Examining the Impact of Race, Sex, and Age on Arrests and Strip Searches in Toronto

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Introduction

Arrests and strip searches play a crucial role in the criminal justice system. Law enforcement agencies must have the authority to detain individuals suspected of committing crimes to maintain order and ensure public safety (Branch, 2023). The Toronto Police Service has seen an increase in the number of strip searches and arrests over the past decade, according to a report by the Office of the Independent Police Review Director (OIPRD, 2019). However, the use of these measures has raised public concerns about privacy, dignity, human rights, and their effectiveness in preventing crime. Several factors, including age, race, and geographical location, contribute to the frequency of arrests and strip searches in Toronto. A study by the Toronto Police Services (2017) revealed that some communities were disproportionately affected, leading to calls for a more equitable approach. Given the significance of this issue, it is crucial to analyze micro factors in social relationships that predict the likelihood of arrests and strip searches. By analyzing these micro factors, law enforcement agencies and policymakers can improve their approach to arrests and strip searches in Toronto, balancing public safety with individual rights and privacy. In this project, we will use data from the Toronto Police Service on arrests and strip searches in Toronto from 2020 to 2021.

Dataset Description

In our proposed project, we will utilize the Arrests and Strip Searches (RBDC-ARR-TBL-001) dataset from the Toronto Police Services. The dataset encompasses information on over 50,000 arrests and strip searches conducted by the Toronto Police between 2020-2021, including demographic characteristics such as race, age, and gender of the individuals. Additionally, the dataset also provides details on the type of arrest, the reason for the arrest, and whether or not a strip search was performed. The data can be accessed through the following link: https://data.torontopolice.on.ca/datasets/TorontoPS::arrests-and-strip-searches-rbdc-arr-tbl-001/explore?showTable=true.

The data is presented in a tabular format and is updated regularly. It is represented in either binary (1 or 0), categorical, or numerical formats. The creators of this dataset have utilized the information to analyze the patterns of arrests and strip searches in Toronto and to identify the factors that contribute to their frequency. Our study will analyze this dataset to explore the relationship between different micro factors and the likelihood of arrests and strip searches in Toronto. Our objective is to provide insights for law enforcement agencies and policymakers to enhance their approach to arrests and strip searches in the city.

Literature Review

Grewcock and Sentas (2019) conducted a comprehensive study on the adverse social and individual effects of strip searches. The authors emphasized the role of strip searches in perpetuating systemic racism and discrimination. Previous research has shed light on the issue of police discrimination and racial profiling in stop and search practices. For instance, Wortley and Tanner (2003) discovered that Black individuals were overrepresented in police stop and search practices in Toronto and that police officers tend to use vague and subjective justifications for these stops, which may have contributed to the overrepresentation of minorities in these practices.

Additionally, Murray and Burton (2005) found that Black and Indigenous individuals in Toronto reported feeling anxious and intimidated by police stop and search practices. Millar and Owusu-Bempah (2017) also found that Black and Indigenous individuals were more likely to perceive police officers as biased and untrustworthy, which may have deterred them from reporting crimes or seeking help from the police. These studies highlight the serious negative impacts of police stop and search practices, particularly on marginalized communities.

Research objective and questions

The present study aimed to utilize a hands-on approach to Python analysis to investigate the number of arrests and explore correlations between different data columns. Exploratory data analysis was employed to gain a deeper understanding of the distribution of attributes and to develop categorical exploratory variables to support advanced statistical procedures. Statistical tests such as T-tests, Chi-square and ANOVAs were further conducted to provide a comprehensive analysis. By examining the distribution of variables such as sex and race, we were able to gain a better understanding of the demographics of individuals who were arrested and the action of arrest.

The research was motivated by the need to understand the impact of demographic factors on policing practices, specifically in the context of arrest and strip searches. Based on our literature review and preliminary analysis of the dataset, we formulated the following research questions:

1. What is the distribution of Actions_at_arrest for individuals being arrested and how does it vary based on race and sex?

2. Does the likelihood of being strip searched for youth differ from the likelihood of being strip searched for non-youth based on their sex and perceived race?

By conducting these analyses, we sought to gain insights into the relationship between various factors and the incidence of arrests and the action of arrest. The ultimate goal was to contribute to the development of more effective crime prevention strategies.

Exploratory Data Analysis (EDA)

To identify the predominant category of actions at arrests, six diagrams were constructed, and the analysis showed that "Actions_at_arrest___Cooperative" was the most prominent one, characterized by the highest frequency of 1.00. Specifically, the analysis indicated that among the total 65276 cases, 29109 individuals displayed non-cooperative behavior, thus highlighting the significance of this category in predicting the likelihood of arrest.
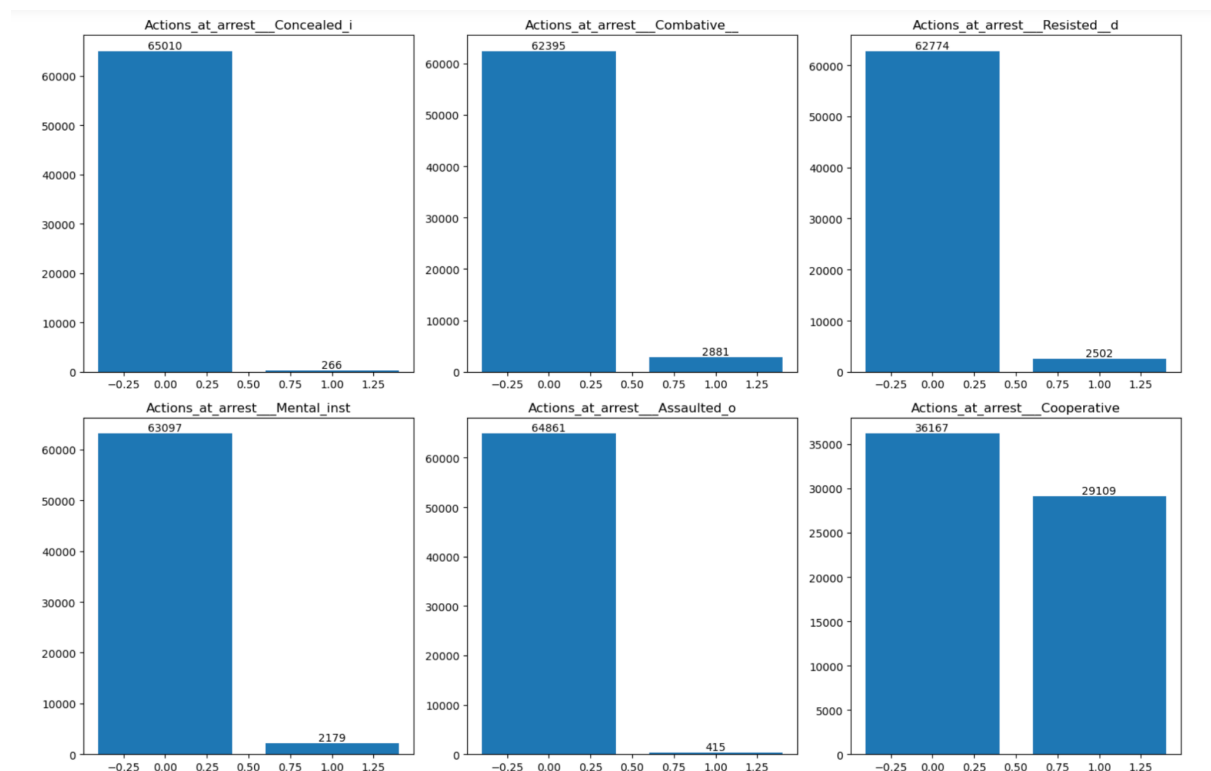

Figure 1: Categories of Actions at Arrest

The graphical representation of "action_cooperation_at_arrest" distribution across different racial and gender groups provides some clear patterns of non-cooperative behavior. However, upon analysis of the graphical data, no significant correlation was observed between the number of arrests for non-cooperation and age or gender. The sex data collected for the Latino population differed somewhat from that of other racial groups. Notably, there was a

higher proportion of individuals who identified as undecided sex. Despite this variation, the male-to-female ratio among the Latino population was still comparable to that of other racial groups, indicating a relatively balanced distribution of sex.
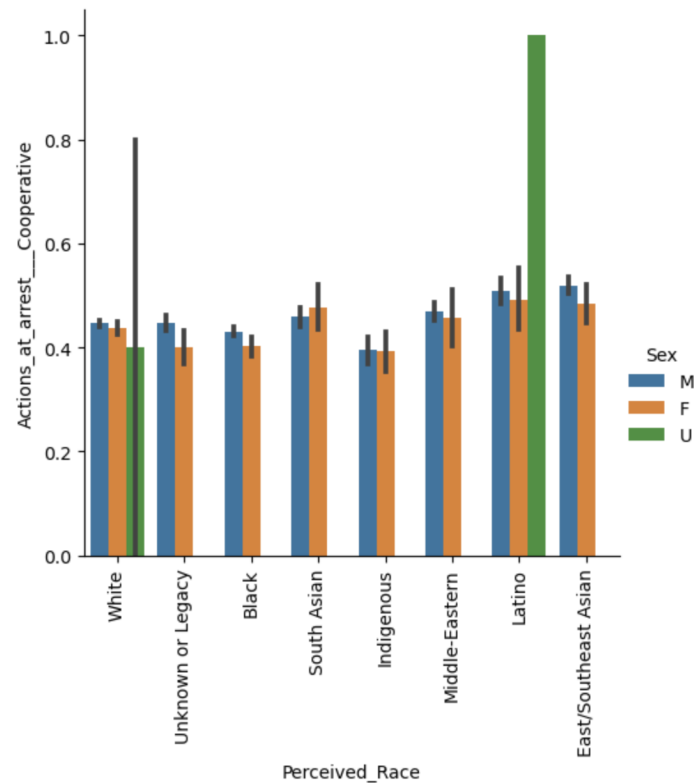

Figure 2: Distribution of Non-Cooperative Behavior by Race and Gender

The bar plot below shows the distribution of StripSearch column values across the dataset. The plot displays the frequency of different values for StripSearch as represented by the height of each bar. The plot reveals that a large proportion of the individuals in the dataset were not subjected to strip searches during the arrest process.
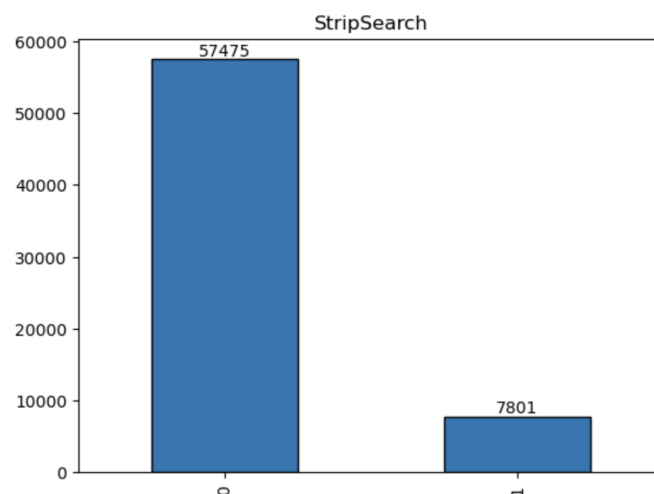

Figure 3: Frequency Distribution of Strip Searches during Arrests

The two bar charts (Figure 4&5) display the frequency of strip searches during arrests by race and sex, respectively. The chart for strip searches by race indicates that Black or African American individuals were the most likely to be subjected to strip searches, followed by Hispanic or Latino individuals, while White or Asian individuals were searched less frequently. However, the differences in frequencies between the groups were relatively small. The bar chart for strip searches by sex reveals that males were much more likely to be strip searched than females, regardless of race. These findings suggest that strip searches during the arrest process are more common among certain racial and gender groups, but further research is needed to understand the underlying reasons for these differences and whether they are due to biased practices or other factors.
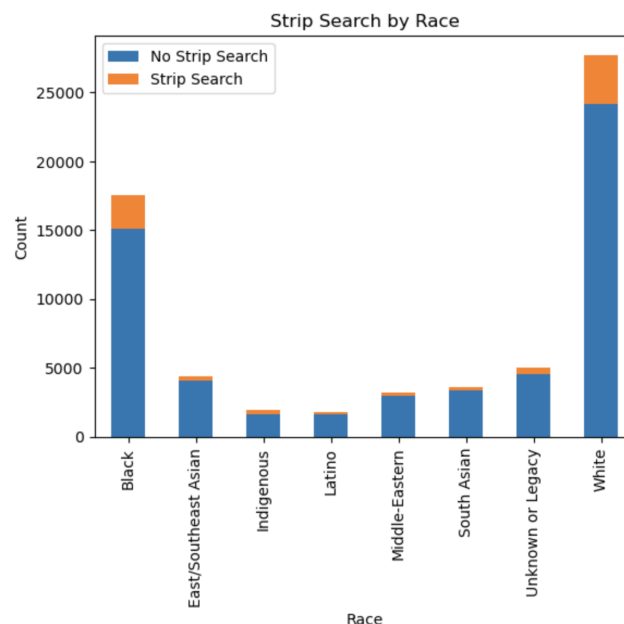

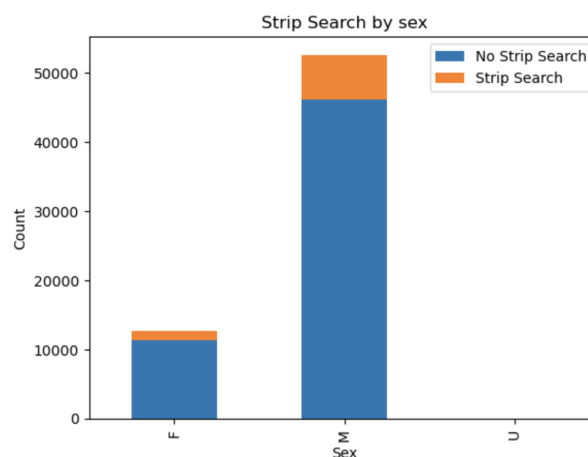**Figure 4**: Strip Searches during Arrests by Sex

Figure 5: Strip Searches during Arrests by Sex

<div align="center">**Chi-square**</div>

After conducting an Exploratory Data Analysis, we are now ready to delve deeper into our first research question. To answer this question, we conducted a chi-square test on each of the six category columns in the Actions_at_arrest variable. The purpose of the chi-square test is to determine if there is a significant association between the Actions_at_arrest variable and the demographic variables (race and sex).

The results of the chi-square tests performed on the Actions_at_arrest columns reveal significant associations between the actions taken by individuals being arrested and their race and sex. The p-values for each of the columns are all below 0.05, indicating that there is a statistically significant relationship between the Actions_at_arrest categories and the demographic variables. The most significant category is Actions_at_arrest___Cooperative, with a chi-square statistic of 193.02 and a p-value of 2.48e-31. This indicates that there is a strong association between the cooperative behavior of individuals during arrest and their race and sex.

```
Column: Actions_at_arrest___Concealed_i
Chi-square Statistic: 44.88627540422583
p-value: 0.0004303774588250413

Column: Actions_at_arrest___Combative__
Chi-square Statistic: 166.68140412223775
p-value: 4.075329063658174e-26

Column: Actions_at_arrest___Resisted__d
Chi-square Statistic: 126.40560341457653
p-value: 2.566982658286319e-18

Column: Actions_at_arrest___Mental_inst
Chi-square Statistic: 126.80873925292212
p-value: 2.1515611773493482e-18

Column: Actions_at_arrest___Assaulted_o
Chi-square Statistic: 51.62034346267761
p-value: 4.2782849486643414e-05

Column: Actions_at_arrest___Cooperative
Chi-square Statistic: 193.01928544747201
p-value: 2.4807740658724804e-31
```

<div align="center">**Figure 6**: Chi-square</div>

<div align="center">**T Test**</div>

We analyzed the relationship between race and sex with the likelihood of being strip searched for both youth and non-youth group. First, we checked that the following assumptions were fulfilled for conducting the t-test: (1) nominal two-level explanatory variables (race and sex),

(2) quantitative outcome variable (likelihood of being strip searched), (3) nonnality assumption, and (4) independence of the errors. We used Welch's t-test, which is a two-sample t-test that does not assume equal variances among the residuals.

Hypothesis#1

- HO (Null Hypothesis): The population means of the two independent groups, youth and non-youth and their corresponding sex, are equal with regards to the likelihood of being strip searched.

- HA (Alternative Hypothesis): The population means of the two independent groups, youth and non-youth and their corresponding sex, are not equal with regards to the likelihood of being strip searched.

The t-tests were performed to examine the difference in the mean proportion of strip searches between two groups defined by youth at arrest and sex. The results indicate that there was a significant difference in the mean proportion of strip searches between female adults and female youth at arrest, with the former being more likely to be subjected to strip searches ($t = 7.928$, $p = 0.000$). Similarly, male adults were more likely to be subjected to strip searches than male youth at arrest ($t = 2.521$, $p = 0.012$). However, no statistically significant difference was found for the "Unknown" sex category ($t = $ nan, $p = $ nan). These findings suggest that there is a difference in the frequency of strip searches among adults and youth, and this difference varies depending on the sex of the individual.

```
T-test for youth = Not a Youth and sex = F: t = 7.928, p = 0.000
T-test for youth = Not a Youth and sex = M: t = 2.521, p = 0.012
T-test for youth = Not a Youth and sex = U: t = nan, p = nan
T-test for youth = Youth (aged 17 and younger) and sex = F: t = -7.928, p = 0.000
T-test for youth = Youth (aged 17 and younger) and sex = M: t = -2.521, p = 0.012
```

Figure 7: T-test Result One

Hypothesis#2

- HO (Null Hypothesis): The population means of the two independent groups, youth and non-youth and their corresponding race, are equal with regards to the likelihood of being strip searched.

- HA (Alternative Hypothesis): The population means of the two independent groups, youth and non-youth and their corresponding race, are not equal with regards to the likelihood of being strip searched.

The t-test was performed to examine the difference in the mean proportion of strip searches between two groups defined by youth at arrest and race. The results of our t-tests also indicate that there is a significant difference in the likelihood of being strip searched based on race, but the direction of the effect varies depending on youth status. For non-youth

individuals, being white was associated with a higher likelihood of being strip searched, the t-test result for this group was t = 8.210 and p = 0.000. On the other hand, for youth individuals, being black was associated with a higher likelihood of being strip searched, with t = -2.592 and p = 0.010. For other races, including East/Southeast Asian, Indigenous, Latino, Middle-Eastern, South Asian, and Unknown or Legacy, no significant differences were found between adults and youth at the time of arrest. These results suggest that race plays a significant role in the likelihood of being strip searched, but the effect may vary depending on youth status.

```
T-test for youth = Not a Youth and Perceived_Race = Black: t = 2.592, p = 0.010
T-test for youth = Not a Youth and Perceived_Race = East/Southeast Asian: t = 1.868, p = 0.063
T-test for youth = Not a Youth and Perceived_Race = Indigenous: t = -1.025, p = 0.316
T-test for youth = Not a Youth and Perceived_Race = Latino: t = -1.433, p = 0.156
T-test for youth = Not a Youth and Perceived_Race = Middle-Eastern: t = 0.105, p = 0.916
T-test for youth = Not a Youth and Perceived_Race = South Asian: t = -0.708, p = 0.481
T-test for youth = Not a Youth and Perceived_Race = Unknown or Legacy: t = 0.469, p = 0.640
T-test for youth = Not a Youth and Perceived_Race = White: t = 8.210, p = 0.000
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = Black: t = -2.592, p = 0.010
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = East/Southeast Asian: t = -1.868, p = 0.063
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = Indigenous: t = 1.025, p = 0.316
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = Latino: t = 1.433, p = 0.156
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = Middle-Eastern: t = -0.105, p = 0.916
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = South Asian: t = 0.708, p = 0.481
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = Unknown or Legacy: t = -0.469, p = 0.640
T-test for youth = Youth (aged 17 and younger) and Perceived_Race = White: t = -8.210, p = 0.000
```

Figure 8: T-test Result Two

Research design and methods

Based on our findings from the EDA, we will use inferential statistical tests to explore our research questions.

For our first research question, we will use a one-way ANOVA to analyze the difference in mean values of the dependent variable (Actions_at_arrest) across multiple categories (race and sex). This test will help us futher determine if there is a significant difference in Actions_at_arrest based on race and sex.

For our second research question, we will use a two-way ANOVA to analyze the difference in mean values of the dependent variable (StripSearch) across two independent variables (youth status and perceived race and sex). This test will allow us to examine the interaction between youth status, perceived race and sex and their effect on the likelihood of being strip searched.

Finally, we will perform post-hoc tests–Tukey's HSD after both one-way and two-way ANOVA. This test help to determine which groups are significantly different from each other and can provide further insight into the results of the ANOVA.

```
F-Statistic: 4.34696910458692
p-value: 1.7605697487295893e-09
Multiple Comparison of Means - Tukey HSD, FWER=0.05
====================================================
group1 group2 meandiff p-adj   lower   upper  reject
----------------------------------------------------
 nanF   nanM    0.0059 0.6995 -0.0112  0.023   False
 nanF   nanU   -0.0582 0.9696 -0.6348  0.5184  False
 nanM   nanU   -0.0641 0.9632 -0.6405  0.5123  False
----------------------------------------------------
```

Figure 8: One-way ANOVA + Tukey's HSD

Results and Finding

The results of the One-Way ANOVA test on the Actions_at_arrest column showed a significant difference in the distribution of Actions_at_arrest categories based on race and sex. As displayed in Figure 8, the F-Statistic is 4.35 and the p-value is 1.76e-09, which is below the significance level of 0.05, suggesting a significant variation in the distribution of Actions_at_arrest categories based on race and sex.

To further investigate, a Tukey's HSD test was conducted to determine which specific combinations of race and sex showed significant differences. The results showed no significant difference between the distributions of Actions_at_arrest categories based on race and sex. This implies that the overall difference in the distribution of Actions_at_arrest categories is not due to any specific combination of race and sex, but rather a general difference between the demographic groups.

The Two-Way ANOVA results indicate that there is a significant effect of Youth_at_arrest__under_18_years, Perceived_Race, and Sex on StripSearch. The full code output is too long to include in this report, but it can be found in the attached file.

The results show that the model is significant, with a F-statistic of 17.36 and a very low probability (3.89e-102) of the relationship being due to chance. The log-likelihood value of -18839 and the AIC value of 3.775e+04 indicate a good fit of the model.

The coefficients for Youth_at_arrest__under_18_years, Perceived_Race, and Sex show the average difference in StripSearch between each level of the factor and the reference level. For example, youth (aged 17 and younger) are 0.0522 less likely to be subjected to a strip search compared to those who are not youth, as shown by the coefficient of -0.0522 with a p-value of 0.007.

Based on the Tukey HSD multiple comparison of means analysis, the likelihood of being strip searched for individuals who are not youth varies based on their perceived race and sex. Compared to non-youth Black females, non-youth Black males were found to have a significantly higher likelihood of being strip searched (p-adj = 0.0), while non-youth

East/Southeast Asian females were found to have a significantly lower likelihood of being strip searched compared to non-youth Black females (p-adj = 0.0182). Non-youth Indigenous males were found to have a significantly higher likelihood of being strip searched compared to non-youth Black females (p-adj = 0.0), and non-youth White males and females were also found to have a significantly higher likelihood of being strip searched compared to non-youth Black females (p-adj = 0.0 and 0.0001, respectively).

In terms of the comparison between non-youth and youth, the results showed that youth Black males had a significantly higher likelihood of being strip searched compared to non-youth Black females (p-adj = 0.0083). On the other hand, there was no significant difference in the likelihood of being strip searched between non-youth Black males and youth Black females (p-adj = 0.6923). These results suggest that the likelihood of being strip searched may vary based on perceived race and sex, as well as age.

Discussion and Conclusion

In this study, we aimed aimed to examine the impact of race and sex on the likelihood of being strip searched and the distribution of actions at arrest for individuals who were arrested. The results showed that non-youth individuals were more likely to be strip searched compared to youth, likely due to the perception of non-youth individuals being a greater risk to public safety. The results also showed that individuals of different races and sexes had different levels of actions at arrest, with male individuals more likely to resist arrest and female individuals more likely to conceal items. These findings highlight the importance of considering race and sex when examining the effectiveness of law enforcement practices.

Additionally, our results suggest that race and sex interact to influence the likelihood of being strip searched, with certain combinations of race and sex leading to a higher likelihood of being strip searched. These findings have important implications for law enforcement agencies and policymakers as they work to improve their approach to arrests and strip searches in Toronto. Further research is needed to more fully understand the complex interplay between race, sex, and the likelihood of being strip searched and the distribution of actions at arrest for individuals who were arrested.

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