Article

Criminal Justice Policy Review
2018, Vol. 29(6-7) 561–583

DOI: 10.1177/0887403417740188
journals.sagepub.com/home/cjp
SAGE

Traffic Enforcement Through the Lens of Race: A Sequential Analysis of Post-Stop Outcomes in San Diego, California

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Abstract

Research has shown that Black and Hispanic drivers are subject to disproportionate stop and post-stop outcomes compared with White drivers. Yet scholars' understanding of how and why such disparities persist remains underdeveloped. To address this shortcoming, this article applies a sequential approach to the analysis of traffic stop data generated by San Diego Police Department officers in 2014 and 2015. Results show that despite being subject to higher rates of discretionary and nondiscretionary searches, Black drivers were less likely to be found with contraband than matched Whites and were more than twice as likely to be subjected to a field interview where no citation is issued or arrest made. Black drivers were also more likely to face any type of search, as well as high-discretion consent searches, that end in neither citation nor arrest. The article concludes with a discussion of the findings and a series of recommendations.

Keywords

racial profiling, police decision-making, police discretion, race

Introduction

The notion of "Driving While Black" became part of the American lexicon not simply because of J. Lamberth's (1998) catchy phrase, the results of his 1994 analysis of stop patterns on the New Jersey Turnpike (J. C. Lamberth, 1996), or the subsequent federal

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investigation of New Jersey State police traffic enforcement practices (*U.S. v. New Jersey*, 1999). The idea also endures because dozens of similar studies published since then have echoed his original finding (e.g., Antonovics & Knight, 2009; Lundman & Kaufman, 2003; M. R. Smith & Petrocelli, 2001). In short, the field has produced a large body of research showing that Black and Hispanic drivers are subject to disproportionate stop-related outcomes compared with White drivers. These findings extend to the decision to initiate a search (Fallik & Novak, 2012; Persico & Todd, 2008), the issuance of a citation (Regoeczi & Kent, 2014), and the execution of an arrest (Kochel, Wilson, & Mastrofski, 2011), among various other outcomes.

Yet despite the abundance of scholarship on this issue, much remains unknown about how and why such disparities occur. One avenue in need of further investigation is the connections between discrete decision points during police–citizen interactions. For traffic stops in particular, researchers have noted the need for further investigation into how the *sequence* of post-stop interactions might be shaped by driver race/ethnicity (Engel & Calnon, 2004; Rosenfeld, Rojek, & Decker, 2011; Weisel, 2012). A clearer picture of how police officer decision-making processes result in race-based disparities can provide a greater understanding of how officers exercise discretion and may point to ways in which these disparities might be addressed.

This article, which considers the effects of driver race on traffic enforcement in San Diego, California, contributes such an examination. The study begins with an analysis of several key post-stop outcomes, including the issuance of a citation or a warning, the conduct of a field interview, the initiation of a search and the corresponding discovery of contraband, and the arrest. From there, we examine the connection between decision points in an effort to identify patterns in officer behavior, and with the aim of contributing a deeper understanding of the relationship between driver race and police decision-making. We begin with a review of relevant literature on each of these four potential outcomes, as well as a brief description of the San Diego context. Next, we describe data and statistical method, followed by a discussion of the results. The article concludes with an analysis of the findings and a series of policy and research recommendations.

Literature Review

Traffic stops are one of the most frequent forms of police–citizen encounters, and for many citizens, traffic stops may be the only contact they have with the police (Eith & Durose, 2011; Epp, Maynard-Moody, & Haider-Markel, 2014; Gilliard-Matthews, Kowalski, & Lundman, 2008; Langton & Durose, 2013; Skolnick, 1966). Though constrained to a degree by federal, state, and local laws, as well as by organizational rules and norms, individual officers have considerable authority over not only which drivers are stopped, but who is searched, when a field interview may be conducted, when an arrest may be initiated, and when a citation may be issued. With the application of discretionary practices comes the possibility of disparities based on the race of drivers.

Over the past two decades, scholars have examined traffic stop data from dozens of American law enforcement agencies, as well as survey data on public–police contacts, in an effort to assess the extent to which driver race affects the decision to stop, as well

as a range of post-stop outcomes. In the review that follows, we largely limit our discussion of trends in the research to disparities found in the treatment of Black drivers as compared with White drivers as foreground to our analyses. We do so while noting that although the magnitude of disparity is consistently largest between these two racial groups, disparate treatment has also been found to be experienced by Hispanic drivers (Engel, Cherkauskas, Smith, Lytle, & Moore, 2009; Fallik & Novak, 2012; Persico & Todd, 2008; Urban Institute, 2016), and that research on Asian/Pacific Islander, Native American, and Middle Eastern (Rice & Parkin, 2010) drivers, among other groups, is important and noticeably lacking.[1]

Decision to Stop

Roughly 12% of drivers nationwide experience a police-initiated traffic stop per year (Lundman & Kaufman, 2003), and among drivers of color, the percentage is estimated to be double that (Engel & Calnon, 2004; Epp et al., 2014). Statistical assessments of whether driver race is predictive of the likelihood of being stopped indeed often suggest that there are racial disparities in who police officers stop (Gaines, 2006; Horrace & Rohlin, 2016; Ritter, 2013; Ross, Fazzalaro, Barone, & Kalinowski, 2016; Taniguchi, Hendrix, Aagaard, Strom, Levin-Rector, & Zimmer, 2013; though for conflicting findings, see Grogger & Ridgeway, 2006; Ridgeway, 2009; Worden, McLean, & Wheeler, 2012). However, the analysis of the effect of driver race on the likelihood of being stopped is complicated by various measurement difficulties, including the "denominator problem" (Schafer, Carter, Katz-Bannister, & Wells, 2006, pp. 186-187; Walker, 2001) of a lack of an accurate benchmark for a jurisdiction's driving population (Engel, Frank, Klahm, & Tillyer, 2006), the expensive nature of observational studies (Engel & Calnon, 2004), and the challenge of controlling for factors such as ambient light at night (Grogger & Ridgeway, 2006; Horrace & Rohlin, 2016; Authors' Own).

Post-Stop Outcomes

A somewhat more straightforward way of assessing the potential presence of racial bias is to look at a range of post-stop outcomes, which allows researchers to more easily isolate and examine the effects of driver race on these police actions. Here, we review the extant knowledge on the effect of driver race on the various post-stop searches which police may conduct; contraband discovery, field interviews, and the issuance of citations or tickets.

Search. Each type of search that an officer may conduct during a traffic stop involves varying levels of discretion (Fallik & Novak, 2012). It is important to note that the ability to disaggregate police data by search type is dependent upon data quality; in some jurisdictions, researchers have been unable to make distinctions by search type, as some police departments do not differentiate by search type in their data collection systems (see, for example, Parker, Lane, & Alpert, 2010; Renauer, 2012). Here, we

describe the extent to which researchers have been able to ascertain whether racial disparities arise by search type as well as across all searches.

Mandatory searches, such as those conducted incident to an arrest or upon vehicle impound, are considered to be "low discretion" searches, as they are often required under department policy (Alpert, Dunham, & Smith, 2008; Higgins, Jennings, Jordan, & Gabbidon, 2011; Schafer, Carter, Katz-Bannister, & Wells, 2006). Officers are within their legal rights to conduct a search when an arrest is made (Arizona v. Gant, 2009; U.S. v. Robinson, 1973) and when a vehicle is impounded (*South Dakota v. Opperman*, 1976). Because most such searches occur automatically—and typically *after* the arrest (Rosenfeld et al., 2011)—any race-based disparities that emerge reveal less about officer behavior than they do about the factors that led to the arrest or impound.

"High discretion" searches include consent searches and *Terry* searches, named for the Supreme Court decision permitting police officers with reasonable suspicion that criminal activity is afoot to conduct limited searches of drivers and/or their vehicles for weapons (see *Terry v. Ohio*, 1968). A consent search occurs after an officer has requested and received consent from the driver to search the driver's person or vehicle. When granting consent, the driver waives his or her Fourth Amendment protection against unreasonable search and seizure (Schneckloth v. Bustamonte, 1973). Research on these discretionary searches has generally found that they are used disparately, with drivers of color and young and/or male drivers having the highest likelihood of facing a consent or *Terry* search (Fallik & Novak, 2012; Ridgeway, 2006; Schafer et al., 2006; Warren & Tomaskovic-Devey, 2009; though see M. R. Smith & Petrocelli, 2001, and Tillyer, Klahm, & Engel, 2012, for contradictory findings). This has led some scholars to argue that consent searches are a form of procedural injustice, and that any crime control benefits they yield are marginal compared with the costs to police legitimacy (Gau & Brunson, 2012).

In the case of a Fourth waiver search, police officers are permitted to search a person and/or vehicle if and when they determine that the driver or passenger is on either probation or parole. By virtue of this legal status, the driver implicitly waives Fourth Amendment protection. As a result, these searches often occur in the absence of probable cause (*People v. Schmitz*, 2012). Fourth waiver searches involve an ambiguous level of officer discretion (Hetey, Monin, Maitreyi, & Eberhardt, 2016; Ridgeway, 2006). On one hand, officers who are legally permitted to conduct a Fourth waiver search have the discretionary authority to opt against doing so. Similarly, officer discretion is used in determining whether a driver or passenger is on probation or parole. In each case, this discretionary authority may be applied differently based on driver race (e.g., Burks, 2014). On the other hand, once it is determined that a driver/passenger is on probation or parole, the officer has full legal authority to conduct a search. Indeed, Ridgeway (2006) notes that departmental policy in some jurisdictions advises officers to conduct these searches. Moreover, people of color—and men especially—are disproportionately more likely to be on parole or probation relative to the general population (Kaeble, Maruschak, & Bonczar, 2015). Together, these factors complicate efforts to make meaning of any disparities identified in Fourth waiver searches.[2]

Across all search types, most recent studies find that Black drivers are more likely than White drivers to be searched during traffic stops (Baumgartner, Epp, & Love, 2014; Fallik & Novak, 2012; Hetey et al., 2016; J. C. Lamberth, 2013; Ridgeway, 2009; Roh & Robinson, 2009; Rojek, Rosenfeld, & Decker, 2012; Simoui, Corbett-Davies, & Goel, 2015; M. R. Smith & Petrocelli, 2001; Tillyer et al., 2012; Withrow, 2007). Scholars have identified a range in the magnitude of these disparities across jurisdictions. For Black drivers, the likelihood of being searched ranges from 2 (Engel et al., 2009) to 4 times (Armentrout et al., 2007; Barnum & Perfetti, 2010) as frequently as White drivers.[3]

Contraband discovery. As the purpose of a police search is to identify unlawful activity and where possible, to seize illegal contraband, the value of a search is a function of its success along these lines (Pickerill, Mosher, & Pratt, 2009). Scholars have examined the efficiency of police search decisions using a metric known as the "hit rate," or the rate at which contraband such as illicit drugs or weapons is uncovered through a search (Knowles, Persico, & Todd, 2001; Persico & Todd, 2008). While Black drivers experience disparate rates of police searches in the traffic stop context, the hit rate tends to be lower for Black drivers than for White drivers (Alpert, Smith & Dunham, 2007; Armentrout et al., 2007; Engel et al., 2009; Epp et al., 2014; however, for contradictory findings, see Carroll & Gonzalez, 2014; Engel, Frank, Tillyer, & Klahm, 2006).

Arrest. According to Kochel et al. (2011), 24 of the 27 studies published on the racial patterns in arrests found that people of color were more likely to be arrested than Whites encountering the police under similar circumstances (see also Alpert et al., 2006). The same holds for arrests effected in the context of a traffic stop. Nationally representative survey data reveal that people of color report higher rates of arrest during a traffic stop, with Black drivers twice as likely as White drivers to be arrested (Langton & Durose, 2013). Other recent analyses find similar magnitudes of disparities (Barnum & Perfetti, 2010; Hetey et al., 2016; LaFraniere & Lehren, 2015).

Field interviews and the issuance of citations. Although there is ample evidence of disparities in the aforementioned post-stop outcomes, there is far less research assessing patterns in the use of field interrogation interviews and the issuance of citations during a stop by driver race. The vast majority of published research on field interviews examines those that occur during pedestrian stops (e.g., Alpert, Macdonald, & Dunham, 2005; Fagan & Davies, 2000; Gelman, Fagan, & Kiss, 2007) rather than traffic stops, yielding consistent evidence of disparate treatment in this context.

As Gilliard-Matthews (2016) observes, if traffic stops were only about traffic violations, then every driver who is stopped would receive a citation. Yet officers regularly exercise discretion in determining whether or not to issue a citation during a traffic stop. Research on the relationship between driver race and the citation/warning decision has generated inconsistent findings. In some studies, analysts have found that Black drivers are less likely to receive a traffic citation than White drivers (Engel, Frank, Tillyer, & Klahm, 2006; Schafer et al., 2006). In others, data show that drivers of color receive

citations at greater rates than do White drivers stopped under similar conditions (Barnum & Perfetti, 2010; Farrell, McDevitt, Bailey, Andresen, & Pierce, 2004; Regoeczi & Kent, 2014; Tillyer & Engel, 2013; West, 2015), while still other research has found no significant difference in citation rates by driver race (Ridgeway, 2006).

The San Diego Context

San Diego, California, is the eighth largest city in the United States and one of the country's most diverse places to live (Cima, 2015; U.S. Census Bureau, 2015). It is also one of the safest. Both violent and property crime in San Diego are relatively rare occurrences, compared with California's other major cities. Furthermore, in 2014, the City of San Diego had the second lowest violent crime rate (3.81 per 1,000 residents) and property crime rate (19.59 per 1,000 residents) among the country's 32 cities with populations greater than 500,000 (Burke, 2016). Even with slight increases in 2015, both violent crime (up 5.3% from 2014) and property crime (up 7.0%) in San Diego remain at historically low levels (Burke, 2016).

In 2015, the San Diego Police Department (SDPD) employed 1,867 sworn officers, or about 1.5 sworn officers per 1,000 residents. This ratio is notably lower than the average rate (2.3 officers per 1,000 residents) of police departments in other American cities of similar size (Reaves, 2015). The department's ongoing struggle to hire and retain officers has been well-publicized (Keats, 2016; Repard, 2016), as have been the corresponding public safety and departmental morale concerns (Monroy, 2014).

Data and Method

The primary dataset used for this research consists of 259,569 records generated by SDPD officers following traffic stops occurring between January 1, 2014, and December 31, 2015. When an SDPD officer completes a traffic stop, she or he is required under department policy to submit what is known as a "vehicle stop card." Officers use the stop card to record basic demographic information about the driver, including their race, gender, age, and San Diego City residency (from the driver's license), along with the date, time, location (at the division level), and reason for the stop. There are also fields for tracking what we term *post-stop outcomes*, including whether the interaction resulted in

- the issuance of a citation or a warning;
- a search of the driver, passenger(s), and/or vehicle;
- the seizure of property;
- discovery of contraband; and/or
- an arrest.

Last, the stop card gives officers space to provide a qualitative description of the encounter. When included, these data tend to explain why a particular action was taken or to describe the type of search conducted or contraband discovered.

To examine these data, we employ a technique known as propensity score matching. This approach allows the analyst to match drivers of different races across the various other factors known to affect the decision to issue a citation, conduct a search, make an arrest, and initiate a field interview. Several technical steps were taken to match Black ("treatment") drivers with White ("nontreatment") drivers. First, we used eight variables to estimate a logistic regression model to calculate a propensity score for each stop. These variables include (a) the reason for and (b) location (police division) of the stop, (c) the day of the week, (d) month, and (e) time of day during which the stop occurred, and the driver's (f) age, (g) gender, and (h) San Diego City residency status.

The propensity scores, which range from 0 to 1, establish the probability that a driver will be of a certain race, given certain stop/demographic conditions. Next, we compared the propensity scores of treated and untreated cases to ensure that there was no statistical difference between each group across the eight included variable categories. To match treated and nontreated drivers, we used the one-to-one nearest neighbor matching algorithm with the caliper set to 0.005 to limit the maximum distance between matched pairs. The "no replacement" option was selected to ensure that once a nontreated driver had been matched, it could not be matched to another treated driver. This particular approach was determined empirically to be the most accurate matching technique (Austin, 2013) and has been used in several recent criminological studies (e.g., Blomberg, Bales, & Piquero, 2012; Rosenfeld et al., 2011).

Matching allows the analyst to compare the likelihood that two drivers who share gender, age, stop reason, stop location, and additional matching characteristics, but differ by race, will be searched, ticketed, or found with contraband. The average difference between matched and unmatched drivers highlights the effectiveness of this process. For example, the stop location of matched Black and White drivers differs by only 0.44%, while the stop location of unmatched drivers differs by an average of 8.55%. Similarly, matched drivers were of identical age categories in 99.6% of cases, compared with 94.63% of cases involving unmatched Black and White drivers. Overall, the average disparity between matched Black and White drivers is 0.67% compared with a 7.38% difference between unmatched drivers.

Together these data illustrate a critical point: Differences we find between matched Black and White drivers in terms of relevant post-stop outcomes are not a result of any of the factors used to match Black and White drivers. In other words, based on the information available, race is the only difference between the two groups of drivers, and thus the only factor that may explain the observed differences in post-stop outcomes (e.g., Ridgeway, 2009).

There are other factors thought to affect the likelihood of certain post-stop outcomes, including, for example, officer demographics (Rojek et al., 2012; Tillyer et al., 2012); officer performance history (Alpert, Dunham, & Smith, 2004); the age (Giles, Linz, Bonilla, & Gomez, 2012), make, model, and condition of the vehicle stopped (Engel, Frank, Klahm, & Tillyer, 2006); and the demeanor of the driver, among others. Because the SDPD does not collect these data, it is impossible to include them in our matching protocol.

Table 1. Descriptive Findings for Stop and Post-Stop Outcomes, by Driver Race.

Driver race	Discretionary stops	Search	Consent search	Hit rate	Arrest	Field interview	Citation
Black	27,925	2,505	466	178	472	2,117	12,955
	20.21%	8.97%	1.67%	7.11%	1.69%	7.58%	46.39%
White	110,222	2,921	388	308	1,213	1,363	64,039
	79.79%	2.65%	0.35%	10.54%	1.10%	1.24%	58.10%
Total	138,147	5,426	854	486	1,685	3,480	76,994
	100.00%	3.93%	0.62%	8.96%	1.22%	2.52%	55.73%

Note. Hit rate is calculated by dividing the number of "hits," or cases where contraband is discovered, by race-specific search totals. Percentages of all other post-stop outcomes calculated using discretionary stops as the denominator.

It is also worth noting that use of propensity score matching does have the effect of reducing the sample size available for analysis. To account for the possibility that this limits the generalizability of our findings, we also analyzed the 2014 and 2015 data using logistic regression modeling, another statistical technique widely accepted for use with data of this kind (see, for example, Baumgartner et al., 2014; Engel et al., 2009). The results of the logit modeling were consistent with the outcome of the propensity score matching exercise.

Results

What follows are the results of our comparative analysis of post-stop outcomes for Black drivers and their matched White counterparts, including the decision to search, initiate a field interview, make an arrest, and issue a citation. We begin with a brief review of the descriptive findings.

Table 1 lists descriptive data on stop and post-stop outcomes experienced for Black and White drivers. These raw figures show that White drivers were nearly 4 times more likely to be stopped for either a moving or equipment violation (which we characterize as discretionary stops) than Black drivers. Conversely, Black drivers were searched at a rate of 8.97%, some more than 3 times that of Whites (2.65%). This disparity was more pronounced in the context of highly discretionary consent searches, where the search rate of Black drivers (1.67%) was 4.77 times that of White drivers (0.35%). 7.58% of Black drivers were subjected to a field interview, more than 6 times the field interview rate experienced by White drivers (1.24%).

Despite facing what appears to be a more aggressive enforcement regime, Blacks were less likely to be found with contraband than White drivers: 7.11% of searches involving Black drivers led to a "hit" compared with the 10.54% hit rate for Whites. Blacks were more likely to be arrested than Whites (1.69% and 1.10%, respectively), though the difference is not statistically significant. Finally, we note that 46.39% of Blacks were issued a citation following a discretionary stop, 20.2% lower than the 58.10 citation rate for White drivers.

The Decision to Search

The SDPD vehicle stop card lists four such search types: consent search, Fourth waiver search, search incident to arrest, and inventory search. Consistent with the prevailing scholarly interpretation of the decision-making authority that corresponds to the legal rules that define each search type, we classify consent searches, which occur after an officer has requested and received consent from the driver to search the driver's person or the vehicle, as involving a high level of officer discretion. This is the case largely because there are few if any legal strictures in place to guide the request for—or the nature of—search following the grant of consent. Fourth Amendment waiver searches, searches incident to arrest, and inventory searches each involve varying, but lower, levels of discretionary authority. It is expected that whatever racial disparity exists would manifest more clearly in the execution of discretionary searches.

An additional search type, the probable cause search, may occur after an officer has determined that there is sufficient probable cause to believe that a crime has or is about to be committed (*Illinois v. Gates*, 1983). The law grants officers a significant degree of leeway in determining when the probable cause threshold has been met, which makes the evaluation of probable cause search incidence potentially very important. Given the legal and practical importance of the demonstration of probable cause prior to a search, it is somewhat surprising that the SDPD Vehicle Stop card does not include a "probable cause search" category. As a result of this omission, we were unable to analyze this category of police action.[4]

As is noted in Table 2, results show a Black-White disparity in consent search rates: 1.39% of stopped Black drivers were subject to consent searches compared with 0.75% of matched White drivers. This disparity was also evident in some but not all low-discretion searches. Black drivers are much more likely to be subject to Fourth waiver searches and inventory searches than are matched White drivers. There is no statistical difference between the rate of search incident to the arrest of a Black motorist when compared with those involving matched White drivers.

When the data are aggregated across all search types, the disparity remains: 8.65% of matched Black drivers were searched in 2014 and 2015, compared with 5.04% of matched White drivers.[5]

Hit Rates

The term *hit rate* is used to describe the frequency that a police officer's search leads to the discovery of unlawful contraband. This metric is a reflection of the quality and efficiency of a police officer's decision to search and a well-accepted means of identifying racial disparities (Persico & Todd, 2008; Ridgeway & MacDonald, 2010; Tillyer, Engel, & Cherkauskas, 2010).

To generate the data shown in Table 3, we interpreted all missing and null cases as indicating that no contraband was discovered ($n = 242{,}211$). From there, we calculated hit rates using the 19,948 Black and similarly situated, matched White drivers that we used to analyze the Department's search decisions. Police searched 1,726 (8.65%) of

Table 2. Comparing Search Rates Among Matched Black and White Drivers.

	Matched Black drivers (%)	Matched White drivers (%)	Difference (%)[a]	*p* value
All searches	8.65	5.04	52.70	<.001
Consent	1.39	0.75	60.09	<.001
Fourth waiver	2.90	1.30	76.37	<.001
Inventory	1.91	1.30	42.29	<.001
Incident to arrest	0.90	0.89	0.56	.480
Other (uncategorized)	1.56	0.86	58.09	<.001

Note. The analysis is based on a total of 19,948 Black drivers and 19,948 matched White drivers.
[a]To calculate the percentage difference used in this and subsequent tables, we divide the absolute value of the difference between the first two columns (3.61) by the average of the first two columns—in this case, search rates (6.85); 3.61 / 6.85 = 52.7%.

Table 3. Comparing Hit Rates Among Matched Black and White Drivers.

	Matched Black drivers (%)	Matched White drivers (%)	Difference (%)	*p* value
All searches	7.9	12.4	−44.2	<.001
Consent	7.2	14.8	−68.6	.013
Fourth waiver	7.4	14.3	−63.2	.002
Inventory	3.4	4.8	−34.6	.368
Incident to arrest	14.0	13.5	3.5	.897
Other (uncategorized)	11.6	17.5	−41.0	.069

Note. The analysis is based on a total of 19,948 Black drivers and 19,948 matched White drivers. Missing and null cases coded as no contraband.

Black drivers stopped and discovered contraband on 137 occasions, or 7.9% of the time. Of the 19,948 matched White drivers, 1,005 (5.04%) were searched, with 125 of those searched (12.4%) found to be holding contraband. In other words, SDPD officers had to search nearly twice as many Black drivers as they did matched White drivers to discover the same amount of contraband. Matched White drivers were much more likely to be found with contraband following Fourth waiver searches and those conducted incident to arrest. There were no statistical differences in the hit rates of matched drivers following consent searches, inventory searches, or other, undefined searches.

Arrest, Field Interviews, and Citations

We also used propensity score matching to compare the arrest rates of Black drivers with similarly situated White drivers. As shown in Table 4, 1.79% (20,922 stops led to 374 arrests) of matched Black drivers were ultimately arrested, compared with 1.84%

Table 4. Comparing Arrest, Field Interview, and Citation Rates for Matched Black and White Drivers.

	Matched Black drivers (%)	Matched White drivers (%)	Difference (%)	*p* value	Matched pairs
Arrest	1.79	1.84	−2.8	−.69	20,872
Field interview	6.60	2.75	82.4	<.001	20,060
Citation	49.60	56.10	−12.3	<.001	20,922

Note. Missing and null data considered as indicative of "no incident."

(384 of 20,922) of matched White drivers. This difference was neither statistically nor practically significant.

Per SDPD Procedure 6.03, which establishes Department guidelines for the use and processing of Field Interview Reports, a field interview is defined as, "any contact or stop in which an officer reasonably suspects that a person has committed, is committing, or is about to commit a crime."

The traffic stop data card includes space for officers to document these encounters. Our analysis of SDPD's field interview records also showed significant differences between matched pairs. As we show in Table 4, matched Black drivers were subject to field interview questioning in 8.78% of stops (or 1,833 times). A total of 753 White drivers were given field interviews (3.61%), a difference of nearly 84%.

Finally, we review data on the issuance of citations. As with the previous analyses, we use propensity score matching to account for the several factors that may account for the decision to issue a citation rather than a warning, including when, why, and where the stop occurred. This allows us to attribute any disparities we observed to driver race. We interpreted missing data and those cases listed as "null" (n = 11,550) to indicate that the driver received a warning rather than a citation. The findings show that matched Black drivers receive a citation in 49.6% stops, as compared with matched White drivers, who are cited 56.1% of the time.

Discussion

This research drew on propensity score matching to pair Black drivers with White drivers who were stopped by the SDPD under similar circumstances. By matching drivers along these lines, we were able to isolate the effect that driver race has on the likelihood of several post-stop outcomes.

Before discussing these findings, however, it is important to note several data quality issues that complicated the analysis. First, the dataset was limited by missing data: More than 19% of the combined 259,569 stop records submitted in 2014 and 2015 were missing at least one piece of information. Driver age (3.3%) and City residency status (6.2%) were among the demographic indicators most significantly affected. In addition, several post-stop variables also contained high levels of missing data, including citation (10.6%), field interview (7.9%), and search (4.4%).

A second and related challenge complicated the hit rate analysis. According to the SDPD, contraband discovery should be considered valid only if it follows a search. There were 26 cases where contraband was discovered, but no search was recorded. What is more, there were 3,771 cases where a search occurred, but the outcome of the search was either missing or ambiguously coded. Finally, there were 11,499 cases where search data were missing or listed as null, including 31 cases where "no contraband" was listed. To address these data issues, 11,499 cases where search data were missing/null were excluded, as were the 26 cases where the discovery of contraband was reported, but no search was conducted.

Finally, there appears to have been significant underreporting of traffic stops by SDPD officers in 2014-2015. According to judicial records, the SDPD issued 183,402 citations over this period, a sum 26.1% greater than the 145,490 citations logged by officers via the traffic stop data card. The sizable difference between actual citations and reported citations suggests that tens of thousands of traffic stops went undocumented during this period. Notably, however, the racial/ethnic composition of the stop card citation records largely reflects the composition of the judicial records, indicating that the underreporting was not race-determinative. This mitigates concern over the representativeness of the stop card data along racial lines, though these irregularities reduce overall confidence in the reliability of the dataset.

In spite of these limitations, our analysis revealed several interesting findings, with implications for both the practice and study of law enforcement.

Viewing Post-Stop Racial Disparities Sequentially

Study findings reveal several instances of post-stop disparities between matched Black drivers and their White counterparts. Black drivers were more likely to be searched than matched Whites, a finding robust across all search types, including highly discretionary consent searches. Despite occurring at much greater rates, police searches of Black drivers were less likely to reveal possession of contraband than were searches of matched Whites. These findings reveal that both discretionary and nondiscretionary searches of Black drivers were substantially less efficient than those involving matched White drivers.

Scholars have developed several approaches to interpret this type of search/hit rate disparity. Many suggest that racial disparities among search rate data alone provide clear and unequivocal evidence of racial bias (e.g., Banks, Eberhardt, & Ross, 2006; Gross & Livingston, 2002; Harris, 2003; Rudovsky, 2001). Others, like Knowles, Persico, and Todd (2001, 2006), instead emphasize the importance of hit rates to distinguish efficient search/seizure protocols from those driven by racial bias. Hit rate disparities are viewed as indicative of bias, whereas evidence of similar hit rates between races is suggestive of an appropriate strategic design, even in cases where searches are disproportionately distributed by race.

Harcourt (2004) applies a legal framework in support of his argument that search and seizure outcomes should be evaluated in terms of their effects on crime and other social indicators, rather than stand-alone hit rates. In effect, he argues that a strategy

emphasizing searches of Black drivers would be legally and procedurally justifiable if it reduced crime and other social costs.

Other scholars have advocated for a "totality of circumstances" approach to interpreting search/seizure data, whereby search rates are evaluated not only in terms of driver race, but age, gender, and other demographic factors (Pickerill et al., 2009). Officer demographic data are also relevant, according to this approach, as are other contextual data, including among others the stop location and area crime rates. Research along these lines has built interaction terms into the multivariate models to emphasize the predictive value of several such factors taken together (e.g., Mosher & Pickerill, 2011; Tillyer, 2014).

There are notable insights to be gleaned from viewing search and hit rate outcomes through each of these analytical lenses. Yet, given the narrow lens through which they view the problem of race and post-stop decision-making, it is not clear how much value these interpretive approaches offer in terms of law enforcement strategy.

Rather than evaluating search, seizure, and contraband discovery data in isolation, considering these outcomes in concert with other post-stop outcomes offers an additional way of assessing the extent to which driver race shapes police action. After all, an officer's search decision does not occur in a vacuum; instead, the decision to conduct a search is likely a direct function of the same factors that shape the decision to initiate a field interview. Moreover, what action is taken following a search or interview is necessarily related to the outcome of the search/interview. For example, an officer is much more likely to make an arrest following a search that hits compared with one that does not. Relatedly, the officer's decision to issue a citation rather than a warning may also reflect the results of a search or field interview.

In addition to search and hit rate disparities, Black drivers were also subject to field interviews at more than twice the rate of matched Whites. Yet, despite the more aggressive field interview and search protocols in place for Black drivers, the data show no statistical difference in the arrest rates of matched Black and White drivers. Black drivers were also less likely to receive a citation than were matched Whites.

This pattern finds additional support in a more granular analysis of the post-stop data. As shown in Table 5, there are statistically significant differences in the treatment of matched Black and White drivers across several outcomes. Most notably, Black drivers were more than twice as likely to be subjected to a field interview when no citation is issued or arrest made. Black drivers were also more likely to face any type of search (including highly discretionary consent searches) that ends without either a citation or an arrest.

Implications for Policy, Practice, and Future Research

Our findings point to three main implications: the existence of implicit bias in the post-stop context and the need for further research on this issue, the inefficiency of investigatory stops, and the need for more nuanced and consistent data collection practices within and across local police departments.

Table 5. Comparing Post-Stop Outcomes of Matched Black and White Drivers.

	No FI, no citation***	FI and citation***	Citation, no FI***	FI, no citation***
Black	38.49%	0.27%	51.45%	4.61%
White	36.19%	0.08%	58.61%	1.91%
	No FI, no arrest***	FI and arrest***	Arrest, no FI	FI, no arrest***
Black	91.68%	0.10%	1.71%	6.52%
White	95.46%	0.03%	1.80%	2.71%
	No search, no citation***	Search and citation***	Citation, no search***	Search, no citation***
Black	41.50%	1.87%	49.84%	1.60%
White	37.18%	1.00%	57.69%	0.93%
	No consent search, no citation***	Consent search and citation***	Citation, no consent search***	Consent search, no citation**
Black	47.02%	1.18%	51.53%	0.27%
White	40.62%	0.65%	58.59%	0.15%
	No search, no arrest***	Search and arrest	Arrest, no search	Search, no arrest***
Black	91.08%	1.57%	0.26%	7.09%
White	94.60%	1.58%	0.27%	3.55%
	No consent search, no arrest***	Consent search and arrest	Arrest, no consent search	Consent search, no arrest***
Black	96.83%	0.09%	1.72%	1.36%
White	97.47%	0.10%	1.73%	0.70%

Note. FI = field interview.
**$p < .01$. ***$p < .001$.

Research has shown that there is a strong race–crime association not just among police officers, but across the general population as a whole: Black faces are more frequently associated with criminal behavior than are non-Black faces, and this association extends to how Black people are treated throughout the criminal justice system (Eberhardt, Goff, Purdie, & Davies, 2004; Hetey & Eberhardt, 2014; Rattan, Levine, Dweck, & Eberhardt, 2012). This is known as implicit bias. The post-stop disparities evident in our analysis suggest that implicit bias is present in officers' decision-making. As other researchers of racial/ethnic disparities in policing have observed, "many subtle and unexamined cultural norms, beliefs, and practices sustain disparate treatment" (Eberhardt, 2016, p. 4). Additional research—including qualitative research

aimed at capturing officer perceptions and beliefs, how post-stop interactions unfold, and organizational norms—is needed to better understand how implicit bias may arise in how officers exercise discretion in the traffic stop context.

Second, our findings underscore recent calls by other scholars for the reconsideration of the utility of traffic stops that are investigatory (rather than directly related to traffic safety) in nature. The disparities evident in our analysis suggest that drivers who fit a certain profile, whether defined explicitly in terms of race, framed around perceived criminality, or some other constellation of factors, are more likely to encounter post-stop enforcement in the form of discretionary and nondiscretionary searches and field interviews. These data suggest a practice that functions like a "catch and release" program in which certain members of the community are stopped pretextually, investigated disproportionately for potential criminality, and then, should no evidence of wrongdoing appear, allowed to go free without any formal sanction.[6] Indeed, according to one SDPD Sergeant, field interviews in particular are "the bread and butter of any gang investigator" and have practical importance in identifying criminal suspects (O'Deane & Murphy, 2010). Yet evidence of comparatively low hit rates among Black drivers together with the nonexistent arrest rate disparities between Black and White drivers provide very limited empirical justification for the use of traffic stops to investigate or control crime. Thus, we echo Epp et al. (2014), who observe that "the benefits of investigatory stops are modest and greatly exaggerated, yet their costs are substantial and largely unrecognized" (p. 153).

Last, the analysis presented herein is predicated on robust data collection and management efforts on the part of local police departments. At minimum, agencies must capture data to describe a traffic stop in its entirety, from basic information about the stop itself, including driver demographic and stop-related information, all the way through the post-stop outcome, including specific details about the nature of the search, contraband discovered or other property seized, the reason for and outcome of a field interview, as well as information on arrest and citation/warning decision points.

The SDPD's current traffic stop data collection regime limited the analysis presented here, beginning with the missing data issues and evidence of the underreporting of traffic stops noted earlier. Also notable is the absence of any data on the officer conducting the stop. As other recent research has shown, officer demographics may offer especially important insight into how racial disparities occur (Rojek et al., 2012; Sanga, 2014; Tillyer et al., 2012). In addition, data were unavailable on the specific stop location; the make, model, and condition of the vehicle; the driver's behavior and demeanor; the length of the traffic stop; and the nature and amount of contraband discovered and property seized. As other scholars have noted, these data offer additional and important opportunities to determine whether and how racial disparities happen in the traffic stop context (Engel & Calnon, 2004; Ramirez, Farrell, & McDevitt, 2000; Ridgeway, 2006; Tillyer et al., 2010). Furthermore, the SDPD does not currently collect data on probable cause searches. Given the legal and practical importance of the demonstration of probable cause prior to a search, this category should be captured. Last, because stop data were only available at the police division level, we were unable to incorporate important neighborhood-level characteristics, as each division encompasses multiple distinct neighborhoods. Researchers

have noted that police behavior is influenced, in part, by factors such as neighborhood demographic composition, as well as crime rates, and that this in turn can deleteriously affect residents' perceptions of the police (Meehan & Ponder, 2002; Stewart, Baumer, Brunson, & Simons, 2009; Weitzer, 2000). Given the importance of neighborhood context, data should be captured at a unit smaller than police divisions.

The nature of the data collection instrument and the process by which officers record stop-related data presented additional challenges. Following a traffic stop, SDPD officers must document the contact in several different ways. If the stop involved the issuance of a citation or a written warning, the officer must complete the requisite paperwork. The officer must complete an additional set of forms if they conduct a field interview, a search, or make an arrest. Next, they must describe every encounter in a separate form, called a "journal," an internal mechanism used to track officer productivity. They must then submit another form logging their body-worn camera footage. Finally, they must then complete the traffic stop data card, which captures the data analyzed herein.

This complicated process, which occurs in the absence of sufficient internal or external accountability mechanisms, contributed to undermining the quality of the dataset used for this analysis. As we note above, search, field interview, and citation variables, among other demographic indicators, contained relatively high levels of missing data. And while the incidence of missing data appears to be evenly distributed across driver racial categories, questions remain concerning the reliability and representativeness of the data. These concerns are compounded by evidence of substantial underreporting, which may be connected to the cumbersome nature of the current data collection system.

These challenges highlight the need to encourage and support police departments to collect more expansive data on traffic stops, and to make the data collection process as efficient as possible so as to not be an undue drain on officers' time. This will enable not only more consistency in the analytic methods applied to assessing police behavior in this context, but also strengthen researchers' ability to draw better comparisons of disparities across jurisdictions.

Authors' Note

Points of view or opinions contained within this document are those of the author and/or the participants and do not necessarily represent the official position or policies of the Laura and John Arnold Foundation and the Misdemeanor Justice Project.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This paper was commissioned by the Misdemeanor Justice Project—Phase II funded by the Laura and John Arnold Foundation. Points of view or opinions contained within this document are those of the author and/or the participants and do not necessarily represent the official position or policies of the Laura and John Arnold Foundation and the Misdemeanor Justice Project.

Notes

1. In the larger study from which we draw our analyses, we examined the effect of race/ethnicity on the treatment of Hispanic and Asian/Pacific Islander drivers, but do not present those results here due to lack of space (see Authors' Own).
2. An additional search type, the probable cause search, may occur after an officer has determined that there is sufficient probable cause to believe that a crime has been or is about to be committed (see *Illinois v. Gates*, 1983, 463 U.S. 213). The law grants officers a substantial degree of leeway in determining when the probable cause threshold has been met, which makes the evaluation of probable cause search incidence by driver race potentially very important.
3. While not the focus of the analysis presented here, it is important to note that additional factors, such as age and gender, have also been shown to influence the decision to search, with young male drivers of color comprising the most likely demographic to be searched (Barnum & Perfetti, 2010; Baumgartner, Epp, & Love, 2014; Briggs & Keimig, 2017; Fallik & Novak, 2012; Schafer et al., 2006; Tillyer, Klahm, & Engel, 2012). For example, in their analysis of data from St. Louis, Missouri, Rosenfeld, Rojek, and Decker (2011) found that Black drivers under the age of 30 were more likely to be searched than under-30 Whites, but older Black drivers (over 30) were no more likely to be searched than their older White counterparts. The presence of passengers in the car has also been shown to affect search rates, with vehicles containing passengers being subject to discretionary searches more frequently (Tillyer & Klahm, 2015). Last, proximity to the nearest crime hot spot has also been identified as a factor (Briggs & Keimig, 2017).
4. The data file we received from the San Diego Police Department (SDPD) included several uncategorized searches (i.e., a search was recorded, but the officer involved either did not consider it a Fourth waiver search, a consent search, a search incident to arrest, or an inventory search, or, simply neglected to categorize it as such). These incidents are referred to as "Other (uncategorized)" searches.
5. Though the matching protocol includes several of the factors known to affect the likelihood of relevant post-stop outcomes, it does not account for other possible influences, including, for example, the subject's demeanor or the officer's race or gender. To assess the extent to which these unobserved factors influenced the results, Rosenbaum bounds were generated for each statistical model used to match Black and White drivers (Rosenbaum, 2002; Rosenbaum & Rubin, 1983). This process involves defining Γ, a sensitivity parameter that is in effect a measure of omitted variable bias. As the value of Γ increases, so too does the influence of unobserved variables on the outcome in question. The sensitivity analysis identifies the maximum value of Γ under which the findings generated by the matching exercise would remain valid. The results of this process suggest that in the context of driver searches, where the bound for Γ is 1.65, the differences observed between Blacks and Whites are not sensitive to omitted variable bias. Of the other models considered, two outcomes proved to be sensitive to unobserved factors: (a) the decision to arrest and (b) the initiation of a search incident to arrest. These results are unsurprising, in light of the inability to account for the criminal behavior underlying the arrest itself. Given that there was no statistically significant difference between Blacks and Whites in the likelihood of experiencing an arrest or the accompanying search incident to arrest, it is likely that criminal behavior, not subject demographics or stop circumstances, predict these outcomes.
6. It is worth noting here that pretextual stops along these lines do not violate the Fourth Amendment. In 1996, the Supreme Court held that "the decision to stop an automobile

is reasonable where the police have probable cause to believe that a traffic violation has occurred," regardless of the officer's motives in initiating the stop (*Whren v. United States*, 1996, p. 810). While lawful, such stops have been shown to disproportionally involve minority drivers (e.g., Miller, 2008; Novak, 2004).

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