

Logistic Regression Analysis of Racial Bias in the NYPD Stop-and-frisk Policy

Abstract

In this study, we investigated the possibility of racial biases in the New York Police Department's highly controversial "stop-and-frisk" policy. We constructed a logistic regression model predicting the probability of being frisked given the suspect is stopped, using physical appearance, Black population in the precinct, and reasons for frisk. Subsequently, we conducted a drop-in-deviance test to determine whether race and appropriate interactions with race significantly improves the model. We found that after taking into account all other variables, race does not significantly influence the probability of being frisked, indicating less apparent bias as compared to stops.

Background and Significance

The New York Police Department's (NYPD) "stop-and-frisk" policy allows police officers to stop, question and frisk individuals for weapons or illegal items; this policy has been under harsh criticism for racial profiling. Indeed, the NYPD stopped a disproportionate number of Blacks and Hispanics in 2012, as compared to Whites. Especially, while Blacks make approximately 25% of the population in New York City (NYC), 53% of all suspects stopped in 2012 were Blacks (Matthews, 2013). In 2013, a U.S. judge ruled that this policy violates the constitutional rights of minority citizens (The New York Times, 2013).

Some view that different characteristics of precincts, such as crime rate, are to be accounted for the racial disparity in stops. Police departments have claimed that crimes are concentrated in areas populated by minorities, and that aggressive investigation in these areas are necessary (MacDonald, 2001).

We were interested in whether racial biases prevail under the current "stop-and-frisk" policy in 2014, after the policy was condemned for racial discrimination. The present study examined whether race (Black and White) influences the chance of being frisked in NYC in 2014 after taking other physical characteristics of the suspect, population of Blacks in the suspect's precinct (Black Pop), and suspected crime types into account. We conducted a drop-in-deviance test to determine whether race and its appropriate interaction terms significantly improve the logistic regression model to predict the probability of being frisked.

Data Acquisition

For this study, we used the 2014 Stop, Question and Frisk dataset retrieved from The City of New York Police Department. Our explanatory variables were items representative of a person's general physical appearance: Sex, Age, Height, Weight and Race. For this analysis, we only focused on Blacks and Whites and excluded subjects from other ethnic groups. The resulting sample size was 22,053, consisted of 17,862 Black and 4191 White suspects. In addition, in order to account for potential confounding variables, we also included the proportion of Blacks in the subject's precinct (Black Pop) and reasons for frisk. The proportions of Blacks were taken from the 2010 census data. Our response variable was whether or not the subject was frisked.

Methods

We constructed a logistic regression model predicting the likelihood of being frisked with 12 explanatory variables of key physical characteristics, reasons for frisk and Black Pop without adding Race and its interaction terms. We restricted our analysis to the probability of being frisked after a suspect has been stopped. The variable descriptions, models and appropriate summary statistics are provided in the Appendix. We performed a drop-in-deviance test to determine whether Race and its interaction terms with Sex, Age and the proportion of Blacks in the subject's precinct are important in predicting the likelihood of a subject being frisked after being stopped.

Key Results

In the drop-in-deviance test, we chose to focus on 4 terms: Race, Race: Sex, Race: Age, and Race: Black Pop. The deviances for the reduced and the full model were 409.45 and 400.46, respectively. A drop-in-deviance tests gave a G-statistic of 8.99, degrees of freedom of 4 and corresponding p -value of 0.061. This marginally significant p -value shows that after taking physical appearance, reasons for frisk and Black Pop into account, we do not have enough evidence to conclude that at least one of the four terms associated with Race improves the predictive power of the model.

To better visualize the relationships between race and other variables, we created logistic regression plots predicting the probability of being frisked from either Black Pop or Age.¹

Interestingly, given that the suspects are stopped, as the precinct proportion of Blacks increases, both Black and White suspects are more likely to be frisked. While this trend is more profound for Black than White suspects, the difference was not statistically significant (Figure 1).

Additionally, young Black suspects are much more likely than their White counterparts to be frisked, given that they are stopped. This difference diminishes as suspect age increases; again, this was not statistically significant (Figure 2).

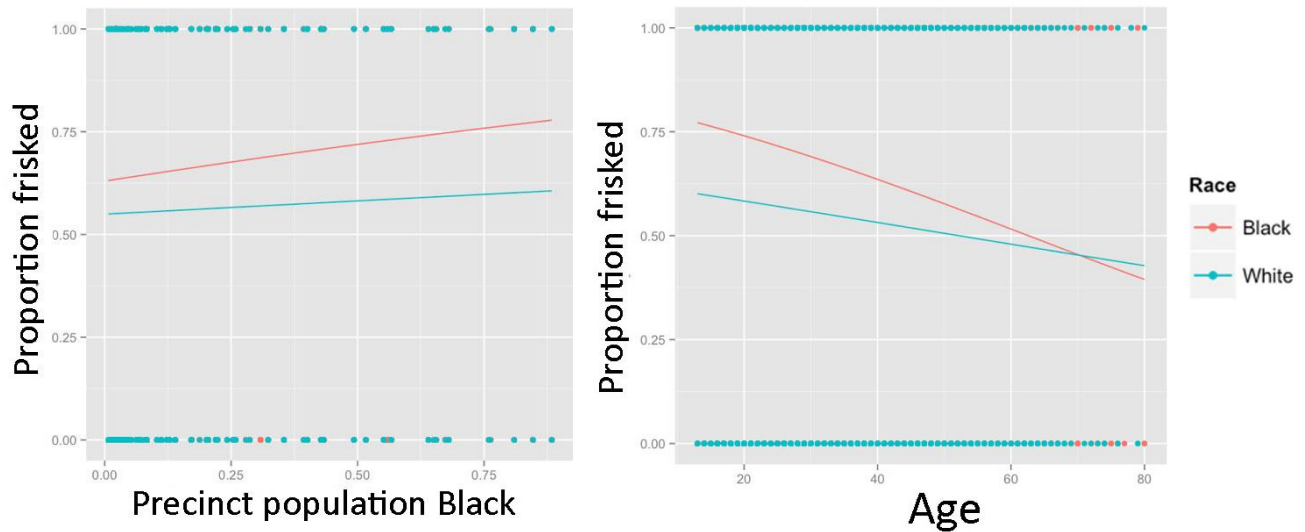


Figure 1. Logistic regression plot predicting probability of being frisked from precinct population Black, compared across race

Figure 2. Logistic regression plot predicting probability of being frisked from age, compared across race

Finally, we looked at bar charts comparing proportion of suspects frisked across sex and race. Finally, male suspects are much more likely to be frisked than females, given they are stopped (Figure 3). However, the bar charts support our model by indicating that the effect of race on the probability of being frisked does not depend on sex.

¹ Figure 1 and 2 are not full models; they are models predicting the probability of being frisked from only precinct population Black or age.

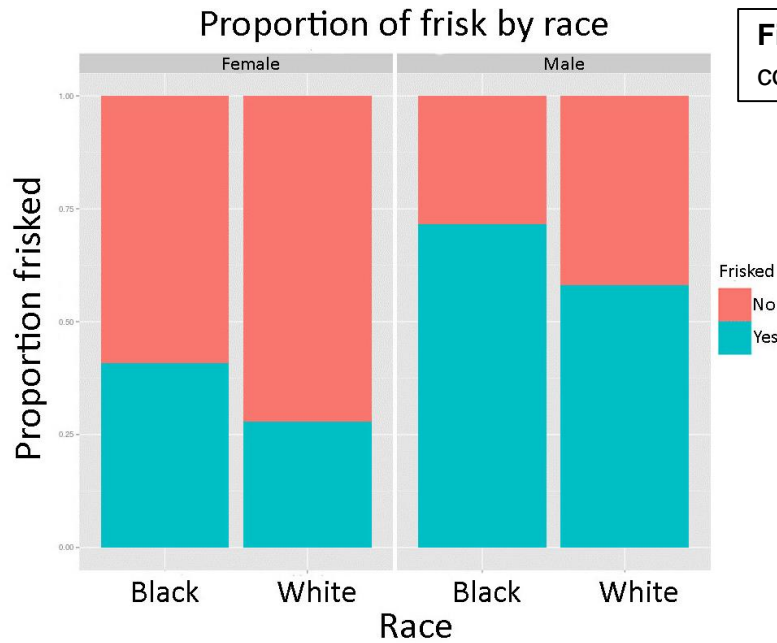


Figure 3. Proportion frisked by race, compared across sex

Discussion

Our graphics examining the relationships between race and precinct population Black, age, and sex indicated some patterns of racial biases in predominantly Black neighborhoods, and against young Black subjects. However, our results suggest that given that the suspect is stopped, after taking key physical appearance characteristics, Black Pop and reasons for frisk into account, race does not significantly influence the chance of being frisked in NYC in 2014.

Previous research has found much more significant disparities in the percentage stopped of the population. For example, Gelman, Fagan, and Kiss (2007) reported that even after controlling for precinct variability, Blacks and Hispanics were stopped more frequently than Whites. In our study, we focused on percentage of frisked of those stopped, to determine whether racial bias holds post-stop. Although Gelman et al, (2007) revealed great disparities in the percentage stopped based on race, we see that if we only look at individuals who are stopped, the disparities are not nearly as extreme. This is supported by Ridgeway (2007), who analyzed stops and frisks in 2006, and found that post-stop outcomes were similar across race.

However, we must be cautious of these interpretations, because all the measures are self-reported by police officers (New York Civil Liberties Union). Thus, the data provided by the NYPD may lack reliability. According to Goodman and Baker (2015), the NYPD has been underreporting stops by not documenting all the stops, which undermines the validity of the data we used in the current study. Nevertheless, there is a possibility that the NYPD “stop-and-frisk” practices are prone to racism, posing threat to minority citizens in NYC. It is crucial that the NYPD continue to evaluate its “stop-and-frisk” policy and make appropriate changes to the policy and/or police officer trainings in order to prevent racial profiling at any level of investigation.

References

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Appendix

Data Cleaning

From the original Stop, Question and Frisk dataset retrieved from New York Police Department, we took the subset of suspects that are either Black or White. Suspects who were younger than 4 years old and older than 95 years old were excluded from the dataset. Additionally, we removed suspects whose weight were more than 550 pounds and shorter than 50 inches. Finally, we merged the dataset with the columns of the proportion of Blacks in the population in the subject's precinct. The final dataset had 22,053 observations compared to 45,788 in the original dataset.

Table 1. List of explanatory variables, their description and levels

Explanatory variable	Description	Levels (if categorical or binary)
Sex	Subject's sex	Female = 1, Male = 0
Age	Subject's age	quantitative
Height	Subject's height	quantitative
Weight	Subject's weight	quantitative
Race	Subject's race	White = 1, Black = 0
Build	Subject's build	H = Heavy, M = Medium, T = Thin, U = Muscular
Percentage Black	Percentage of Blacks in the subject's precinct	quantitative
Reason for Frisk	Reason why the subject was frisked	violent crime suspected, other suspicion of weapons, inappropriate attire, actions of engaging in a violent crime, refuse to comply with officer's directions, knowledge of suspect's prior crim behavior, furtive movements, suspicious bulge

Table 2. Logistic Regression Model (Reduced Model)

	Coefficients	SE	Z	p-value
(Intercept)	-1.503e+01	4.142e+00	-3.629	0.000285
Height	1.353e-01	5.851e-02	2.313	0.020720
Sex	2.270e-01	6.547e-01	0.347	0.728760
Age	-2.460e-02	1.624e-02	-1.515	0.129743
Black proportion in precinct	1.878e-02	8.466e-03	2.219	0.026517
RF violent crime suspected	2.953e+01	2.094e+03	0.014	0.988745
RF other suspicion of weapons	2.992e+01	3.351e+03	0.009	0.992876
RF inappropriate attire	2.896e+01	3.150e+03	0.009	0.992665
RF actions of engaging in a violent crime	2.832e+01	2.812e+03	0.012	0.991962
RF refuse to comply with officer's directions	2.853e+01	2.340e+03	0.014	0.990271
RF knowledge of suspect's prior crim behav	2.848e+01	3.768e+03	0.008	0.993969
RF furtive movements	2.926e+01	1.612e+03	0.018	0.985521
RF suspicious bulge	2.911e+01	3.253e+03	0.009	0.992861

Table 3. Logistic Regression Model (Full Model)

	Coefficients	SE	Z	p-value
(Intercept)	-1.426e+01	4.115	-3.466	0.000529
Height	1.320e-01	5.798e-02	2.277	0.022761
Sex	3.099e-01	6.550e-01	0.473	0.636072
Age	-2.446e-02	1.642e-02	-1.490	0.136316
Black proportion in precinct	1.173e-02	9.479e-03	1.238	0.215780
RF violent crime suspected	4.011e+01	2.909e+03	0.014	0.988745
RF other suspicion of weapons	4.118e+01	4.479e+03	0.009	0.992666
RF inappropriate attire	4.123e+01	4.196e+03	0.010	0.992160
RF actions of engaging in a violent crime	4.123e+01	4.196e+03	0.011	0.991306
RF refuse to comply with officer's directions	4.131e+01	3.199e+03	0.013	0.989697
RF knowledge of suspect's prior crim behav	4.017e+01	4.750e+03	0.008	0.993252
RF furtive movements	4.153e+01	2.364e+03	0.018	0.985982
RF suspicious bulge	4.006e+01	4.215e+03	0.010	0.992416
Race	-2.211e+00	2.880	-0.768	0.442496
Race *Age	4.473e-02	7.623e-02	0.587	0.557341
Race*BlackPop	-5.503e-02	7.432e-02	-0.740	0.459025
Race*Sex	-1.283e+01	1.283e+01	-0.011	0.991006