Police Use of TASER before Lethal Force

by

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TABLE OF CONTENTS

Page

LIST OF ABBREVIATIONS

Abbreviation	Description
GIS	**GEOGRAPHIC INFORMATION SYSTEM**
OIS	**OFFICER INVOLVED SHOOTING**
OC	**OLEORESIN CAPSICUM**

I. Introduction

Police use of lethal force in the United States of America is an issue that has been widely reported by major news outlets, from high profile cases such as Michael Brown in Ferguson, Missouri, to local outcry in smaller communities asking for change ("Documents released in the Ferguson case," 2014)("Police Shootings - The Washington Post," n.d.). These events have sparked violence, riots, protests, the formation of Black Lives Matter, and led a sitting President to weigh in on the issue ("Read President Obama's Remarks On Recent Police Shootings | Time," n.d.). The documentation and data on these instances often remain with the primary police agency involved, and although they may be shared with their respective state, rarely are they shared at the federal level. Without such a federal level reporting process, it is difficult to create a database of officer involved shootings and to analyze spatial patterns or trends at scales greater than the local police jurisdiction.

The lack of documentation of police use of force has been an issue in the United States since at least the early 1930s (Smith, Kaminski, Rojek, Alpert, & Mathis, 2007) (Alpert, 2016). The Bureau of Justice Statistics (McEwen, 1996) reports about one thousand officer involved shooting (OIS) deaths in 2015 and 2016 nationally. While many datasets show the annual number of OISs to be approximately one thousand as well, no two datasets provide the exact same numbers. There is not a central repository or single database of all OISs, which perpetuates an inaccurate representation of the use of lethal force in America. Efforts to compile and make public such a database are being developed, but they deal with the same reporting issues listed above and their level of completeness is unknown and may, therefore, limit inter-agency cooperation (Arslan &

Farkas, n.d.) A single database would improve understanding of OISs and aid in reducing unnecessary uses of lethal force (Alpert, 2016). In a time where the police/citizen relationship is somewhat weak, gathering a better understanding of the ultimate end to an OIS has the potential to strengthen society's perception of the police and reduce the instances of lethal force.

Graves (2017) emphasizes the lack of spatial analysis of OISs by stating that "[l]ess scrutinized is the spatial pattern of officer-involved shootings…", even though there are some small-scale examples of research on spatial aspects of the use of police force. Ma et al., (2019) examine neighborhood predictors of OIS in Los Angeles County, California. Leonard (2017) performed a media analysis to elucidate spatial patterns of controversial police shootings. Arslan and Farkas (Insert date) use the SHOT database and a Geographic Information System (GIS) to analyze community factors that may lead to increased police shootings. In each of these examinations of spatial patterns it is noted that the lack of a complete, current database on OISs hinders the expansion of research this topic deserves. The current literature reviewed focuses on OISs but is not specific on the means taken to prevent a fatal shooting (e.g. TASER usage). This research, therefore, examines the spatial pattern of OISs in Texas, but moves a step further by additionally analyzing TASER usage prior to police use of force. Our objective is to assess whether TASER usage matches the spatial patterns expected based on city populations and fatalities. We use a comprehensive OIS database developed by Williams (2018) that indicates what weapons, if any, were used by the suspects and if the officers involved deployed a TASER prior to the shooting. Simultaneously analyzing the spatial patterns of

OISs and TASER usage has not been done until now and sets the path for further research into this method of analyzing less-lethal force.

II. Literature Review

Use of Force Continuum

The "use of force continuum" is an escalating sequence of actions that officers take to resolve a situation(Terrill & Paoline, 2013). The mere presence of an officer to deter crime or manage a situation is the first and most non threating action the officer can take. From there the officer uses commands in a professional manner, with increasing volume and shorter commands to gain control of the situation. The first two actions are verbal, non-physical, and use very little force. If these actions are not successful, the officer moves onto physical techniques, both soft and hard. Soft techniques refer to joint manipulations and holds to restrain an individual. Hard techniques refer to punches, kicks and more physical holds to gain control. Keep in mind that each situation is unique, and the officer sometimes moves through the continuum from step to step in seconds and may skip a step if the situation calls for it. If officer presence and authoritative verbal commands are not enough, the officer is then to deploy less lethal methods (taser, asp, pepper spray) in an attempt to gain control. If the situation is escalating rather quickly, the officer might skip less-lethal methods and employ the use of deadly force to gain control of or end the situation, in rare instances, discharging the firearm in order to stop the threat. This occurs quite often, as the situation is too intense to consider another method and the officers sometime have just seconds to react and resolve a situation. The U.S. Supreme Court decision in *Tennessee v. Garner* stated that deadly force is restricted to situations in which a "citizen poses a threat of serious physical harm, either to the

officers or others."(Tennessee v. Garner, 1985) This Supreme Court case provides backing for the police and their use of deadly force, allowing for a reasonable officer to hold the discretion and allowing for the use of force continuum to, in rare cases, come full circle when the conditions call for it.

Research on Less Lethal Methods

Research and development for less-lethal alternatives and varying use of force options for police dates back to the Civil Rights Riots of the 1960s. From there the development of numerous tools occurred from oleoresin capsicum (OC) spray, batons, ballistic rounds and most recently TASERs. It wasn't until the early 2000s that TASERs started to become more prevalent. The preferred less lethal option of the 90s was OC spray and pepper spray. The prevalence of a TASER in the hands of law enforcement has increased since the early 2000s and has been adopted by an estimated 8,000 police agencies nationwide in 2005 and roughly another 8,000 agencies worldwide(MacDonald, Kaminski, Alpert, & Tennenbaum, 2001; Williams, 2013). Several studies have researched the effectiveness of OC spray and showed a high rate of incapacitation, reduced injuries of officers and less reliance on other types of force, such as deadly force(Gauvin, 1995). Additionally, Thomas, et al (Thomas, Collins, & Lovrich, 2010) found similar results from a study conducted on the use of TASERs that indicated 50% of surveyed departments reported that TASERs reduced the need to use lethal force. On the contrary, Lee, et al. (2009) surveyed 113 California agencies and observed that equipping officers with TASERs did not translate to a decrease of fatality shootings by police. In order to better understand if TASER policies per department are coupled with fatal police shootings a wide-ranging research project on TASER deployment from a sample of

officers across the nation showed that numerous agencies reported a drop in lethal forces incidents after the introduction of TASERs (Smith et al., 2008). In addition, a more thorough study was conducted focusing on mentally ill individuals, based on self-reporting of TASER use of law enforcement agencies. Results estimate that 50% of justifiable use of deadly force cases were avoided because of the deployment of a TASER (Ho, Dawes, Johnson, Lundin, & Miner, 2007). However**,** it is unknown just how many fatal shootings were prevented by a TASER being deployed and effectively stopping the threat. Based on these findings many fatality shootings by police can simply be avoided with the use of a TASER. The potential for fewer fatal shootings exists with the implementation of TASERs (Ferdik, Kaminski, Cooney, & Sevigny, 2014) Less than one percent of officers will ever kill a suspect in the line of duty (Polk, 2018), which could imply the use of TASERs are effective or the occurrence of shooting a suspect is simply rare by nature.

McBide and Tedder (McBide & Tedder, 2005) argue that the use of a TASER is an effective alternative to lethal force, avoiding unnecessary suspect death and officer injury. White & Ready (White & Ready, 2007) examined the use and effectiveness of TASERs in a large metropolitan police department over a 3-year period. Their findings indicate that TASERs were effective, with about 85% of suspects that were classified as "emotionally disturbed" being taking into custody with no further incident. In another study, officers responded to a questionnaire indicating their satisfaction with the performance of their issued TASER and approximately 78% of officers reported satisfaction (White & Ready, 2007). In 2006, Austin, Texas experienced a reduction in

injuries of officers during citizen encounters after adopting TASERs (Sousa, Ready, & Ault, 2010).

TASER Efficacy

The deployment of a TASER is designed to stop the threat and end the situation peacefully, yet TASERs fail between 15% to 30% of the time (TASER International, n.d.; White & Ready, 2007). These numbers indicate that occurrences of a TASER failing are likely, and when that does happen, deadly force is sometimes the only alternative. Reasons for use of deadly force after TASER deployment might include failure of the device, the device did not affect the suspect, or simply the two probes that carry the current did not penetrate potentially thick clothing the suspect was wearing. Regardless, the TASER was potentially not as effective as it could be and the alternative of lethal force was used.

Study Area

California and Texas have the highest rates of OISs in the nation (H. E. Williams, 2018). Under Texas law, all in-custody suspect deaths (due to lethal force or other causes) must be reported no later than 30 days following death. This reporting requirement should give Texas a comprehensive and accurate collection of OISs and make it an ideal State to study. Based on reported nationwide trends (Nolan, 2004) large Texas cities that are associated with higher crime rates and more police/citizen encounters should have higher rates of fatal police shootings and TASER usage.

The Texas cities of Houston (2.3 million), San Antonio (1.5 million), Dallas (1.3 million), Austin (950,000) and Fort Worth (875,000) constitute one-third of the largest 15

cities in the USA (U.S. Census Bureau, 2010) and while we expect to see high rates of OISs and TASER usage in these cities, we also suspect that smaller cities will experiences OISs and TASER usage.

TASERs have been the preferred less-lethal option for nearly 20 years [9] and evidence suggests they are effective tools for reducing lethal force. The effectiveness of the device is undoubtedly enhanced by the additional training received by police on techniques to deescalate a situation. Simultaneously mapping TASER deployment prior to lethal force and direct use of lethal force will show where TASER usage is most prevalent. This research aims to identify spatial patterns of OISs, and TASER use based on factors such as race, population and whether a suspect is armed or unarmed. Applying spatial analysis techniques allows for a unique view of TASER deployment across Texas.

(1) Do more officer involved shooting fatalities occur in highly populated cities?

H_0—There is no relationship between city population and the number of OIS fatalities.

H_A—There is a positive relationship between city population and the number of OIS fatalities.

(2) Does more TASER usage occur in highly populated cities?

H_0—There is no relationship between TASER use and city population.

H_A—There is a positive relationship between TASER use and city population.

(3) Is TASER use clustered?

H_0—TASER usage exhibits a spatially random pattern that shows no clustering of instances.

H_A—TASER usage exhibits spatial patterns that show clustering of instances.

(4) Are there unique patterns of TASER use by race or victim weapon?

III. Methodology

Database Construction

Construction of the database followed a multi-faceted approach to identify and confirm incidents of interest (H. E. Williams, 2018). Each approach had inherent limitations, but, by including several approaches, the effects of those limitations were minimized. The first approach involved searching commercial news media sources through two subscription databases with extensive, though not necessarily concurrent, data sources: NewsLibrary and LexisNexis. News reports of officer involved shooting deaths do not always contain standardized language to facilitate searches, so this approach required searching several different search terms and text strings.

The second approach involved searching the Internet through Bing and Google search engines using text strings to identify officer involved shootings that resulted in fatalities. This approach sought web pages referring to officer involved shooting deaths that might, or might not, have appeared in commercial news media reports. This approach included searching several specific web sites related to officer involved shootings, including the *Washington Post's* Fatal Force, the *Guardian's* The Counted, Fatal Encounters, Mapping Police Violence, Fatal Encounters, and Gun Violence Archives. Information from individually hosted, non-commercial and crowd sourced websites were included if listed incidents could be verified through other sources.

The third approach involved searching the LexisNexis and FindLaw databases for court decisions involving wrongful death claims arising from officer involved shootings. In their published opinions, judges often included a synopsis of the facts of the case before applying the law and rendering a decision. The fourth approach involved

searching the custody death databases required by law in Texas, California, Massachusetts, and Connecticut.

All cases discovered from each of the four approaches were cross-researched through the other sources to ensure proper selection for the database, and duplicate entries were deleted. Cases that did not fit the definition of arrest-related shooting death were excluded. Questionable cases were preserved for verification through other sources. Cases from apocryphal web sites that appeared to be officer involved shooting deaths were preserved pending verification through other sources. Cases from reliable sites, such as news or government web pages, that fit the definition of officer involved shooting deaths were recorded in the data base. All deaths that had involved the use of a TASER were coded as such.

Although we believe this four-fold approach produced a nearly complete listing of officer involved shooting deaths, it is possible that some cases remained undiscovered. The data used for this research ranges from January 1 of 2006 to September of 2019.

Methods

Of the ~12,000 OIS fatalities in the United States, 1182 (~10%) occurred in Texas, and 820 (~70%) of those were made by city-level peace officers. We analyzed the city-level data since it provides the most locational certainty for a spatial analysis. The remaining 362 (~25%) OIS fatalities in Texas were made at either the County, State or Federal levels, but these were not further analyzed because of their greater locational uncertainty. We simply note here that County, State and Federal level OISs do not appear significantly different that city level data and that OISs on the US-Mexico border are not more prevalent than other areas.

The 820 city-level OIS fatalities were imported to a PostgreSQL database for cleaning, aggregation and extraction of relevant data for Texas cities. Data cleaning involved removing some double entries and misspellings of city or state names. Data was aggregated by city and contained the city name, agency responsible, number of tasers deployed, total fatalities, and whether the weapon used by the suspect was a firearm, blade, impact, vehicle, replica firearm, unknown or if the suspect was unarmed. Data tables were extracted for (1) all OISs, (2) OISs where the suspect was unarmed and a TASER was not used, (3) OISs where the suspect was armed and a TASER was not used, (4) OISs where the suspect was armed and a TASER was used, (5) OISs where the suspect was white, armed and a TASER was used, (6) OISs where the suspect was not white, unarmed and a TASER was used. Once aggregated and coded to Texas cities, the dataset contained 176 cities, each with the number of OISs and the total number of times a TASER was deployed.

Location data for Texas cities was obtained from The Texas Department of Transportation (TXDOT) Open Data Portal ("TxDOT Open Data Portal," n.d.). The summaries for each city noted above were assigned an identification number that corresponded to the TXDOT city data and both datasets were joined together, including decadal population data accompanying the city dataset. Accordingly, the TASER database could be mapped, and spatial patterns analyzed. Figure 1 shows a baseline of the numbers and distribution of fatalities resulting from lethal force in each of the Texas cities in the database.

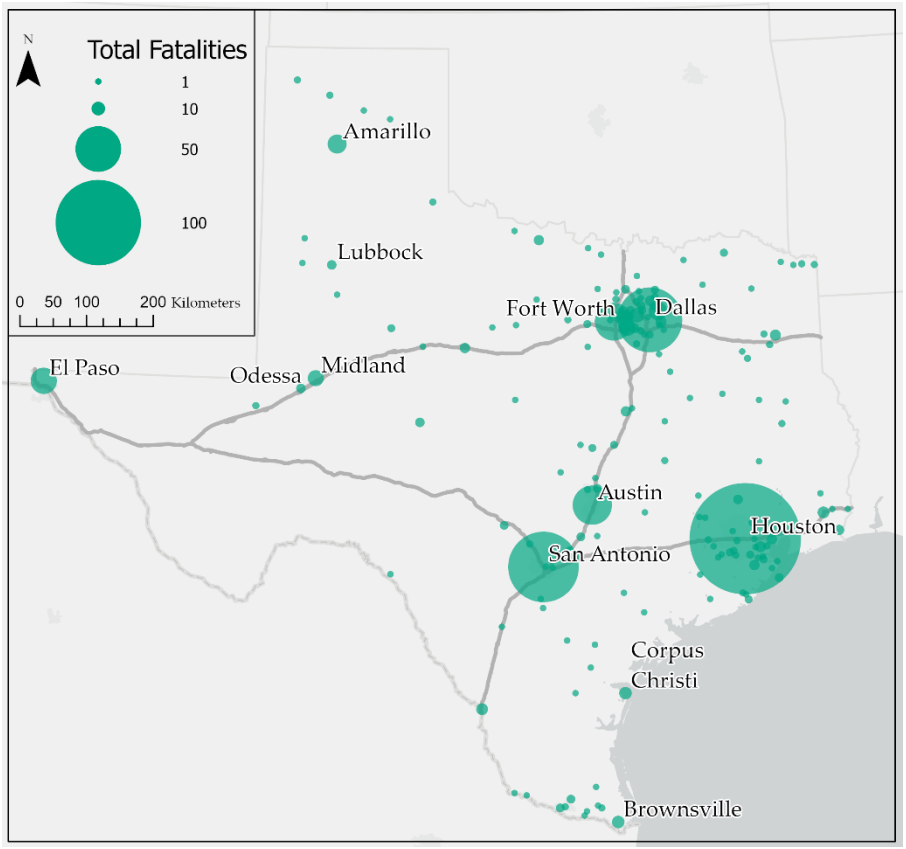

Figure 1. Spatial distribution of total fatalities per city, demonstrating the prominence of large metropolitan areas. Cities are represented as proportional symbols based on total city population.

Exploratory spatial data analysis (ESDA), Ordinary Least Squares (OLS) regression and cluster analysis were used to analyze spatial and attribute patterns and test the hypotheses outlined in the introduction. Specifically, OLS regression was used to test hypotheses 1 and 2, the Bernoulli based scan statistic algorithm was used to test hypothesis 3, and ESDA was used to test hypothesis 4. It is hypothesized that the total fatalities resulting from OISs is strongly related to the city population—that larger populations lead to greater numbers of OISs.

Regression analysis will uncover the average trend across Texas cities, but we aim to specifically examine clusters of cities based on their population, number of OIS fatalities and number of TASERS deployed. Examining which cities cluster in attribute space

allows us to find commonalities across cities with differing populations and to examine outliers to the average patterns revealed in the regression analyses. The DBSCAN algorithm identifies points found in high- and low-density neighborhoods in attribute space. High density neighborhoods of points become core cluster centers and other points are either assigned to a nearest cluster center or designated as outliers. Two parameters are essential for successful execution of the DBSCAN algorithm: the neighborhood size (designated as ε or eps) and the minimum number of samples necessary to define a core point. Proper selection of the neighborhood size parameter is essential; select too small a size and many points are labeled as outliers; select too large a size and all points form a single cluster. To select an optimum neighborhood size and minimum cluster size that reduced the number of unassigned outliers and maximized the number of output clusters, we iterated over a range of possible values (Figures 2 and 3). We selected as optimal values 6.4 and 4 for the neighborhood size and minimum cluster size, respectively. This allowed us to obtain 4 attribute clusters with only 19 outliers, which we manually assigned to existing clusters or a new cluster based on review of the data.

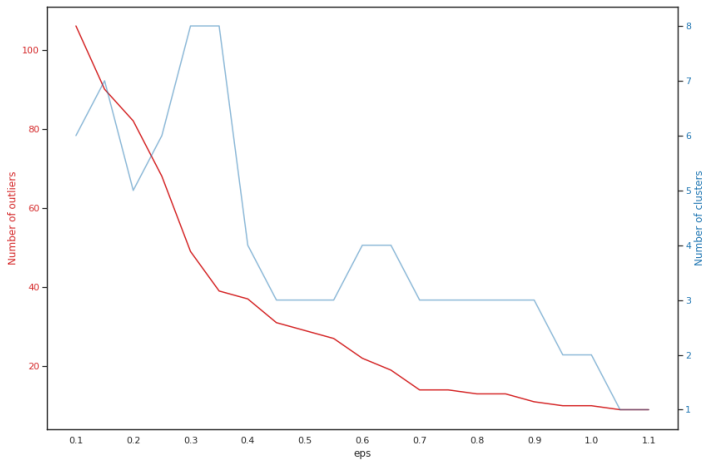

Figure 2. The number of outliers and clusters resulting from iterating over a series of neighborhood size (eps) values. The optimal neighborhood size was determined to be 6.5.

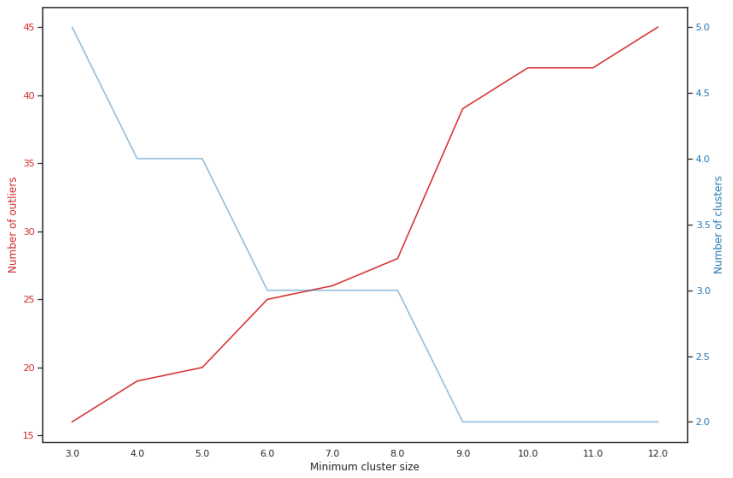

Figure 3. The number of outliers and clusters resulting from iterating over a series of minimum cluster sizes. The optimal minimum cluster size was determined to be 4.

To test this hypothesis, we use bivariate OLS regression with population as the independent variable and the total number of fatalities as the dependent variable. If we hypothesize that TASER usage matches the pattern of OIS fatalities across cities of different populations, then we expect the pattern of TASER usage to match the regression findings of OIS fatalities. Therefore, we conduct a second bivariate analysis with population as the independent variable and the total number of TASERS deployed as the dependent variable. Regression analysis will uncover the average trend across Texas cities, but we aim to specifically examine clusters of cities based on their population, number of OIS fatalities and number of TASERS deployed. Examining which cities cluster in attribute space allows us to find commonalities across cities with differing populations and to examine outliers to the average patterns revealed in the regression analyses. The Bernoulli based spatial scan statistic identifies clusters of high- and low-rate cases in attribute space. Bernoulli-based scan statistics are best used with dichotomous variables when looking at cases and non-cases. High rate neighborhoods of

points become core clusters of either high number of cases or low number of cases based on the expected number of occurrences given in the Bernoulli output statistics.

IV. Results and Discussion

Regression results show a strong significant relationship between city population and OIS fatalities, with an adjusted R^2 of 0.967 (p-value < 0.000) (Figure 4). The y-intercept was not significantly different than 0, but the slope was significant with a p-value less than 0.000. As expected, cities with higher populations have more OIS fatalities and the null hypothesis for research question #1 is rejected. The five cities with the largest numbers of OIS fatalities are Houston (132), San Antonio (81), Dallas (74), Austin (42) and Fort Worth (40) (Table 1). Together they account for ~42% of all OIS fatalities in Texas for the period examined. East Texas has many smaller cities that have fewer OIS fatalities (Houston being the exception). West Texas is more sparsely populated and has fewer OIS fatalities. The relationship between TASER usage and city population is also significant (adj. R^2: 0.805; p-value: 0.000), rejecting the null hypothesis of research question #2. While this may seem to indicate that TASER usage prior to OIS fatality occurs uniformly across cities of different populations, further analysis reveals that this is not fully true. Population does not explain as much of the variation in TASER usage as it does for total fatalities (Figure 3), suggesting that other factors lead to the patterns of TASER use exhibited. Importantly, most cites (varying in size from only a few citizens to approximately 750 thousand citizens) have only deployed a TASER once. While we reject the null hypothesis for research question #2, further investigation is necessary to determine how and where the pattern of TASER usage varies from that of total fatalities.

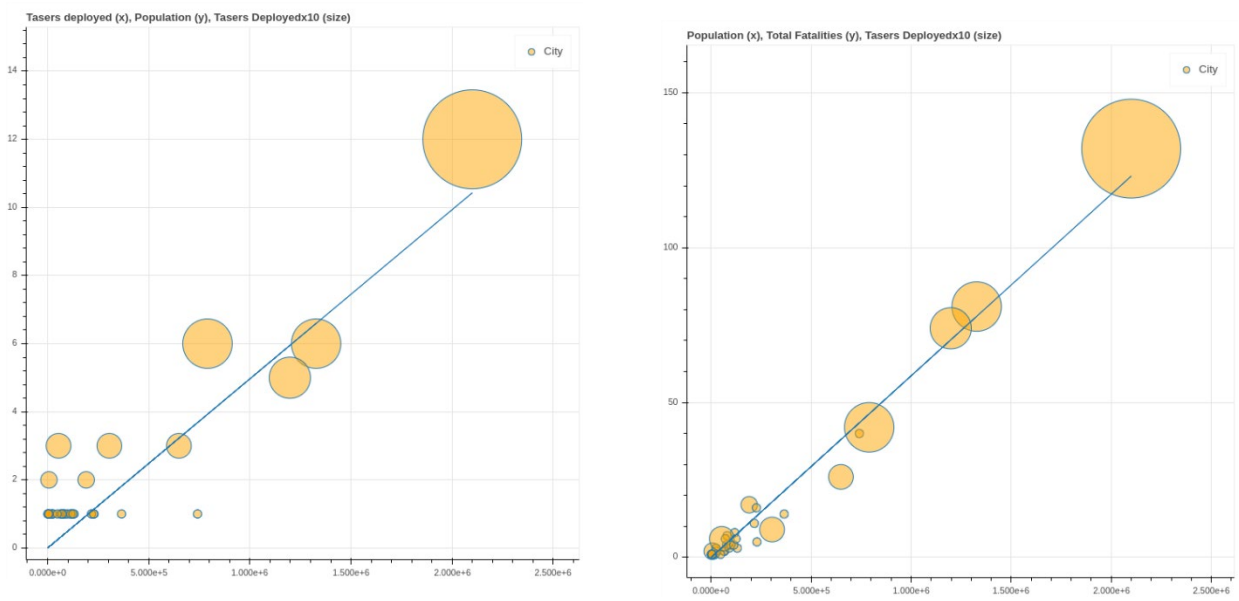

Figure 4. Relationships between population and total fatalities by OIS (left) and between population and TASER deployed (right) for all years and cities in Texas.

Table 1. Total Fatalities.

Police Department[1]	Total Fatalities
Houston	132
San Antonio	81
Dallas	74
Austin	42
Fort Worth	40
El Paso	26
Amarillo	17
Garland	16
Arlington	14
Midland	13
Irving	11

[1]All other Texas cities have fewer than 10 fatal officer involved shootings.

Mapping taser usage (the percentage of times TASERs are deployed prior to an OIS fatality) shows that the cities with the largest populations use TASERs at a smaller rate than many smaller cities (Figure 5). The proportional symbols of Houston, San Antonio, Dallas, Austin and Fort Worth shrink in size compared to their size in the total fatalities map (Figure 1). Many smaller East Texas towns have a 50% or 100% rate of TASER

deployment while larger cities like Houston deployed a TASER 12 times, or 9.1% of the time. San Antonio and Dallas show similar results with TASER usages at 7.4% and 6.8%, respectively. It is interesting to note that the cities with higher TASER usage are generally on or east of Interstate Highway 35 which runs from the US-Mexico border through Dallas and Fort Worth.

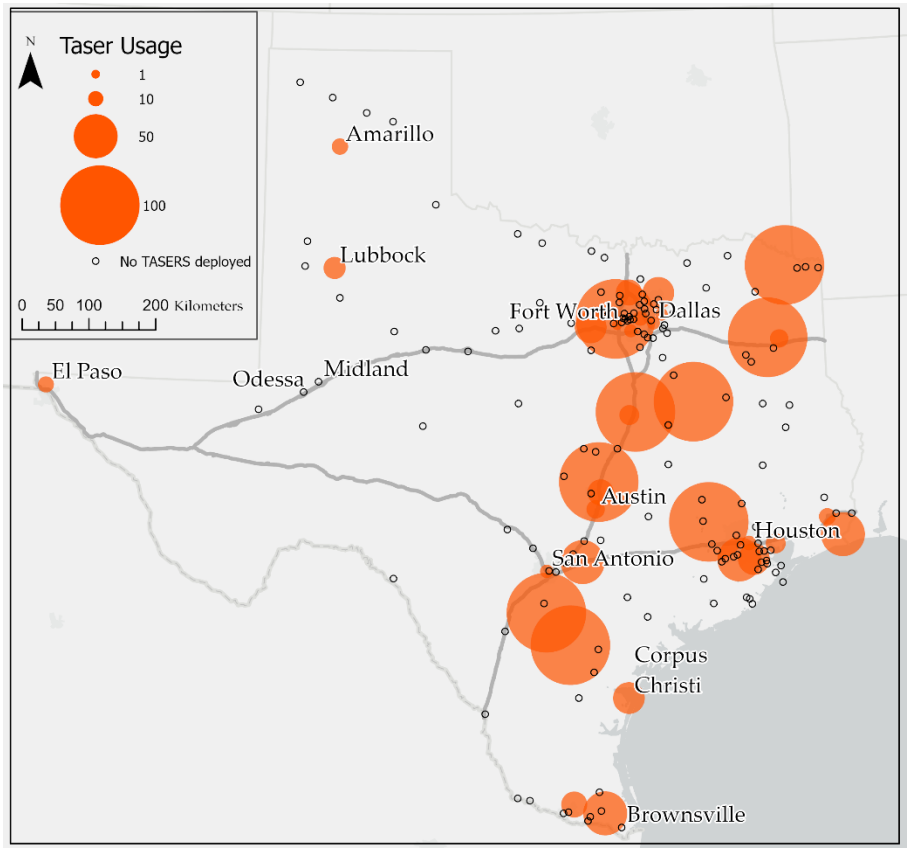

Figure 5. The percentage of TASER deployments per fatal police shootings. Cities are represented as proportional symbols based on the percentage of total OISs preceded by use of a TASER. Empty circles had one fatality but no TASER usage.

When we normalize TASER usage by population (Figure 6) we see a stark difference from total fatalities (Figure 1) and add further visual evidence to the trend that was becoming apparent in the taser usage map (Figure 5)—that the large cities deploy TASERs at lower rates than small cities. Some small cities have deployed TASERS at surprisingly

high rates. It is true that those cities have fewer fatalities, but they have used TASERS prior to 50-100% of those fatalities. An alternative perspective is that the probability of being shot is less in large cities: a 1 in 18,000 chance in Austin and a 1 in 15,900 chance in Houston, even if they use TASERS less frequently.

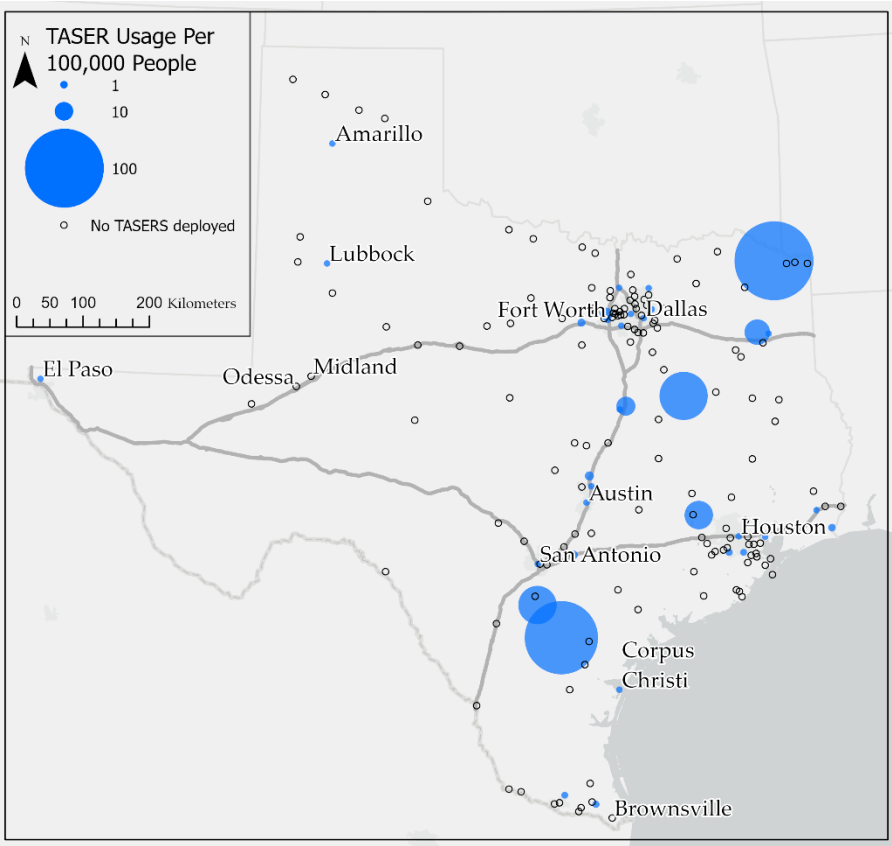

Figure 6. The percentage of TASER deployments per number of fatal police shootings normalized by population. Cities are represented as proportional symbols based on TASER usage per 100,000 people. Empty circles had one fatality but no TASER usage.

Using SatScan, a Bernoulli based scan statistic was ran to examine high and low rates of OIS and Taser usage per population. The Bernoulli model looks at cases and no cases using 0/1 variables and is best suited for clustering of extremely rare events (Kaminski, Jefferis, & Chanhatasilpa, 2000). For instance, TASER (1), no TASER (0) in terms of this research. The outputs from the Bernoulli model provide rates of the cases being examined based on an expected rate of case and an actual observed rate of cases. For this research,

four separate statistical scans were ran using the Bernoulli model: a high and a low rate for OISs, and a high and low rate for TASER usage. Figure (7) shows high and low rates of TASER usage.

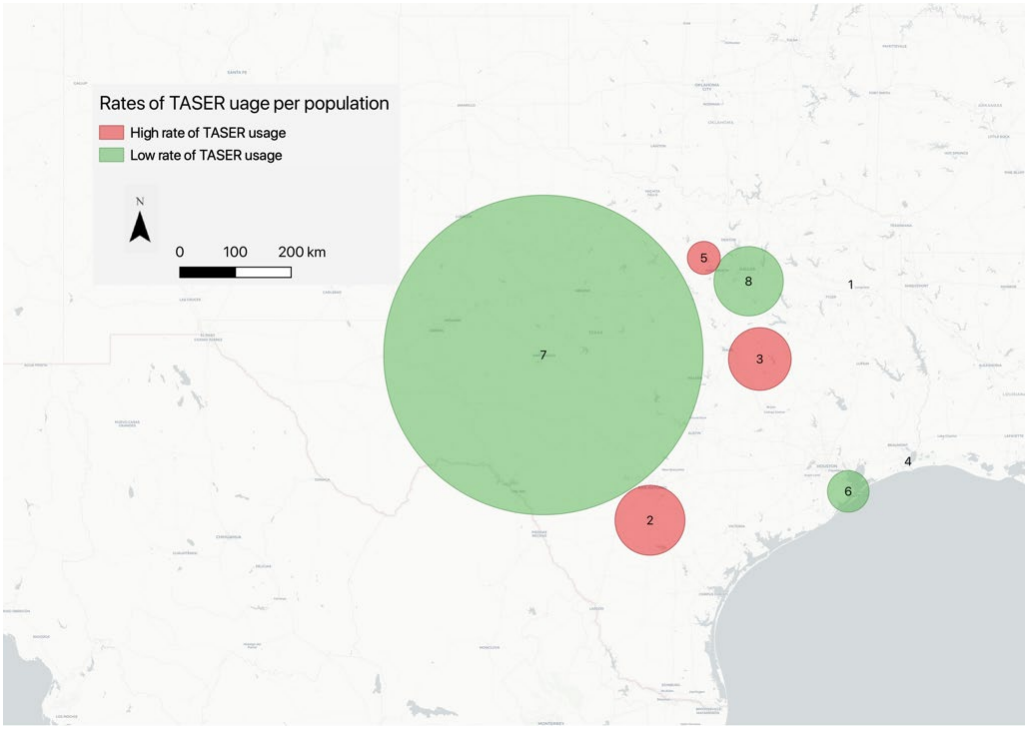

Figure 7. Rates of TASER usage based on Bernoulli Scan Statistic

Other interesting patterns arise by examining subsets extracted from the original data table. The small number of cities in these extracted subsets is too small to map or spatially analyze, but they tell an interesting story, nonetheless. The extracted subsets are shown in the following tables (Tables 2-4) and discussed in the following paragraphs.

Table 2 shows the number of fatalities of armed suspects that were not preceded by use of a TASER ("No TASER Deployed"), and the total number of fatalities of all suspects, whether armed, unarmed or of unknown armament ("Total Fatalities"). For example, of the 132 total fatalities in Houston, a TASER was not deployed on 87 armed suspects (~66% of the total). The rates of TASER deployment on armed suspects shown in Table 2 range from ~42% in El Paso to 70% in Fort Worth. This table demonstrates that most fatal shootings

in Texas are on armed suspects, which may present police with justification to deploy lethal force and forgo less lethal force. Unsurprisingly the 5 largest Texas cities are included on this list.

Table 2. No TASER deployed on armed[1] suspects

Police Department[2]	Armed Suspects	Total Fatalities
Houston	88	132
San Antonio	42	81
Dallas	41	74
Fort Worth	28	40
Austin	25	42
El Paso	11	26
Amarillo	10	17
Garland	10	16
Arlington	8	14
Midland	7	13
All other cities	197	365

[1] Armed suspects include those armed with a firearm, blade, impact device, vehicle or replica firearm. [2] There are a total of 120 cities that had 1 or more fatalities of an armed suspect on whom a TASER was not deployed, but only the top 10 are shown.

Table 3 indicates that when a suspect is armed with a weapon (whether white or not), it is unlikely that the police will deploy a TASER prior to using lethal force. For example, in only one of 132 OISs in Houston did police deploy a TASER on an armed suspect. That suspect was not white and most suspects in this table were not white. In fact, Austin had the only case of TASER deployment on a white suspect prior to the use of lethal force. This suggests that in the rare case when a TASER is used on an armed suspect, it is most often used on a non-white suspect. Austin and San Antonio were the only cities that had more than one case of TASER deployment on an armed suspect prior to the use of lethal force. The 10 cities listed in Table 3 are the only ones that deployed a TASER prior to the fatality of an armed suspect.

Table 3. TASERs deployed on armed individuals.

Police Department	All races	Non-white	Total Fatalities
Dekalb	1	1	1
Georgetown	1	1	1
Missouri City	1	1	2
McKinney	1	1	3
Lubbock	1	1	5
Port Arthur	1	1	6
Amarillo	1	1	17
Houston	1	1	132
Austin	2	1	42
San Antonio	2	2	81

The patterns in Tables 2 and 3 are two parts of the same scenario. When presented with an armed subject, police understandably escalate to lethal force on the use-of-force continuum. We see many examples of this situation in Table 2. Conversely, we see few examples of less-lethal methods deployed on armed suspects in Table 3. The Table 3 data suggest police make difficult decisions to deescalate dangerous situations even when that means assuming greater risk for themselves when they are presented with an armed suspect. Interestingly, when a less-lethal method was deployed on an armed suspect, the suspect was almost always not white.

Table 4 represents fatalities of unarmed suspects where police used lethal force immediately instead of first using a TASER. This occurred approximately 23% of the time in Dallas (17 of 74 fatalities), ~11% of the time in Houston and ~14% of the time in San Antonio. Interestingly, 76% (13 of 17) of unarmed suspects in Dallas were not white, indicating that lethal force was used on unarmed, non-white suspects with greater

frequency than white suspects. One hundred percent of the unarmed suspects on whom a less-lethal method was not deployed were not white in Conroe and Grapevine. The lowest percentage of non-white suspects in this table is 50%, indicating that frequently a less-lethal method is not deployed for non-white, unarmed suspects.

Table 4. No TASER deployed on unarmed individuals.

Police Department[1]	All Races	Non-white[2]	Total Fatalities
Dallas	17	13	74
Houston	14	9	132
San Antonio	11	10	81
Austin	4	4	42
Mesquite	4	2	7
Grapevine	2	2	3
El Paso	2	1	26
Conroe	2	2	5
Arlington	2	1	14

[1] These are the 9 cities with the greatest number of fatalities without TASER deployment prior to the use of lethal force. Twenty-five additional cities had 1 fatality without prior TASER deployment on an unarmed suspect, including the cities of Beaumont (8 total fatalities), Brownsville (9), Carrolton (4), Farmer's Branch (3), Fort Worth (40), Humble (2), Midland (13), Mineral Wells (2), Paris (3), Plano (6), Poteet (1), San Angelo (5), Texarkana (2) and Wichita Falls (6).

[2] Police departments with only 1 no-TASER fatality of non-white, unarmed suspects include Arlington (14 total fatalities), Beaumont (8), Brownsville (9), Carrollton (4), El Paso (26), Farmers Branch (3), Fort Worth (40), Humble (2), Midland (13), Mineral Wells (2), Paris (3), Plano (6), Poteet (1), San Angelo (5), Texarkana (2), Wichita Falls (6).

The race of the suspect shows to have little to no impact on the decision of officers to use a TASER or not. In fact, table 4 indicates fewer instances of not deploying a TASER on suspects classified as non-white. Dallas, Houston and San Antonio all have more fatal shootings where a TASER was not deployed on a white suspect than on a non-white. This indicates based on the data that racial bias or discrimination is not very prevalent when making the decision to forgo a TASER as a means of less lethal force and implement lethal force.

V. Conclusion

The objective of this paper was to assess whether TASER usage matched the spatial patterns expected based on city population size and total fatalities in Texas cities. The database we used for this analysis came from a collection of nationwide officer involved shootings (OIS) and included the suspect's race and armament, the city where the OIS occurred and whether police deployed a TASER prior to use of lethal force. Our analysis consisted of OLS regressions, exploratory spatial data analysis and mapping, Bernoulli based scan statistic and examinations of suspect race.

Deployment of a TASER prior to lethal force, as outlined in the use-of-force continuum, is rare in Texas. Of the 820 OISs by local police departments, a TASER was deployed only 68 times (~8%). Austin, Dallas, Houston and San Antonio account for 29 (~42%) of those cases, just under half of TASER deployments in all of Texas.

City population size explained ~97% of the variance in OISs ($R^2 = 0.967$), and it was expected that TASER usage would match the same pattern. Large cities deploy a larger number of TASERs than small cities, but the pattern did not match that of population and OISs. Only ~81% of the variance in TASER usage was explained by population. Rates of TASER deployment per fatality and per 100,000 population were all higher for small cities than for large cities. Moreover, TASER usage per 100,000 people was largest in small towns east of Interstate Highway 35, especially cities with few fatalities and a population less than 10,000.

Interesting patterns arose when examining suspect armament and race. In situations where the suspect was armed police do not often use a TASER—an expected scenario. In

every case but one, the armed suspects on whom a TASER was deployed were not white. Paradoxically, when police shot an unarmed suspect without first deploying a TASER, ~76% were not white. Further research into these interesting patterns should be done.

More work needs to be done on TASER use so that TASERs can be used most effectively and the police/citizen relationship may be strengthened by creating a broader understanding of the police and how they should operate. A better understanding of the ultimate end to an OIS has the potential to strengthen society's perception of the police and reduce the instances of lethal force.

Our research only examined OISs at the city level, but the database also records OISs at the county, state and federal levels. The many small towns of sparsely populated west Texas are policed by the county Sheriff's office and the State police. Federal and State police work throughout the State but concentrate on the US-Mexico border. We suspect that a county level analysis might shift the pattern of OISs and TASER usage to the west and a federal level analysis might shift the patterns of OISs and TASER usage to the south. Exploration of these patterns is a topic for future analysis.

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