the suspect was known to have a close combat weapon, such as a blunt instrument or a knife.

Figure 30: ***Suspect Weapon Known Deadly Force Usage***

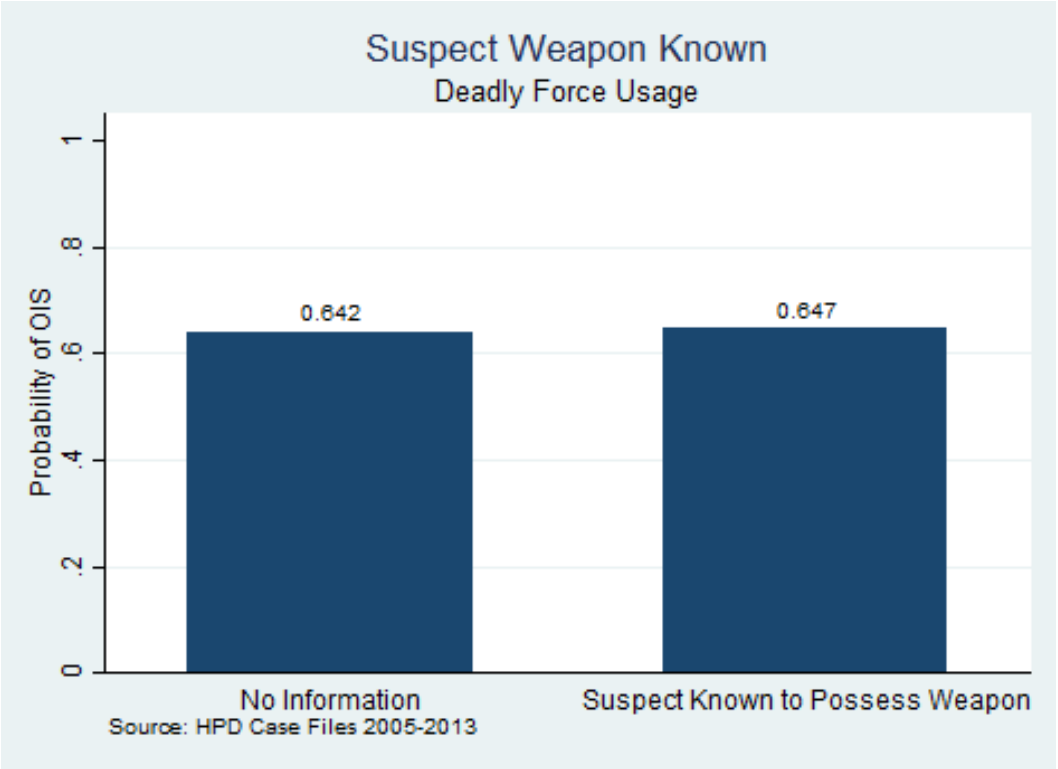


Figure 31: ***Suspect Weapon Type Known Total Numbers***

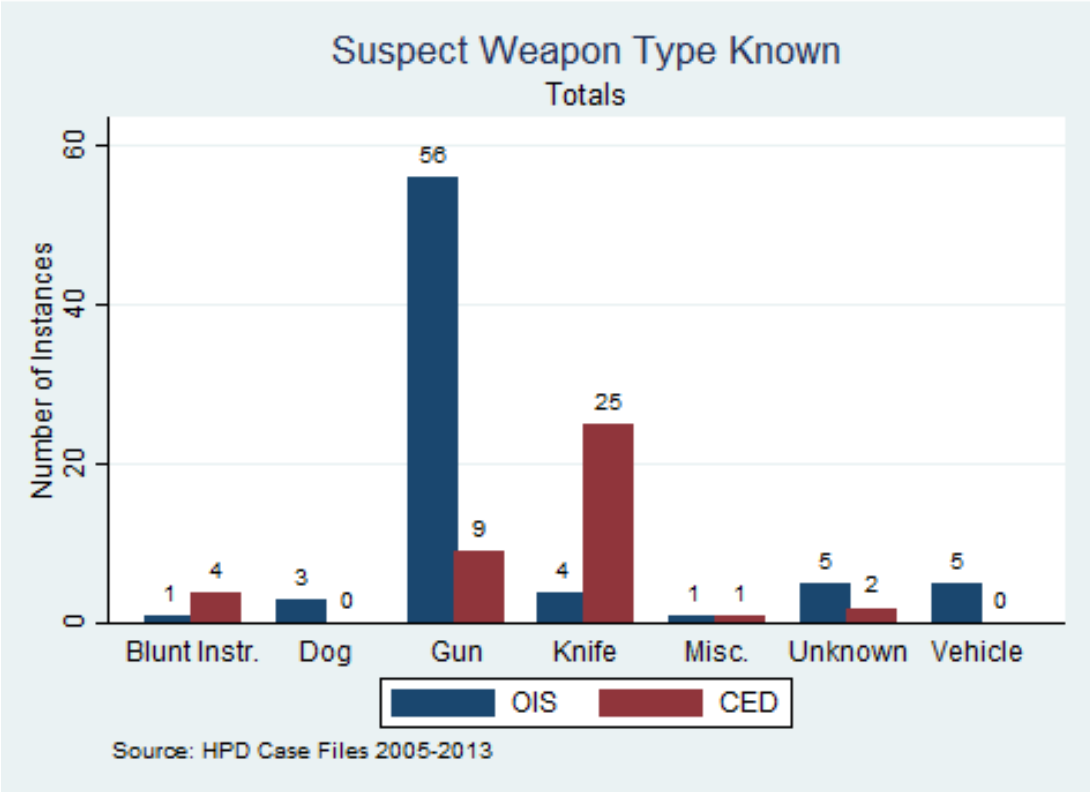
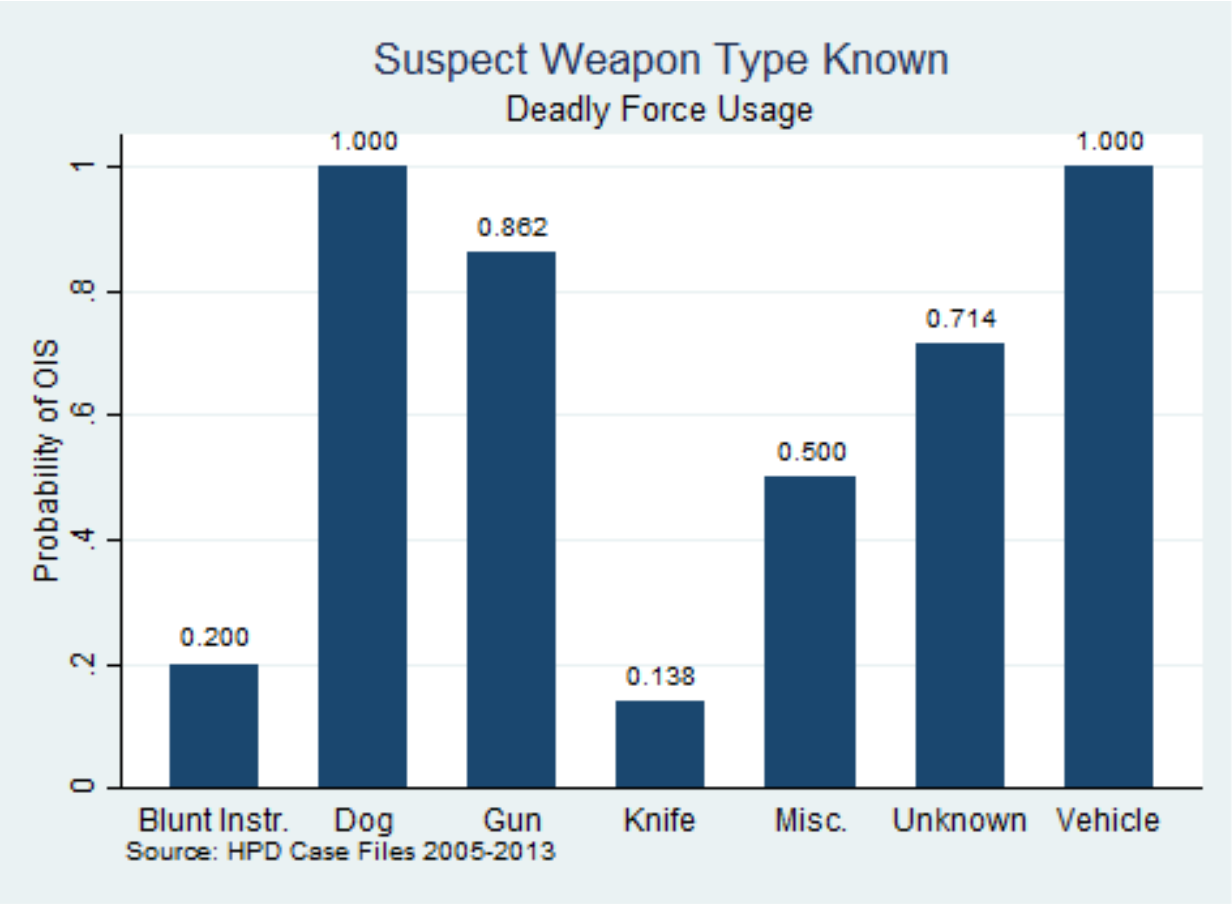


Figure 32: ***Suspect Weapon Type Known Deadly Force Usage***



The premise variable was examined to find that most incidents that warranted the use of deadly force occurred in the street or a parking lot (Figure 33). The premise with the highest occurrence of OIS per permitted incident was also found to be parking lots (Figure 34).

Figure 33: ***Premise Total Numbers***

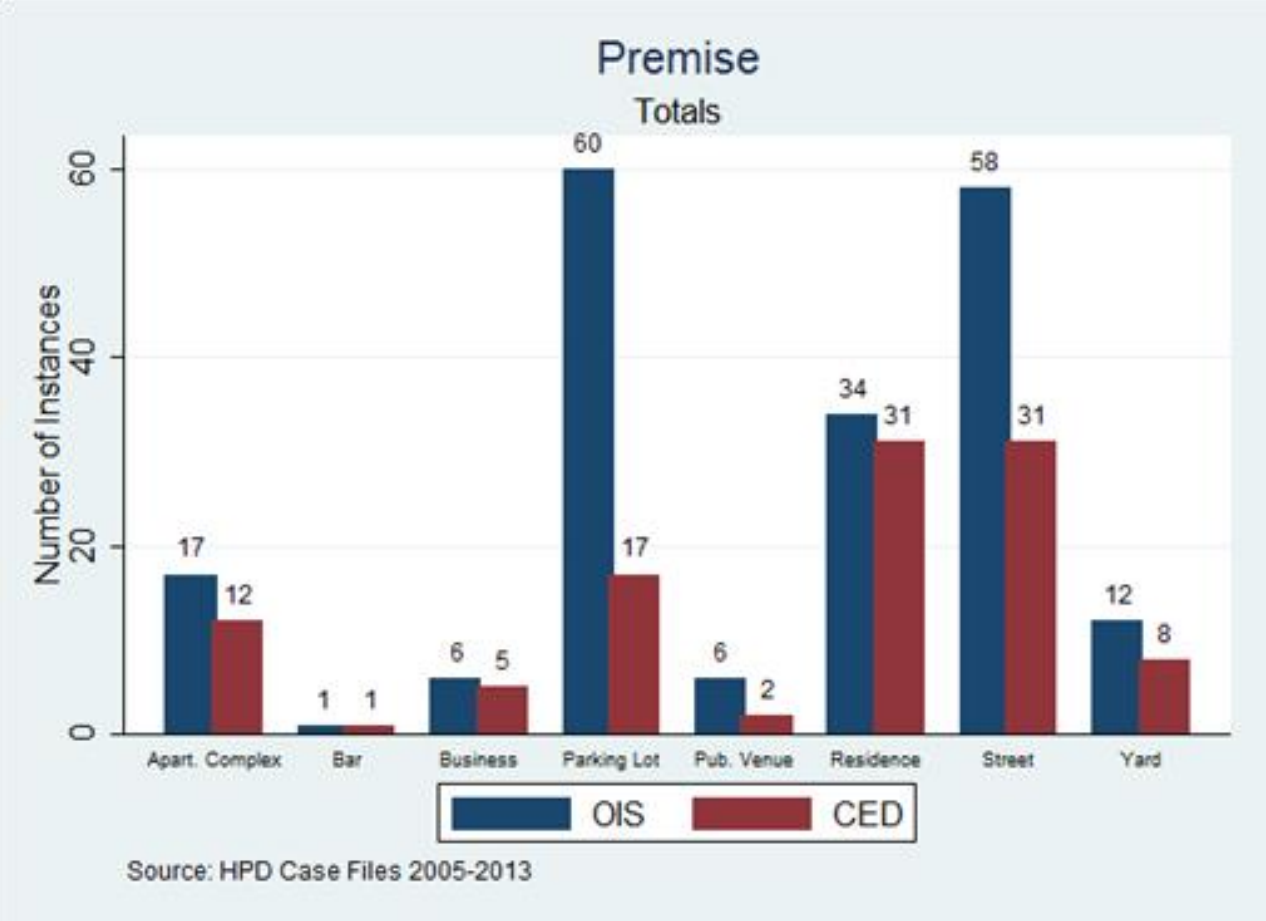
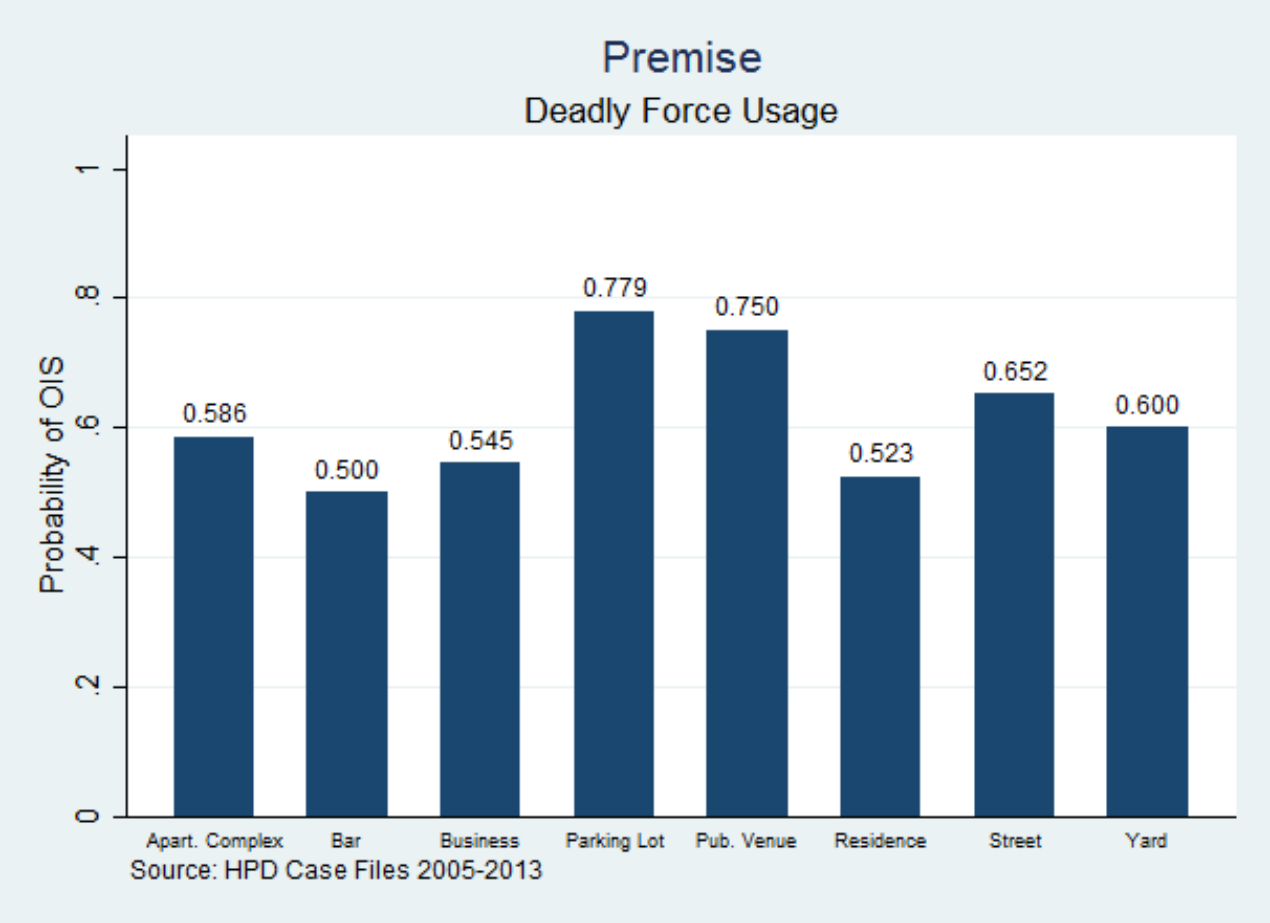


Figure 34: ***Premise Deadly Force Usage***



Another variable this research intends to dissect is an officer's approach; whether the shooting officer approached the suspect with his firearm drawn, his CED drawn, or both weapons holstered. Figure 35 reveals the seemingly obvious results that an officer was much more likely to use a specific weapon when he approached with it drawn. This means that the involved officer had his weapon (either firearm or CED) drawn as he approached the suspect, leading to a higher instance of using that specific weapon. However, Figure 36 shows something peculiar in the relationship. If an officer approached with one of his weapons drawn he was about 87 percent likely to use that unholstered weapon in the event of a life-threatening situation regardless of whether it was a CED or a firearm. Also noticeable in Figure 36, when an officer approached with his weapons holstered, he was more likely to use his CED in the event of a

situation that warranted deadly force. The approach variable seems a key predictor of what kind of force was used; so further regression analysis is needed to examine the relationship between approach and likelihood of OIS incident.

Figure 35: ***Officer's Approach Total Numbers***

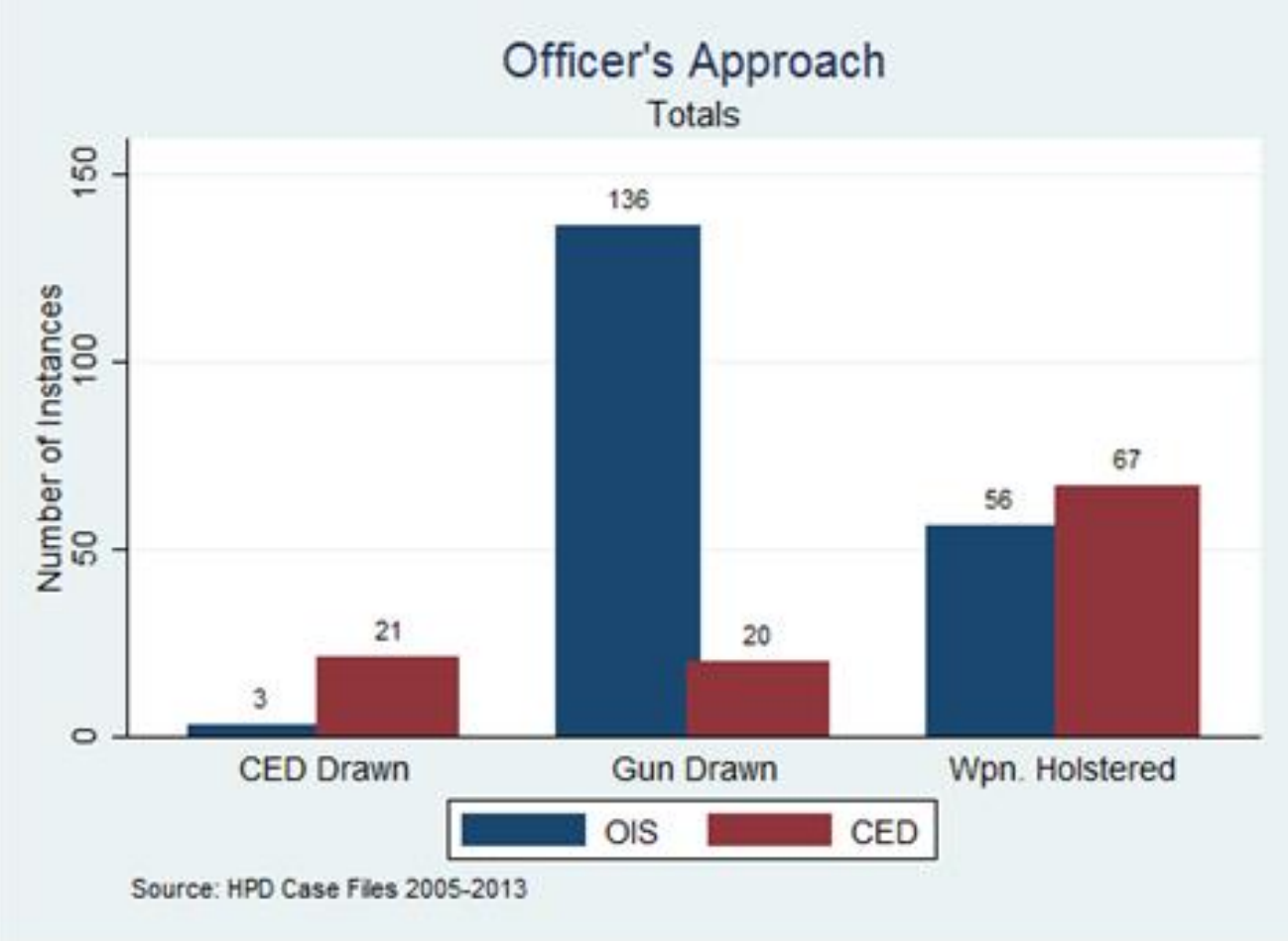
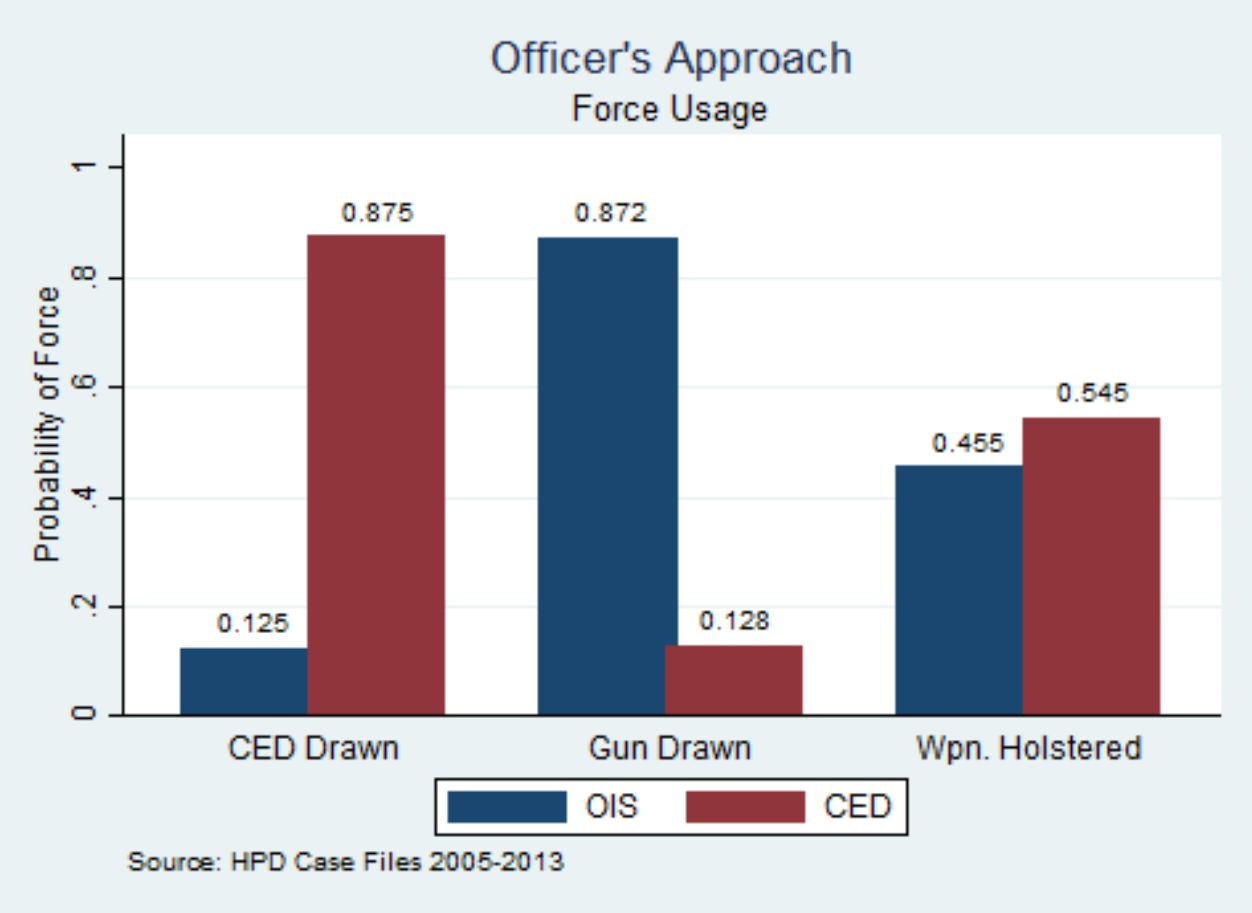


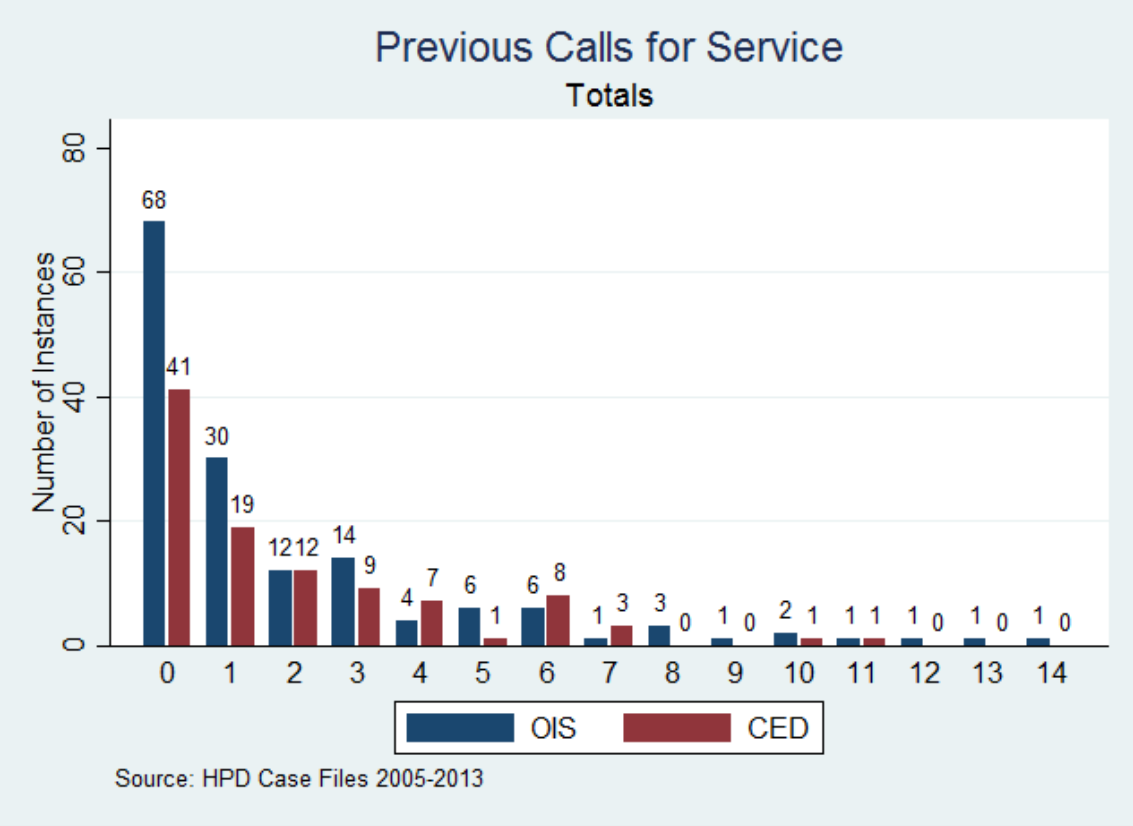
Figure 36: ***Officer's Approach Force Usage***



Previous call for service (CFS) was looked at as an indicator of stress or fatigue that may lead to the decision to use a gun. The rationale was that if an officer had received many calls earlier on his shift he may be more stressed out or tired, leading to greater inclination to use a firearm, or less able to recall and apply critical training guidelines. After analyzing the variable indicating calls for service in an officer's shift prior to the life-threatening incident, it appeared that the main trend in the data is that it's more likely for an officer to face a life-threatening situation as one of his first calls for service. Of the 256 cases in which an officer was on duty, 158 (61.7 percent) of the life-threatening situations that we studied were an officer's first or second call for service. Additionally, incidents in which an officer could use deadly force were so rare after a high instance of previous CFS that it is hard to make useful analysis of the data

(Figure 37). It did allow the research team to initially form a different hypothesis: it could be possible that after an officer faced a couple CFS on his shift, he or she settled down into a shift and was more able to handle a high stress incident like one in which a firearm was warranted. More years of data would be needed to evaluate this hypothesis.

Figure 37: ***Previous Calls for Service Total Numbers if On Duty***



Supplementing the above analysis of previous calls for service, the team also evaluated the mean of the priority numbers for each previous CFS, per life-threatening incident with at least one previous CFS (n=158). The mean of priority numbers of previous calls for service was found by summing up the priority number of each previous CFS and dividing by the total number of previous CFS per case. Looking at Figure 38, amongst those OIS and CED incidents with prior calls for service, a mean of three and four had the greatest portions of OIS and CED incidents. However, this could just be a result of more frequent occurrences of previous incidents

with priority number three and four. Therefore, while Figure 38 was useful in deciphering which mean priority numbers were associated with a higher absolute number of OIS and CED incidents, it is not very useful in representing the priority numbers' association with likelihood of OIS. To observe that trend, the team graphed Figure 39, which seems to indicate a general downward trend in likelihood of OIS as mean priority number for previous calls for service increased from 1 to 8, except for a slight jump for priority number 7. This is an interesting finding because it appears to indicate that calls for more serious incidents prior to the case that warranted deadly force, had a direct positive effect on likelihood of officer using gun. A caveat is that the mean priority number did not account for the absolute number of previous calls for service, which could have an effect on the officer's likelihood of using gun as well. In Chapter 7, the team took this third variable effect into account by running a focus regression of "ois" on mean priority number, while controlling for number of previous calls for service.

Figure 38: ***Mean Priority Number of Previous CFS Total Numbers if On Duty***

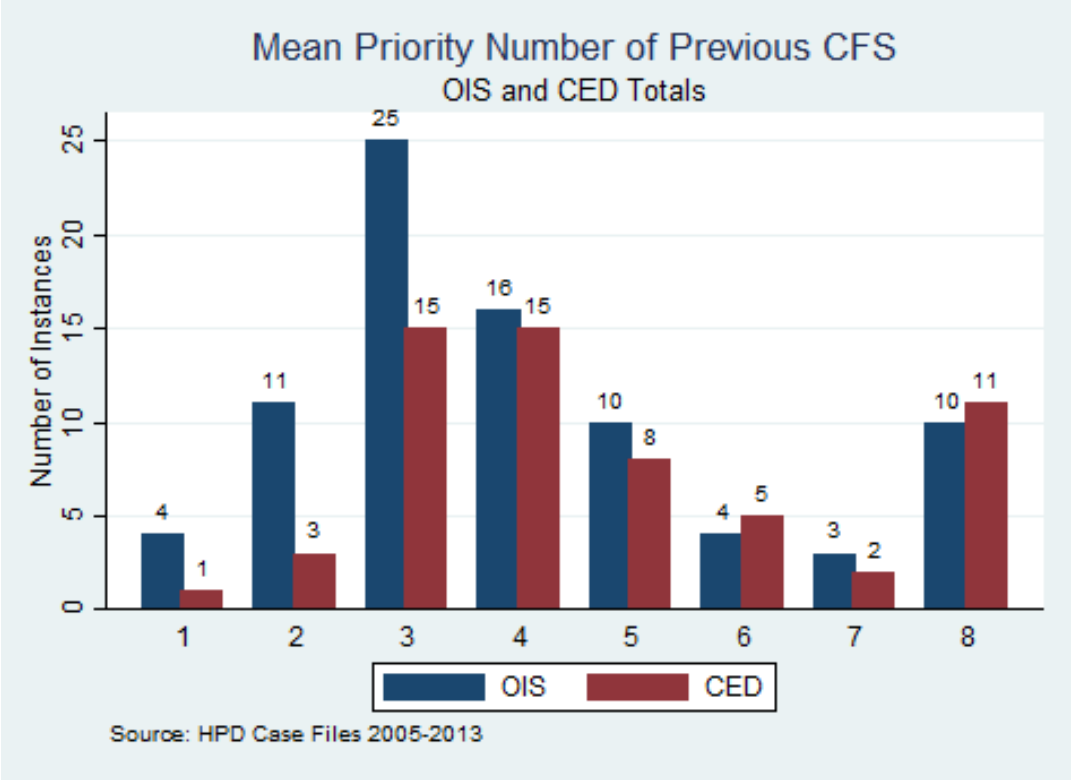
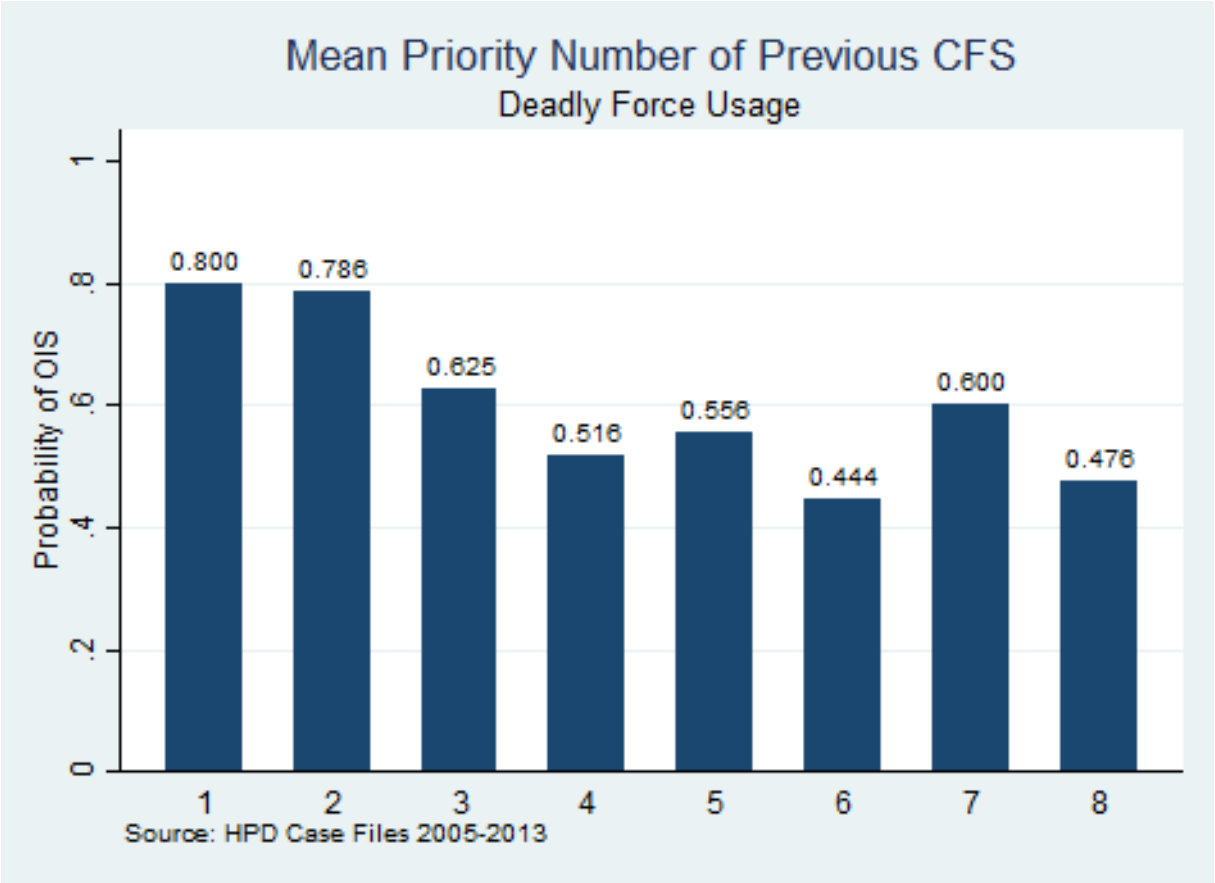


Figure 39: ***Mean Priority Number of Previous CFS Deadly Force Usage if On Duty***



Information given to an officer was analyzed, as it was seen as an actionable area that could be improved upon if shown to have a positive impact. These specific pre-scene variables were coded: was the suspect described, was the suspect already engaged in a foot pursuit, or was the suspect already engaged in a vehicle pursuit. Figures 40-45 show the general relations between these variables and an officer's decision to use deadly or less deadly force (CED). For suspect described, when an officer was aware of the description, then he or she was less likely to use deadly force (Figure 40 and 41). This variable was analyzed further in the regression analysis to see how it affected an officer's decision when all else was considered. Figure 42 shows the low frequency of cases in which the officer who used force knew, prior to arriving on the scene, that there was already an engaged foot pursuit (n=15). When the officer knew about the foot

pursuit, it resulted in a lower probability of using deadly force (Figure 43). The low instance of observations in which this variable was known makes any conclusion premature, but this lower probability could be a result of the ruling in *Tennessee v. Garner*, protecting a fleeing suspect. The vehicle pursuit variable seemed to follow the pattern of other vehicle involved variables in which a vehicle undermined the efficacy of the CED, unless an officer was able to fire his CED through the window of a slowly moving suspect's car (Figure 44). While infrequent, when an officer knew of the vehicle pursuit prior to arriving on the scene, the probability of the officer engaging with his firearm was extremely high (Figure 45).

Figure 40: ***Suspect Described Total Numbers***

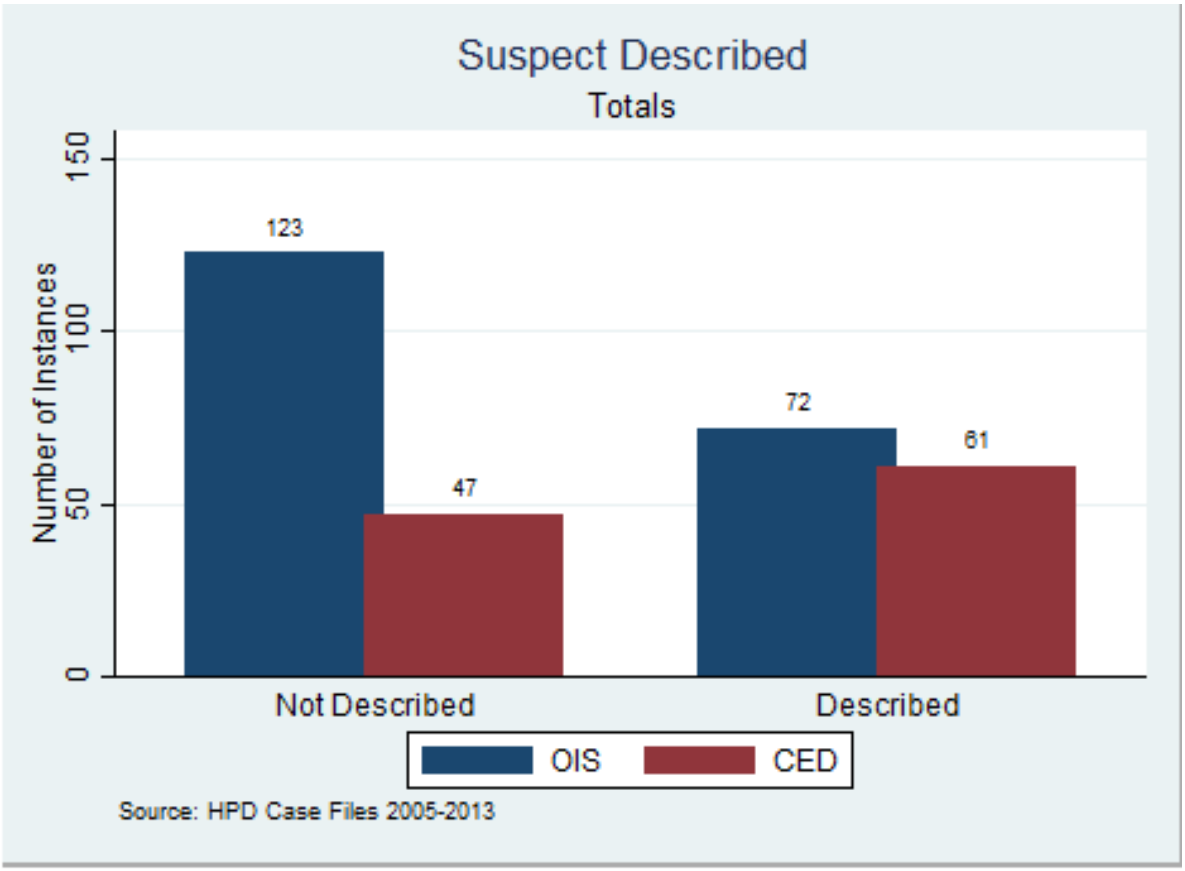


Figure 41: ***Suspect Described Deadly Force Usage***

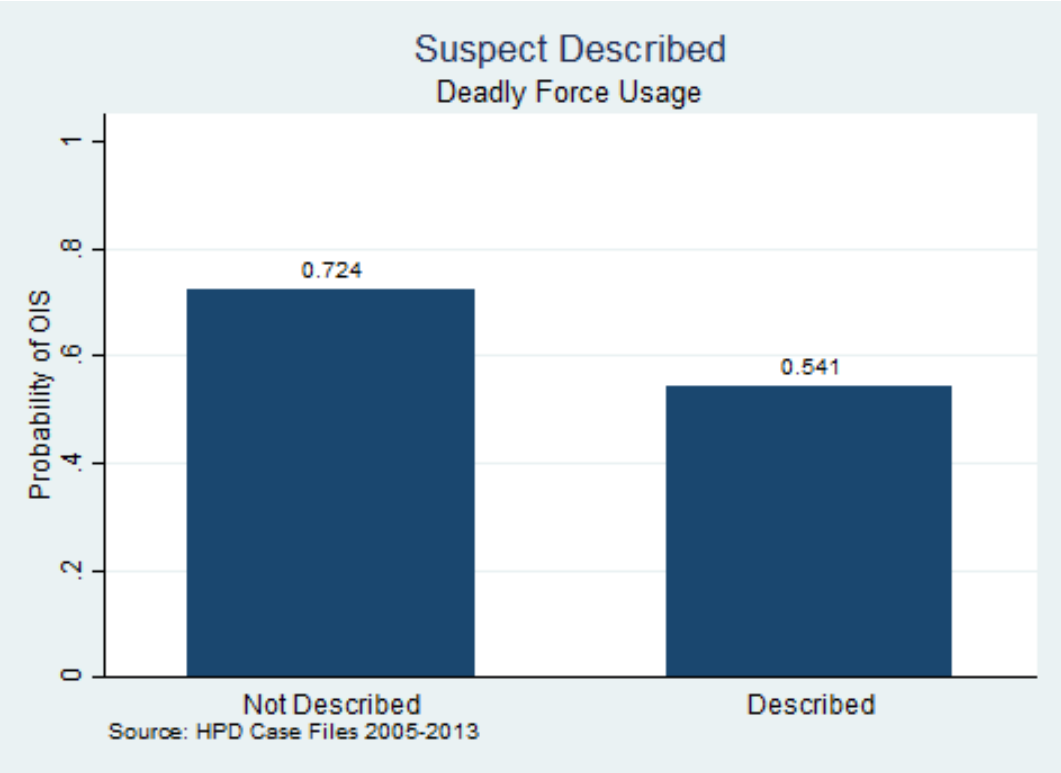


Figure 42: ***Foot Pursuit Total Numbers***

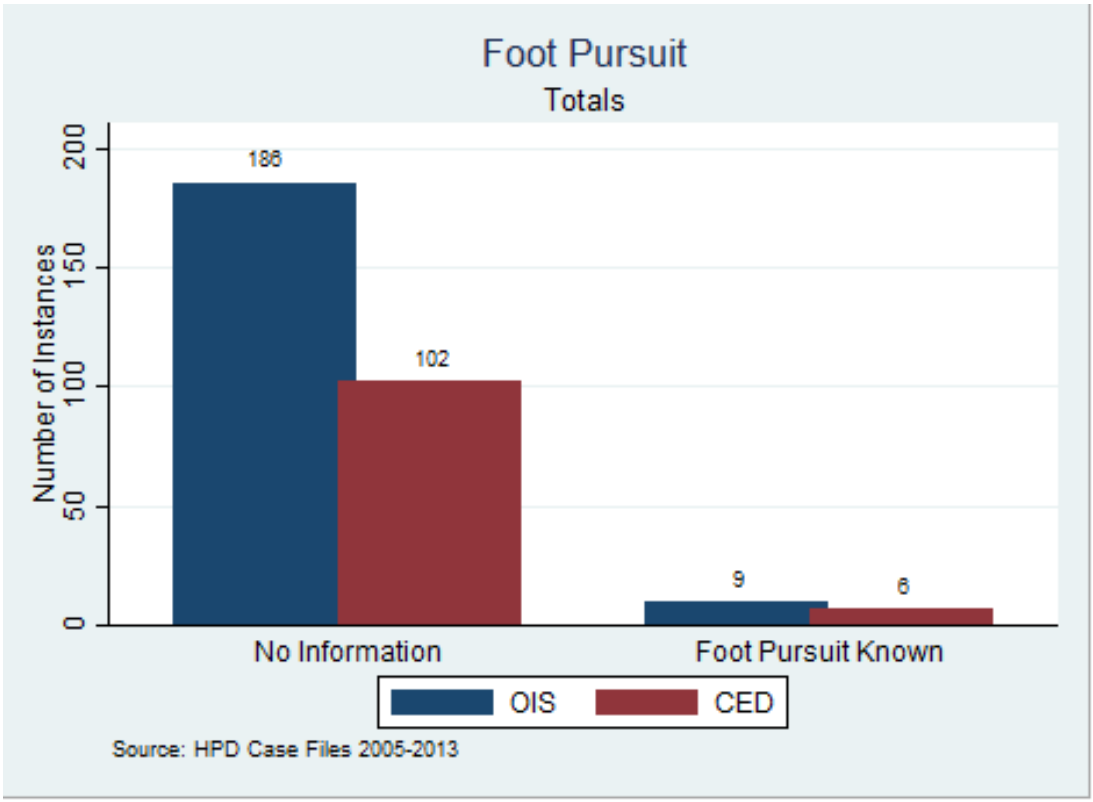


Figure 43: ***Foot Pursuit Deadly Force Usage***

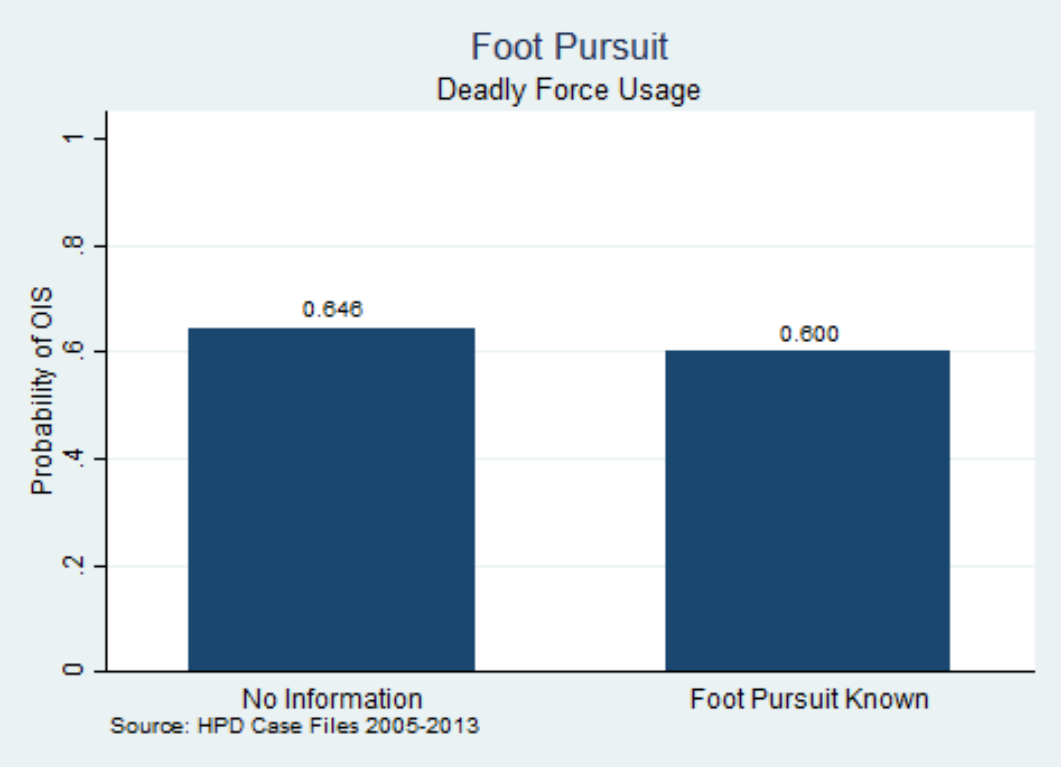


Figure 44: ***Vehicle Pursuit Total Numbers***

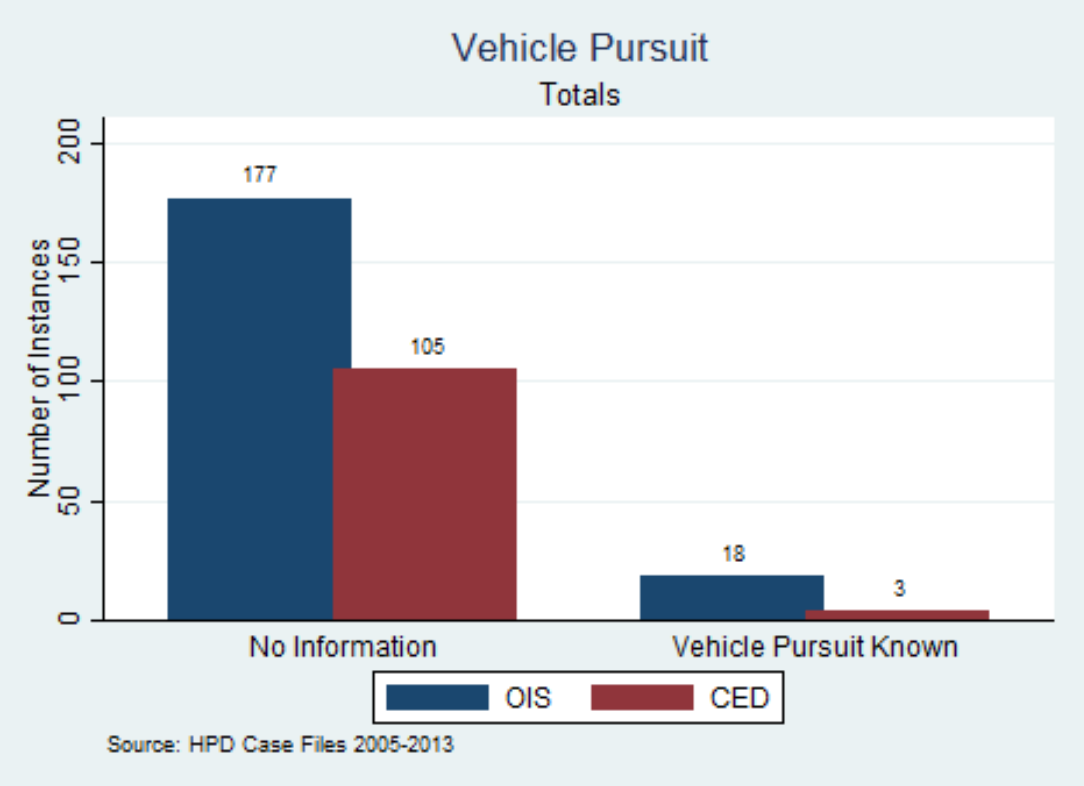
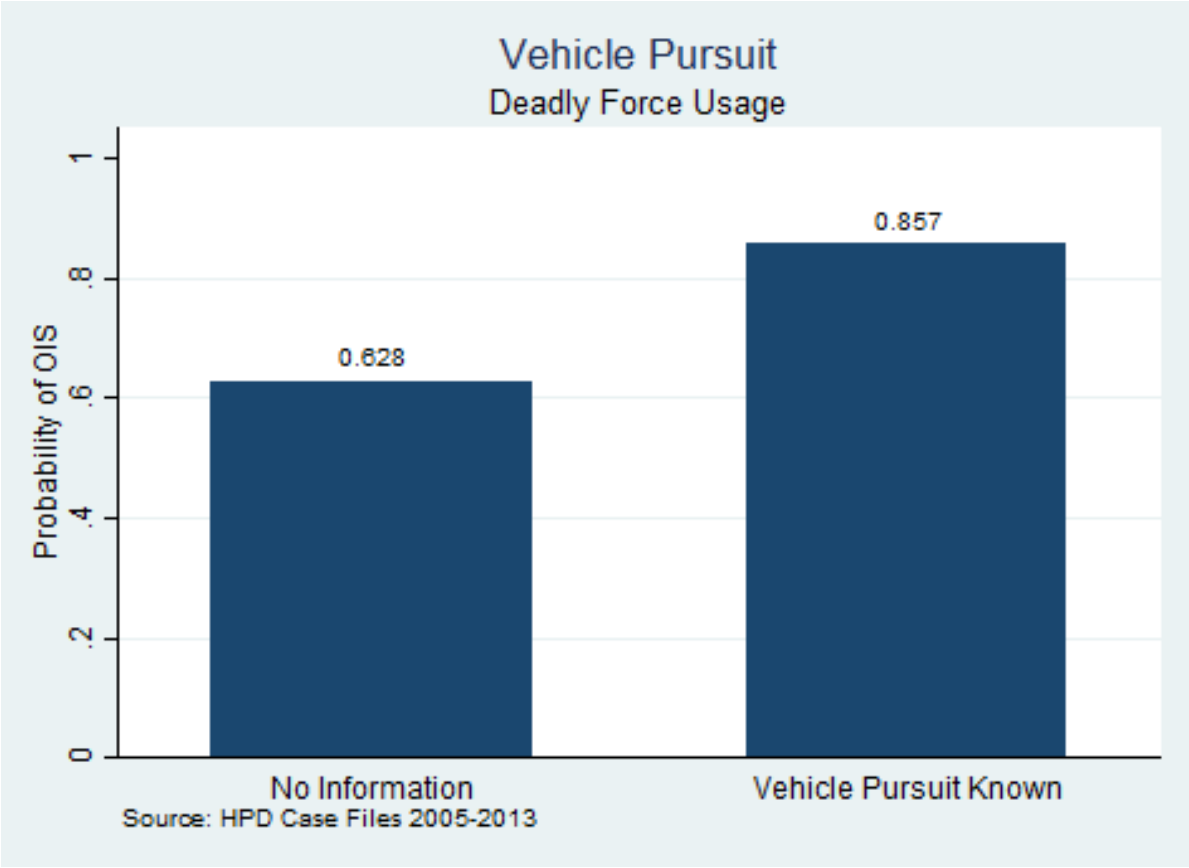


Figure 45: ***Vehicle Pursuit Deadly Force Usage***



The vehicle and foot pursuit pre-scene variable had an on scene counterpart, which was the suspect fleeing before the officer used any sort of force (n=150). It is seen in Figure 46 that an officer was much more likely to use deadly force when a suspect was fleeing. The higher resulting probability of OIS from a fleeing suspect (Figure 47) is most likely a product of the suspect creating too much space between himself and the officer for a CED to be useful. This would lead to an officer reaching for his firearm when the suspect made any quick or sudden motions that would indicate a possible threat to the officer's life, or to a third party.

Figure 46: ***Suspect Fleeing Total Numbers***

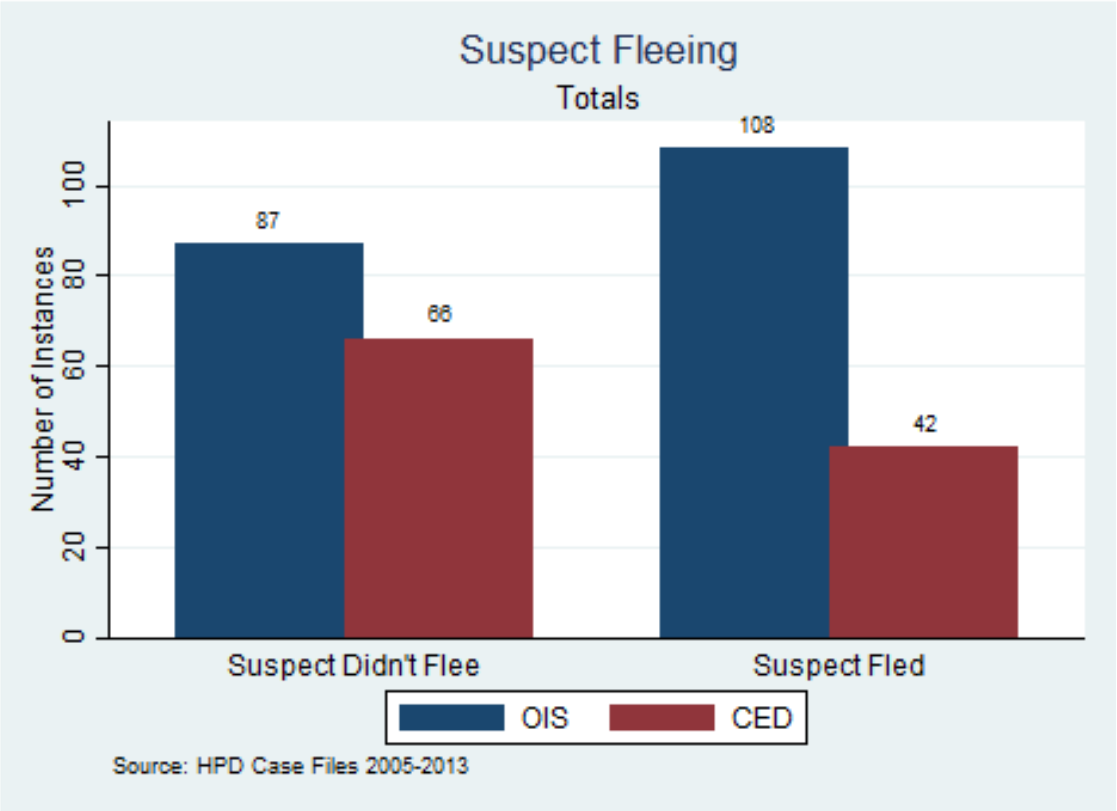
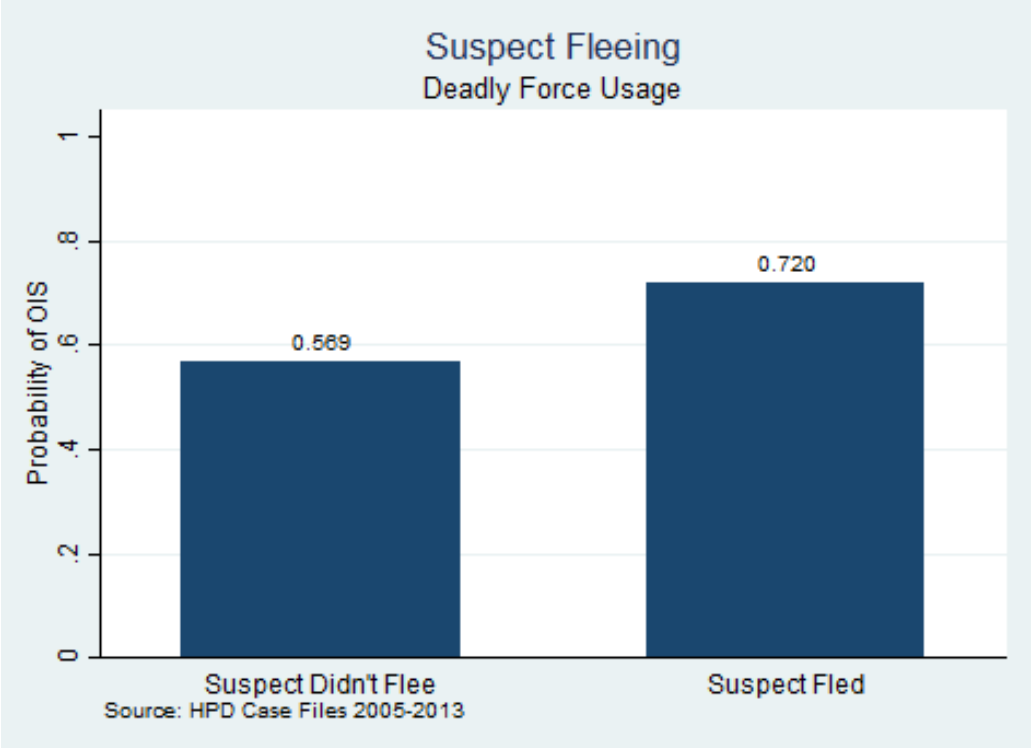


Figure 47: ***Suspect Fleeing Deadly Force Usage***



Another intriguing aspect of the situation prior to an officer's decision to use deadly force is verbal exchange with the suspect. Verbal commands, verbal communication, and language barriers were coded from the case files to examine any elementary trends in the data. Officers used verbal commands in about 84 percent of these high intensity situations (Figure 48). When used, it can be seen that the instance of OIS to CED usage fell from about a 9-to-1 ratio (OIS to CED) without commands to about a 3 to 2 ratio with commands (Figure 49).

Figure 48: ***Verbal Commands Total Numbers***

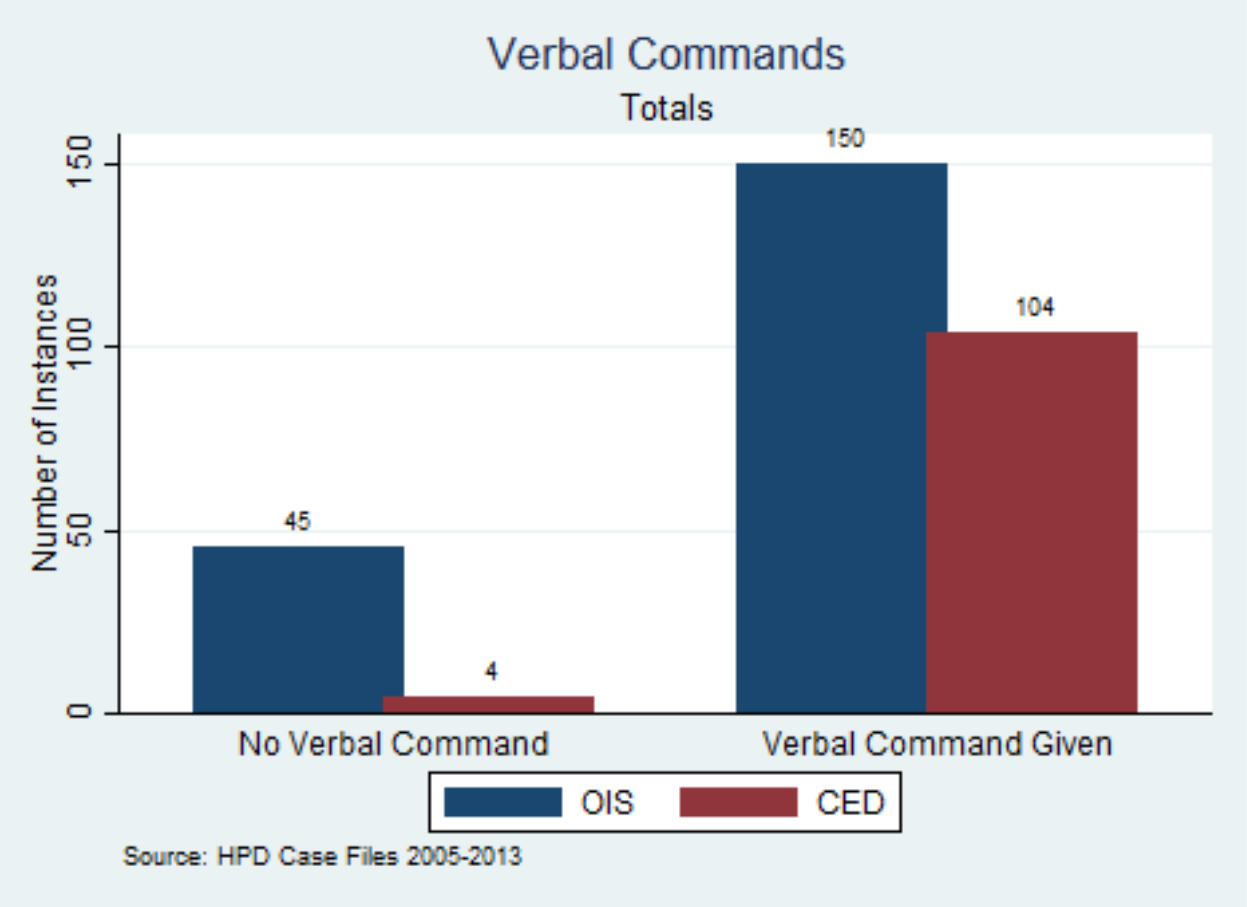
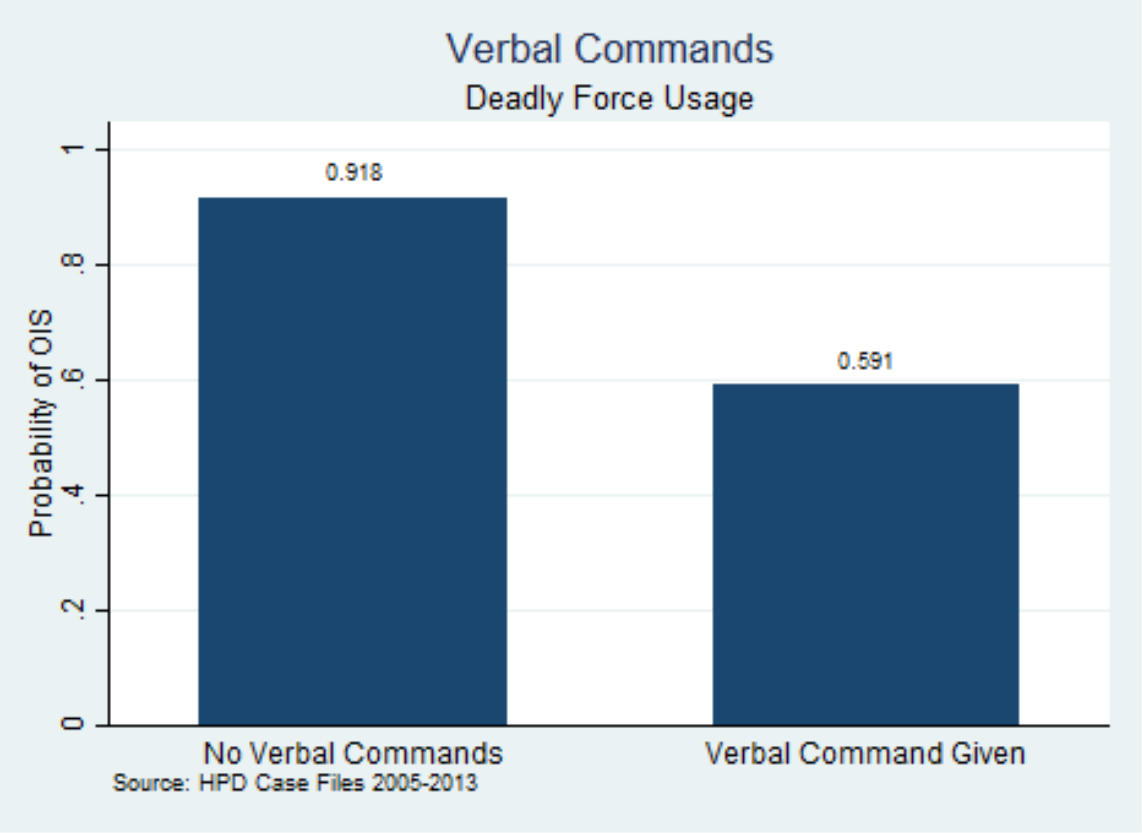


Figure 49: ***Verbal Commands Deadly Force Usage***



Verbal communication, coded as any sort of exchange in which both parties verbally responded to each other, was much less common than verbal commands due to the nature of an officer's job (Figure 50). When an officer engaged in verbal communication before the life-threatening incident, a similar 3 to 2 ratio was seen in both OIS and CED occurrences. Figure 51 exhibits the OIS to CED ratio without verbal communication, which did not appear as high as without verbal commands, clocking in at a 2 to 1 ratio. These variables were not mutually exclusive, as a case could have been coded as using both verbal commands and verbal communication, so the effects of these different exchanges were hard to separate with such simple analysis.

Figure 50: ***Verbal Communication Total Numbers***

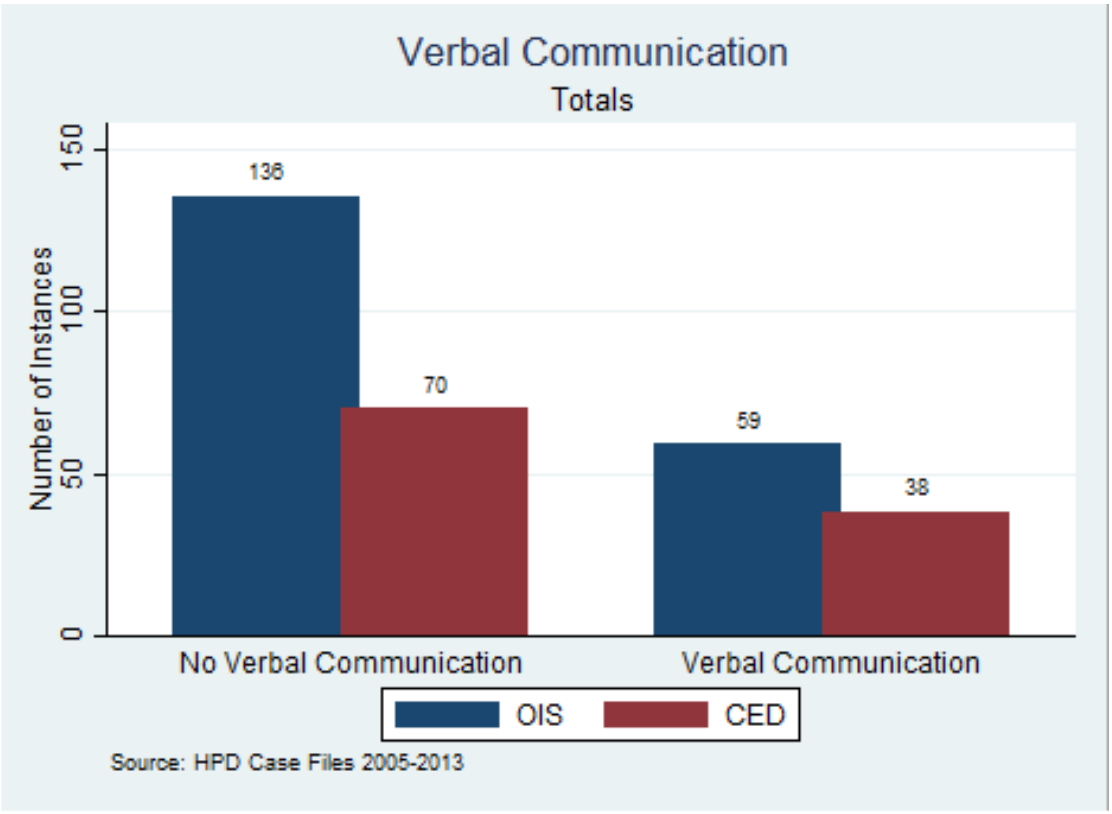
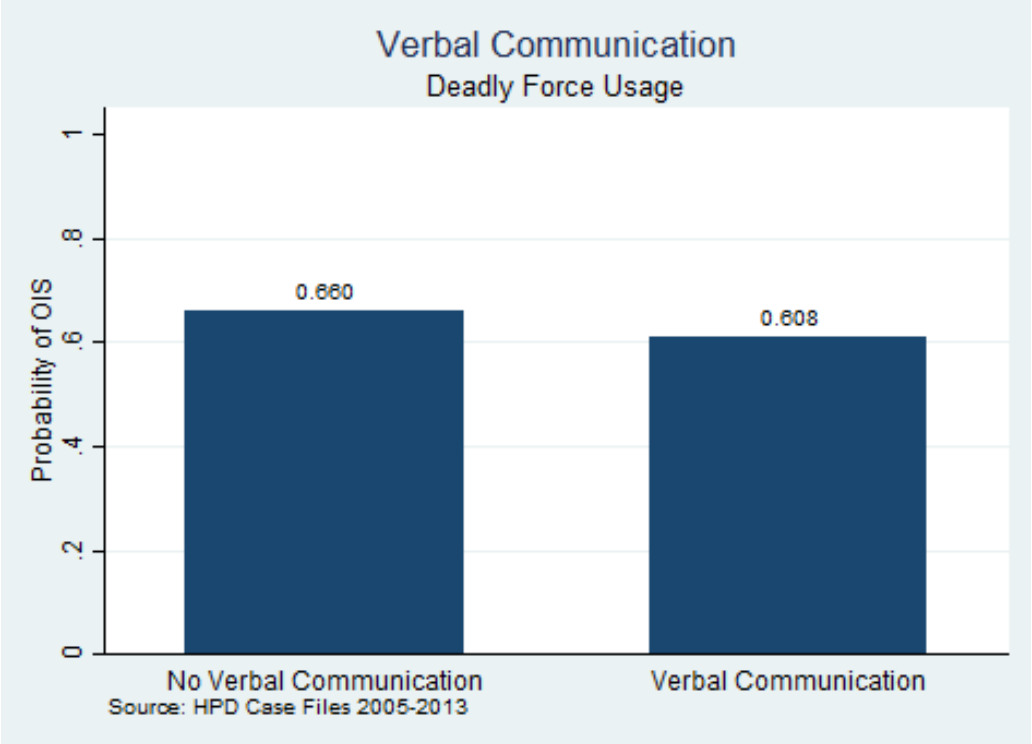


Figure 51: ***Verbal Communication Deadly Force Usage***



Language barriers followed an expected pattern, with the presence of a barrier leading to higher instances of OIS (Figure 52), but since there is a relatively low N, this relationship requires further regression analysis (Figure 53).

Figure 52: ***Language Barriers Total Numbers***

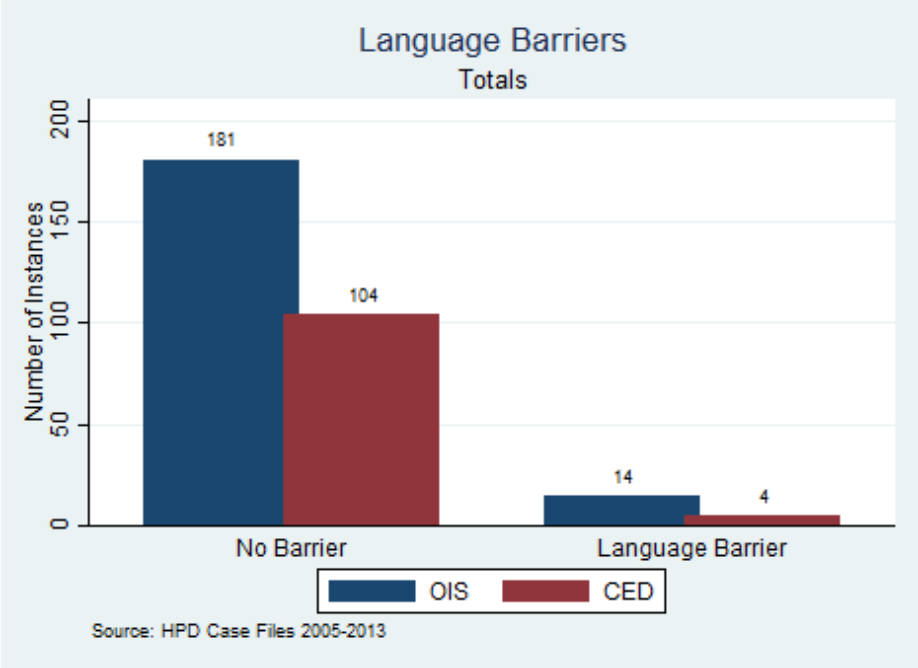
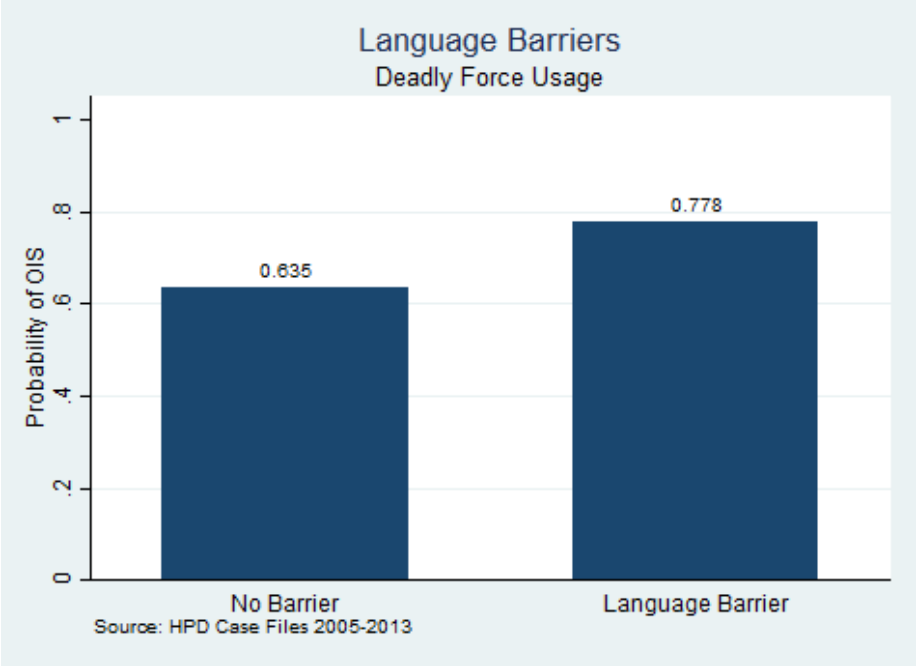
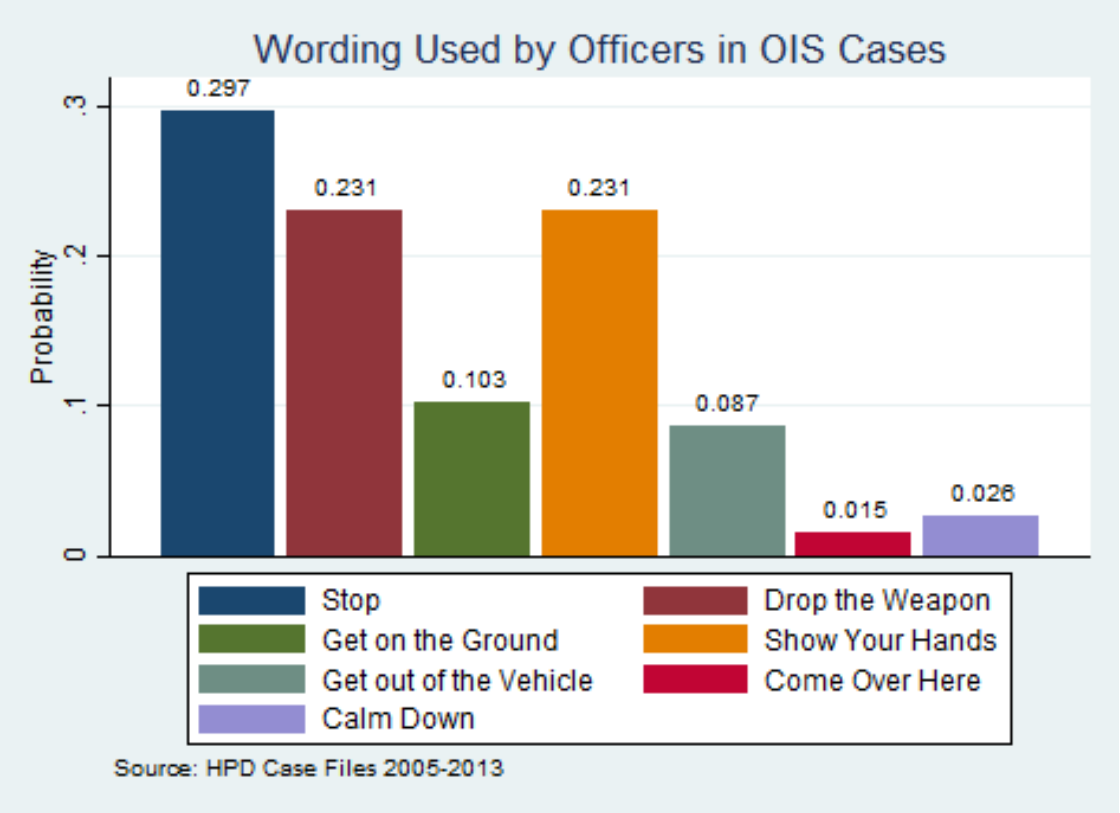


Figure 53: ***Language Barriers Deadly Force Usage***



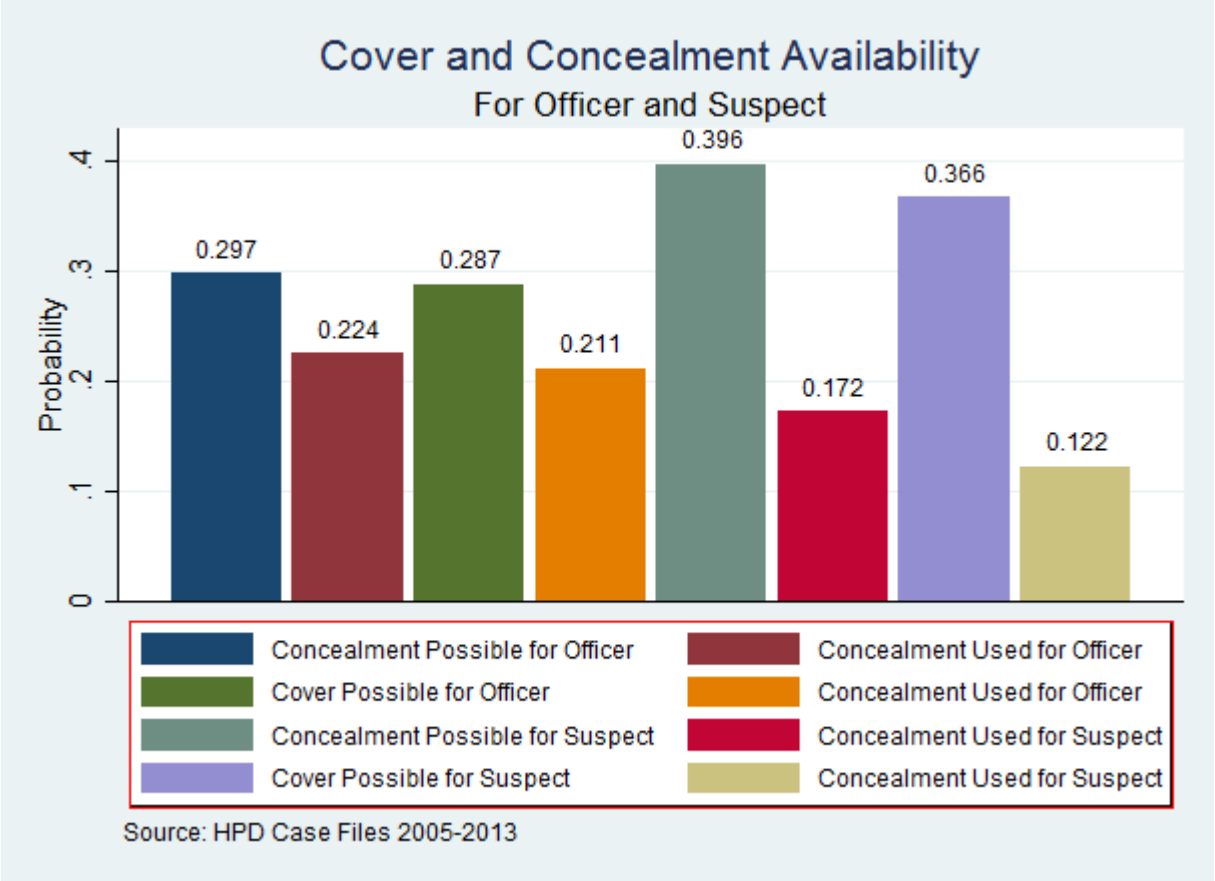
To understand the popularity of various commonly used verbal commands, the team graphed the likelihood of each common verbal command across both OIS and CED incidents (Figure 54). The top three verbal commands in terms of frequency were "stop", "drop the weapon", and "show your hands" in descending order. This finding is not surprising since these verbal commands are reactions to immediate threat or danger. In particular, "drop the weapon" and "show your hands" are common verbal commands used during a threat to life situation, while "stop" is a universal command that is applicable to almost all risky situations, and many non-risky ones as well. The other commands, "get on the ground", "get out of the vehicle", "come over here", and "calm down" were used much less often. A possible explanation is that these commands did not initially arise during dangerous situations, instead they were given as secondary commands after the initial risky scenario had played out.

Figure 54: ***Probability Wording Used by Officer in OIS Cases***



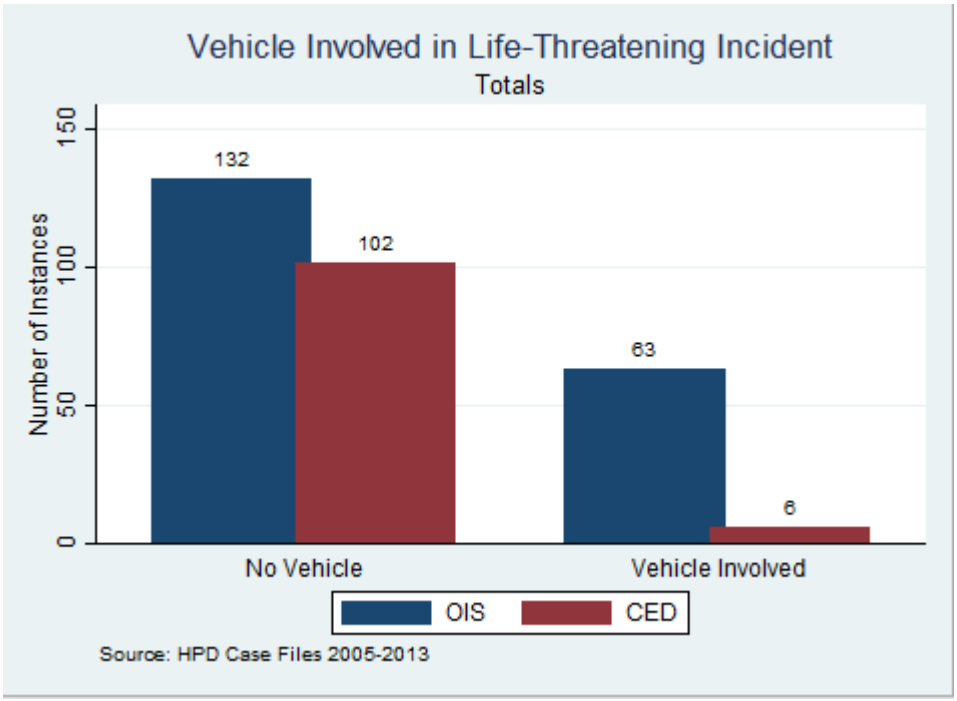
In terms of concealment and cover, the team found a particularly interesting result when graphing the average possibility and usage of concealment and cover by officers and suspects (Figure 55). From the graph, it appears that across OIS and CED incidents, while concealment and cover were more likely to be possible for suspects than officers, they were less likely to be used by suspects as compared to officers. In other words, while officers were less likely to be provided concealment and cover, they were more prone to using them when given the opportunity to do so. This observation could be attributed to the rigorous training that HPD officers had undertaken, and continuously undergo. More importantly, this finding indicates that HPD officers adhered to and applied training lessons and practices in actual use of force situations.

Figure 55: ***Probability of Cover and Concealment***



Finally, with vehicle involvement taken out, one can see in Figure 51 that an officer was closer to 50/50 on his decision to use a CED or a firearm. Also as mentioned before, when a vehicle was involved, the predisposition of almost all officers was intuitively to use a firearm instead of a CED. CEDs did not have the range that an officer would need to guarantee his safety, and hence to deploy CEDs at a fast moving car would be highly ineffective.

Figure 56: ***Vehicle Involved in Life-Threatening Incident Total Numbers***



As noted in the literature review, racial aspects of OIS are often perceived as important, so the thesis team felt it was useful to address this issue. In terms of officer race, white officers were involved in the most number of incidents, for both OIS and CED incidents. This trend is followed by Hispanic officers, Black officers, and Asian officers (Figure 57). However, this trend may be a reason of HPD having more white officers, followed by Hispanic officers etc. In terms of probability of OIS, comparative statistics indicate that Black officers are most likely to be involved in OIS, followed by Hispanic, Asian and then White officers (Figure 58).

Figure 57: ***Officer Race Total Numbers***

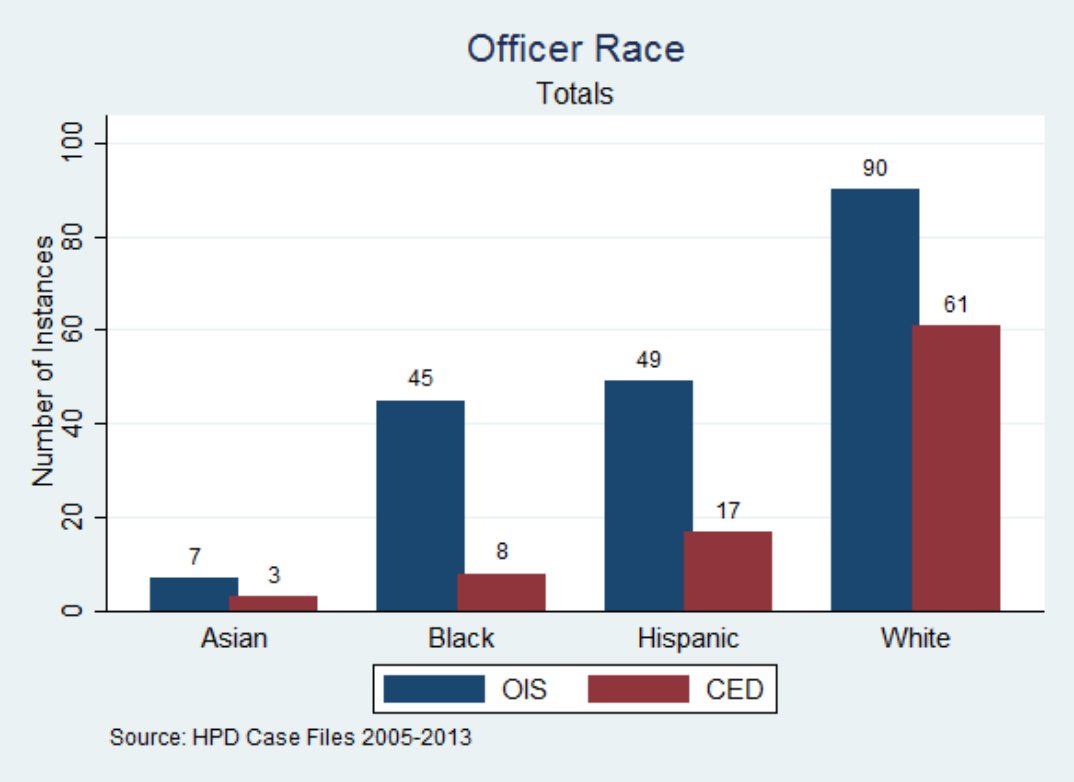
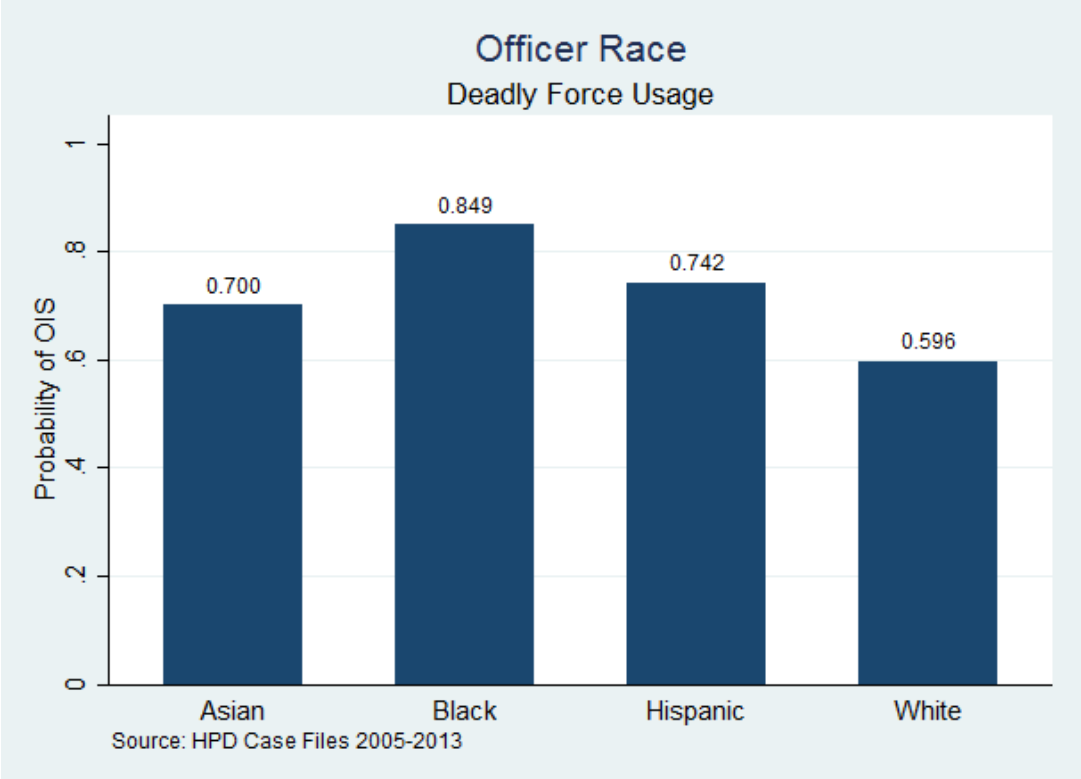


Figure 58: ***Deadly force usage by Officer Race***



In terms of suspect race, black suspects were involved in the most total number of OIS and CED incidents, followed by Hispanic suspects, white suspects and then Asian suspects (Figure 59). However, just looking at CED incidents alone, white suspects were involved in more CED cases than Hispanic suspects. More importantly, it seems that Hispanic suspects were most likely to be involved in OIS (Figure 60). Though black suspects were involved in the most number of incidents, their probability of being involved in OIS is second to Hispanic suspects. This is followed by White and then Asian suspects.

Figure 59: ***Suspect Race Total Numbers***

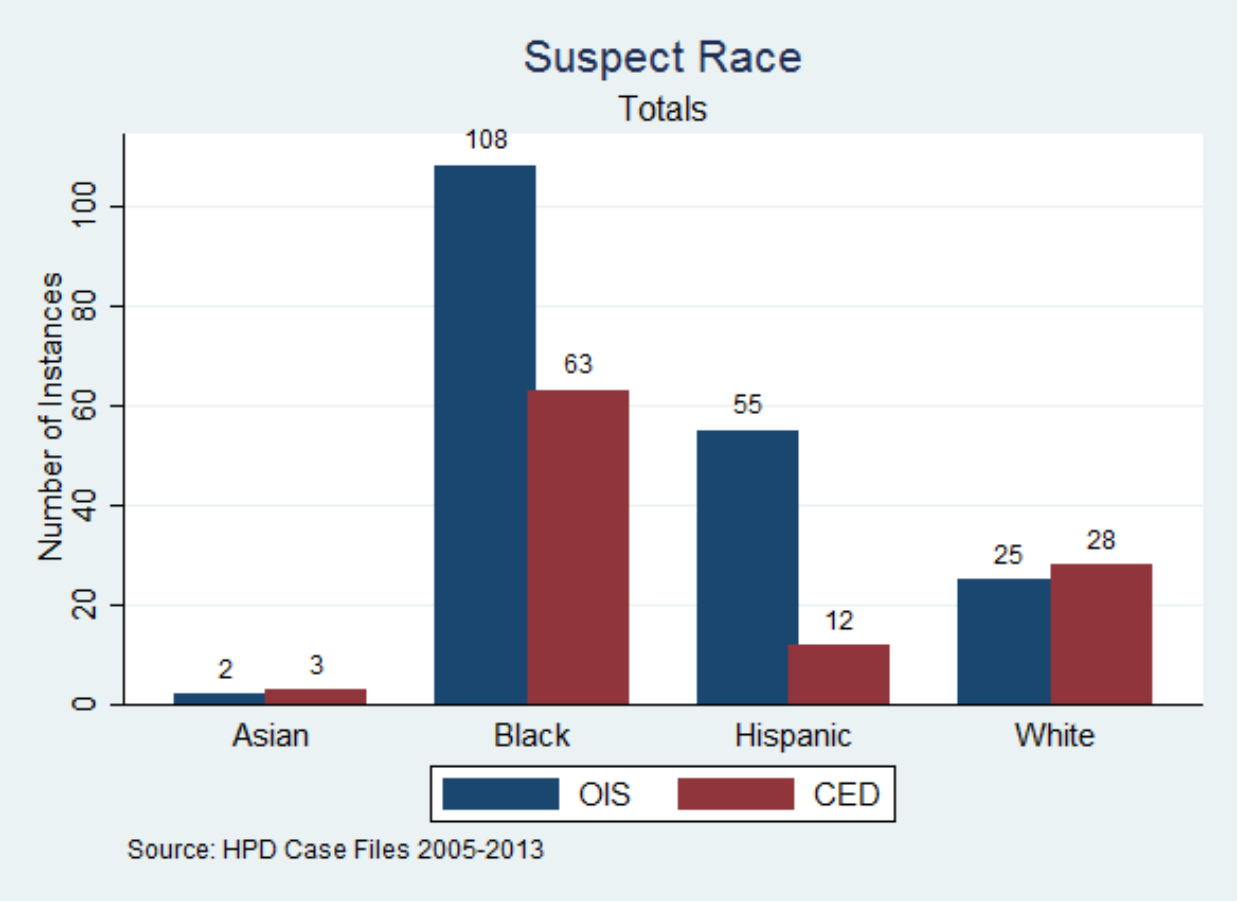
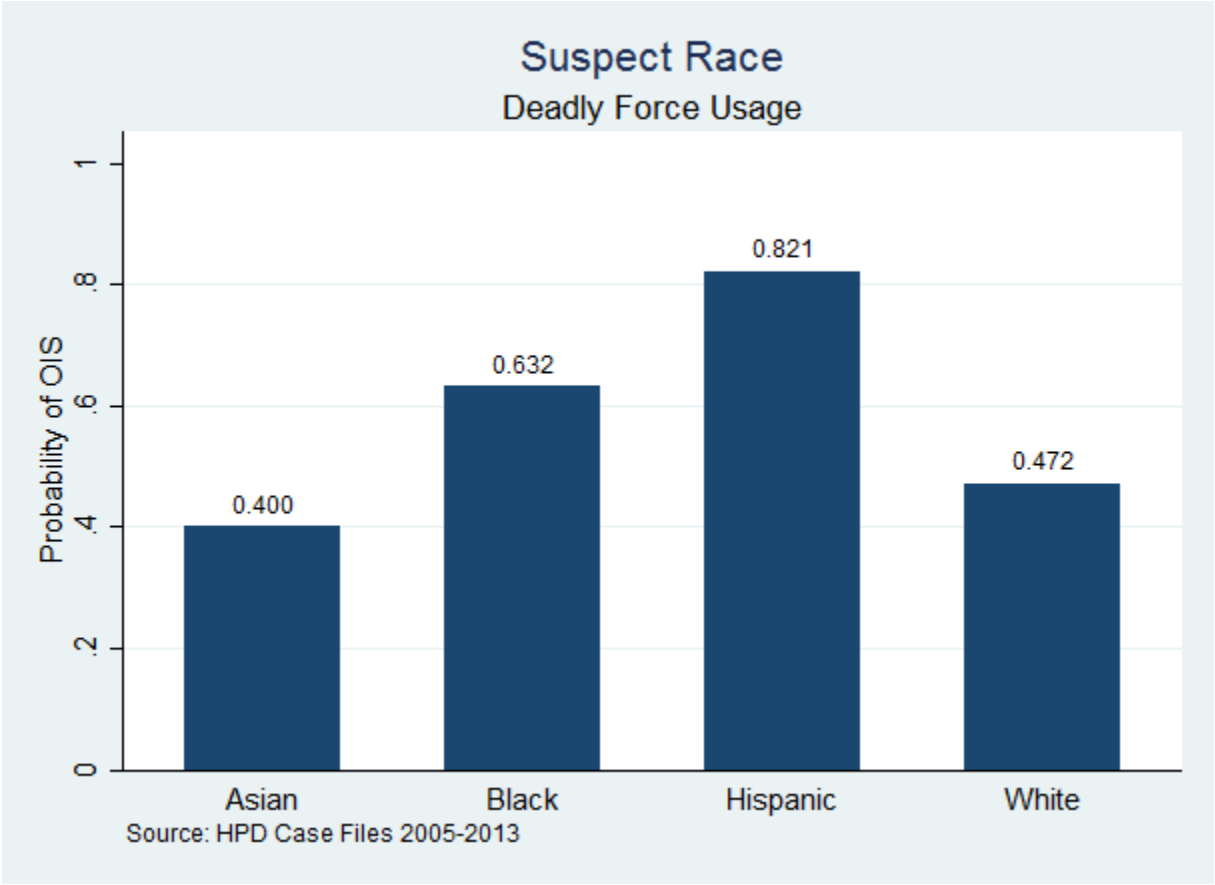


Figure 60: ***Deadly force usage by Suspect Race***



In terms of suspect gender, it appears that male suspects were involved in more OIS as well as CED incidents (Figure 61). Similarly, male suspects were more likely than female suspects to be involved in OIS (Figure 62). This is not surprising because one would expect most of the suspects to be male, and males to be more aggressive than females, leading to a higher likelihood of OIS.

Figure 61: ***Suspect Gender Total Numbers***

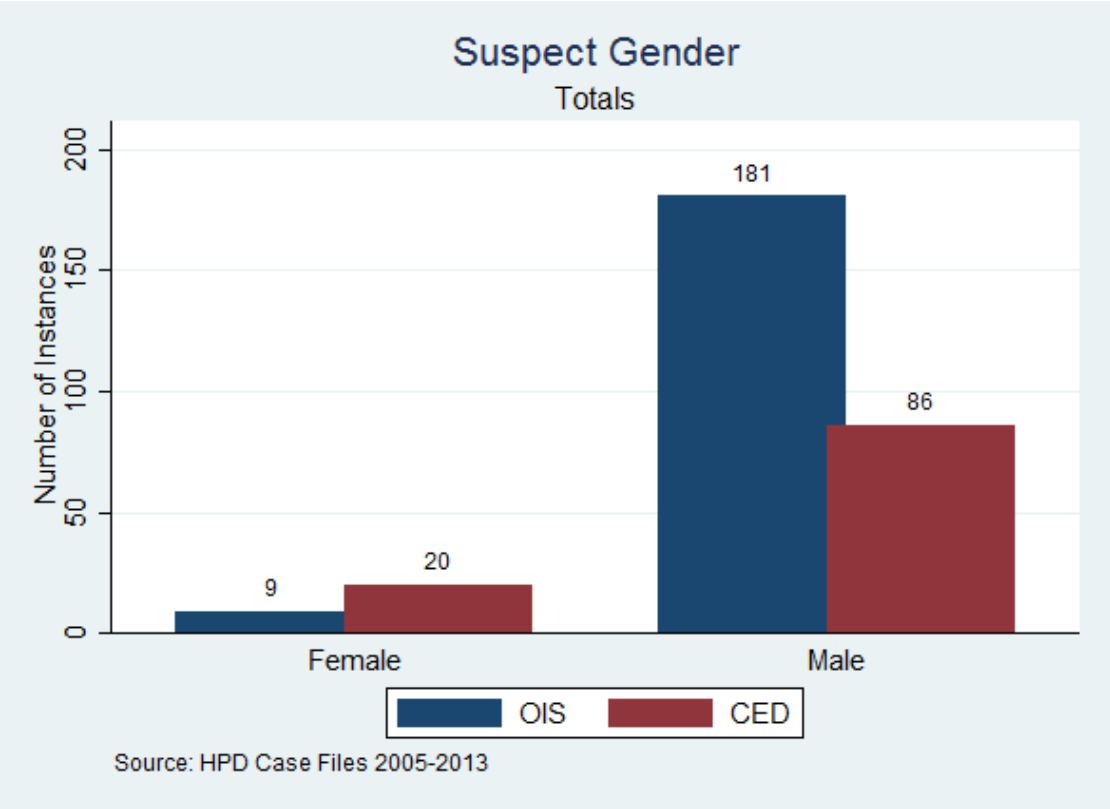
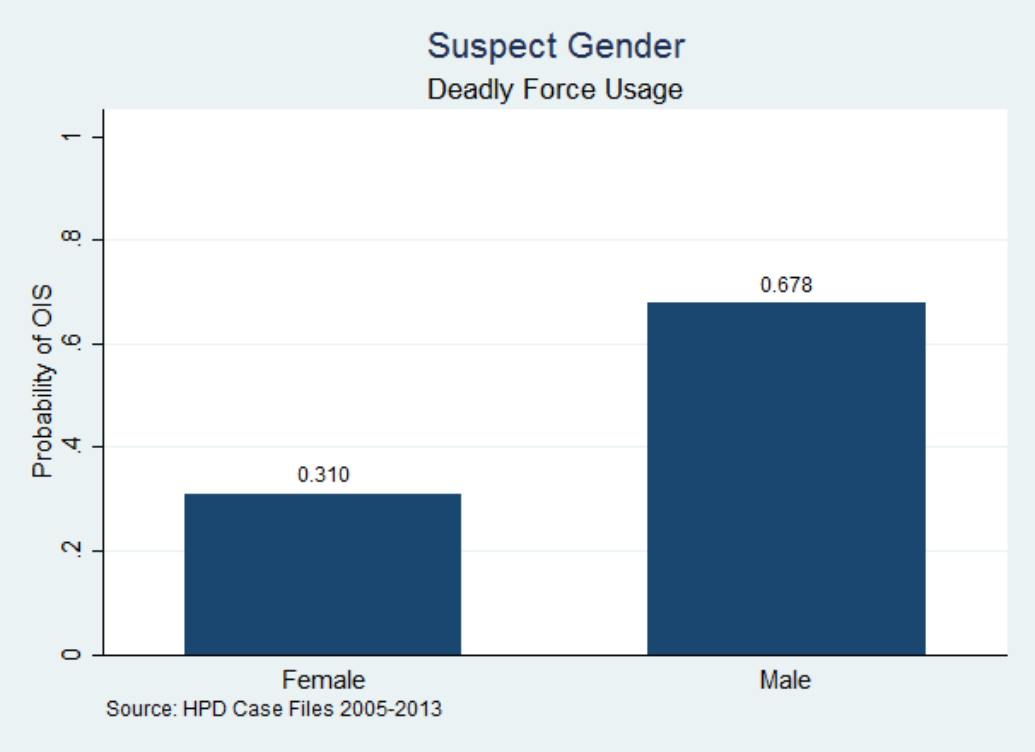


Figure 62: ***Deadly force usage by Suspect Gender***



In terms of suspects' age, suspects of age 20+ were involved in the most number of OIS and CED incidents, followed by 30+ and 40+ suspects (Figure 63). Note that suspects' ages are expressed in decades, and rounded down. While 20+ age old suspects were involved in the most number of total incidents, the probability of the suspect being involved in OIS appears to follow a somewhat downward trend as suspects' age increases, with 20+ age olds being slightly more likely to be involved in OIS than suspects of other ages (Figure 64).

Figure 63: ***Suspect Age by Decades Total Numbers***

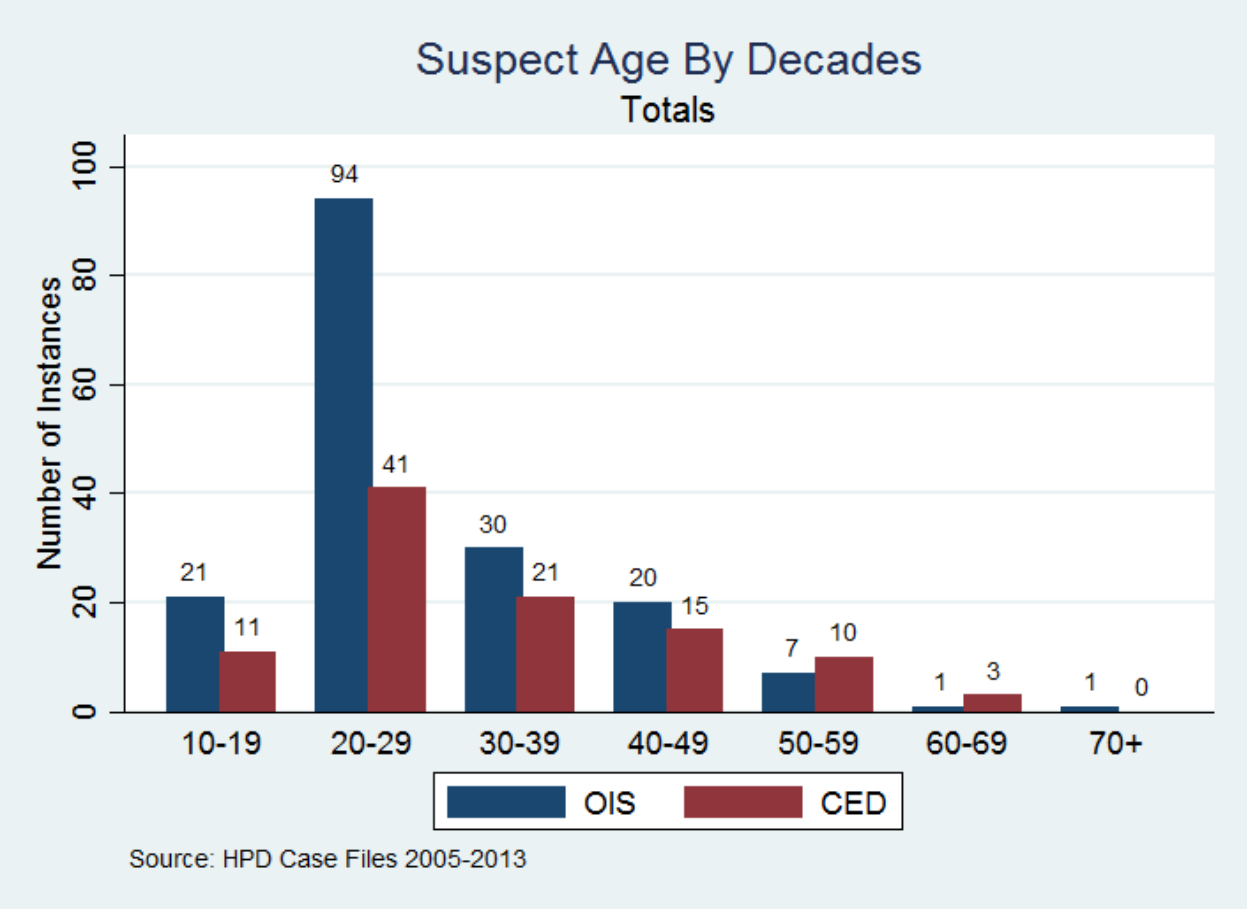
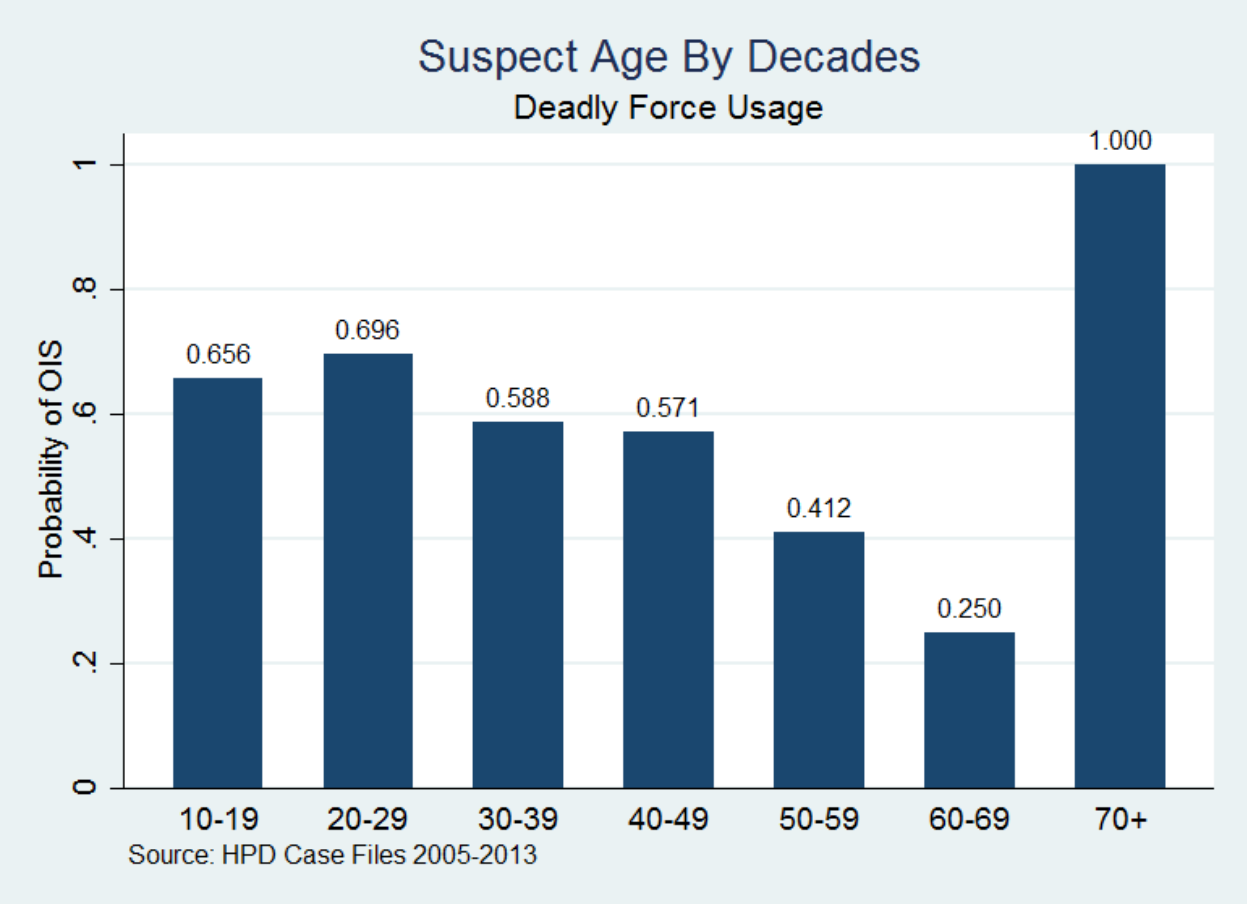
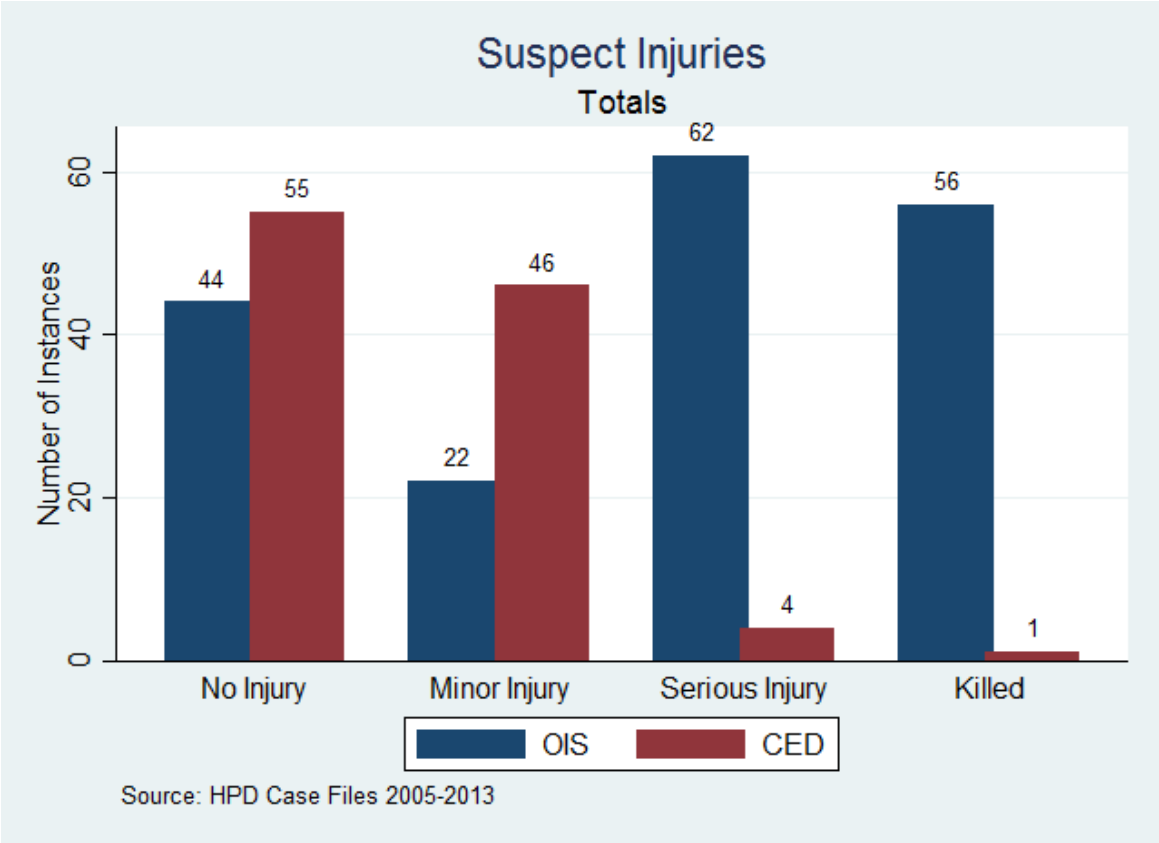


Figure 64: ***Deadly force usage by Suspect Age***



Shown in Figure 65, suspect injuries varied greatly between OIS and CED cases. When the officer used a gun, suspects sustained at least a minor injury in 76 percent of cases and were seriously injured or killed in 64 percent of cases. In contrast, suspects were uninjured in 52 percent of cases where an officer only used a CED. In only 5 percent of cases did suspects sustain a serious injury (including self-inflicted injuries) when officers used a CED. This contrast, while unsurprising reflects the large disparity in level of force between guns and CEDs and incentivizes the use of CEDs when possible.

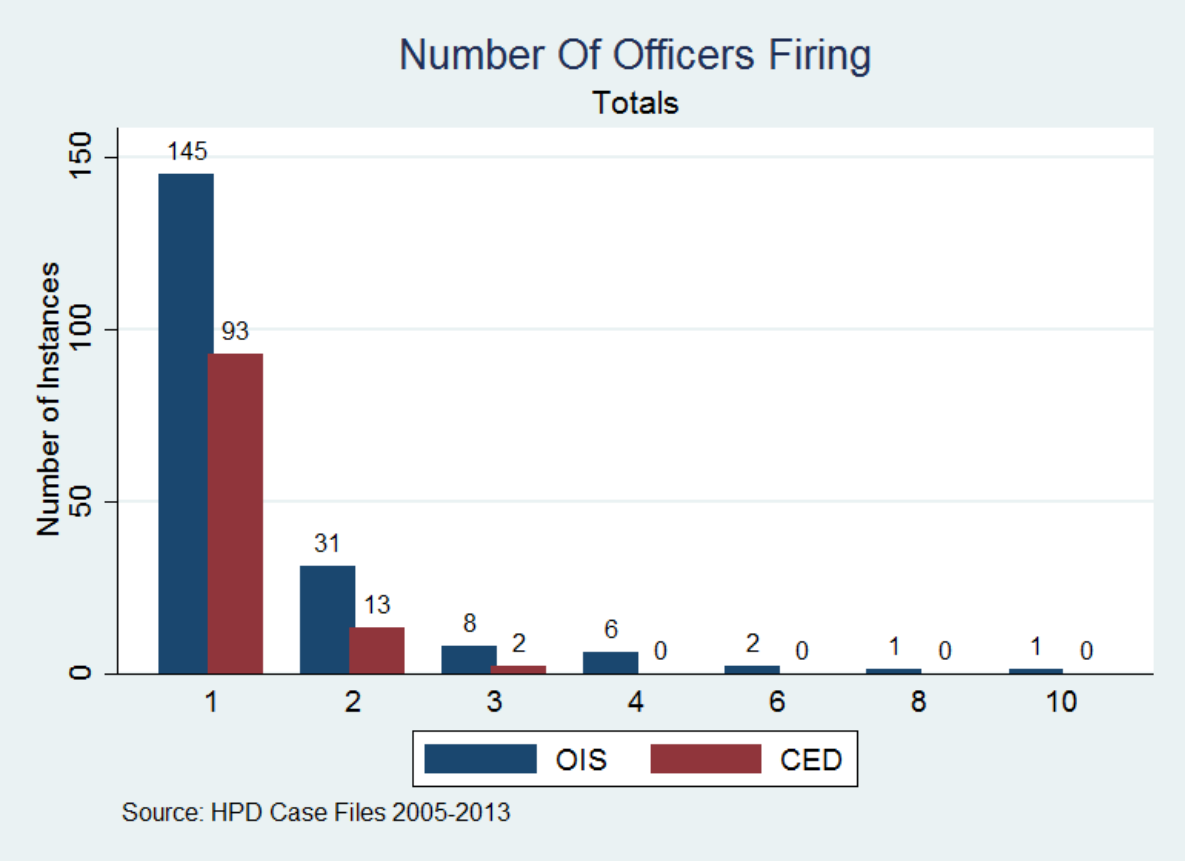
Figure 65: ***Suspect Injuries Total Numbers***



There is an interesting relationship between the level of force and the number of officers who end up using weapons. While it can be seen in Figure 66 that there is obviously a greater magnitude of OIS cases than CED cases where a single officer fires their weapon, the relative frequencies reveal greater nuance. Specifically, in 75 percent of OIS, one officer fired his/her gun, and in 15 percent, two officers discharged their guns. The proportion of OIS with three or more officers shooting was 10 percent. Only 14 percent of CED cases involve multiple officers using their weapons, whereas 25 percent of OIS cases have more than one officer firing. There were no CED cases with more than 3 officers using their weapons, while 10 OIS cases have more than 3 officers firing and 1 case involved 10. This is likely explained in part by the relative effect of an additional officer firing a gun versus using a CED. If one officer successfully uses a CED against a suspect, another officer firing a different CED will usually have little added

effect. Alternatively, another officer firing a gun increases the likelihood the suspect will be incapacitated or surrender. The issue of CED range also likely plays a role. When many officers are firing, they are often far away from a suspect or firing on a position of cover. There are fewer situations in which multiple officers will be in positions to use CEDs against the suspect than there are with guns.

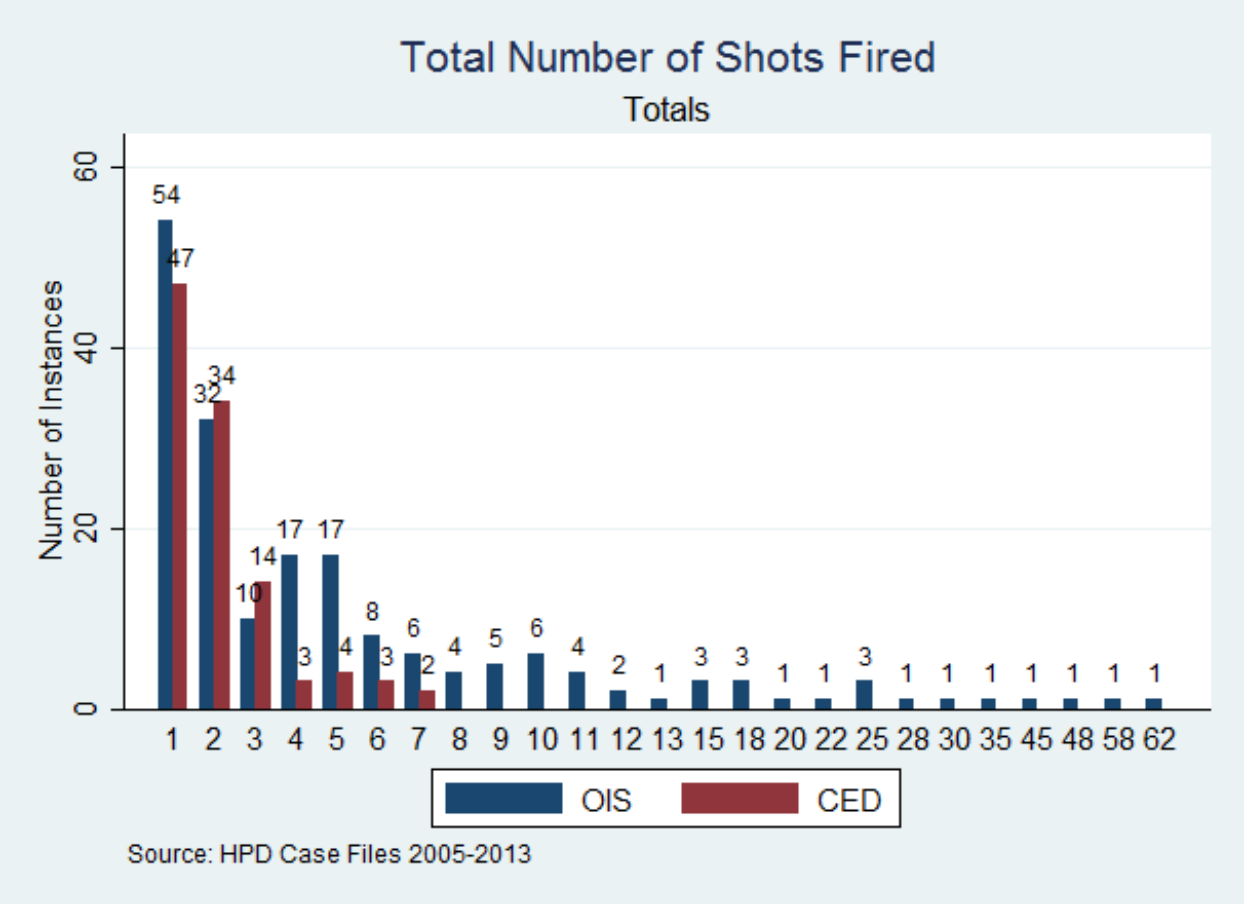
Figure 66: ***Number of Officers Firing Total Numbers***



Similar to the data on number of officers shooting, looking at the number of shots fired in these incidents provides insight into the characteristics of OIS and CED incidents (Figure 67). Officers fired only a single bullet in 29 percent of OIS cases and only a single charge in 44 percent of CED cases. Officer fired two bullets or two charges in 17 percent of OIS cases and 32 percent of CED cases, respectively. Officers fired 10 or more shots in 17 percent of OIS cases

and never fired a CED more than 7 times in a single incident. The higher concentration of CED cases at the low end of the distribution again is likely due to the mechanics of the application of the CED versus the gun. The CED must cycle between charges meaning that it cannot be fired in rapid succession if the suspect does not cooperate. Guns, on the other hand, can be fired very quickly and officers in violent, high-tension situations sometimes emptied 12 or 15 round clips in a matter of seconds. Also, if the suspect was not incapacitated by the CED, they often either fled out of range of the CED, or approached and tried to attack while the CED was cycling. It is worth mentioning that the total number of shots fired is 1,131 over a period of 8.5 years, which works out to 133 shots/year. Given HPD has around 5318 officers, this works out to about one shot fired for every 40 years in service, which is roughly the length of an officer's career.

Figure 67: ***Total Number of Shots Fired***



The data analysis shows some hopefully significant variables that need to be analyzed further through regression analysis that will control for other factors. Some significant indicators of OIS usage may be officer's approach, vehicle involved, verbal commands, and mean priority number of previous calls for service.

Chapter 6: Regression Analysis

Statistical Models Employed in this Study

To study real world relationships where the dependent variable is affected by multiple explanatory variables, the group had to employ statistical models to run multivariable regressions. The statistics software chosen was Stata because of its user friendliness, comprehensiveness, and ability to handle moderately large data sets. The results of these regressions shed light on the marginal effects of each explanatory variable on the dependent variable, given that other variables were held constant. The results also tell us whether these marginal effects are reliable from a statistical perspective, i.e. statistically significant.

The main regression models that the group employed were Logit and Probit models, instead of the more commonly used Ordinary Least Square (OLS) regression model. This is because our variable of interest, "ois", is binary in nature, i.e. it only takes on a value of "0" or "1". "0" means the officer was not involved in an officer-involved-shooting and chose to use the CED instead, while "1" means the officer was involved in an OIS and chose to use the gun. The logit model is superior to a simple linear model because of several reasons, the most important of which is that a logit model always yields predicted values of "ois" that are meaningful and within the range of 0 and 1. Recall that "ois" is binary and only takes on values of 0 and 1 (Refer to Appendix D1).

From the regression results, the team observed the marginal effects of the explanatory variables, i.e. the coded pre-scene and on-scene variables, on the dependent variable, i.e. "ois". Marginal effect should be understood as the change in probability of "ois", i.e. probability of officer involved in an officer-involved-shooting, when the explanatory variable increases marginally or by one unit, holding other explanatory variables constant. For a binary explanatory variable, a marginal increase refers to a change from "0" to "1", i.e. the binary explanatory

variable is “switched on” (Refer to Appendix D1). The team confirmed the regression results are reliable by checking that both the overall regression and effects of individual variables are statistically reliable. The former is confirmed by observing the R-squared value while the latter is confirmed by observing the p-value (Refer to Appendix D2).

It is important to note that while logit and probit are very similar, they make different assumptions. Specifically, the logit model assumes a logistic function while the probit model assumes a standard normal cumulative distribution function (Refer to Appendix D3). Specifically, the logistic function, say G(z), employs exponentials, namely: $G(z) = \exp(z)/[1+\exp(z)]$ for all real number z. In this paper, the team has run logit regressions as running both would provide essentially redundant results and the logit is slightly more widely used. As a side note, the team also performed regressions that included interaction terms, so as to account for different relationships between variables of interests and the dependent variable across select variables (Refer to Appendix D4).

One limitation of our analysis derives from the data sample size. Even with the universe of OIS incidents, and a large sample of CED incidents where the officer could have used a firearm, the team found that the number of observations (303) was large, but not large enough for statistical regressions to produce meaningful results for all explanatory variables. This is because the team has coded a large number of variables that could potentially affect the chance of an officer being involved in an OIS incident. As a result, the team could not find many statistically significant coefficients. To mitigate this limitation, the team decided to use its discretion in focusing its regressions on explanatory variables that are more likely to impact our dependent variable so that more statistically significant results can be obtained.

Another limitation of our data is that of multicollinearity. This problem arose due to two reasons. First, some of our binary explanatory variables predicted "ois" perfectly because they were not present in any CED cases. For example, "off duty" predicted "ois" perfectly, i.e. in our model, if an officer was off-duty, the chance of him or her using a gun when such a situation arose was 100 percent. Second, some of our explanatory variables are highly correlated. For example, if an officer was assigned to the Patrol division, it was also highly likely that he or she was dispatched to the incident. In both cases, the said explanatory variables became less significant in our model. To resolve the first issue, the team dropped the variables that predict "ois" perfectly since a regression including them yields no meaningful results. In fact, Stata does this automatically. The second issue was tackled in two ways. First, the team identified variables that are highly correlated and dropped the one that is less likely to be influential in predicting "ois". Second, when the highly correlated variables are both deemed likely to be important, the team kept both variables in the regression so that their effects could be studied. The downside is that the standard deviations of these coefficients were inflated, which made finding statistically significant results more difficult.

The last limitation of the data is that the team did not have information on all incidents where a firearm could have been used. This incomplete information problem was unavoidable because of the nature of reporting and documentation, which only captured OIS and CED incidents. It could be that there were instances where an officer could have used firearm but did not fire his gun or deploy his CED for some reason. Therefore, the description and summary of data as well as statistical analysis in this paper should be understood in a more specific way. In description of data, probability of OIS should not be taken as the likelihood of OIS under all conditions but rather the likelihood of gun use over CED when an officer was faced with a

situation that warranted use of firearm. In the regression analysis, the probability of "ois" should be understood as the probability of an officer being involved in an OIS as opposed to CED incident given he was faced with a scenario that warranted firearm use.

Regression Results

Employing the regression models outlined in the previous chapter, relationships between specific variables of interest and multiple explanatory variables were established and investigated. This project employed three groups of models designed to analyze different areas of interest. The first set investigated the fundamental relationship between circumstances of incidents and chances of an officer using a gun versus a CED in that instance. The second set looked at particular officer behaviors to see what factors may have affected how officers acted when using force against suspects. The final set of models inquired into different focused areas like the effects of seniority on officer tendencies and the relationship between different on-scene factors.

Primary Analysis

The primary analysis model directly related the "ois" variable to an array of potentially explanatory variables in order to identify which factors made officers more or less likely to use their weapon during an incident. This first regression controlled only for pre-scene factors such as officer characteristics, type of incident and officer knowledge before arrival at the scene. Certain pre-scene variables, "assigdiv_traffic", "typecrime_barricadedsusp" and "wpn_dog" for example, were left out of the regression due to low numbers of observations. Others, such as "assigdiv_narcotics" and "wpn_vehicle", did not include any CED instances and could, therefore not provide insight through regression. Since the data did not contain any cases of off-duty

officers using CEDs, likely due to the fact that officers do not CEDs while off-duty, all off-duty observations were dropped from the regression.

Examination of the primary model marginal effects coefficients reveals several variables with significant effects on the likelihood of officers to end up using their duty weapons. According to the regression, (Figure 68, full regression results in Appendix E1), officers were 27 percent more likely to use their guns in spring incidents and 24 percent more likely to use their guns in summer incidents with the same pre-scene conditions. Studies have indicated a positive relationship between temperatures and crime rates, particularly in regards to violent crime, which could manifest itself in the data with a greater share of dangerous incidents more likely to lead to OIS. Alternatively, officers may have simply been more agitated or anxious in higher temperatures, leading them to use guns more often. These seasonal effects were sustained throughout all the regression models. There was no significant effect on the "ois" variable from the shift or weekend variables.

Certain dummy variables indicating officers assigned divisions also registered effects in this model. Patrol units were shown as 42 percent more likely to be involved with shootings and division tactical unit (DTU) officers were 17 percent more likely. These coefficients may be misleading, though, as the regression results also suggested that patrol related incidents were 37 percent less likely to be OIS incidents than other cases. Seeing as most of the patrol units in the data were involved with patrol related incidents, this would only come to a five percent net increase in likelihood for those officers. This effect is likely explained by the types of incidents patrol officers were involved with. Traffic stops, largely initiated by patrol units, were associated with an 18 percent increase in OIS likelihood. Since traffic stops were significantly correlated

with vehicle-involved incidents, this was likely a manifestation of the effects of vehicles, more so than officer's natural predisposition to fire a gun during a traffic stop.

Figure 68: ***Significant Coefficients from OIS Likelihood on Pre-Scene Variables***

assigdiv_patrol	.422**
sea_spring	.266***
sea_summer	.239***
typecrime_narcotics	.197***
trafficstop	.179***
oneoff	.174***
typecrime_stolenveh	.172***
typecrime_robbery	.172**
wpn_gun	.171*
typecrime_suspiciouspersveh	.170***
assigdiv_dtu	.162**
backup	.159***
footpursuit	.150**
vehpursuit	.138*
incident_patrol_related	-.370***
wpn_knife	-.476*
typecrime_cit	-.572*

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

Some variables related to the circumstances of the officer involvement showed significance as well. An officer responding alone was 17 percent more likely to be involved with an OIS incident than two officer units. The expectation of backup decreased this result, but only slightly. This result suggests a different dynamic when more than one officer on the scene where multiple officers may be more able to control the scene or may simply feel safer than officers acting alone or suspects may see less potential advantage in being combative when facing more than one officer.

Different types of crimes that officers had to respond to also displayed effects on their likelihood to shoot. Notably, robbery, stolen vehicle and suspicious person calls were all associated with a 17 percent increase in likelihood of shooting. Narcotics crimes associated with a 19 percent increase in OIS likelihood, likely reflecting the higher incidence of plainclothes officers who do not carry CEDs and high-intensity incidents where quick takedowns of a suspect may be necessary.

Displaying a reverse effect, officers called to incidents designated for the Crisis Intervention Team (CIT) were associated to a 57 percent decrease in the likelihood that officers would use guns during the incident. All HPD officers receive some training to prepare for such incidents, but certain officers are selected to receive more extensive training. This result would seem to indicate that officers approached such calls with greater caution about using deadly force due to training, although it may simply reflect the selection of officers who are considered better trained to handle crisis situations.

Information provided to the officer beyond the type of crime is also shown as significant in this model. Specifically, if the officer was informed of a foot or vehicle pursuit before his/her direct involvement with an incident, he/she was approximately 15 percent more likely to be

involved with an OIS incident. This effect may be explained by the fact that such incidents could tactically call for a longer range weapon than a CED which has an maximum range of approximately 21 feet, but which is most effective from five to twelve feet. Also, whether officers were informed of weapons had strikingly different effects based on what type of weapon they were informed of. In cases where the officer was told that the suspect was carrying a gun, he/she was 17 percent more likely to use a gun themselves. In cases where they knew the suspect to have a knife, officers used a gun 47 percent less than otherwise. Although unsurprising, this finding provides evidence that HPD officers used pre-scene information to assess potential danger before they became involved with incidents.

The pre-scene model provides several variables that could potentially affect an officer's mindset and actions as he/she approached a potentially dangerous incident. The next model introduces on-scene factors largely dealing with officer and suspect actions in order to control for the progression of incidents to provide different insight into the coefficients for the pre-scene variables and to look at how the officer-suspect interactions play a role in the outcome of use-of-force incidents.

In order to avoid issues of multicollinearity, certain insignificant variables from the pre-scene regression were dropped when on-scene variables were added. Overall, this model saw the measure of fit, R^2, increase to 0.623, implying that the explanatory variables in the model accounted for 62.3 percent of the variation in the dependent, "ois" variable. This increased from 42.2 percent in the pre-scene model.

From Figure 69 (full table in Appendix E2), the spring and summer variables were again significant and increased OIS likelihood, but their effects were approximately half what they

were in the previous model at a 12 percent increase. This discrepancy implies that some of the effect suggested in the pre-scene model was the result of on-scene effects that were more likely

Figure 69: ***Significant Coefficients from OIS Likelihood on Pre-Scene and On-Scene Variables***

approach_gundrawn	.370***
crit_aggrstance	.351***
crit_usewpn	.224***
suspwpnknown	.196*
veh_involved	.179***
backup	.130***
sea_spring	.128**
crit_footpursuit	.125***
crit_wpn_pointedatoff	.122*
sea_summer	.120**
trafficstop	.116***
oneoff	.109**
verb_communicate	.101**
crit_reachforwpn	.099*
typecrime_narcotics	.099*
vehpursuit	.093**
verb_commandgiven	-.101**
wpn_knife	-.662**
typecrime_cit	-.819***

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

during spring and summer. No assigned division variables were significant, supporting the notion that any effect suggested in pre-scene was due to different types of incidents, as opposed to inherent effects of working in one given division versus another.

Again, officers in one officer units, whether or not they expected backup during the call, were more likely to shoot than officers initially responding with more than one officer. However, this effect was dampened somewhat when controlling for on-scene variables, with the implication that officers or suspects behaved differently when a single officer responded, leading officers to be more likely to use a gun.

In this model, narcotics violations and CIT instances were the only crimes with an effect on officers likelihood to shoot. Officers informed of narcotics violations were 10 percent more likely to use a gun than other officers. Of greater note, an officer given information about a CIT incident before arriving at the scene was 82 percent less likely to shoot than other officers. This effect was amplified from the already large negative effect from the first regression model. This difference implies that officers were more likely to use a CED in a CIT situation even when characteristics of the on-scene situation would suggest that a gun was more likely to be used.

Information about suspects carrying weapons was again significant. In this model, "suspwpnknown" expressed as significant and "wpn_gun" did not, but this implies more about officer knowledge of an ambiguous weapon since a gun would still cause about a 20 percent increase in the likelihood of gun use by the officer, but so would any other weapon, which was not expressed in the first model. Additionally, knowledge of the suspect carrying a knife would seem to have indicated a 66 percent decrease in OIS likelihood, but the overall effect was nearly equal to the first regression since the officer must know the suspect had a weapon in order to

know that weapon was a knife. Therefore, officer knowledge of the suspect carrying a knife indicated a 47 percent decrease in OIS likelihood.

As for on scene variables, several variables gave insights into what made an officer more likely to shoot. Unsurprisingly, an officer who approached with his/her gun drawn was 37 percent more likely to use that gun in the incident. This result inspired one of the secondary regressions to investigate what made officers more likely to approach a scene with their weapon drawn (These results are explored in the next section). Incidents where a vehicle was directly involved with the officer's use of force were also more likely to be OIS incidents. CEDs are not guaranteed to penetrate a vehicle if the windows are closed and may not have the range to hit vehicles evading an officer.

Some results could not have been predicted as easily. Communication with the suspect (defined as reciprocated verbal contact between officer and suspect) and verbal commands given to the suspect had opposite effects in the model. Officers who communicated with suspects were 10 percent more likely and officers who gave verbal commands were 10 percent less likely to use their weapons in an incident. The dataset included only 3 instances where the officer communicated with the suspect but did not give any verbal commands. Therefore, the effect is essentially only expressed in the cases where the officer used verbal commands, but did not communicate, implying officers verbal commands were in some part successful in controlling or de-escalating situations down from deadly force.

Several variables related to the vital incident leading to use of force by the officer also showed significance. Since these variables were not mutually exclusive, their results could sum on top of one another. Officers were more likely to use a gun if the suspect was reaching for a weapon (10 percent), if they were engaged in a foot pursuit (12 percent), if the suspect had a

weapon pointed at the officer (12 percent), if the suspect used a weapon (22 percent) or if the suspect was taking an aggressive stance against the officer (35 percent).

Secondary (Officer Action) Analysis

With the primary analysis, the team identified explanatory variables that were statistically significant in predicting the likelihood of "ois". The team was specifically interested in significant on-scene variables because they immediately preceded gun use in most incidents. The two on-scene variables of interest are officer approaching with gun drawn, and verbal command given. These on-scene variables were in turn caused by pre-scene and possibly on-scene variables and the team wished to investigate this relationships. Therefore, the aim of the secondary analysis was to perform analysis on significant on-scene explanatory variables to identify pre-scene or on-scene variables that significantly affect the likelihood of officer approaching with gun drawn or officer giving verbal command.

For the first regression, the team regressed officer approaching with gun drawn, on pre-scene variables so as to study the effects of pre-scene variables on approach with gun drawn, which was a critical factor in determining the likelihood of gun use. Here, the team only controlled for pre-scene variables, which kept variance lower, and increased the likelihood of marginal effect coefficient being statistically significant. There is a tradeoff between likelihood of finding significant coefficients and R^2, which describes the amount of variation of the dependent variable that is explained by the explanatory variables, i.e. the model's overall predictive power. This tradeoff is especially pronounced when explanatory variables are highly correlated. Therefore, by including only pre-scene variables in this regression, the team was able to enjoy a higher likelihood of finding statistically significant variables but gave up a potentially higher R^2, or the model's predictive power.

From the first regression, summarized in Figure 70 (full results in Table E3), the team noticed that prior knowledge of vehicle pursuit increased the likelihood of officer approaching with gun drawn by 42.2 percent. This relationship is not surprising because knowledge of a vehicle pursuit indicated to the officer that he/she was involved with an intense situation and a suspect who was willing to take risks and act unsafely in defiance of the authorities.

Prior knowledge that the suspect had a gun had the second highest marginal effect coefficient. It increased the likelihood of approaching with gun drawn by 36.7 percent. Again, this relationship is not surprising because prior knowledge that the suspect was in possession of a gun clearly indicated to the officer that the suspect was dangerous and that he or she should approach the suspect with extreme caution.

Figure 70: ***Significant Coefficients from Approach - Gun Drawn on Pre-Scene Variables***

vehpursuit	.422***
wpn_gun	.367***
typecrime_burglary	.339***
typecrime_disturbance	.307**
typecrime_robbery	.290*
prevcfs	.034 (per previous call)*
incident_patrol_related	-.364***

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

Three types of crime variables were significant in affecting the likelihood of officer approaching with gun drawn. They were burglary, disturbance and robbery. These types of crime were associated with increases in likelihood of approaching with gun drawn by 33.9 percent, 30.7 percent and 29.0 percent respectively. The reason for this is probably because burglary, disturbance and robbery were crimes that were accompanied by warnings for suspects with weapons and hence officers responding to such incidents are more likely to approach suspects with gun drawn.

Previous calls for service or dispatch calls that officers responded to also affected the likelihood of approach with gun drawn. Specifically, the team found that a unit increase in number of previous call(s) increased the likelihood of approach with gun drawn by 3.4 percent, which means 5 previous calls for service during that shift would increase the likelihood of approach with gun drawn by roughly 17 percent. The reason for this positive correlation between previous calls for service and likelihood of approach with gun drawn is consistent with the team's expectations. It is logical for an officer to be tired and more worn out after each dispatch call, which could lead to a greater tendency to approach with firearm drawn. However, "prevcfs" has a p-value of more than 0.05 but less than 0.1, and hence its marginal effect coefficient might not be as reliable.

When the incident was patrol related, the likelihood of approach with gun drawn decreased by 36.4 percent. This result is consistent with the negative correlation between incident patrol related and likelihood of ois. The reason for the negative relationship between incident patrol related and likelihood of gun drawn is probably because the chances of an incident that is related to patrol being dangerous enough to warrant an approach with gun drawn is lower than non-patrol related incidents, which involved specific dispatch calls for targeted

units and types of crimes, such as SWAT and barricaded suspects respectively. Patrol related incidents are more mixed and less specific and therefore less dangerous on average.

While the likelihood of officer approaching with gun drawn was affected by pre-scene factors such as prior knowledge about the suspect through dispatch call slips, it was also affected by various on-scene factors that occur or manifest before the officer's approach. To investigate the relationship between both pre-scene and on-scene variables on likelihood of approach with gun drawn, the team ran logit regression of approach_gundrawn on both pre-scene and on-scene variables. This model has a higher R^2 than the pre-scene only regression, implying that this model has a better fit and predictive power. This result is not surprising since this model included more explanatory variables and hence controlled for more possible explanations for officer approaching with gun drawn. However, the tradeoff is that the chances of finding statistically reliable marginal effect coefficients were potentially lower.

From the seven significant results obtained in the pre-scene only regression, only four remained statistically reliable in the pre-scene and on-scene regression. They are prior knowledge of vehicle pursuit, burglary, disturbance and patrol-related incidents. It is interesting to note that their marginal effect coefficients were different across the regressions. Specifically, their effects became more pronounced in the second regression, as compared to the first regression, i.e. positive relationships became more positive and the reverse is true for negative relationships. These results can be seen in Figure 71 and the full regression is included in Appendix E4.

On the other hand, the team noticed that some pre-scene variables that were not significant in the first regression became significant in the second regression. The first one is traffic stop as a cause of encounter, which increased the likelihood of approach with gun drawn

by 46.7 percent. The team found this result surprising because traffic stop typically indicated the possibility of a more minor incident and hence a lower likelihood of approach with gun drawn. Likely, this effect is due to the fact that traffic stops that end up requiring force from the officer are vehicle pursuits or felony stops, neither of which provide much opportunity for officers to use CEDs. This reason would explain the strong positive relationship between traffic stop and likelihood of approach with gun drawn.

Figure 71: ***Significant Coefficients from Approach - Gun Drawn on Pre-Scene and On-Scene Variables***

vehpursuit	.493***
trafficstop	.467***
typecrime_burglary	.347***
typecrime_disturbance	.328**
suspwpnknown	.248**
backup	.231*
indoors	-.230*
init_confrontsusp	-.330*
incident_patrol_related	-.396***
typecrime_evaderesistarrest	-.440**
init_suspinitiates	-.492***
init_interview	-.497***
init_issueticket	-.577***

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

Another pre-scene factor is prior knowledge that suspect had a weapon, but not necessarily knowledge of the type of weapon. This knowledge increased the likelihood of approach with gun drawn by 24.8 percent. On hindsight, it was rational for an officer to approach a suspect with caution and gun drawn when he or she knew that the suspect had a weapon.

One officer unit with backup increased the likelihood of gun drawn by 23.1 percent over two or more officer units present on scene. This is not surprising because an officer responding to an incident alone was more vulnerable than when he or she was with at least one other colleague. Therefore, given the greater vulnerability, it is logical for the officer waiting for backup to approach with gun drawn.

The last pre-scene variable that did not appear significant in the first regression is evade or resist arrest as type of crime. When officers knew that they were potentially facing an evade or resist arrest incident, the likelihood of them approaching with gun drawn decreased by 44.0 percent. The team reckons that this is probably because officers did not find it effective to approach with gun drawn when chasing after the suspect.

An on-scene variable that significantly affected the likelihood of gun drawn was indoor setting. An indoor setting was associated with a decrease of 23.0 percent in likelihood of approach with gun drawn. This is probably because officers were more reluctant to draw their firearm indoors since use of firearm indoors is more risky as it could result in ricochet or other unintended consequences. It could also be that indoor incidents typically involved less intense cases that did not warrant an approach with gun drawn as much.

Several on-scene initial encounter factors affected the likelihood of approach with gun drawn. Confronting suspect was associated with a 33.0 percent decrease in likelihood of gun drawn. This is an interesting result that the team could not provide a reasonable explanation for.

However, the p-value for init_confrontsusp is more than 0.05 and hence its effects may not as be statistically reliable. If the suspect played a larger role in initiating the encounter instead, the likelihood of gun drawn decreased by 49.2 percent. This relationship makes sense because an officer had less time to respond with a gun-draw if the suspect initiated the encounter instead. Further, in some cases where the suspect did not approach the officer in an aggressive manner, the officer might not have a reason to draw his gun initially. An interview decreased the likelihood of gun drawn by 49.7 percent. Lastly, issuing ticket was associated with a 57.7 percent decrease in likelihood of gun drawn. This inverse relationship is not surprising because an initial encounter that involved ticket-issuing probably did not place the officer in serious danger and hence did not warrant the need for an approach with gun drawn.

The next model investigates factors that may make an officer use verbal commands during an incident. The results, displayed in Figure 72 and fully shown in Appendix E5, indicate that certain divisions were marginally more likely to use verbal commands in their encounters, specifically Division Tactical Units (DTU) and Gang/Crime Reduction Units(CRU). Officers assigned to DTU and Gang/CRU divisions were 6 percent and 7 percent more likely, respectively, to use verbal commands when controlling for the pre-scene characteristics and the initial encounter between officer and suspect. This effect could be due to differences in training within these divisions or in the types of encounters officers with these assignments were typically involved with.

Figure 72: ***Significant Coefficients from Verbal Command Use on Pre-Scene and On-Scene Variables***

coverposssusp	.149*
assigdiv_gangcru	.072**
init_searchbuilding	.072**
assigdiv_dtu	.062*
prevcfs	.014 (per call)*
off_seniority	.005 (per year)*
selfinitiated	-.440*
typecrime_assault	-.555**

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

This model also suggests an effect from the years of seniority of the involved officer, the first indication that an officer's characteristics may systematically affect their behavior. For each additional year of seniority, the officer was, on average, 0.5 percent more likely to use verbal commands. While this effect was quite small from year to year, it indicates a definite difference between officers near the end of the 30-year range in seniority presented in the sample. This may reflect effects from additional training throughout officers' careers or a trend of officers with more seniority having more maturity or life experience to defuse a situation than younger officers.

Incidents marked self-initiated were much less likely to include officers giving verbal commands. Officers in such incidents gave verbal commands 44 percent less of the time than other types of incidents. Also of note, officers responding to calls for assault were 55 percent less likely to use verbal commands. It is possible that officers deemed assault calls as more severe so

they did not feel they had a chance to de-escalate due to imminent danger to themselves or another person. Notably, officers used verbal commands in every CIT-designated incident, so those incidents did not factor into the results.

Incidents where the officer was searching a building were 7 percent more likely to have verbal commands used. Officers in these situations were likely giving verbal commands as or even before they encountered the suspect in order to identify themselves or get compliance from the suspect. Officers were 15 percent more likely to give verbal commands to suspects with cover available to them. In these cases, officers were likely to recognize a possible cover and use verbal commands in order to stop the suspect from gaining a tactical advantage in the use-of-force situation.

Focused Analysis

By regressing OIS on seniority of more than five years, approaching with gun drawn, and their interaction term, the team can identify the difference in effect of approaching with gun drawn for officers of different seniority. Shown in Figure 73 and given context in Appendix E6, the team found that more experienced officers, of seniority of more than five years, were 22.7 percent more likely than junior officers with seniority of less than five years, to use their guns when approaching with gun drawn[3]. This is surprising as one would expect an officer with seniority of more than five years to be less likely to use his gun when he approaches a suspect with his gun drawn, as opposed to an officer with seniority of less than five years. The officer with a higher seniority has more experience and could presumably defuse the situation better. In this case, the interaction term is defined mathematically as seniority_morethan5

[3] Effect consistent even when controlling for officer's assigned division and type of crime that they encounter (Refer to Appendix E7)

*approach_gundrawn, which only contains values for observations where officers have more than five years of seniority and approached with gun drawn.

Figure 73: ***Significant Coefficients from OIS Likelihood on Gun Drawn/Seniority Interaction***

approach_gundrawn	0.307*
gundrawn_morethan5	0.227*

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

From the regression results in Figure 74 (full table in Appendix E9, it appears that a unit increase in mean priority number for previous calls for service decreased the likelihood of OIS by 3.9 percent. While this number may appear small, increases in priority number could be important when one considers a larger increase. For example, in the case of an increase from priority number 1 to 7, the likelihood of OIS is predicted to decrease by 23.4 percent. This finding provides supporting evidence for the hypothesis that prior conditions of an officer has an effect on the likelihood of gun use.

Figure 74: ***Significant Coefficients from OIS Likelihood on Averaged Priority Number of Previous Calls for Service***

meanprioritynо_prevcfs	-.039 (for each increase in priority number)*

Note: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level

These regression results provide a great deal of insight to combine with the tabulations from the previous chapter. For example, the significant effect of one officer units from the regression of OIS likelihood on pre-scene and on-scene variables corroborates the findings from

Figure 24. Both would indicate that officers by themselves are more likely to be involved with OIS incidents than those with fellow officers at the scene. In the same regression, the variable signifying vehicle involvement is associated with higher likelihood of OIS. This meshes with Figure 51, which shows a very low number of cases where a vehicle was involved where the officer uses a CED. These, and other corroborations, provide insight into the data from which conclusions may be drawn.

Chapter 7: Conclusion

Through this report, the team had attempted to shed more light on the highly significant and controversial topic of Officer-Involved-Shooting. The first deliverable was a data set fit for statistical analysis that was made possible by extensive data mining, collation and cleaning. The data set consists of 303 observations, and 269 variables.

The second deliverable was a comprehensive overview of the data set, which was achieved through detailed summaries and descriptions of the variables. This can be found in Chapter 5, where the team highlighted important and interesting observations about the number of OIS, and CED incidents, and likelihood of OIS by different variable categories. For example, the team found that when an officer approached with a weapon in hand, he or she was about 87 percent more likely to eventually use his or her weapon of approach instead of the other. In other words, if an officer approached with gun, he or she was 87 percent more likely to use a gun. The same is true for CED.

The third deliverable was a three stage statistical analysis of the data set, leading to different insights about the nature of OIS and pre-scene and on-scene factors. The primary analysis results shed light on the relationship between likelihood of OIS and various meaningful explanatory pre-scene and on-scene variables. The secondary analysis allowed the team to identify the causes behind important on-scene officer behaviors that accurately predicted gun use. In the focus analysis, the team ventured further to explore more specific relationships, and identify different levels of effects across different variable categories.

The HPD's key concerns were addressed in our research and report, and summarized as follows:

- **What was the officer's call history for that day prior to being involved in the shooting incident?** To address this question, the team extracted and coded two separate

variables: one that captured the number of previous calls for service prior to the OIS incident, and one that captured the average priority number for the previous calls for service. In restricting our regressions to only officers on duty, the team noticed that an increase in average priority number for previous calls for service decreased the likelihood of OIS by 3.9 percent (per unit increase), however the number of previous calls for service appeared to be insignificant in predicting the likelihood of OIS. It is worth noting that (as shown in Figure 32), in half of the OIS, the officers had no prior calls for service in that shift. Further, in 34 of those cases that had prior calls for service, officers had only one prior CFS. Together, these cases represent roughly two-thirds of the 195 OIS coded.

- **What type of information about the event did the officer have before arriving at the location?** In most dispatch calls, the officer had some information about the priority number of the dispatch call, type of crime reported, suspect description, whether there was a foot or vehicle pursuit and whether the suspect had a weapon and, if so, what type of weapon. Officers received descriptions of the suspects in 37 percent of OIS cases and 56 percent of CED cases. Officers were aware that the suspect(s) had a weapon in 38 percent of OIS and CED cases. Of this prior information, the regression results indicated that details about type of crime, specifically CIT and Narcotics, vehicle pursuit, whether suspect had a weapon, and in particular whether the weapon was a knife, were significant in predicting the likelihood of OIS.
- **What type of verbal exchanges (if any) occurred between the officer and the suspect who was shot at?** Most of the time, officers either communicated (with suspect reciprocating) or issued verbal commands whenever they could. However, sometimes the situation escalated too quickly or involved a language barrier, which prevented verbal

exchanges from occurring. Overall, officers used verbal commands in 77 percent of OIS incidents and 96 percent of CED cases in the dataset. Officers had reciprocated communication with suspects in 30 percent of OIS cases and 35 percent of CED cases. The most common verbal commands used by officers were variations of "stop", "drop the weapon" and "show your hands". Of the types of verbal commands given, the team found that "drop the weapon" reduced and "get out of the vehicle" increased the likelihood of suspect attacking officer by 20.1 percent and 38.5 percent respectively, compared to not giving the respective commands.

- **How did the issue of "cover and concealment" affect the status of the scene?** The dataset included notation of when cover and concealment were possible or used for both the suspect and officer. The tabulations indicate that suspects are more likely to have cover and concealment available to them during encounters, but officers are more likely to use the cover and concealment in those situations. When cover was possible for suspect, the likelihood of officer issuing verbal commands increased by 14.9 percent, as compared to cover was not possible for suspect. The team also found that when concealment was possible for the officer, the likelihood of officer attacked fell significantly by 40.5 percent, as compared to concealment was not possible for officer.
- **What physical actions were taken by the suspect prior to the discharge of the officer's firearm?** The team coded physical actions taken by suspect that led to the critical event, i.e. discharge of officer's firearm, into seven categories: foot pursuit, resist arrest, reaching for weapon, using weapon, not obeying commands, aggressive stance and weapon pointed at officer. The most common physical actions taken by suspects prior to discharge of the officer's firearm are pointing the weapon at officer and taking an

aggressive stance. From the regression, the team found that foot pursuit, reaching for weapon, using weapon, aggressive stance, weapon pointed at officer increased the likelihood of Officer-Involved Shooting by 12.5 percent, 9.9 percent, 22.4 percent, 35.1 percent, and 12.2 percent, as compared to situations where suspect did not take each respective action.

- **What reactions did the officer take in response to the suspect's actions?** The team coded reactions of officer in terms of approaching with gun drawn, approaching with CED drawn, whether verbal command was given, whether the officer communicated with suspect, and whether the officer eventually used gun or CED. Because of limitations in data collection and regression, it would be improper to draw conclusions about immediate officer reactions to specific suspect actions.
- **What type of tactical training did each officer have prior to being involved in the shooting incident?** While the officer case files included lists of training that officers had done, the number of different characteristics of use of force incidents made it very difficult to identify which training hours would be relevant to a given situation.
- **What was the qualification status for the last five years prior to the officer's involvement in the shooting incident?** The dataset did not include qualification information for most officers involved with CED incidents, meaning no comparison across groups could be drawn in order to answer this question.

A possible improvement to the project is to improve the reliability of the regression results; the team could perform outlier analysis for logit regressions (Refer to Appendix D5). An outlier is defined as "an observation that deviates so much from other observations as to arouse suspicion that it was generated by a different mechanism" (Nurunnabi and Nasser, p. 90). Hence,

it would be beneficial to perform outlier analysis to ensure the accuracy of the fitted logistic regression model. Failing to do so "can have severe distortion on the validity of the inferences drawn from such modeling" (Sarkar, Midi, Rana, 2011).

As mentioned in Chapter 6, one of the limitations of the dataset was its relatively small number of observations, as compared to number of variables. The team expects the analysis results to be more accurate and significant as HPD gathers more information about OIS and CED incidents over time. Hence, a possible continuation of the project is to update the dataset with new information and perform similar data summaries and statistical analyses to yield up to date and possibly better results.

More importantly, given more time and resources, a possible extension to this study is to analyze all seemingly important or meaningful relationships between and amongst "ois" and pre-scene and on-scene factors. Such an endeavor would take time and much effort since it requires the researchers to conduct extensive preliminary investigations to exhaustively identify all the meaningful relationship, and then proceed to conduct statistical analysis to explore all these relationships, which also takes time since the regression results have to be interpreted. If successful, the team could possibly use the results to picture a very detailed, sequential and dynamic picture of Officer-Involved-Shooting incidents in HPD.

Appendices

Appendix A1: Coded Variables

Number	**Name**	Possible values	Description/Notes	Collected from where?	EXAMPLE CASE CODED AND VERIFIED
Stage One - Pre-scene Conditions/Factors Effecting Officer					
1	**Case Number**	1338712-197202506		Case File	33424709
2	**Payroll Number**	34554-141029	Of target officer, as indicated in call historical data	Officer Statement/Call History	113248
3	**Date of Shooting**	04/08/05-08/20/2013	MM/DD/YY	VLOOKUP	03/08/13
4	**Day of week**	Sunday, Monday…		VLOOKUP	Saturday
5	**Hour**	0-2359	Time of event, expressed from 0-2400	VLOOKUP	829
6	**Shift**	1,2,3	Using HPD shifts based on time of event	VLOOKUP	1
7	**Weather Conditions**	Hot, Clear, Rainy, Cold Cloudy	Describe	Case File	Clear
8	**Day-Light**	Y/N	Based on time of day, season	Call History	Y
9	**Division where shooting occurred**	51-65	HPD provided Division number	VLOOKUP	61
10	**District where shooting occurred**	1-20	HPD provided District number	VLOOKUP	14
11	**Beat where shooting occurred**	01A10-20H50	HPD provided Beat code	VLOOKUP	14D20
12	**Address of Shooting**	Example: 1662 W. Sam Houston Pkwy.	Address where critical event took place.	Officer Statement/Scene Diagram	1326 Charnwood St.
13	**Officer Firing assigned division**	Eastside Patrol, Narcotics, Kingwood DTU…	Division that officer indicates in statement	Officer Statement	Southeast Patrol
14	**One officer unit**	Y/N	Did officer engage without expectation of other officers on scene?	Officer Statement	N

15	**One Officer Unit with back-up**	Y/N	Did officer engage by himself, but with expectation of other officers arriving?	Officer Statement	N
16	**Two (or more) officer unit**	Y/N	Was more than one officer involved in initial engagement?	Officer Statement	Y
17	**Male officer**	Y/N		Officer Training Record	Y
18	**Female Officer**	Y/N		Officer Training Record	N
19	**Age of Officer**	21-60		Officer Training Record	34
20	**Seniority less than 2 years**	Y/N		Officer Training Record	N
21	**Seniority 2+ yrs. -5 yrs.**	Y/N		Officer Training Record	N
22	**Seniority 5+ yrs. - 10 yrs.**	Y/N		Officer Training Record	N
23	**Seniority 10 + yrs.**	Y/N		Officer Training Record	Y
24	**Extra Job Related**	Y/N	Was officer working outside of HPD duties?	Officer Statement	N
25	**Off-Duty Related**	Y/N	Mutually exclusive from extra job	Officer Statement	N
26	**Officer in Uniform**	Y/N	Includes raid jackets, riot gear, etc.	Officer Statement	Y
27	**Nature of Operation**	Traffic Stop, Off-Duty Security Job	What action was officer involved with prior to incident?	Officer Statement	Pursuit of Suspicious Person
28	**Non Dispatched-Planned Operation**	Y/N	Had officers planned in advance to engage suspect?	Officer Statement	N
29	**Patrol Related**	Y/N	Was officer riding patrol or otherwise engaged in patrol duties at time of incident	Officer Statement	Y

30	**Non-Patrol Unit**	Y/N	Non Patrol Units include other divisions in the department like - but not limited to: Investigative Divisions (Narcotics, Homicide, Auto Theft, etc.), Special Operations, Traffic Enforcement, Employee Services, etc.	Officer Statement	N
31	**Responsible Division/Unit**	Narcotics, Auto Theft	If not a dispatched call, what division was responsible for the operation?	Officer Statement	None
32	**Traffic Stop**	Y/N	Officer stopping a traffic violator	Officer Statement	N
33	**Self-Initiated**	Y/N	Officer self-initiated the activity	Officer Statement	N
34	**On-View**	Y/N	Officer came upon the activity	Officer Statement	N
35	**Dispatched**	Y/N	Officer was sent to the activity by dispatch	Officer Statement	Y
36	**Priority of Call as Dispatched**	1,2,5,8	First Digit of the Call Type	VLOOKUP	3
37	**Original Call Type at time of Dispatch (Analyst Provides)**	1300, 2038	See HPD Call Type List for numerical call type number, also described in the "call-slip"	VLOOKUP	3080
38	**Type of Crime**	Assault - Weapon, Disturbance - CIT	What type of crime led officer to be involved with incident?	VLOOKUP/Officer Statement	Suspicious Person
39	**Suspect Described**	Y/N	Did officer have suspect description prior to engagement?	Officer Statement	Y
40	**Foot Pursuit**	Y/N	Was officer informed of a foot pursuit prior to engagement?	Officer Statement/Call History	N
41	**Vehicle Pursuit**	Y/N	Was officer informed of a vehicle pursuit prior to engagement?	Officer Statement/Call History	Y

42	**Suspect Weapon Known**	Y/N	Did officer know before engagement that suspect had a weapon?	Officer Statement/Call History	Y
43	**Suspect Weapon Type**	Gun. Knife, Vehicle	Weapon that officer knew suspect to be in possession of prior to engagement.	Officer Statement/Call History	Shotgun
Stage Two - Factors Existing at the Scene					
44	**What was the officer doing?**	Officer responding to assault with unknown weapon dispatch	On Patrol, Searching for suspect, In chase, On surveillance, On break, Traffic Stop, etc.	Officer Statement	Officers were riding day patrols and received a dispatch of a suspicious person possibly involved in a homicide
45	**Initial Encounter**	Officer sees suspect crouch behind car in parking lot, drives into lot to investigate possible car burglary	Confronting Suspect, Issuing Ticket, Interviewing, Searching Building, arresting suspect, etc.	Officer Statement	Officers running surveillance on suspect residence encounter suspect in vehicle and begin to follow in marked patrol units in order to set up a felony stop
46	**Situation Leading to the Critical Event**	Suspect climbing fence in order to flee with handgun held in hand, drops to ground, stands and starts to turn towards officer	Foot Pursuit, Fight, Resisting Arrest, Suspect reached in Glove box, etc.	Officer Statement	Officers execute a felony stop, suspect gets out of vehicle with a shotgun and aims it at officers who fire on suspect
47	**Premise**	Street, Residence, Business	Residence, Business, Retail, Public Street, Apartment Complex, Parking Lot, Club, Bank, etc. (If available give detail description)	Officer Statement/Scene Diagram	Residence/Driveway
48	**Indoors or outdoors**	Indoors, Outdoors	Did shooting incident happen indoors or outdoors?		Outdoors
49	**Visibility**	Good, Fair, Poor	How good was visibility at the scene for officer?	Officer Statement/Case File	Good
50	**Lighting**	Daylight	Define (street lights, day light, dusk etc.	Officer Statement/Case File	Daylight

51	**Concealment Possible-Officer**	Y/N	Concealment hides the officer (bushes)	Officer Statement/Scene Diagram	Y
52	**Concealment Used-Officer**	Y/N		Officer Statement/Scene Diagram	Y
53	**Cover Possible-Officer**	Y/N	Cover protects the officer (brick wall)	Officer Statement/Scene Diagram	Y
54	**Cover Used-Officer**	Y/N		Officer Statement/Scene Diagram	Y
55	**Concealment Possible-Suspect**	Y/N		Officer Statement/Scene Diagram	Y
56	**Concealment Used-Susp**	Y/N		Officer Statement/Scene Diagram	Y
57	**Cover Possible-Susp**	Y/N		Officer Statement/Scene Diagram	Y
58	**Cover Used-Susp**	Y/N		Officer Statement/Scene Diagram	Y
59	**Did Officer Communicate with Susp**	Y/N	Did officer have reciprocated verbal contact with suspect?	Officer Statement	Y
60	**Language Barrier**	Y - Spanish/English, N	Describe (English to Spanish, etc.)	Officer Statement/Case File	N
61	**Was Susp given verbal commands**	Y/N	By any officer	Officer Statement	Y
62	**What verbal commands were used**	"Stop", "Put your hands in the air"	What verbal commands did any officer give to suspect?	Officer Statement	"Don't move" "Show your hands"
63	**Did Susp. Obey verbal commands**	Y, Y temporarily, N		Officer Statement	N
64	**What type of de-escalation efforts were made**	Verbal commands, negotiation, intermediate weapons	Officer presence assumed for all cases, noted if otherwise.	Officer Statement	Verbal commands, communication

65	**How many Susps were involved**	1, 2, 3…	How many suspects involved incident directly related to OIS/CED use?	Officer Statement/Case File	1
66	**Suspect Surprised Officer**	Y/N	Did suspect act unexpectedly or suddenly during incident or cause initial engagement with officer?	Officer Statement	N
67	**How was officer surprised**	EXAMPLE: Suspect suddenly lunged at officer after briefly complying with commands	Describe situation of surprise	Officer Statement	N/A
68	**How did officer approach suspect**	EXAMPLE: Officer followed after suspect on foot with weapon drawn and giving verbal commands	How did officer approach? Were weapons drawn or holstered during approach?	Officer Statement	Officers were conducting a felony stop and knew suspect had shotgun so they approached cautiously with weapons drawn
69	**Susp. Fleeing or evading**	Y/N	Did suspect flee or evade at any point during the encounter leading up to the OIS/CED incident?	Officer Statement	Y
70	**What Actions Did Officer Take**	EXAMPLE: Officer entered suspect's house, observed suspect run to back of the house and pursued, believed suspect was in the process of pulling a weapon out of his waistband and fired on suspect once		Officer Statement	Officers recognized suspect based on vehicle description from dispatch, pursued vehicle along highway to residence, executed felony stop, fired on suspect when he threatened with shotgun
71	**Officer Attacked**	Y/N	Did suspect physically attack or use a weapon against the officer prior to OIS/CED use?	Officer Statement	N

72	**Was there a struggle**	Y/N	Did officer physically struggle against the suspect prior to OIS/CED use?	Officer Statement	N
73	**Officer Threatened**	Y/N	Did suspect act in a threatening or menacing manner (with or without weapons) prior to OIS/CED use?	Officer Statement	Y
74	**Officer Defending Life**	Y/N	Did officer act in the defense of their own or another person's (including suspect) life during OIS/CED use?	Officer Statement	Y
75	**Did suspect threaten, shoot or kill others on scene**	Y/N	Did suspect cause or threaten harm to someone besides the primary officer during the incident? (Includes other officers, does not include suspect themselves)	Officer Statement	Y
76	**Did Suspect Appear to be Intoxicated (or mentally unstable)**	Y/N	Did officer indicate that suspect seemed intoxicated or mentally unstable?	Officer Statement	N
77	**Was weapon visible**	Y/N	Was suspect in possession of a visible weapon at time of incident?	Officer Statement	Y
78	**Was weapon pointed at officer**	Y/N	Was suspect pointing weapon at primary officer at time of incident?	Officer Statement	Y
79	**Did suspect use the weapon**	Y/N	Had suspect used weapon at any point during the incident leading to OIS/CED use?	Officer Statement	N
80	**Who shot first**	Officer, Suspect, Simultaneous		Officer Statement	Officer

81	**Did the officer have alternative weapons**	Y/N	Was officer carrying weapon beside the one used in incident? (assumed yes if officer is on-duty)	Officer Statement	Y
83	**Were other officers present**	Y/N	Were other officers on scene at time of shooting?	Officer Statement	Y
84	**Did other officers shoot**	Y/N		Officer Statement	Y
85	**Was Vehicle Involved at time of shooting**	Y/N		Officer Statement	Y
86	**How was the veh. Involved**	EXAMPLE: Suspects were driving vehicle at officers attempting to hit them	Describe relation to officers and suspects	Officer Statement	Suspect was standing next to vehicle, using it for cover
87	**Was Vehicle Stolen**	Y/N	Did officers know vehicle was stolen?	Officer Statement	N
88	**Was vehicle wanted in a crime**	Y/N	Was vehicle wanted in crime separate from OIS/CED incident?	Officer Statement	Y
89	**Was suspect reaching for something**	Y/N	Did suspect reach inside vehicle during OIS/CED incident?	Officer Statement	Y
90	**Was a "Felony Stop" being used**	Y/N		Officer Statement	Y
92	**Did Officer try to move away from vehicle before discharge**	Y/N	Did officer make any attempt to move out of path of vehicle or away in order to maintain safety?	Officer Statement	N

Appendix A2: Stata Variables

Number	Name	Meaning	Possible Values	Type	Example
1	**payroll number**	See Appendix A1 "Payroll Number"	See Appendix A1 "Payroll Number"	Number	127996
2	**off_class rank**	Officer rank in cadet class taken from Training Records	1,2,3…(highest 73)	Ordinal	48
3	**case num**	See Appendix A1 "Case Number"	See Appendix A1 "Case Number"	Number	1338712
4	**ois**	1 if officer used gun, 0 otherwise	0,1	Dummy	1
5	**date**	See Appendix A1 "Date of Shooting"	See Appendix A1 "Date of Shooting"	Date	01/04/12
6	**yr2005**	1 if date in 2005, 0 otherwise	0,1	Dummy	0
7	**yr2006**	1 if date in 2006, 0 otherwise	0,1	Dummy	0
8	**yr2007**	1 if date in 2007, 0 otherwise	0,1	Dummy	0
9	**yr2008**	1 if date in 2008, 0 otherwise	0,1	Dummy	0
10	**yr2009**	1 if date in 2009, 0 otherwise	0,1	Dummy	0
11	**yr2010**	1 if date in 2010, 0 otherwise	0,1	Dummy	0
12	**yr2011**	1 if date in 2011, 0 otherwise	0,1	Dummy	0
13	**yr2012**	1 if date in 2012, 0 otherwise	0,1	Dummy	1
14	**yr2013**	1 if date in 2013, 0 otherwise	0,1	Dummy	0
15	**year**	Combination of 9 above dummies	2005-2013	Ordered	2012
16	**sea_winter**	1 if date between 12/21 and 3/21, 0 otherwise	0,1	Dummy	1
17	**sea_spring**	1 if date between 3/21 and 6/21, 0 otherwise	0,1	Dummy	0
18	**sea_summer**	1 if date between 6/21 and 9/21, 0 otherwise	0,1	Dummy	0
19	**sea_fall**	1 if date between 9/21 and 12/21, 0 otherwise	0,1	Dummy	0
20	**season**	Combination of 4 above dummies	spring, summer, fall, winter	String	winter
21	**day_sun**	1 if incident happened on a Sunday, 0 otherwise	0,1	Dummy	0
22	**day_mon**	1 if incident happened on a Monday, 0 otherwise	0,1	Dummy	0
23	**day_tues**	1 if incident happened on a Tuesday, 0 otherwise	0,1	Dummy	0
24	**day_wed**	1 if incident happened on a Wednesday, 0 otherwise	0,1	Dummy	1

25	**day_thurs**	1 if incident happened on a Thursday, 0 otherwise	0,1	Dummy	0
26	**day_fri**	1 if incident happened on a Friday, 0 otherwise	0,1	Dummy	0
27	**day_sat**	1 if incident happened on a Saturday, 0 otherwise	0,1	Dummy	0
28	**day**	Combination of 7 above dummies	sun, mon, tue…	String	wed
29	**weekday**	1 if between 0600 on Sunday and 1800 on Friday	0,1	Dummy	1
30	**weekend**	1 if between 1800 on Friday and 0600 on Sunday	0,1	Dummy	0
31	**time**	See Appendix A1 "Hour"	See Appendix A1 "Hour"	Dummy	225
32	**hour**	Time to nearest hour	000-2300	Dummy	200
33	**shift 1**	1 if time between 0600 and 1400, 0 otherwise	0,1	Dummy	0
34	**shift 2**	1 if time between 1400 and 2200, 0 otherwise	0,1	Dummy	0
35	**shift 3**	1 if time between 2200 and 0600, 0 otherwise	0,1	Dummy	1
36	**string_shift**	Combination of 3 above dummies	1,2,3	Number	3
37	**bad_time on shift**	Time, minus time when shift started	0-799		425
38	**prev cfs**	Number of previous calls recorded for officer in Call Historical Data	0,1,2…	Counting	0
39	**weather_cold**	1 if weather indicated cold, 0 otherwise	0,1	Dummy	1
40	**weather_clear**	1 if weather indicated clear, 0 otherwise	0,1	Dummy	0
41	**weather_cloud**	1 if weather indicated cloudy, 0 otherwise	0,1	Dummy	0
42	**weather_rain**	1 if weather indicated rain, 0 otherwise	0,1	Dummy	0
43	**weather_hot**	1 if weather indicated hot, 0 otherwise	0,1	Dummy	0
44	**weather**	Combination of 5 above dummies	hot, cloudy, cold…	String	cold
45	**div51**	1 if incident occurred in Division 51, 0 otherwise	0,1	Dummy	0
46	**div52**	1 if incident occurred in Division 52, 0 otherwise	0,1	Dummy	0

47	**div53**	1 if incident occurred in Division 53, 0 otherwise	0,1	Dummy	0
48	**div54**	1 if incident occurred in Division 54, 0 otherwise	0,1	Dummy	0
49	**div55**	1 if incident occurred in Division 55, 0 otherwise	0,1	Dummy	0
50	**div56**	1 if incident occurred in Division 56, 0 otherwise	0,1	Dummy	0
51	**div57**	1 if incident occurred in Division 57, 0 otherwise	0,1	Dummy	0
52	**div58**	1 if incident occurred in Division 58, 0 otherwise	0,1	Dummy	0
53	**div59**	1 if incident occurred in Division 59, 0 otherwise	0,1	Dummy	1
54	**div60**	1 if incident occurred in Division 60, 0 otherwise	0,1	Dummy	0
55	**div61**	1 if incident occurred in Division 61, 0 otherwise	0,1	Dummy	0
56	**div62**	1 if incident occurred in Division 62, 0 otherwise	0,1	Dummy	0
57	**div63**	1 if incident occurred in Division 63, 0 otherwise	0,1	Dummy	0
58	**div64**	1 if incident occurred in Division 64, 0 otherwise	0,1	Dummy	0
59	**div65**	1 if incident occurred in Division 65, 0 otherwise	0,1	Dummy	0
60	**division**	Combination of 15 above dummies	51,52,…,65	Number	59
61	**dist1**	1 if incident occurred in district 1	0,1	Dummy	0
62	**dist2**	1 if incident occurred in district 2	0,1	Dummy	0
63	**dist3**	1 if incident occurred in district 3	0,1	Dummy	0
64	**dist4**	1 if incident occurred in district 4	0,1	Dummy	0
65	**dist5**	1 if incident occurred in district 5	0,1	Dummy	0
66	**dist6**	1 if incident occurred in district 6	0,1	Dummy	0
67	**dist7**	1 if incident occurred in district 7	0,1	Dummy	0
68	**dist8**	1 if incident occurred in district 8	0,1	Dummy	0

69	**dist9**	1 if incident occurred in district 9	0,1	Dummy	0
70	**dist10**	1 if incident occurred in district 10	0,1	Dummy	0
71	**dist11**	1 if incident occurred in district 11	0,1	Dummy	1
72	**dist12**	1 if incident occurred in district 12	0,1	Dummy	0
73	**dist13**	1 if incident occurred in district 13	0,1	Dummy	0
74	**dist14**	1 if incident occurred in district 14	0,1	Dummy	0
75	**dist15**	1 if incident occurred in district 15	0,1	Dummy	0
76	**dist16**	1 if incident occurred in district 16	0,1	Dummy	0
77	**dist17**	1 if incident occurred in district 17	0,1	Dummy	0
78	**dist18**	1 if incident occurred in district 18	0,1	Dummy	0
79	**dist19**	1 if incident occurred in district 19	0,1	Dummy	0
80	**dist20**	1 if incident occurred in district 20	0,1	Dummy	0
81	**dist**	Combination of 20 above dummies	1,2,…,20	Number	11
82	**beat**	See Appendix A1 "Beat where shooting occurred"	See Appendix A1 "Beat where shooting occurred"	String	11H10
83	**address**	See Appendix A1 "Address of Shooting"	See Appendix A1 "Address of Shooting"	Address	7024 Lawndale, Houston, TX
84	**assigdiv_patrol**	1 if officer assigned to Patrol unit, 0 otherwise	0,1	Dummy	1
85	**assigdiv_dtu**	1 if officer assigned to Division Tactical Unit, 0 otherwise	0,1	Dummy	0
86	**assigdiv_narcotics**	1 if officer assigned to Narcotics unit, 0 otherwise	0,1	Dummy	0
87	**assigdiv_swat tod**	1 if officer assigned to SWAT/Tactical Operations Division, 0 otherwise	0,1	Dummy	0

88	**assigdiv_gang cru**	1 if officer assigned to Gang/Crime Reduction Unit, 0 otherwise	0,1	Dummy	0
89	**assigdiv_canine**	1 if officer assigned to K-9 unit, 0 otherwise	0,1	Dummy	0
90	**assigdiv_traffic**	1 if officer assigned to Traffic division, 0 otherwise	0,1	Dummy	0
91	**assigdiv_auto theft**	1 if officer assigned to Auto Theft division, 0 otherwise	0,1	Dummy	0
92	**assigdiv_special ops**	1 if officer assigned to Special Operations division, 0 otherwise	0,1	Dummy	0
93	**assigdiv_drt**	1 if officer assigned to DRT unit, 0 otherwise	0,1	Dummy	0
94	**assigdiv_misc**	1 if officer assigned to unit not already specified, 0 otherwise	0,1	Dummy	0
95	**assigdiv**	Combination of 11 above dummies	patrol, narcotics, gangcru…	String	patrol
96	**locdiv_beechnut**	1 if officer assigned to Beechnut division, 0 otherwise	0,1	Dummy	0
97	**locdiv_central**	1 if officer assigned to Central division, 0 otherwise	0,1	Dummy	0
98	**locdiv_clearlake**	1 if officer assigned to Clear Lake division, 0 otherwise	0,1	Dummy	0
99	**locdiv_eastside**	1 if officer assigned to Eastside division, 0 otherwise	0,1	Dummy	0
100	**locdiv_fondren**	1 if officer assigned to Fondren division, 0 otherwise	0,1	Dummy	0
101	**locdiv_kingwood**	1 if officer assigned to Kingwood division, 0 otherwise	0,1	Dummy	0
102	**locdiv_midwest**	1 if officer assigned to Midwest division, 0 otherwise	0,1	Dummy	0
103	**locdiv_north east**	1 if officer assigned to Northeast division, 0 otherwise	0,1	Dummy	1
104	**locdiv_north**	1 if officer assigned to North division, 0 otherwise	0,1	Dummy	0
105	**locdiv_north west**	1 if officer assigned to Northwest division, 0 otherwise	0,1	Dummy	0
106	**locdiv_south central**	1 if officer assigned to South Central division, 0 otherwise	0,1	Dummy	0

107	**locdiv_south east**	1 if officer assigned to Southeast division, 0 otherwise	0,1	Dummy	0
108	**locdiv_south west**	1 if officer assigned to Southwest division, 0 otherwise	0,1	Dummy	0
109	**locdiv_westside**	1 if officer assigned to Westside division, 0 otherwise	0,1	Dummy	0
110	**locdiv_south gessner**	1 if officer assigned to South Gessner division, 0 otherwise	0,1	Dummy	0
111	**locdiv**	Combination of 15 above dummies	central, clearlake, eastside…	String	north east
112	**one off**	See Appendix A1 "One officer unit	See Appendix A1 "One officer unit	Dummy	0
113	**back up**	See Appendix A1 "One officer unit with back-up"	See Appendix A1 "One officer unit with back-up"	Dummy	0
114	**two off**	See Appendix A1 "Two (or more) officer unit"	See Appendix A1 "Two (or more) officer unit"	Dummy	1
115	**unit**	Combination of 3 above dummies	one off, backup, two off	String	two off
116	**male**	See Appendix A1 "Male officer"	See Appendix A1 "Male officer"	Dummy	1
117	**female**	See Appendix A1 "Female officer"	See Appendix A1 "Female officer"	Dummy	0
118	**age**	See Appendix A1 "Age of officer"	See Appendix A1 "Age of officer"	Number	34
119	**age_decades**	Age, rounded down to nearest 10	10,20,30…		30
120	**seniority_2**	See Appendix A1 "Seniority less than 2 years"	See Appendix A1 "Seniority less than 2 years"	Dummy	0
121	**seniority_2_5**	See Appendix A1 "Seniority 2+ yrs. - 5 yrs."	See Appendix A1 "Seniority 2+ yrs. - 5 yrs."	Dummy	0
122	**seniority 5_10**	See Appendix A1 "Seniority 5+ yrs. - 10 yrs."	See Appendix A1 "Seniority 5+ yrs. - 10 yrs."	Dummy	1
123	**seniority_10**	See Appendix A1 "Seniority 10+ yrs."	See Appendix A1 "Seniority 10+ yrs."	Dummy	0

124	**seniority_bucket**	Combination of 4 above dummies	seniority_2, seniority_2_5…	String	seniority 5_10
125	**seniority_lessthan5**	1 if officer seniority less than 5 years, 0 otherwise	0,1	Dummy	0
126	**seniority_morethan5**	1 if officer seniority more than 5 years, 0 otherwise	0,1	Dummy	1
127	**off_seniority**	Years from date of commission to date of incident, rounded down	0,1,2,3….	Number	5
128	**extra job**	See Appendix A1 "Extra job related"	See Appendix A1 "Extra job related"	Dummy	1
129	**off duty**	See Appendix A1 "Off-duty related"	See Appendix A1 "Off-duty related"	Dummy	0
130	**on duty**	1 if not off-duty or at extra job, 0 otherwise	0,1	Dummy	0
131	**duty status**	Combination of 3 above dummies	extra job, off duty, on duty	String	extra job
132	**uniform**	See Appendix A1 "Officer in uniform"	See Appendix A1 "Officer in uniform"	Dummy	0
133	**planned operation**	See Appendix A1 "Non-Dispatched Planned Operation"	See Appendix A1 "Non-Dispatched Planned Operation"	Dummy	0
134	**incident_patrol_related**	See Appendix A1 "Patrol Related"	See Appendix A1 "Patrol Related"	Dummy	0
135	**non patrol unit**	See Appendix A1 "Non-Patrol Unit"	See Appendix A1 "Non-Patrol Unit"	Dummy	0
136	**traffic stop**	See Appendix A1 "Traffic Stop"	See Appendix A1 "Traffic Stop"	Dummy	0
137	**self-initiated**	See Appendix A1 "Self-Initiated"	See Appendix A1 "Self-Initiated"	Dummy	1
138	**on view**	See Appendix A1 "On-View"	See Appendix A1 "On-View"	Dummy	0
139	**dispatched**	See Appendix A1 "Dispatched"	See Appendix A1 "Dispatched"	Dummy	0
140	**cause for encounter**	Combination of 4 above dummies	traffic stop, self-initiated, on view, dispatched	String	self-initiated
141	**priority no**	See Appendix A1 "Priority of Call as Dispatched"	See Appendix A1 "Priority of Call as Dispatched"		

142	**typecrime_assault**	1 if response to assault, 0 otherwise	0,1	Dummy	0
143	**typecrime_robbery**	1 if response to robbery, 0 otherwise	0,1	Dummy	0
144	**typecrime_burglary**	1 if response to burglary, 0 otherwise	0,1	Dummy	0
145	**typecrime_assist off**	1 if response to officer call for assistance, 0 otherwise	0,1	Dummy	0
146	**typecrime_barricaded susp**	1 if response to barricaded suspect, 0 otherwise	0,1	Dummy	0
147	**typecrime_disturbance**	1 if response to disturbance, 0 otherwise	0,1	Dummy	0
148	**typecrime_cit**	1 if response to Critical Incident Training-designated situation, 0 otherwise	0,1	Dummy	0
149	**typecrime_traffic violation**	1 if response to traffic violation, 0 otherwise	0,1	Dummy	0
150	**typecrime_evade resist arrest**	1 if response to suspect evading/resisting arrest, 0 otherwise	0,1	Dummy	0
151	**typecrime_narcotics**	1 if response to narcotics violation, 0 otherwise	0,1	Dummy	0
152	**typecrime_stolen veh**	1 if response to stolen vehicle, 0 otherwise	0,1	Dummy	0
153	**typecrime_warrants**	1 if response to open warrants, 0 otherwise	0,1	Dummy	0
154	**typecrime_suspicious pers veh**	1 if response to suspicious person/vehicle, 0 otherwise	0,1	Dummy	0
155	**typecrime_misc**	1 if not previously designated, 0 otherwise	0,1	Dummy	1
156	**crime**	Combination of 14 above dummies	assault, robbery, burglary…	String	misc
157	**susp desc**	See Appendix A1 "Suspect Described"	See Appendix A1 "Suspect Described"	Dummy	0
158	**foot pursuit**	See Appendix A1 "Foot Pursuit"	See Appendix A1 "Foot Pursuit"	Dummy	0
159	**veh pursuit**	See Appendix A1 "Vehicle Pursuit"	See Appendix A1 "Vehicle Pursuit"	Dummy	0
160	**susp wpn known**	See Appendix A1 "Suspect Weapon Known"	See Appendix A1 "Suspect Weapon Known"	Dummy	0
161	**wpn_gun**	1 if officer know suspect has gun, 0 otherwise	0,1	Dummy	0

162	**wpn_knife**	1 if officer know suspect has knife, 0 otherwise	0,1	Dummy	0
163	**wpn_dog**	1 if officer know suspect has dog, 0 otherwise	0,1	Dummy	0
164	**wpn_blunt instruments**	1 if officer know suspect has a blunt instrument (pipe, bat, etc.), 0 otherwise	0,1	Dummy	0
165	**wpn_vehicle**	1 if officer know suspect using vehicle as weapon, 0 otherwise	0,1	Dummy	0
166	**wpn_misc**	1 if officer know suspect has miscellaneous weapon, 0 otherwise	0,1	Dummy	0
167	**wpn**	Combination of 6 above dummies	gun, knife, dog…	String	none
168	**offdoing_on patrol**	1 if officer had been on patrol, 0 otherwise	0,1	Dummy	0
169	**offdoing_search susp**	1 if officer had been searching for suspect, 0 otherwise	0,1	Dummy	0
170	**offdoing_in chase**	1 if officer had been in a pursuit, 0 otherwise	0,1	Dummy	0
171	**offdoing_on surveillance**	1 if officer had been on surveillance detail, 0 otherwise	0,1	Dummy	0
172	**offdoing_on break**	1 if officer had been on break, 0 otherwise	0,1	Dummy	0
173	**offdoing_traffic stop**	1 if officer had been conducting traffic stop, 0 otherwise	0,1	Dummy	0
174	**offdoing_off duty**	1 if officer had been off duty, 0 otherwise	0,1	Dummy	1
175	**offdoing_misc**	1 if officer had been doing something not previously designated, 0 otherwise	0,1	Dummy	0
176	**offdoing**	Combination of 8 above dummies	on patrol, search susp, in chase	String	off duty
177	**init_confront susp**	1 if officer initially confronting suspect, 0 otherwise	0,1	Dummy	1
178	**init_issue ticket**	1 if officer initially issuing ticket to suspect, 0 otherwise	0,1	Dummy	0
179	**init_interview**	1 if officer initially interviewing suspect, 0 otherwise	0,1	Dummy	0

180	**init_search building**	1 if officer searching for suspect, 0 otherwise	0,1	Dummy	0
181	**init_arrest susp**	1 if officer initially arresting suspect, 0 otherwise	0,1	Dummy	0
182	**init_susp initiates**	1 if suspect initiates encounter with officer, 0 otherwise	0,1	Dummy	0
183	**init_misc**	1 if different situation, 0 otherwise	0,1	Dummy	0
184	**string_init**	Combination of 7 above dummies	confront susp, issue ticket, interview…	String	confront susp
185	**crit_foot pursuit**	1 if suspect in foot pursuit at time of critical incident, 0 otherwise	0,1	Dummy	0
186	**crit_resist arrest**	1 if suspect resisting arrest at time of critical incident, 0 otherwise	0,1	Dummy	1
187	**crit_reach for wpn**	1 if suspect reaching for weapon at time of critical incident, 0 otherwise	0,1	Dummy	0
188	**crit_use wpn**	1 if suspect using weapon at time of critical incident, 0 otherwise	0,1	Dummy	0
189	**crit_not obey**	1 if suspect not obeying verbal commands at time of critical incident, 0 otherwise	0,1	Dummy	0
190	**crit_aggr stance**	1 if suspect taking aggressive stance at time of critical incident, 0 otherwise	0,1	Dummy	1
191	**crit_wpn_pointed at off**	1 if suspect pointing weapon at officer at time of critical incident, 0 otherwise	0,1	Dummy	1
192	**prem_apart complex**	1 if incident took place in an apartment complex, 0 otherwise	0,1	Dummy	0
193	**prem_parking lot**	1 if incident took place in a parking lot, 0 otherwise	0,1	Dummy	1
194	**prem_yard**	1 if incident took place in a yard or field, 0 otherwise	0,1	Dummy	0
195	**prem_bar**	1 if incident took place in a bar, 0 otherwise	0,1	Dummy	0
196	**prem_business**	1 if incident took place at a private business, 0 otherwise	0,1	Dummy	0

197	**prem_public**	1 if incident took place at a public venue, 0 otherwise	0,1	Dummy	0
198	**prem_street**	1 if incident took place on a street or highway, 0 otherwise	0,1	Dummy	0
199	**prem_residence**	1 if incident took place in a private residence, 0 otherwise	0,1	Dummy	0
200	**prem**	Combination of 8 above dummies	apart complex, parking lot, yard…	String	parking lot
201	**indoors**	Dummy version of indoors/outdoors	0,1	Dummy	0
202	**vis_good**	1 if visibility at the scene was good, 0 otherwise	0,1	Dummy	0
203	**vis_fair**	1 if visibility at the scene was fair, 0 otherwise	0,1	Dummy	0
204	**vis_poor**	1 if visibility at the scene was poor, 0 otherwise	0,1	Dummy	1
205	**lit_day light**	1 if daylight present at the scene, 0 otherwise	0,1	Dummy	0
206	**lit_street lights**	1 if streetlights present at the scene, 0 otherwise	0,1	Dummy	1
207	**lit_residence lights**	1 if residence lights present at the scene, 0 otherwise	0,1	Dummy	1
208	**lit_police lighting**	1 if police lights (car, flashlights or spot lights) present at the scene, 0 otherwise	0,1	Dummy	0
209	**conceal poss off**	See Appendix A1 "Concealment Possible - Officer"	See Appendix A1 "Concealment Possible - Officer"	Dummy	1
210	**conceal used off**	See Appendix A1 "Concealment Used - Officer"	See Appendix A1 "Concealment Used - Officer"	Dummy	1
211	**cover poss off**	See Appendix A1 "Cover Possible - Officer"	See Appendix A1 "Cover Possible - Officer"	Dummy	1
212	**cover used off**	See Appendix A1 "Cover Used - Officer"	See Appendix A1 "Cover Used - Officer"	Dummy	1

213	**conceal poss susp**	See Appendix A1 "Concealment Possible - Suspect"	See Appendix A1 "Concealment Possible - Suspect"	Dummy	0
214	**conceal used susp**	See Appendix A1 "Concealment Used - Suspect"	See Appendix A1 "Concealment Used - Suspect"	Dummy	0
215	**cover poss susp**	See Appendix A1 "Cover Possible - Suspect"	See Appendix A1 "Cover Possible - Suspect"	Dummy	0
216	**cover used susp**	See Appendix A1 "Cover Used - Suspect"	See Appendix A1 "Cover Used - Suspect"	Dummy	0
217	**verb_communicate**	See Appendix A1 "Did Officer Communicate with Susp"	See Appendix A1 "Did Officer Communicate with Susp"	Dummy	1
218	**verb_lang barr**	See Appendix A1 "Language Barrier"	See Appendix A1 "Language Barrier"	Dummy	0
219	**verb_command given**	See Appendix A1 "Was Susp given verbal commands"	See Appendix A1 "Was Susp given verbal commands"	Dummy	1
220	**verb_stop**	1 if officer commanded suspect to "Stop", 0 otherwise	0,1	Dummy	1
221	**verb_drop the weapon**	1 if officer commanded the suspect to "Drop the weapon", 0 otherwise	0,1	Dummy	1
222	**verb_get on the ground**	1 if officer commanded suspect to "Get on the ground", 0 otherwise	0,1	Dummy	0
223	**verb_show your hands**	1 if officer commanded the suspect to "Show your hands", 0 otherwise	0,1	Dummy	0
224	**verb_get out of the vehicle**	1 if officer commanded suspect to "Get out of the vehicle", 0 otherwise	0,1	Dummy	0
225	**verb_come over here**	1 if officer commanded the suspect to "Come over here", 0 otherwise	0,1	Dummy	0
226	**verb_calm down**	1 if officer commanded suspect to "Calm down", 0 otherwise	0,1	Dummy	0

227	**verb_comm obey**	1 if suspect obeyed officers verbal commands, 0 otherwise	0,1	Dummy	1
228	**verb_comm temp**	1 if suspect only temporarily obeyed officers commands, 0 otherwise	0,1	Dummy	0
229	**deesc_inter_wpn**	1 if officer used intermediate weapons during the encounter, 0 otherwise	0,1	Dummy	0
230	**deesc_negotiation**	1 if officer negotiated or warned the suspect during the encounter, 0 otherwise	0,1	Dummy	0
231	**number of susp**	See Appendix A1 "How many Susps were involved"	See Appendix A1 "How many Susps were involved"	Number	1
232	**surprised_off**	See Appendix A1 "Suspect Surprised Officer"	See Appendix A1 "Suspect Surprised Officer"	Dummy	1
233	**approach_gun drawn**	1 if officer approached suspect with gun drawn, 0 otherwise	0,1	Dummy	0
234	**approach_ced drawn**	1 if officer approached suspect with CED drawn, 0 otherwise	0,1	Dummy	0
235	**approach_wpn holstered**	1 if officer approached suspect with weapons holstered, 0 otherwise	0,1	Dummy	1
236	**approach**	Combination of above dummies	gun drawn, ced drawn, wpn holstered	String	wpn holstered
237	**fleeing**	See Appendix A1 "Susp. Fleeing or evading"	See Appendix A1 "Susp. Fleeing or evading"	Dummy	1
238	**justif_off attacked**	See Appendix A1 "Officer Attacked"	See Appendix A1 "Officer Attacked"	Dummy	1
239	**justif_struggle**	See Appendix A1 "Was there a struggle"	See Appendix A1 "Was there a struggle"	Dummy	1
240	**justif_off threatened**	See Appendix A1 "Officer Threatened"	See Appendix A1 "Officer Threatened"	Dummy	1

241	**justif_off defend life**	See Appendix A1 "Officer Defending Life"	See Appendix A1 "Officer Defending Life"	Dummy	1
242	**justif_susp threaten others**	See Appendix A1 "Did suspect threaten, shoot or kill others on scene"	See Appendix A1 "Did suspect threaten, shoot or kill others on scene"	Dummy	1
243	**justif_susp_intoxicated**	See Appendix A1 "Did Suspect appear to be Intoxicated (or mentally unstable)"	See Appendix A1 "Did Suspect appear to be Intoxicated (or mentally unstable)"	Dummy	1
244	**justif_wpn_visible**	See Appendix A1 "Was weapon visible"	See Appendix A1 "Was weapon visible"	Dummy	1
245	**justif_wpn_used**	See Appendix A1 "Did suspect use the weapon	See Appendix A1 "Did suspect use the weapon	Dummy	0
246	**shot first**	See Appendix A1 "Who shot first"	See Appendix A1 "Who shot first"	Dummy	1
247	**altwpn**	See Appendix A1 "Did the officer have alternative weapons"	See Appendix A1 "Did the officer have alternative weapons"	Dummy	0
248	**other_off_present**	See Appendix A1 "Were other officers present"	See Appendix A1 "Were other officers present"	Dummy	1
249	**other_off_shoot**	See Appendix A1 "Did other officers shoot"	See Appendix A1 "Did other officers shoot"	Dummy	0
250	**veh_involved**	See Appendix A1 "Was Vehicle Involved at time of shooting"	See Appendix A1 "Was Vehicle Involved at time of shooting"	Dummy	1
251	**veh_flee**	1 if suspect was using vehicle to flee, 0 otherwise	0,1	Dummy	1
252	**veh_weapon**	1 if suspect was using vehicle as a weapon, 0 otherwise	0,1	Dummy	0
253	**veh_concealment cover**	1 if suspect was using the vehicle for concealment/cover, 0 otherwise	0,1	Dummy	0

254	**veh_stolen**	See Appendix A1 "Was Vehicle Stolen"	See Appendix A1 "Was Vehicle Stolen"	Dummy	0
255	**veh_wanted**	See Appendix A1 "Was vehicle wanted in a crime"	See Appendix A1 "Was vehicle wanted in a crime"	Dummy	0
256	**veh_reaching**	See Appendix A1 "Was suspect reaching for something"	See Appendix A1 "Was suspect reaching for something"	Dummy	0
257	**veh_felony stop**	See Appendix A1 "Was a 'Felony Stop' being used"	See Appendix A1 "Was a 'Felony Stop' being used"	Dummy	0
258	**veh_moveaway**	See Appendix A1 "Did Officer try to move away from vehicle before discharge"	See Appendix A1 "Did Officer try to move away from vehicle before discharge"	Dummy	0
259	**seniority_dec**	10 deciles of officers seniority (in years)	1 to 10	Ordinal	3
260	**ced**	“ced” is 1 if incident involved CED instead of gun use	1 or 0	Dummy	1
261	**meanpriorityno_prevcfs**	Average priority number of prior calls for service	1-8	Ordinal	3
262	**officerrace**	Race indicated in officer training record	White, Black, Hispanic, Asian	String	Hispanic
263	**susprace**	Race indicated in case file	White, Black, Hispanic, Asian	String	Hispanic
264	**suspgender**	Gender indicated in case file	Male, Female	String	Male
265	**suspage**	Age indicated in case file	14 to 77	Number	23
266	**injuriestosusp**	As indicated in officer statement	No Injury, Minor Injury, Serious Injury, Killed	String	No Injury
267	**numoff_firing**	Number of officers based on statements provided	1 to 10	Number	1
268	**totalshotsfired**	As indicated in officer statements and recovered evidence	1 to 62	Number	10
269	**suspage_decades**	Suspect age rounded down to nearest 10	10, 20, 30, 40, 50, 60, 70	Number	20

Appendix B1: OIS

Reasons/Incident #	total number	oneoff	backup	twooff	male	female	seniority_2	seniority_2_5	seniority5_10	seniority_10	seniority_lessthan5	seniority_morethan5	extrajob	_offduty	onduty	__uniform
assault	38	9	9	20	34	4	8	6	7	15	14	22	6	5	27	32
barricaded susp	3	0	0	3	3	0	0	0	0	3	0	3	0	0	3	3
burglary	26	12	8	6	25	1	2	8	3	12	10	15	3	9	14	19
cit	3	0	0	3	3	0	0	0	0	3	0	3	0	0	3	3
disturbance	20	6	3	11	20	0	4	4	2	10	8	12	2	0	18	20
evade resist arrest	9	1	5	3	9	0	1	1	1	6	2	7	0	0	9	9
misc	6	1	1	4	6	0	1	2	1	2	3	3	2	0	4	4
narcotics	19	2	1	16	17	2	2	0	5	12	2	17	1	0	18	17
robbery	29	9	6	14	27	2	1	4	5	19	5	24	5	3	21	25
stolen veh	7	2	1	4	7	0	0	5	0	2	5	2	1	0	6	6
suspicious pers veh	17	5	3	9	16	1	5	3	3	6	8	9	3	0	14	17
traffic violation	14	6	0	8	13	1	4	6	1	3	10	4	0	1	13	13
warrants	4	0	1	3	4	0	0	1	1	2	1	3	0	0	4	4
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	195	53	38	104	184	11	28	40	29	95	68	124	23	18	154	172
Percentage of Total	***100.00%***	***27.18%***	***19.49%***	***53.33%***	***94.36%***	***5.64%***	***14.36%***	***20.51%***	***14.87%***	***48.72%***	***34.87%***	***63.59%***	***11.79%***	***9.23%***	***78.97%***	***88.21%***

Reasons/Incident #	plannedoperation	incident_patrol_related	nonpatrolunit	trafficstop	selfinitiated	onview	dispatched	suspdesc	footpursuit	vehpursuit	suspwpnknown	wpn_gun	wpn_knife	_wpn_dog	_wpn_bluntinstruments	_wpn_vehicle
assault	2	20	3	0	3	13	22	16	2	3	14	12	1	0	0	0
barricaded susp	0	0	3	0	0	0	3	3	0	0	3	3	0	0	0	0
burglary	4	9	6	0	3	16	7	2	2	1	2	0	0	0	0	1
cit	0	2	1	0	0	0	3	3	1	1	3	3	0	0	0	0
disturbance	1	13	2	0	1	4	15	15	0	1	17	12	2	0	1	0
evade resist arrest	0	9	0	2	0	1	6	4	0	5	4	2	0	0	0	2
misc	2	2	2	0	2	2	2	0	0	0	0	0	0	0	0	0
narcotics	16	3	17	0	14	5	0	3	0	0	5	3	0	1	0	1
robbery	1	19	4	1	2	11	15	13	4	5	15	13	0	0	0	0
stolen veh	0	5	1	1	1	4	1	1	0	0	1	0	0	0	0	1
suspicious pers veh	0	13	3	0	5	1	11	10	0	1	9	8	1	0	0	0
traffic violation	0	12	4	11	2	1	0	0	0	1	0	0	0	0	0	0
warrants	3	0	4	0	4	0	0	2	0	0	2	0	0	2	0	0
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	29	107	50	15	37	58	85	72	9	18	75	56	4	3	1	5
Percentage of Total	***14.87%***	***54.87%***	***25.64%***	***7.69%***	***18.97%***	***29.74%***	***43.59%***	***36.92%***	***4.62%***	***9.23%***	***38.46%***	***28.72%***	***2.05%***	***1.54%***	***0.51%***	***2.56%***

Reasons/Incident #	_wpn_misc	offdoing_onpatrol	offdoing_searchsusp	offdoing_inchase	offdoing_onsurveillance	offdoing_onbreak	offdoing_trafficstop	offdoing_offduty	offdoing_misc	init_confrontsusp	init_issueticket	init_interview	init_searchbuilding	init_arrestsusp	init_suspinitiates	init_misc
assault	0	17	8	0	2	1	0	2	8	18	1	3	0	5	4	7
barricaded susp	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	2
burglary	1	11	0	0	4	2	0	6	3	17	0	0	2	4	1	2
cit	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0	2
disturbance	0	16	1	0	0	0	0	2	1	12	0	3	2	1	0	2
evade resist arrest	0	3	1	4	0	0	1	0	0	3	1	0	0	4	1	0
misc	0	2	0	0	2	0	0	1	1	2	0	0	0	3	1	0
narcotics	0	4	3	0	5	0	0	0	7	6	1	2	8	1	1	0
robbery	0	17	5	1	0	1	0	4	1	12	0	1	3	8	1	4
stolen veh	0	4	0	0	1	1	0	1	0	0	1	0	0	5	0	1
suspicious pers veh	0	12	3	0	0	0	0	0	2	9	0	3	0	2	1	2
traffic violation	0	8	1	0	0	0	3	1	1	3	6	0	0	3	0	2
warrants	0	0	4	0	0	0	0	0	0	1	0	0	1	0	1	1
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	96	28	5	14	5	4	17	26	83	10	12	17	37	11	25
Percentage of Total	***0.51%***	***49.23%***	***14.36%***	***2.56%***	***7.18%***	***2.56%***	***2.05%***	***8.72%***	***13.33%***	***42.56%***	***5.13%***	***6.15%***	***8.72%***	***18.97%***	***5.64%***	***12.82%***

Reasons/Incident #	crit_footpursuit	crit_resistarrest	crit_reachforwpn	crit_usewpn	crit_notobey	crit_aggrstance	crit_wpn_pointedatoff	prem_apartcomplex	prem_parkinglot	prem_yard	_prem_bar	prem_business	prem_public	prem_street	prem_residence	indoors
assault	5	2	6	18	3	18	23	4	15	0	0	1	1	13	4	0
barricaded susp	0	0	0	1	0	2	3	0	0	0	0	1	0	0	2	0
burglary	1	2	7	9	3	12	17	2	8	1	0	0	3	9	3	3
cit	0	0	0	0	0	3	1	0	2	0	0	0	0	0	1	0
disturbance	0	1	1	4	5	15	16	0	6	0	1	1	1	4	7	6
evade resist arrest	1	4	2	5	1	4	3	1	0	1	0	0	0	6	0	0
misc	1	5	0	1	1	2	3	1	2	1	0	0	0	2	0	0
narcotics	0	2	4	9	4	9	13	2	4	1	0	0	0	3	9	9
robbery	7	1	4	6	0	20	20	3	13	1	0	3	0	5	4	4
stolen veh	2	3	3	3	0	2	4	0	3	1	0	0	0	3	0	0
suspicious pers veh	1	0	1	8	2	11	12	2	4	4	0	0	1	3	3	0
traffic violation	2	3	7	3	2	6	8	1	2	2	0	0	0	9	0	0
warrants	0	0	0	2	0	2	4	1	1	0	0	0	0	1	1	2
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	20	23	35	69	21	106	127	17	60	12	1	6	6	58	34	24
Percentage of Total	***10.26%***	***11.79%***	***17.95%***	***35.38%***	***10.77%***	***54.36%***	***65.13%***	***8.72%***	***30.77%***	***6.15%***	***0.51%***	***3.08%***	***3.08%***	***29.74%***	***17.44%***	***12.31%***

Reasons/Incident #	vis_good	vis_fair	vis_poor	lit_daylight	lit_streetlights	lit_residencelights	lit_policelighting	concealpossoff	concealusedoff	coverpossoff	coverusedoff	concealposssusp	concealusedsusp	coverposssusp	coverusedsusp	verb_communicate
assault	24	8	2	16	12	3	2	17	13	15	13	12	5	12	5	13
barricaded susp	2	0	0	1	0	2	0	3	3	2	0	3	1	3	1	1
burglary	18	3	2	12	10	1	1	7	6	7	5	14	6	13	6	5
cit	2	1	0	3	1	0	0	3	2	3	2	3	1	3	1	0
disturbance	17	2	1	12	4	6	1	10	10	10	9	10	6	9	4	9
evade resist arrest	7	0	1	5	2	0	1	3	2	3	3	5	3	6	3	2
misc	2	0	3	1	3	1	0	2	1	2	1	1	0	1	0	2
narcotics	10	0	5	7	5	7	3	8	7	8	7	14	9	12	5	8
robbery	21	4	0	11	9	10	1	11	6	11	6	11	4	11	2	2
stolen veh	3	2	1	2	4	0	1	0	0	0	0	5	3	5	2	3
suspicious pers veh	9	3	5	6	5	3	4	7	6	6	6	12	6	10	5	8
traffic violation	9	3	2	4	9	0	1	8	7	8	6	7	3	7	3	6
warrants	4	0	0	4	0	0	0	0	0	0	0	2	0	2	0	0
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	128	26	22	84	64	33	15	79	63	75	58	99	47	94	37	59
Percentage of Total	***65.64%***	***13.33%***	***11.28%***	***43.08%***	***32.82%***	***16.92%***	***7.69%***	***40.51%***	***32.31%***	***38.46%***	***29.74%***	***50.77%***	***24.10%***	***48.21%***	***18.97%***	***30.26%***

Reasons/Incident #	verb_langbar	verb_commandgiven	verb_stop	verb_dropthweapon	verb_getontheground	verb_showyourhands	verb_getoutofthevehicle	verb_comeoverhere	verb_calmdown	verb_commobey	verb_commtemp	deesc_inter_wpn	deesc_negotiation	numberofsusp	surprised_off	approach_gundrawn
assault	2	24	10	8	1	8	3	0	2	1	1	0	2	50	12	24
barricaded susp	0	1	0	1	0	0	0	0	0	0	0	0	2	3	0	3
burglary	1	20	5	2	6	8	4	0	0	1	2	1	0	46	14	23
cit	0	2	0	2	0	0	0	0	0	0	0	0	0	4	0	3
disturbance	1	18	5	11	3	6	0	1	1	0	1	2	3	21	3	19
evade resist arrest	1	8	4	2	0	3	2	0	0	0	0	0	0	11	6	6
misc	2	6	4	2	0	0	0	0	0	1	1	3	0	7	4	1
narcotics	1	15	3	2	5	5	2	0	1	1	0	0	0	29	7	10
robbery	2	22	11	5	3	6	0	1	1	0	1	0	0	53	10	24
stolen veh	0	7	4	1	1	4	3	0	0	0	0	1	0	11	5	4
suspicious pers veh	1	16	8	7	1	2	2	0	0	0	0	0	1	25	5	11
traffic violation	1	11	4	2	0	3	1	1	0	1	1	1	0	22	10	6
warrants	2	0	0	0	0	0	0	0	0	0	0	0	0	8	3	2
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	14	150	58	45	20	45	17	3	5	5	7	8	8	290	79	136
Percentage of Total	***7.18%***	***76.92%***	***29.74%***	***23.08%***	***10.26%***	***23.08%***	***8.72%***	***1.54%***	***2.56%***	***2.56%***	***3.59%***	***4.10%***	***4.10%***	***######***	***40.51%***	***69.74%***

Reasons/Incident #	approach_cedrawn	approach_wpnholstered	fleeing	justif_offattacked	justif_struggle	justif_ofthreatened	justif_ofdefendlife	justif_suspthreatenothers	justif_susp_intoxicated	justif_wpn_visible	justif_wpn_used	officer shotfirst	altwpn	other_off_present	other_off_shoot	veh_involved
assault	0	14	17	12	5	34	37	34	12	30	21	18	32	25	5	13
barricaded susp	0	0	0	0	0	2	3	3	2	3	1	2	3	3	1	0
burglary	0	3	14	15	3	25	24	9	2	17	9	18	18	8	4	12
cit	0	0	2	1	0	2	3	3	3	3	1	2	3	3	3	1
disturbance	0	1	5	5	2	16	20	20	11	19	7	15	20	14	4	1
evade resist arrest	1	2	8	4	2	8	8	8	3	6	4	5	9	7	5	5
misc	1	4	3	5	5	5	6	6	1	4	1	5	4	3	0	1
narcotics	0	9	8	8	3	17	17	13	2	14	9	11	18	17	5	8
robbery	0	5	26	7	1	27	26	23	1	24	9	22	25	16	7	4
stolen veh	1	2	6	4	1	6	6	4	0	5	3	4	6	4	3	5
suspicious pers veh	0	6	8	8	0	15	16	11	4	15	9	8	17	10	6	5
traffic violation	0	8	11	5	4	13	12	8	3	8	4	10	13	8	1	7
warrants	0	2	0	3	0	4	4	4	0	4	3	1	4	4	3	1
assist off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3	56	108	77	26	174	182	146	44	152	81	121	172	122	47	63
Percentage of Total	***1.54%***	***28.72%***	***55.38%***	***39.49%***	***13.33%***	***89.23%***	***93.33%***	***74.87%***	***22.56%***	***77.95%***	***41.54%***	***62.05%***	***88.21%***	***62.56%***	***24.10%***	***32.31%***

Reasons/Incident #	veh_flee	veh_weapon	veh_concealmentcover	veh_stolen	veh_wanted	veh_reaching	veh_felonystop	veh_moveaway
assault	4	2	9	1	1	3	0	2
barricaded susp	0	0	0	0	0	0	0	0
burglary	6	5	4	4	5	8	2	6
cit	0	0	1	1	0	0	0	1
disturbance	0	0	1	0	0	1	1	0
evade resist arrest	1	3	2	0	1	1	4	2
misc	1	0	0	0	0	0	0	0
narcotics	2	4	5	0	2	2	2	3
robbery	2	2	3	1	2	1	2	4
stolen veh	1	4	1	4	1	1	2	3
suspicious pers veh	0	3	1	1	1	3	1	3
traffic violation	3	2	3	1	4	5	3	2
warrants	0	0	1	0	0	0	0	0
assist off	0	0	0	0	0	0	0	0
Total	20	25	31	13	17	25	17	26
Percentage of Total	***10.26%***	***12.82%***	***15.90%***	***6.67%***	***8.72%***	***12.82%***	***8.72%***	***13.33%***

Appendix B2: CED

Reasons/Incident #	total number	oneoff	backup	twooff	male	female	seniority_2	seniority_2_5	seniority5_10	seniority_10	seniority_lessthan5	seniority_morethan5	extrajob	_offduty	onduty	__uniform
assault	20	2	4	14	15	5	4	5	1	5	9	6	2	0	18	20
barricaded susp	1	0	0	1	1	0	0	0	0	1	0	1	0	0	1	1
burglary	6	1	1	4	4	2	2	2	1	1	4	2	1	0	5	6
cit	17	0	1	16	14	3	2	4	1	7	6	8	0	0	17	17
disturbance	18	5	2	11	14	4	3	4	2	7	7	9	1	0	17	18
evade resist arrest	3	0	1	2	3	0	1	0	0	2	1	2	0	0	3	3
misc	8	1	1	6	7	1	3	1	2	1	4	3	0	0	8	8
narcotics	4	0	0	4	4	0	1	0	0	3	1	3	1	0	3	4
robbery	7	0	2	5	6	1	1	2	1	1	3	2	0	0	7	7
stolen veh	3	2	0	1	3	0	0	0	0	3	0	3	0	0	3	3
suspicious pers veh	7	2	0	5	7	0	4	2	1	0	6	1	0	0	7	7
traffic violation	11	1	3	7	10	1	3	5	2	0	8	2	0	0	11	11
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	3	1	0	2	1	2	0	0	1	0	0	1	1	0	2	2
Total	108	15	15	78	89	19	24	25	12	31	49	43	6	0	102	107
Percentage of Total	***100.00%***	***13.89%***	***13.89%***	***72.22%***	***82.41%***	***17.59%***	***22.22%***	***23.15%***	***11.11%***	***28.70%***	***45.37%***	***39.81%***	***5.56%***	***0.00%***	***94.44%***	***99.07%***

Reasons/Incident #	plannedoperation	incident_patrol_related	nonpatrolunit	trafficstop	selfinitiated	onview	dispatched	suspdesc	footpursuit	vehpursuit	suspwpnknown	wpn_gun	wpn_knife	_wpn_dog	_wpn_bluntinstruments	_wpn_vehicle
assault	0	17	2	1	0	9	10	8	3	0	8	0	5	0	2	0
barricaded susp	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
burglary	0	5	0	0	0	1	5	4	0	0	1	0	1	0	0	0
cit	0	16	1	0	0	0	17	17	0	0	14	3	10	0	0	0
disturbance	1	16	1	0	0	2	16	10	1	0	9	3	5	0	1	0
evade resist arrest	0	3	0	0	0	0	3	3	1	1	0	0	0	0	0	0
misc	0	8	0	0	0	2	6	6	1	0	1	0	1	0	0	0
narcotics	1	3	2	0	3	1	0	1	0	0	0	0	0	0	0	0
robbery	0	7	1	0	0	1	6	5	0	1	5	3	0	0	1	0
stolen veh	0	3	1	0	1	1	1	1	0	1	0	0	0	0	0	0
suspicious pers veh	0	7	0	0	1	1	5	5	0	0	3	0	3	0	0	0
traffic violation	0	11	1	6	4	1	0	0	0	0	0	0	0	0	0	0
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	0	2	0	1	0	1	1	0	0	0	0	0	0	0	0	0
Total	2	98	10	8	9	20	71	61	6	3	41	9	25	0	4	0
Percentage of Total	***1.85%***	***90.74%***	***9.26%***	***7.41%***	***8.33%***	***18.52%***	***65.74%***	***56.48%***	***5.56%***	***2.78%***	***37.96%***	***8.33%***	***23.15%***	***0.00%***	***3.70%***	***0.00%***

Reasons/Incident #	_wpn_misc	offdoing_onpatrol	offdoing_searchsusp	offdoing_inchase	offdoing_onsurveillance	offdoing_onbreak	offdoing_trafficstop	offdoing_offduty	offdoing_misc	init_confrontsusp	init_issueticket	init_interview	init_searchbuilding	init_arrestsusp	init_suspinitiates	init_misc
assault	1	17	0	0	1	1	0	0	1	10	1	0	2	5	1	1
barricaded susp	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
burglary	0	5	0	0	0	0	0	1	0	2	0	0	1	2	1	0
cit	0	15	2	0	0	0	0	0	0	10	0	2	1	2	2	0
disturbance	0	16	2	0	0	0	0	0	0	10	0	3	1	2	2	0
evade resist arrest	0	2	0	1	0	0	0	0	0	1	0	0	0	1	0	1
misc	0	7	1	0	0	0	0	0	0	3	0	1	1	2	1	0
narcotics	0	2	1	0	0	0	0	1	0	2	0	2	0	0	0	0
robbery	0	6	0	1	0	0	0	0	0	5	0	0	0	2	0	0
stolen veh	0	3	0	0	0	0	0	0	0	2	0	1	0	0	0	0
suspicious pers veh	0	7	0	0	0	0	0	0	0	6	0	1	0	0	0	0
traffic violation	0	8	0	0	0	0	3	0	0	5	5	1	0	0	0	0
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	0	1	0	0	1	0	1	0	0	1	1	0	0	1	0	0
Total	1	89	7	2	2	1	4	2	1	57	7	12	6	17	7	2
Percentage of Total	***0.93%***	***82.41%***	***6.48%***	***1.85%***	***1.85%***	***0.93%***	***3.70%***	***1.85%***	***0.93%***	***52.78%***	***6.48%***	***11.11%***	***5.56%***	***15.74%***	***6.48%***	***1.85%***

Reasons/Incident #	crit_footpursuit	crit_resistarrest	crit_reachforwpn	crit_usewpn	crit_notobey	crit_aggrstance	crit_wpn_pointedatoff	prem_apartcomplex	prem_parkinglot	prem_yard	_prem_bar	prem_business	prem_public	prem_street	prem_residence	indoors
assault	0	5	3	7	3	6	11	2	3	3	1	1	1	5	4	7
barricaded susp	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
burglary	0	2	2	0	2	4	3	0	1	0	0	2	0	0	3	4
cit	0	2	1	2	5	13	8	2	3	0	0	0	1	1	9	7
disturbance	1	5	3	1	6	9	2	4	2	0	0	0	0	3	9	7
evade resist arrest	0	2	2	0	0	0	0	0	0	1	0	0	0	2	0	0
misc	1	2	2	2	1	2	5	2	0	0	0	1	0	3	2	3
narcotics	0	3	1	0	1	1	1	1	3	0	0	0	0	0	0	0
robbery	1	1	3	0	2	2	2	0	1	1	0	0	0	5	0	0
stolen veh	0	1	2	0	0	1	1	0	3	0	0	0	0	0	0	0
suspicious pers veh	1	2	2	1	3	2	1	0	0	2	0	1	0	3	1	1
traffic violation	4	6	3	0	2	5	1	1	0	1	0	0	0	7	2	1
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	0	2	0	0	2	0	0	0	1	0	0	0	0	2	0	0
Total	8	33	24	13	27	46	36	12	17	8	1	5	2	31	31	30
Percentage of Total	***7.41%***	***30.56%***	***22.22%***	***12.04%***	***25.00%***	***42.59%***	***33.33%***	***11.11%***	***15.74%***	***7.41%***	***0.93%***	***4.63%***	***1.85%***	***28.70%***	***28.70%***	***27.78%***

Reasons/Incident #	vis_good	vis_fair	vis_poor	lit_daylight	lit_streetlights	lit_residencelights	lit_policelighting	concealpossoff	concealusedoff	coverpossoff	coverusedoff	concealposssusp	concealusedsusp	coverposssusp	coverusedsusp	verb_communicate
assault	12	2	1	7	4	4	0	3	1	3	1	3	1	2	0	3
barricaded susp	1	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1
burglary	2	2	1	1	1	3	0	1	0	1	0	2	0	2	0	2
cit	11	0	0	11	0	4	0	2	1	4	3	5	1	5	0	8
disturbance	10	1	1	6	0	8	0	3	3	2	2	6	1	5	0	8
evade resist arrest	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
misc	7	0	1	4	1	1	1	1	0	1	0	2	1	1	0	2
narcotics	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3
robbery	5	0	0	4	1	0	0	0	0	0	0	0	0	0	0	1
stolen veh	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
suspicious pers veh	5	0	0	4	0	0	0	0	0	0	0	1	0	1	0	6
traffic violation	3	1	2	2	3	0	1	0	0	0	0	0	0	0	0	2
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Total	61	6	7	43	13	20	2	11	5	12	6	21	5	17	0	38
Percentage of Total	***56.48%***	***5.56%***	***6.48%***	***39.81%***	***12.04%***	***18.52%***	***1.85%***	***10.19%***	***4.63%***	***11.11%***	***5.56%***	***19.44%***	***4.63%***	***15.74%***	***0.00%***	***35.19%***

Reasons/Incident #	verb_langbar	verb_commandgiven	verb_stop	verb_dropthweapon	verb_getontheground	verb_showyourhands	verb_getoutofthevehicle	verb_comeoverhere	verb_calmdown	verb_commobey	verb_commtemp	deesc_inter_wpn	deesc_negotiation	numberofsusp	surprised_off	approach_gundrawn
assault	0	19	6	6	3	3	0	2	1	0	0	4	0	27	6	5
barricaded susp	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	1
burglary	0	6	1	2	2	2	0	0	0	1	1	0	0	6	2	1
cit	0	16	0	13	0	1	0	2	0	0	1	0	2	17	4	4
disturbance	1	17	6	7	1	4	1	0	0	0	1	0	3	22	4	5
evade resist arrest	1	3	1	0	2	1	0	0	0	0	0	0	1	4	0	1
misc	0	8	3	3	1	1	0	1	0	0	1	0	0	8	0	1
narcotics	0	4	1	0	0	2	0	1	0	1	0	0	0	7	1	0
robbery	0	7	4	1	2	2	0	1	0	0	2	0	0	8	4	1
stolen veh	0	3	2	1	1	1	0	0	0	0	0	0	0	6	0	0
suspicious pers veh	1	7	3	2	0	2	0	0	1	0	0	0	2	7	1	1
traffic violation	0	10	3	1	3	4	2	0	0	1	2	1	0	12	6	0
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	1	3	1	0	1	0	1	0	0	0	0	1	0	6	1	0
Total	4	104	31	37	16	23	4	7	2	3	8	7	8	131	29	20
Percentage of Total	***3.70%***	***96.30%***	***28.70%***	***34.26%***	***14.81%***	***21.30%***	***3.70%***	***6.48%***	***1.85%***	***2.78%***	***7.41%***	***6.48%***	***7.41%***	***######***	***26.85%***	***18.52%***

Reasons/Incident #	approach_cedrawn	approach_wpnholstered	fleeing	justif_offattacked	justif_struggle	justif_ofthreatened	justif_ofdefendlife	justif_suspthreatenothers	justif_susp_intoxicated	justif_wpn_visible	justif_wpn_used	officer shotfirst	altwpn	other_off_present	other_off_shoot	veh_involved
assault	5	10	8	10	10	17	18	18	10	18	8	13	20	13	1	2
barricaded susp	0	0	0	0	0	1	1	1	1	1	0	1	1	1	1	0
burglary	2	3	2	3	2	5	4	5	2	4	1	5	6	4	1	0
cit	8	5	0	2	0	11	16	8	17	16	4	13	17	16	5	0
disturbance	2	11	2	2	4	10	12	14	9	14	5	13	18	11	4	2
evade resist arrest	0	2	2	0	2	2	3	3	2	0	0	3	3	2	0	1
misc	2	5	3	3	2	7	6	7	5	6	3	5	8	6	1	0
narcotics	0	4	2	2	4	4	3	1	3	2	0	4	4	4	2	0
robbery	1	5	7	1	2	7	7	6	1	4	1	6	7	5	1	0
stolen veh	0	3	2	2	2	3	3	0	0	2	0	3	3	1	0	0
suspicious pers veh	0	6	3	1	2	6	6	3	4	4	2	5	7	5	0	1
traffic violation	1	10	9	9	9	11	7	3	3	4	1	10	11	5	3	0
warrants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
assist off	0	3	2	2	3	2	1	2	3	1	0	3	3	2	0	0
Total	21	67	42	37	42	86	87	71	60	76	25	84	108	75	19	6
Percentage of Total	***19.44%***	***62.04%***	***38.89%***	***34.26%***	***38.89%***	***79.63%***	***80.56%***	***65.74%***	***55.56%***	***70.37%***	***23.15%***	***77.78%***	***######***	***69.44%***	***17.59%***	***5.56%***

Reasons/Incident #	veh_flee	veh_weapon	veh_concealmentcover	veh_stolen	veh_wanted	veh_reaching	veh_felonystop	veh_moveaway
assault	1	0	1	0	1	2	1	0
barricaded susp	0	0	0	0	0	0	0	0
burglary	0	0	0	0	0	0	0	0
cit	0	0	0	0	0	0	0	0
disturbance	0	0	2	0	1	2	0	1
evade resist arrest	0	0	1	0	1	1	0	1
misc	0	0	0	0	0	0	0	0
narcotics	0	0	0	0	0	0	0	0
robbery	0	0	0	0	0	0	0	0
stolen veh	0	0	0	0	0	0	0	0
suspicious pers veh	0	0	1	0	0	0	0	0
traffic violation	0	0	0	0	0	0	0	0
warrants	0	0	0	0	0	0	0	0
assist off	0	0	0	0	0	0	0	0
Total	1	0	5	0	3	5	1	2
Percentage of Total	***0.93%***	***0.00%***	***4.63%***	***0.00%***	***2.78%***	***4.63%***	***0.93%***	***1.85%***

Appendix C: Officer Decile Information

seniority_dec	mean	sd	N
1	.7173913	.4552432	46
2	2	0	19
3	3	0	20
4	4.486486	.5067117	37
5	6	0	10
6	8.888889	1.120897	27
7	12.81081	1.075945	37
8	15.8125	.75	16
9	21.60714	1.892271	28
10	27.17391	1.77488	23
Total	9.711027	8.540885	263

Appendix D: Statistical Model Explanations

D1: Advantages and disadvantages of using logit and probit on binary dependent variables; Interpretation of regression results

In almost all our regressions, the dependent variables are limited dependent variables (LDVs). For example, "ois" where 1 represents officer involved in OIS and 0 represents officer not involved in OIS, is a LDV. LDV is "broadly defined as a dependent variable whose range of values is substantively restricted". Dummy variable "ois" is a LDV because it is a "binary variable that takes on only two values, zero and one" (Wooldridge, p. 583). While the team could have employed the more common linear probability model, it chose to use the logit and probit models instead. Running more sophisticated binary response models like logit or probit regressions on binary dependent variables is advantageous because they avoid problems like "the fitted probabilities [being] less than zero or greater than one", which the linear probability model faces. Recall that the dependent variable only takes on two values, i.e. zero and one, and hence its predicted value should not be out of the range of zero and one inclusive.

A downside is that the results of the logit and probit models are more difficult to interpret. While a traditional logit or probit regression yields the odds ratio for each explanatory variable, it does not directly provide results regarding the effects of each variable on the probability of dependent variable, like "ois", occurring. It is important to note that since the logit and probit models assume a non-linear distribution, the marginal effect of each explanatory variable differs for different values of explanatory variables. At extreme values, a unit change in explanatory variables has very little effect, but at average values, a unit change has a larger effect. Fortunately, Stata is able to run further analysis to show the marginal effect of each explanatory variable on the binary dependent variable. Holding other explanatory variables constant at their mean value, the effect of each explanatory variable should be interpreted as the average marginal effect, which refers to the change in response probability, or in our case the chance of an officer involved in OIS, when the explanatory variable increases marginally, holding other variables fixed at their observed values. In other words, the marginal effect coefficients should be interpreted as the marginal effects at the mean values of the independent variables, holding other variables constant. When the explanatory variable is a dummy variable, marginal increase refers to the dummy variable "turning on", i.e. changing from 0 to 1; when it is a continuous variable, marginal increase refers to the explanatory variable increasing by 1 unit.

D2: Identifying regression fit and statistical significance of coefficient results

Before identifying the statistically significant variables, one should first ensure that the overall regression has an acceptable fit, by examining the R-squared value of the overall regression. R-squared is a measure of the model's fit and refers to the amount of variation of the dependent variable explained by the regression model. Typically, one should accept the

regression results if the R-squared value is above a minimum of 0.4, which means at least 40 percent of the variation of the dependent variable is explained by the model.

More importantly, R-squared should be used to compare models, and one should choose the model with a higher R-squared value since it indicates that the model has a better fit. Statistical significance of our coefficient results was determined by looking at their p-values, which tells us the maximum significance level for which the result would still be statistically significant. For example, if the p-value is 0.05 then the coefficient is significantly different from zero for up to a significance level of 5 percent. Formally, if the value was less than 0.05, then we can say with at least 95 percent confidence that the coefficient of the explanatory variable was not zero, i.e. significantly different from zero. The 95 percent confidence interval refers to the range where one could say the coefficients true value lie with 95 percent confidence or probability.

D3: Difference between logit and probit models

While both logit and probit models are binary response models, they make different assumptions about G, the distribution function that the response probability is a function of. Specifically, $P(y=1|\mathbf{x}) = G(B_0 + B_1x_1 + \ldots + B_kx_k)$, where y is the dependent variable, e.g. "ois", and **x** represent the vectors of all the explanatory variables, i.e. $x_1 \ldots x_k$.

G is a "function taking on values strictly between zero and one" and hence "ensures that the estimated response probabilities are strictly between zero and one" (Wooldridge, p. 584). In the logit model, G is defined as the logistic function: $G(z) = \exp(z)/[1+\exp(z)]$ for all real number z. In the probit model, G is defined as the standard normal cumulative distribution function (cdf). While logit and probit regressions typically generate differing results, the differences are usually small and predictable. In fact, one can obtain probit regression results by directly scaling the values from logit regression results.

D4: Interaction terms

For example, the relationship between "approaching with gun drawn" and "ois" is likely to differ across a seniority partition, e.g. seniority of more than five years and seniority of less than five years. In particular, one would expect an officer with seniority of more than five years to be less likely to use his gun when he approaches a suspect with his gun drawn, as opposed to an officer with seniority of less than five years. This is because the officer with a higher seniority has more experience and could presumably diffuse the situation better. In this case, the interaction term is defined mathematically as seniority_5*approach_gundrawn, which only contains values of approach_gundrawn, for observations where officers have more than five years of seniority. After running the focus logit regression with interaction term included, one could extract the difference in marginal effects of approaching with gun drawn on the likelihood of "ois" for an officer with seniority of more than five years as opposed to one with

seniority of less than five years. This difference is the coefficient on the interaction term. In this case, one would expect this coefficient to be negative for the reason explained above.

D5: Outlier Analysis with logit regression

While there are various outlier diagnostic measures, one possibility is to look at extreme values, i.e. top five and bottom five predicted values. Using Stata, one could list out the cases where the predicted values of "ois" were at the extremes. Following that, the team can perform the same regressions again, but drop the outlier observations this time. While such an approach is not the most rigorous way to perform outlier analysis, it can potentially yield positive results for the team. More rigorous outlier analysis diagnostic measures like "standardized residuals" are outside the scope of this project.

Appendix E: Full Regression Tables and Results

* Note that highlighted variables are statistically significant at 10% level.

Table E1

Stata command:

logit ois off_classrank sea* weekday shift1 shift2 prevcfs assigdiv* oneoff backup male off_seniority extrajob plannedoperation incident_patrol_related trafficstop selfinitiated onview typecrime* suspdesc footpursuit vehpursuit suspwpnknown wpn* if _offduty==0

OIS on Pre-Scene	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
off_classrank	0.003	0.002	1.27	0.203	-0.001	0.007
sea_winter	0.117	0.078	1.50	0.135	-0.036	0.271
sea_spring	0.266	0.067	3.95	0.000	0.134	0.397
sea_summer	0.239	0.067	3.56	0.000	0.108	0.371
weekday	0.093	0.093	1.00	0.318	-0.090	0.275
shift1	-0.034	0.127	-0.27	0.786	-0.284	0.215
shift2	0.047	0.082	0.57	0.567	-0.113	0.207
prevcfs	0.015	0.015	0.98	0.328	-0.015	0.045
assigdiv_patrol	0.422	0.195	2.16	0.030	0.040	0.805
assigdiv_dtu	0.162	0.078	2.07	0.038	0.009	0.316
assigdiv_swattod	0.131	0.121	1.08	0.281	-0.107	0.368
assigdiv_gangcru	0.084	0.123	0.68	0.497	-0.158	0.325
oneoff	0.174	0.060	2.87	0.004	0.055	0.292
backup	0.159	0.060	2.65	0.008	0.041	0.277
male	0.114	0.200	0.57	0.568	-0.277	0.505
off_seniority	0.005	0.006	0.80	0.426	-0.007	0.017
extrajob	-0.124	0.346	-0.36	0.721	-0.803	0.555
plannedoperation	0.076	0.182	0.42	0.676	-0.280	0.432
incident_patrol_related	-0.370	0.127	-2.92	0.004	-0.618	-0.121
trafficstop	0.179	0.065	2.75	0.006	0.052	0.307
selfinitiated	0.058	0.137	0.43	0.669	-0.209	0.326
onview	-0.142	0.160	-0.88	0.377	-0.456	0.172
typecrime_assault	0.099	0.105	0.95	0.343	-0.106	0.304
typecrime_robbery	0.172	0.079	2.16	0.031	0.016	0.327
typecrime_burglary	0.080	0.114	0.70	0.484	-0.144	0.304
typecrime_disturbance	-0.010	0.159	-0.06	0.951	-0.322	0.303
typecrime_cit	-0.572	0.297	-1.93	0.054	-1.154	0.009
typecrime_trafficviolation	0.049	0.174	0.28	0.776	-0.291	0.390
typecrime_evaderesistarrest	0.061	0.163	0.37	0.711	-0.259	0.381
typecrime_narcotics	0.197	0.067	2.96	0.003	0.067	0.328
typecrime_stolenveh	0.172	0.059	2.90	0.004	0.056	0.288

typecrime_suspiciouspersveh	0.170	0.065	2.63	0.009	0.043	0.296
suspdesc	-0.148	0.106	-1.40	0.163	-0.357	0.060
footpursuit	0.150	0.066	2.27	0.023	0.020	0.279
vehpursuit	0.138	0.082	1.67	0.095	-0.024	0.299
suspwpnknown	0.127	0.125	1.01	0.311	-0.119	0.372
wpn_gun	0.171	0.098	1.75	0.081	-0.021	0.363
wpn_knife	-0.476	0.258	-1.84	0.065	-0.982	0.030

R^2 - 0.4219

Table E2

Stata Command:

logit ois sea* assigdiv* oneoff backup trafficstop selfinitiated onview typecrime* suspdesc footpursuit vehpursuit suspwpnknown wpn* crit* indoors verb_communicate verb_commandgiven numberofsusp surprised_off approach_gundrawn approach_ceddrawn fleeing veh_involved if _offduty==0

OIS on Pre/On-Scene	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
sea_winter	-0.037	0.088	-0.42	0.674	-0.2102	0.1359
sea_spring	0.128	0.055	2.31	0.021	0.0193	0.2365
sea_summer	0.120	0.055	2.17	0.030	0.0118	0.2282
assigdiv_patrol	0.003	0.104	0.03	0.977	-0.2025	0.2086
assigdiv_dtu	0.045	0.093	0.48	0.633	-0.1388	0.2284
assigdiv_swattod	0.013	0.146	0.09	0.931	-0.2746	0.2998
assigdiv_gangcru	-0.351	0.325	-1.08	0.280	-0.9880	0.2859
oneoff	0.109	0.044	2.45	0.014	0.0218	0.1962
backup	0.130	0.044	2.94	0.003	0.0432	0.2158
trafficstop	0.116	0.044	2.60	0.009	0.0284	0.2041
selfinitiated	0.093	0.061	1.52	0.129	-0.0269	0.2131
onview	-0.086	0.109	-0.78	0.433	-0.2999	0.1286
typecrime_assault	-0.165	0.175	-0.94	0.348	-0.5083	0.1791
typecrime_robbery	-0.051	0.168	-0.30	0.762	-0.3811	0.2791
typecrime_burglary	0.000	0.131	0.00	0.999	-0.2575	0.2572
typecrime_disturbance	-0.331	0.269	-1.23	0.219	-0.8588	0.1965
typecrime_cit	-0.819	0.146	-5.59	0.000	-1.1057	-0.5319
typecrime_trafficviolation	-0.533	0.365	-1.46	0.145	-1.2501	0.1838
typecrime_evaderesistarrest	-0.567	0.434	-1.30	0.192	-1.4191	0.2855
typecrime_narcotics	0.099	0.054	1.80	0.072	-0.0088	0.2066
typecrime_stolenveh	0.002	0.167	0.01	0.992	-0.3264	0.3298
typecrime_suspiciouspersveh	-0.384	0.310	-1.24	0.215	-0.9919	0.2233
suspdesc	-0.066	0.077	-0.85	0.396	-0.2185	0.0863
footpursuit	-0.006	0.126	-0.04	0.965	-0.2542	0.2430
vehpursuit	0.093	0.046	1.98	0.047	0.0010	0.1844
suspwpnknown	0.196	0.117	1.67	0.095	-0.0339	0.4254
wpn_gun	0.024	0.124	0.19	0.849	-0.2203	0.2678
wpn_knife	-0.662	0.301	-2.19	0.028	-1.2526	-0.0703
crit_footpursuit	0.125	0.041	3.00	0.003	0.0434	0.2074
crit_resistarrest	0.083	0.071	1.17	0.243	-0.0562	0.2220
crit_reachforwpn	0.099	0.055	1.79	0.073	-0.0094	0.2080
crit_usewpn	0.224	0.072	3.07	0.002	0.0808	0.3664
crit_notobey	0.054	0.056	0.95	0.341	-0.0573	0.1658

crit_aggrstance	0.351	0.134	2.61	0.009	0.0873	0.6154
crit_wpn_pointedatoff	0.122	0.064	1.90	0.057	-0.0038	0.2488
indoors	-0.279	0.180	-1.55	0.121	-0.6324	0.0735
verb_communicate	0.101	0.050	2.01	0.044	0.0025	0.1990
verb_commandgiven	-0.101	0.044	-2.24	0.025	-0.1887	-0.0126
numberofsusp	0.028	0.038	0.71	0.478	-0.0484	0.1034
surprised_off	0.043	0.054	0.80	0.423	-0.0627	0.1495
approach_gundrawn	0.370	0.097	3.80	0.000	0.1788	0.5602
approach_ceddrawn	-0.256	0.260	-0.98	0.326	-0.7667	0.2551
fleeing	-0.065	0.068	-0.94	0.347	-0.1996	0.0702
veh_involved	0.179	0.052	3.44	0.001	0.0772	0.2813

R^2 - 0.6230

Table E3

Stata Command:

logit approach_gundrawn off_classrank shift1 shift2 prevcfs assigdiv* oneoff backup off_seniority incident_patrol_related trafficstop selfinitiated onview typecrime* suspdesc footpursuit vehpursuit suspwpnknown wpn* if offduty==0

approach_gundrawn on Pre-Scene	dy/dx	Std. Err.	z	P>z	[95%	C. I.]
off_classrank	0.001	0.0026	0.28	0.781	-0.0044	0.0058
shift1	0.026	0.1293	0.20	0.839	-0.2271	0.2796
shift2	0.091	0.1037	0.88	0.380	-0.1123	0.2943
prevcfs	0.034	0.0187	1.83	0.067	-0.0024	0.0708
assigdiv_patrol	-0.071	0.1799	-0.40	0.692	-0.4239	0.2815
assigdiv_dtu	-0.133	0.2021	-0.66	0.510	-0.5291	0.2629
assigdiv_swattod	-0.169	0.2843	-0.59	0.552	-0.7262	0.3883
assigdiv_gangcru	-0.211	0.2001	-1.06	0.291	-0.6036	0.1807
oneoff	-0.154	0.1118	-1.38	0.168	-0.3732	0.0652
backup	0.030	0.1310	0.23	0.821	-0.2272	0.2864
off_seniority	0.007	0.0069	1.06	0.291	-0.0062	0.0208
incident_patrol_related	-0.364	0.1151	-3.17	0.002	-0.5900	-0.1388
trafficstop	0.297	0.2015	1.47	0.141	-0.0982	0.6915
selfinitiated	-0.065	0.1894	-0.34	0.733	-0.4360	0.3065
onview	-0.146	0.1604	-0.91	0.361	-0.4609	0.1679
typecrime_assault	0.100	0.1885	0.53	0.595	-0.2693	0.4697
typecrime_robbery	0.290	0.1656	1.75	0.079	-0.0341	0.6151
typecrime_burglary	0.339	0.1286	2.64	0.008	0.0870	0.5913
typecrime_disturbance	0.307	0.1531	2.01	0.045	0.0072	0.6073
typecrime_cit	-0.091	0.2708	-0.33	0.738	-0.6213	0.4401
typecrime_trafficviolation	-0.123	0.3242	-0.38	0.705	-0.7582	0.5127
typecrime_evaderesistarrest	-0.054	0.3384	-0.16	0.874	-0.7172	0.6094
typecrime_narcotics	0.033	0.2276	0.15	0.884	-0.4128	0.4793
Typecrime_stolenveh	0.140	0.2449	0.57	0.569	-0.3404	0.6197
Typecrime_suspiciouspersveh	0.220	0.1807	1.22	0.223	-0.1337	0.5745
suspdesc	-0.072	0.1204	-0.60	0.552	-0.3078	0.1643
footpursuit	0.065	0.2132	0.31	0.760	-0.3528	0.4830
vehpursuit	0.422	0.1094	3.86	0.000	0.2074	0.6362
suspwpnknown	0.066	0.1590	0.41	0.680	-0.2460	0.3772
wpn_gun	0.367	0.1349	2.72	0.006	0.1029	0.6318
wpn_knife	-0.181	0.2093	-0.87	0.387	-0.5913	0.2291

R^2 - 0.2624

Table E4

Stata Command:

logit approach_gundrawn off_classrank shift1 shift2 prevcfs assigdiv* oneoff backup off_seniority incident_patrol_related trafficstop selfinitiated onview typecrime* suspdesc footpursuit vehpursuit suspwpnknown init* indoors concealpossoff coverpossoff concealposssusp coverposssusp numberofsusp

approach_gundrawn on Pre/On-Scene	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
off_classrank	-0.001	0.0027	-0.19	0.848	-0.0058	0.0048
shift1	0.168	0.1227	1.37	0.170	-0.0719	0.4089
shift2	0.067	0.1109	0.60	0.546	-0.1504	0.2842
prevcfs	0.027	0.0195	1.40	0.161	-0.0108	0.0655
assigdiv_patrol	0.086	0.1850	0.47	0.640	-0.2761	0.4490
assigdiv_dtu	0.100	0.2184	0.46	0.646	-0.3277	0.5285
assigdiv_swattod	-0.089	0.3252	-0.27	0.784	-0.7264	0.5483
assigdiv_gangcru	-0.072	0.2527	-0.29	0.775	-0.5673	0.4231
oneoff	-0.123	0.1241	-0.99	0.323	-0.3658	0.1207
backup	0.232	0.1251	1.85	0.064	-0.0137	0.4768
off_seniority	0.005	0.0069	0.78	0.436	-0.0081	0.0189
incident_patrol_related	-0.396	0.1212	-3.27	0.001	-0.6339	-0.1588
trafficstop	0.467	0.0973	4.80	0.000	0.2762	0.6576
selfinitiated	-0.017	0.2041	-0.08	0.934	-0.4168	0.3831
onview	-0.143	0.1753	-0.82	0.414	-0.4866	0.2004
typecrime_assault	0.020	0.1960	0.10	0.920	-0.3643	0.4038
typecrime_robbery	0.223	0.1824	1.22	0.221	-0.1344	0.5804
typecrime_burglary	0.347	0.1283	2.71	0.007	0.0957	0.5986
typecrime_disturbance	0.329	0.1473	2.23	0.026	0.0400	0.6175
typecrime_cit	-0.266	0.2435	-1.09	0.275	-0.7431	0.2114
typecrime_trafficviolation	-0.337	0.2732	-1.23	0.217	-0.8725	0.1983
typecrime_evaderesistarrest	-0.440	0.2065	-2.13	0.033	-0.8450	-0.0355
typecrime_narcotics	0.034	0.2518	0.14	0.892	-0.4592	0.5279
typecrime_stolenveh	-0.022	0.3084	-0.07	0.944	-0.6262	0.5826
typecrime_suspiciouspersveh	0.238	0.1728	1.38	0.169	-0.1010	0.5764
suspdesc	-0.032	0.1292	-0.25	0.805	-0.2851	0.2214
footpursuit	-0.127	0.2323	-0.55	0.584	-0.5822	0.3282
vehpursuit	0.493	0.0726	6.79	0.000	0.3508	0.6355
suspwpnknown	0.248	0.1102	2.25	0.025	0.0318	0.4637
init_confrontsusp	-0.330	0.1873	-1.76	0.078	-0.6971	0.0372
init_issueticket	-0.577	0.0668	-8.63	0.000	-0.7080	-0.4460
init_interview	-0.497	0.1146	-4.34	0.000	-0.7216	-0.2723
init_searchbuliding	-0.132	0.2858	-0.46	0.644	-0.6922	0.4280
init_arrestsusp	-0.032	0.2324	-0.14	0.891	-0.4874	0.4237

init_suspinitiates	-0.492	0.1076	-4.57	0.000	-0.7029	-0.2810
indoors	-0.230	0.1264	-1.82	0.069	-0.4776	0.0179
concealpossoff	0.040	0.2566	0.16	0.876	-0.4628	0.5432
coverpossoff	0.180	0.2520	0.71	0.476	-0.3141	0.6737
concealposssusp	-0.078	0.1964	-0.40	0.691	-0.4631	0.3068
coverposssusp	0.244	0.1910	1.28	0.201	-0.1301	0.6187
numberofsusp	-0.009	0.0645	-0.14	0.886	-0.1357	0.1172

R^2 - 0.3427

Table E5

Stata Command:

logit verb_commandgiven off_classrank shift1 shift2 prevcfs assigdiv* oneoff backup off_seniority incident_patrol_related trafficstop selfinitiated onview typecrime* suspdesc footpursuit vehpursuit suspwpnknown init* indoors concealpossoff coverpossoff concealposssusp coverposssusp numberofsusp

verb_commandgiven on Pre/On-Scene	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
off_classrank	0.001	0.0010	0.80	0.424	-0.0012	0.0027
shift1	-0.015	0.0530	-0.28	0.779	-0.1187	0.0890
shift2	0.046	0.0386	1.19	0.233	-0.0296	0.1215
prevcfs	0.014	0.0082	1.76	0.079	-0.0017	0.0303
assigdiv_patrol	0.031	0.0617	0.49	0.621	-0.0904	0.1516
assigdiv_dtu	0.062	0.0326	1.91	0.056	-0.0017	0.1261
assigdiv_swattod	-0.267	0.4120	-0.65	0.517	-1.0745	0.5405
assigdiv_gangcru	0.072	0.0292	2.46	0.014	0.0147	0.1290
oneoff	-0.027	0.0533	-0.50	0.617	-0.1312	0.0778
backup	0.042	0.0399	1.05	0.293	-0.0362	0.1200
off_seniority	0.005	0.0031	1.73	0.084	-0.0007	0.0113
incident_patrol_related	0.108	0.0815	1.33	0.184	-0.0514	0.2682
trafficstop	-0.324	0.3747	-0.86	0.388	-1.0579	0.4107
selfinitiated	-0.440	0.2469	-1.78	0.074	-0.9243	0.0434
onview	-0.045	0.0884	-0.51	0.613	-0.2179	0.1286
typecrime_assault	-0.555	0.2482	-2.24	0.025	-1.0411	-0.0683
typecrime_robbery	-0.205	0.2622	-0.78	0.435	-0.7186	0.3090
typecrime_burglary	-0.323	0.2890	-1.12	0.263	-0.8898	0.2431
typecrime_disturbance	-0.172	0.2273	-0.76	0.450	-0.6173	0.2738
typecrime_trafficviolation	-0.113	0.2273	-0.50	0.620	-0.5583	0.3327
typecrime_evaderesistarrest	-0.614	0.4158	-1.48	0.140	-1.4286	0.2013
typecrime_narcotics	-0.058	0.1520	-0.38	0.701	-0.3563	0.2395
suspdesc	-0.027	0.0588	-0.45	0.651	-0.1418	0.0887
footpursuit	-0.122	0.2201	-0.55	0.579	-0.5535	0.3092
vehpursuit	-0.089	0.1562	-0.57	0.569	-0.3950	0.2171
suspwpnknown	-0.064	0.0632	-1.01	0.312	-0.1877	0.0599
init_confrontsusp	0.073	0.0636	1.14	0.254	-0.0522	0.1972
init_issueticket	-0.013	0.1147	-0.11	0.913	-0.2374	0.2122
init_interview	0.001	0.0783	0.01	0.991	-0.1526	0.1543
init_searchbuilding	0.072	0.0331	2.17	0.030	0.0070	0.1366
init_arrestsusp	0.055	0.0427	1.29	0.198	-0.0288	0.1387
init_suspinitiates	-0.084	0.1829	-0.46	0.647	-0.4421	0.2747
indoors	-0.050	0.0734	-0.68	0.498	-0.1935	0.0941
concealpossoff	-0.131	0.4854	-0.27	0.788	-1.0819	0.8207

coverpossf	-0.065	0.3775	-0.17	0.864	-0.8045	0.6752
concealposssusp	-0.203	0.1364	-1.49	0.137	-0.4705	0.0643
coverposssusp	0.149	0.0777	1.92	0.055	-0.0030	0.3015
numberofsusp	-0.008	0.0212	-0.36	0.722	-0.0490	0.0339

R^2 - 0.3788

Table E6

Stata Command:

logit ois seniority_morethan5 approach_gundrawn gundrawn_morethan5

ois on seniority/ approach interaction	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
seniority_morethan5	-0.012	0.0661	-0.19	0.852	-0.1418	0.1172
approach_gundrawn	0.307	0.0831	3.70	0.000	0.1443	0.4702
gundrawn_morethan5	0.227	0.0964	2.35	0.019	0.0380	0.4159

R^2 - 0.2136

Table E7

Stata Command:

logit ois seniority_morethan5 approach_gundrawn gundrawn_morethan5 typecrime* assigdiv*

ois on interaction while controlling for type of crime and assigned division	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
seniority_morethan5	-0.029	0.0707	-0.41	0.680	-0.1677	0.1094
approach_gundrawn	0.319	0.0944	3.39	0.001	0.1345	0.5044
gundrawn_morethan5	0.210	0.0970	2.16	0.031	0.0195	0.3998
typecrime_assault	0.058	0.0939	0.62	0.538	-0.1262	0.2419
typecrime_robbery	0.046	0.1149	0.40	0.688	-0.1790	0.2713
typecrime_burglary	0.044	0.1147	0.38	0.704	-0.1812	0.2683
typecrime_disturbance	-0.204	0.1705	-1.20	0.232	-0.5381	0.1302
typecrime_cit	-0.583	0.1849	-3.15	0.002	-0.9453	-0.2207
typecrime_trafficviolation	0.019	0.1138	0.17	0.868	-0.2041	0.2418
typecrime_evaderesistarrest	0.093	0.1130	0.83	0.409	-0.1282	0.3148
typecrime_narcotics	0.132	0.0827	1.60	0.110	-0.0300	0.2943
typecrime_stolenveh	0.104	0.1000	1.04	0.299	-0.0921	0.3000
typecrime_suspiciouspersveh	0.065	0.0999	0.65	0.513	-0.1305	0.2610
assigdiv_patrol	-0.130	0.0911	-1.43	0.153	-0.3085	0.0484
assigdiv_dtu	-0.008	0.1558	-0.05	0.957	-0.3138	0.2968
assigdiv_swattod	-0.044	0.2406	-0.18	0.856	-0.5151	0.4280
assigdiv_gangcru	-0.195	0.2022	-0.97	0.334	-0.5916	0.2011

R^2 - .3089

Table E8

Stata Command:

logit justif_offattacked conceal* cover* verb_commandgiven verb_stop verb_droptheweapon verb_getontheground verb_showyourhands verb_getoutofthevehicle verb_comeoverhere verb_calmdown

justif_offattacked on verbal commands and cover/conceal	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]
concealpossoff	-0.405	0.1668	-2.43	0.015	-0.7316	-0.0776
concealusedoff	-0.054	0.2393	-0.22	0.822	-0.5228	0.4153
coverpossoff	0.127	0.2970	0.43	0.668	-0.4548	0.7094
coverusedoff	0.323	0.2461	1.31	0.190	-0.1598	0.8049
concealposssusp	0.150	0.1868	0.80	0.422	-0.2160	0.5164
concealusedsusp	-0.185	0.1340	-1.38	0.168	-0.4476	0.0777
coverposssusp	-0.154	0.1684	-0.91	0.361	-0.4838	0.1763
coverusedsusp	0.284	0.1872	1.52	0.130	-0.0832	0.6505
verb_commandgiven	-0.236	0.1130	-2.09	0.037	-0.4578	-0.0147
verb_stop	0.056	0.0761	0.73	0.464	-0.0934	0.2048
verb_droptheweapon	-0.201	0.0753	-2.67	0.008	-0.3483	-0.0532
verb_getontheground	-0.015	0.0951	-0.16	0.871	-0.2019	0.1710
verb_showyourhands	0.015	0.0822	0.18	0.856	-0.1462	0.1761
verb_getoutofthevehicle	0.385	0.1207	3.19	0.001	0.1485	0.6217
verb_comeoverhere	0.243	0.1780	1.37	0.172	-0.1058	0.5920
verb_calmdown	0.299	0.2110	1.42	0.157	-0.1148	0.7122

R^2 - 0.1285

Table E9

Stata Command:

logit ois prevcfs meanprioritynо_prevcfs if onduty==1

ois on number of prior CFS, and mean priority no. of prior CFS	dy/dx	Std. Err.	z	P>z	[95%	C.I.]
prevcfs	0.007	0.0154	0.45	0.656	-0.0233	0.0369
meanpr~s	-0.039	0.0213	-1.82	0.069	-0.0806	0.0031

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