An Exploratory Analysis of the Relationship between Race, Sex, Age Group and Strip Searches using the RBDC Dataset

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Abstract

In 2020, the Toronto Police Services conducted 7,114 strip searches (Forester & Jacobs, 2022). While being in violation of the Human Rights Charter, unless judiciously conducted, the preliminary literature review indicates that strip searches have been regularly performed as an integral part of the Toronto Police Services policing practices. A preliminary analysis of both scholarly and literature in the public domain, indicates that both the frequency and the manner in which these searches were conducted and the associated data have played a significant role in systemically "stigmatizing communities". The Race Based Data Collection Strategy was undertaken in response to the public outcry against systemic racism and the Service's role in perpetuating negative and stigmatized stereotypes of racialized communities. That the TPS has conducted more than "hundreds of strip searches" which were not in accordance with procedure is indicative of a "decoupling" of practice from policy (Barabas et al., 2020) (Aragon et al., 2022), and is worrisome. This line of thinking has motivated this study to investigate the relationship between the perceptions of race and sex and their interaction in policing decisions which result in strip searches.

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Introduction

"In 2001, in a landmark decision on the constitutionality of strip search practices (R. v. Golden), the Supreme Court of Canada defined what amounts to a strip search, and when and how it can lawfully be done. Despite this decision on the legality of strip searches, courts in Ontario continue to regularly find that police officers unlawfully or unreasonably conduct strip searches, sometimes resulting in the exclusion of evidence or the stay of charge."

"… Strip searches are "inherently humiliating and degrading…" (R. v. Golden, [2001] 3 SCR 679, para 90. (CanLII) http://canlii.ca/t/51xm). Individuals who have experienced strip searches have described them as "demeaning," "upsetting" and "devastating." Some suffer varying degrees of psychological harm as a result of being strip searched. This is especially so for individuals who have been traumatized in the past or are otherwise vulnerable…

…Often, those involved in the justice system do not fully understand the impact on those who are affected. Police officers must only conduct or authorize the use of strip searches in compliance with the law, including section 8 of the Canadian Charter of Rights and Freedoms, which states, "everyone has the right to be secure against unreasonable search and seizure." (Breaking The *Golden* Rule, A Review of Police Strip Searches in Ontario, p. 5.6)

In 2020, the Toronto Police Services conducted 7,114 strip searches (Forester & Jacobs, 2022). These are the findings stated in the detailed report on the *Race & Identity Based Data-Collection Strategy* - a living document put together by Professors Dr. Forestor & Dr. Jacobs, the TPS and relevant community agencies including those that represent Black, Indigenous, minority groups and marginalized communities (June 2022). According to this report, while the arrested population (total number of arrests) that year was 31, 979, a staggering nearly 42% of the 17, 096 offenders who were taken into custody (54% of the total arrested population) were strip searched.

While being in violation of the Human Rights Charter, unless judiciously conducted, the preliminary literature review indicates that strip searches have been regularly performed as an integral part of the Toronto Police Services policing practices (Toronto police officer strips naked "hundreds" of people | The Star). Historically, reasons for being subjected to one could include offences such as impaired driving to suspicion of drug trafficking, to court restrictions violations among others (Breaking the Golden Rule, p. 3, 4). Reasons that necessitate the administration of one are stated by the Service as being a proactive measure employed to ensure officer safety as well as of the inmates, upon the offender joining others in the cells. Essentially, the stripsearch is deployed as a pre-emptive measure to forestall any illegal activity behind bars. These could include carrying contraband or weaponry in one's privates or underwear for the purpose of escaping, or

doing intentional harm to an inmate or officer on duty. However, the Supreme Court of Canada has ruled that proper procedure must be followed should it be deemed necessary for a strip search to be conducted. The ruling clearly states that the Service must establish "probable cause" which include reasons (possession) as justification, circumstances (location) regarding where one should be conducted and the manner (one piece of clothing and body area at a time) (R v Golden - Wikipedia). In other words, enforcing strip searches as part of "routine procedure" and without just cause is unconstitutional in Canada.

More recently, following the implemented changes to the *Search of Persons* policy in October 2020, a significant decrease in the number of stripsearches was noted. As per the RBDC Strategy report, the number of individuals subjected to stripsearches fell from 27.3% to 4.9%. See fig. 1 below for reference (Forester & Jacobs, 2022, p.75).

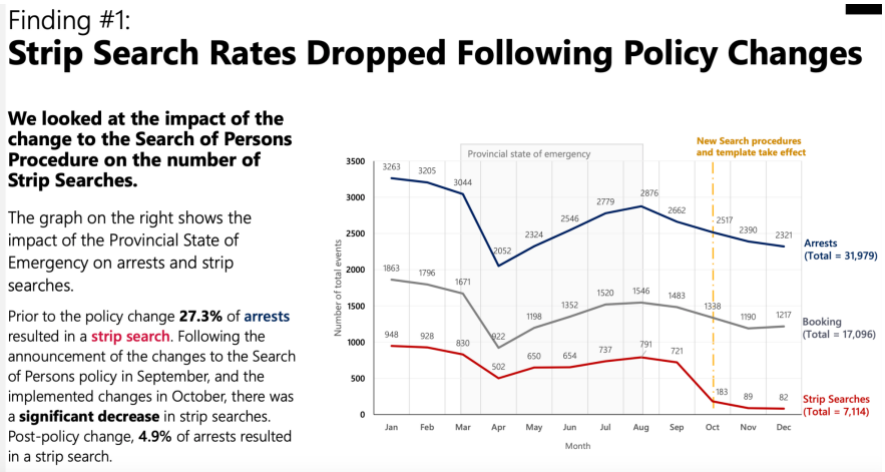

Figure 1 Source. *Forester & Jacobs, 2022, p.75*

Literature Review / Background

Historically, mandatory strip searches have been enforced as routine procedure by the Toronto Police Services. A preliminary analysis of both scholarly and literature in the public domain, indicates that both the frequency and the manner in which these searches were conducted and the associated data have played a significant role in systemically "stigmatizing communities". As can be summarized from the *OPIRD's Breaking the Golden Rule* report, the fact that the records of such searches were not consistently and correctly maintained further exacerbated the situation. This is because even though there was public outcry and sufficient motivation to prompt investigations into complaints, the lack of insufficient data, especially race-based data impeded the cause (*OIPRD_Breaking-the-Golden-Rule_Report_Accessible.pdf*, p. 9,10). The implementation of the changes to the *Search of Persons policy* and the RBDC strategy is corrective measure that is designed as a systematic data-based approach to address systemic racism in the Services (Forester & Jacobs, 2022). This Race Based Data Collection Strategy was undertaken in response to the public outcry against systemic racism and the Service's role in perpetuating negative and stigmatized stereotypes of racialized communities. The Strategy can be described as a methodology designed to identify and address inequality, and racist practices in the use and abuse of racialized data of citizens to target and perpetuate harm.

The Human Rights Charter is central to and guides policy especially as it relates to ensuring equitable treatment of all citizens. That the TPS has conducted more than "hundred's of strip searches" which were not in accordance with procedure is indicative of a "decoupling" of practice from policy (Barabas et al., 2020) (Aragon et al., 2022), and is worrisome. The accounts of Forrester (Kirkup, 2009) and Golden (2001) and the infamous and heart breaking George Floyd incident only make vivid the violence that racist attitudes and biases can result in. This line of thinking motivated this study to investigate the relationship between the perceptions of race and sex and their interaction in policing decisions which result in strip searches.

Research Question

This research is interested in statistically examining the following three research questions:

1) What kind of relationship/ influence if any does the variable Sex of the offender have on the stripsearch outcome?
2) What kind of relationship/ influence if any does the variable Perceived_Race of the offender have on the stripsearch outcome?
3) What kind of a relationship/ influence do variables Perceived_Race and Sex, when taken together have on the stripsearch outcome?
4) Is there a difference in the strip search counts between white and black, controlling for age?
5) Do Age Group, Sex and Race influence the chance of getting strip search?

Method

The study applies a quantitative analysis approach to investigating whether an offender will be stripsearched. The data analysis was conducted in Python using the Pandas and Numpy libraries for processing the data whereas seaborn and matplotlib packages were used for the graphical presentation of the data (data visualization).

3.1 Data Set

This research uses the "Arrests and Strip Searches (RBDC_ARR_TBL_001)" dataset, maintained by the Toronto Police Service, contains information on individuals who were arrested and strip searched in Toronto between January 1, 2010, and December 31, 2019 and can be accessed through Toronto Police Service Public Safety Data Portal

The purpose of this dataset is to provide transparency to the public regarding the activities of the Toronto Police Services in conducting arrests and strip searches and to identify potential issues or areas for improvement in police practices. The dataset contains 65,276 entries that provide information about different characteristics of each arrest and strip search, such as the arrestee's age, sex, and perceived race, as well as the location and cause for the arrest. There are no null or duplicate values in the dataset.

	Arrest_Year	Arrest_Month	EventID	ArrestID	PersonID	Perceived_Race	Sex
0	**2020**	July-Sept	1005907	6017884	326622	White	M
1	**2020**	July-Sept	1014562	6056669	326622	White	M
2	**2020**	Oct-Dec	1029922	6057065	326622	Unknown or Legacy	M
3	**2021**	Jan-Mar	1052190	6029059	327535	Black	M
4	**2021**	Jan-Mar	1015512	6040372	327535	South Asian	M
5	**2021**	Apr-June	1019145	6060688	327535	South Asian	M
…	…	…	…	…	…	…	…
65271	**2021**	Oct-Dec	1055609	6044336	316123	Indigenous	F
65272	**2021**	Oct-Dec	1032758	6031692	307736	South Asian	M
65273	**2021**	Oct-Dec	1021067	6064396	324057	White	F
65274	**2021**	Oct-Dec	1008998	6008662	331870	Unknown or Legacy	M
65275	**2021**	Oct-Dec	1033395	6032145	310583	Latino	M

Table 1. *"Arrests and Strip Searches (RBDC_ARR_TBL_001)" dataset*

3.2 Measurement

The measurement variables selected in this study were used to determine the causality between race of the individual, their sex, age and the chance of being stripsearched. The assumption underpinning the analysis is that stripsearches are not part of "routine procedure", but are deemed necessary as per the situation or criminal activity being investigated. Data Types that were non-numeric were factorized for convenience of calculation and data presentation. The explanation and the meaning of each variable is derived from the accompanying metadata literature pertaining to the dataset (*rbdc-resources*).

3.2.1 Independent Variables

The independent variables for this study are *Sex, Perceived_Race and Age Group.* Both variables are of categorical data type in the original dataset. While the datatype for *Perceived_Race* is retained, that of *Sex* has been factored. Each has multiple levels. The levels of *Perceived_Race* are self-explanatory and listed as: *White, Black, Unknown or Legacy, East/Southeast Asian, South Asian, Middle-Eastern, Indigenous, Latino.* The variable *Sex* has three levels: *Male, Female, Unknown* where each value corresponds to the appropriate letter *M, F, U*. After factorizing, the string values are presented as 0 for Male or M, 1 for Female or F, and 2 for Unknown or U. The variable *Age Group* refers to the age range of the individuals at the time they were arrested. This variable categorizes the individuals into different age groups, such as younger than 17, 18-24, 25-34, 35-44, 45-54, 55-64, and 65 and over. *ArrestLocDiv* is the area where the arrest was made and under which divisional unit (*rbdc-resources)*. While this variable is not actively engaged as a predictor, it serves to inform as a proxy to the *Perceived_Race* variable. In that, it provides information of the area in which the arrests were made thus also pointing to the demographic details of the locality (*Race & Identity Based Data Collection Strategy Understanding Use of Force & Strip Searches in 2020 Detailed Report Toronto Police Service*. 2022, p. 62) *ArrestLocDiv* is of datatype *int* with 17 unique values: each stands for a divisional unit of the Service. This variable was factorized to ensure privacy as well as to facilitate calculation. (see Appendix 2C for details)

3.2.2 Dependent Variable

The response variable StripSearch is a categorical variable that classifies 0 = False and 1 = True to indicate whether a strip search was performed. There is only one dependent variable for this study.

3.3 Data Analysis

The Exploratory Data Analysis was performed on a subset of the original dataset. The new dataset *tbd* comprises 65276 rows and 6 columns, namely, *Perceived_Race, Sex, Age Group, ArrestLocDiv, Occurence_Category* and *StripSearch*. *Occurence_Category* was dropped as it is not relevant to the study at this time. As discussed above, variables *Perceived_Race, Age Group* and *Sex* are the key Predictor Variables and *StripSearch* is the Response Variable. *ArrestLocDiv* is useful as a proxy variable. There are no null or duplicate values.

	Perceived_Race	Sex	Age_group__at_arrest_	ArrestLocDiv	Occurrence_Category	StripSearch
0	White	M	Aged 35 to 44 years	54	Assault & Other crimes against persons	0
1	White	M	Aged 35 to 44 years	54	Assault & Other crimes against persons	0
2	Unknown or Legacy	M	Aged 35 to 44 years	54	Assault & Other crimes against persons	0
3	Black	M	Aged 25 to 34 years	XX	Harassment/Threatening	0
4	South Asian	M	Aged 25 to 34 years	XX	FTA/FTC/Compliance Check/Parollee	0
5	South Asian	M	Aged 25 to 34 years	42	Assault	0
...	...	...	...	...	...	...
65271	Indigenous	F	Aged 25 to 34 years	XX	Vehicle Related	0
65272	South Asian	M	Aged 35 to 44 years	54	Assault	0
65273	White	F	Aged 45 to 54 years	XX	Assault	0
65274	Unknown or Legacy	M	Aged 17 years and under	XX	Robbery/Theft	0
65275	Latino	M	Aged 18 to 24 years	XX	Mischief	0

Table 2. *Subset of "Arrests and Strip Searches (RBDC_ARR_TBL_001)" Dataset*

The following assumptions informed the study:

- The RBDC Strategy is a methodology employed to unpack biases against racial and gender stereotyping that inform policing decisions to conduct strip searches. Its purpose is to facilitate the monitoring, identifying and addressing the practices that perpetuate systemic racism that continue to harm and stigmatize racialized communities; (*Race & Identity Based Data*

Collection Strategy Understanding Use of Force & Strip Searches in 2020 Detailed Report Toronto Police Service. 2022)

- The dataset serves as a tool to identify racist practices perpetuated as a result of prevailing biases in the TPS. It is not intended for the purpose of identification and violation of privacy of individuals in the Service nor is the data collected intended to be used for punishment; (*Race & Identity Based Data Collection Strategy Understanding Use of Force & Strip Searches in 2020 Detailed Report Toronto Police Service*. 2022)
- Racial bias is operationalized by the variable *Perceived_Race* which makes it a key predictor in the analyses;
- Strip searches are not part of "routine procedure";
- The data input for *Perceived_Race* is not acquired through self-identification. According to the accompanying metadata literature and the section on Strip Searches, R*ace & Identity Based Data Collection Strategy Understanding Use of Force & Strip Searches in 2020 Detailed Report Toronto Police Service* (2022), this datapoint is determined and entered by the Officer In Charge;
- It is assumed that *Sex* is confirmed with the offender and can thus be assumed as self-identified. However, according to the literature review, in cases where confirmation is not determined to be reliable, the OIC has the last word on the value selection of the *Sex* of the individual (*Race & Identity Based Data Collection Strategy Understanding Use of Force & Strip Searches in 2020 Detailed Report Toronto Police Service,* 2022)

  Note: there is no explanation in the description of this variable or practice in the accompanying metadata literature.

The following insights were gleaned:

- The mean value of the population *StripSearch* is 0.119787, while its median and IQR values are 0.00. This indicates that there are higher numbers of False values in the dataset than True values. It can be inferred that fewer strip searches were recorded as well as the chances of getting stripsearched were less than probable at that time. This could be attributed to the changes made to the *Search of Persons* policy. (See fig 1 for more information.

Variable	Count	Mean	St.Dev.	Min.	Q1	Med	Q3	Max
Sex	65107	0.1935	0.3954	0.0000	0.0000	0.0000	0.0000	2.0000
ArrestLovDiv	65107	5.0517	5.1194	0.0000	1.0000	2.0000	9.0000	17.0000
StripSearch	65107	0.1198	0.3247	0.0000	0.0000	0.0000	0.0000	1.0000

Table 3. *Descriptive Statistics of dataset tpd*

- The mean value of the population *Sex* is 0.1935, with more males than females who were subjected to strip searches. Note, that the data accounts for all individuals stripsearched using binary classification as explained in the metadata literature. To state emphatically, gender is not captured in the dataset only the sex of the individual is. This can prove to be particularly problematic in cases where an individual may be in transition or undergoing gender reassignment as discussed by Kirkup (2009).
- The correlation matrix in figure 4 indicates that *Sex* of an individual is negatively correlated with the chances of someone being stripsearched. However, the location of where an arrest is made (*ArrestLocDiv*), i.e the locality where a community or racialized population resides, has a positive correlation with *StripSearch*. This finding can be used to attest that the higher number of arrests made in a location lead to the subsequent stripsearches of those arrested resulting in certain groups being over-represented in the data. This information can be used to test whether racial biases towards certain groups in the population result in members of those communities being stripsearched and over-represented as being subjected to strip searches .

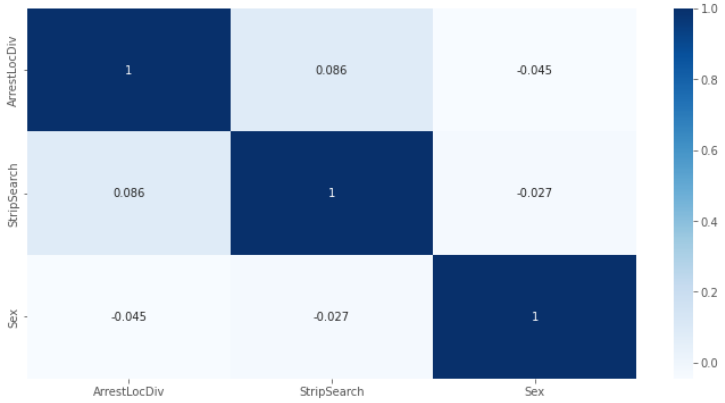

Figure 2. *Correlations Matrix of Numeric Variables*

In conclusion, it can be inferred that while fewer strip searches were recorded, the chances of getting stripsearched were less than probable based on *Sex* of the individual. This could be attributed to the changes made to the *Search of Persons* policy. However, there is the likelihood that the ones that were recorded were influenced by racial bias as is indicated by the correlation between *ArrestLocDiv* and *StripSearch*.

Analysis of Predictor Variable *Perceived_Race*

The bar graph below presents the demographic distribution of racial groups presented in the data. The pairs plot shows the relationships between both categorical and continuous variables.

Each group serves as a level of the categorical variable *Perceived_Race*. White and Black groups have a significantly larger presence, with those identified as White are present nearly twice as much as those identified as Black. However as the pairs plot in fig.6 indicates the Black community is over-represented in arrests and strip searches thereby suggesting an over-representation and a strong case for racial bias. This is because given that the information about an individual's race is used as a key identifier, and is dependent on the perception of the officer, it can be attributed to having significant influence in determining a positive outcome for StripSearch.

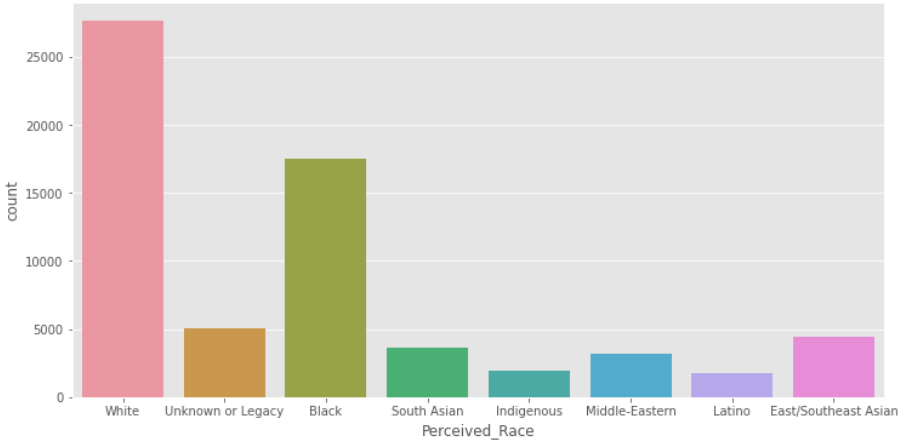

Figure 3. *Bar Graph showing the different levels of Perceived_Race*

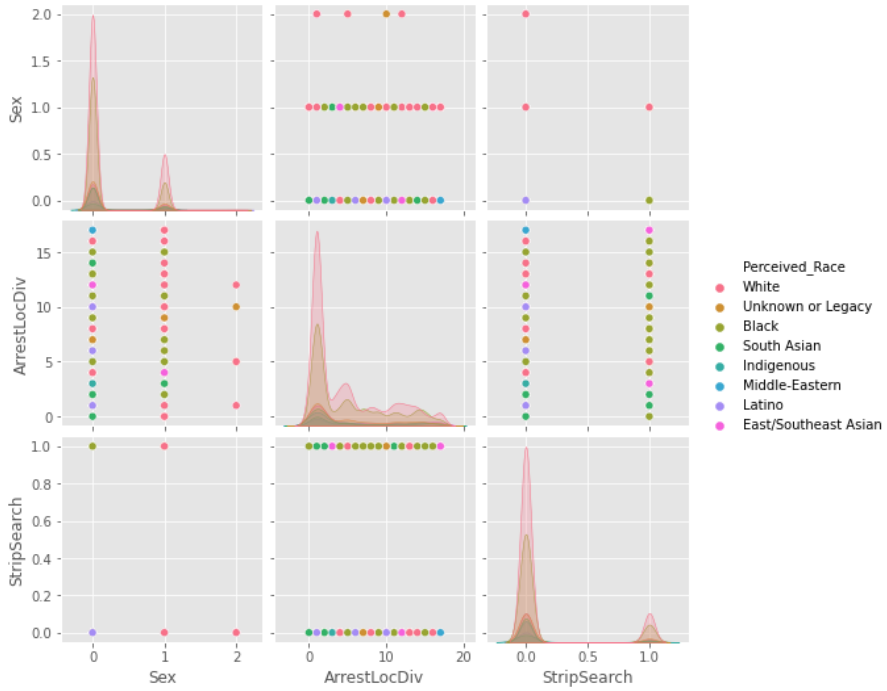

Figure 4. *Pairsplot showing relationships between both Perceived_Race and Sex, ArrestLocDiv and StripSearch variables.*

Indigenous population is under-represented in the data. In that their population count is significantly lower than the Black and White populations yet comparatively over-represented in the StripSearch count. Such a skewed representation is demonstrative of systemic bias resulting in continued stigmatizing and negative stereotyping of communities.

An Analysis of Predictor Variable *Sex*

It can be inferred from the pairs plot in figure 6 nearly twice as many males were arrested as females. It must be pointed out that the differentiation is on the basis of *Sex* and not on the gender of the person. Those identified as Unknown were significantly few. As discussed earlier, *Sex* does not appear to have a significant impact on whether a strip search will be performed as it is negatively correlated. That is, an individual who identifies as ‘Male’ or ‘Female’ has an equal chance of getting stripsearched. The scatterplot below confirms this finding.

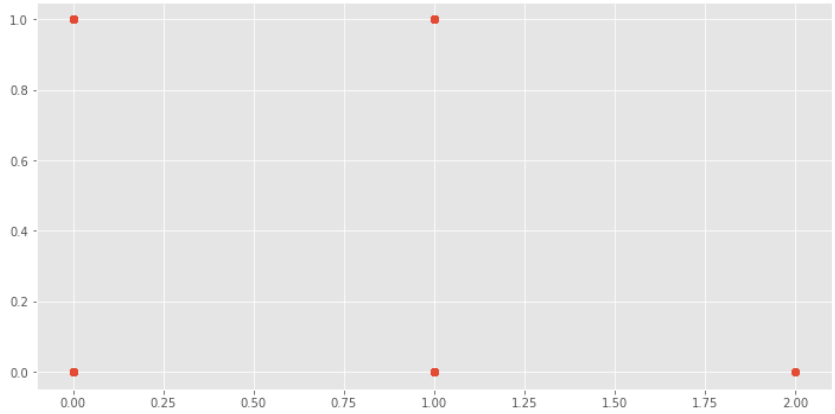

Figure 5. *Scatterplot showing the relationship between Sex and StripSearch*

Analysis for Dependent Variable *StripSearch*

The bar plot and box plots below present the number of strip searches that were performed. While those that were performed were fewer, the times where an arrest led to a strip search is more than 5 times. Note that these are measured against the proxy variable for *Perceived_Race*. Referring back to the pairs plot, a more meaningful analysis indicates that even though the StripSearch counts were fewer, the majority of those stripsearched were identified as Black.

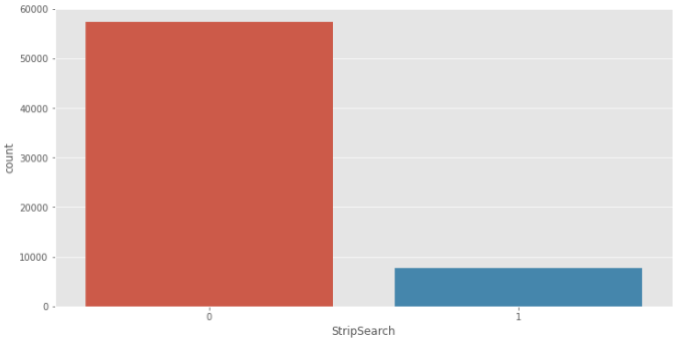

Figure 6. *Bar Graph showing True and False Counts of StripSearch*

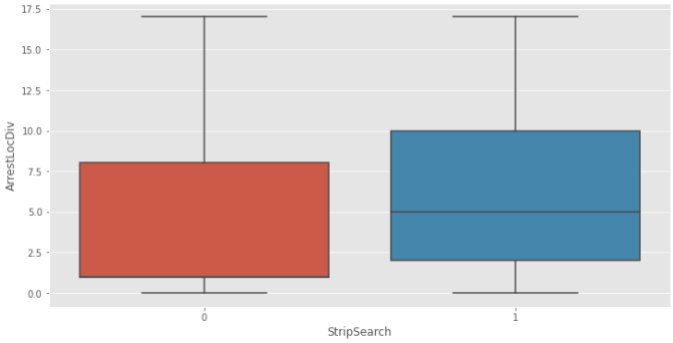

Figure 7. *Boxplot showing values of StripSearch v/s ArrestLocDiv*

From the discussion above it can be concluded that *Perceived_Race* and *Sex* have a significant influence in who is subjected to a stripsearch.

The analysis on *Age Group*

The bar chart analyzed the distribution of individuals across 7 different age groups. The data revealed that Aged under 17 had 2248 individuals, Aged 18 to 24 years had 6430 individuals, Aged 25 to 34 years had 14623 individuals, Aged 35 to 44 years had 11389 individuals, Aged 45 to 54 years had 6412 individuals, Aged 55 to 64 years had 3248 individuals, and Aged over 65 had 881 individuals. The bar chart showed that Aged 25 to 34 years had the highest frequency, followed by Aged 35 to 44 years while Aged under 65 years had the lowest frequency. This suggests that the number of individuals detained in the middle age range of the adult age group is significantly higher than that of the younger and older adult groups. This may indicate that there are more opportunities for individuals in the middle age range to be subjected to strip searches.

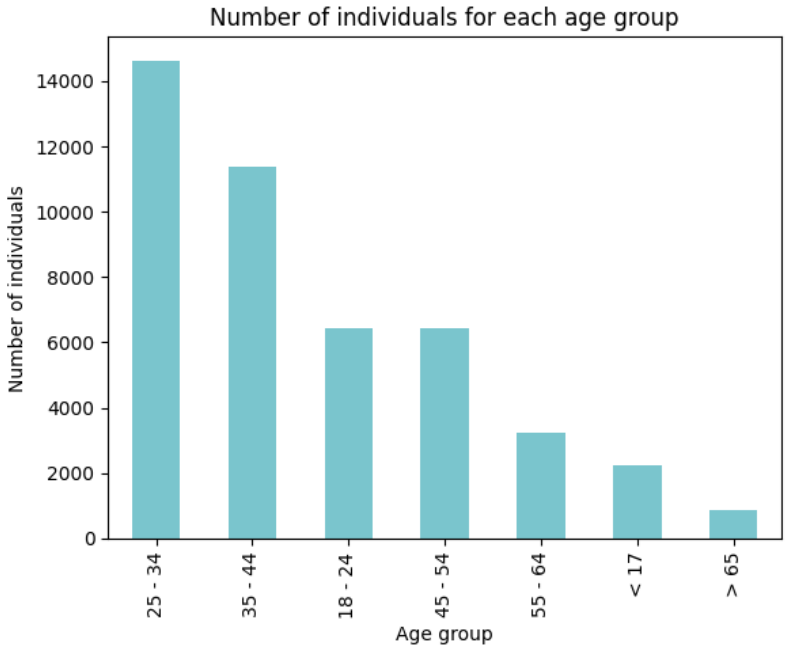

Figure 8. *Number of Individuals for Each Age Group*

The analysis on *Strip Search* frequency by *Age Group* and *Race*

The advanced bar chart displays the frequency of strip searches among different age groups and races, focusing specifically on the White and Black individuals. Each age group bar is colour-

coded to display the number of White and Black individuals who were subjected to strip searches, as well as those who were not.

Based on the data, it is evident that Black individuals under the age of 17 have a higher number of arrests than White individuals. However, due to the low number of cases involving strip searches for young Black individuals, we are unable to obtain more comprehensive information regarding the frequency of strip searches among this group.

In the 18-24 age group, Black individuals have a higher percentage of strip searches (16.96%) compared to White individuals (12.58%). Additionally, Black individuals in this age group have a higher total number of arrests than White individuals. These findings suggest that young Black individuals are more likely to be arrested and subjected to strip searches than their White counterparts.

In the 35-44 age group, the frequency of strip searches is 13.04% for Black individuals and 14.56% for White individuals. Similarly, in the 25-34 age group, the percentage of strip searches for Black individuals is 14.04% compared to 15.44% for White individuals. These patterns suggest that even as the total number of arrests for Black individuals decreases, the frequency of strip searches remains comparable to that of White individuals in these age groups. In the 45-54 age group, the number of arrests for Black individuals is significantly lower than in other age groups, but the frequency of strip searches is still comparable to that of White individuals, with rates of 10.04% and 8.83%, respectively.

Overall, the data suggests that there are disparities in the frequency of strip searches among different age groups and races. While young Black individuals are more likely to be arrested and subjected to strip searches compared to their White counterparts, this discrepancy decreases with age. However, even in older age groups where the total number of arrests for Black individuals is lower, the frequency of strip searches remains comparable to that of White individuals.

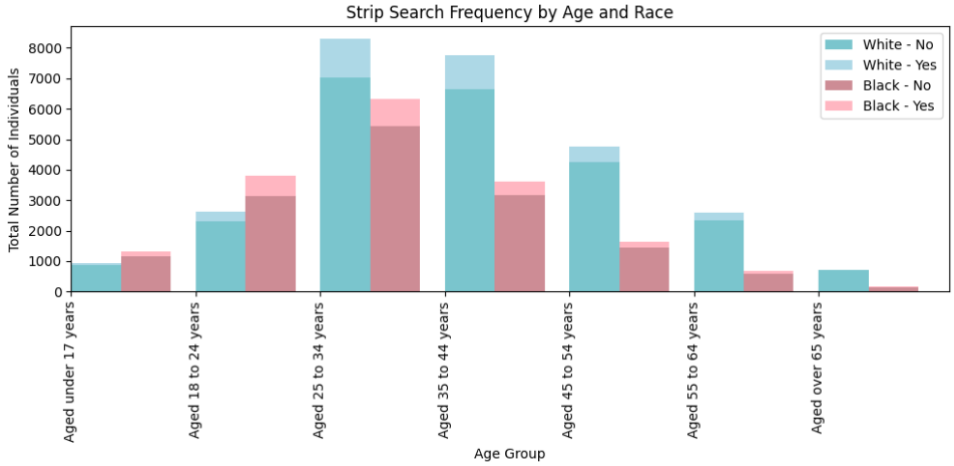

Figure 9. *Strip Search Frequency by Age and Race*

3.4 Power Analysis

A power analysis is a statistical tool used to determine the required sample size to achieve a desired level of statistical power. In our case, a power analysis was conducted to compare our effect size with 3 other standard levels of effect size, namely 0.2, 0.5, and 0.8m,which are benchmarks for interpreting the magnitude of an effect in research.

Prior to conducting a t-test to analyze whether an individual's chance of being strip-searched (outcome variable) differed between White and Black individuals (two-level explanatory variable), we calculated the effect size of the explanatory variable using Cohen's d metrics, which was -0.03, indicating a very small effect. Based on this effect size, we performed a power analysis to determine the required sample size for the analysis with a desired statistical power of 80%.
The power analysis shows that a sample size of 22,118 was needed for White individuals, while a sample size of 13,918 was required for Black individuals. However, the dataset provided a sample size of 27,713 for White individuals and 17,518 for Black individuals, which exceeded the required sample sizes, resulting in a statistical power of 1 for both groups. This indicates that the sample size is sufficient to achieve the desired level of statistical power and the results are reliable for both groups, making it suitable to conduct further tests.

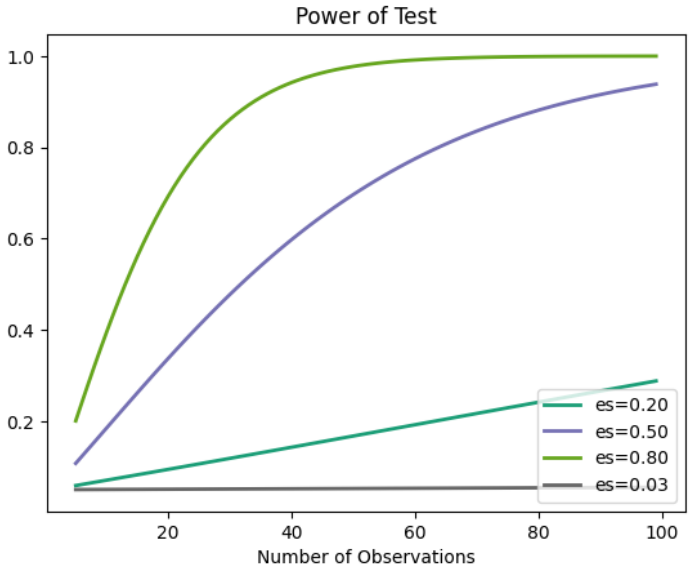

Figure 10. *Power of Tests for Race and Chances of getting Stip Search*

3.5 T-tests

The T-test is a statistical tool utilized to compare the means of two distinct groups. By employing the t test, we can find out whether the two groups exhibit any significant differences. To examine the variables we want to explore, we will conduct a total of five t tests.

Sex(Male, Female) and getting strip search

Our initial inquiry focused on whether there was a discrepancy in the likelihood of undergoing a strip search between female and male. To test our hypothesis, we formulated the following statements:

Null hypothesis (H0): on average, there is no discernible difference in the probability of a strip search occurring between males and females.

Alternative hypothesis (H1): on average, there is a difference between the sexes in the chance of undergoing a strip search.

Upon analyzing the t test results, we obtained a p-value of 4.3e-13. This value is much smaller than the significance level of 0.05, indicating that we can reject the null hypothesis with a high degree of certainty. Therefore, we can confidently state that there is a true difference in means between the sexes regarding the likelihood of a strip search occurring. Note this finding is different from that presented by the scatterplot in fig. 8.

Perceived race(White, Black) and strip search

Our second investigation examines whether there is a variation in the likelihood of a strip search between white individuals and black individuals. To test our hypothesis, we formulated the following statements:

Null hypothesis (H0): On average, white individuals and black individuals DO NOT differ in the chance of getting strip search.

Alternative hypothesis(H1): On average, white individuals and black individuals DO differ in the chance of getting strip search.

After analyzing the t test output, we obtained a p-value of 0.0019. This value is lower than the significance level of 0.05, indicating that we can reject the null hypothesis with a high degree of confidence. Therefore, we can confidently state that there is a genuine difference in means between white individuals and black individuals regarding the likelihood of undergoing a strip search.

Perceived race(Indigenous, Black) and strip search

Our third investigation aims to determine if there is a difference in the probability of a strip search occurring between indigenous individuals and black individuals. To test our hypothesis, we created the following statements:

Null hypothesis (H0): On average, indigenous individuals and black individuals DO NOT differ in the chance of getting strip search.

Alternative hypothesis(H1): On average, indigenous individuals and black individuals DO differ in the chance of getting strip search.

Upon examining the t test results, we obtained a p-value of 0.026. This value is smaller than the significance level of 0.05, indicating that we can reject the null hypothesis and state that there is a difference in means between indigenous individuals and black individuals regarding the likelihood of a strip search occurring.

Black Male and Black Female and getting strip search

Our final investigation is focused on determining if there is a difference in the likelihood of a strip search occurring between black female individuals and black male individuals. To test our hypothesis, we formulated the following statements:

Null hypothesis (H0): On average, black female individuals and black male individuals DO NOT differ in the chance of getting strip search.

Alternative hypothesis(H1): On average, black female individuals and black male individuals DO differ in the chance of getting strip search.

Upon analyzing the t test output, we obtained a p-value of 1.62e-28. This value is way smaller than the significance level of 0.05, indicating that we can reject the null hypothesis with a high level of

confidence. Therefore, we can confidently state that there is a difference in means between black female individuals and black male individuals regarding the likelihood of undergoing a strip search.

By grouping the 7 age categories into 3 distinct groups, it may be easier to compare and contrast the patterns and trends between different groups, rather than analyzing each age group separately. In this case, combining age under 17 and age 18-24 into a "young" age group, age 25 to 54 years into a "median" age group and age above 55 years into a "older" age group can be useful for identifying whether certain age groups are more likely to be subjected to strip searches.

"Young" age group and "Median" age group and getting strip search

Our subsequent inquiry focused on whether there was a discrepancy in the likelihood of undergoing a strip search between "young" and "median" age group. To test our hypothesis, we formulated the following statements:

Null hypothesis (H0): On average, "young" and "median" age groups DO NOT differ in the chance of getting strip search.

Alternative hypothesis(H1): On average, "young" and "median" age groups DO differ in the chance of getting strip search.

Upon analyzing the t test results, we obtained a p-value of 0.67. This value is much larger than the significance level of 0.05, indicating that we fail to reject the null hypothesis. Therefore, we can confidently state that there is no significant difference in means between "young" and "median" age group regarding the likelihood of a strip search occurring.

"Young" age group and "Older" age group and getting strip search

Our subsequent inquiry focused on whether there was a discrepancy in the likelihood of undergoing a strip search between "young" and "older" age group. To test our hypothesis, we formulated the following statements:

Null hypothesis (H0): On average, "young" and "older" age groups DO NOT differ in the chance of getting strip search.

Alternative hypothesis(H1): On average, "young" and "older" age groups DO differ in the chance of getting strip search.

Upon analyzing the t test results, we obtained a p-value of 3.75e-26. This value is much smaller than the significance level of 0.05, indicating that we can reject the null hypothesis with a high degree of certainty. Therefore, we can confidently state that there is true significant difference in means between “young” and “older” age group regarding the likelihood of a strip search occurring. The t-statistics value is 10.61 which indicates the “young” age group is significantly more likely to undergo a strip search compared to the “older” age group.

“Median” age group and “Older” age group and getting strip search

Our subsequent inquiry focused on whether there was a discrepancy in the likelihood of undergoing a strip search between “median” and “older” age group. To test our hypothesis, we formulated the following statements:

Null hypothesis (H0): On average, “median” and “older” age groups DO NOT differ in the chance of getting strip search.

Alternative hypothesis(H1): On average, “median” and “older” age groups DO differ in the chance of getting strip search.

Upon analyzing the t test results, we obtained a p-value of 1.58e-39. This value is much smaller than the significance level of 0.05, indicating that we can reject the null hypothesis with a high degree of certainty. Therefore, we can confidently state that there is true significant difference in means between “median” and “older” age group regarding the likelihood of a strip search occurring. The t-statistics value is 13.25 which indicates the “median” age group is significantly more likely to undergo a strip search compared to the “older” age group.

In conclusion, the results of our t tests demonstrate that there is a statistically significant difference in the likelihood of a strip search occurring depending on the sex , age group and race of the individuals involved. These findings suggest that there may be bias and discrimination present in the strip search practices of the population under study. Further investigation and intervention may be necessary to address and rectify these issues.

Results

For our study, we utilized various statistical analyses to address our research questions. Specifically, we employed two one-way ANOVA tests to investigate the first two research questions, one two-way ANOVA test for the third research question, a Logistic Regression for the fourth research question, and an ANCOVA test for the final research question.

4.1 One-way ANOVA Test

Using one-way ANOVA tests to see if there is a significant difference between sex and getting strip search and perceived race and strip search, we were able to address answers for the first research question. The null hypothesis in this context posits that the average of getting strip searched is the same across all categories of independent variables, namely sex and perceived race. On the other hand, the alternative hypothesis proposes that there exists a difference in at least one mean from the others.

Upon conducting our study, we found a statistically significant difference in the mean of receiving a strip search based on sex ($F(2) = 24.3$, $p < 0.001$). Further examination via a Tukey post-hoc test exposed significant pairwise difference between female and male, with an average difference of 0.001 bushels/acre ($p < 0.01$). However, there was no statistical difference in the mean of getting stripsearched between female and unknown and male and unknown.

The results of our statistical analysis show that there is a statistically significant difference in the mean rates of individuals receiving strip searches based on their perceived race. Specifically, our analysis revealed that the mean rates of strip searches differed significantly across racial groups ($F(7) = 55.2$, $p < 0.001$). To further explore these differences, we conducted a Tukey post-hoc test to compare the pairwise mean differences between the racial groups. Our analysis revealed that there were statistically significant differences in the mean rates of receiving a strip search between Black and Asian individuals ($p = 0.001$), Black and White individuals ($p < 0.05$), Indigenous and White individuals ($p < 0.01$), Indigenous and Asian individuals ($p = 0.001$), Latino and White individuals ($p = 0.001$), and Asian and White individuals ($p = 0.001$). These findings suggest that

these groups experience different rates of strip searches based on their perceived race. However, our analysis also revealed that there was no statistically significant difference in the mean rates of receiving a strip search between Asian and Eastern individuals and between Black and Indigenous individuals, as the p-values were 0.9, which are much larger than the significance level of 0.05. Therefore, we cannot conclude that there is a significant difference in the mean rates of strip searches between these two groups.

4.2 Two-way ANOVA Test

In our study, we aimed to investigate the influence of both gender and perceived race on the likelihood of being subjected to a strip search by police officers. To analyze the data, we conducted a two-way ANOVA test, which allowed us to assess the impact of both variables on the outcome of interest. Our findings indicate that there was a significant interaction between *Perceived_Race* and *Sex*, as evidenced by the p-value being much lower than the level of significance set at 0.01.

To further explore the relationship between the variables, we carried out Tukey post-hoc tests, which were similar to the ones we performed in the one-way ANOVA analysis. Our results confirmed that there is a statistically significant difference between *Perceived_Race* and *Strip Search*, as well as between *Sex* and *StripSearch*.

While the two-way ANOVA did not provide any new substantial information, we constructed an interaction plot below to visually depict the relationship between *Perceived_Race*, *Sex*, and the likelihood of being strip-searched. Our analysis of the plot showed that the Indigenous and Black group had the highest mean rate of being strip-searched by police officers, followed by Black males.

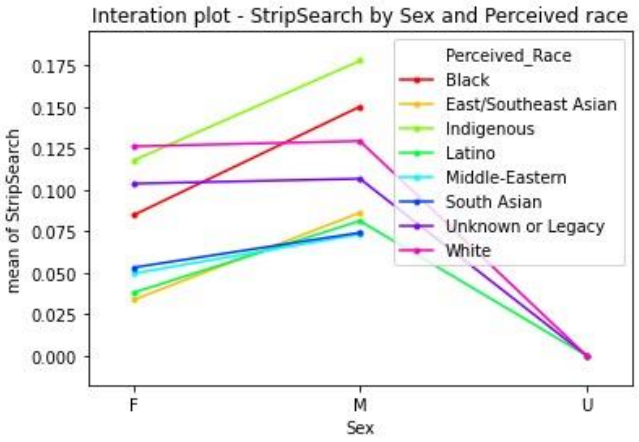

Figure 11. *Interaction plot - StripSearch by Sex and Perceived Race*

4.3 ANCOVA Test

The ANCOVA test was conducted to determine whether there is a significant relationship between the chance of getting strip searched and race (White and Black), while controlling for the effects of age groups. The null hypothesis for ANCOVA is that there is no significant effect of getting strip searched on the race, after controlling for age groups. The alternative hypothesis would be that there is a significant relationship between getting strip search and race, while controlling for age groups.

The ANCOVA results show that there is no significant effect of race on the chance of getting strip searched, after controlling for age groups. The small effect size (np2 = 0.000018) and the non-significant p-value (p-unc = 0.3635) suggest that the difference in the chance of getting strip searched between White and Black individuals, while controlling for age groups, is not statistically significant.

The ANCOVA results reveal that age has a significant impact on the likelihood of being strip searched, regardless of race. The large effect size (np2 = 0.0017) and highly significant p-value (p-unc = 1.858e-18) indicate that certain age groups have a higher chance of being strip searched compared to others. It is important to note that these findings underscore the importance of controlling for age when examining the relationship between strip searches and race, as the presence of confounding variables can skew results and lead to inaccurate conclusions. By

controlling for age, we are able to accurately evaluate the relationship between strip searches and race.

Overall, these results suggest that while age may play a role in the chance of getting strip searched, race does not have a significant effect on the chance of getting strip searched after controlling for age groups.

After the ANCOVA test, we created an interaction plot to explore the relationship between race and strip search in different age groups. The x-axis represents seven different age groups, and the y-axis shows the mean of strip search. The plot includes two lines, one for Black individuals and the other for White individuals, represented in two different colors. The non-parallel lines indicate that the effect of race on the likelihood of getting strip searched may vary across different age groups.

The plot shows that Black individuals under 24 years old and those over 45 years old had a higher chance of being subjected to strip searches compared to White individuals in the same age groups. However, the only age range where Black individuals experienced lower chances of being strip searched was between 25 and 44 years old, which is a relatively narrow age range of only 19 years. These findings suggest that age and race may both play a role in determining the likelihood of being strip searched, with age having a more consistent effect.

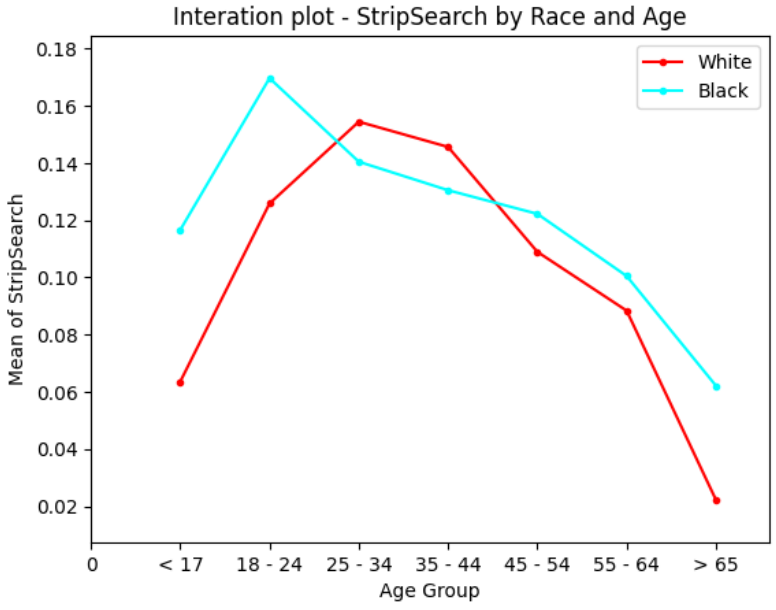

Figure 12. *Interaction plot - StripSearch by Race and Age Group*

4.4 Logistic Regression

The objective of this logistic regression analysis is to investigate the potential association between an individual's likelihood of being subjected to a strip search and a set of independent variables, namely age, race, and sex. The goal is to determine the degree to which these factors may impact the probability of a strip search and to assess the direction and strength of any such associations.

The logistic regression results suggest that there is a significant relationship between the likelihood of being strip searched and the sex and age of an individual, but not their race.

For the Sex feature, the coefficient for Sex[T.M] is 0.2476, which means that males have a higher log odds of being strip searched than females. The coefficient is positive, which indicates that being male is associated with an increased likelihood of being strip searched. Since the odds ratio is 1.283244 and 95% CI falls in between 1.180888 and 1.394473, which is higher than 1, this means that the odds of being strip searched for males are 1.283244 times the odds of being strip searched for females while holding all other variables constant.

For the Age group, the coefficient is -0.1010, which means that for every one group increase in age, there is a decrease in the log odds of being strip searched. The coefficient is negative, which indicates that older individuals are less likely to be strip searched than younger individuals. The odds ratio is indicated 0.896793 and 95% CI falls in between 0.874816 and 0.919322, which means that for every one group increase in age, the odds of being strip searched decrease by a factor of 0.896793, while holding all other variables constant.

For Race, the coefficient is 0.01, but it is not statistically significant as the p-value($p > |z| = 0.732$) is larger than the significant level of 0.05. Therefore, the analysis did not find a significant relationship between race and the likelihood of being strip searched. The odds ratio is 1.016666 and 95% CI falls in between 0.95138 and 1.086433 which means that the odds of being strip searched for Black individuals are 1.016666 times the odds of being strip searched to the white individuals. However, this coefficient is not statistically significant.

Finally, the Pseudo R-squared value is 0.003815, which suggests that the model explains only a small amount of the variation in the likelihood of being strip searched. However, the Log-Likelihood Ratio (LLR) p-value is very small (4.373e-29), indicating that the model as a whole is statistically significant. These results suggest that while race may not be a significant predictor of being strip searched, sex and age are important factors to consider in determining the likelihood of being subject to a strip search.

Optimization terminated successfully.
Current function value: 0.389932
Iterations 6

Logit Regression Results

Dep. Variable	Strip Search	No. Observations	45226
Model	Logit	Df Residuals:	45222
Method	MLE	Df Model	3
Date	Sun, 16 Apr 2023	Pseudo R-squ	0.003815
Time	23:22:18	Log-Likelihood	-17703
Converged	TRUE	LL-Null	-17703
Covariance Type	nonrobust	LLR p-value	4.373e-29

	coef	**std err**	**z**	**p > |z|**	**[0.025**	**0.975]**
Intercept	-1.7263	0.052	-33.298	0.000	-1.828	-1.625
Race[T.2]	0.01	0.029	0.343	0.732	-0.047	0.067
Sex[T.M]	0.2476	0.037	6.768	0.000	0.176	0.319
Age	-0.1010	0.011	-9.22	0.000	-0.122	-0.080

Table 4. *Logistic Regression Results*

The odds ratio of the Logistic Regression Coefficien	
Intercept	0.181538
Race[T.Black]	1.016666
Sex[T.M]	1.283244
Age	0.896793

Table 5. *The odds ratio of the Logistic Regression Coefficient*

A confusion Matrix then conducted to evaluate the performance of a binary classification model. It compares the predicted values with the actual values and shows the number of true positives, true negatives, false positives, and false negatives. The True Positive (TP) is the model correctly predicted that the individual would be strip searched. The True Negative (TN) is the model correctly predicted that the individual would not be strip searched. The False Positive (FP) is the

model predicted that the individual would be strip searched, but they were not actually strip searched. And the False Negative (FN) is the model predicted that the individual would not be strip searched, but they were actually strip searched. Moreover, the model has a test accuracy of 87%, which means that 87% of the predictions made by our model on the test dataset is accurate.

Confusion Matrix	
9794	0
1513	0

Test accuracy: 0.8661890864066507

Table 5. *Confusion Matrix*

The prediction interval plot represents the predicted probability of an outcome based on a logistic regression analysis with the independent variable Age Group and the dependent variable Strip Search. The predicted probability curve, which is the blue line shown in the plot, demonstrates the relationship between the probability of the outcome (Strip Search) and the Age Group variable. The prediction interval, which is the green shaded part, represents the range of values within which a future observation is likely to fall 95% of the time, given the value of chances of getting Strip Search. The width of the interval reflects the level of uncertainty, with wider intervals indicating greater uncertainty.

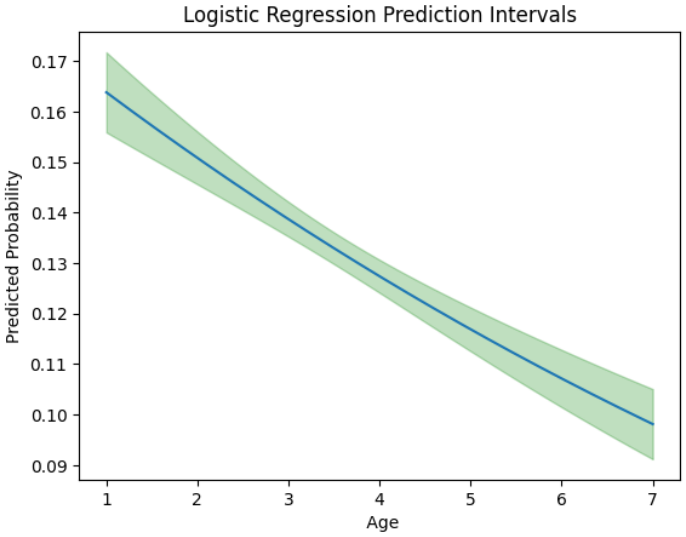

Figure 13. *Prediction Intervals*

Discussion

To address our first research question, we conducted a statistical analysis using a one-way ANOVA test to examine the association between gender and the likelihood of undergoing a strip search. The results of the analysis showed a significant difference in the mean values of strip searches received based on sex, with males having a greater chance of being subjected to strip searches than females. This suggests that male individuals were disproportionately impacted by police officers in terms of strip search practices.

Moving on to our second research question regarding the relationship between *Perceived_Race* and *StripSearch,* we conducted another one-way ANOVA test. The results of this analysis showed that the mean rates of *StripSearch* differed significantly across racial groups. The Tukey hsd results revealed statistically significant differences between various racial groups, with Black and Asian individuals, Black and White individuals, Asian and White individuals, and Indigenous and other race groups showing significant differences in mean rates. These findings suggest that strip searches are racially biased, with some racial groups, such as Black individuals, being disproportionately impacted by police officers.

Moving on, a two-way ANOVA was performed to answer our third research question about the impact of the interaction of *Sex* and *Perceived_Race* on the likelihood of undergoing a strip search. The analysis revealed a significant interaction between *Perceived_Race* and *Sex*, with Indigenous males and Black males having the high mean rates of being strip-searched by police officers. These findings provide valuable insights into the possible disproportionate impact of perceived race and sex on police officers' decisions to conduct strip searches.

Fourth research question was answered with the ANCOVA test, the test found that race does not have a significant effect on the likelihood of being subjected to a strip search, after controlling for age groups. This suggests that law enforcement agencies may not be engaging in racial profiling when performing strip searches. However, the interaction plot showed that Black individuals under 24 years old and those over 45 years old had a higher chance of being subjected to strip searches

compared to White individuals in the same age groups. These findings highlight the need for continued monitoring and evaluation of the use of strip searches, particularly in regards to the potential for age and race-based disparities.

Finally, the logistic regression model was to answer the last research question. It provided valuable insights into the factors that may influence the likelihood of being strip searched, including sex, age group, and race. While being male and younger were found to be associated with an increased likelihood of being strip searched, the analysis did not find a significant relationship between race and the likelihood of being strip searched. Furthermore, the confusion matrix provides a useful tool for evaluating the performance of the binary classification model. The high test accuracy of 87% suggests that the model is effective in predicting whether an individual will be strip searched or not.

These findings have important implications for law enforcement agencies and policymakers, who may need to revisit their policies and procedures related to the use of strip searches.

Limitations and Future Work

Although the dataset from Toronto Police Service regarding arrests and strip searches provides valuable information for research and analysis, there are several limitations to consider.

First, the dataset contains information only about individuals arrested and strip-searched by Toronto Police Service officers, which may not be representative of the population as a whole (ie. Services across Canada). The data set cannot be used to draw conclusions about the prevalence of strip-searches or arrest rates in the wider population. Also, the data set covers only a limited time range from 2020 to 2021, and only includes data from the Toronto Police Service. As a result, this data set may not be generalizable to other police forces or more recent time periods.

Second, the majority of the variables in this dataset are categorical, which may present certain limitations in terms of identifying meaningful relationships and patterns in the data. Numerical variables can provide a more nuanced and detailed understanding of the data. But in this case, most of the variables in this dataset are categorical, the options for conducting exploratory data analysis (EDA) are somewhat limited. For example, certain types of visualizations such as box plots and line graphs require descriptive statistics such as mean and standard deviation, which may not be available for this dataset especially for key predictor variables such as *Perceived_Race*.

Third, although this study investigated several variables and generated five research questions, it may not account for all the potentially influencing factors. As the issue of strip searches by police officers is complex, there could be other factors beyond the ones investigated in this study that may also play a role. Therefore, future research can investigate the relationship between strip searches and other factors such as the severity of the offense, the location of the arrest, or the time of day. By examining these factors in conjunction with age, we may gain a more nuanced understanding of the likelihood of strip searches among different groups. Such research can provide policymakers and law enforcement agencies with a more comprehensive picture of the underlying factors that contribute to strip searches and help them develop policies and guidelines that ensure the fair and equitable treatment of all individuals.

Fourth, the t-test result for Black and Indigenous individuals suggests that there is a significant difference between the mean rates of strip searches received by these two groups. However, the Tukey HSD test, which compares mean rates across multiple groups, did not find a significant difference between Black and Indigenous individuals. While the p-values for both tests are close to 0.05, it is important to conduct further studies to obtain a more accurate conclusion.

Fifth, the last research question of the study only focused on two racial categories, White and Black. This limited scope may not accurately capture the experiences of individuals from other racial and ethnic groups. Further research could be conducted to examine the potential biases in the strip search process. For example, are individuals from certain racial or ethnic backgrounds more likely to be subjected to strip searches? Exploring these questions could help identify potential issues in the current process and could lead to recommendations for improving the fairness and effectiveness of the strip search process.

Sixth, as the True Negative and False Positive for the confusion matrix are zero resulting the f1 score equals to 0 which means that the model did not predict any negative instances in the test dataset. This could be due to an imbalanced dataset where the positive class dominates the data, or there could be an issue with the model's training or evaluation process. In this case, I would be considering investigating the dataset and the model's performance thoroughly, considering using techniques such as oversampling or undersampling to handle.

Furthermore, the study is limited by the potential for measurement error. The data was collected through self-report, which may not always be accurate. Additionally, the accuracy of the age reported by the individuals may be questionable. This may have led to inaccurate classification of individuals into age groups and affected the results of the study.

Therefore, the results of this study should be interpreted with caution and further research may be needed to fully understand the relationships between gender, race, and strip searches.

Conclusion

The study's objective is to examine the connections between the likelihood of being subjected to a strip search and the independent variables of *Perceived_Racc, Age Group* and *Sex*. The dataset used is the Arrests and Strip Searches dataset from the Toronto Police Service Public Safety Data Portal. The EDA provides a quick overview of the dataset, with analyses conducted on each variable of interest and visual aids such as pairs plots and box plots. The t-tests demonstrate significant gender and racial differences in the likelihood of being strip-searched, which suggest potential discrimination and bias in the strip search practices under study. The statistical analysis results indicate that males are more likely to undergo strip searches than females, and certain racial groups, such as Black individuals, are more likely to be subjected to strip searches than White and Asian individuals. Additionally, the study reveals a significant interaction between perceived race and gender concerning the likelihood of strip searches. Although it would be inaccurate and inappropriate to attribute the chance of being strip-searched solely to race and gender, since many other factors may impact an officer's decision, including the location, time of day, and potential weapons, for instance. All relevant variables must be considered to arrive at a sound conclusion. Furthermore, age group may be a confounding factor in this relationship, highlighting the need for continued monitoring and evaluation of the use of strip searches in different age groups. Nonetheless, the research suggests potential racial bias, highlighting the importance of conducting strip searches in a just and impartial manner, free from discrimination or bias.

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List of Appendices

Table 1. *Descriptive Statistics (N = 65275).*

	Arrest_Year	Arrest_Month	EventID	ArrestID	PersonID	Perceived_Race	Sex
0	**2020**	July-Sept	1005907	6017884	326622	White	M
1	**2020**	July-Sept	1014562	6056669	326622	White	M
2	**2020**	Oct-Dec	1029922	6057065	326622	Unknown or Legacy	M
3	**2021**	Jan-Mar	1052190	6029059	327535	Black	M
4	**2021**	Jan-Mar	1015512	6040372	327535	South Asian	M
5	**2021**	Apr-June	1019145	6060688	327535	South Asian	M
…	…	…	…	…	…	…	…
65271	**2021**	Oct-Dec	1055609	6044336	316123	Indigenous	F
65272	**2021**	Oct-Dec	1032758	6031692	307736	South Asian	M
65273	**2021**	Oct-Dec	1021067	6064396	324057	White	F
65274	**2021**	Oct-Dec	1008998	6008662	331870	Unknown or Legacy	M
65275	**2021**	Oct-Dec	1033395	6032145	310583	Latino	M

Table 2. *Subset Dataset of Descriptive Statistics (N = 65275).*

	Perceived_Race	Sex	Age_group__at_arrest_	ArrestLocDiv	Occurrence_Category	StripSearch
0	White	M	Aged 35 to 44 years	54	Assault & Other crimes against persons	0
1	White	M	Aged 35 to 44 years	54	Assault & Other crimes against persons	0
2	Unknown or Legacy	M	Aged 35 to 44 years	54	Assault & Other crimes against persons	0
3	Black	M	Aged 25 to 34 years	XX	Harassment/Threatening	0
4	South Asian	M	Aged 25 to 34 years	XX	FTA/FTC/Compliance Check/Parollee	0
5	South Asian	M	Aged 25 to 34 years	42	Assault	0
…	…	…	…	…	…	…
65271	Indigenous	F	Aged 25 to 34 years	XX	Vehicle Related	0
65272	South Asian	M	Aged 35 to 44 years	54	Assault	0
65273	White	F	Aged 45 to 54 years	XX	Assault	0
65274	Unknown or Legacy	M	Aged 17 years and under	XX	Robbery/Theft	0
65275	Latino	M	Aged 18 to 24 years	XX	Mischief	0

Table 3. *Dataset tpd*

Variable	Count	Mean	St.Dev.	Min.	Q1	Med	Q3	Max
Sex	65107	0.1935	0.3954	0.0000	0.0000	0.0000	0.0000	2.0000
ArrestLovDiv	65107	5.0517	5.1194	0.0000	1.0000	2.0000	9.0000	17.0000
StripSearch	65107	0.1198	0.3247	0.0000	0.0000	0.0000	0.0000	1.0000

Table 4. *One - way ANOVA*

Sex

Source of Variance	Sum of Squares	df	F	Sig.
Between Groups	5.1	2	24.3	2.9e-11 ***
Within Groups	6863.6	65273		
Total	6868.7	65275		

Table 5. *Tukey multiple comparisons of means*

95% family-wise confidence level

group1	group2	meandiff	p-adj	lower	upper	reject
F	M	0.0221	0.001	0.0146	0.0296	TRUE
F	U	-0.1017	0.6055	-0.3551	0.1517	FALSE
M	U	0.1238	0.4879	-0.3771	0.1296	FALSE

Table 6. *One - way ANOVA*

Perceived_Race

Source of Variance	Sum of Squares	df	F	Sig.
Between Groups	40.4	7	55.2	3.8e-79 ***
Within Groups	6827.5	65264		
Total	6867.9	65271		

Table 7. *Tukey multiple comparisons of means*

95% family-wise confidence level

group1	group2	meandiff	p-adj	lower	upper	reject
Black	Asian	-0.06	0.001	-0.08	-0.04	TRUE
Black	White	-0.01	0.0229	-0.02	-0.0008	TRUE
Indigenous	White	-0.03	0.0025	-0.05	-0.0065	TRUE
Indigenous	Asian	-0.09	0.001	-0.11	-0.06	TRUE
Latino	Asian	-0.003	0.9	-0.032	0.0249	FALSE
Latino	White	0.054	0.001	0.03	0.08	TRUE
Asian	White	0.06	0.001	0.04	0.07	TRUE

Table 8. *ANCOVA Test*

Source	SS	DF	F	p-unc	np2
Race	0.095221097	1	0.829140932	0.362525908	1.83E-05
Age	8.83161745	1	76.90160879	1.86E-18	0.001697424
Residual	5194.122728	45228	NaN	NaN	NaN

OLS Regression Results

Dep. Variable:	StripSearch	R-squared:	0.002
Model:	OLS	Adj. R-squared:	0.002
Method:	Least Squares	F-statistic:	43.38
Date:	Sun, 16 Apr 2023	Prob (F-statistic):	1.51e-19
Time:	18:25:54	Log-Likelihood:	-15234.
No. Observations:	45231	AIC:	3.047e+04
Df Residuals:	45228	BIC:	3.050e+04
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	0.1703	0.005	32.987	0.000	0.160	0.180
Race[T.2]	0.0031	0.003	0.911	0.363	-0.004	0.010
Age	-0.0108	0.001	-8.769	0.000	-0.013	-0.008

Omnibus:	17379.181	Durbin-Watson:	1.747
Prob(Omnibus):	0.000	Jarque-Bera (JB):	48675.239
Skew:	2.159	Prob(JB):	0.00
Kurtosis:	5.679	Cond. No.	13.9

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

Table 9. *Logistic Regression Results*

Optimization terminated successfully.
Current function value: 0.389932
Iterations 6

Logit Regression Results

Dep. Variable	Strip Search	No. Observations	45226
Model	Logit	Df Residuals:	45222
Method	MLE	Df Model	3
Date	Sun, 16 Apr 2023	Pseudo R-squ	0.003815
Time	23:22:18	Log-Likelihood	-17703
Converged	TRUE	LL-Null	-17703
Covariance Type	nonrobust	LLR p-value	4.373e-29

	coef	**std err**	**z**	**p > |z|**	**[0.025**	**0.975]**
Intercept	-1.7263	0.052	-33.298	0.000	-1.828	-1.625
Race[T.2]	0.01	0.029	0.343	0.732	-0.047	0.067
Sex[T.M]	0.2476	0.037	6.768	0.000	0.176	0.319
Age	-0.1010	0.011	-9.22	0.000	-0.122	-0.080

Table 10. *The odds ratio of the Logistic Regression Coefficient*

The odds ratio of the Logistic Regression Coefficien	
Intercept	0.181538
Race[T.Black]	1.016666
Sex[T.M]	1.283244
Age	0.896793

Table 11. *Confusion Matrix*

Confusion Matrix	
9794	0
1513	0

Test accuracy: 0.8661890864066507

Appendix 2

A: Distribution by Perceived_Race

```
# check distribution of values
tpd.Perceived_Race.value_counts()
```

```
White                   27723
Black                   17526
Unknown or Legacy        5056
East/Southeast Asian     4415
South Asian              3613
Middle-Eastern           3237
Indigenous               1934
Latino                   1768
Name: Perceived_Race, dtype: int64
```

```
#tpd['Perceived_Race'] = pd.factorize(tpd['Perceived_Race'])[0]
```

```
# calculate percentage of Perceived_Race
tpd.Perceived_Race.value_counts(normalize=True)
```

```
White                   0.424730
Black                   0.268507
Unknown or Legacy       0.077460
East/Southeast Asian    0.067640
South Asian             0.055353
Middle-Eastern          0.049592
Indigenous              0.029630
Latino                  0.027087
Name: Perceived_Race, dtype: float64
```

B: Datatypes of each variable in subset tpd

```
Perceived_Race          object
Sex                      int64
ArrestLocDiv             int64
Occurrence_Category     object
StripSearch              int64
dtype: object
```

C: ArrestLocDiv factorization

```
t[19]: XX    29643
       51     5025
       14     3117
       41     2640
       43     2607
       52     2340
       31     2266
       32     2088
       12     1902
       22     1849
       42     1846
       11     1789
       23     1738
       55     1552
       54     1437
       53     1376
       13     1102
       33      955
       Name: ArrestLocDiv, dtype: int64

[20]:  1 tpd.ArrestLocDiv.isnull().sum()
t[20]: 0

[21]:  1 # step 3: factorize ArrestLocDiv to change from object to int (XX to a numeric value
       2 tpd['ArrestLocDiv'] = pd.factorize(tpd['ArrestLocDiv'])[0]

[22]:  1 tpd.ArrestLocDiv.unique()
t[22]: array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
              17])

[23]:  1 # step 4: check if XX is changed to numeric value
       2 tpd.ArrestLocDiv.value_counts()
t[23]: 1     29643
       5      5025
       4      3117
       11     2640
       14     2607
       3      2340
       7      2266
       17     2088
       9      1902
       12     1849
       2      1846
       8      1789
       15     1738
       13     1552
       0      1437
       6      1376
       10     1102
       16      955
       Name: ArrestLocDiv, dtype: int64
```

Figure 2. *Correlations Matrix of Numeric Variables*

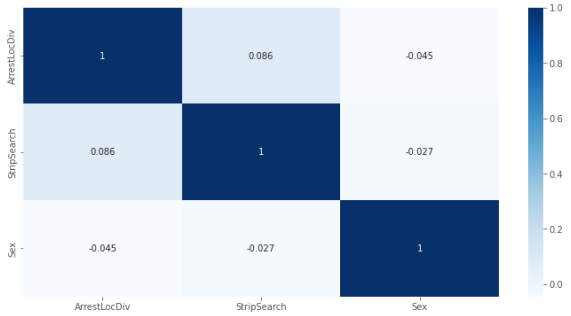

Figure 3. *Bar Graph showing the different levels of Perceived_Race*

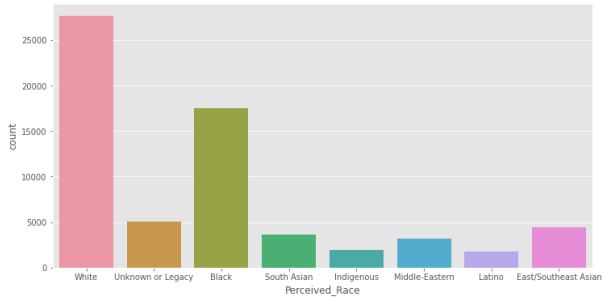

Figure 4. *Pairsplot showing relationships between both Perceived_Race and Sex, ArrestLocDiv and StripSearch variables.*

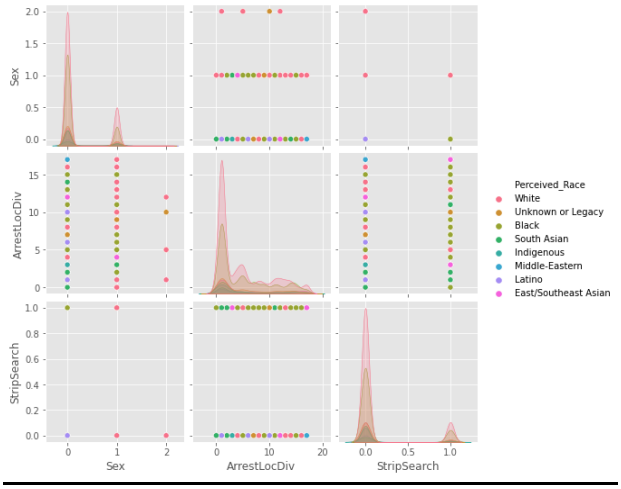

Figure 5. *Scatterplot showing the relationship between Sex and StripSearch*

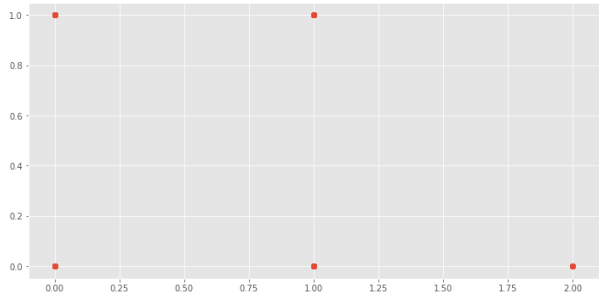

Figure 6. *Bar Graph showing True and False Counts of StripSearch*

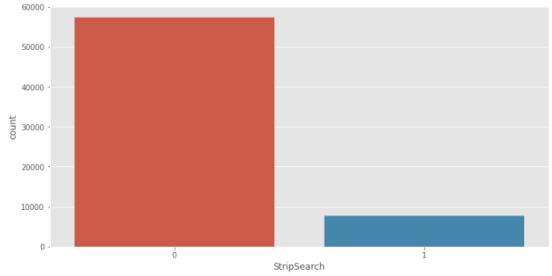

Figure 7. *Boxplot showing values of StripSearch v/s ArrestLocDiv*

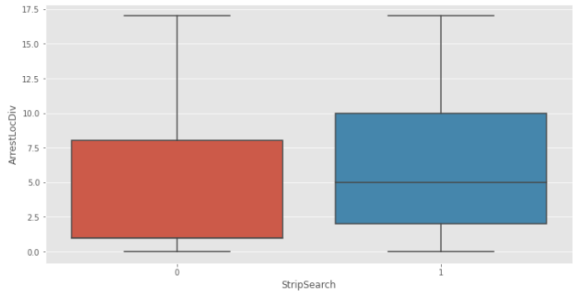

Figure 8. *Number of Individuals for Each Age Group*

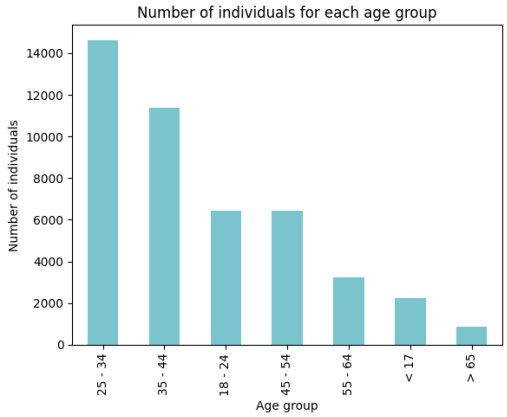

Figure 9. *Strip Search Frequency by Age and Race*

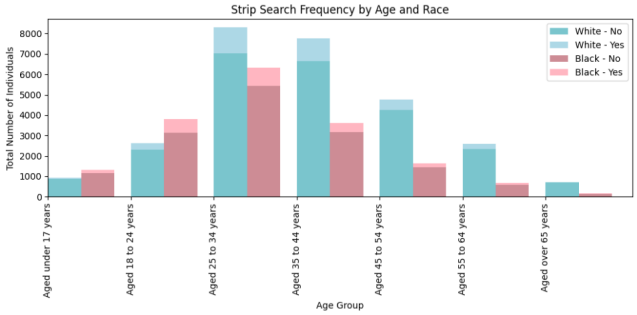

Figure 10. *Power of Tests for Race and Chances of getting Stip Search*

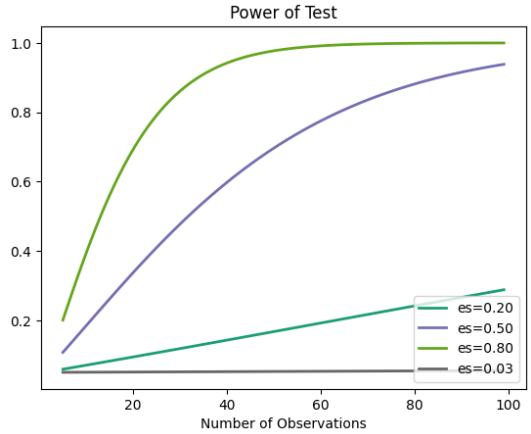

Figure 12. *Interaction plot - StripSearch by Race and Age Group*
Figure 11. *Interaction plot - StripSearch by Sex and Perceived Race*

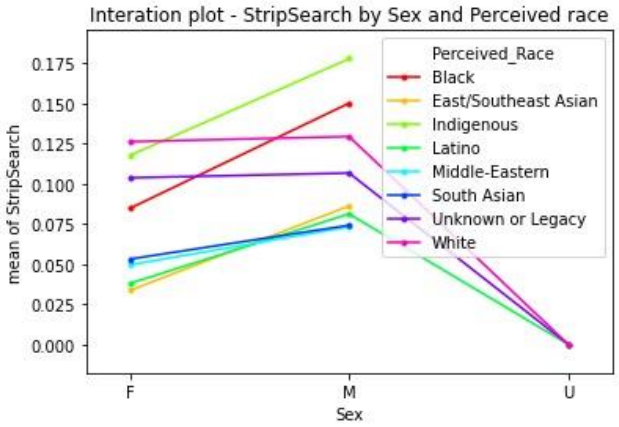

Figure 13. *Prediction Intervals*