

INF2178 Midterm Project

Study on Factors Affecting Strip Search Rate

By Group 5:

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1. Introduction

According to The Economist's Safe Cities Index 2021, Toronto ranks second, behind Copenhagen. However, crime is on the rise in Toronto, as shown by the key crime indicator statistics compiled by the Toronto Police Service, such as theft of motor vehicles, breaking and entering (Vilkhov Law, 2022).

Furthermore, as we know, Canada is a country of immigrants with multi-culture and in 2021, the number of hate crimes reported by police increased by 27% to 3,360. Compared to 2019, hate crimes have increased by 72% in the last two years. More hate crimes against religion (+67%) (including Jewish, Muslim and Catholic) and sexual orientation (+64%) are the main reasons for the national change, along with more incidents against race or ethnicity (+6%) (Moreau, G., 2022). Based on existing research, we are intrigued by examining the correlation between different races and crime rates.

Moreover, race is certainly not the only variable associated with crime rates. intimate partnership violence has also been a topic of concern in Toronto. According to Statistics Canada, Compared to Ontario (81%) and Canada (79%), Toronto had an overwhelming majority of female victims of intimate relationship abuse (83%) (Statistics Canada, 2020). Therefore, we also want to investigate whether male are more likely to commit crimes than females and what age groups are more likely to commit crimes?

Last but not least, Based on the given dataset, it includes information related to all arrests and strip searches. In our study, we also want to investigate whether criminals were treated fairly in the Toronto crime incident. For in the landmark case of *R. v. Golden* (2001), the Supreme Court of Canada defined strip searches as a distinct type of "personal search". In *Golden*, the Court recognized the fundamentally intrusive nature of strip searches. They "represent a significant invasion of privacy," and the Supreme Court recognized that black and indigenous peoples suffer disproportionate harm due to the racial trauma associated with strip searches (Monika Lemke, 2023). In Toronto, courts and watchdog organizations have been attempting to regulate how police conduct strip searches for the past 20 years in an effort to reduce the overall amount of strip searches that are carried out. Consequently, we will examine what the likelihood is of being strip-searched in Toronto for crimes related to race, age and sex.

Literature Review

Literature Reviews About Race and Age

The literature "The usual suspects: police stop and search practices in Canada" examines the use of stop and search practices by police in Canada, with a particular focus on the impact of racial profiling. The authors (Wortley, S., & Owusu-Bempah, A., 2011) use data in 2007 from a

national survey of police officers and interviews with community members to explore the extent to which stop and search practices are influenced by race and ethnicity.

The literature highlights several key findings, including that people from racialized communities are disproportionately targeted for stop and search practices. The authors note that this is particularly true for Black and Indigenous people, who are more likely to be stopped and searched than other groups. They also note that there is a lack of transparency and accountability around stop and search practices, which can make it difficult to address concerns about racial profiling.

Furthermore, it's worth mentioning that compared to white and Chinese counterparts, black Torontonians are often younger and less wealthy. Hence, it may not be racial prejudice but rather youth or poverty that accounts for why black people are more likely to be stopped and searched.

Therefore, we will use this literature to explore if there is any relationship between race and age and strip search by descriptive analysis and quantitative analysis.

Literature Reviews About Race and Gender

In addition to exploring how race and age affect strip search rate, We are also curious if there is any gender bias when the police search people. Do they think women are safer? Or do they think men are more likely to commit crimes?

In the literature "Racial profiling in Canada", the authors argue that racial profiling is a widespread problem in Canadian policing, with racialized individuals more likely to be stopped, questioned, and searched by police than non-racialized individuals. They also note that men are more likely to be subject to police stops and searches than women, and that racial profiling often leads to the violation of individual rights and freedoms (Wortley, S., & Tanner, J. , 2003).

Consequently, these studies have found that men tend to be more likely than women to be searched by police when committing crimes, and minorities or blacks are also more likely to be searched. These differences are related to a variety of factors including gender stereotypes, ethnic and immigrant background, police practices, and culture. In the following, we will conduct comprehensive research questions to see how these attributes (race, age, gender) affect the dependent variable (strip search rate).

Limitations about literature review

There are two limitations for this literature review. First of all, it's about the time this data was collected. This paper uses data from a 2007 survey of Toronto residents, but the dataset we will explore is about 2020 & 2021. So the situation may have changed in Toronto in recent years, in turn, it may give us inaccurate predictions of how race and age affect the probability of an

arrestee being subjected to a strip search. Secondly, since the data in this literature review are collected from police officers and interviews with respondents who have been stopped by the police, which may lack accuracy. Unlike the United States and Great Britain, Canadian researchers do not have regular access to official data on the race of people stopped and searched by the police. So, most research on this issue is typically conducted qualitative in nature.

Research Objective and Questions

Our study will seek to examine how perceived race, gender, and age interact with strip search rates in line with existing literature.

We propose to investigate the below research questions for our project. We formed these questions based on knowledge gained from our literature review and preliminary dataset analysis (please see the descriptive statistics and t-tests section below for our initial exploration of the data).

- RQ1: Is the probability of an arrestee being subjected to a strip search related to their age, gender, or perceived race?
- RQ2: How do different perceived races along with genders affect the probability of an arrestee being subjected to a strip search? Do specific genders of minority groups of non-white races experience differential strip search possibilities when they are arrested?
- RQ3: How do different perceived races along with age affect the probability of an arrestee being subjected to a strip search? Does any age group of minority groups experience differential strip search possibilities when they are arrested?

2. Exploratory Data Analysis

In our proposed project, we will use the *Arrests and Strip Searches (RBDC-ARR-TBL-001)* dataset from Toronto Police Service Public Safety Data Portal shared with us by professor Guha on GitHub for our research. This dataset is available on GitHub and can be found through the following link:

[https://raw.githubusercontent.com/Shinpai111/inf2178-expdesignfordatascience-w23-Zhenyu_Yuan/main/project%20dataset/Arrests_and_Strip_Searches_\(RBDC-ARR-TBL-001\).csv](https://raw.githubusercontent.com/Shinpai111/inf2178-expdesignfordatascience-w23-Zhenyu_Yuan/main/project%20dataset/Arrests_and_Strip_Searches_(RBDC-ARR-TBL-001).csv)

A brief description of this dataset is available on Toronto Police Service Public Safety Data Portal and can be found through the following link: <https://data.torontopolice.on.ca/datasets/TorontoPS::arrests-and-strip-searches-rbdc-arr-tbl-001/about>

This dataset includes information related to all arrests and strip searches from Toronto city. According to the description from the Toronto Police Service Public Safety Data Portal, a strip search refers to a search conducted by a police officer on a person, which includes the removal of some or all clothing and a visual inspection of the body. This dataset contains 65276 entries and 25 attributes, and in this research, the main attributes we are focusing are:

Perceived_Race: The perceived race of an arrestee.

Age_group__at_arrest_: The age group to which the arrestee belongs.

Sex: The gender of the arrestee.

StripSearch: Whether the arrestee was subjected to a strip search

Due to some data in the dataset requiring partial modification and the merging of some duplicate categories, we will provide a detailed description of these attributes below, and provide a table of these attributes in Table 1.

Variables

We employed four attributes as variables in this research:

Perceived_Race, *Age_group__at_arrest__Sex*, and *StripSearch*.

The *Perceived_Race* variable contains 8 different categories: *White*, *Unknown or Legacy*, *Black*, *South Asian*, *Indigenous*, *Middle-Eastern*, *Latino*, *East/Southeast Asian*. The *Age_group__at_arrest__* variable contains 9 different categories: *Aged 17 years and younger*, *Aged 17 years and under*, *Aged 18 to 24 years*, *Aged 25 to 34 years*, *Aged 35 to 44 years*, *Aged 45 to 54 years*, *Aged 55 to 64 years*, *Aged 65 and older*, and *Aged 65 years and older*. The *Sex* variable contains 3 categories: *F*, *M*, and *U*. The *StripSearch* variable contains 2 different categories: *0 or 1*, which indicates whether or not an arrestee has been subjected to a strip search. Before conducting experiments with these variables, we dropped rows containing missing data from the selected variables. Also, since the categories 'Aged 17 years and younger' and 'Aged 17 years and under', as well as 'Aged 65 and older' and 'Aged 65 years and older', were duplicated within the *Age_group__at_arrest__* variable, we merged these duplicate categories and renamed the 'Aged 17 years and younger' category to 'Aged 17 years and under', and the 'Aged 65 and older' category to 'Aged 65 years and older'. After that, to facilitate our experiment, since the *Age_group__at_arrest__* variable from the original dataset was not sorted by the order of different age groups of the arrestees, we will factorize the different age stages in the 'Age' variable and in ascending order, starting from 'Aged 17 years and under' as 0, and sorting up to 'Aged 65 years and older' as 6." And finally, we excluded the *U* category from the *Sex* variable in our analysis since the observation size under the *U* category was insufficient compared to *M* and *F* and excluded the *Unknown or Legacy* category from the *Perceived_Race* variable since this category is not clear enough compared to other categories. After the previous preprocessing, our new data frame contains 60187 entries and 4 attributes. We can define the variables with more details as follows.

Table 1 Variables Table

Variables	Categories
Sex	M (Male) F (Female)
Age_group__at_arrest__	0 (indicating 'Aged 17 years and under') 1 (indicating 'Aged 18 to 24 years') 2 (indicating 'Aged 25 to 34 years') 3 (indicating 'Aged 35 to 44 years')

	4 (indicating 'Aged 45 to 54 years')
	5 (indicating 'Aged 55 to 64 years')
	6 (indicating 'Aged 65 years and older')
Perceived_Race	White
	Black
	Latino
	East/Southeast Asian
	Indigenous
	Middle-Eastern
	South Asian
StripSearch	0, (arrestee has not been subjected to a strip search)
	1, (arrestee has been subjected to a strip search)

Source: Arrests and Strip Searches (RBDC-ARR-TBL-001)

Descriptive Statistics

The dataset provided on GitHub was available in one CSV file. To first understand the dataset file, we produced the following count charts based on the age group at arrest, gender, and race of the arrestees, showing whether they were strip-searched (Figure 1 and 2).

Figure 1

Number of cases with strip search has been applied and without strip search has been applied based on different perceived races of arrestees in the Arrests and Strip Searches dataset (broken down by perceived races).

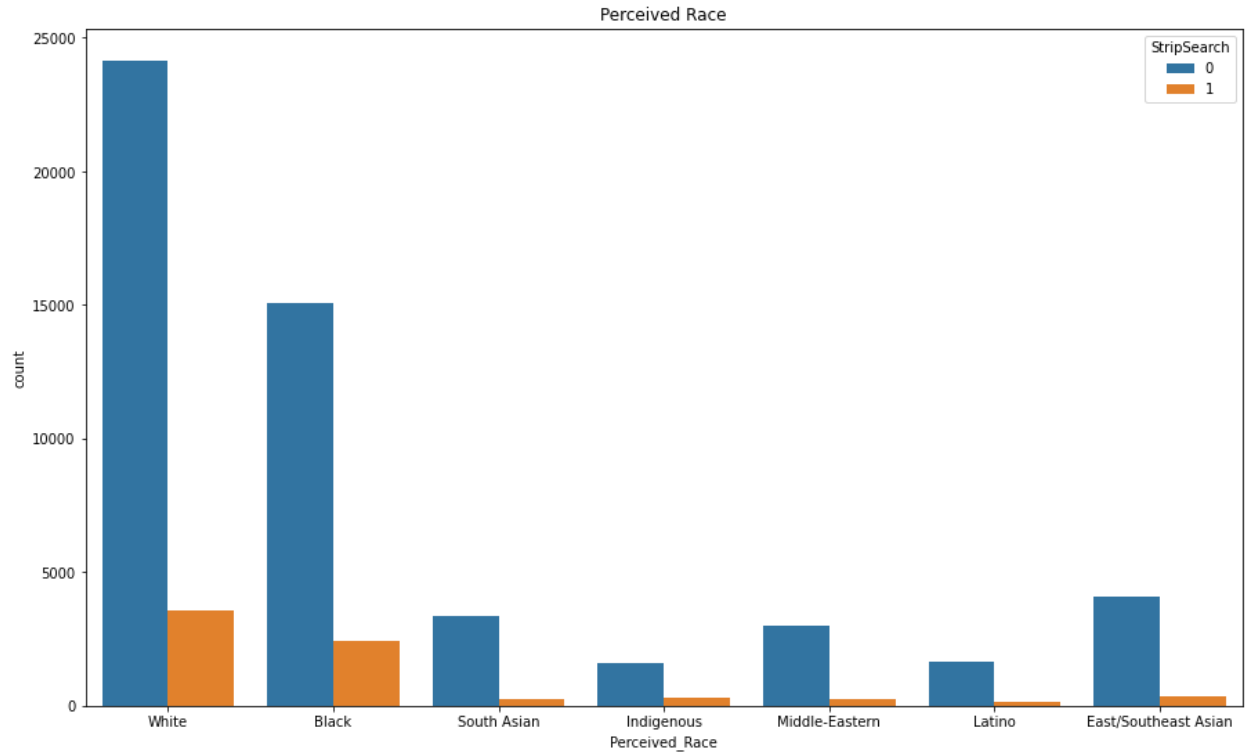
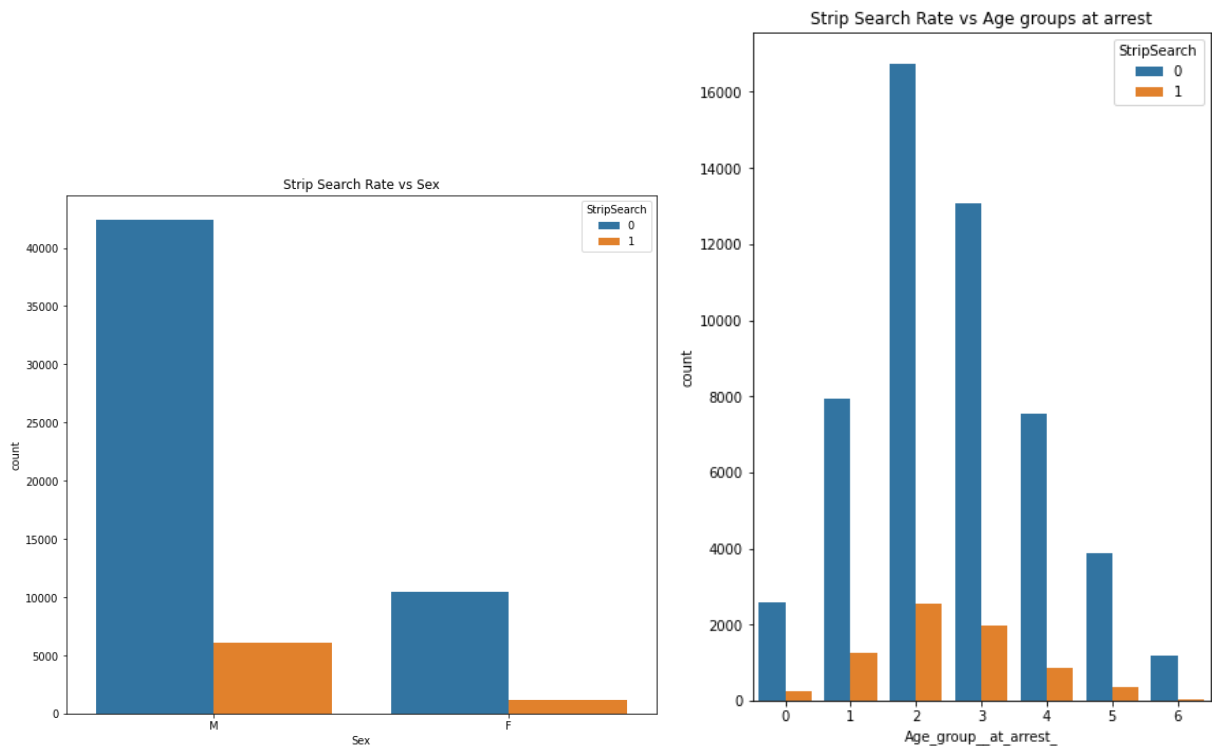


Figure 2

Number of cases with strip search has been applied and without strip search has been applied based on different gender and age groups at arrest in the Arrests and Strip Searches dataset (broken down by gender and different age groups).



We also looked at how arrestees' average strip search possibility differed for each perceived race, age group at arrest, and gender depending on the subject, by looking at how the mean value of *StripSearch* variable differed for each perceived race, age group at arrest, and gender (Table 2 and figure 3).

Table 2 Average Strip Search Possibility for Each Perceived Race, Age Group at Arrest, Gender

Perceived_Race	Average Strip Search possibility	std
Black	0.139	0.346
East/Southeast Asian	0.077	0.267
Indigenous	0.158	0.365
Latino	0.075	0.263
Middle-Eastern	0.070	0.256
South Asian	0.071	0.257
White	0.129	0.335
Age_group__at_arrest__		
0 (indicating 'Aged 17 years and under')	0.092	0.289
1 (indicating 'Aged 18 to 24 years')	0.136	0.342
2 (indicating 'Aged 25 to 34 years')	0.133	0.339
3 (indicating 'Aged 35 to 44 years')	0.131	0.337
4 (indicating 'Aged 45 to 54 years')	0.101	0.302
5 (indicating 'Aged 55 to 64 years')	0.082	0.274
6 (indicating 'Aged 65 years and older')	0.027	0.163
Sex		
F	0.102	0.302
M	0.125	0.331

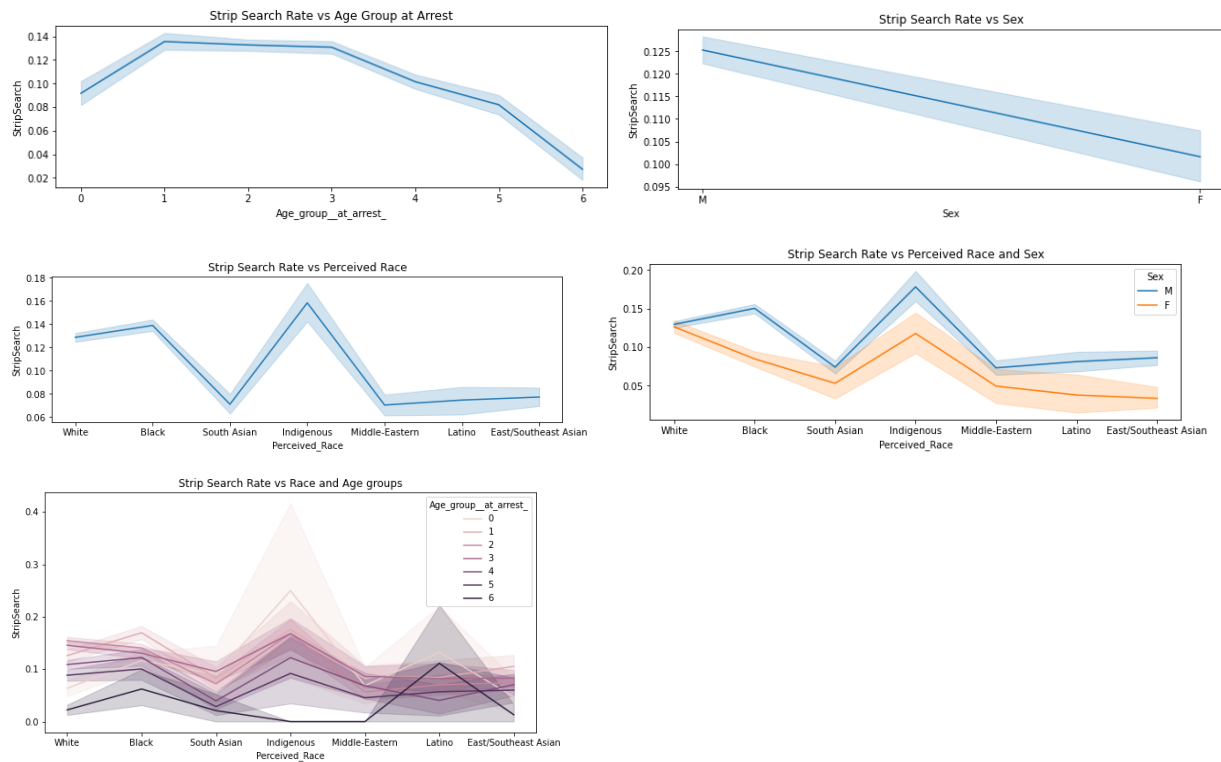
Source: Arrests and Strip Searches (RBDC-ARR-TBL-001)

From the line charts in Figure 3, we could see differences in the average possibility of an arrestee having been subjected to a strip search between different gender, age group at arrest and perceived race. We can see those arrestees in age groups 1 to 3, which is between 18 and 44 years old, are the most likely to be strip-searched, with strip-searched rates exceeding 0.12, higher than those in age groups 0, 4, and 5, which is below 17 years old or between 45 and 64 years old, with strip-searched rates around 0.1 ~ 0.08. Arrestees over 65 years old are the least likely to be strip-searched, with a strip-searched rate of less than 0.03. Moreover, we can see male arrestees are relatively more likely to be strip-searched than female arrestees, and arrestees who appear to be of South Asian, Middle Eastern, Latin American, and East/Southeast Asian

descent are less likely to be strip-searched compared to those who are White, Black, or Indigenous.

At the same time, it is not surprising to see that the probability of male and female arrestees being strip-searched varies largely among almost all races except between White males and White females. The difference in the probability of being strip-searched between Black males and Black females is the largest among the same races, and the difference between Indigenous men and East/Southeast Asian women is the largest among all racial and gender disparities. Moreover, we also see that the probability of arrestees being strip-searched after arrest varies among almost all races in different age groups. Among them, the difference in strip-searched rates among different age groups of Indigenous individuals is the largest, with youth Indigenous arrestees having the highest risk rate among all racial and age groups, while Indigenous arrestees over 65 years old have the lowest risk rate among all racial and age groups.

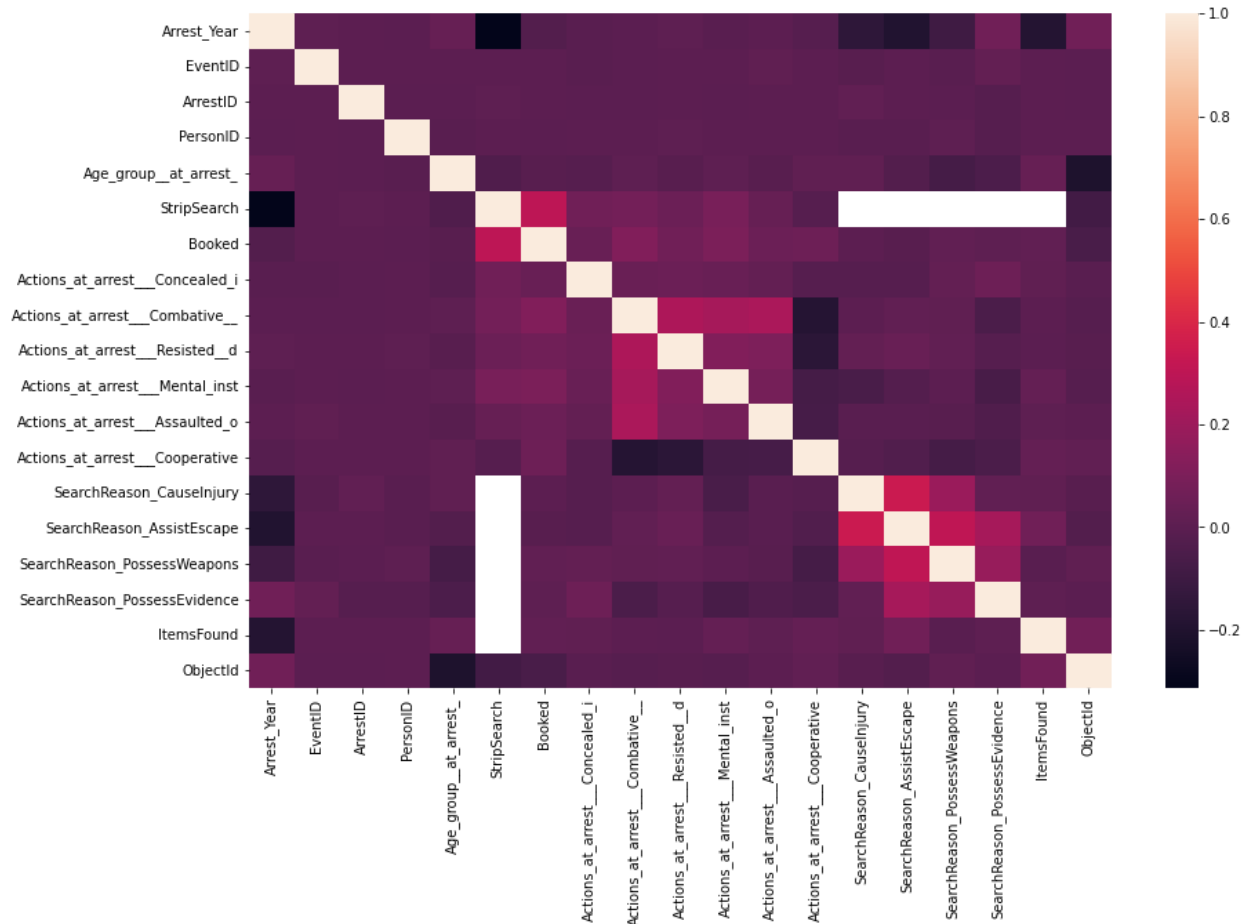
Figure 3



Looking at the line charts in Figure 3 and according to existing literature mentioned in the literature review section, perceived races, age groups, and gender groups among arrestees can affect the possibility of an arrestee being strip-searched, and it seemed possible that the combined effect of the attributes mentioned above could affect the possibility of an arrestee being strip-searched.

Furthermore, we generated a correlation heatmap of the numerical attributes in the dataset to look at the correlation between the attributes of the dataset (Figure4). The heat map showed that there were no noticeable differences in correlation between meaningful attributes.

Figure 4



T-Test

After the descriptive statistics, we ran multiple Welch's t-tests with the categorical attributes in the dataset. Before running the tests, we checked that the following assumptions were fulfilled: (1) a nominal two-level explanatory variable; (2) a quantitative outcome variable; (3) a normality assumption; and (4) independence of the errors. Seeing as we ran Welch's t-test, equal variance among the residuals was not assumed. The following paragraphs outline the results of noteworthy results from our t-tests.

Perceived_Race and StripSearch

We computed the mean strip search rates for arrestees from different perceived races, and found that compared with White arrestees, the mean strip search rate was higher for Black arrestees and Indigenous arrestees, but was lower for South Asian, Middle-Eastern, Latino, and East/Southeast Asian arrestees. Subsequently, we conducted 6 Welch's T-tests to analyze whether the strip

search rate (outcome variable) differs between different perceived race groups compared with White arrestees.

The hypotheses being tested for each t-test are the following:

For each t-test, for the White arrestee group and each of the minority(Black, South Asian, Indigenous, Middle-Eastern, Latino, East/Southeast Asian) arrestee groups:

H0 (Null Hypothesis): The population means of the two independent groups, White arrestee group and the specific minority arrestee group are equal.

HA (Alternative Hypothesis): The population means of the two independent groups, White arrestee group and the specific minority arrestee group are not equal.

The results indicate that:

For t-test between white and black arrestee groups:

The mean strip search rate for white arrestees ($M=0.129$, $SD=0.335$) is lower than for black arrestees ($M=0.139$, $SD=0.346$). With alpha established at 0.05, this is a statistically significant difference as the p-value (0.0019) is less than 0.05, 95% CI[-0.017, -0.004]. Therefore, we reject the null hypothesis of this t-test.

For t-test between white and South Asian arrestee groups:

The mean strip search rate for white arrestees ($M=0.129$, $SD=0.335$) is higher than for South Asian arrestees ($M=0.071$, $SD=0.257$). With alpha established at 0.05, this is a statistically significant difference as the p-value ($1.108e-33$) is less than 0.05, 95% CI[0.048, 0.067]. Therefore, we reject the null hypothesis of this t-test.

For t-test between white and Indigenous arrestee groups:

The mean strip search rate for white arrestees ($M=0.129$, $SD=0.335$) is lower than for Indigenous arrestees ($M=0.158$, $SD=0.365$). With alpha established at 0.05, this is a statistically significant difference as the p-value (0.0005) is less than 0.05, 95% CI[-0.046, -0.013]. Therefore, we reject the null hypothesis of this t-test.

For t-test between white and Middle-Eastern arrestee groups:

The mean strip search rate for white arrestees ($M=0.129$, $SD=0.335$) is higher than for Middle-Eastern arrestees ($M=0.070$, $SD=0.256$). With alpha established at 0.05, this is a statistically significant difference as the p-value ($8.3467e-32$) is less than 0.05, 95% CI[0.049, 0.068]. Therefore, we reject the null hypothesis of this t-test.

For t-test between white and Latino arrestee groups:

The mean strip search rate for white arrestees ($M=0.129$, $SD=0.335$) is higher than for Latino arrestees ($M=0.075$, $SD=0.263$). With alpha established at 0.05, this is a statistically significant difference as the p-value ($3.5784e-16$) is less than 0.05, 95% CI[0.041, 0.067]. Therefore, we reject the null hypothesis of this t-test.

For t-test between white and East/Southeast Asian arrestee groups:

The mean strip search rate for white arrestees ($M=0.129$, $SD=0.335$) is higher than for East/Southeast Asian arrestees ($M=0.077$, $SD=0.267$). With alpha established at 0.05, this is a statistically significant difference as the p-value ($5.2727e-30$) is less than 0.05, 95% CI[0.0426, 0.0602]. Therefore, we reject the null hypothesis of this t-test.

Gender and StripSearch

We computed the mean strip search rates for arrestees from different genders and found that compared with males, the mean strip search rate was lower for female arrestees. To further examine this, we conducted a Welch's T-test to analyze whether the strip search rate (outcome variable) differs based on their gender (two-level explanatory variable). The hypotheses being tested are the following:

H0 (Null Hypothesis): The population means of the two independent groups, the male arrestee group and the female arrestee group are equal.

HA (Alternative Hypothesis): The population means of the two independent groups, male arrestee group and female arrestee group, are not equal.

Our results indicate that the mean strip search rate for male arrestees ($M=0.125$, $SD=0.331$) is higher than for female arrestees ($M=0.102$, $SD=0.302$). With alpha established at 0.05, this is a statistically significant difference as the p-value ($9.0501e-14$) is less than 0.05, 95% CI[0.0175, 0.0299]. Therefore, we can reject the null hypothesis.

Age group at arrest and StripSearch

Before conducting t-tests, there are 7 categories of age classification, and if t-tests are performed one by one, the total number of t-tests will be too large. In order to simplify the number of t-tests, based on the number of arrests for different age groups, we temporarily divide age groups into two groups: those over 34 years old and those under 34 years old, with a relatively similar number of cases on both sides. Then, t-tests will be conducted on these two groups.

We computed the mean strip search rates for arrestees from different age groups and found that compared with arrestees older than 34 years old, the mean strip search rate was higher for arrestees younger than 34 years old. To further examine this, we conducted a Welch's T-test to

analyze whether the strip search rate (outcome variable) differs based on arrestees' age groups (two-level explanatory variable). The hypotheses being tested are the following:

H0 (Null Hypothesis): The population means of the two independent groups, arrestees older than 34 years old and arrestees younger than 34 years old are equal.

H0 (Null Hypothesis): The population means of the two independent groups, arrestees older than 34 years old and arrestees younger than 34 years old are not equal.

Our results indicate that the mean strip search rate for arrestees older than 34 years old ($M=0.111$, $SD=0.314$) is lower than for arrestees younger than 34 years old ($M=0.130$, $SD=0.336$). With alpha established at 0.05, this is a statistically significant difference as the p-value ($6.1221e-13$) is less than 0.05, 95% CI[-0.0243, -0.0139]. Therefore, we can reject the null hypothesis.

T-test concluding remarks

The above t-test results presented some important findings from the dataset. In line with existing literature, we found that arrestees' mean strip search possibilities were statistically different depending on arrestees' perceived race groups, gender and age groups.

3. Methods

Table 1 from the exploratory Data Analysis section outlines the specific details of the variables that will be used. We provide a brief summary of variables here:

The Sex variable retains two categories, F and M, indicating female and male arrestees.

The Age_group__at_arrest_ variable retains seven categories, 0 ~ 6, representing seven different age groups from low to high.

The Perceived_Race variable still contains 7 different categories, which are *White*, *Black*, *South Asian*, *Indigenous*, *Middle-Eastern*, *Latino*, *East/Southeast Asian*, indicating the perceived race of an arrestee.

The StripSearch variable contains 2 different categories, 0 or 1, which indicate whether or not an arrestee has been subjected to a strip search.

Due to space limitations and the nature of the t-test itself, we only conducted one t-test in the age group at arrest attribute and only compared white arrestees with other minority arrestee groups in the perceived race attribute during the t-test stage. In the following research, based on our research questions, we want to perform two 2-way ANOVAs to further analyze the effect of age group at arrest, gender and perceived race on mean strip search, and provide Tukey's HSD as post-hoc tests for each ANOVA tests. After that, we will provide 2 interaction plots in the Result section to further explain our findings.

In the following two 2-way ANOVA tests, we will respectively analyze the effects of perceived race and gender on the mean strip search, and the effects of perceived race and age group at arrest on the mean strip search.

ANOVA tests and Tukey's HSD tests design

Perceived race and Age group at arrest on strip search

The main effect of perceived race (set 1):

H0 (Null Hypothesis): The population means of different perceived races are equal.

H0 (Null Hypothesis): The population means of different perceived races are not equal.

The main effect of age group at arrest (set 2):

H0 (Null Hypothesis): The population means of different age groups at arrest are equal.

H0 (Null Hypothesis): The population means of different age groups at arrest are not equal.

The main effect of perceived race and age group at arrest (set 3):

H0 (Null Hypothesis): The effect of perceived race on strip search between different age groups at arrest are equal.

H0 (Null Hypothesis): The effect of perceived race on strip search between different age groups at arrest are not equal.

A two-way ANOVA will be performed to analyze the effect of perceived races and different age groups at arrest on strip search.

After we have conducted the above ANOVA test, if the interaction effect is statistically significant, we will use the Tukey HSD test as a post-hoc test to further analyze our research question.

Perceived race and Gender at arrest on strip search

The main effect of perceived race:

H0 (Null Hypothesis): The population means of different perceived races are equal.

H0 (Null Hypothesis): The population means of different perceived races are not equal.

The main effect of age group at arrest:

H0 (Null Hypothesis): The population means of different gender groups at arrest are equal.

H0 (Null Hypothesis): The population means of different gender groups at arrest are not equal.

The main effect of perceived race and age group at arrest:

H0 (Null Hypothesis): The effect of perceived race on strip search between different gender groups at arrest are equal.

H0 (Null Hypothesis): The effect of perceived race on strip search between different gender groups at arrest are not equal.

A two-way ANOVA will be performed to analyze the effect of perceived races and different gender groups at arrest on strip search.

After we have conducted the above ANOVA test, if the interaction effect is statistically significant, we will use the Tukey HSD test as a post-hoc test to further analyze our research question.

4.Results

Perceived race and Age group at arrest on strip search

ANOVA test result is shown in Table 3, alpha established at 0.05.

Simple main effects analysis showed that perceived races did have a statistically significant effect on strip search. ($p = 1.233e-76$). Null hypothesis (set1) is rejected.

Simple main effects analysis showed that age groups at arrest did have a statistically significant effect on strip search. ($p = 6.529e-55$). Null hypothesis (set2) is rejected.

A two-way ANOVA revealed that there was a statistically significant interaction between the effects of perceived races and different age groups at arrest ($p = 1.072e-08$). Null hypothesis (set 3) is rejected.

Table 3 2-Way ANOVA Test Result Perceived Race and Age group at arrest on StripSearch

	sum_sq	df	F	PR(>F)
C(Perceived_Race)	38.835453	6.0	61.700552	1.233072e-76
C(Age_group__at_arrest_)	28.150854	6.0	44.725196	6.529425e-55
C(Perceived_Race):C(Age_group__at_arrest_)	11.039273	36.0	2.923142	1.072262e-08
Residual	6308.658931	60138.0	NaN	NaN

Source: Arrests and Strip Searches (RBDC-ARR-TBL-001)

While all null hypotheses are rejected, to further investigate the effects, a Tukey HSD test was conducted to compare all possible pairs of means. Since the output table of the Tukey HSD test is too large, due to page limitation, we will put the test results into an external document and provide a link to the document. Link of the Tukey HSD test results: https://docs.google.com/document/d/1cCHhcaYUOfXJiDQgC9tRo4Ds_p7KI4sb_3TsNkR6s/e_dit

The result suggests that there were significant differences in means of strip search rates for the relatively low number of all pairs of races and age groups.

Perceived race and Gender at arrest on strip search

ANOVA test result is shown in Table 5, alpha established at 0.05.

Simple main effects analysis showed that perceived races did have a statistically significant effect on strip search. ($p = 5.526e-82$). Null hypothesis (set1) is rejected.

Simple main effects analysis showed that different gender groups at arrest did have a statistically significant effect on strip search. ($p = 4.658e-17$). Null hypothesis (set2) is rejected.

A two-way ANOVA revealed that there was a statistically significant interaction between the effects of perceived races and different age groups at arrest ($p = 4.419e-13$). Null hypothesis (set 3) is rejected.

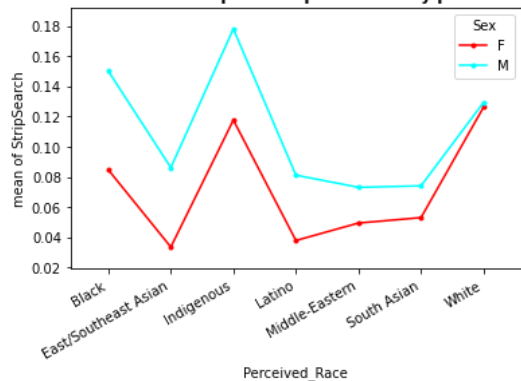
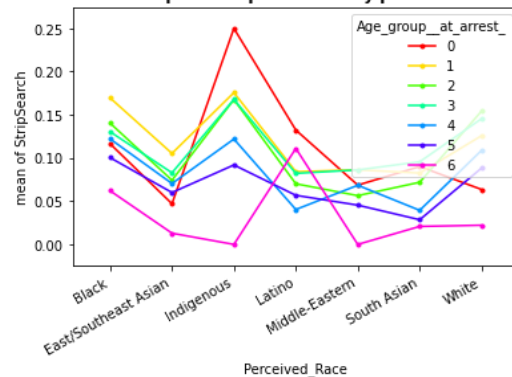
Table 5 2-Way ANOVA Test Result Perceived Race and Gender group at arrest on StripSearch

	sum_sq	df	F	PR(>F)
C(Perceived_Race)	41.599256	6.0	65.875129	5.526450e-82
C(Sex)	7.421914	1.0	70.518499	4.657528e-17
C(Perceived_Race):C(Sex)	7.354067	6.0	11.645644	4.418843e-13
Residual	6333.073078	60173.0	NaN	NaN

Source: Arrests and Strip Searches (RBDC-ARR-TBL-001)

While all null hypotheses are rejected, to further investigate the effects, a Tukey HSD test was conducted to compare all possible pairs of means. Since the output table of the Tukey HSD test is too large, due to page limitation, we will put the test results into an external document and provide a link to the document. Link of the Tukey HSD test results: https://docs.google.com/document/d/1cCHhcaYUOfXJiDQgC9tRo4Ds_p7KI4sb_3TsNkR6s/e_dit

The result suggests that there were significant differences in means of strip search rates for around half of all pairs of races and gender groups.

Figure5**Interaction Plot to show mean strip search possibilities by perceived race and gender****Interaction Plot to show mean strip search possibilities by perceived race and age group at arrest**

Although above interaction plots in Figure 5 do not provide any information on statistically significant differences, the plots showed that: (a) the average number of strip searches conducted on male arrestees is greater than that of female arrestees in all populations; (b) there is a noticeable big difference in the likelihood of strip searches conducted on arrestees of all races and genders; (c) the difference in the likelihood of strip searches conducted on white male and female arrestees is the least noticeable; (d) male arrestees of East/Southeast Asian, Latino, Middle-Eastern, and South Asian descent even have lower strip search rates than female arrestees of other races. (e) there are noticeable differences in the likelihood of strip searches conducted on arrestees of all races and age groups; (f) Indigenous juvenile arrestees have the highest strip search rate; (g) overall, arrestees aged 65 and above are the least likely to be subjected to strip searches.

Back to our RQs:

RQ1: Is the probability of an arrestee being subjected to a strip search related to their age, gender, or perceived race?

According to our research results, the probability of an arrestee being subjected to a strip search is related to their age, gender and perceived race. Both the ANOVA tests we performed have indicated such results, and such finding is consistent with our literature review, which has shown the strip search likelihood are different from different age, gender and perceived races.

RQ2: How do different perceived races along with genders affect the probability of an arrestee being subjected to a strip search? Do specific genders of minority groups of non-white races experience differential strip search possibilities when they are arrested?

According to our research results, different perceived races along with genders do affect the probability of an arrestee being subjected to a strip search. Our two-way ANOVA test on perceived race and gender groups on strip search indicated such results, and the Tukey HSD test after the two-way ANOVA test further helped us to summarize in-depth which races and genders are more likely to be searched relative to white people, and which races and genders are less likely to be searched relative to white people. Overall, Black and Indigenous males are more likely to be subjected to body searches compared to White males, while minority females are not more likely to be searched compared to White females. Such findings are consistent with our literature review.

RQ3: How do different perceived races along with age affect the probability of an arrestee being subjected to a strip search? Does any age group of minority groups experience differential strip search possibilities when they are arrested?

According to our research results, different perceived races along with age groups do affect the probability of an arrestee being subjected to a strip search. Our two-way ANOVA test on perceived race and age groups at arrest on strip search indicated such results, and the Tukey HSD test after the two-way ANOVA test further helped us to summarize in-depth which races and age groups are more likely to be searched relative to white people, and which races and genders are less likely to be searched relative to white people. Overall, compared with perceived races along with gender, perceived races along with age groups are less likely to affect the strip search likelihood of an arrestee, despite the ANOVA test result being still significant. In this case, indigenous minors who are arrested have the highest rate of being subjected to strip searches.

Limitation

Our experiment has the following limitations:

- The sample size of perceived races is not very equal, and there are relatively few crime cases of minority groups compared with black or white. So it's limited to compare the strip search rate under different sample sizes.

- The given dataset has some empty data in our mail attributes, which lacks a certain level of accuracy. And we have dropped the U category from the *Sex* attribute since its sample size is relatively insufficient.
- Due to the lack of a reliable codebook, we need to assume the specific meanings of some attributes and their subcategories within a dataset, which may cause unclear aspects in our experimental results and display.

Preliminary Suppositions and Implications

Through our project, we hope to find out what combination of features affects strip search likelihood between perceived race, age, and gender groups. The main focus in our research is still perceived race, which is the reason why this attribute appeared in both ANOVA tests. This project will provide insight into how different perceived race, age and gender groups interact with strip search likelihood. Knowledge gained from this project will contribute to existing literature and help policymakers and police departments enhance fairness in law enforcement.

5. Discussion and Conclusion

The test results of our analyses revealed significant differences in the mean likelihood of being subjected to a strip search across different racial groups, age groups, gender groups, combined age and racial groups, and combined gender and racial groups. Specifically, we found that certain groups were more likely to be subjected to strip searches than other groups. The finding highlights the need for further investigation into potential inequalities in the criminal justice system.

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7. Appendices

 Tukey HSD test result

https://docs.google.com/document/d/1cCHhcaYUOfXJiDQgC9tRo4Ds_p7KI4sb_3TsNkR6s/edit