

Demographic Factors Impacting Formal Booking and Strip Search

Based on PSDP

By

Group 62

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Introduction

The dataset "Arrests and Strip Searches" published from Public Safety Data Portal on November 10, 2022, contains 65,276 records with 24 attributes. This dataset contains data regarding all arrests and strip searches, as well as indicators indicating whether a person was booked at a police station within 24 hours of the arrest event.

The dignity and rights of the individual being arrested need to be respected and the strip search needs to be conducted in the least intrusive manner possible. From a police perspective, whether belonging to different groups affects the likelihood that an arrestee will be booked or strip searched.

By examining the data related to demographic factors of individuals being arrested, this research seeks to provide valuable insights for police officers to precisely conduct strip searches and formal bookings, by determine the influence of demographic factors on booked or strip search, including Perceived Race, Sex and Age group(at arrest), in consideration of promoting fair and unbiased law enforcement practices and fostering greater public accountability.

In this research, three methods of Power Analysis, One-way ANCOVA and Logistics Regression will be used to analyze the impact of different Sex, different Perceived Race or different Age groups on being Booked or StripSearch.

By applying these different methods of analysis, we aim to gain a comprehensive understanding of how Sex, Perceived Race, and Age group affect the likelihood of being Booked or StripSearch. This report seeks to shed light on potential bias and discrimination in law enforcement practice and to provide evidence for the need for public accountability.

Literature Review

The article "Strip-Searching of Women in Canada: Wrongs and Rights"(Michelle P. & Elizabeth S., 2016) examines the legal and ethical issues surrounding the strip-searching of women in Canada. They believe that strip searches are a serious violation of women's rights, especially when they are performed without proper reason or in an insulting, humiliating manner. In the case of R.v. Golden in 2001(R. V. Golden), the Supreme Court of Canada ruled that justice strip searches should not be carried out as a routine policy. The court also stipulates the legal standards that must be met for a legal strip search, along with 11 safeguards that police must adhere to when carrying out such searches. Although the law provides protection for women's rights, there are cases of non-compliance in implementation. Psychological damage can occur during the strip search. The authors suggest that, for women who have experienced sexual violence or abuse, strip searches may cause trauma and even exacerbate existing psychological problems. This article advocates that, under clear and reasonable circumstances, strip searches should be carried out in a respectful manner, and minimized the harm to the search as much as possible. At the same time, it is necessary to strengthen supervision and accountability during the body search process to ensure respect for women's deprivation rights.

The jurisprudence of strip searches(McNeilly, G., 2019) shows that when the police have no evidence that the person suspected of crime is a threat to themselves, others or the facility, or there is no reason to believe that the person suspected of crime has concealed items on the body, the court usually justice that the strip search is unreasonable. For some specific situations, such as people who have hidden drugs in their bodies or have a history of violent behavior, the court justifies that the strip search is reasonable.

Exploratory Data Analysis

1. Dataset

This research is based on a dataset of

“Arrests_and_Strip_Searches_(RBDC-ARR-TBL-001).csv” which contains data collected from the Public Safety Data Portal of Toronto Police Service. This dataset has sufficient information related to all arrests and strip searches, including 65,276 records with 24 variables. The dataset is available through Toronto Police Service official website with the following link:

<https://data.torontopolice.on.ca/datasets/TorontoPS::arrests-and-strip-searches-rbdc-arr-tbl-001/explore>. In this research we choose 5 variables for analysis, a detailed description of each variable is shown in the Table 1 below.

Table 1.

Data Description

Variables	Unique	Type
Perceived_Race	8	Text
Sex	3	Text
Age_group__at_arrest__	9	Text
StripSearch	2	Number
Booked	2	Number

2. Measurement

2.1 Independent Variables

In this research, “Perceived_Race, Sex, Age_group__at_arrest_” were chosen to analyze the effect on the person who was booked and was strip searched respectively. Which are all categorical variables, with eight, three and nine different categories(Appendix Table A).

2.2 Dependent Variables

According to the research question, the dependent variables were chosen as “Booked” and “StripSearch”(Appendix Table B), which indicate whether a person was booked at police

station within 24 hours and a person was strip searched. Determining the influence of variables on these indicators is the main focus of this research.

3. Data analysis

For this research, the data analysis was divided into three parts. In the first part, in order to reduce the impact of unknown factors on the data, we cleared all the null values and the information of people whose Sex is shown as unknown, 65,239 records was left and the description is shown in the Table 2 below.

Table 2. Descriptive Statistics

	Perceived_Race	Sex	Age_group__at_arrest_	StripSearch	Booked
Valid	65239	65239	65239	65239	65239
Missing	0	0	0	0	0
Mean				0.120	0.528
Std. Deviation				0.324	0.499
Minimum				0.000	0.000
Maximum				1.000	1.000

Note. Not all values are available for *Nominal Text* variables

The second part is plots analysis, the histogram of Booked and StripSearch(Figure 1), shows that people who have been booked are slightly more than those who are not and the count, the number of people being strip searched is much smaller than those not been strip searched . In addition, the count plots between each independent variable and dependent variable(Figure 2-7) are shown below, which compares the quantitative relationship of the situation that has been booked or strip searched between different perceived races, genders, and age groups.

Figure 1. Histogram of Booked and StripSearch

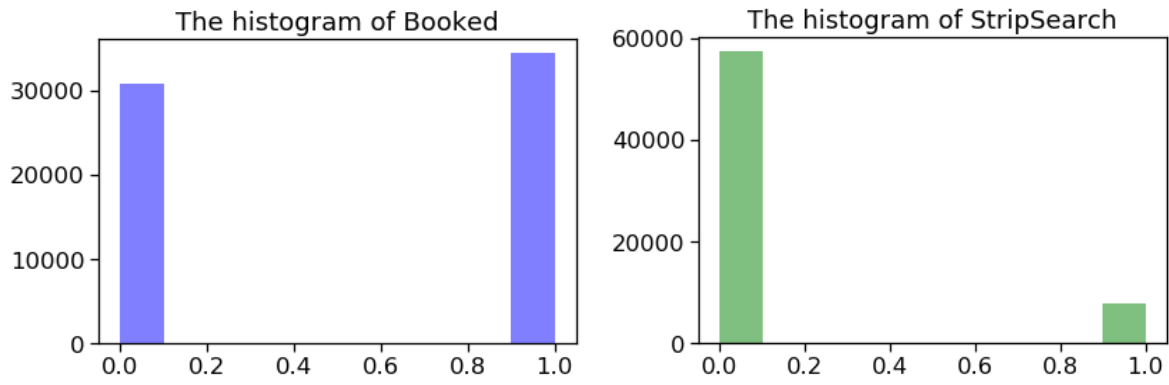


Figure 2. Countplot of Booked vs. Perceived_Race

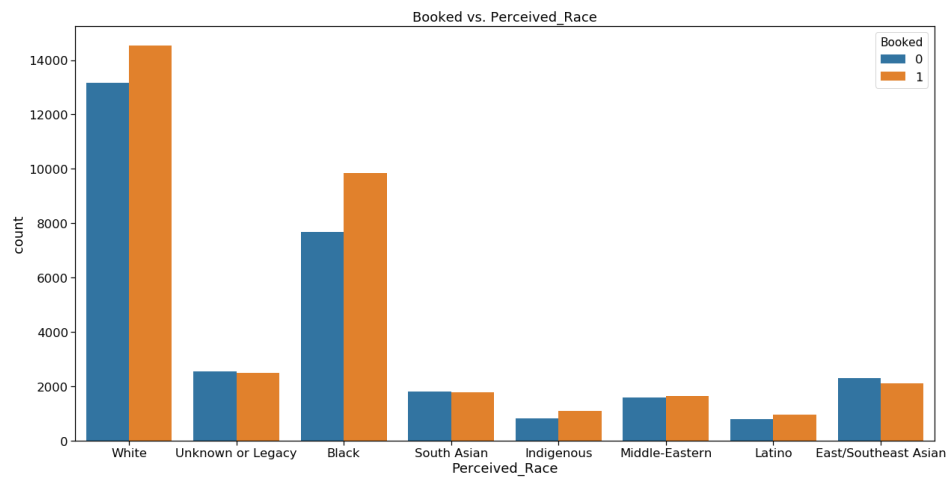


Figure 3. Countplot of Booked vs. Sex

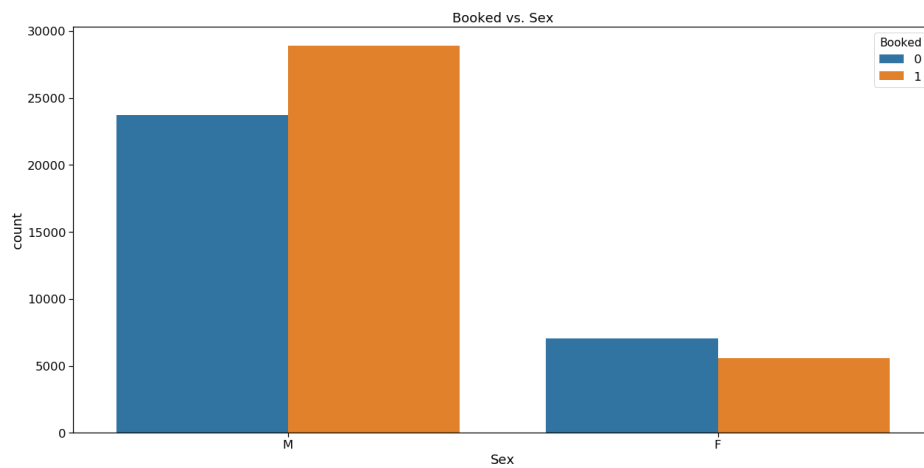


Figure 4. Countplot of Booked vs. Age_group_at_arrest_

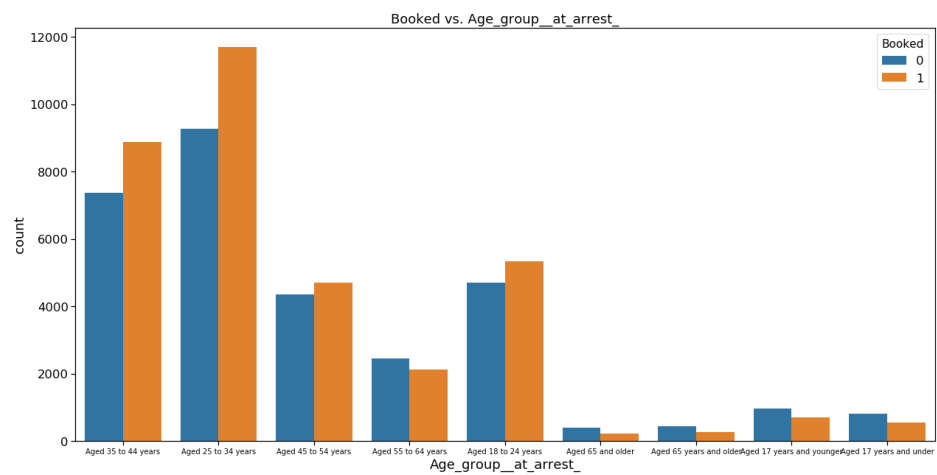


Figure 5. Countplot of StripSearch vs. Perceived_Race

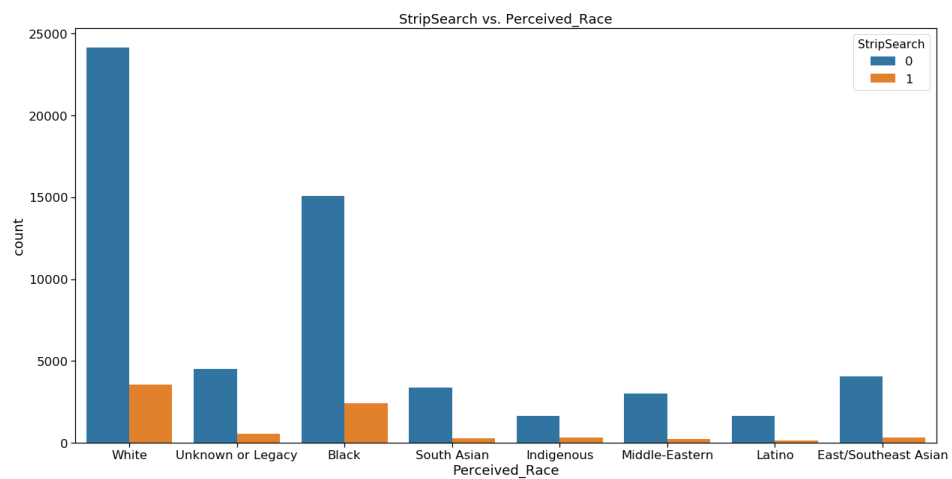


Figure 6. Countplot of StripSearch vs. Sex

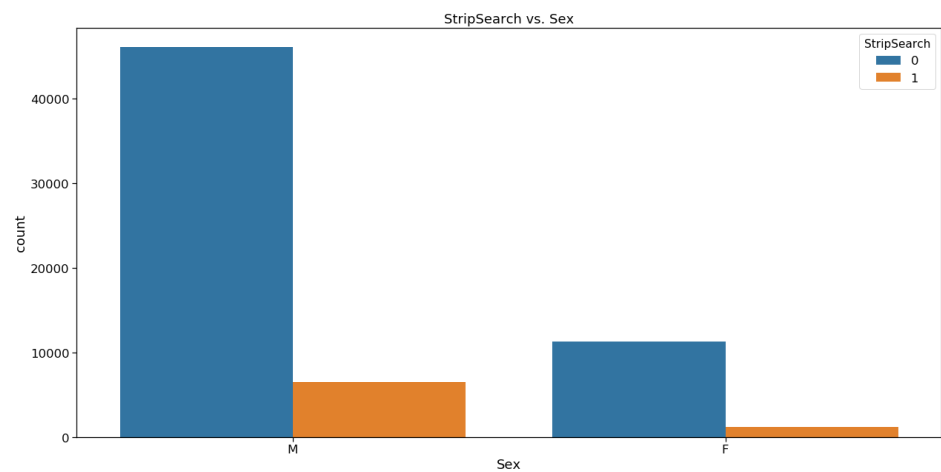
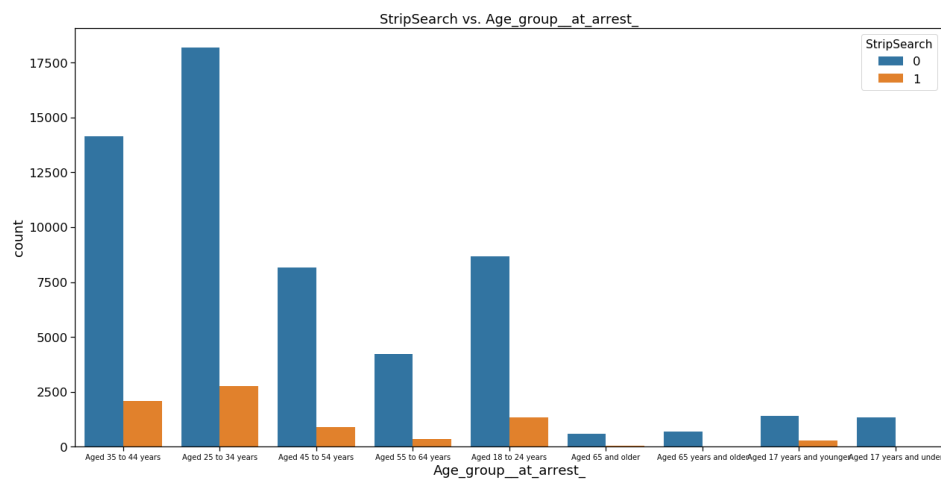
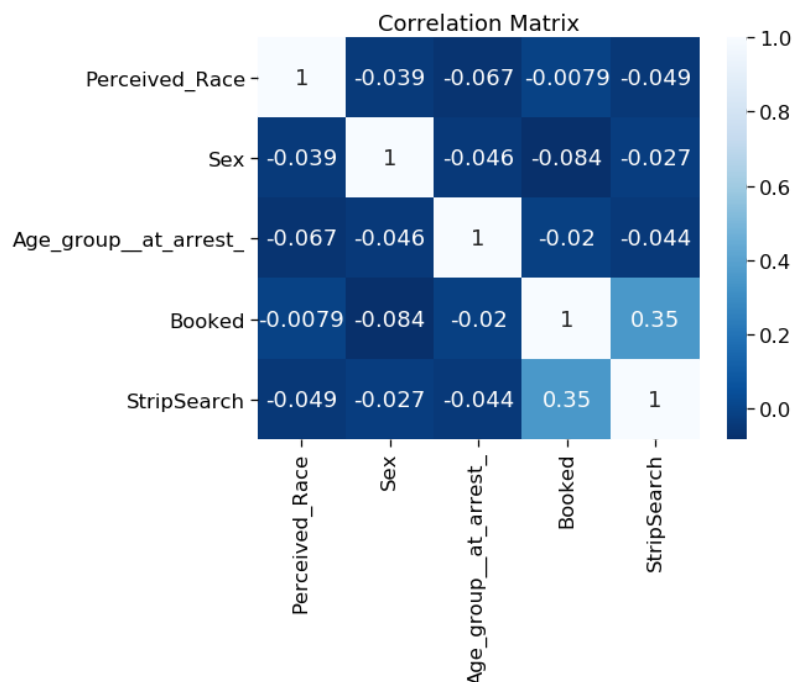


Figure 7. Countplot of StripSearch vs. Age_group__at_arrest__



For further analysis, we converted all variables of the object type into int, as Perceived_Race: White, Black, Unknown or Legacy, East/Southeast Asian, South Asian, Middle-Eastern, Indigenous and Latino to 1-8, Sex: M to 1 and F to 2, and merge the group 'Age 17 years and under' & 'Age 17 years and younger' and 'Aged 65 and older' & 'Aged 65 years and older', convert Age_group__at_arrest: Age(<17), Age(18-24), Age(25-34), Age(35-44), Age(45-54), Age(55-64) and Age(>65) to 1-7, then made a correlation matrix(Figure 8) between these variables.

Figure 8. Correlation Matrix



The last part is Welch's T-test. Before running the Welch's T-test, we need to check the assumption of normality first. The test statistic and p-value of each group is shown in Table 3.

Table 3. Test of Normality (Shapiro-Wilk)

	W(Booked)	p(Booked)	W(StripSearch)	p(StripSearch)
Male	0.927	0.002	0.927	0.002
Female	0.936	0.006	0.036	0.005
White	0.929	0.296	0.946	0.496
Black	0.951	0.577	0.963	0.773
Unknown or Legacy	0.867	0.038	0.886	0.070
East/Southeast Asian	0.928	0.289	0.970	0.870
South Asian	0.926	0.270	0.959	0.700
Middle-Eastern	0.901	0.118	0.898	0.106
Indigenous	0.799	0.005	0.938	0.392
Latino	0.764	0.002	0.917	0.196
Age(<17)	0.959	0.652	0.798	0.003
Age(18-24)	0.938	0.326	0.935	0.288
Age(25-34)	0.908	0.108	0.950	0.487
Age(35-44)	0.911	0.122	0.978	0.947
Age(45-54)	0.923	0.186	0.952	0.536
Age(55-64)	0.927	0.221	0.941	0.365

Age(>65)	0.919	0.163	0.723	0.0003
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Note. Significant results suggest a deviation from normality.

The groups that neither of the variables violates the assumption of normality can continue with the analysis, by comparing the p-value with 0.05. Groups grouped by perceived race with similar count value in the countplot and age-grouped groups at similar ages were selected for further examination.

We computed the mean of Booked and StripSearch for groups. The hypothesis being tested are following:

- **H0(Null Hypothesis):** The means between different groups are equal.
- **H1(Alternative Hypothesis):** The means between different groups are different.

Following are groups that with result pass the Welch's T-test(Table 4).

Table 4. Independent Samples T-Test

		t	p
Booked	Black vs. East/Southeast Asian	2.609	0.015
	Age(<17) vs. Age(18-24)	-3.323	0.003
StripSearch	Middle-Eastern vs. Indigenous	-3.277	0.005
	Indigenous vs. Latino	2.235	0.036

Note. Welch's t-test.

The results show that the mean of Booked of Black vs. East/Southeast Asian and Age(<17) vs. Age(18-24) is different, and the mean of StripSearch of Middle-Eastern vs. Indigenous and Indigenous vs. Latino is different. The p-value is less than the alpha determined as 0.05, which is statistically significant. Therefore, we can reject the null hypothesis that mean between groups are equal.

Methods

1. Research Objective

Drawing on insights from the literature review and initial exploratory data analysis, our study aims to investigate the magnitude of effect size of perceived race and age group at arrest on the chance of being strip searched or formally booked. Additionally, we aim to examine the relationship between one demographic factor and the likelihood of undergoing a strip search or formal booking at the police station within 24 hours, while controlling for the other two factors as covariates. Furthermore, we are motivated to investigate which perceived race male teenagers are more likely to undergo strip search. A comprehensive list of detailed research questions is provided below to guide the direction of our entire project.

2. Research Questions

- **Research Question 1:** How much impact does perceived race have on the chance of being strip searched or formally booked? How much impact does age group at arrest have on the chance of being strip searched or formally booked? In this particular context, perceived race on mean strip search score include Middle-Eastern vs. Indigenous, Indigenous vs. Latino. Perceived race on mean booked score includes Black vs. East/Southeast Asian. Age range at arrest on mean booked score includes Age(<17) vs. Age(18-24).
- **Research Question 2:** While controlling for perceived race and sex, will individuals from all age groups at arrest have different strip search scores or booked scores on average? While controlling for age group at arrest and sex, will individuals from all perceived races have different strip search scores or booked scores on average?
- **Research Question 3:** Are white male teenagers (17 years old or younger) more likely to be strip searched? or male teenagers of other perceived races more likely to be strip searched?

3. Research Design and Methods

Prior to conducting Welch's t-test, several power analyses were performed using Cohen's D metric to determine the effect size of the explanatory variables on response variables and the required sample size for each group. Descriptive statistics and Welch's t-tests were then used

to examine whether there was a significant difference between the mean strip search score and mean booked score for each group. Alongside this, we utilized one-way ANCOVA tests to explore the relationship between each explanatory variable and the two response variables while controlling for the other two covariates. The subsequent text provides a detailed explanation of how these methods were applied to answer each research question.

- **Digesting Research Question 1:** Through the use of power analysis, we evaluated the effect size of perceived race and age group at arrest, providing a quantitative measure of the impact these variables have on the chance of being subjected to strip searches or formal bookings. This analytical approach facilitated the identification of the required sample sizes for each group based on perceived race and age, enabling us to verify the reliability of our results by comparing them against the actual size. Additionally, we generated power curves to determine the optimal effect size that balanced the trade-off between sample size and statistical power.
- **Digesting Research Question 2:** The aim of this research question is to investigate whether there exist differences in the mean strip search scores or mean booked scores among different groups based on an explanatory variable, while simultaneously controlling for the effects of other explanatory variables as covariates. To accomplish this, we employed one-way ANCOVA to assess (1) the significance of the differences in the means of strip search score/booked score across various levels of perceived race, while taking into account the influence of age group at arrest and sex, and (2) the significance of the differences in the means of strip search score/booked score across diverse levels of age group at arrest, while adjusting for the effects of perceived race and sex.
- **Digesting Research Question 3:** Logistic regression was used to predict the likelihood of undergoing a strip search based on three explanatory variables, by building upon test and train data. Specifically, the logistic regression model was utilized to investigate whether white male teenagers aged 17 years or younger were more susceptible to being strip searched compared to male teenagers of other perceived races. The odds ratio, confidence interval, confusion matrix and test accuracy were computed to evaluate the performance of the model and to ascertain the strength and direction of the relationship between perceived race and the occurrence of strip searches. To provide a clear visual representation of the perceived

race with the highest probability of being subjected to strip searches, a logistic regression plot with its prediction interval was generated.

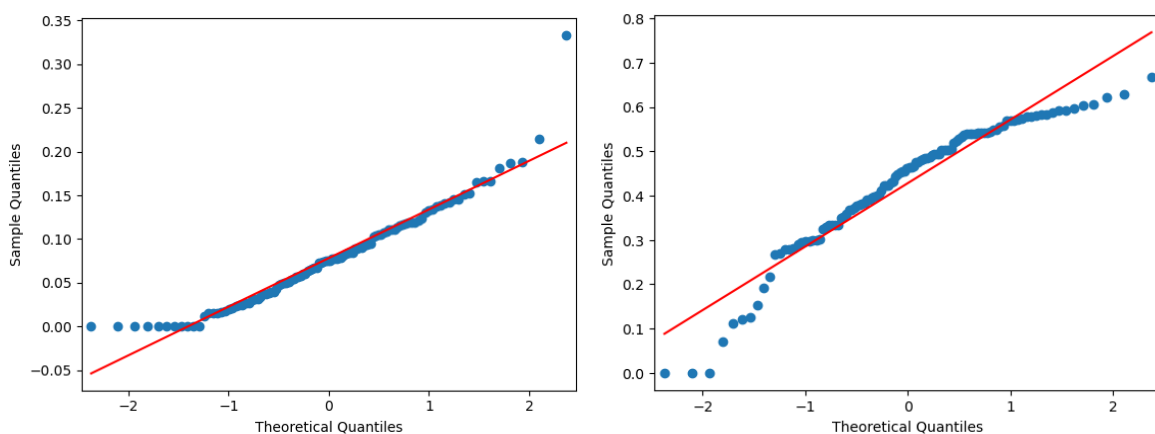
4. Preprocessing

Prior to essentially performing the tests, we need to clean the data to eliminate any missing values, duplicate groups and variables that would not contribute to our research this time. To that end, we removed all the empty values from sex, perceived race, age group at arrest, strip search and formal booking, and only the five variables mentioned beforehand are kept. Specifically, we replaced 'Aged 65 years and older' with 'Aged 65 and older', 'Aged 17 years and under' with 'Aged 17 and younger' and 'Aged 17 years and younger' with 'Aged 17 and younger' in the age group at arrest. In addition, Sex 'U' was removed because the data is unknown and of no notable importance.

In order to conduct one-way ANCOVA tests, a continuous variable as the response variable must be present for the test to be valid. Nonetheless, both strip search and formal booking are binary variables that render the variance of data not meaningful. With respect to this particular context, we created two new variables called mean strip search score and mean booked score which are obtained from grouping by sex, perceived race and age group at arrest and calculating the mean strip search and formal booking for each group. This significantly helps us to generate continuous variables and form a new dataset with only distinct combinations of groups, containing 112 rows and 5 columns of data (See Appendix Table C).

Figure 9

Q-Q Plots for mean strip search score and mean booked score



Note: Left is for mean strip search score, right is for mean booked score

Table 5. *Levene's test results for mean strip search score homogeneity of variances (Alpha = 0.05)*

Independent Variable	Statistic	P-value
Sex	0.17	0.67
Perceived Race	1.74	0.11
Age Group at Arrest	0.90	0.50

Note: all p-values > 0.05.

Table 6. *Levene's test results for mean booked score homogeneity of variances (Alpha = 0.05)*

Independent Variable	Statistic	P-value
Sex	11.32	0.01
Perceived Race	0.60	0.75
Age Group at Arrest	1.98	0.076

Note: only p-value of Sex < 0.05.

We can minimize potential biased results from the ANCOVA test by first checking its three assumptions: independence, normality, and equal variance. The groups in the new dataset are mutually exclusive, as the data is grouped by a few variables and cleaned at the beginning. Figure 9 shows that most residuals follow a straight line, with only a few deviations at the tail, leading us to conclude that the mean strip search score and mean booked score are normally distributed. Finally, based on the results from Table 5 and 6, we found that there were no statistically significant differences in variability between groups, as indicated by the non-significant results of the Levene's test for homogeneity of variances. Only sex had a significant p-value, but we decided not to consider it. Since none of the three assumptions were violated, we proceeded with one-way ANCOVA tests.

Results/Findings

1. Power Analysis

Table 7. Power Analysis

		Effect Size	Required Sample Size	Actual Size
Booked	Black vs. East/Southeast Asian	0.986	17.160	14
	Age(<17) vs. Age(18-24)	-1.175	12.410	16
StripSearch	Middle-Eastern vs. Indigenous	-1.239	11.278	14
	Indigenous vs. Latino	-0.845	23.001	14

Note: Following the computation of the effect size, the required sample size was derived by incorporating the obtained effect size and controlling the statistical power at 80%. The direction of the effect size (positive or negative) was determined by the specific type of comparison that was being investigated.

Before conducting a t-test to examine the differences in mean booked scores (as the response variable) between Black individuals and East/Southeast Asians (as the two-level explanatory variable), a large effect size of the explanatory variable was estimated using Cohen's D metric, which was found to be 0.986. The subsequent computations indicated that a sample size of 17 was necessary for each group. Of note, the actual sample sizes in the dataset for both groups were 14, which may affect the reliability of the results.

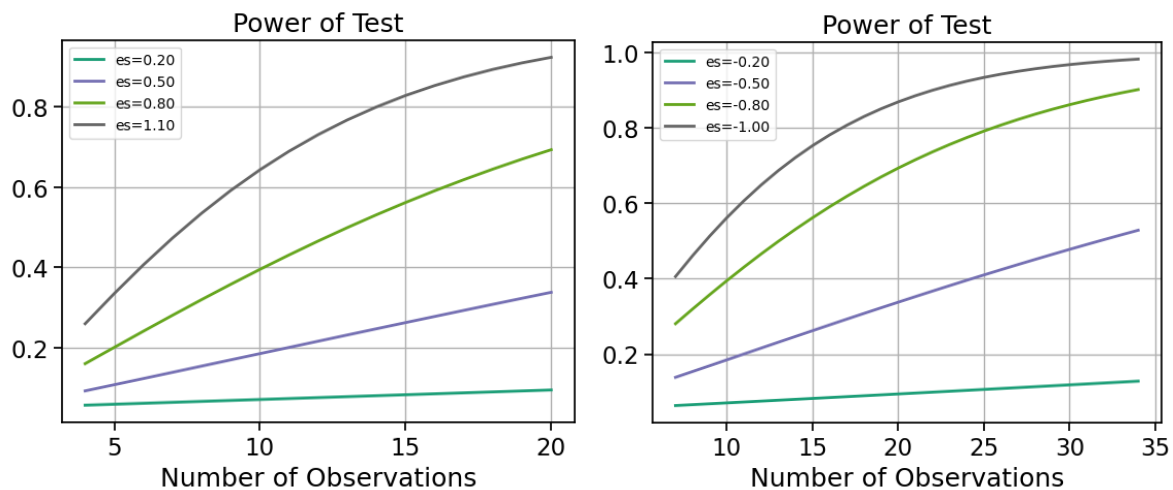
Prior to performing a t-test to investigate the differences in mean booked scores (as the response variable) between Age(<17) at the time of arrest and Age(18-24) at arrest (as the two-level explanatory variable), a large effect size of the explanatory variable was evaluated using Cohen's D metric, which was determined to be -1.175. Subsequently, the required sample size for each group was computed to be 12. It is worth mentioning that the actual sample sizes in the dataset for both groups were 16, which met the required size.

A large effect size of the explanatory variable was estimated using Cohen's D metric (-1.239) before conducting a t-test to explore the differences in mean strip search scores (as the response variable) between Middle-Eastern and Indigenous groups (as the two-level

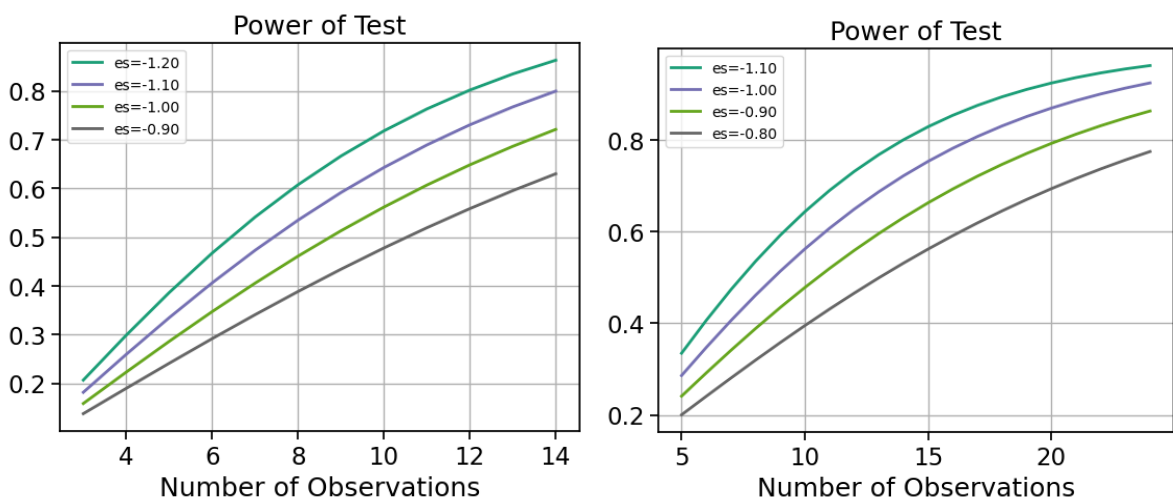
explanatory variable). Following this, the required sample size for each group was computed to be 11. It is noteworthy that the actual sample sizes in the dataset for both groups were 14, which fulfilled the required sample size criteria.

Before conducting a t-test to investigate the differences in mean strip search scores (as the response variable) between Indigenous and Latino groups (as the two-level explanatory variable), a large effect size of the explanatory variable was estimated using Cohen's D metric (0.845). Afterward, the required sample size for each group was determined to be 23. It is worth mentioning that the actual sample sizes in the dataset for both groups were 14, which fail to meet the criteria and thus lack reliability in results.

Figure 10. Power Curves



Note: Left is for Perceived Race (Black vs. East/Southeast Asian) Mean Booked Score, right is for Age Group at Arrest (aged <17 vs. aged 18-24) Mean Booked Score.



Note: Left is for Perceived Race (Middle-Eastern vs. Indigenous) Mean Strip Search Score, right is for Perceived Race (Indigenous vs. Latino) Mean Strip Search Score.

To validate our earlier power analysis, we used power curves to compare the calculated effect size (Table 7) with the observed effect size (Figure 10). We aim to achieve a statistical power of 80% for all tests, and we observed the effect size in power curves based on the required sample size.

The Perceived Race (Black vs. East/Southeast Asian) Mean Booked Score shows a calculated effect size of 0.986. When the required sample size is 17, the observed effect size is very close to the calculated one at 1. The Age Group at Arrest (aged <17 vs. aged 18-24) Mean Booked Score shows a calculated effect size of -1.175. When the required sample size is 12, the observed effect size is very close to the calculated one at -1.2. For the Perceived Race (Middle-Eastern vs. Indigenous) Mean Strip Search Score, the calculated effect size is -1.2. When the required sample size is 11, the observed effect size is similar to the calculated effect size, at -1.3. The Perceived Race (Indigenous vs. Latino) Mean Strip Search Score has a calculated effect size of -0.845. With a required sample size of 23, the observed effect size is very close to the calculated effect size, at -0.8.

2. One-way ANCOVA

Black vs. East/Southeast Asian (Booked)

- **H0(Null Hypothesis):** There is no relationship between being Booked and the Perceived Race, controlling for the Sex and Age group at arrest. Black and East/Southeast Asian have the same population mean.
- **H1(Alternative Hypothesis):** There is a relationship between being Booked and the Perceived Race, controlling for the Sex and Age group at arrest. Black and East/Southeast Asian have a different population mean.

Table 8. ANCOVA - Black vs. East/Southeast Asian (Booked)

Source	SS	DF	F	p-unc	np2
Perceived_Race	0.077	1	19.383	0.000	0.447
Sex	0.188	1	47.326	0.000	0.664

Age_group__at_arrest__	0.011	1	2.714	0.113	0.102
Residuals	0.095	24			

Statistical interpretation Interpretation p-unc = “uncorrected p-value” for Perceived_Race is less than 0.05. We can reject the null hypothesis that there is a significant difference between the population mean of Black and East/Southeast Asian being Booked, controlling for the Sex and Age group at arrest.

Practical interpretation We hypothesized that the perceived race would be related to being booked. From our result, we see that there is statistically significant relationship between perceived race and booked when controlling for their sex and age group. This discrepancy may indicate an underlying bias in the police system against Black individuals, compared to East/Southeast Asians. Alternatively, it may indicate an underlying demographic or socioeconomic difference between the two groups that causes the observed differences.

OLS Regression was also performed on the model, which showed that the R-squared was 0.743, and the fitting degree of the model was relatively high. The output is shown in Appendix Table D.

Age(<17) vs. Age(18-24) (Booked)

- **H0(Null Hypothesis):** There is no relationship between being Booked and the Age group at arrest, controlling for the Sex and Perceived Race. Age(<17) and Age(18-24) have the same population mean.
- **H1(Alternative Hypothesis):** There is a relationship between being Booked and the Age group at arrest, controlling for the Sex and Perceived Race. Age(<17) and Age(18-24) have different population mean.

Table 9. ANCOVA - Age(<17) vs. Age(18-24) (Booked)

Source	SS	DF	F	p-unc	np2
Age_group__at_arrest_	0.184	1	17.351	0.000	0.383
Sex	0.203	1	19.082	0.000	0.405
Perceived_Race	0.001	1	0.054	0.818	0.002
Residuals	0.297	28			

Statistical interpretation Interpretation p-unc = “uncorrected p-value” for Age_group__at_arrest_ is less than 0.05. We can reject the null hypothesis that there is a significant difference between the population mean of Age(<17) and Age(18-24) being Booked, controlling for the Sex and Perceived Race at arrest.

Practical interpretation We hypothesized that the age group would be related to being booked. From our result, we see that there is statistically significant relationship between age group and booked when controlling for their sex and perceived race. This finding may indicate that people in the 18-24 age group are more likely to engage in criminal behavior, or may be more frequently targeted by police. Alternatively, it may indicate that the police system may be biased against people of this age.

OLS Regression was also performed on the model, which showed that the R-squared was 0.566, and the fitting degree of the model was good. The output is shown in Appendix Table E.

Middle-Eastern vs. Indigenous (StripSearch)

- **H0(Null Hypothesis):** There is no relationship between StripSearch and the Perceived Race, controlling for the Sex and Age group at arrest. Middle-Eastern and Indigenous have the same population mean.

- **H1(Alternative Hypothesis):** There is a relationship between StripSearch and the Perceived Race, controlling for the Sex and Age group at arrest. Middle-Eastern and Indigenous have a different population mean.

Table 10. ANCOVA - Middle-Eastern vs. Indigenous (StripSearch)

Source	SS	DF	F	p-unc	np2
Perceived_Race	0.045	1	22.522	0.000	0.484
Sex	0.016	1	7.905	0.010	0.248
Age_group__at_arrest__	0.046	1	22.621	0.000	0.485
Residuals	0.048	24			

Statistical interpretation Interpretation p-unc = “uncorrected p-value” for Perceived_Race is less than 0.05. We can reject the null hypothesis that there is a significant difference between the population mean of Middle-Eastern and Indigenous being StripSearch, controlling for the Sex and Age group at arrest.

Practical interpretation We hypothesized that the perceived race would be related to being stripsearch. From our result, we see that there is a statistically significant relationship between perceived race and stripsearch when controlling for their sex and age group. This discrepancy may indicate an underlying bias in the public security system against Middle Easterners, compared with indigenous peoples. Alternatively, it may indicate an underlying demographic or cultural difference between the two groups that causes the observed differences.

OLS Regression was also performed on the model, which showed that the R-squared was 0.689, and the fitting degree of the model was good. The output is shown in Appendix Table F.

Indigenous vs. Latino (StripSearch)

- **H0(Null Hypothesis):** There is no relationship between StripSearch and the Perceived Race, controlling for the Sex and Age group at arrest. Indigenous and Latino have the same population mean.
- **H1(Alternative Hypothesis):** There is a relationship between StripSearch and the Perceived Race, controlling for the Sex and Age group at arrest. Indigenous and Latino have a different population mean.

Table 11. ANCOVA - Indigenous vs. Latino (StripSearch)

Source	SS	DF	F	p-unc	np2
Perceived_Race	0.026	1	6.936	0.015	0.224
Sex	0.020	1	5.481	0.028	0.186
Age_group__at_arrest__	0.025	1	6.625	0.017	0.216
Residuals	0.089	24			

Statistical interpretation Interpretation p-unc = “uncorrected p-value” for Perceived_Race is less than 0.05. We can reject the null hypothesis that there is a significant difference between the population mean of Indigenous and Latino being Stripsearch, controlling for the Sex and Age group at arrest.

Practical interpretation We hypothesized that the perceived race would be related to being stripsearch. From our result, we see that there is a statistically significant relationship between perceived race and stripsearch when controlling for their sex and age group. This disparity could indicate an underlying bias or disparity in the police system, with Indigenous people more likely to be strip-searched than Latinos. This may indicate an underlying demographic or socioeconomic difference between the two groups that contributes to the observed differences.

OLS Regression was also performed on the model, which showed that the R-squared was 0.442, and the fitting degree of the model was relatively low. The output is shown in Appendix Table G.

3. Logistic Regression

Table 12. Odds Ratio and Confidence Interval

	Lower CI	Upper CI	OR
Intercept	0.302	0.388	0.342
Perceived_Race	0.892	0.921	0.907
Sex	0.719	0.831	0.773
Age_group__at_arrest__	0.881	0.918	0.899

We conducted a logistic regression analysis to explore how perceived race, sex, and age group at arrest impact the likelihood of an individual being subjected to strip searches. Our findings as shown in Table 12 reveal that all of the variables are statistically significant, as the confidence interval for the odds ratio did not encompass 1.

The probability of an individual being strip searched is influenced by their perceived race, with the following order having the highest likelihood: White > Black > Unknown or Legacy > East/Southeast Asian > South Asian > Middle-Eastern > Indigenous > Latino. The odds ratio for this relationship is approximately 0.907, indicating that for each increase in perceived race category (e.g., from White to Black), the odds ratio of being subjected to a strip search decreases by about 0.907 times.

Sex affects the likelihood of an individual being strip searched, with males having the highest probability followed by females. The odds ratio for this relationship is around 0.773, suggesting that for each increase in sex category (e.g., from Male to Female), the odds ratio of being subjected to a strip search decreases by approximately 0.773 times.

The likelihood of an individual being subjected to a strip search is influenced by their age group at arrest, with the highest probability among those aged 17 and younger, followed by those aged 18 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, 55 to 64 years, and 65 and older. The odds ratio for this relationship is approximately 0.899, indicating that for each increase in age group category (e.g., from Aged 17 and younger to Aged 18 to 24 years), the odds ratio of being strip searched decreases by around 0.899 times.

Table 13. Confusion Matrix

		Actual Class	
		Positive (P)	Negative (N)
Predicted Class	Positive (P)	True Positive (14451)	False Positive (0)
	Negative (N)	False Negative (1859)	True Negative (0)

Note. Test Accuracy = 0.886

Table 13's confusion matrix indicates that the logistic model accurately predicted 14451 positive cases and failed to predict 1859 positive cases. Since there are no negative cases, both False Negatives and True Negatives are zero, implying that the model did not make any incorrect positive or correct negative predictions. The logistic model's accuracy was estimated by dividing the number of correct predictions (14451) by the total number of predictions (16310), resulting in a test accuracy of approximately 0.886.

Figure 11. Logistic Regression and its Prediction Interval

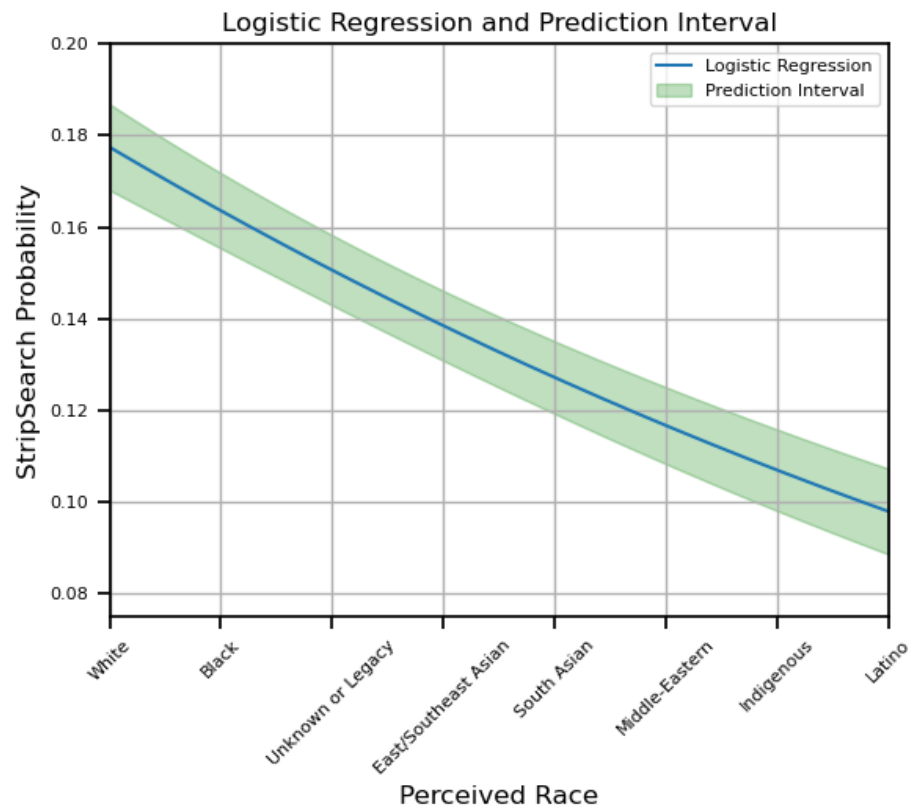


Figure 11 supported the initial conclusion drawn from the odds ratio. The plot showed a clear downward trend from the White group to the Latino group, indicating that the probability of being strip searched decreases in the following order: White, Black, Unknown or Legacy, East/Southeast Asian, South Asian, Middle-Eastern, Indigenous, Latino. This trend provided an answer to our third research question: white male teenagers (17 years old or younger) are the demographic group most likely to be strip searched. The logistic regression prediction interval indicated the range of values in which the predicted probability is expected to lie. The interval was shown to be relatively moderate and narrow in Figure 11, indicating that the model had made relatively accurate predictions. This finding was consistent with the relatively high test accuracy of 0.886.

Discussion

A large effect size was defined as an absolute value greater than 0.8, while a small effect size was defined as less than 0.2. In our project, the difference in mean booked scores between Black individuals and East/Southeast Asians is large, although the results may be unreliable due to the sample size being smaller than required. Similarly, the difference in mean strip search scores between Middle-Eastern and Indigenous groups is large. On the other hand, the difference in mean booked scores between Age (<17) at the time of arrest and Age (18-24) at arrest is also large. Finally, the magnitude of the difference in mean strip search scores between Indigenous and Latino groups is also large, but as with the previous case, the results may be unreliable due to the sample size being smaller than required.

The results of the ANCOVA analysis show that, controlling for sex and age group, there are significant differences in the likelihood of being booked for Black and East/Southeast Asian, as well as for Middle-Eastern and Indigenous, Indigenous and Latino in the likelihood of being strip-searched by police. This means that perceived race may be a contributing factor in police bookings and strip-searches. While controlling for sex and perceived race, age group was also a contributing factor to be booked, with significant differences in the likelihood of being booked with the police between age(<17) and age(18-24).

However, it is also important to acknowledge the limitations of this research. ANCOVA can only control for the variables included in the analysis, and there may be other important factors affecting police book and strip searches that are not taken into account, which may lead to biased estimates and inaccurate conclusions.

At the same time, the study may be limited by its sample size or sample representativeness. In order to meet the conditions of normality, linearity and variance homogeneity of ANCOVA, we have processed the data, resulting in a small amount of data actual size, which may not be able to achieve sufficient statistical power in the end.

Furthermore, ANCOVA can only establish associations between variables, not causation, and further investigation may be required to identify underlying factors responsible for differences between different perceived races or age groups.

Based on our analysis of the odds ratio, its confidence interval, confusion matrix, and logistic regression plot with its prediction interval, we have determined that the probability of being strip searched decreases in the following order: White, Black, Unknown or Legacy,

East/Southeast Asian, South Asian, Middle-Eastern, Indigenous, and Latino. The model has demonstrated a relatively high level of accuracy with a test accuracy of 0.886. Conclusively, our research has revealed that white male teenagers (17 years old or younger) are the demographic group that is most likely to be subjected to strip searches.

Conclusion

In this project, we analyzed the impact of perceived race and age group on the probability of being subjected to strip searches or formal booking. Moreover, we explored the connection between a particular demographic factor and the likelihood of undergoing strip searches or formal booking within 24 hours of arrest, while accounting for the other two factors as covariates. Additionally, we investigated the extent to which male teenagers of various perceived races are more susceptible to strip searches. This project represents our initial effort to investigate whether demographic factors play a role in the implementation of strip searches. Moving forward, we will investigate the potential impact of arrest actions on strip searches and the role of demographic factors in different types of strip search rationales. We also plan to develop additional predictive models based on the current dataset and validate our findings using another real-world dataset. As a result, we can enhance the accuracy of our models in future studies by pinpointing the variables and algorithms that are most effective in predicting the outcome. Our ultimate objective is to foster equitable and impartial law enforcement practices and increase public accountability, for police officers to precisely conduct strip searches and formal bookings.

Reference

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Appendix

Table A. Describe of independent variables

```
White                27708
Black                17518
Unknown or Legacy    5052
East/Southeast Asian 4412
South Asian          3613
Middle-Eastern       3237
Indigenous           1932
Latino               1767
Name: Perceived_Race, dtype: int64
M      52631
F      12608
Name: Sex, dtype: int64
Aged 25 to 34 years   20944
Aged 35 to 44 years   16240
Aged 18 to 24 years   10038
Aged 45 to 54 years    9065
Aged 55 to 64 years    4588
Aged 17 years and younger 1681
Aged 17 years and under 1361
Aged 65 years and older  698
Aged 65 and older     624
Name: Age_group__at_arrest_, dtype: int64
```

Table B. Describe of dependent variables

	Booked	StripSearch
count	65239.000000	65239.000000
mean	0.528426	0.119560
std	0.499195	0.324449
min	0.000000	0.000000
25%	0.000000	0.000000
50%	1.000000	0.000000
75%	1.000000	0.000000
max	1.000000	1.000000

Table C. Cleaned Dataset with 112 rows and 5 columns

	Sex	Perceived_Race	Age_group__at_arrest_	StripSearch	Booked
0	F	Black	Aged 17 and younger	0.037975	0.367089
1	F	Black	Aged 18 to 24 years	0.118911	0.462751
2	F	Black	Aged 25 to 34 years	0.080416	0.475875
3	F	Black	Aged 35 to 44 years	0.072917	0.463542
4	F	Black	Aged 45 to 54 years	0.116541	0.447368
5	F	Black	Aged 55 to 64 years	0.024096	0.301205
6	F	Black	Aged 65 and older	0.000000	0.384615
7	F	East/Southeast Asian	Aged 17 and younger	0.024390	0.268293
8	F	East/Southeast Asian	Aged 18 to 24 years	0.037594	0.278195
9	F	East/Southeast Asian	Aged 25 to 34 years	0.026316	0.378947
10	F	East/Southeast Asian	Aged 35 to 44 years	0.037037	0.328042
11	F	East/Southeast Asian	Aged 45 to 54 years	0.030928	0.298969
12	F	East/Southeast Asian	Aged 55 to 64 years	0.057971	0.217391
13	F	East/Southeast Asian	Aged 65 and older	0.000000	0.192308
14	F	Indigenous	Aged 17 and younger	0.111111	0.111111
15	F	Indigenous	Aged 18 to 24 years	0.114943	0.597701
16	F	Indigenous	Aged 25 to 34 years	0.137809	0.547703
17	F	Indigenous	Aged 35 to 44 years	0.102941	0.463235
18	F	Indigenous	Aged 45 to 54 years	0.076923	0.474359
19	F	Indigenous	Aged 55 to 64 years	0.121212	0.484848
20	F	Indigenous	Aged 65 and older	0.000000	0.333333
21	F	Latino	Aged 17 and younger	0.000000	0.071429
22	F	Latino	Aged 18 to 24 years	0.084746	0.491525
23	F	Latino	Aged 25 to 34 years	0.021053	0.505263
24	F	Latino	Aged 35 to 44 years	0.015625	0.421875
25	F	Latino	Aged 45 to 54 years	0.047619	0.380952
26	F	Latino	Aged 55 to 64 years	0.000000	0.000000
27	F	Latino	Aged 65 and older	0.166667	0.333333
28	F	Middle-Eastern	Aged 17 and younger	0.033333	0.300000

29	F	Middle-Eastern	Aged 18 to 24 years	0.063158	0.452632
30	F	Middle-Eastern	Aged 25 to 34 years	0.056180	0.359551
31	F	Middle-Eastern	Aged 35 to 44 years	0.065789	0.289474
32	F	Middle-Eastern	Aged 45 to 54 years	0.019608	0.294118
33	F	Middle-Eastern	Aged 55 to 64 years	0.000000	0.125000
34	F	Middle-Eastern	Aged 65 and older	0.000000	0.000000
35	F	South Asian	Aged 17 and younger	0.040000	0.120000
36	F	South Asian	Aged 18 to 24 years	0.074766	0.411215
37	F	South Asian	Aged 25 to 34 years	0.064935	0.422078
38	F	South Asian	Aged 35 to 44 years	0.049587	0.396694
39	F	South Asian	Aged 45 to 54 years	0.015873	0.333333
40	F	South Asian	Aged 55 to 64 years	0.000000	0.269231
41	F	South Asian	Aged 65 and older	0.076923	0.153846
42	F	Unknown or Legacy	Aged 17 and younger	0.027027	0.297297
43	F	Unknown or Legacy	Aged 18 to 24 years	0.132530	0.481928
44	F	Unknown or Legacy	Aged 25 to 34 years	0.118380	0.429907
45	F	Unknown or Legacy	Aged 35 to 44 years	0.107296	0.394850
46	F	Unknown or Legacy	Aged 45 to 54 years	0.089109	0.376238
47	F	Unknown or Legacy	Aged 55 to 64 years	0.017544	0.280702
48	F	Unknown or Legacy	Aged 65 and older	0.000000	0.000000
49	F	White	Aged 17 and younger	0.053640	0.279693
50	F	White	Aged 18 to 24 years	0.104972	0.432320
51	F	White	Aged 25 to 34 years	0.165605	0.502695
52	F	White	Aged 35 to 44 years	0.145056	0.502664
53	F	White	Aged 45 to 54 years	0.089730	0.454054
54	F	White	Aged 55 to 64 years	0.051151	0.368286
55	F	White	Aged 65 and older	0.015267	0.297710
56	M	Black	Aged 17 and younger	0.141700	0.528340
57	M	Black	Aged 18 to 24 years	0.181054	0.603298
58	M	Black	Aged 25 to 34 years	0.152417	0.604739
59	M	Black	Aged 35 to 44 years	0.141311	0.582951

60	M	Black	Aged 45 to 54 years	0.123268	0.557257
61	M	Black	Aged 55 to 64 years	0.111301	0.486301
62	M	Black	Aged 65 and older	0.067568	0.479730
63	M	East/Southeast Asian	Aged 17 and younger	0.054264	0.348837
64	M	East/Southeast Asian	Aged 18 to 24 years	0.118326	0.503608
65	M	East/Southeast Asian	Aged 25 to 34 years	0.083252	0.540646
66	M	East/Southeast Asian	Aged 35 to 44 years	0.092531	0.545151
67	M	East/Southeast Asian	Aged 45 to 54 years	0.078351	0.492784
68	M	East/Southeast Asian	Aged 55 to 64 years	0.060510	0.493631
69	M	East/Southeast Asian	Aged 65 and older	0.015625	0.390625
70	M	Indigenous	Aged 17 and younger	0.333333	0.666667
71	M	Indigenous	Aged 18 to 24 years	0.214815	0.622222
72	M	Indigenous	Aged 25 to 34 years	0.186788	0.592255
73	M	Indigenous	Aged 35 to 44 years	0.187783	0.583710
74	M	Indigenous	Aged 45 to 54 years	0.138756	0.588517
75	M	Indigenous	Aged 55 to 64 years	0.074074	0.629630
76	M	Indigenous	Aged 65 and older	0.000000	0.555556
77	M	Latino	Aged 17 and younger	0.166667	0.574074
78	M	Latino	Aged 18 to 24 years	0.084000	0.540000
79	M	Latino	Aged 25 to 34 years	0.078947	0.580827
80	M	Latino	Aged 35 to 44 years	0.093264	0.593264
81	M	Latino	Aged 45 to 54 years	0.039548	0.536723
82	M	Latino	Aged 55 to 64 years	0.060241	0.578313
83	M	Latino	Aged 65 and older	0.095238	0.571429
84	M	Middle-Eastern	Aged 17 and younger	0.074713	0.402299
85	M	Middle-Eastern	Aged 18 to 24 years	0.090000	0.531667
86	M	Middle-Eastern	Aged 25 to 34 years	0.056478	0.539313
87	M	Middle-Eastern	Aged 35 to 44 years	0.088647	0.542768
88	M	Middle-Eastern	Aged 45 to 54 years	0.075419	0.569832
89	M	Middle-Eastern	Aged 55 to 64 years	0.050000	0.518750
90	M	Middle-Eastern	Aged 65 and older	0.000000	0.400000

91	M	South Asian	Aged 17 and younger	0.104651	0.372093
92	M	South Asian	Aged 18 to 24 years	0.084034	0.465546
93	M	South Asian	Aged 25 to 34 years	0.073045	0.540123
94	M	South Asian	Aged 35 to 44 years	0.103546	0.548936
95	M	South Asian	Aged 45 to 54 years	0.042793	0.542793
96	M	South Asian	Aged 55 to 64 years	0.031963	0.502283
97	M	South Asian	Aged 65 and older	0.012048	0.325301
98	M	Unknown or Legacy	Aged 17 and younger	0.111111	0.422222
99	M	Unknown or Legacy	Aged 18 to 24 years	0.119013	0.494920
100	M	Unknown or Legacy	Aged 25 to 34 years	0.129909	0.579305
101	M	Unknown or Legacy	Aged 35 to 44 years	0.108446	0.523462
102	M	Unknown or Legacy	Aged 45 to 54 years	0.077329	0.455185
103	M	Unknown or Legacy	Aged 55 to 64 years	0.049020	0.444444
104	M	Unknown or Legacy	Aged 65 and older	0.030303	0.333333
105	M	White	Aged 17 and younger	0.067350	0.352855
106	M	White	Aged 18 to 24 years	0.133751	0.540752
107	M	White	Aged 25 to 34 years	0.150768	0.569142
108	M	White	Aged 35 to 44 years	0.145703	0.568983
109	M	White	Aged 45 to 54 years	0.113506	0.542597
110	M	White	Aged 55 to 64 years	0.095064	0.484461
111	M	White	Aged 65 and older	0.023769	0.390492

Table D. OLS Regression Results*Black vs. East/Southeast Asian (Booked)*

OLS Regression Results						
Dep. Variable:	Booked	R-squared:	0.743			
Model:	OLS	Adj. R-squared:	0.711			
Method:	Least Squares	F-statistic:	23.14			
Date:	Fri, 14 Apr 2023	Prob (F-statistic):	2.91e-07			
Time:	21:53:17	Log-Likelihood:	39.838			
No. Observations:	28	AIC:	-71.68			
Df Residuals:	24	BIC:	-66.35			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	0.8716	0.057	15.264	0.000	0.754	0.989
Perceived_Race	-0.0524	0.012	-4.403	0.000	-0.077	-0.028
Sex	-0.1638	0.024	-6.879	0.000	-0.213	-0.115
Age_group__at_arrest_	-0.0098	0.006	-1.647	0.113	-0.022	0.002
Omnibus:	2.147	Durbin-Watson:	1.294			
Prob(Omnibus):	0.342	Jarque-Bera (JB):	1.656			
Skew:	-0.425	Prob(JB):	0.437			
Kurtosis:	2.165	Cond. No.	27.9			

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table E. OLS Regression Results*Age(<17) vs. Age(18-24) (Booked)*

OLS Regression Results						
Dep. Variable:	Booked	R-squared:	0.566			
Model:	OLS	Adj. R-squared:	0.519			
Method:	Least Squares	F-statistic:	12.16			
Date:	Fri, 14 Apr 2023	Prob (F-statistic):	2.83e-05			
Time:	21:53:17	Log-Likelihood:	29.455			
No. Observations:	32	AIC:	-50.91			
Df Residuals:	28	BIC:	-45.05			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	0.4213	0.087	4.838	0.000	0.243	0.600
Age_group__at_arrest_	0.1517	0.036	4.165	0.000	0.077	0.226
Sex	-0.1591	0.036	-4.368	0.000	-0.234	-0.085
Perceived_Race	0.0018	0.008	0.233	0.818	-0.014	0.018
Omnibus:	0.581	Durbin-Watson:	2.129			
Prob(Omnibus):	0.748	Jarque-Bera (JB):	0.246			
Skew:	0.215	Prob(JB):	0.884			
Kurtosis:	3.001	Cond. No.	28.0			

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table F. OLS Regression Results*Middle-Eastern vs. Indigenous (StripSearch)*

OLS Regression Results						
=====						
Dep. Variable:	StripSearch	R-squared:	0.689			
Model:	OLS	Adj. R-squared:	0.650			
Method:	Least Squares	F-statistic:	17.68			
Date:	Fri, 14 Apr 2023	Prob (F-statistic):	2.84e-06			
Time:	21:53:17	Log-Likelihood:	49.330			
No. Observations:	28	AIC:	-90.66			
Df Residuals:	24	BIC:	-85.33			
Df Model:	3					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

Intercept	-0.2827	0.115	-2.464	0.021	-0.520	-0.046
Perceived_Race	0.0805	0.017	4.746	0.000	0.045	0.116
Sex	-0.0477	0.017	-2.812	0.010	-0.083	-0.013
Age_group__at_arrest_	-0.0202	0.004	-4.756	0.000	-0.029	-0.011
=====						
Omnibus:	3.072	Durbin-Watson:	1.446			
Prob(Omnibus):	0.215	Jarque-Bera (JB):	1.661			
Skew:	0.322	Prob(JB):	0.436			
Kurtosis:	4.004	Cond. No.	108.			
=====						

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table G. OLS Regression Results*Indigenous vs. Latino (StripSearch)*

OLS Regression Results						
Dep. Variable:	StripSearch	R-squared:	0.442			
Model:	OLS	Adj. R-squared:	0.373			
Method:	Least Squares	F-statistic:	6.347			
Date:	Fri, 14 Apr 2023	Prob (F-statistic):	0.00253			
Time:	21:53:17	Log-Likelihood:	40.846			
No. Observations:	28	AIC:	-73.69			
Df Residuals:	24	BIC:	-68.36			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	0.6918	0.178	3.897	0.001	0.325	1.058
Perceived_Race	-0.0605	0.023	-2.634	0.015	-0.108	-0.013
Sex	-0.0538	0.023	-2.341	0.028	-0.101	-0.006
Age_group__at_arrest_	-0.0148	0.006	-2.574	0.017	-0.027	-0.003
Omnibus:	10.110	Durbin-Watson:	1.367			
Prob(Omnibus):	0.006	Jarque-Bera (JB):	9.209			
Skew:	1.000	Prob(JB):	0.0100			
Kurtosis:	4.974	Cond. No.	136.			

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table H. Logistic Regression Results

Dep. Variable:	StripSearch	No. Observations:	48929
Model:	Logit	Df Residuals:	48925
Method:	MLE	Df Model:	3
Date:	Sun, 16 Apr 2023	Pseudo R-squ.:	0.007615
Time:	01:26:44	Log-Likelihood:	-17954.
converged:	True	LL-Null:	-18091.
Covariance Type:	nonrobust	LLR p-value:	1.963e-59

	coef	std err	z	P> z 	[0.025	0.975]
Intercept	-1.0720	0.064	-16.726	0.000	-1.198	-0.946
Perceived_Race	-0.0981	0.008	-11.998	0.000	-0.114	-0.082
Sex	-0.2574	0.037	-6.923	0.000	-0.330	-0.185
Age_group__at_arrest_	-0.1061	0.011	-9.974	0.000	-0.127	-0.085