Equality of Injury: Likelihood Models for Inequitable Injuries by the Dallas Police Department

In 2020 there have been numerous events that have taken place, but two of the biggest that come to mind are the COVID-19 pandemic and the death of George Floyd. Following his death in late May of 2020 there were widespread protests throughout the major cities of America calling for police reform to address issues of systemic racism in policing. These calls are nothing new however, because policing has been under scrutiny for inequality between whites and minorities since its inception. Inevitably, academics turned their attention to the subject and began producing studies on race's role in American policing. The focus of many of these studies is the extent to which the force used by police officers, most commonly lethal force, against individuals differs by race throughout cities, states and the entire country. Notable among these were studies was one by Gerald Robin in 1963 into the killings of black men by police officers in Philadelphia from 1950 to 1960. He determined that while blacks made up 22% of the population, they accounted for 30.6% of arrests and 87.5% of the lethal shootings by police in that time period (Robin 1963). Since that time there have been numerous studies into this area, not just to detect if there are inequalities, but to further determine if these inequalities are attributable to race or if they are due to socioeconomic or crime factors. The first among these seems to be an analysis by David Jacobs and David Britt who attempted to determine if race remained a significant factor in the use of lethal force by police when controlling for state-wide characteristics such as economic inequality and prevalence of violent crime. According to their regression the differences in the killings by police officers can best be explained by the presence of economic inequality and violence (both were significant) rather than the percent of the population that was black (Jacobs and Britt 1979). While these early attempts at understanding the issues of racism in policing show interest in the issue, more contemporaneous studies have

employed greater degrees of control variables and more specific data to determine if these findings hold up at a localized level across time.

There are still differences that exist between the experiences of black individuals and white individuals interactions with police. An important study by Frank Edwards et al from 2019 showcased that racial differences in police killings still exist. By using a database compiled by journalists this analysis determined that while white men had a 36 in 100,000 chance of being killed by a police officer over their lifetime black men had a 1 in 1,000 chance (Edwards et al 2019). An important distinction to make is that this study did not attempt to explain causality, rather it just showcased the differences between these two groups. From this incident and other media exposure, the institution of policing apparently has a poor track record when it comes to race, but it is important to look into the issue further before passing judgement. Using these studies and statistics as context we decided on our research question: to explore the uses of force by the Dallas Police Department from 2017-2019 to determine which individual characteristics, if any, of the officer and citizen have a significant impact on the likelihood of the citizen being injured. To determine this our study uses the findings and methods of recent studies to construct a model for determining if racial bias exists in the use of force interactions between police officers and suspects.

To further develop our question and methodology we referenced four previous studies into the area. First among these was a study into the likelihood that an officer discharges their weapon at a suspect by creating a model controlling for the census block characteristics around the shooting location. Importantly, the authors included racial makeup of the census block, socioeconomic status of the census block, and the prevalence of violent crime in the area. Initially it was found that racial composition and socioeconomic conditions had a significant

impact, but once violent crime was included racial and socioeconomic composition became insignificant (Klinger at al 2016). This would suggest that race and socioeconomic factors are correlated with the causal factors, but they are not the primary motivators for the use of lethal force. However, an important distinction between this study and others was the usage of spatial econometrics for this study, whereas most of the other literature used individual interactions with police officers. Following this study, we also considered an analysis of use of force interactions between officers and citizens for eight mid to large size cities. This study by Eugene Paoline et al in 2018 specifically dealt with instances when police officers used force against suspects, to determine if there were differences between black and white officers or black and white citizens. Interestingly, they found white officers were more likely to use greater force against black citizens than black officers even when controlling for levels of suspect resistance (Paoline et al 2018). However, to make it more interesting black and white suspects did not show significant differences in their levels of resistance offered to officers of any race (Paoline et al 2018). These findings seemingly suggest that white officers may resort to force more often than black officers because of individual racial bias. Using this as a backdrop we wanted to consider if citizens were more likely to be non-lethally injured by police, because it is a topic less often researched. Further, non-lethal encounters with police make up an overwhelming majority of use of force interactions between police and citizens which means there might be greater likelihood of racial bias creeping into the routine decisions of officers.

The second to last study we considered for our literature review investigated the propensity of police officers to turn to TASERS when dealing with suspects. While the first regression of the study did not find evidence of racial bias in how police officers use TASERS over an entire encounter, the second regression found that white officers were twice as likely to

use a TASER against Hispanic suspects as a first measure of force when compared to white suspects (Gau et al 2010). This is a massively important finding, because it would suggest treatment throughout encounters may be similar, but white officers potentially let racial biases creep in when initially dealing with suspects. This finding was corroborated by another study that examined use of force incidents from a medium to large police department on the west coast. The purpose of this study was to determine if the level of force used by officers over time was different for suspects according to race. This analysis determined that while the use of force evens out over longer encounters, black and Hispanic citizens were subject to higher initial levels of force by police officers than white citizens (Kahn et al 2017). This finding corroborates the earlier conclusion that officers are more likely to let racial bias creep into their interactions with citizens at the start of an encounter.

After examining the relevant literature, we clarified our question based on what the previous work did, and what gaps existed in this work. Specifically, we attempted to examine injuries due to use of force because we wanted to see if the outcomes of police use of force would be different for suspects of different races. The idea for this stems from the fact that black and Hispanic suspects were found to be subject to higher levels of initial force than white suspects. If they were subject to higher levels of initial force, then we wanted to determine if that would lead to a greater likelihood of injuries for these individuals.

According to the previous literature the results seem to be mixed. We would expect to find significant differences in the treatment of minorities by police, but the level may be different for the period analyzed in this study. While the closet study also analyzed the Dallas Police Department, they did so from 2014-2015 when Dallas was in the midst of widespread police reform from the police chief David Brown. Brown implemented a variety of changes during his

time at police chief (2010-2016) but following his resignation many of his changes regarding encouraging the use of de-escalation tactics by police were rolled back (Kalthoff 2018). Another important distinction was the previous study only tried to predict what level of force would be used, but since this is not as likely to impact the citizen as being injured we decided to model the likelihood of being injured. While the previous study did control for the mental state of the suspect, it neglected to include a variable for if the suspect was armed, and whether the suspect was actively aggressive. These factors do not seem to have been included in the dataset used by the previous study, but since the adoption of the Open Data Initiative by the DPD in 2016 the quality of the data seems to have increased. With everything taken into consideration, it would be expected that the race of the suspect would have a significant role in the likelihood that the suspect was injured, but the race of the officer would not be significant. To determine the effects of each of the control and independent variables on the likelihood of a suspect being injured we created 3 models: a linear probability model, a logistic regression, and a probit regression. For each of these we analyzed the percent correctly predicted, the r-squared values, and the adherence to similar models to determine which model was the best choice.

Econometric Models and Estimation Methods

The population model for our regression is that of a relatively socioeconomically and racially diverse mid-to-large size city in the United States. The attempt to understand potential racial biases in the use of force decisions of police officers for Dallas could be applied to most other mid-to-large size cities across the US. The goal of this regression would be to apply these findings to the policing practices of other midsized cities to hopefully alleviate any potential racial biases detected by the regression. To test for these biases, we used the following

independent and control variables to estimate the likelihood of a citizen being injured by a police officer in a use of force encounter.

Aggressive	Count
TRUE	2297
FALSE	5911

Armed	Count
TRUE	569
FALSE	7639

Arrested	Count
TRUE	7343
FALSE	865

Citizen Impaired	Count
TRUE	4013
FALSE	4195

Officer Hospitalized	Count
TRUE	137
FALSE	8071

Race Match	Count
TRUE	2221
FALSE	5987

Officer Gender	
Female	903
Male	7307

Citizen Gender	
Female	1391
Male	6817
Unknown	2

Officer Race	
American Ind	39
Asian	306
Black	1035
Hispanic	2030
Other	63
White	4737
Grand Total	**8210**

Citizen Race	
American Ind	21
Asian	45
Black	4479
Hispanic	1787
Other	46
White	1832
Grand Total	**8210**

After determining what our independent variables would be, we then turned to what variables we should control for. First among those was if a citizen was armed at the time of the incident, which was included in the model as a binary, armed. This was a relevant variable included in most of the literature because it would clearly impact an officer's decision to use greater degrees of force. The next control variable was a binary variable for if the citizen was being aggressive to the officer or other citizens at the time of the incident. This was also related

to the two of the remaining binary control variables included, which were the mental state of the citizen and whether they were arrested. We determined that the aggressiveness and the potential inebriation, measured by mental state, would likely play into an officer's decision to use force. The arrested control variable was included because if the citizen was arrested it is likely that the officer resorted to using more force for a potential takedown, or similar method of arrest. Last among the control variables were a binary for if the officer was hospitalized after the incident, the officer's gender, the citizens gender, and the years of experience an officer had. Each of these control variables were included in all the relevant literature, so it seemed reasonable to include them in our regression.

Data

The data used for the project comes directly from the Dallas Police Department. In 2016 the department adopted the transparency practices mentioned earlier and made all the data public. Our dataset was created by merging the excel files for 3 years, 2017 to 2019, and cleaning the data of variables irrelevant to the current analysis. This data is available for free via the Dallas Open Data portal. Taking a deeper look at the data one will notice that a majority of the variables, less the hire date and incident date, are qualitative data regarding the use of force incident. One important calculated value for this analysis was the experience value (date of the incident minus the date of hire) which had a mean of 7.24 years and a standard deviation of 6.59 years. Outside of that, the rest of the data had ordinal or nominal values that the researchers coded into factors or binaries. Also included in the data were locational factors, but due to the current scope of the project they were neglected. Most importantly among the variables was the dependent variable on whether the citizen was injured or not. Due to the nature of the data,

which contained only less than lethal usage of force, the researchers used a binary for whether the citizen was injured in any way by the police officer(s).

Result

	LPM	PROBIT	LOGIT
(INTERCEPT)	-0.02	-1.72 ***	-2.92 ***
	(0.03)	(0.09)	(0.17)
OFFSEXB	0.01	0.01	0.02
	(0.02)	(0.05)	(0.08)
ORACE1.FAMERICAN IND	0.15 *	0.43 *	0.72 *
	(0.07)	(0.21)	(0.34)
ORACE1.FASIAN	0.04 .	0.13 .	0.23 .
	(0.03)	(0.08)	(0.13)
ORACE1.FBLACK	0.01	0.02	0.03
	(0.02)	(0.05)	(0.08)
ORACE1.FHISPANIC	0.01	0.04	0.06
	(0.01)	(0.04)	(0.06)
ORACE1.FOTHER	0.04	0.14	0.23
	(0.05)	(0.17)	(0.29)
EXPY	0.00 **	0.01 **	0.01 **
	(0.00)	(0.00)	(0.00)
CITSEXB	0.10 ***	0.34 ***	0.58 ***
	(0.01)	(0.04)	(0.08)
CRACE1.FAMERICAN IND	-0.20 *	-0.81 *	-1.42 .
	(0.09)	(0.39)	(0.75)
CRACE1.FASIAN	0.09	0.27	0.46
	(0.07)	(0.20)	(0.33)
CRACE1.FBLACK	-0.03 *	-0.10 *	-0.16 *
	(0.01)	(0.04)	(0.07)
CRACE1.FHISPANIC	-0.02	-0.06	-0.10
	(0.01)	(0.05)	(0.08)
CRACE1.FOTHER	0.03	0.07	0.13
	(0.06)	(0.20)	(0.33)
RACEMATCH	0.04 **	0.12 **	0.20 **
	(0.01)	(0.04)	(0.07)
AGGRESSIVE	0.11 ***	0.33 ***	0.54 ***
	(0.01)	(0.03)	(0.06)
ARMED	-0.09 ***	-0.40 ***	-0.71 ***
	(0.02)	(0.07)	(0.14)
C.STATE	0.04 ***	0.13 ***	0.21 ***
	(0.01)	(0.03)	(0.05)
O.HOSPITAL	0.25 ***	0.66 ***	1.07 ***
	(0.04)	(0.11)	(0.18)
C.ARREST	0.16 ***	0.66 ***	1.16 ***
	(0.02)	(0.06)	(0.12)

PERCENT CORRECTLY PREDICTED	73.75%	73.76%	73.73%
R^2	0.06		
ADJ. R^2	0.05		
NUM. OBS.	8210	8210	8210
AIC		9079.03	9082.75
BIC		9219.29	9223.01
LOG LIKELIHOOD		-4519.51	-4521.37
DEVIANCE		9039.03	9042.75

When we look at our estimated coefficients, we can see that the control variables armed, aggressive, mental state, officer hospitalized, citizen arrested, citizen gender and officer years of experience were significant at the 5% level. We see that officer gender is not significant at any reasonable level of confidence. This could be due to having a dataset with mostly male officers or that gender does not influence citizen injury. Moving on to our independent variables we can see that officer race is not significantly different than zero in this model at a 5% level of significance. When we look at citizen race, we see that the black and American Indian race variables are significant across all models at the 5% level, all other citizen race variable are not significant at any reasonable level. We can also see that if the officer and citizen were the same race they had a positive effect on the models with a level of significance of at least 5%. Importantly, the r-squared is very low at 0.06, but since the literature had an average LPM r-squared between 0.05 and 0.15 it seems consistent with the extant models.

When analyzing the models there are differing coefficients that did not agree with the prior literature. We first see that experience leads to a negligible increase in likelihood for citizen injury but remains significant. The armed binary also shows that if a citizen is armed, they will have a decreased chance for being injured. However, since this dataset is all incidents that non-lethal force was used our inference is that if a citizen was armed that officers would be more likely to use lethal force and skip nonlethal, that information was not available in our dataset. It

could be the source of bias in the armed variable. The variable race match also is conflicting with the literature findings that if the officer and citizen are the same race, they are less likely to use force. The assumption is we are missing a variable that would help clarify the effect more so than the individual.

Overall, the different models and methods used for testing provided similar results. There were no major changes in significance between the LPM, probit, and logit models which was a good sign. Additionally, the signs are all the same for each of the models which suggests that we have established a relatively consistent model for the dataset.

Conclusion

From the results of the regressions we can determine that both a citizen being black and the citizen and officer being the same race have significant non-zero effects on the likelihood of a citizen being injured in a use of force encounter. The regression indicated a slightly lower likelihood of black individuals being injured by police and a slightly greater likelihood of a citizen being injured by a police officer if they are of the same race. This may seem contrary to the literature however, the effects we saw in the regression seemed to support the work by Klinger et al. This study ascribed most of the differences in the likelihood of being shot at by police to the violent crime in the neighborhood, which relegated the effect of race to be insignificant. Additionally, these findings seem consistent with the works of Kimberly Kahn and Jacinta Gau which found levels of force were greater for black and Hispanic suspects at the start of the encounter but were consistent over the length of the encounter. This could mean that most injuries in non-lethal encounters happen towards the end of the interaction, which would support these findings. However, to determine this further research is required on when an individual is

most likely to be injured by an officer during a use of force encounter. Another surprising finding would the increase in the likelihood of injury if the officer and citizen were of the same race. All the literature that examined this before determined that such an effect should be negative, because white officers seem to be more willing to use greater degrees of force more quickly on subjects of different races. The best explanation for the phenomena in this scenario might be that the aggregation of officers of difference races undermined the effect of white officers. This is a topic that warrants further study by future papers. With all these findings considered, this paper sheds some light onto the practices of the DPD to show there is little, if any, evidence of racial bias in the likelihood of injury of a suspect.

However, there exist certain important limitations to this analysis. First among these factors was the exclusion of locational factors for the analysis of use of force data. The previously mentioned study by Klinger et al found the violent crime frequency in the community surrounding the incident was significant and controlled for a serious part of the racial factors in that analysis. However, due to the skills of the researchers spatial analysis was not a reasonable possibility for the current project. Future studies could find great merit in replicating the current study but including control variables for violent crime in the area surrounding the incident. An additional limitation to mention is the low r-squared value of the current study's models which was 0.06. This is less concerning once one considers the studies by Gau et al and Paoline et al which examined individual characteristics as predictors of use of police force. Each of these analyses had similar control variables and race variables while attempting to predict use of force or TASERS respectively by police. Each of these widely cited studies had r-squared values below .15 for their models, which makes the current analysis' values seem to be less of an issue. As a side note, a limitation to all these papers is a low r-squared value. While each of them

attempts to examine what individual characteristics play a part in the use of force, because the r-squared is so low it could mean that these models are not the best measures for predicting use of force. Instead, it may be worthwhile to investigate other personal factors, or even departmental factors that influence an officer's use of force. Lastly, with growing calls for institutional changes in policing there is a possibility that many of the causes of apparent racism in policing in the United States are due to the current institutions of policing. If this were the case, then the low r-squared values for these models would make sense because it would mean most of the variation in treatment would be due to the departmental differences across cities. This would be a difficult area to quantify or measure, but it is another avenue for research to understand the causes for the apparent differences in treatment of minorities by police officers.

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