

RACIAL/ETHNIC DISPARITIES IN TRAFFIC STOPS:
ANALYSIS OF VERMONT STATE POLICE DATA, 2010-15

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EXECUTIVE SUMMARY

In this study, we assess racial disparities in Vermont State Police traffic stops and outcomes. Our analysis is based on data for July 1, 2010 through December 31, 2015.

We examine several indicators, no single one of which is evidence of racial bias. Rather, the collective results from all of our indicators provide the basis for our summary assessment. Our indicators include: 1) stop rates by race, comparing these to racial shares of the population; 2) investigatory stops by race; 3) the proportion of drivers receiving citations versus warnings; 4) racial differences in arrest rates; 5) search rates by race; 6) the percentage of searches that yield contraband (the “hit” rate); 7) differences in racial stop behavior by trooper; and 8) racial disparities in search and hit rates by agency (barracks) within the Vermont State Police.

We also provide information on the trends over time for each of the indicators. The latter is useful in assessing the impact of efforts (such as anti-bias training) the VSP has adopted to address racial bias in policing (such as anti-bias training). Finally, we evaluate the quality of the data generated by the VSP.

A summary of our major findings:

- Black stop rates exceed their population share and this gap has widened over time.
- Black-white and Hispanic-white disparities are the most severe.
- Asian drivers are treated similarly to white drivers except in the case of citations where Asians receive citations at a higher rate than white drivers (48.1% compared to 36.9%).
- Blacks and Hispanics have a higher probability of being arrested and searched, and a lower probability of being found with contraband, once searched.
- The black-white disparity in search rates is particularly wide with blacks being searched at a rate that is roughly 4.6 times that of white drivers. The black-white disparity in search rates has *widened* since 2011, indicating a worsening of racial disparity in searches.
- Hispanic drivers are searched at a rate 4 times that of white drivers.
- Black and Hispanic drivers who are searched are significantly less likely to be carrying contraband than white drivers, which is evidence of inefficient policy, and potential racial bias. The trends in these disparities have narrowed only marginally since 2011.
- There are substantial racial disparities in policing across barracks. For example, the search rate of black drivers is 6 times greater than white drivers in the area of the

Brattleboro and Rutland barracks compared to 2 times greater in the Middlesex and Williston barracks.

- There are significant differences across troopers in their stop rates of black and Hispanic drivers.
- There are data quality problems including missing and inconsistently recorded information that impede the ability to accurately analyze police actions.

RACIAL/ETHNIC DISPARITIES IN TRAFFIC STOPS: ANALYSIS OF VERMONT STATE POLICE DATA, 2010-15

I. INTRODUCTION

Concerns about racial profiling and racial disparities in policing have drawn the attention of Vermonters in recent years, particularly as the state has become more racially and ethnically diverse. A number of agencies in Vermont voluntarily moved to collect race data in traffic stops before such data collection was mandated by the legislature.¹ The Vermont State Police (VSP) was one of these agencies, and began data collection in July of 2010. This paper reports the results of an analysis of the Vermont State Police's race data on traffic stops, arrests, and searches for the period July 1, 2010 through December 2015.² Our approach in this analysis is to focus on outcomes that are the result of trooper discretion—that is, where troopers are in a position to make independent decisions on whom to stop, search, ticket, or arrest. We therefore omit instances of traffic stops that are externally generated and we omit arrests based on a warrant.³

To assess racial disparities in outcomes, we examine several indicators. First, we evaluate stop rates by race, comparing these to racial shares of the population. Second, we compare racial differences in investigatory stop rates.⁴ Third, we evaluate the proportion of drivers receiving citations (hereafter called tickets) versus warnings. Fourth, we compare racial differences in arrest rates. Fifth, we examine search rates by race, as well as the percentage of searches that yielded contraband. Because we are also interested in focusing on cases of substantive infractions,⁵ we calculate the percentage of searches by race that yields contraband in which the outcome was a ticket or arrest (but not a warning). Sixth, we examine differences in racial stop behavior by trooper. Seventh, we evaluate racial disparities by agency (barracks) within the Vermont State Police.

¹ During the 2014 Session, the Vermont Legislature passed Act 193, which amended 20 V.S.A. § 2366 to make such race data collection mandatory.

² The data were provided to the authors by the VSP in January 2016 and were also made publicly available on the VSP website. In the analysis that follows, we include 2010 data in the full data set, but exclude 2010 from the annual data analysis, given that only 6 months of data were collected that year. The remaining data are for full years.

³ Examples of sources of such externally generated stops could be a Be On the Lookout (BOLO) alert from a police agency, or a 911 call.

⁴ Troopers must identify the reason for a stop for each incident they report. An investigatory stop is based on a “reasonable suspicion,” based upon explainable, objective facts that the driver is engaged in criminal activity. A modest amount of suspicion is enough for a brief stop, but a vague hunch is not.

⁵ The range of contraband found in searches can be minor (e.g., cigarettes carried by a teenager) to serious (e.g., a large quantity of illegal substances).

Our analysis is based on estimates of these indicators for the 5.5-year period (July 2010 through December 2015). We also provide information on the trends over time for each of the indicators. The latter is useful in assessing the impact of efforts (such as anti-bias training) the VSP has adopted to address racial bias in policing (such as anti-bias training). Finally, we evaluate the quality of the data generated by the VSP.

Our intention in this report is to conduct an analysis that is rigorous, focused, well reasoned and careful. We present the findings in a straightforward and transparent format that allows for public verification and learning. We hope the model of analysis presented here will be updated regularly by the Vermont State Police and the Director of Fair and Impartial Policing and Community Affairs, thus minimizing the need for external assistance.

II. Racial Disparities in Stop Rates and Stop Reasons

A. Stop Rates

In order to calculate the rate at which drivers are stopped by race/ethnicity, we compute the number of traffic stops⁶ by race divided by the racial share of the population, using U.S. Census data.⁷ The race of the driver is based on trooper perception since Vermont drivers' licenses do not include this information.

Accurate and up-to-date data on racial shares of the population present a challenge, because the latest Census was conducted in 2010, and the racial/ethnic composition of the state may have changed since that time. One source of information is the American Community Survey (ACS), which reports estimates of population by race and ethnicity for Vermont. For our population estimates we use the most recently available 5-year estimates (2010-14) of racial shares of the population as our denominator in calculating traffic stop rates.⁸

⁶ The data provided by the VSP record a single stop multiple times if there was more than one outcome per stop (e.g., a driver could receive a warning and a ticket, or two tickets). We have corrected for this.

⁷ It would be preferable to have an estimate of the actual driving population. The Department of Motor Vehicles (DMV) collects accident data, which is a potential source of such data. More than 22% of VSP accident reports for 2010-15 have no data on race of drivers, however, making these data an unreliable source of information on racial shares. If we make the strong and potentially unreliable assumption that the racial shares of missing data are the same as the share of accidents in which race is reported (thus using total accidents minus accidents missing data on race as our denominator), racial shares are as follows: 94.5% white, 2.2% black, 2.3% Asian, and 0.7% Hispanic. The Northeastern Institute of Racial Justice study (presented to VSP in May 2016) found black drivers to be a smaller share (1%) of no-fault drivers in accidents, but it is not clear a) how the fault of the driver was identified in the dataset, b) whether the authors used accident reports from all jurisdictions or only those accidents reported by VSP. Further, the authors of the study count black drivers as a share of all accident no-fault drivers rather than only of those for whom race is identified. Their approach implicitly assumes that in all cases where race of driver is missing, the driver is not black, which may not be valid. These different estimates point in part to the weaknesses of the DMV data set, given its limited quality. In our analysis, instead of placing all of our weight on stop rates, we investigate a variety of post-stop outcomes to assess whether patterns are similar across all indicators.

⁸ The ACS calculates annual population estimates but these statistics are somewhat volatile with relatively large margins of error, thus we have chosen to use the 5-year estimate. The number of whites is calculated as those that identify as White Alone (from Table B02001) in the ACS, while Blacks are those who identify as Black Alone or in combination with one or more other races (Table B02009). The number of Asians is similarly estimated (Table B2011).

Table 1 compares the number and percentage of annual and total traffic stops by race/ethnicity for 2010-15. The share of stops and the racial share of population are provided in Table 1 for Blacks, Asians, and white drivers.⁹ For Hispanic drivers, we only provide the share of stops but not the population share because the ACS and the police officers do not use comparable methods of classifying drivers as Hispanic. In the table, we also denote the number of stops where the race of the driver is either missing or marked unknown. For the purposes of calculating the racial shares of stops, however, we only count those stops for which the trooper recorded the perceived race of the driver.

Table 1. Stops and Stop Rates by Race/Ethnicity, 2010-15

Year	White	Black	Asian	Hispanic	Missing/ Unknown	Grand Total
<i>Total number of stops</i>						
2010 ¹⁰	22,513	416	268	188	544	23,952
2011	44,989	857	531	350	785	47,551
2012	48,314	946	601	432	1,163	51,506
2013	52,782	1,062	722	559	757	55,948
2014	50,143	1,232	804	524	575	53,329
2015	41,162	1,041	636	515	886	44,279
Grand Total	259,903	5,554	3,562	2,568	4,710	276,565
<i>Share of stops</i>						
2010	96.2%	1.8%	1.1%	0.8%	2.3%	100%
2011	96.2%	1.8%	1.1%	0.7%	1.7%	100%
2012	96.0%	1.9%	1.2%	0.9%	2.3%	100%
2013	95.6%	1.9%	1.3%	1.0%	1.4%	100%
2014	95.1%	2.3%	1.5%	1.0%	1.1%	100%
2015	94.9%	2.4%	1.5%	1.2%	2.0%	100%
Grand Total	95.6%	2.0%	1.3%	0.9%	1.7%	100%
<i>Share of population</i>						
2010-14	95.1%	1.6%	1.8%	NA	NA	

Note: Asians includes Native Hawaiians and Pacific Islanders.

Source: Authors' calculations based on raw data provided by Vermont State Police in January 2016. Population data are from US Census Bureau, extracted from Social Explorer, American Community Survey 5-year estimates (2010-14), Tables B02001, B02009, B02011. Data were accessed on April 20, 2016.

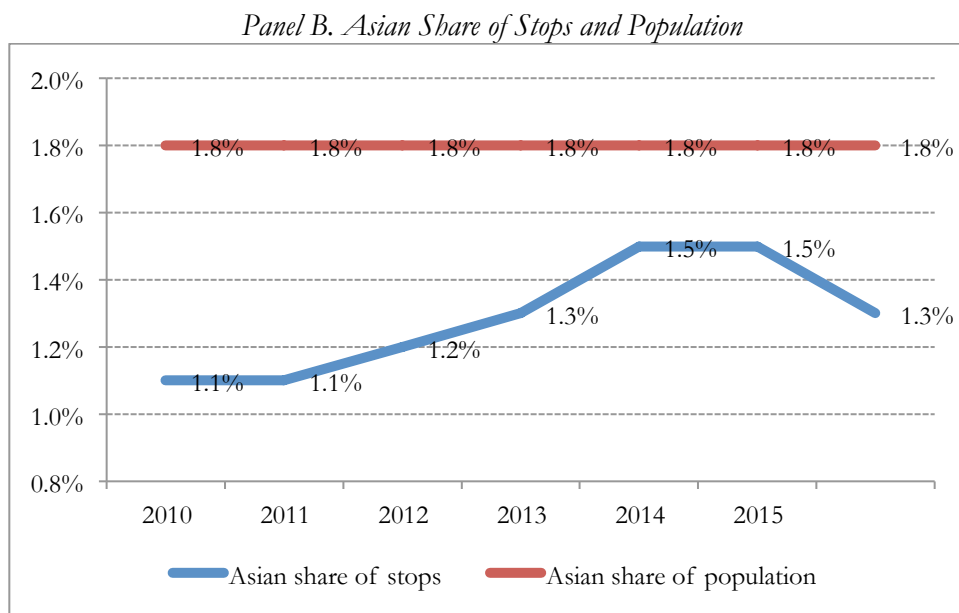
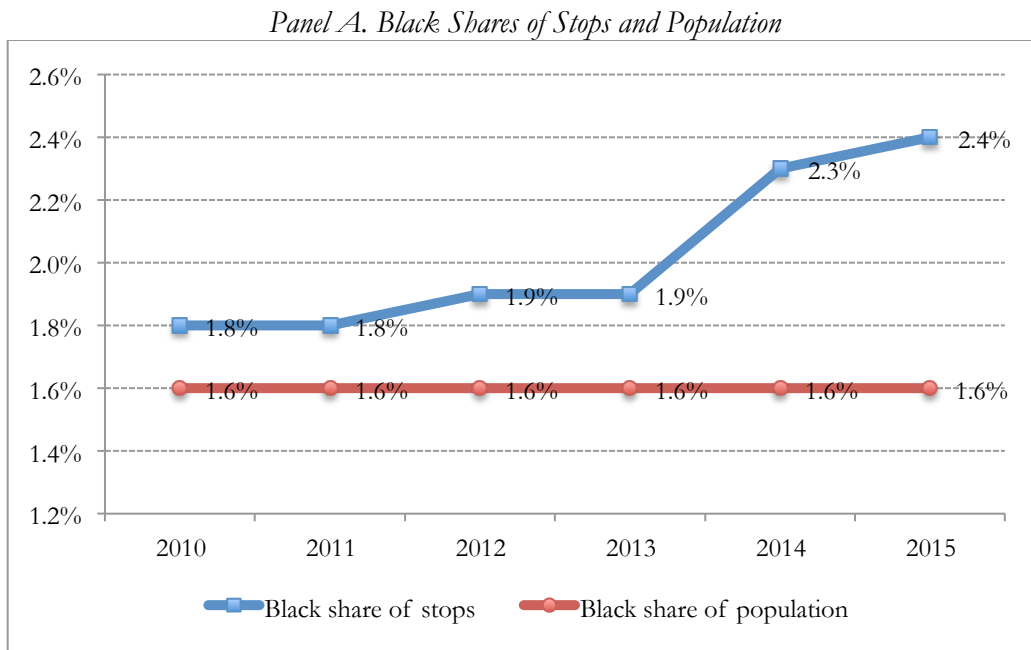
The first step in identifying disparities is to compare the percentage of stopped drivers to their share of the population. As the data indicate, white and Asian drivers are stopped at a lower rate than would be expected, given their population shares while black driver stop rates exceed their share of the population. For the period 2010-15, Asians are stopped at the lowest rate relative to their population share. Asians are approximately 1.8% of the

⁹ We exclude Native Americans from the analysis due to a small sample size, making statistical inferences unreliable. A total of 279 stopped drivers were perceived as Native Americans from 2010 to 2015, roughly 0.1% of all stops.

¹⁰ The data for 2010 is only from the last 6 months of the year.

population but only 1.3% of those stopped. In contrast, blacks are estimated to be about 1.6% of the population but they are 2.0% of those stopped. Our estimates of the population are only an imperfect measure of the driving population, and thus these results should be viewed with some caution. That said, *Panel A* in Figure 1 shows the trend over time of black drivers as a share of stops as compared to their population share. Their share of stops is rising. In particular, by 2015, black drivers were stopped at a rate that is 50% higher than their estimated population share. This is indicative of a worsening of racial disparity in traffic stops.

Figure 1. Black and Asian Share of Stops and Population



The data in *Panel B* of Figure 1 show that the Asian share of stops is lower in every year than their share of the population. The disparity narrowed until 2014 when it began to widen again. A comparison of *Panels A* and *B* demonstrates that disparity in traffic stops across different minorities and thus the importance of analyzing these groups separately.

B. Investigatory Stops

On their incident reports, police officers identify the reason for a traffic stop. Apart from externally generated stops, discussed above, possible reasons include: moving violation, vehicle equipment, suspicion of driving while intoxicated, and investigatory stops. Here, we examine in further detail the racial disparities in investigatory stops. These stops are always discretionary, and may be for minor violations like driving too slowly or failing to signal a turn. Racial bias can especially come into play in such stops since the stop is prompted by suspicion rather than identifiable behavior. Racial stereotypes often shape those biases and thus suspicions.

From 2010 to 2015, a total of 3,713 investigatory stops were conducted, about 1.3 percent of all stops. The share of stops of black drivers for which the stop is identified as an investigatory stop is 1.31%, compared to 1.36% for whites, 1.03% for Hispanics and 0.53% for Asians. The rate of investigatory stops is not statistically different between black, Hispanic, and Asian drivers as compared to white drivers and thus we conclude there is no evidence of racial bias or disparity in terms of investigatory stop rates.¹¹

III. Post-Stop Outcomes

Police officers and troopers frequently state they do not know the race of a driver before a stop. Once a driver has been stopped, however, the police are in a position to form an assessment of the driver's race. Therefore, post-stop outcomes are of significant interest. The data in Table 2 summarize post-stop outcomes for 2010-15. We first discuss ticket and warning rates, then arrest, search, and "hit" rates (the percentage of searches that result in contraband being found). Annual data are provided in the appendix in Table A.1.

A. Ticket and Warning Rates

One way to evaluate possible racial differences in post-stop outcomes is to compare the percentage of drivers receiving a warning versus a citation (ticket). The data in Table 2 summarize these data, and show that Asians were more likely to receive tickets (citations) than any other racial/ethnic group, at a rate of 48.1% of all stops. Hispanics and blacks were ticketed at the rate of 44.6% and 42.3%, respectively. White drivers received tickets the least

¹¹ In total there were 19 Asian, 27 Hispanic, 73 black, and 3538 white investigatory stops.

frequently of all racial groups, at a rate of 36.9%.¹² Not surprisingly, then, whites were more likely to receive warnings than other groups (Table 2).

Table 2. Post-Stop Outcomes, 2010-15

	White	Black	Asian	Hispanic
Tickets	95,793	2,348	1,713	1,145
Warnings	159,791	3,054	1,817	1,369
Arrests	2,684	107	21	39
Searches	2,702	274	29	103
<i>Consent searches</i>	2,541	253	28	102
<i>Searches with warrant</i>	161	21	1	1
Hits (Ticket or arrest as outcome)	1,626	119	21	43
Hits (Warning, ticket, or arrest as outcome)	2021	169	22	67
Ticket Rate	36.9%	42.3%	48.1%	44.6%
Warning Rate	61.5%	55.0%	51.0%	53.3%
Arrest Rate	1.0%	1.9%	0.6%	1.5%
Search Rate	1.0%	4.6%	0.8%	4.0%
Hit Rate (excl. warnings)	64.0%	47.0%	75.0%	42.2%
Hit Rate (all outcomes)	79.5%	66.8%	78.6%	65.7%

Note: The top section of the table shows the raw numbers of stopped drivers who received tickets, warnings, or were arrested or searched. Searches include only consent searches, based on probable cause and reasonable suspicion (thus excluding searches on warrant). The bottom section shows ticket, warning, arrest, and search rates (consent searches only) as a share of all stops. Data on percentage of searches that yield contraband are also provided.

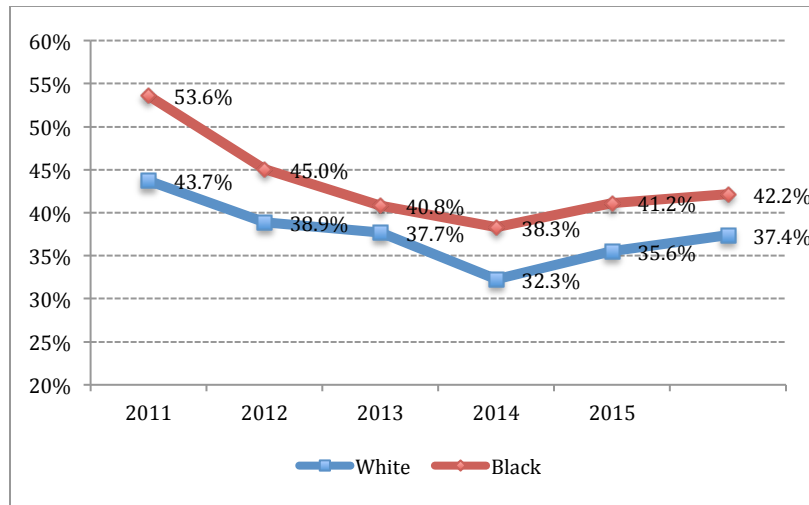
Panel A in Figure 2 shows the evolution of ticket rates from 2011 to 2015 for black and white drivers.¹³ Blacks are ticketed at a higher rate than whites in every year, although the disparity has narrowed since 2011. Panel B in Figure 2 shows ticket rates for all racial/ethnic groups, and here, too, we observe that whites are ticketed at a lower rate than all other groups. Asians are ticketed at the highest rate, and the white-Asian gap is the widest, averaging roughly 11 percentage points over this time period.

¹² Table A.4 in the appendix provides the hypothesis test results for the differences in proportions (i.e., differences in rates) between the black and Hispanic groups compared to the white population for all post-stop outcomes.

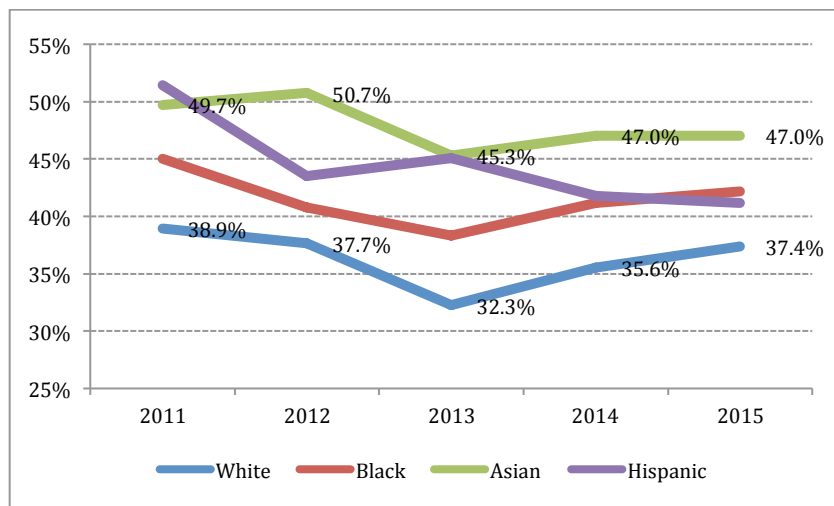
¹³ We omit data from 2010 in the annual graphs. Data collection only began in July of that year, and seasonal variations may affect ticket rates. For reasons of strict comparability, then, we exclude 2010 year from our annual analyses.

Figure 2. Trends in Ticket Rates, 2011-15

Panel A. Trends in Black and White Ticket Rates, 2011-15



Panel B. Trends in Ticket Rates for All Racial/Ethnic Groups, 2011-15

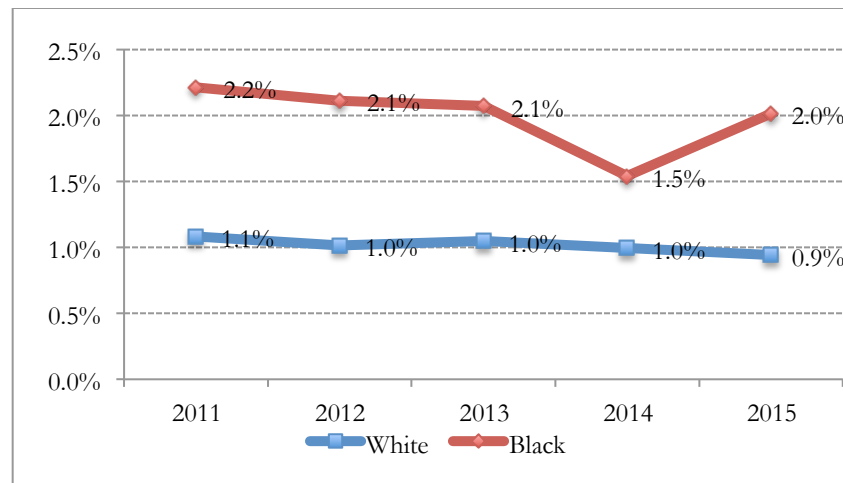


B. Arrest Rates

As the data in Table 2 show, Hispanics and Blacks were more likely to be arrested than whites. The black arrest rate is almost twice the white arrest rate (1.9% for blacks

compared to 1.0% for whites) and 50% higher for Hispanics (1.5%) than whites. This difference is statistically significant. Overall, Asians were arrested at that lowest rate. It is interesting and perhaps surprising that Asians were significantly more likely to be ticketed but much less likely to be arrested. This points to the importance of conducting analysis by racial/ethnic group rather combining non-white groups into a single minority category. The data in Figure 3 provides trend data on black and white arrest rates.¹⁴ In all years, the black arrest rate exceeds the white rate. Although the gap narrowed in 2014, the overall trend indicates ongoing racial disparity among racial/ethnic groups.

Figure 3. Trends in Black and White Arrest Rates, 2011 to 2015



C. Search Rates

The VSP traffic dataset provides information on searches based on three criteria: 1) probable cause; 2) reasonable suspicion (a lower bar of evidence than probable cause); and 3) warrants. The first two are known as consent searches. In those cases, the driver agrees to a search. A search based on a warrant typically results from a case in which a trooper requests but does not obtain consent, then impounding the vehicle and seeking a warrant from a judge.¹⁵

We focus here on consent searches, although the inclusion of searches based on a warrant would not substantially alter our results.¹⁶ As the data in Table 2 indicate, the average search rate of black drivers from 2010 to 2015 is 4.6%, a rate that is more than 4 times that of whites. Although Asians comprise a larger share of the population than blacks (1.8%

¹⁴ We do not show arrest, search or hit rate trends for Asians and Hispanics because the annual totals are too small.

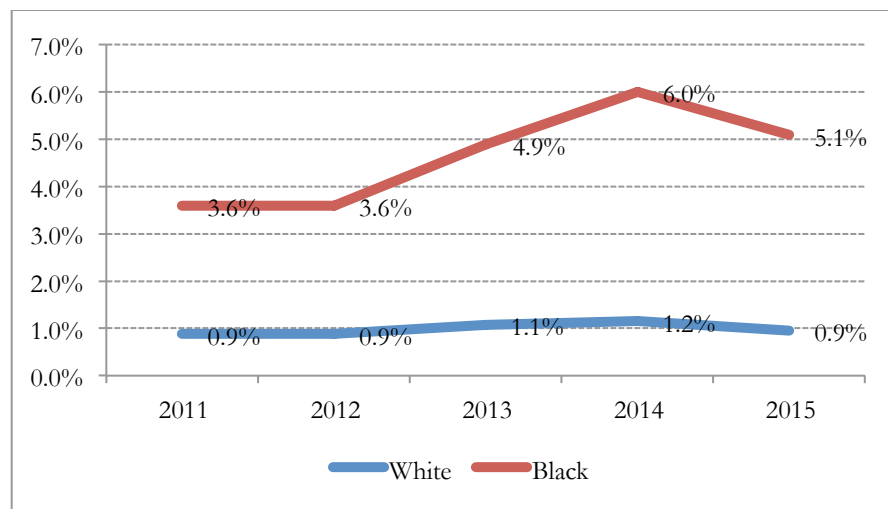
¹⁵ Searches based on a warrant are not entirely discretionary since a judge must grant the warrant, although such requests are rarely denied.

¹⁶ In total over the 5.5 years there were only 187 searches on warrant out of 3,154 total searches. Of those 187 searches on warrant, 21 (11%) were of black drivers.

compared to 1.6%, according to ACS data), VSP conducted almost 10 times as many searches of black drivers compared to Asian drivers (274 vs. 29). Consent searches of black drivers totaled 253, compared to only 28 of Asians during 2010-15. This difference again underscores why studies of racial disparities must be analyzed by racial/ethnic group rather than aggregated into one minority group. The search rate of drivers that troopers perceived to be Hispanic is also very high, at 4.0% compared to white and Asian drivers. The black-white and Hispanic-white differences in search rates are statistically significant (Table A.4).

Trends in search rates for blacks and whites since 2011 are shown in Figure 4. While the black-white gap in the consent search rate was 2.7 percentage points in 2011, that gap has widened substantially. By 2015, the black search rate is 4.5 percentage points higher than the white rate.

Figure 4. Trends in Black and White Search Rates, 2011 to 2015



D. Contraband and “Hit” Rates

A key method for detecting racial bias in policing is the evaluation of differences in the percentage of searches in which contraband is found (this is, in jargon, called the *hit rate*). In the absence of racial bias, troopers would be expected to pursue a search strategy that maximizes the number of successful searches, defined as searches that yield contraband. Without bias, one would expect the hit rates to be the same across racial/ethnic groups, although the search rates might differ. If, however, racial bias plays a role in influencing the decision to search, the hit rate for minority drivers (e.g., black drivers) would be lower than that of white drivers. Another way to view this is that minority hit rates that are lower than white hit rates are an indication that police are over-searching minorities (and/or under-searching whites).

We examined hit rates in two ways. First, we calculate hit rates only in those cases where a ticket is issued or the driver is arrested (or both). Thus, we ignore those hits where only a warning is issued. The rationale for excluding hits that result in warnings is that the

contraband found is likely to have been of a relatively insignificant amount or quality. For example, an underage driver with cigarettes and/or drivers with small amounts of marijuana may only receive warnings. Second, we also calculate the hit rate for searches that yield contraband and result in *any* outcome—a ticket, warning, or arrest.

For the period 2010-2015, the lowest hit rates when warnings are excluded are for Hispanics and blacks (42.2% and 47.0%, respectively). This compares to 75.0% for Asians and 64.0% for whites. The white-black and white-Hispanic differences are statistically significant (Table A.4). **What is notable then is that the hit rates are lowest for the two racial/ethnic groups with the highest search rates.** This is indicative, at a minimum, of inefficient policing.

Inclusion of searches that result in warnings obviously raises all hit rates. When warnings are included, the white hit rate rises to 79.5% for whites, the highest amongst all groups, followed by 78.6% for Asians. Here, too, hit rates are lowest for Hispanics and blacks (65.7% and 66.8%, respectively).¹⁷

Racial stereotypes are often informed by media portrayals of blacks and Hispanics as disproportionately involved in drug trafficking. The VSP data, and in particular, the data on hit rates that exclude warnings suggest the importance of revisiting these stereotypes. That is because, when we remove warnings (likely indicative of a less serious form of contraband), the white-black and white-Hispanic gaps in hit rates widen considerably. The Hispanic-white disparity in hit rates increases from 13.8 percentage points to 21.8 percentage points and the black-white disparity increases from 12.7 to 17.0 percentage points. This is suggestive of over-searching of black and Hispanic drivers, and therefore inefficient policing.

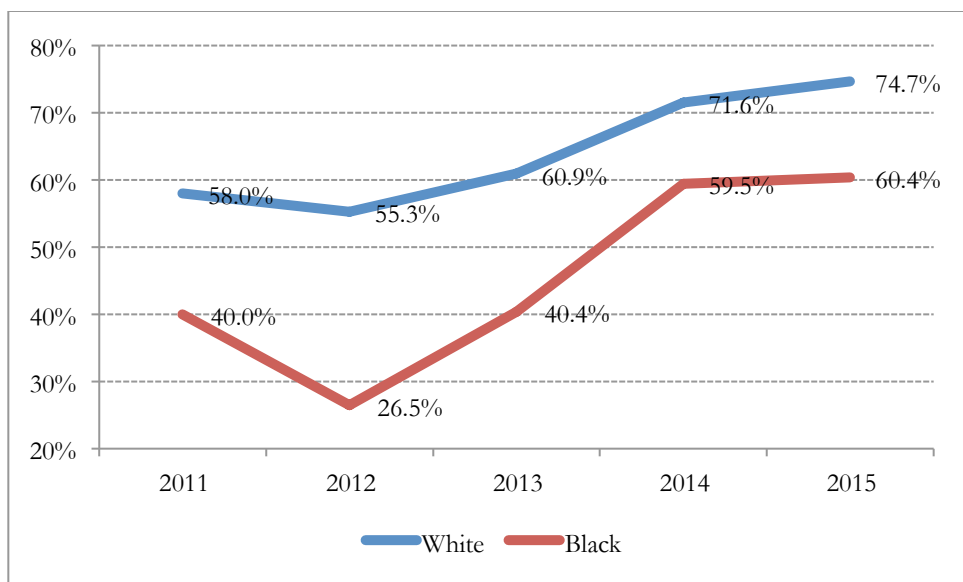
Figure 5 shows trends in hit rates for white and black drivers. *Panel A* reflects trends for searches that result in a ticket or an arrest. Searches of white drivers are substantially more likely to yield contraband than searches of black drivers. This disparity has narrowed over the last 4 years, such that the gap in white-black hit rates fell from 18.0 percentage points in 2011 to 14.3 percentage points in 2015. Nevertheless, this gap continues to be wide, and is suggestive of inefficiency in search decisions, given the lower probability that searched black drivers are found carrying contraband, compared to white drivers.

Panel B indicates trends in hit rates for searches, regardless of outcome. Here, too, the white hit rate is greater than the black rate in every year. And, here too, the gap is narrowing, in fact much more substantially than the hit rate that excludes warnings as outcomes. While this is encouraging in terms of the reduction in racial disparities, we put more weight on the former measure that focuses on more serious evidence of contraband. Unfortunately, the data do not permit a more refined analysis of contraband evidence. **It would be useful for VSP to differentiate felony versus misdemeanor contraband.**

¹⁷ In appendix A.4, we also include a statistical test that includes the situations where contraband was found but no search was recorded (e.g., the contraband may have been seen by the trooper without the need for a search, been a search incident to an arrest, or an error in data entry). For whites there were 170 stops in which contraband was found and a ticket or arrest occurred, but no search was made. For blacks, there were only 4 stops of that type.

Figure 5. Trends in Percentages of Searches Yielding Contraband, 2011 to 2015

Panel A. With tickets or arrests as an outcome of the search



Panel B. Tickets, arrests, or warnings as outcome of the search



III. Black Driver Stop Rates by Trooper

Trooper identification codes are provided in the VSP data set, allowing us to assess racial disparities in traffic policing by trooper. To conduct this analysis, we exclude those troopers who have recorded fewer than 100 stops over the period 2010-15 in order to avoid small sample size and to focus on those troopers routinely engaged in traffic policing.

We calculate stop rates of drivers perceived as black (Figure 6) and Hispanic (Figure 7) by trooper separately (as indicated by the trooper code number).

A. Black Driver Stop Rates by Trooper

The red line in Figure 6 is the estimated share of the Vermont population that is black and we would expect that, absent racial disparities, the share of stopped drivers would be roughly equivalent to 1.6%. On the left of Figure 6, we observe that for 45 troopers, the share of black drivers they stop exceeded 3% (almost double the black population share). For about 100 troopers, the share of drivers stopped who are perceived as black exceeded 2%. The data also indicate that blacks are more than 5% of all stops for a small number of troopers. This variation in policing behavior is notable, and suggests differences in policing behavior that warrant further consideration.

Analysis of the data shown in Figure 7 shows a wide disparity in Hispanic stop rates by trooper. Due to differences in the methodologies used to classify the race/ethnicity of drivers adopted by the VSP and U.S. Census, we do not include an estimate of the Hispanic share of the Vermont population.¹⁸

Figure 6. Blacks as % of Stops by Trooper, Ranked High to Low (100 stops+), 2010-15

¹⁸ The ACS measures Hispanic as an ethnicity—a person has BOTH a race and an ethnicity (i.e., they answer yes or no to Hispanic ethnicity AFTER choosing their race which does *not* include Hispanic as a choice). But, VSP and other Vermont police agencies consider Hispanic to be one of several racial groups (e.g., a person can be perceived as black OR Hispanic, but not both). We thus have no estimate of the Hispanic population that is consistent with how the police are identifying Hispanic drivers.

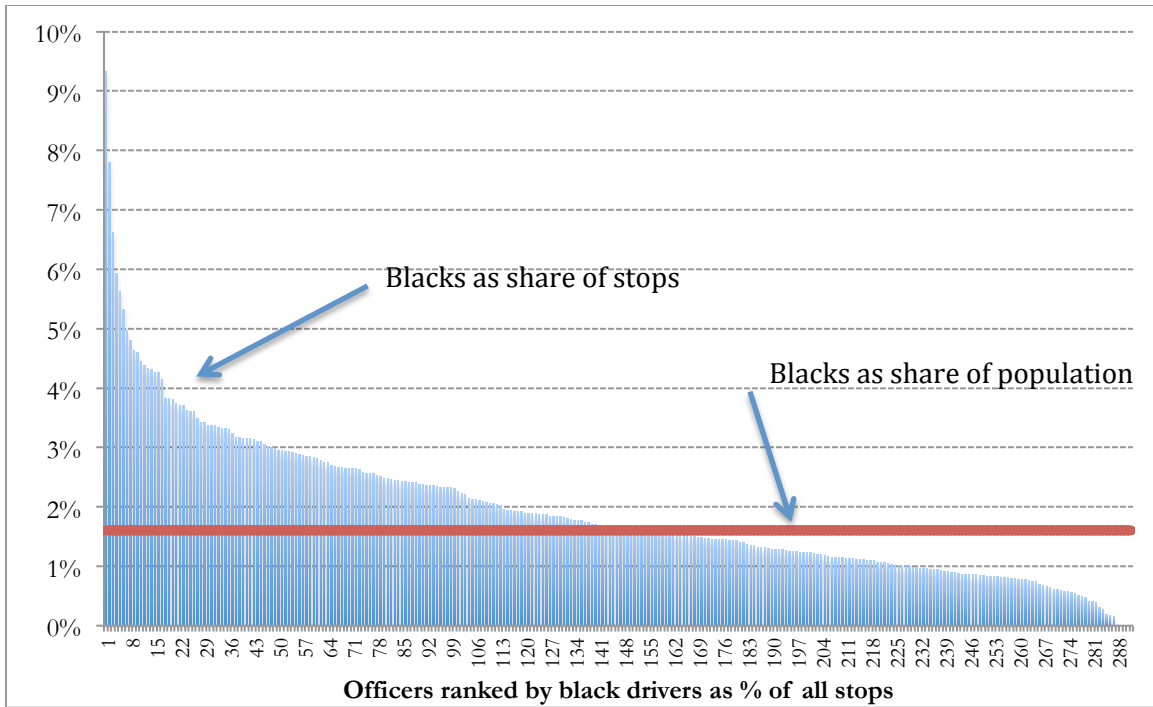
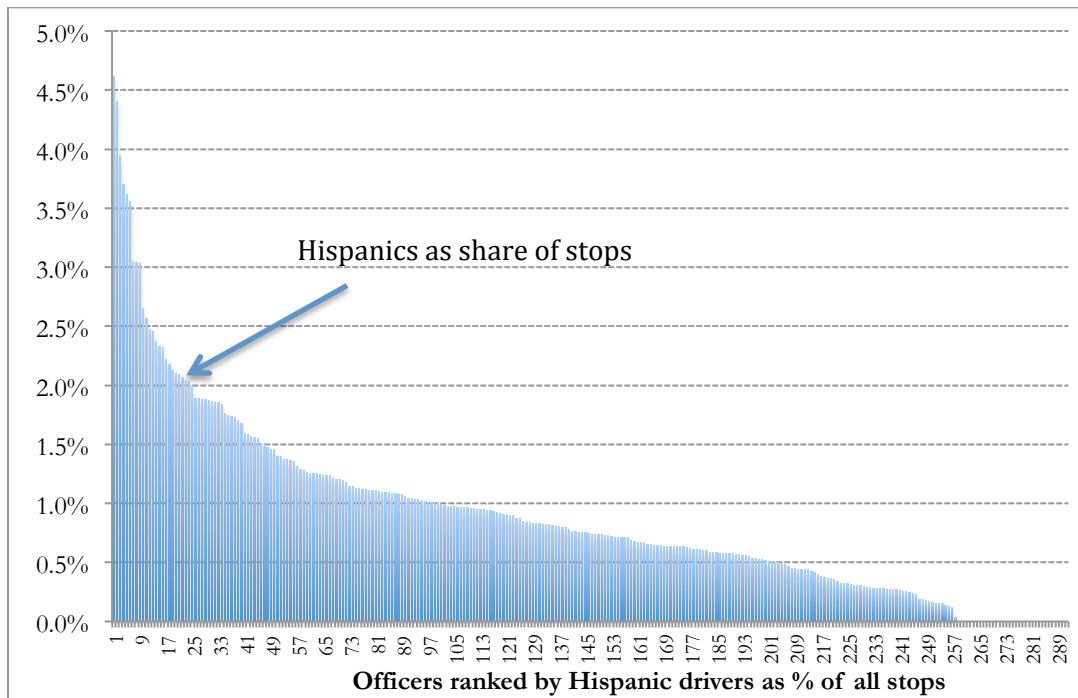


Figure 7. Hispanics as % of Stops by Trooper, Ranked High to Low (100 stops+), 2010-15



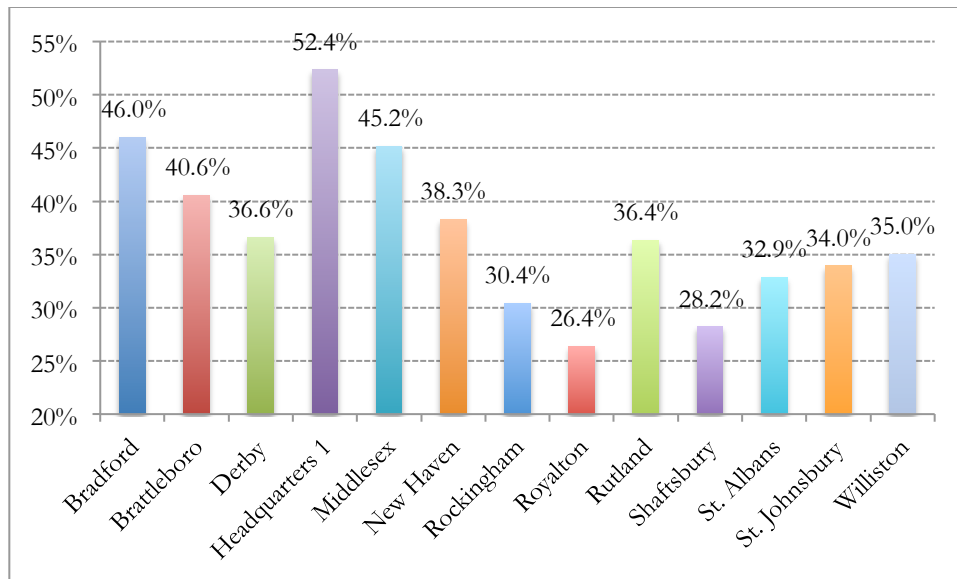
IV. Racial Disparities in Traffic Stops by Agency, 2010 – 2015

Policing behavior is influenced by the culture of the agency as well as the role of leadership in encouraging, tolerating, or discouraging racially disparate treatment of drivers. Within the VSP, there are 12 barracks, each with its own commander, in addition to an administrative center (labeled as Headquarters 1 in the data set).¹⁹ The culture regarding race in policing as well as leadership may differ among these units. Of course, they are also located in different parts of the state with varying shares of minorities on the road. We therefore focus on post-stop outcomes by barracks, where troopers have now formed a perception of the race of the driver. We focus on variations in black post-stop outcome rates, to reiterate, because (1) this group tends to face the greatest disparity relative to whites, not only in Vermont but also in the US as a whole and (2) the sample size for Hispanics and Asians by barrack is too small for analysis. Raw data on stops and outcomes by barracks are shown in Table A.2.

Figure 9 focuses on ticket (Panel A) and arrest rates (Panel B) and shows the wide variation in policing practices by barracks. These data are for all races/ethnicities. As can be seen the percentage of stops resulting in the trooper issuing a citation ranges from a low of 26.4% in Royalton to a high of 52.4% at Headquarters 1. Arrest rates vary from 0.2% in Derby barracks to 1.9% in St. Albans.

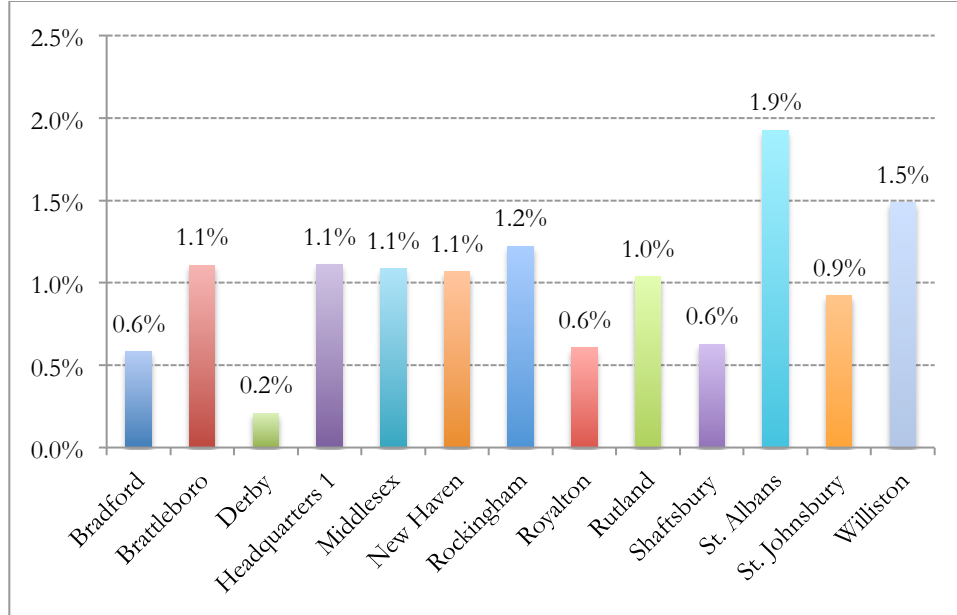
Figure 9. Ticket and Arrest Rates by Barracks, 2010-15

Panel A. Ticket Rates



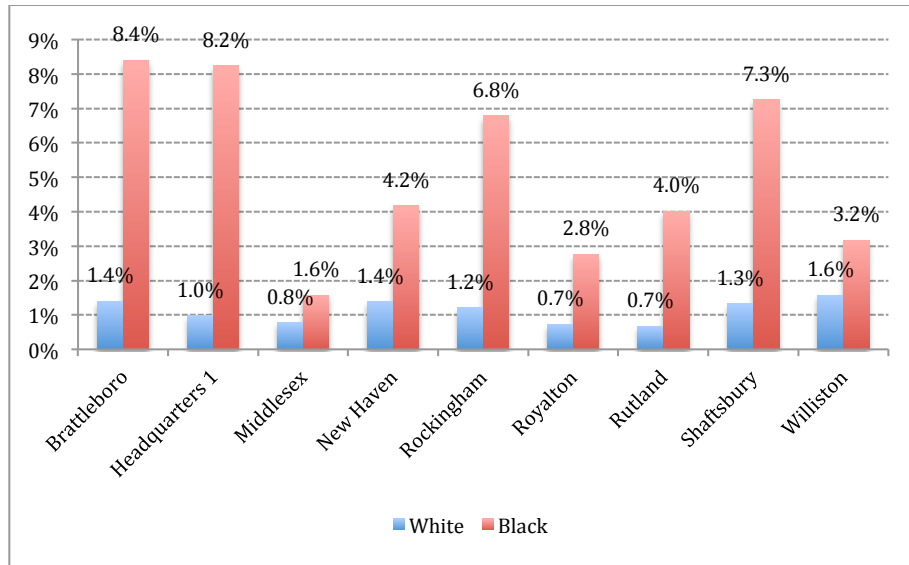
¹⁹ An additional administrative center is provided in the VSP dataset, Headquarters 2. This latter has a very small number of stops and this is ignored in this analysis.

Panel B. Arrest Rates



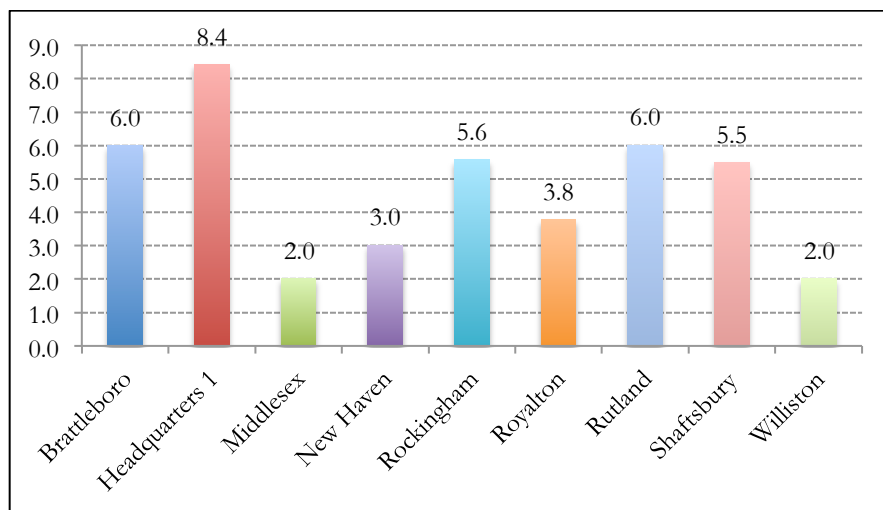
Results of an analysis of racial disparities in traffic policing focused on differences across barracks in white and black search and hit rates are summarized here. Figure 10 provides search rate data (consent searches only) for white and black drivers. We include data on those barracks for which there have been a minimum of 10 searches of blacks and of whites, so as to have a statistically large enough sample on which to base inferences. The white search rate (that is the percentage of stopped white drivers who were searched) ranges from a low of 0.7% in Rutland to a high of 1.6% in Williston. In stark contrast, the black search rate ranges from a low of 0.6% in St. Johnsbury to a high of 8.4% of black drivers in Brattleboro. In several other barracks as well, the search rates are extremely elevated, again raising questions about policing protocol in these barracks.

Figure 10. White and Black Search Rates by Agency, 2010-15



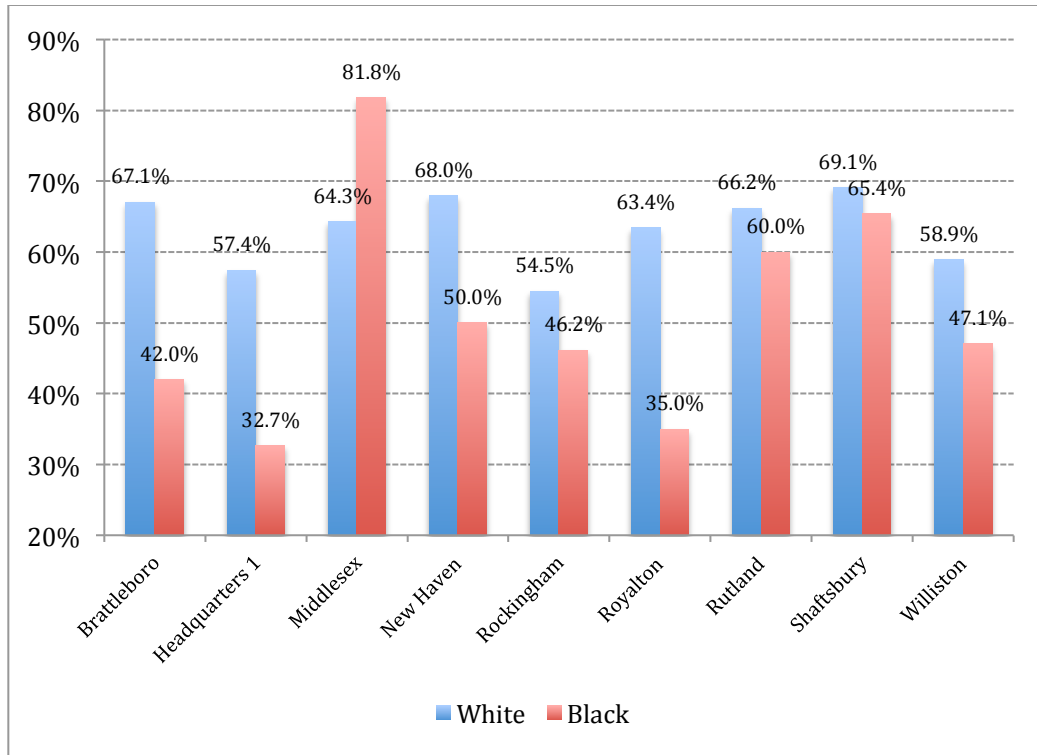
The data in Figure 11 show the ratio of black to white search rates. This can be read as the difference in the probability a black driver will be searched as compared to a white driver. **A black driver stopped by a trooper in the barracks Headquarter1 is more than 8 times as likely to be searched as a white driver, and 6 times more likely in Brattleboro and Rutland. Even in those barracks with lower ratios—Middlesex and Williston—black drivers are twice as likely to be searched as white drivers.**

Figure 11. Ratio of Black to White Search Rates by Barracks, 2010-15



While search rates of blacks are higher than of whites in all barracks, hit rates on consent searches (excluding searches that result in a warning) are *lower* in all barracks with the exception of Middlesex (Figure 12). The widest racial gaps are found in Royalton (28.5 percentage points) and Brattleboro (25.0 percentage points).

Figure 12. Hit Rates on Consent Searches (excluding warnings as outcomes)



V. Data Quality

Data quality depends in large part on the completeness of incident reports. Table 3 summarizes the number of incidents for which categories of data were missing or marked “unknown.” (Table A.3 provides raw data counts on missing and unknowns). The highest percentage of missing/unknown data—1.7%—is the race of the driver. There is a modest decrease in the “missingness” of race data since 2010, but the increase from 2014 to 2015 with almost double the share of stops missing race of driver, is of concern. The share of stops with age of driver missing is on the rise, although not as high as the race of driver. Other types of data show improvement by 2015, with decreasing percentages shown as missing or unknown.

Table 3. Number of Incident Reports with Missing/Unknown Data, 2010-15

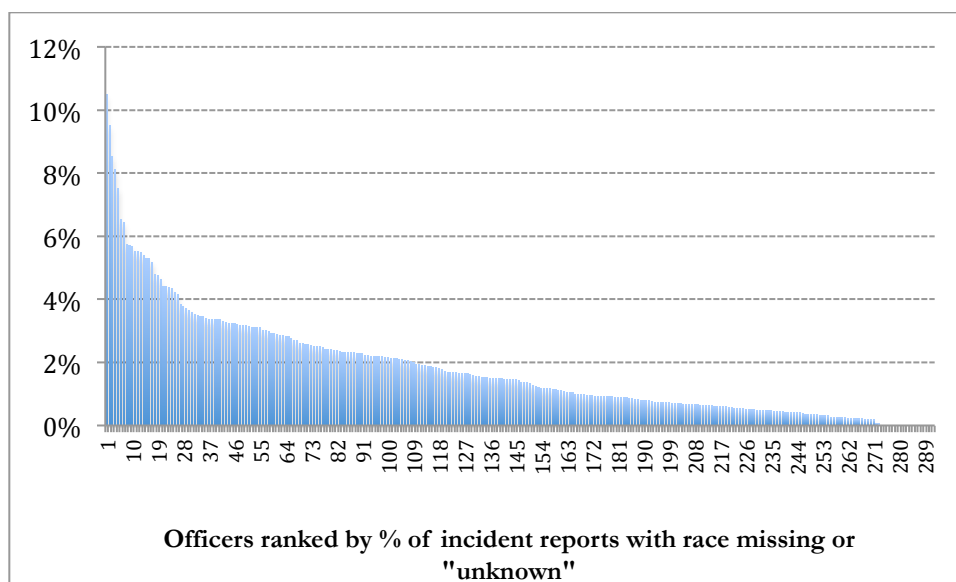
Year	Total Incidents	Age	Race	Sex	Reason for Stop	Outcome	Search	Search Outcome
2010	23,980	0.3%	2.3%	0.5%	1.0%	1.0%	1.0%	1.1%
2011	47,598	0.4%	1.6%	0.7%	0.9%	1.0%	1.0%	1.1%

2012	51,522	0.2%	2.3%	0.5%	0.6%	0.6%	0.6%	1.1%
2013	55,969	0.2%	1.4%	0.7%	0.9%	0.9%	0.9%	1.0%
2014	53,391	0.3%	1.1%	0.6%	1.0%	1.0%	1.0%	1.2%
2015	44,426	1.0%	2.0%	0.5%	0.4%	0.5%	0.4%	0.6%
Grand Total	276,886	0.4%	1.7%	0.6%	0.8%	0.8%	0.8%	1.0%

Note: The data refer to the number of incidents, reflecting the possibility that a stop may result in more than one incident report. Externally generated stops are excluded.

The rate of “missingness” of race data is not uniform across troopers. The data in Figure 14 display the percentage of incident reports missing the race of the driver, ranked from high to low by trooper number. Again, we exclude data on troopers with fewer than 100 stops over the period 2010-15. For approximately 100 troopers, race data are missing/unknown more than 2% of the time.

Figure 14. Percentage of Incident Reports With Race of Driver Missing or Recorded as “Unknown” by Trooper (100+ stops), 2010-2015



In addition, another data quality concern is inconsistently recorded information. For example, with regard to searching, an officer records two pieces of information about the search. Did a search occur during the stop and, if so, what was the result of that search (i.e., was contraband found or was no contraband found)? There are 179 stops where the officer recorded that a search of the vehicle had, in fact, taken place, yet when the officer recorded the outcome of that search, the *outcome* was recorded “no search.”

As noted earlier in the paper, there are also 249 stops in which the officer reported that no search had occurred but a positive outcome of a search was then recorded (i.e., contraband was found). In this case, we are unsure if contraband found without the need for a formal search or if this is another case of inconsistent recording of information.

VI. Conclusion

In this analysis, we examine trends in racial disparities in traffic policing by the Vermont State Police from July 1, 2010 to December 31, 2015. We evaluate the data for patterns of disparities in stops and post-stop outcomes. Table 4 below summarizes our general findings. There are statistically significant disparities in all categories of post stop outcomes for blacks and Hispanics, relative to whites, and for Asians relative to whites only in the rate at which citations are issued. This underscores the need to disaggregate non-white outcomes. Asians tend to be treated more favorably by the VSP than blacks and Hispanics.

Table 4. Statistically Significant Racial Disparities in Outcomes

	Black-white	Asian-white	Hispanic-white
Investigatory stop	No	No	No
Ticket/Citation rate	Yes	Yes	Yes
Arrest rate	Yes	No	Yes
Search rate	Yes	No	Yes
Hit rate (white - nonwhite group)	Yes	No	Yes

Note: The data are for all stops, excluding externally generated stops, 2010-15. Search rates are for consent searches. Hit rates are for “hits” (i.e., contraband found) in which the outcome was a ticket or arrest on violation. These results do not include arrests or searches based on a warrant. In all cases, the statistical test is a one-tail test. In the first 4 rows, the research hypothesis is that the rate for the non-white drivers will be higher than for the white drivers. In the last row on hit rates, the research hypothesis is that the non-white drivers will have a lower rate.

One of the most important uses of multi-year data is to observe trends over time. This allows the VSP to assess whether measures it is taking to reduce disparities are having the intended effect. We focus on time trends in black and white outcomes for two reasons. These disparities are the largest of all groups and the single year samples sizes of Hispanics and Asians are in a number of cases too small to make reliable comparisons and statistical inferences. From 2011 to 2015, we observe that the stop rate of blacks is rising relative to the black population share, while the Asian stop rate is consistently below its population share to varying degrees. Blacks are issued citations at a higher rate than whites, although this gap is narrowing. The black arrest rate is roughly double that of the white rate and has been stable over the time period examined. Of particular note is that the amount by which the black search rate exceeds the white search rate is rising over time, so that by 2015, black drivers are searched at a rate that is 5.5 times that of white drivers.

Our analysis shows wide disparities in stop rates of blacks and Hispanic drivers by trooper. For example, blacks were more than 7% of all drivers stopped for several troopers. We cannot assess the reasons for these disparities at this level of analysis, but these data do offer a starting point for the VSP to internally explore possible explanations and steps to be taken to respond to such disparities, if necessary.

Finally, we provide evidence of wide disparities in outcomes by barracks. Some barracks are located near interstate highways and the racial composition of the driving population may vary substantially from that of the local population. We therefore emphasize post-stop outcomes. Of particular note is that the probability of a stopped black driver being searched by troopers from the Brattleboro, Rutland, Rockingham, Shaftsbury or Headquarters barracks is more than 5 times higher than a white driver being searched. And yet, in all of these barracks, the hit rate of searched white drivers *exceeds* that of black searched drivers.

The persistent disparities revealed in these data warrant continued attention, analysis and efforts to reduce them.

APPENDIX

Table A.1 Raw Data

All Years	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							
<i>Including externally generated stops</i>	265,906	5,727	3,604	279	2,620	4,802	282,938
<i>Excluding externally generated stops</i>	259,903	5,554	3,562	268	2,568	4,710	276,565
Outcomes (excl. externally generated stops)							
<i>Ticket</i>	95,793	2,348	1,713	130	1,145	1,996	103,125
<i>Warning</i>	159,781	3,054	1,817	132	1,369	2,349	168,502
<i>Arrest for violation</i>	2,684	107	21	6	39	8	2,865
<i>Arrest for warrant</i>	59	6	0	0	3	0	68
Searches (excl. externally generated stops)							
<i>Total Stops with No Search</i>	255,415	5,233	3,521	258	2,452	4,299	271,178
<i>Total Stops with Unknown Search</i>	1,786	47	12	0	13	375	2,233
<i>Total Stops with Search</i>	2,702	274	29	10	103	36	3,154
<i>Search with probable cause</i>	1,883	169	17	4	59	17	2,149
Stops with No contraband found	135	23	0	2	10	0	170
Stops with Unknown contraband found	22	3	0	0	0	0	25
Stops with Contraband found	1,633	137	16	2	49	16	1,853
<i>Incidents</i>							
<i>Warning</i>	293	39	0	0	18	5	355
<i>Ticket</i>	857	63	8	1	22	9	960
Arrest on violation	482	35	8	1	10	2	538
<i>Search with reasonable suspicion</i>	658	84	11	5	43	17	818
Stops with No contraband found	228	40	4	2	19	11	304
Stops with Unknown contraband found	3	0	0	0	0	0	3
Stops with Contraband found	387	34	6	3	17	5	452
<i>Incidents</i>							
<i>Warning</i>	102	11	1	0	6	0	120
<i>Ticket</i>	165	13	5	2	8	3	196
Arrest on violation	122	8	0	1	3	2	136
<i>Search with warrant</i>	161	21	1	1	1	2	187
Stops with No contraband found	9	4	0	0	0	0	13
Stops with unknown contraband found	3	0	0	0	0	0	3
Stops with Contraband found	131	17	1	1	1	1	152
<i>Incidents</i>							
<i>Warning</i>	9	3	0	0	0	1	13
<i>Ticket</i>	34	5	0	0	0	0	39
Arrest on violation	85	9	1	1	1	0	97
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	61.5%	55.0%	51.0%	49.3%	53.3%	49.9%	60.9%
<i>Ticket rate</i>	36.9%	42.3%	48.1%	48.5%	44.6%	42.4%	37.3%
<i>Arrest rate</i>	1.03%	1.93%	0.59%	2.24%	1.52%	0.17%	1.04%
<i>Search rates</i>	1.04%	4.93%	0.81%	3.73%	4.01%	0.76%	1.14%
<i>Search rate (excl. searches on warrant)</i>	0.98%	4.56%	0.79%	3.36%	3.97%	0.72%	1.07%
<i>Search rate (incl. searches on warrant)</i>	1.04%	4.93%	0.81%	3.73%	4.01%	0.76%	1.14%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	79.5%	66.8%	78.6%	55.6%	65.7%	61.8%	77.7%
Hit rates (excl. warnings as outcomes of searches)	64.0%	47.0%	75.0%	55.6%	42.2%	47.1%	61.7%
Stops with Hits Despite No Search Recorded (all outcomes)	236	5	2	1	1	4	249
Stops with Hits Despite No Search Recorded (excl.	170	4	1	0	1	2	178

warnings)							
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2010	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							
<i>Including externally generated stops</i>	22,979	434	270	23	192	553	24,451
<i>Excluding externally generated stops</i>	22,513	416	268	23	188	544	23,952
Outcomes (excl. externally generated stops)							
<i>Ticket</i>	9,839	223	140	15	94	251	10,562
<i>Warning</i>	12,255	185	125	7	88	225	12,885
<i>Arrest for violation</i>	265	6	0	1	5	2	279
<i>Arrest for warrant</i>	5	0	0	0	0	0	5
Searches (excl. externally generated stops)							
<i>No search conducted</i>	22,135	404	265	22	175	475	23,476
<i>Unknown if searched</i>	161	2	3	0	2	65	233
<i>Total searches conducted</i>	217	10	0	1	11	4	243
<i>Search with probable cause</i>	121	3	0	0	6	3	133
No contraband found	11	1	0	0	4	0	16
Unknown contraband	0	1	0	0	0	0	1
Contraband found	103	0	0	0	2	3	108
<i>Incident Outcomes:</i>							
<i>Warning</i>	18	0	0	0	2	3	23
<i>Ticket</i>	37	0	0	0	0	0	37
Arrest on violation	48	0	0	0	0	0	48
<i>Search with reasonable suspicion</i>	75	7	0	1	5	1	89
No contraband found	29	5	0	0	3	1	38
Unknown contraband	1	0	0	0	0	0	1
Contraband found	40	1	0	1	2	0	44
<i>Incident Outcomes:</i>							
<i>Warning</i>	10	0	0	0	1	0	11
<i>Ticket</i>	12	1	0	0	0	0	13
Arrest on violation	20	0	0	1	1	0	22
<i>Search with warrant</i>	21	0	0	0	0	0	21
No contraband found	2	0	0	0	0	0	2
Unknown contraband	2	0	0	0	0	0	2
Contraband found	16	0	0	0	0	0	16
<i>Incident Outcomes:</i>							
<i>Warning</i>	1	0	0	0	0	0	1
<i>Ticket</i>	1	0	0	0	0	0	1
Arrest on violation	14	0	0	0	0	0	14
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	54.4%	44.5%	46.6%	30.4%	46.8%	41.4%	53.8%
<i>Ticket rate</i>	43.7%	53.6%	52.2%	65.2%	50.0%	46.1%	44.1%
<i>Arrest rate</i>	1.18%	1.44%	0.00%	4.35%	2.66%	0.37%	1.16%
<i>Search rates</i>	0.96%	2.40%	0.00%	4.35%	5.85%	0.74%	1.01%
<i>Search rate (excl. searches on warrant)</i>	0.87%	2.40%	0.00%	4.35%	5.85%	0.74%	0.93%
<i>Search rate (incl. searches on warrant)</i>	0.96%	2.40%	0.00%	4.35%	5.85%	0.74%	1.01%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	74.0%	10.0%	-	100.0%	36.4%	75.0%	68.5%
Hit rates (excl. warnings as outcomes of searches)	59.7%	10.0%	-	100.0%	9.1%	0.0%	54.1%
Stops with Hits Despite No Search Recorded (all outcomes)	22	1	1	0	0	0	24
Stops with Hits Despite No Search Recorded (excl. warnings)	8	0	0	0	0	0	8

2011	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							
<i>Including externally generated stops</i>	45,980	888	538	40	359	799	48,604
<i>Excluding externally generated stops</i>	44,989	857	531	39	350	785	47,551
Outcomes (excl. externally generated stops)							
<i>Ticket</i>	17,510	386	264	18	180	385	18,743
<i>Warning</i>	26,654	439	263	20	162	330	27,868
<i>Arrest for violation</i>	487	19	0	1	6	1	514
<i>Arrest for warrant</i>	11	1	0	0	0	0	12
Searches (excl. externally generated stops)							
<i>No search conducted</i>	44,197	817	523	37	333	691	46,598
<i>Unknown if searched</i>	390	9	2	0	1	77	479
<i>Total searches conducted</i>	402	31	6	2	16	17	474
<i>Search with probable cause</i>	232	14	2	1	5	4	258
No contraband found	20	2	0	0	0	0	22
Unknown contraband	2	1	0	0	0	0	3
Contraband found	198	11	2	1	5	3	220
<i>Incident Outcomes:</i>							
<i>Warning</i>	41	3	0	0	2	1	47
<i>Ticket</i>	80	4	2	0	0	1	87
Arrest on violation	79	4	0	1	3	1	88
<i>Search with reasonable suspicion</i>	147	16	4	1	11	12	191
No contraband found	68	8	3	1	5	10	95
Unknown contraband	0	0	0	0	0	0	0
Contraband found	72	5	0	0	2	1	80
<i>Incident Outcomes:</i>							
<i>Warning</i>	10	1	0	0	0	0	11
<i>Ticket</i>	34	1	0	0	1	1	37
Arrest on violation	27	3	0	0	1	0	31
<i>Search with warrant</i>	23	1	0	0	0	1	25
No contraband found	0	0	0	0	0	0	0
Unknown contraband	0	0	0	0	0	0	0
Contraband found	22	1	0	0	0	1	24
<i>Incident Outcomes:</i>							
<i>Warning</i>	1	0	0	0	0	1	2
<i>Ticket</i>	4	0	0	0	0	0	4
Arrest on violation	16	1	0	0	0	0	17
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	59.2%	51.2%	49.5%	51.3%	46.3%	42.0%	58.6%
<i>Ticket rate</i>	38.9%	45.0%	49.7%	46.2%	51.4%	49.0%	39.4%
<i>Arrest rate</i>	1.08%	2.22%	0.00%	2.56%	1.71%	0.13%	1.08%
<i>Search rates</i>	0.89%	3.62%	1.13%	5.13%	4.57%	2.17%	1.00%
<i>Search rate (excl. searches on warrant)</i>	0.84%	3.50%	1.13%	5.13%	4.57%	2.04%	0.94%
<i>Search rate (incl. searches on warrant)</i>	0.89%	3.62%	1.13%	5.13%	4.57%	2.17%	1.00%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	71.5%	53.3%	33.3%	50.0%	43.8%	25.0%	66.8%
Hit rates (excl. warnings as outcomes of searches)	58.0%	40.0%	33.3%	50.0%	31.3%	18.8%	54.1%
Stops with Hits Despite No Search Recorded (all outcomes)	37	1	0	0	0	0	38
Stops with Hits Despite No Search Recorded (excl. warnings)	26	1	0	0	0	0	27

2012	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							

<i>Including externally generated stops</i>	49,286	976	611	52	443	1,183	52,551
<i>Excluding externally generated stops</i>	48,314	946	601	50	432	1,163	51,506
Outcomes (excl. externally generated stops)							
<i>Ticket</i>	18,197	386	305	25	188	543	19,644
<i>Warning</i>	29,337	535	291	25	235	585	31,008
<i>Arrest for violation</i>	491	20	4	0	3	1	519
<i>Arrest for warrant</i>	12	1	0	0	0	0	13
Searches (excl. externally generated stops)							
<i>No search conducted</i>	47,590	902	594	49	412	1,122	50,669
<i>Unknown if searched</i>	270	5	3	0	5	38	321
<i>Total searches conducted</i>	454	39	4	1	15	3	516
<i>Search with probable cause</i>	322	23	1	0	6	0	352
No contraband found	36	3	0	0	0	0	39
Unknown contraband	3	0	0	0	0	0	3
Contraband found	268	18	1	0	6	0	293
<i>Incident Outcomes:</i>							
<i>Warning</i>	73	12	0	0	4	0	89
<i>Ticket</i>	80	4	0	0	2	0	86
Arrest on violation	112	2	1	0	0	0	115
<i>Search with reasonable suspicion</i>	105	11	2	1	9	2	130
No contraband found	32	3	0	0	5	0	40
Unknown contraband	0	0	0	0	0	0	0
Contraband found	69	6	2	1	3	2	83
<i>Incident Outcomes:</i>							
<i>Warning</i>	24	2	1	0	2	0	29
<i>Ticket</i>	23	1	1	1	1	1	28
Arrest on violation	21	2	0	0	0	1	24
<i>Search with warrant</i>	27	5	1	0	0	1	34
No contraband found	2	0	0	0	0	0	2
Unknown contraband	0	0	0	0	0	0	0
Contraband found	21	5	1	0	0	0	27
<i>Incident Outcomes:</i>							
<i>Warning</i>	2	0	0	0	0	0	2
<i>Ticket</i>	5	1	0	0	0	0	6
Arrest on violation	14	4	1	0	0	0	19
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	60.7%	56.6%	48.4%	50.0%	54.4%	50.3%	60.2%
<i>Ticket rate</i>	37.7%	40.8%	50.7%	50.0%	43.5%	46.7%	38.1%
<i>Arrest rate</i>	1.02%	2.11%	0.67%	0.00%	0.69%	0.09%	1.01%
<i>Search rates</i>	0.94%	4.12%	0.67%	2.00%	3.47%	0.26%	1.00%
<i>Search rate</i> (excl. searches on warrant)	0.88%	3.59%	0.50%	2.00%	3.47%	0.17%	0.94%
<i>Search rate</i> (incl. searches on warrant)	0.94%	4.12%	0.67%	2.00%	3.47%	0.26%	1.00%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	78.0%	67.6%	100.0%	100.0%	60.0%	100.0%	78.0%
Hit rates (excl. warnings as outcomes of searches)	55.3%	26.5%	66.7%	100.0%	20.0%	100.0%	52.5%
Stops with Hits Despite No Search Recorded (all outcomes)	13	0	0	0	0	1	14
Stops with Hits Despite No Search Recorded (excl. warnings)	7	0	0	0	0	1	8

2013	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							
<i>Including externally generated stops</i>	53,972	1,097	733	69	566	774	57,211
<i>Excluding externally generated stops</i>	52,782	1,062	722	66	559	757	55,948
Outcomes (excl. externally generated stops)							

<i>Ticket</i>	17,032	407	327	31	252	277	18,326
<i>Warning</i>	34,804	614	392	35	296	394	36,535
<i>Arrest for violation</i>	554	22	4	0	9	0	589
<i>Arrest for warrant</i>	13	3	0	0	1	0	17
Searches (excl. externally generated stops)							
<i>No search conducted</i>	51,801	988	715	63	534	668	54,769
<i>Unknown if searched</i>	388	16	0	0	1	88	493
<i>Total searches conducted</i>	593	58	7	3	24	1	686
<i>Search with probable cause</i>	441	32	5	1	17	0	496
No contraband found	22	8	0	1	4	0	35
Unknown contraband	4	0	0	0	0	0	4
Contraband found	389	23	4	0	13	0	429
<i>Incident Outcomes:</i>							
<i>Warning</i>	88	6	0	0	4	0	98
<i>Ticket</i>	191	5	1	0	8	0	205
Arrest on violation	106	12	3	0	1	0	122
<i>Search with reasonable suspicion</i>	127	20	2	2	7	1	159
No contraband found	44	11	0	1	2	0	58
Unknown contraband	2	0	0	0	0	0	2
Contraband found	65	8	2	1	3	1	80
<i>Incident Outcomes:</i>							
<i>Warning</i>	17	4	0	0	0	0	21
<i>Ticket</i>	25	3	2	1	2	1	34
Arrest on violation	24	1	0	0	1	0	26
<i>Search with warrant</i>	25	6	0	0	0	0	31
No contraband found	0	3	0	0	0	0	3
Unknown contraband	1	0	0	0	0	0	1
Contraband found	21	3	0	0	0	0	24
<i>Incident Outcomes:</i>							
<i>Warning</i>	1	1	0	0	0	0	2
<i>Ticket</i>	10	2	0	0	0	0	12
Arrest on violation	10	0	0	0	0	0	10
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	65.9%	57.8%	54.3%	53.0%	53.0%	52.0%	65.3%
<i>Ticket rate</i>	32.3%	38.3%	45.3%	47.0%	45.1%	36.6%	32.8%
<i>Arrest rate</i>	1.05%	2.07%	0.55%	0.00%	1.61%	0.00%	1.05%
<i>Search rates</i>	1.12%	5.46%	0.97%	4.55%	4.29%	0.13%	1.23%
<i>Search rate (excl. searches on warrant)</i>	1.08%	4.90%	0.97%	4.55%	4.29%	0.13%	1.17%
<i>Search rate (incl. searches on warrant)</i>	1.12%	5.46%	0.97%	4.55%	4.29%	0.13%	1.23%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	79.4%	59.6%	85.7%	33.3%	66.7%	100.0%	77.7%
Hit rates (excl. warnings as outcomes of searches)	60.9%	40.4%	85.7%	33.3%	50.0%	100.0%	59.1%
Stops with Hits Despite No Search Recorded (all outcomes)	45	2	0	1	1	1	50
Stops with Hits Despite No Search Recorded (excl. warnings)	32	2	0	0	1	0	35

2014	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							
<i>Including externally generated stops</i>	51,381	1,262	809	53	533	586	54,624
<i>Excluding externally generated stops</i>	50,143	1,232	804	51	524	575	53,329
Outcomes (excl. externally generated stops)							
<i>Ticket</i>	17,826	507	378	23	219	180	19,133
<i>Warning</i>	31,404	695	420	24	293	311	33,147
<i>Arrest for violation</i>	499	19	5	4	10	3	540

<i>Arrest for warrant</i>	9	1	0	0	0	0	10
Searches (excl. externally generated stops)							
<i>No search conducted</i>	49,109	1,143	796	48	499	484	52,079
<i>Unknown if searched</i>	419	10	1	0	4	84	518
<i>Total searches conducted</i>	615	79	7	3	21	7	732
<i>Search with probable cause</i>	458	59	5	2	13	7	544
No contraband found	29	6	0	1	2	0	38
Unknown contraband	11	1	0	0	0	0	12
Contraband found	398	50	5	1	11	7	472
<i>Incident Outcomes:</i>							
<i>Warning</i>	46	10	0	0	4	1	61
<i>Ticket</i>	280	33	3	1	5	5	327
Arrest on violation	70	7	2	0	2	1	82
<i>Search with reasonable suspicion</i>	122	15	2	0	7	0	146
No contraband found	31	7	1	0	2	0	41
Unknown contraband	0	0	0	0	0	0	0
Contraband found	89	6	1	0	5	0	101
<i>Incident Outcomes:</i>							
<i>Warning</i>	24	1	0	0	2	0	27
<i>Ticket</i>	43	4	1	0	3	0	51
Arrest on violation	22	0	0	0	0	0	22
<i>Search with warrant</i>	35	5	0	1	1	0	42
No contraband found	3	1	0	0	0	0	4
Unknown contraband	0	0	0	0	0	0	0
Contraband found	24	4	0	1	1	0	30
<i>Incident Outcomes:</i>							
<i>Warning</i>	1	2	0	0	0	0	3
<i>Ticket</i>	8	1	0	0	0	0	9
Arrest on violation	14	1	0	1	1	0	17
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	62.6%	56.4%	52.2%	47.1%	55.9%	54.1%	62.2%
<i>Ticket rate</i>	35.6%	41.2%	47.0%	45.1%	41.8%	31.3%	35.9%
<i>Arrest rate</i>	1.00%	1.54%	0.62%	7.84%	1.91%	0.52%	1.01%
<i>Search rates</i>	1.23%	6.41%	0.87%	5.88%	4.01%	1.22%	1.37%
<i>Search rate (excl. searches on warrant)</i>	1.16%	6.01%	0.87%	3.92%	3.82%	1.22%	1.29%
<i>Search rate (incl. searches on warrant)</i>	1.23%	6.41%	0.87%	5.88%	4.01%	1.22%	1.37%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	83.6%	74.3%	85.7%	50.0%	80.0%	100.0%	83.0%
Hit rates (excl. warnings as outcomes of searches)	71.6%	59.5%	85.7%	50.0%	50.0%	85.7%	69.9%
Stops with Hits Despite No Search Recorded (all outcomes)	61	0	1	0	0	1	63
Stops with Hits Despite No Search Recorded (excl. warnings)	50	0	1	0	0	0	51

2015	White	Black	Asian	Native American	Hispanic	Unknown	Total
Total Traffic Stops							
<i>Including externally generated stops</i>	42,308	1,070	643	42	527	907	45,497
<i>Excluding externally generated stops</i>	41,162	1,041	636	39	515	886	44,279
Outcomes (excl. externally generated stops)							
<i>Ticket</i>	15,389	439	299	18	212	360	16,717
<i>Warning</i>	25,327	586	326	21	295	504	27,059
<i>Arrest for violation</i>	388	21	8	0	6	1	424
<i>Arrest for warrant</i>	9	0	0	0	2	0	11
Searches (excl. externally generated stops)							

<i>No search conducted</i>	40,583	979	628	39	499	859	43,587
<i>Unknown if searched</i>	158	5	3	0	0	23	189
<i>Total searches conducted</i>	421	57	5	0	16	4	503
<i>Search with probable cause</i>	309	38	4	0	12	3	366
No contraband found	17	3	0	0	0	0	20
Unknown contraband	2	0	0	0	0	0	2
Contraband found	277	35	4	0	12	3	331
<i>Incident Outcomes:</i>							
<i>Warning</i>	27	8	0	0	2	0	37
<i>Ticket</i>	189	17	2	0	7	3	218
Arrest on violation	67	10	2	0	4	0	83
<i>Search with reasonable suspicion</i>	82	15	1	0	4	1	103
No contraband found	24	6	0	0	2	0	32
Unknown contraband	0	0	0	0	0	0	0
Contraband found	52	8	1	0	2	1	64
<i>Incident Outcomes:</i>							
<i>Warning</i>	17	3	0	0	1	0	21
<i>Ticket</i>	28	3	1	0	1	0	33
Arrest on violation	8	2	0	0	0	1	11
<i>Search with warrant</i>	30	4	0	0	0	0	34
No contraband found	2	0	0	0	0	0	2
Unknown contraband	0	0	0	0	0	0	0
Contraband found	27	4	0	0	0	0	31
<i>Incident Outcomes:</i>							
<i>Warning</i>	3	0	0	0	0	0	3
<i>Ticket</i>	6	1	0	0	0	0	7
Arrest on violation	17	3	0	0	0	0	20
Outcome rates as a % of stops (excl. externally generated stops and arrests on warrant)							
<i>Warning rate</i>	61.5%	56.3%	51.3%	53.8%	57.3%	56.9%	61.1%
<i>Ticket rate</i>	37.4%	42.2%	47.0%	46.2%	41.2%	40.6%	37.8%
<i>Arrest rate</i>	0.94%	2.02%	1.26%	0.00%	1.17%	0.11%	0.96%
<i>Search rates</i>	1.02%	5.48%	0.79%	0.00%	3.11%	0.45%	1.14%
<i>Search rate (excl. searches on warrant)</i>	0.95%	5.09%	0.79%	0.00%	3.11%	0.45%	1.06%
<i>Search rate (incl. searches on warrant)</i>	1.02%	5.48%	0.79%	0.00%	3.11%	0.45%	1.14%
<i>Hit rates (as a % of searches)</i>							
Hit rates (includes all outcomes)	85.9%	81.1%	100.0%	-	93.8%	100.0%	84.2%
Hit rates (excl. warnings as outcomes of searches)	74.7%	60.4%	100.0%	-	75.0%	100.0%	73.6%
Stops with Hits Despite No Search Recorded (all outcomes)	58	1	0	0	0	1	60
Stops with Hits Despite No Search Recorded (excl. warnings)	47	1	0	0	0	1	49

Table A.2 Stops and Outcomes by Barracks

Agency	Indicator	White	Black	Asian	Hispanic	Total
Bradford	Stops	19,817	223	201	167	20,956
	Consent searches	115	5	0	4	127
	Hits (excl. warnings)	94	3	0	3	101
	Warnings	10,629	74	71	53	11,140
	Tickets	9,028	148	128	111	9,643
	Arrest	115	1	1	3	122

Brattleboro	Stops	18,405	595	379	394	19,966
	Consent searches	258	50	6	26	344
	Hits (excl. warnings)	173	21	5	14	214
	Warnings	10,662	340	183	226	11,569
	Tickets	7,481	244	190	159	8,099
	Arrest	202	6	5	8	221
Derby	Stops	9,803	75	58	39	10,083
	Consent searches	6	0	0	1	7
	Hits (excl. warnings)	4	0	0	1	5
	Warnings	6,180	46	33	15	6,347
	Tickets	3,580	29	25	24	3,691
	Arrest	21	0	0	0	21
Headquarters 1	Stops	22,076	595	304	228	23,583
	Consent searches	216	49	3	16	287
	Hits (excl. warnings)	124	16	2	3	145
	Warnings	10,137	298	120	119	10,816
	Tickets	11,591	269	179	100	12,351
	Arrest	228	24	4	6	262
Middlesex	Stops	25,563	701	481	314	27,626
	Consent searches	199	11	4	8	223
	Hits (excl. warnings)	128	9	3	2	142
	Warnings	13,656	319	191	128	14,440
	Tickets	11,362	372	284	183	12,485
	Arrest	284	6	4	2	300
New Haven	Stops	22,232	335	235	175	23,648
	Consent searches	309	14	2	1	335
	Hits (excl. warnings)	210	7	2	0	227
	Warnings	13,395	169	128	80	14,110
	Tickets	8,387	154	106	93	9,058
	Arrest	242	5	1	2	252
Rockingham	Stops	21,097	575	474	234	22,482
	Consent searches	257	39	4	23	324
	Hits (excl. warnings)	140	18	4	7	170
	Warnings	14,500	362	267	136	15,333
	Tickets	6,316	195	204	88	6,836
	Arrest	250	15	2	8	275
Royalton	Stops	23,917	724	487	314	25,770
	Consent searches	175	20	2	14	214
	Hits (excl. warnings)	111	7	1	9	129

	Warnings	17,578	466	282	203	18,736
	Tickets	6,136	248	202	111	6,795
	Arrest	148	5	1	0	156
Rutland	Stops	20,799	374	183	121	21,997
	Consent searches	139	15	3	1	159
	Hits (excl. warnings)	92	9	2	1	105
	Warnings	12,828	205	102	71	13,493
	Tickets	7,494	150	80	49	7,996
	Arrest	212	14	0	1	228
Shaftsbury	Stops	19,585	358	181	183	20,384
	Consent searches	259	26	1	2	289
	Hits (excl. warnings)	179	17	1	1	199
	Warnings	13,983	235	122	113	14,492
	Tickets	5,475	114	59	68	5,752
	Arrest	119	9	0	0	128
St. Albans	Stops	20,044	303	149	102	20,730
	Consent searches	187	6	1	1	195
	Hits (excl. warnings)	114	3	1	0	118
	Warnings	12,922	172	82	54	13,288
	Tickets	6,543	121	64	42	6,811
	Arrest	385	5	3	6	399
St. Johnsbury	Stops	14,079	154	102	85	14,850
	Consent searches	64	1	0	0	76
	Hits (excl. warnings)	40	1	0	0	42
	Warnings	9,049	87	58	50	9,557
	Tickets	4,798	61	45	33	5,042
	Arrest	133	3	0	0	137
Williston	Stops	22,362	537	327	210	24,355
	Consent searches	353	17	2	5	383
	Hits (excl. warnings)	208	8	0	1	223
	Warnings	14,178	278	177	119	15,091
	Tickets	7,566	241	147	84	8,525
	Arrest	343	14	0	3	362
Total	Stops	259,903	5,554	3,562	2,568	276,565
	Consent searches	2,541	253	28	102	2,967
	Hits (excl. warnings)	1,618	119	21	42	1,821
	Warnings	159,781	3,054	1,817	1,369	168,502
	Tickets	95,793	2,348	1,713	1,145	103,125
	Arrest	2,684	107	21	39	2,865

Table A.3 Missing/Unknown Data

Year	Total Incidents	Age	Race	Sex	Reason for Stop	Outcome	Search	Search Outcome
2010	23,980	76	544	122	232	237	234	267
2011	47,598	181	785	340	439	457	479	535
2012	51,522	102	1,165	256	303	326	321	560
2013	55,969	102	757	415	501	493	493	542
2014	53,391	160	576	332	521	550	520	662
2015	44,426	465	890	206	184	205	191	286
Grand Total	276,886	1,086	4,717	1,671	2,180	2,268	2,238	2,852

Note: The data refer to the number of incidents, reflecting the possibility that a stop may result in more than one incident report. Externally generated stops are excluded.

Table A.4. Summary of Statistical Tests: p-values and confidence intervals for differences in proportions from 2010-2015

Panel A. Black-White Proportions						
	Proportion Difference (Black - White)	Standard Error	Confidence Interval for the Difference in Proportions (95%)		z score	p-value
Tickets	0.0542	0.0067	0.041	0.0673	8.3	0.0000
Arrests for violations	0.0089	0.0019	0.0053	0.0126	6.5	0.0000
Searches (PC +RS)	0.0358	0.0028	0.0303	0.0413	25.9	0.0000
Searches (PC +RS + warrant)	0.0389	0.0029	0.0332	0.0446	27.3	0.0000
Hit rate (white-black) when search is with PC or RS and outcome is ticket or arrest	0.1695	0.0328	0.1053	0.2338	5.3	0.0000
Hit rate (white-black) when search is with PC or RS with any outcome	0.1273	0.0307	0.0673	0.1875	4.7	0.0000
Hit rate (white-black) when search is with PC, RS, or no search recorded but contraband found and outcome is ticket or arrest*	0.1839	0.0325	0.1203	0.2475	5.9	0.0000

Panel B. Hispanic-White Proportions						
	Proportion Difference (Hispanic - White)	Standard Error	Confidence Interval for Difference in Proportions (95%)		z score	p-value
Tickets	0.0773	0.0099	0.058	0.0966	8.1	0.0000
Arrests for violations	0.0049	0.0024	0.0001	0.0092	2.4	0.0078
Searches (PC+RS)	0.0299	0.0039	0.0224	0.0375	15.1	0.0000
Searches (PC +RS + warrant)	0.0297	0.0038	0.0224	0.0377	14.6	0.0000

Hit rate (white-Hispanic) when search is with PC or RS and outcome is ticket or arrest	0.2183	0.0498	0.1207	0.316	4.5	0.0000
Hit rate (white-Hispanic) when search is with PC or RS with any outcome	0.1385	0.0477	0.045	0.232	3.4	0.0003
Hit rate (white-Hispanic) when search is with PC, RS, or no search recorded but contraband found and outcome is ticket or arrest*	0.2353	0.0496	0.1381	0.3325	4.9	0.0000

Note: All tests of the differences in the proportions use a one-tail test. The null hypothesis for each test is that the non-white group is not treated worse than whites (or, more precisely, the difference in proportions between the groups, e.g., difference in arrest rates, is zero). The p-value is the probability of obtaining the difference in the proportions found in the data if the null hypothesis is true. Therefore, p-values of less than 0.01 (i.e., 1 percent) allow us to say that is unlikely that the differences in treatment found between white drivers vs. the black or Hispanic drivers is due to statistical randomness.