A Test of Racial Disproportionality in Traffic Stops Conducted by the Raleigh Police Department

REPORT

Prepared for

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Recent research has raised questions regarding the Raleigh Police Department's (RPD) use of race as a proxy for criminal behavior. News reports going back to 2000 make claims of racial bias based on the disparity between the racial composition of stopped motorists and the racial composition of the city (Associated Press, 2000). Critically, these kinds of analyses typically use census population estimates to establish a benchmark for the driving population. Census estimates, however, demonstrate only where people reside and serve as a poor proxy for the actual driving population. Therefore, census population cannot accurately measure the population at risk (i.e., the driving population that is likely to be involved in a traffic stop). RTI International conducted a series of analyses to address this methodological limitation. This research was funded internally by RTI to serve the community and to contribute to a growing body of scientific research on this topic.

Data

The analysis described below was conducted on data from 419,697 traffic stops conducted by the RPD from January 1, 2010, through November 30, 2015. The stop data analyzed here were obtained from the North Carolina state-maintained traffic stop information data system.

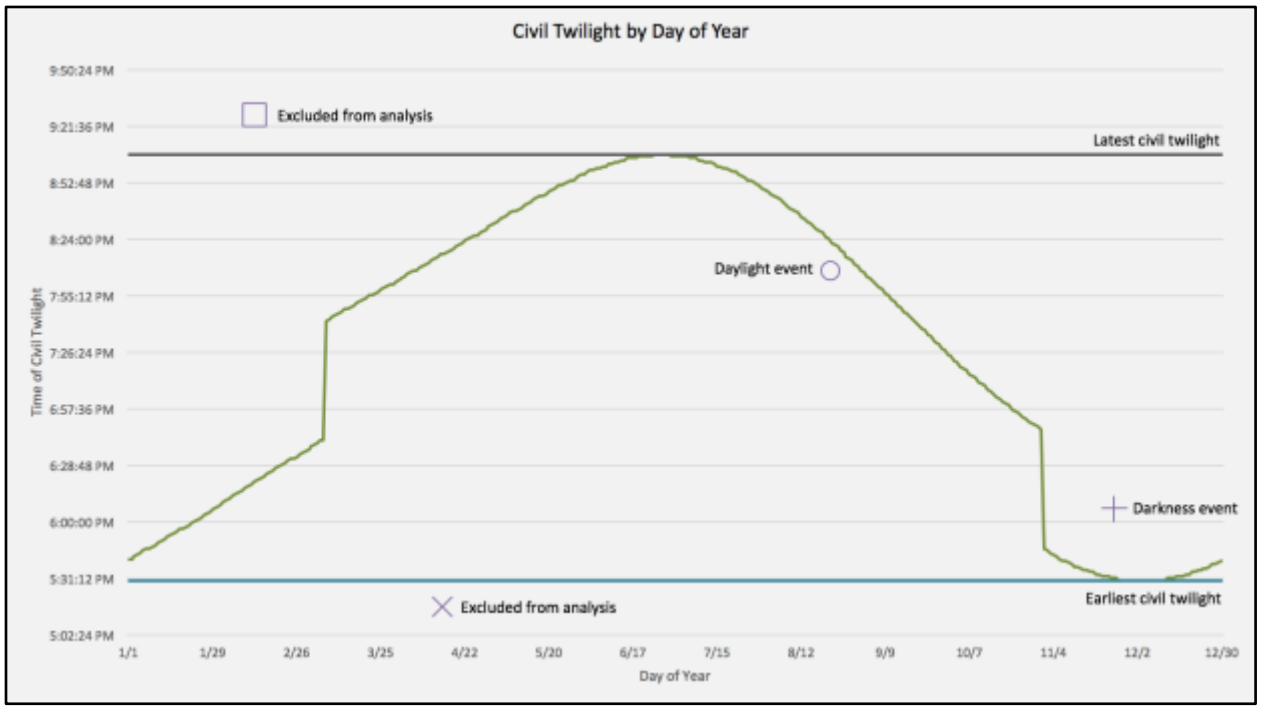
Analytical Approach

To study the racial distribution of traffic stops in Raleigh, we used the "veil of darkness" (VOD) approach, which is based on the logic that police officers are less likely to be able to ascertain the race of a motorist after dark than they are during daylight. As such, stops occurring in darkness serve as a comparison group for stops occurring during daylight, so the existence of racial profiling can be assessed by comparing the numbers of drivers of each race stopped during daylight with the numbers of drivers of each race stopped after dark. The analysis is limited to stops that occur during the intertwilight period (roughly between 5:30 p.m. and 9:15 p.m.) in order to reduce the variation in travel patterns that are dependent upon time of day. Figure 1 graphically depicts the intertwilight period.

The VOD method was developed and first employed by Jeffery Grogger and Greg Ridgeway in an analysis of traffic stops in Oakland, California, in 2006 (Grogger & Ridgeway, 2006) and Cincinnati, Ohio, in 2009 (Ridgeway et al., 2009). The method has also been used to explore racial bias in Minneapolis, Minnesota (Ritter & Bael, 2009), Syracuse, New York (Worden, McLean, & Wheeler, 2010), San Diego, California (Burks, 2015), and the state of Connecticut (Ross et al., 2015). Using this method, evidence of racial bias was identified in Minneapolis and for several jurisdictions in Connecticut.

One benefit of the VOD approach is the simple interpretation of results. If the daylight indicator is statistically nonsignificant, it suggests that daylight was not associated with the race of the driver who was stopped. Alternatively, if the daylight indicator is statistically significant and positive, it suggests that Black motorists are more likely to be stopped during times when visibility is higher. Evidence of racial bias is present if minority drivers are over-represented during daylight hours compared with during times of darkness.

Figure 1: Civil Twilight by Day of Year



☐ Events above the black line occurred *after* the latest civil twilight—always in the dark. These events are excluded.

X Events below the blue line occurred *before* the earliest civil twilight—always during daylight. These events are excluded.

O Events between the blue and black lines occurred after the earliest civil twilight and before the latest civil twilight. Events under the green curve occurred before civil twilight of that day and are considered daylight events.

\+ Events outside of the green curve occurred after civil twilight for that day and are considered darkness events.

We processed RPD's traffic stop data for 2010–2015 and incorporated information on civil twilight, collected from a public database maintained by the U.S. Naval Observatory. Using the VOD method, we explored three areas of interest:

1. The relationship between light visibility and race of the driver stopped
2. The relationship between light visibility and race of the driver stopped among male drivers only
3. The relationship between light visibility and race of the driver stopped among female drivers only

Our models incorporate one enhancement from the previous studies: We use a random intercepts model to control for differences between officers. By doing so, we recognize that officers may have inherent differences in the percentage of Black motorists they are likely to encounter. These differences may be caused by factors such as geographic deployment, unit assignment, or individual characteristics (e.g., unique decision-making processes).

Results

Table 1 presents descriptive statistics for the race and sex of drivers for the overall sample of stops (N = 419,697) and for the stops that occurred during the intertwilight period (n = 52,114). An assessment of group percentages indicates only minor differences between the overall sample and the sample restricted to intertwilight stops. Traffic stops more commonly involved men than women, and the vast

majority of stops (approximately 96%) involved either a Black or a White driver. Overall, White drivers made up a slightly larger percentage of all traffic stops than Black drivers. Conversely, Black drivers made up a slightly larger percentage of intertwilight stops than White drivers.

Table 1: Race and Sex of People Stopped (n = 419,697)

	Overall (*N* = 419,697)		Intertwilight Period Stops (*n* =52,114)	
	Frequency	%	Frequency	%
Sex				
Male	257,463	61.34	32,248	61.88
Female	162,234	38.66	19,866	38.12
Total	419,697	100.00	52,114	100.00
Race				
Asian	8,206	1.96	1,005	1.93
Black	200,230	47.71	26,095	50.07
Native American	237	.05	40	.08
Unknown	5,199	1.24	580	1.11
White	205,825	49.04	24,394	46.81
Total	419,697	100.00	52,114	100.00d

Note. Data on traffic stops from Raleigh, North Carolina, from January 1, 2010, through November 30, 2015, were obtained from the state-maintained traffic stop information data system.

Model 1 presents the results of the VOD analysis conducted on the entire subset of stops that occurred during the intertwilight period (see ***Table 2***). We did not find a statistically significant relationship between lighting and driver race. Subset analyses were conducted for males only (Model 2) and then again for females only (Model 3). We found no relationship between lighting and driver race among the male and female subset.[1, 2] Given these results, we did not find evidence of racial bias among traffic stops conducted by the RPD for the years of 2010–2015.

[1] Likelihood ratio tests were conducted for each set of analyses (i.e., overall, males only, and females only) to assess goodness-of-fit between the full model and a model that excluded the night/day indicator. The chi-squared statistic was statistically nonsignificant (at $p < .05$) for the overall, male-only models and female-only models suggesting that the inclusion of the daylight indicator did not improve model fit.

[2] We used random intercepts models to control for differences between officers. As such, we calculated intraclass correlation coefficients to determine how much of the variation in the dependent variable was accounted for by officer-level variation. Results indicated that, for each model, approximately 16% of the total variation in the probability of the driver's being Black was accounted for by the officer who was conducting the stop.

Table 2: Veil of Darkness Results

Model	*N*	Odds Ratio
Model 1: Overall	52,114	1.03
Model 2: Males only	32,248	1.03
Model 3: Females only	19,866	1.02

Notes. Data on traffic stops from Raleigh, North Carolina, from January 1, 2010, through November 30, 2015, were obtained from the state-maintained traffic stop information data system. Models also controlled for day of week, year, and time of stop as a linear term. Model fit tests were conducted to determine whether quadratic terms for time of stop should also be included in the models; these tests did not indicate that adding these terms improved model fit and thus were not included in the models. Coefficients for control variables are omitted for brevity. Models were specified as generalized linear mixed models where officer ID was treated as a random effect.

Discussion

We found no evidence of racial bias in the traffic stops conducted by the RPD from 2010 through most of 2015. Overall, there was no relationship between available lighting and the race of the driver stopped. Analyses on the male-only and female-only subsample produced similar results. There was no evidence that Black males or Black females were disproportionately involved in traffic stops during daylight hours.

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