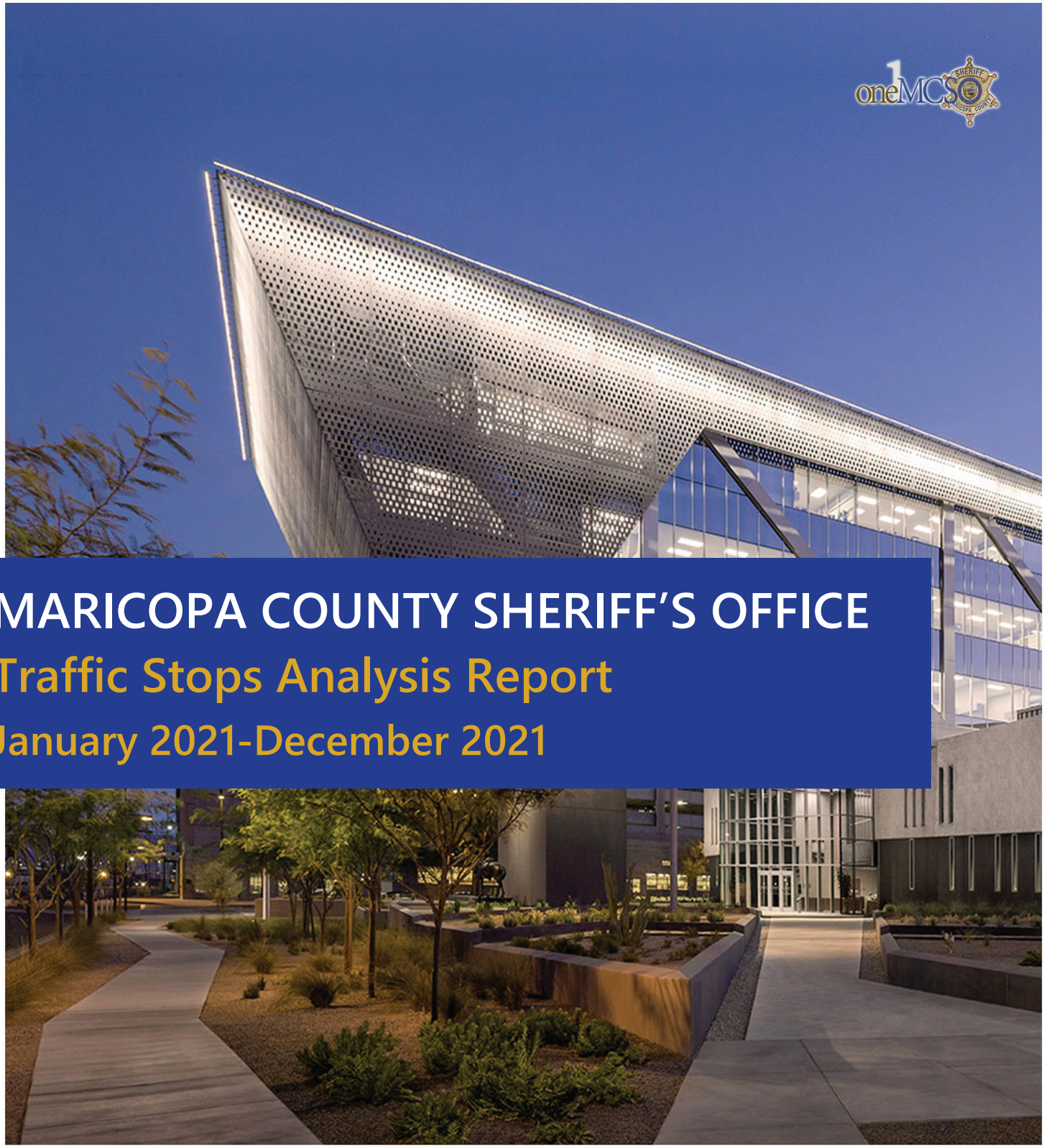

MARICOPA COUNTY SHERIFF'S OFFICE

Traffic Stops Analysis Report

January 2021-December 2021

CNA

This document contains the best opinion of CNA at the time of issue.

CNA Analysis Team:

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Executive Summary

The Maricopa County Sheriff's Office (MCSO), established in 1871, serves and protects the unincorporated areas of Maricopa County, Arizona, and several cities to which the office provides law enforcement services on a contractual basis.[1] Since 2014, the MCSO has worked towards achieving compliance with two federal court orders requiring the MCSO to stop its immigration enforcement and refrain from using Hispanic ancestry as a factor in making law enforcement decisions. The MCSO currently operates under two related court orders, respectively titled the First Order and Second Order. As a feature of the First Order, the MCSO must conduct organizational- and individual-level analyses of patrol activity to determine whether racial disparities exist in MCSO traffic stop outcomes.

In November 2016, Paul Penzone was elected as Maricopa County Sheriff and took office in January 2017. In 2018, the MCSO contracted with the CNA Center for Justice Research and Innovation to analyze patrol activity on an annual and monthly basis and support the development of quarterly reports on special topics related to traffic stops.

This report examines patterns of patrol activity within the MCSO; it does not analyze or identify individual deputies. The analysis in this report includes all traffic stops made by MCSO deputies from the start of January 2021 through the end of December 2021. The MCSO expects to use this report to understand patrol activity in the office and as a foundation to inform potential interventions, initiatives, and new or revised policies. This work will take place in conjunction with the appointed Monitoring Team and Parties to the Court Orders (namely the Department of Justice and American Civil Liberties Union).

The MCSO uses its Traffic and Criminal Software (TraCS) data system to capture data in the field from traffic stops. Of the 209 variables available through TraCS (which include deprecated legacy variables), we used a subset to analyze racial disparities in stop outcomes and construct data using variables from TraCS and appending data from other MCSO systems. To accurately estimate the differential outcomes from traffic stops based on the race of the driver, we used two statistical approaches across the five relevant outcome variables (stop length, search rates, citation rates, arrest rates, and seizure rates). To analyze the stop length, searches, citations versus warnings, and arrests, we used propensity score matching. *Propensity score matching* is a quasi-experimental method of statistical comparison that identifies the most similar events in a condition of interest—in this case, Hispanic, Black, or all racial and ethnic minority drivers[2] compared to White drivers—using a propensity score. To analyze seizure rates during searches, we used chi-square testing, which examines whether the racial distribution of searches that result in seizures is different from the racial distribution of searches that do not result in seizures.

Over the 12-month period from January 2021 to December 2021, MCSO deputies performed 16,860 traffic stops. The rates of traffic stops per month were relatively steady throughout the year. The total number of stops decreased about 17 percent during 2021 compared to 2020. This decrease can likely be attributed, at least in part, to the ongoing effects of COVID-19 on law enforcement activity during 2021. Within the 16,860 traffic stops,

[1] Much of the material in this section is identical to the executive summary from the *Maricopa County Sheriff's Office Traffic Stops Analysis Report: January 2019–December 2019*.

[2] The "all racial and ethnic minority drivers" (referred to as "all minority drivers") analysis includes Hispanic, Black, Asian, and Native American drivers, compared with White drivers.

deputies perceived 66 percent of drivers as White, 23 percent as Hispanic, and 7 percent as Black. The remaining 4 percent of stops involved individuals from other historically marginalized groups, including Asian and Native American individuals. The drivers stopped were 63 percent male and 37 percent female. In the dataset, approximately 85 percent of the stops that deputies made ranged from 5 to 19 minutes. Approximately 54 percent of stops ended with a citation, 46 percent ended with a warning, and 5 percent ended with an arrest (arrests can occur in the same stop as a citation or warning). Less than 1 percent of stops resulted in a non-incidental search of a driver or vehicle, meaning the search was a discretionary decision by the deputy. The seizure rate during non-incidental searches of drivers was 12 percent, and the seizure rate during non-incidental vehicle searches was 51 percent.

The MCSO and the CNA analysis team conclude that there is evidence of disparate outcomes by driver race or ethnicity in traffic stops on most stop outcomes. This finding is consistent with past studies of traffic stop outcomes in other agencies (as noted in this report's introduction), as well as previous court-ordered traffic stop analyses within the MCSO. Stops involving Hispanic drivers were more likely to be longer and to result in a citation, arrest, or search than stops involving White drivers. Stops involving Black drivers were not more or less likely to be longer or to end in a search or arrest than stops involving White drivers; stops involving Black drivers were less likely to end in a citation than those involving White drivers. These disparities represent potential indicia of bias as described in the Court Order; however, the limitations of these analyses prevent concluding that office-wide bias influences MCSO patrol functions, since other factors not captured in these analyses may be leading to disparities.[3] Despite those limitations, the MCSO is taking reasonable steps to investigate and monitor this situation and, when necessary, shall implement interventions to combat these disparities. For example the the Traffic Stop Monthly Reoprt and review process allows MCSO to identify individual deputies with the most disparate outcomes and intervene when possible bias exists.

The results of this annual report are generally consistent with those from the most recent annual report, *Maricopa County Sheriff's Office Traffic Stops Analysis Report: January 2020–December 2020* (TSAR 6), particularly for analyses involving Hispanic drivers. For additional discussion of findings from this and previous annual reports, please refer to the Conclusion section.

The MCSO and the CNA analysis team worked collaboratively to collate the data for this analysis, address missing values and other data irregularities, analyze traffic stops outcomes, and develop the *Maricopa County Sheriff's Office Traffic Stops Analysis Report: January 2021–December 2021*. The MCSO had primary responsibility for collating data and adjudicating missing values and data irregularities, as well as reviewing the annual report. The CNA analysis team had primary responsibility for developing and executing the analytical plan and authoring the annual report. The MCSO then had primary responsibility for drawing conclusions from the analytical results.

In addition to other research on traffic stop activity (e.g., the Traffic Stop Monthly Reports and the Traffic Stop Quarterly Reports (TSQR)), the MCSO will use this report to better understand its traffic stop activity and better serve the residents of Maricopa County. The MCSO and CNA will continue to work closely to analyze traffic stop activity by MCSO deputies, including developing additional annual analysis reports, monthly analysis reports focused on individual deputies, and quarterly reports on special topics as determined by the MCSO, CNA, and the Monitoring Team in consultation with the Parties.

[3] Traffic Stop Quarterly Report 6: 2020 Citations and Warnings demonstrated the importance controlling for specific offending behaviors and number of violations observed in a traffic stop; however, neither of these are controlled for in these or previous Traffic Stops Analysis Report (TSAR) analyses.

Introduction

Background

The Maricopa County Sheriff's Office (MCSO), established in 1871, serves and protects the unincorporated areas of Maricopa County and several cities to which the office provides law enforcement services on a contractual basis.[4] In 2016, the residents of Maricopa County elected Sheriff Paul Penzone to lead the office, which includes more than 3,000 employees and provides enforcement and detention services to the more than four million residents of Maricopa County. The MCSO operates the Fourth Avenue, Durango, Estrella, Lower Buckeye, and Towers jails; the Intake, Transfer, and Release facility; and smaller temporary holding facilities in district substations. The MCSO provides patrol and investigative operations for the seven patrol districts of the county, which include an array of businesses, residents, and communities. Additionally, the MCSO operates specialized units and teams, such as narcotics investigations, the animal crimes unit, canine teams, and tactical operations.

Since 2014, the MCSO has worked towards achieving compliance with a federal court order entered in 2013, requiring the MCSO to stop its immigration enforcement and refrain from using Hispanic ancestry as a factor in making law enforcement decisions. In *Manuel de Jesus Ortega Melendres v. Arpaio* (now *Manuel de Jesus Ortega Melendres v. Penzone*), a federal judge found that the MCSO violated the rights of Latinos and Latinas in Maricopa County through racial profiling and a policy of unconstitutionally stopping persons without reasonable suspicion of criminal activity, in violation of their Fourth and Fourteenth Amendment rights. In 2013, Judge G. Snow of US District Court, Arizona, issued the First Supplemental Court Order (First Order) to the Maricopa County Sheriff's Office to address the pattern of disparate treatment of Hispanic community members in Maricopa County. The First Order established actions required for the MCSO to attain compliance, including introducing new analysis, training, and policies and appointing an independent monitor.[5] As a feature of the First Order, the MCSO must conduct organizational- and individual-level analyses of patrol activity to investigate racial disparities in traffic stop outcomes. In 2018, the MCSO contracted the CNA Center for Justice Research and Innovation to analyze patrol activity on an annual basis and produce quarterly reports on special topics related to traffic stops.

This report directly responds to the First Order requirement to analyze the MCSO traffic stop activity to determine whether disparate outcomes exist by race or ethnicity of drivers. This approach relies on propensity score matching to compare stops that had similar characteristics other than the race or ethnicity of the driver. This report examines patterns of patrol activity within the MCSO; it does not analyze or identify individual deputies. The MCSO expects to use this report as a knowledge base of traffic stop activity in the organization and as a guide for future research and potential interventions, initiatives, and policies. The MCSO works collaboratively with the Monitoring Team and Parties to develop policy and activities to address racial or ethnic inequality related to MCSO's mission.

[4] Much of the material in this introduction is identical to the introduction in the *Maricopa County Sheriff's Office Traffic Stops Analysis Report: January 2020–December 2020*.

[5] In 2016, the court issued the Second Supplemental Court Order (Second Order), establishing additional oversight and reforms for the MCSO. The Second Order does not include actions or requirements related to traffic stops.

Purpose of traffic stop analyses

Analyses of patrol activity are increasingly common across US law enforcement agencies. Law enforcement agencies face heavy scrutiny from the public and the media, who have concerns about bias and disparate outcomes by race in interactions between the police and community members. The interactions under scrutiny include a wide variety of activities, including officer-involved shootings, use of force, searches, and traffic stops (see, for example, Baumgartner et al. 2021; Correll et al. 2007; Fridell & Lim 2017; Fryer 2016; Ridgeway 2006; Ritter 2017; Shoub 2021). Although most law enforcement officers do not intentionally practice biased policing, they may exhibit behaviors that appear biased or that result from implicit bias (Ekstrom et al. 2021; Marsh 2009; Nix et al. 2017; Spencer, Charbonneau, & Glaser 2016). Even though law enforcement strives for fair treatment, officers may unconsciously treat community members differently (Hall, Hall, & Perry 2016; Helfers 2016; Stroshine & Dunham 2008). Of course, incidents involving explicit bias, such as racial profiling, have occurred in law enforcement practice, including the pattern of directed racial profiling that resulted in MCSO's court-ordered monitoring. MCSO has not uncovered additional evidence of explicit bias under Sheriff Penzone's leadership and the auspices of the Monitoring Team.

Implicit bias refers to attitudes or stereotypes that unconsciously affect understanding, actions, and decisions (Staats, Capatoso, Wright, & Contractor 2015). In contrast to implicit bias, *explicit bias* refers to conscious attitudes and beliefs about a person or group (James 2018), such as prejudice. Implicit bias occurs and affects all individuals without their awareness or intentional control (Staats et al. 2015). Officers' implicit biases may affect their interactions with a driver when making a traffic stop and may affect stop outcomes on an individual level. This issue persists beyond the scope of law enforcement agencies—all people possess implicit biases, and implicit biases occur naturally on a subconscious level (Staats et al. 2015). Awareness of implicit bias gives law enforcement agencies the opportunity to work with organizations and researchers on methods and training to reduce implicit bias and its effects. Researchers can develop methods to identify officers who need implicit bias or other training through quantitative analysis of disparate outcomes.

Over time, methods for identifying evidence of disparate outcomes have evolved. Early research on bias in policing and disparate outcomes relied primarily on correlational and simple comparative methods (Gaines 2006; Novak 2004; Persico & Todd 2006; Rodriguez et al. 2015; Smith & Petrocelli 2001). Researchers now use methods such as propensity score matching and weighting to analyze traffic stops and other law enforcement activity outcomes for evidence of racial disparity (Riley et al. 2005; Ridgeway 2006; Tillyer et al. 2010). Methods for assessing disparate outcomes have also evolved to incorporate measures beyond stop rates, focusing on stop outcomes such as citations and searches (Fridell 2004; Fridell 2005; Tillyer et al. 2010). Researchers also use more sophisticated benchmarks, moving away from population as an external benchmark for assessing disparate outcomes (Grogger & Ridgeway 2006; Lange, Johnson, & Voas 2007).

Understanding the expectations and limitations of quantitative analysis for investigating implicit bias is important for interpreting the findings in this report. Research on traffic stops includes both pre-stop and post-stop analysis. Pre-stop analysis studies whether the race of the driver affects stop rates; post-stop analysis studies whether the race of the driver affects the outcome of a stop. The different limitations of these two analyses illustrate the difficulties of traffic stop analysis. A pre-stop analysis requires estimating the local driving population, which is a complex problem. Using census data is imprecise, since it includes non-drivers and may not accurately reflect the driving population or the racial distribution of drivers who violate traffic laws (McMahon, Garner, Davis, & Kraus 2002; Tregle, Nix, & Alpert 2019). Other methods for estimating the racial distribution of the driving population,

such as observing and recording the race of drivers in a given jurisdiction over time or using driver license race data, can be cost-prohibitive or infeasible because of data unavailability (Fridell 2004; Tillyer et al. 2010), which is the case in Arizona because race is not captured in Arizona driver license or registration documentation.

Conducting post-stop analysis mitigates some of these issues because the population under study is contained within the traffic stop data and does not need to be estimated (Ridgeway & MacDonald; 2010 Withrow, Dailey, & Jackson 2008). Despite improvements in analytical methods, analysts still need correct and in-depth traffic stop data from agencies to accurately measure disparate outcomes; the absence of adequate data can limit the scope and effectiveness of the results. Some agencies track data for their traffic stops meticulously, while other agencies may track only limited information, such as when a stop occurred, the driver's race, and limited stop outcomes, or they may store data about traffic stops across data systems that cannot be readily linked.

Based in part on the limitations of traffic stop analysis, the presence of disparate outcomes does not necessarily indicate the presence of bias. Practitioners and consumers of bias research should understand that disparate outcomes do not definitively indicate bias (Fridell 2004; Simoiu, Corbett-Davies, & Goel 2017). Quantitative analysis cannot capture all the possible reasons that could explain the disparate outcomes. Even with these limitations, the results from statistical analyses can provide better insight into policing practices in an agency, helping the agency identify disparate outcomes to address. Such analyses provide agencies with a tool to review officer traffic stop conduct and determine the necessary actions, if any, for officers and agencies as a whole.

A greater number of law enforcement agencies now analyze their traffic stop data internally or in partnership with researchers and analysts. The majority of analyses conducted to date have found racial disparity in traffic stop outcomes. Tillyer et al. (2010) states, "Analyses of these data demonstrate a relatively consistent trend of racial/ethnic disparities in vehicle stops and vehicle outcomes." The majority of existing studies have found evidence of racially disparate rates of stops or outcomes of patrol activity in law enforcement agencies (Ariel & Tankebe 2018; Baumgartner, Epp, & Shoub 2018; Engel & Calnon 2004; Gaines 2006; Gelman, Fagan, & Kiss 2012; Hannon, Neal, & Gustafson 2020; Norris et al. 1992; Novak 2004; Pierson et al. 2020; Rodriguez et al. 2019; Rojek, Rosenfeld, & Decker 2004; Rosenfeld, Rojek, & Decker 2012; Smith & Petrocelli 2001; Tillyer & Engel 2013; Vito et al. 2020; Webb et al. 2021; Weiss & Rosenbaum 2006). A few studies have documented findings of no racial disparity in traffic stop outcomes (Groggery & Ridgeway 2006; Higgins et al. 2012; Taniguchi et al. 2016; McCabe, Kaminski, & Boehme 2020; Zhang & Zhang 2021). The balance of the evidence suggests that disparate outcomes during traffic stop activity are common in law enforcement agencies in the United States; however, acknowledging the prevalence of the problem does not imply that agencies should not pragmatically and proactively address disparate outcomes by promoting anti-bias policy, training, and practices.

Researchers have analyzed patrol activity in many ways. Recently, the Stanford Computational Policy Lab (Pierson et al. 2019) compiled a dataset of 100 million traffic stops from municipal and state agencies. To date, this project is the largest traffic stop study to investigate racial disparities in outcomes. The study used a "veil of darkness" method to compare stop rates by race in situations in which officers presumably could see the race of the driver versus those (in conditions of darkness) in which officers presumably could not. The study found evidence of disparate outcomes in traffic stops across the compiled agencies when controlling for time of day. Several law enforcement agencies have taken on the task of analyzing their patrol activity data and developing a plan to reduce racial disparities, including the Cincinnati Police Department (Ridgeway 2009), Durham Police Department (Taniguchi et al. 2016), Minneapolis Police Department (Ritter & Bael 2005), and New York Police Department (Ridgeway 2007).

Overall, the use of statistical analysis for identifying racial disparities in traffic stops is increasingly crucial, and previous analyses indicate that disparities exist across the nation.

Organization of this report

This report is organized into four sections: introduction, approach, findings, and conclusion. The approach section explains the MCSO and CNA's methods for analyzing traffic stop outcomes and developing this report. The findings section details results of the traffic stop analysis on the selected outcomes. Finally, the conclusion section reviews the analytical findings and discusses ongoing and future activities the MCSO is or will be conducting in response to these findings as well as future analyses that the MCSO and CNA will conduct in response to the First Order. The appendices provide a reference list and list of abbreviations.

Additionally, we provide supplemental appendices to this report in a separate companion document, including supporting data tables, alternate propensity score matching models, and analytical support and robustness checks. Law enforcement researchers and analytical practitioners looking to implement similar studies in other agencies will likely find these appendices of interest.

Approach

In this section, we discuss the data, variables, and methodology we used in the traffic stops analysis. We begin by describing the MCSO Traffic and Criminal Software (TraCS) data system, defining the variables used in the analysis, and describing the data cleaning process prior to analysis. We then discuss the propensity score matching approach we used to assess racial disparity in the length of stops, searches, citations, and arrests, as well as the chi-square analysis we used to assess racial disparity in seizure rates. We discuss the alternate specifications we used for the propensity score matching analyses. We close by noting specific considerations for interpreting the findings from this analysis, as well as limitations of the approach.

Overview of data and variables

The MCSO uses TraCS to capture data from the field about traffic stops. TraCS is a data collection, records management, and reporting software for public safety professionals. Deputies use TraCS to document aspects of traffic stops, including driver and vehicle characteristics and activities that occur during the stop. TraCS captures the start time, end time, and geolocation for the traffic stop.[6] The system also requires the deputy to enter variables such as the perceived race of the driver,[7] the contact conclusion, and search and seizure information. TraCS also includes data fields capturing information about any delays during the stop such as training, driving under the influence (DUI) investigations, tows, technical issues, or language barriers, and it includes a comment field for deputies to input additional information.[8] After the deputy fills out the event in TraCS, the system forwards entries for supervisory review and, if necessary, revision. Of the 209 variables available through TraCS (including deprecated legacy variables), we used a subset to analyze racial disparities in stop outcomes, as well as construct and append data using variables present in TraCS and other MCSO systems. Here, we briefly describe the variables we used in the analysis and those constructed by the analysis team. For all categorical variables coded into a single variable (such as stop classification or the perceived race of the driver), we constructed indicator variables for each category.

Data about the stop. We used the stop date, stop start time, and stop end time variables to develop descriptive information about stops conducted by the MCSO. We also used the start time and end time to construct the stop length variable, which codes how long a stop lasted in minutes from reported start to finish. We also used stop time to construct an indicator variable capturing stops occurring between 8:00 p.m. and 8:00 a.m. as a proxy for time of day used as a matching variable.[9] Stop classification summarizes the reason for the stop, per the Arizona Revised Statutes (ARS), classified into four categories: criminal, civil traffic, criminal traffic, and petty. Deputies can also indicate whether circumstances beyond their control extended the length of a stop, including technical issues (e.g., a printer failure), a language barrier, a DUI stop, training, or calling for a tow. We also include a variable

[6] In some patrol areas, particularly within Lake Patrol's jurisdiction, GPS coverage can be inconsistent. In these cases, TraCS may not automatically capture the GPS coordinates of the stop. We discuss this issue further in the section on missing data.

[7] Note that Arizona does not collect information about race as part of its driver license system; thus, all race categories within the TraCS data are based on the perception of the deputy who made the stop.

[8] A detailed description of the TraCS data collection system and included variables is available in MCSO policy #EB-2, "Traffic Stop Data Collection," available publicly on the MCSO website: https://www.mcso.org/about-us/general-info/mcso-policies.

[9] The use of time of day as a matching variable is complicated by the cyclical nature of time variables, in which 23:59 is closer to 00:01 than it is to 23:00, which cannot be readily captured using any continuous variable construction.

capturing information about the deputy's assignment (based on call sign), broken out as normal patrol, Lake Patrol, off-duty assignment, designated traffic stop car, supervisor, and other.

Data about stop outcomes. Stop conclusion data describe the outcome of the stop as a citation, warning, or incidental contact. TraCS indicates whether a stop included a search of the driver or vehicle (we omitted passenger searches from this analysis because our focus is on drivers) and whether that search was incident to arrest or towing. We constructed a variable for analyzing searches that indicates whether a search of the driver or vehicle took place. For this analysis, we restricted our interest in searches to those that were non-incidental (i.e., discretionary) in nature. For example, policy dictates that all individuals be searched prior to arrest detentions and all vehicles be inventoried prior to tow; searches that occur incident to arrests or tows are not discretionary and thus were excluded from our analysis of outcomes. Deputies also indicate in TraCS whether a search resulted in the seizure of contraband.

Data about the driver. We used the post-stop perceived race of the driver, as entered by the deputy, to classify the driver race as Asian, Black, Hispanic, Native American, or White. We also used the post-stop perceived sex of the driver to create an indicator variable for male drivers (with female drivers and unknown sex drivers collapsed as the comparison category). We also included the reported license plate state of the vehicle the driver was operating, classifying it as either an in-state or out-of-state plate.

The CNA analysis team appended data not housed in TraCS into our analysis, including information about special assignments. The MCSO manually compiles data about special assignments by deputy and by date. During the time frame of this analysis, the only special assignment was a DUI task force. The analysis team also constructed a deputy traffic stop count variable equal to the number of stops the deputy made over the 12-month period, for descriptive purposes.

Data verification and missing data

The analysis team reviewed the 2021 TraCS data for data quality (e.g., missing data or out-of-range values) and verification. We identified missing and inaccurate data in several fields. The MCSO and CNA identified that deputies had coded 636 latitudes and longitudes to a default value indicating that they lacked connectivity during the stop. The MCSO used the coded address location for these stops to code accurate latitude and longitude data.

The analysis team identified additional missing data that the MCSO could not adjudicate or impute. Two stops lacked data for the vehicle license plate; we omitted these from all comparative analyses, since we used in-state plate status as a propensity score matching variable. We also noted 196 stops for which a call sign category could not be identified. These missing data represent 1 percent of the overall data, below any standard threshold that would trigger concerns about missing data biasing analysis or findings. Supplemental Appendix 1 describes the missing data by variable.

To prepare the final dataset for analysis, in addition to constructing variables as noted above, the analysis team removed non–traffic stop data, corrected inaccurate stop outcomes, and dropped duplicate stop entries. In the review of the data, the MCSO and CNA identified and removed 44 lines of data in which no enforcement actions took place and the driver was free to go (e.g., stops pre-empted by priority calls for service). In addition, TraCS creates duplicate lines to capture data for multiple contacted passengers; since this analysis focuses solely on drivers, these lines represent duplicate data. We identified these duplicate entries based on the event number, deputy's badge number, and driver's first and last name, and we removed them.

Methodology

To most accurately estimate differential outcomes from traffic stops based on the race of the driver, we used two statistical approaches across the five outcome variables under consideration. To analyze the length of stops, searches, citations versus warnings, and arrests, we used propensity score matching. To analyze seizure rates during searches, we used chi-square testing. We discuss each of these approaches in more detail below.

Propensity score matching is a quasi-experimental method of statistical comparison. Researchers use quasi-experimental methods in circumstances in which random assignment (i.e., experimental approaches) are not feasible or practical; these techniques leverage specific data structure and statistical techniques to approximate experimental conditions (Shadish, Cook, & Campbell 2002). In this case, propensity score matching matches individual events (i.e., traffic stops) with similar events based on their characteristics (listed at the end of this paragraph). Specifically, propensity score matching identifies the most similar events in or not in a condition of interest (in this case, Hispanic, Black, or all minority drivers[10]) using a propensity score (Rosenbaum & Rubin 1983; Apel & Sweeten 2010).

For this traffic stops analysis, we used a logistic regression in the first stage of propensity score matching to determine the probability that a stop involved a driver of a particular race (i.e., Hispanic, Black, and all minorities). For all analyses, stops involving White drivers are the comparison conditions. We performed matching analyses using observed characteristics of the stop—namely the driver's sex, the stop longitude and latitude, whether the stop was conducted as part of a special assignment, whether the stop took place between 8:00 a.m. and 8:00 p.m., the stop classification (operationalized as civil traffic stops versus all others), whether the vehicle had out-of-state plates, whether the deputy indicated the stop was extended for one of the five reasons discussed above, and the call sign category the deputy was operating under. In addition, for the length of stop analysis only, we include whether the stop involved an arrest or a search; both these circumstances necessarily result in longer stops. We exclude stops with extended stop indicators because the MCSO's *Traffic Stops Quarterly Report: Extended Traffic Stop Indicator Use* verified that deputies are using extended stop indicators appropriately.[11]

After this matching step, we conducted comparisons using the propensity scores to match observations. For the baseline analysis presented in the main body of this report, we used nearest neighbor matching (in which stops in the condition of interest are compared by propensity score with the nearest one stop that is not in the condition of interest). We chose nearest neighbor matching as the baseline case because it is the least susceptible to problems with achieving common support (Caliendo & Kopeinig 2005), a necessary condition for validating propensity score matching results. Supplemental Appendix 6 describes common support and results from common support testing in more detail. To check the robustness of our results, we ran each analysis using radius matching (in which stops in the condition of interest are compared with all stops within a certain propensity score range that are not in the condition of interest) using multiple radii values. Finally, we also used nearest N-neighbor matching (in which stops in the condition of interest are compared with the nearest N stops by propensity score that are not in the condition of interest). We also considered matching with and without replacement as a sensitivity check. Supplemental Appendix 6 presents detailed results from the robustness check analyses.

For all analyses, we present findings in terms of the average treatment effect—that is, the average difference of outcomes between stops in and not in the condition of interest (Rosenfeld, Rojek, & Decker 2012). We report the

[10] The "all minority drivers" analysis includes Hispanic, Black, Asian, and Native American drivers, compared with White drivers.

[11] This is the first year the TSAR had used only the non-extended stops as a baseline for the stop length outcome. Previous TSARs used all stops in the baseline model.

average treatment effect, reflecting the difference between outcomes in stops involving Hispanic, Black, or all minority community members versus White community members. We report the average treatment effect in lieu of the average treatment on the treated, since the average treatment on the treated is appropriate when individuals can choose their assignment into the condition of interest, which is not the case for minority status. For all propensity score analyses, we conducted standard checks of balance and common support. We summarize these results in the body of the report and present them in detail in Supplemental Appendix 4.

We analyzed the rate of seizures during searches using a standard chi-square test of homogeneity across mutually exclusive categories (in this case, perceived race). This test uncovers whether rates of seizures vary significantly across racial categories. As noted in the literature, different rates of seizures may indicate racial bias, since differences suggest deputies may use different decision criteria or thresholds prior to searches of drivers of different races or ethnicities (Persico & Todd 2006; Ridgeway & MacDonald 2009; Walker 2003; Simoiu et al. 2017). For this analysis, we considered only searches that were not incident to arrest or towing. We used a standard chi-square analysis with Pearson's and likelihood ratio tests (Pearson 1900). We also ran Fisher's exact test (due to the small number of stops of Asian and Native American drivers) for comparison purposes.

Alternate specifications

As noted above, we varied the propensity score approach for the propensity score matching analyses to encompass two matching methods: radius and neighbor. We also varied the parameters used for the radius caliper size and the number of neighbors matched. Finally, we considered the effect of allowing replacement (i.e., whether an observation can be used as a match for multiple other observations) for nearest neighbor and radius matching.[12] The Supplemental Appendices to this report present the results from the alternate specifications.

For the length of stop analysis, we also considered an alternate specification in which we added controls for extended stop indicators to estimate the average treatment on the treated, as well as a model in which we used the extended stop indicators as matching variables. Including control variables in the second stage of the propensity score matching analysis is feasible only when nearest neighbor matching is used; therefore, we present only findings from that specification for these alternate specifications.

For the arrest analysis, we also considered alternate specifications related to the type of arrest: warrant arrests, cite-and-release arrests, and booked arrests. These alternate specifications are presented in the Findings section.

Considerations and limitations

Propensity score matching represents a substantial improvement over past methods of estimating racial disparity in law enforcement activities, since it does not rely on the development of imperfect or cost-prohibitive external benchmark data, and it more precisely estimates the true differences in outcomes when accounting for differences in circumstance between interactions (e.g., traffic stops). However, the methodology is not without limitations. First, as noted above, the matching step relies on the estimation of a logistic regression, which requires estimates to converge over iterative analysis steps. This requirement can limit the inclusion of variables and observations if convergence is impossible for a given model specification. The model also cannot account for any variable that perfectly predicts the condition of interest, though this did not occur in any of the estimated models in this analysis.

[12] Matching without replacement cannot be feasibly conducted on N-to-1 neighbor matching analyses.

Finally, as with all statistical techniques to assess outcomes and behavior from law enforcement personnel, the results from these analyses can uncover only evidence of disparities in outcomes based on race—they cannot provide insight into the underlying causes of these disparities on their own.

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Findings

In this section, we begin by describing the included variables. As part of the descriptive statistics, we present the rates of traffic stops by race of driver. The analysis team worked closely with the MCSO to assess various options for external benchmarks to use as a comparison condition for stop rates by race. Most existing or proposed external benchmarks provide inaccurate estimates of the driving population (census population) or are cost-prohibitive (collection of data on driver race using observations at intersections). We considered several emerging practices (comparison of daytime versus nighttime stop rates, use of accident data, comparison of criminal versus civil traffic stop rates), but we could not implement them using the currently available data from the MCSO. Therefore, for stop rates, we present descriptive statistics only.

Below, we present the findings from the comparative propensity score matching and chi-square test of homogeneity. For each stop outcome we analyzed using propensity score matching, we include results from comparing Hispanic drivers to White drivers, comparing Black drivers to White drivers, and comparing all minority drivers to White drivers. We did not specifically analyze Asian or Native American drivers because of the relative sparsity of stops involving drivers of these races. The chi-square analysis includes drivers of all races.

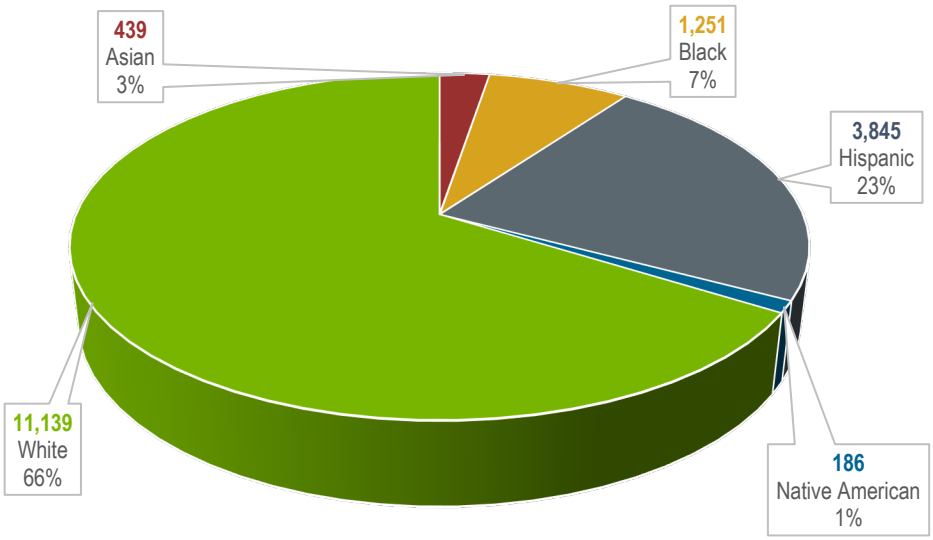
Descriptive statistics

In this section, we describe the data included in this analysis of traffic stops conducted by the MCSO between January 2021 and December 2021 (a 12-month period). We present the characteristics of the stops themselves, the characteristics of stop outcomes, and the traffic stop count of the deputies making the stops. Supplemental Appendix 1 provides a full table of descriptive statistics for each variable.

Driver characteristics

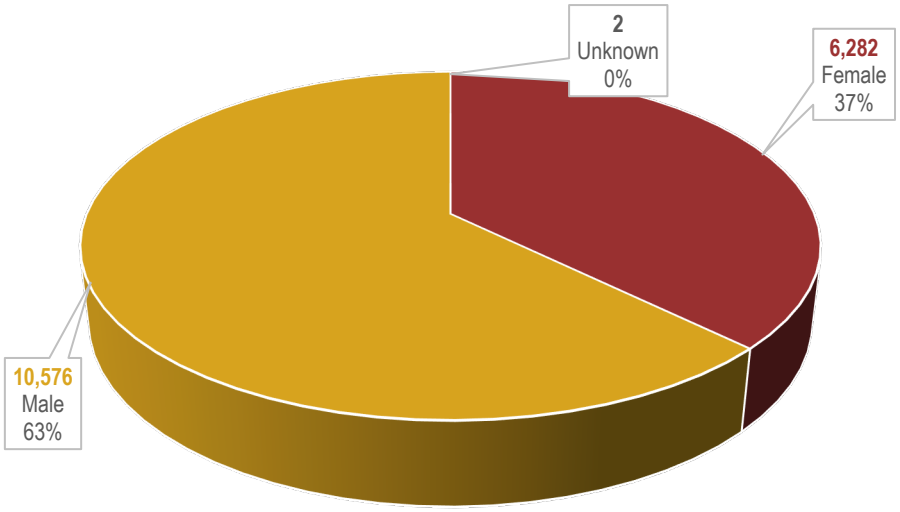
When deputies make a traffic stop, they document their observation of the perceived race of the driver both pre- and post-stop in TraCS. We omitted analysis of the pre-stop perception of driver race, since this variable takes the value "unknown" in over 98 percent of stops. Post-stop, deputies perceived 66 percent of drivers as White, 23 percent as Hispanic, and 7 percent as Black. The remaining 4 percent of stops were of Native American and Asian drivers.

Figure 1. Stops by post-stop perceived driver race



The deputies also enter post-stop perceived sex in TraCS. The drivers stopped were 63 percent male and 37 percent female, plus two stops (less than 1 percent) for which the deputy could not determine the sex of the driver.

Figure 2. Stops by post-stop perceived driver sex

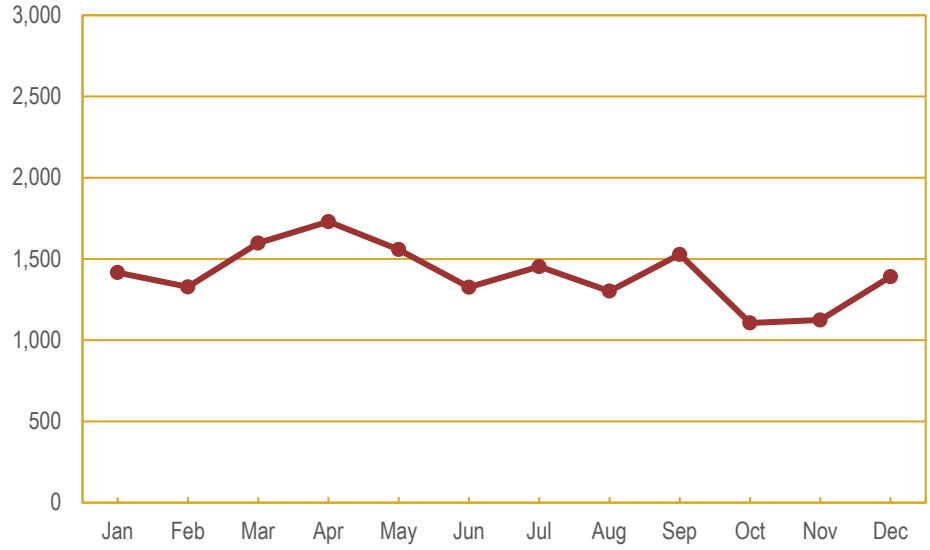


Stop characteristics

Over the 12-month period for this analysis, the MCSO deputies performed 16,860 traffic stops. Traffic stops over this period trended upwards between February and April 2021 and again in September 2021. Traffic stops decreased in October 2021 and November 2021 before increasing back to a very similar number of stops at the end of the year as it was in the beginning of the year. This overall trend is different from what was observed in late 2018 and throughout 2019, when the number of stops trended steadily upwards. Additionally, this trend is different from what was observed in 2020, when stops trended downward at the beginning of the year but were

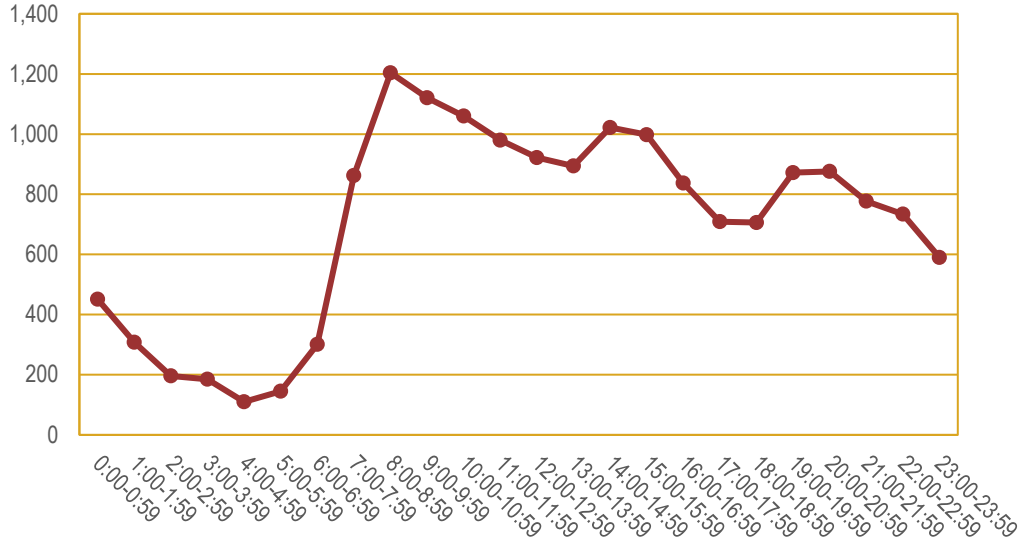
more stable for the remainder of the year. The number of stops during 2021 decreased almost 17 percent compared to 2020.

Figure 3. Stops by month, January 2021–December 2021



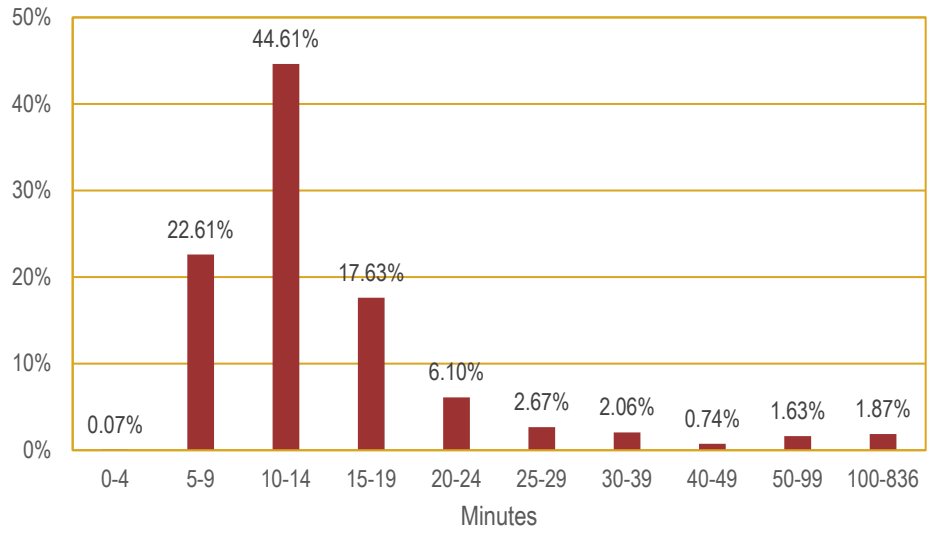
We also considered the time of day that a stop took place. A majority of the stops in 2021 occurred between 7:00 a.m. and 5:00 p.m., which is similar to the trends in 2019 and 2020.

Figure 4. Stops by time of day



Stop length is of particular importance to this analysis, since it is a core aspect of the Order. Stops lasted an average of 17.73 minutes, a 5.04 percent increase from the previous annual report (in which the average stop length was 16.88 minutes). The majority of stops lasted between 5 and 39 minutes.

Figure 5. Stops lengths, in minutes



Deputies document in TraCS whether a stop is extended for reasons that would reasonably extend a stop. The extended stops field contains five options: DUI stop, language barrier, technical issues, training stop, and vehicle towed. Deputies selected extended stop indicators for 3,442 stops, representing 20.4 percent of total stops. This number represents an increase from the previous annual report, in which extended stops represented 15.3 percent of total traffic stops. Each stop indicator besides technical issues increased in the percentage of stops in comparison to the previous annual report. Training stops occurred the most at 7.28 percent, while technical issues were close behind at 7.05 percent. This trend in extended stop reasons is similar to the trend in 2020, although the number of stops documented as training stops increased.

Table 1. Extended stop reasons

Reason Indicated	Percentage of Stops
DUI Stop	2.77%
Language Barrier	1.35%
Technical Issues	7.05%
Training Stop	7.28%
Vehicle Towed	1.97%

We also considered which stops occurred while the deputy was on a special patrol assignment. Of the 16,860 stops in the dataset, 187 stops occurred while deputies were on DUI Task Force assignment, the only special assignment in the traffic stop data for 2021.

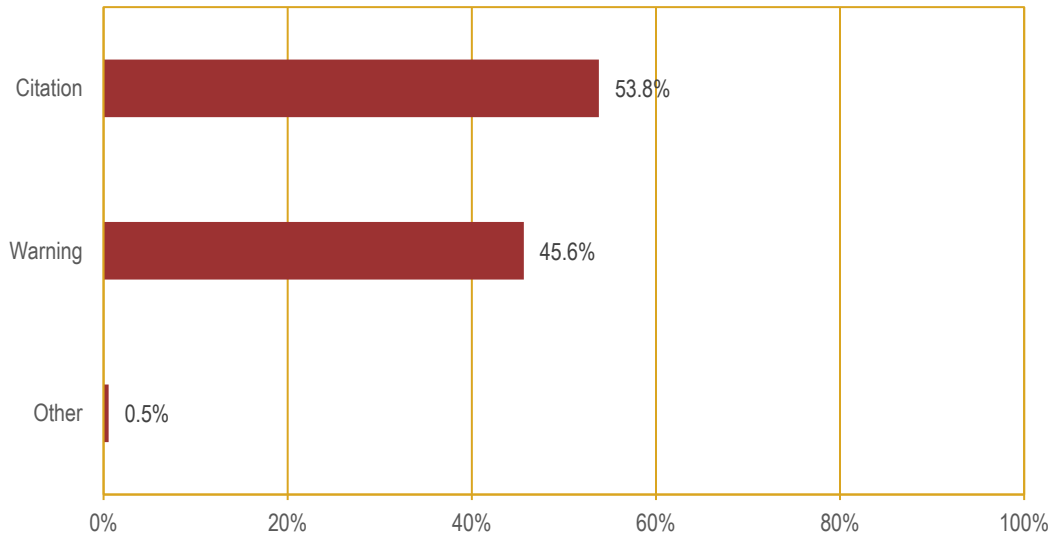
Table 2. Stops conducted during special assignments

Special Assignment	Counts
DUI Task Force	187

Stop outcomes

Contact conclusion documents the outcomes from each stop. Of the stops, almost 54 percent concluded with a citation, almost 46 percent ended with a warning, and less than 1 percent ended with non-enforcement outcomes, such as when a deputy is pre-empted for a priority call and ends the traffic stop without issuing a citation or formal warning.

Figure 6. Traffic stop contact conclusions



The MCSO organizes stops into five categories, based on ARS code: civil traffic, criminal traffic, petty, criminal, and civil. The majority of the stops that occurred in 2021 were civil traffic stops. *Civil traffic violations* are violations for which the driver does not face jail time and instead pays a fine. Examples of these include speeding, equipment violations, or seatbelt violations. *Criminal traffic violations* are traffic violations that result in a fine and involve possible jail time. These include criminal speeding, reckless driving, driving under the influence, or driving on a revoked or cancelled license. *Petty violations* are criminal violations with less severe penalties that do not include the possibility of jail time. These include boating violations, park violations, and curfew violations. *Criminal violations* are non-traffic violations that involve possible jail time and typically are incident to the traffic stop, such as a stopped individual having an active warrant for criminal activity or engaging in criminal activity not related to the stop. Of the traffic stops that result in a citation, over 96 percent result in a civil traffic classification, and almost 4 percent result in a criminal traffic classification. The dataset contains 27 criminal classifications and 4 petty classifications, accounting for less than 0.2 percent of the stop classification reasons. No stops were classified as civil in 2021.

Figure 7. Traffic stop classifications

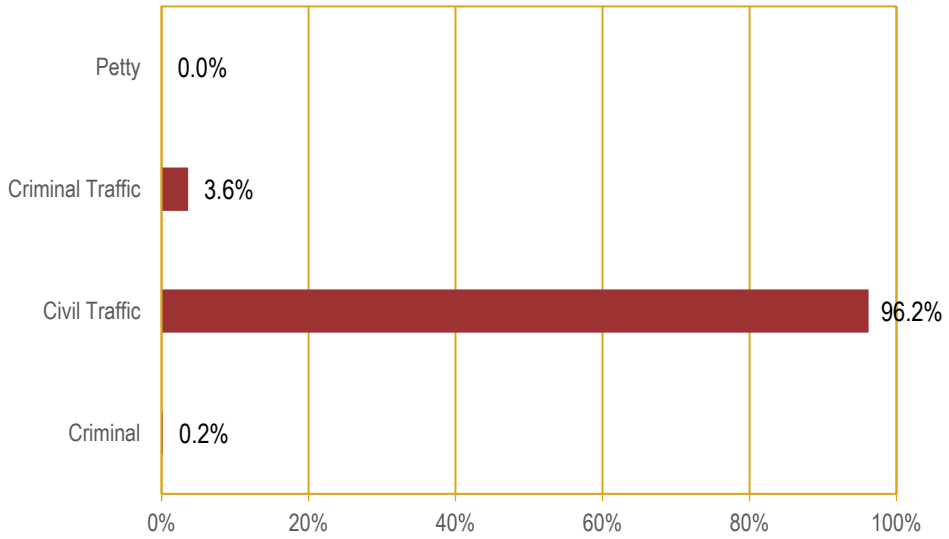
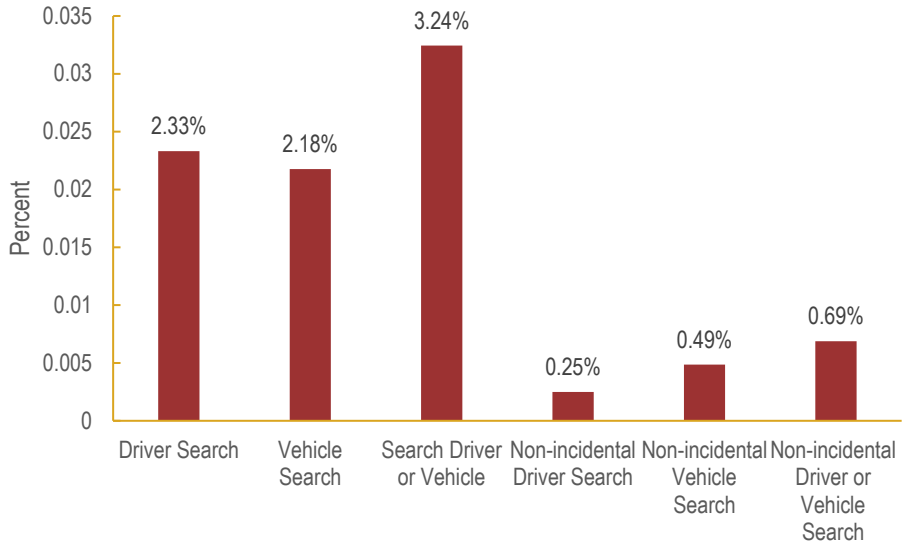


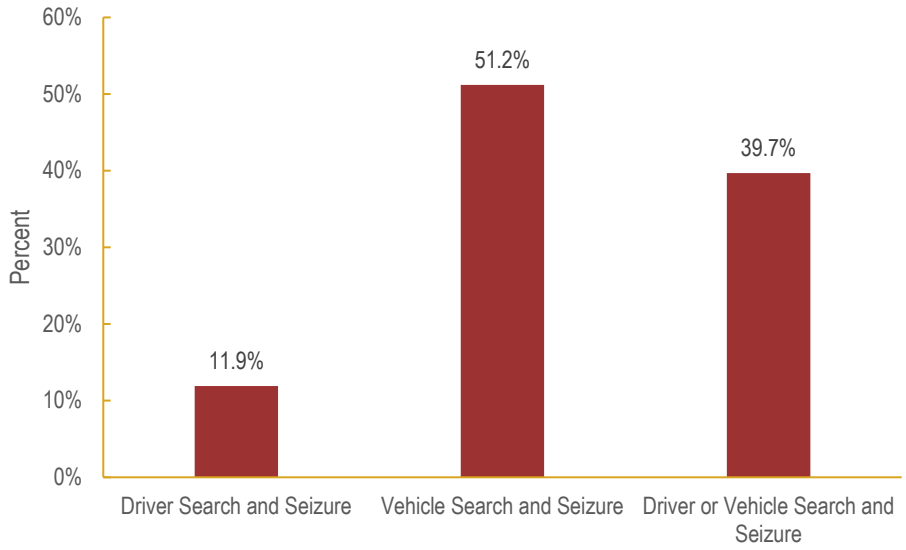
Figure 8 presents information about searches. MCSO policy dictates that deputies search all arrested drivers and search all towed vehicles; these searches are not discretionary on the part of the deputy. *Non-incidental searches* refer to searches that are not connected to arrests or tows; these represent discretionary searches conducted by deputies. As Figure 8 shows, the majority of searches of drivers occurred incident to arrest. For this analysis, we considered searches of drivers or vehicles as a search outcome; in 2021, MCSO deputies conducted slightly more searches of vehicles than searches of drivers.

Figure 8. Searches



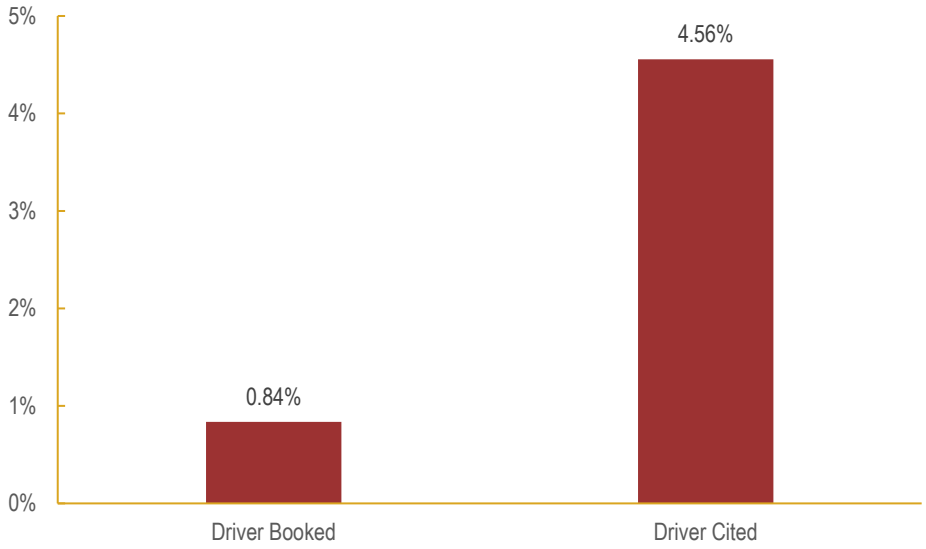
For all stops involving a search, deputies record whether the search turned up contraband (i.e., the incidence of seizures predicated on searches). Overall 39.7 percent of non-incidental searches resulted in seizures.

Figure 9. Seizures during non-incidental searches



Deputies use the driver arrest variable field to document whether arrests are classified as cite and release (i.e., citation in lieu of detention) or bookings. Depending on the charges against the driver, deputies can use their discretion to choose between the two options. For example, a deputy arresting an individual for driving under the influence may use his or her discretion regarding whether the individual is too impaired to be released on their own recognizance and should be booked for the night. Arrests of drivers are rare among traffic stops, representing 5.4 percent of total traffic stops.

Figure 10. Arrests during traffic stops

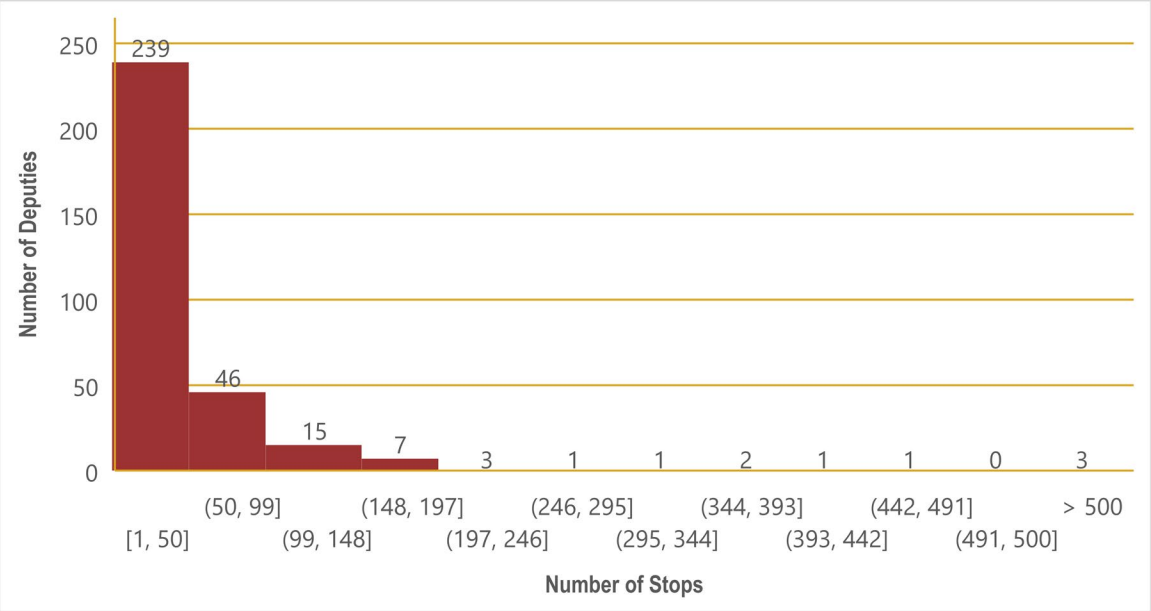


Deputy characteristics

The dataset includes 319 deputies from the MCSO. We present data about deputy traffic stop activity measured as the total number of stops conducted by deputies over the 12-month period in this analysis. As Figure 11 shows,

most deputies conducted between 1 and 51 stops during this period, but a few deputies made over 500 stops in the same period. This trend is similar to trends in 2019 and 2020.

Figure 11. Deputy traffic stop count (number of stops over the 12-month period)



Comparative analysis

In this section, we present the findings from analyzing each stop outcome, and we summarize the findings from the statistical analysis. This report also includes supplemental appendices, which are as follows:

- Supplemental Appendix 1, as previously noted, presents descriptive statistics for all variables.
- Supplemental Appendix 2 includes results from the logistic regressions for each of the conditions of interest.
- Supplemental Appendix 3 includes detailed tables of the propensity score matching results.
- Supplemental Appendix 4 provides results from the analyses of stop length that include extended stop indicators.
- Supplemental Appendix 5 provides results from all other alternate specifications.
- Supplemental Appendix 6 provides details on the results of the common support and balance tests for each specification.

We present the full analysis of seizures predicated on searches in the main body of the report.

For the propensity score matching results, we used a p-value of 0.05 or less to indicate significance. Given that the sample size for all analyses was more than 100, this resulted in a critical t-statistic of 1.96 (t-statistics above this value indicate significance, and those below indicate a failure to reject the null hypothesis of no statistically significant difference).

Common support and balance assumptions were met for all the baseline analyses (see Supplemental Appendix 6 for further details on these tests). In propensity score matching analysis, common support is assumed for valid estimation, meaning that all observations contain a positive probability of being in the condition of interest or not,

based on the probability score (p-score) (Khandker, Koolwal, & Samad 2010). Balance evaluates the effectiveness of the matching procedure in reducing observable differences between observations within and out of the condition of interest (Khandker, Koolwal, & Samad 2010). After matching takes place, the differences between observations in the condition of interest and their matches on the observable characteristics used for matching should be minimal.

Analyses presented in this section include all observations unless otherwise noted.

Stop length

The analysis team investigated differences in stop length between Hispanic and White drivers, Black and White drivers, and all minority and White drivers. As noted above, deputies can indicate whether they experienced specific circumstances that extended the length of a stop beyond their control, which include technical issues (e.g., a printer failure), a language barrier, a DUI stop, training, or calling for a tow. These analyses removed all extended stops based on MCSO's quarterly report, which audited extended stop length indicators and found that deputies were using them appropriately and non-discriminatorily.

To provide context and a comparison point, the average stop length for White drivers in 2021 was approximately 15.72 minutes (or approximately 15 minutes and 43 seconds). Removing the extended stops, the average stop length for White drivers in 2021 was approximately 12.92 minutes (or approximately 12 minutes and 55 seconds). Table 3 summarizes the findings from this analysis. **Our analysis found statistically significant differences in stop lengths between Hispanic and White drivers, with the average stop lengths for Hispanic drivers being about a minute longer than the average stop lengths for White drivers.** Unlike previous years, our analysis does not show a statistically significant difference between Black and White drivers or between all racial and ethnic minority drivers and White drivers.

Table 3. Propensity score matching results for stop length, extended stops removed

Model	Difference (in minutes)	t-statistic	Statistically significant?
Hispanic v. White drivers	0.99	3.59	Yes
Black v. White drivers	0.26	0.66	No
Minority v. White drivers	0.46	1.51	No

For the purposes of comparison to previous reports, we also present the results from three alternate specifications: an analysis of all stops (including extended stop), an analysis using extended stop indicators as second stage control variables, and an analysis using extended stop indicators as matching variables. The following three tables present those results. Based on the findings in the Traffic Stops Quarterly Report: Extended Traffic Stop Indicator Use, the results without the extended stops likely reflect the disparities experienced by the community the most accurately, absent unusual circumstances that extend stop length by definition.

Table 4. Propensity score matching results for stop length, all stops (previous baseline model)

Model	Difference (in minutes)	t-statistic	Statistically significant?
Hispanic v. White drivers	2.58	4.31	Yes
Black v. White drivers	0.25	0.04	No
Minority v. White drivers	1.70	2.56	Yes

Table 5. Propensity score matching results for stop length, controlling for extended stop indicators

Model	Difference (in minutes)	t-statistic	Statistically significant?
Hispanic v. White drivers	0.20	0.49	No
Black v. White drivers	-0.51	0.75	No
Minority v. White drivers	0.25	0.87	No

Table 6. Propensity score matching results for stop length, including extended stop indicators as matching variables

Model	Difference (in minutes)	t-statistic	Statistically significant?
Hispanic v. White drivers	1.44	2.86	Yes
Black v. White drivers	1.00	1.43	No
Minority v. White drivers	0.93	2.01	Yes

Citations

The analysis team investigated differences in citation rates (i.e., the percentage of stops that involved citations rather than warnings or incidental contacts) between Hispanic and White drivers, Black and White drivers, and all minority and White drivers. To provide context and a comparison point, approximately 55.68 percent of stops involving White drivers ended in a citation. Table 7 summarizes the findings from this analysis. **Compared to White drivers, Hispanic drivers were 2.62 percentage points more likely to receive citations rather than warnings or other stop outcomes. Black drivers, however, were 7.27 percentage points less likely to receive citations rather than warnings or other stop outcomes when compared to White drivers.** These findings are somewhat consistent with those from the previous annual report in terms of statistical significance. In the past, we have seen a statistically significant difference between all racial and ethnic minority drivers and White drivers. Also noteworthy, the difference between Hispanic drivers and White drivers decreased from TSAR 6. The findings were consistent across all alternate specifications of the main propensity score matching model with replacement.

Table 7. Propensity score matching results for citations

Model	Difference (percentage points)	t-statistic	Statistically significant?
Hispanic v. White drivers	2.62	2.24	Yes
Black v. White drivers	-7.27	3.43	Yes
Minority v. White drivers	0.98	1.02	No

Searches

The analysis team investigated differences in search rates (i.e., the percentage of stops that involved searches not incident to arrest or tow) between Hispanic and White drivers, Black and White drivers, and all minority and White drivers. To provide context and a comparison point, approximately 0.44 percent of stops of White drivers involved a search. Table 8 summarizes the findings from this analysis. **Search rates had statistically significant differences (higher rates) for the Hispanic and all minority drivers comparisons, including a difference of 0.67 percentage points for Hispanic drivers and a difference of 0.46 percentage points for all minority drivers compared with White drivers.** These findings are consistent with those from the previous annual report in terms of statistical

significance; however, rates have decreased from TSAR 6. These findings are consistent across all alternate specifications of the main propensity score matching model with replacement.

Table 8. Propensity score matching results for non-incidental searches

Model	Difference (percentage points)	t-statistic	Statistically significant?
Hispanic v. White drivers	0.67	3.12	Yes
Black v. White drivers	0.53	1.24	No
Minority v. White drivers	0.46	2.64	Yes

Arrests

The analysis team investigated differences in arrest rates (i.e., the percentage of stops that involved arrests) between Hispanic and White drivers, Black and White drivers, and all minority and White drivers. To provide context and a comparison point, approximately 4.47 percent of stops involving White drivers ended in an arrest. Table 9 summarizes the findings from this analysis. **We found statistically significant differences in arrest rates, with higher rates for Hispanic and all racial and ethnic minority drivers, but not for Black drivers.** These findings are consistent with those from the previous annual report in terms of statistical significance and are consistent in the size of the observed differences. The findings were consistent across all alternate specifications of the main propensity score matching model with replacement.

Table 9. Propensity score matching results for arrests

Model	Difference (percentage points)	t-statistic	Statistically significant?
Hispanic v. White drivers	1.31	2.27	Yes
Black v. White drivers	1.13	1.31	No
Minority v. White drivers	1.45	2.94	Yes

This TSAR expanded our analysis of arrest outcomes. Specifically, we also compared booked arrests to all other arrests, booked arrests to cite-and-release arrests outcomes, and non-warrant arrests to all arrests (Table 10, Table 11, and Table 12). During booked arrests, the individual is processed in a jail facility, while during cite-and-release arrests, individuals receive a criminal citation and future court date but are free to leave the stop. For comparison, across all drivers, booked arrests accounted for approximately 0.84 percent of all arrests, compared with cite-and-release arrests (among White drivers, booked arrests account for approximately 0.59 percent of all arrests). **We found statistically significant differences in arrest rates for booked drivers and for Hispanic and all racial and ethnic minority drivers, but not for Black drivers.**

Table 10. Propensity score matching results for booked arrests, compared to all other stops

Model	Difference (percentage points)	t-statistic	Statistically significant?
Hispanic v. White drivers	0.49	2.31	Yes
Black v. White drivers	0.51	1.05	No
Minority v. White drivers	0.69	2.73	Yes

We also compared booked arrests to cite-and-release arrests. For this comparison, **we continued to find statistically significant differences in arrest rates for booked drivers and for Black drivers, but not for Hispanic drivers or all racial and ethnic minority drivers.**

Table 11. Propensity score matching results for booked arrests, compared to cite and release arrests

Model	Difference (percentage points)	t-statistic	Statistically significant?
Hispanic v. White drivers	0.65	0.20	No
Black v. White drivers	10.1	1.98	Yes
Minority v. White drivers	3.04	1.08	No

Finally, we compared non-warrant arrests to all other arrests. For comparison, across all drivers, non-warrant arrests accounted for approximately 3.64 percent of all traffic stops but approximately 67.22 percent of all arrests. **We found statistically significant differences (higher rates than White drivers) in the rates of non-warrant arrests for Hispanic and all racial and ethnic minority drivers, but not for Black drivers.**

Table 12. Propensity score matching results for non-warrant arrests, compared to all stops

Model	Difference (percentage points)	t-statistic	Statistically significant?
Hispanic v. White drivers	0.95	2.01	Yes
Black v. White drivers	0.23	0.37	No
Minority v. White drivers	0.85	2.07	Yes

Racial differences in arrest activity for booked, cite and release, and warrant arrests are currently being explored in the Traffic Stop Quarterly report that will be released at the end of the second quarter of 2022. That report will shed additional light on the disparities evidenced here and will help MCSO better address these disparities if they are driven by MCSO traffic patrol activity.

Seizures

The analysis team investigated differences in seizure rates, predicated on non-incidental searches, by the race of the driver. Deputies made 116 stops involving non-incidental searches during the analysis period. Table 11 presents the breakdown of searches with and without seizures by the race of the driver. The chi-square test of homogeneity returned χ^2=0.123, p=0.989, and the Fisher's exact test returned p=0.984, indicating **no statistically significant difference in the distributions of searches with and without seizures across driver race**. These findings are consistent with those of the previous annual reports.

Table 13. Seizures during non-incidental searches by race of driver

Race of driver	Percentage of searches without seizures	Percentage of searches with seizures
Asian	N/A	N/A
Black	61.5	38.5
Hispanic	58.8	41.2
Native American	66.7	33.3
White	61.2	38.8
Overall	60.3	39.7

Conclusion

The MCSO and the CNA analysis team conclude that there is evidence of disparate outcomes by driver race in traffic stops. This finding is consistent with past studies of traffic stop outcomes in other agencies (as noted in this report's introduction), as well as with previous traffic stop analyses within the MCSO under the Court Order. Stops involving Hispanic drivers were more likely to be longer and to result in a citation, arrest, or search than stops involving White drivers. Stops involving Black drivers were not more or less likely to be longer or to end in a citation, search, or arrest than stops involving White drivers. Similar to stops involving Hispanic drivers, stops of all racial and ethnic minorities were more likely to be longer and result in a citation, arrest, or search than stops involving White drivers. Analysis also suggests that the indicators for extended stop reasons may explain some of the differences in stop lengths, which the MCSO explored further in *Traffic Stop Quarterly Report 3*.

Taken together, we identified disparities in many, but not all, stop outcomes, which were generally consistent with disparities observed in prior years (as indicated in Table 14).[13] Note that the calculated differences for each year cannot necessarily be assumed to represent statistically significant differences over time; this information is purely descriptive. In the table below, green check marks represent statistical significance, and red null symbols represent a lack of statistically significant differences between the identified group and White drivers.

Table 14. Comparison of statistical significance and differences across TSARs

	2017–2018 Finding		2019 Finding		2020 Finding		2021 Finding	
Outcome	Stat. sig.	Diff.	Stat. sig.	Diff.	Stat. sig.	Diff.	Stat. sig.	Diff.
Stop length	H: ✓	0.49 min	H: ✓	0.91 min	H: ✓	1.15 min	H: ✓	0.99 min
	B: Ø	0.35 min	B: ✓	1.28 min	B: ✓	1.52 min	B: Ø	N/A
	M: ✓	0.64 min	M: ✓	0.94 min	M: ✓	0.97 min	M: Ø	N/A
Citations	H: ✓	2.3%	H: ✓	4.1%	H: ✓	4.6%	H: ✓	2.6%
	B: Ø	N/A	B: Ø	N/A	B: Ø	N/A	B: ✓	-7.3%
	M: ✓	2.0%	M: ✓	4.1%	M: ✓	3.6%	M: Ø	N/A
Searches	H: Ø	N/A	H: Ø	N/A	H: ✓	0.9%	H: ✓	0.7%
	B: ✓	1.7%	B: ✓	0.9%	B: Ø	N/A	B: Ø	N/A
	M: ✓	0.6%	M: ✓	0.4%	M: ✓	1.0%	M: ✓	0.5%
Arrests	H: ✓	2.1%	H: ✓	1.6%	H: ✓	1.5%	H: ✓	1.3%
	B: ✓	3.7%	B: Ø	N/A	B: Ø	N/A	B: Ø	N/A
	M: ✓	2.1%	M: ✓	1.3%	M: ✓	1.3%	M: ✓	1.5%
Seizures	Ø		Ø		Ø		Ø	

[13] Notes on models used for comparisons:

- All models use White drivers as the comparison condition, reflecting the change made for the 2019 analysis.
- All models reflect a correction to the statistical syntax used to classify the time of day and define non-incidental searches of vehicles. The uncorrected syntax was present in the 2017–2018 and 2019 models.
- All models use the matching variables used in the original analysis, including differences in special assignments, and the 2017–2018 analysis includes fewer matching variables (see *Maricopa County Sheriff's Office Traffic Stops Analysis Report: January 2019–December 2019* for details on the added variables).
- All stop length models reflect the analysis with extended stops removed, reflecting the change in the baseline model made for the 2021 analysis. This model was found in Table 7 in previous reports.

Figure 12 visually depicts the trend in the difference in average length of traffic stops across the last four comparable TSAR reports. This difference, for Hispanic and all minority drivers, has consistently been under one minute. The MCSO remains concerned about these disparate outcomes. Through *Traffic Stop Quarterly Report 3: Extended Stop Indicators* and *Traffic Stop Quarterly Report 4: Long Non-Extended Traffic Stops* MCSO identified the need to collect additional data regarding stop length as unmeasured characteristics of stops have not been accounted for in this or previous TSARs. In February of 2022 MCSO began collecting information that identifies delays in traffic stops due to drivers not having the required "Driving Documentation" (license, registration and insurance) with them at the time of the stop as well as an "Other" category in which deputies can identify a reason for an extended stop other than those captured by the existing Extended Stop Indicators which include technical issues (e.g., a printer failure), a language barrier, a DUI stop, training, or calling for a tow. The MCSO is committed to identifying the contributing factors to these differences in traffic stop length and to taking steps to combat them.

Figure 12. Difference in average length of traffic stop by race/ethnicity (compared to White drivers)

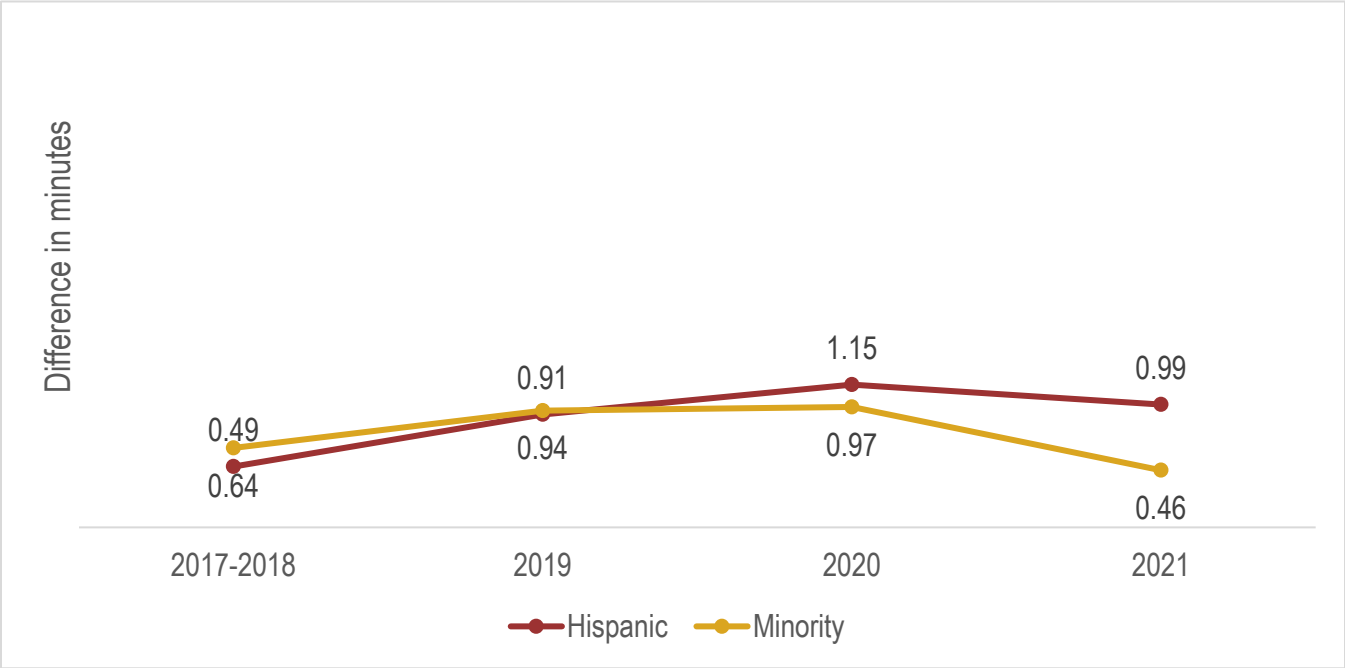


Figure 13 presents an upward trend in differences in citation rates for Hispanic and all minority drivers compared with White drivers, which decreases in 2021. The MCSO recently completed a quarterly report analysis to further investigate the cause. Examining the types and number of violations that result in citations and warnings helped provide insight into the cause of these disparities, and therefore how to target efforts to combat them.

Figure 13. Difference in citation rate by race/ethnicity (compared to White drivers)

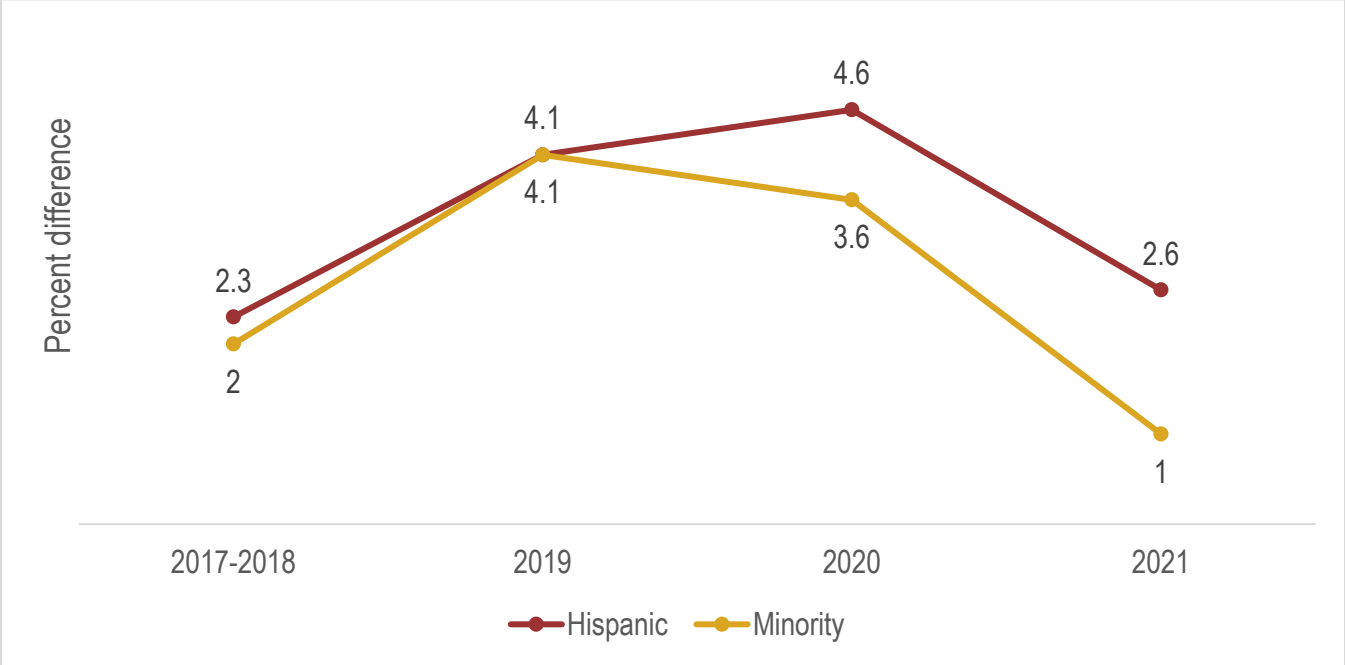


Figure 14 shows the difference between search rates for Hispanic and all minority drivers compared with White drivers. Although the differences for Hispanic drivers were not statistically significant in the previous annual reports, they closely track with the observed differences for all minority drivers, which decreased slightly in the 2019 analysis, increased in 2020, and decreased again in 2021. The MCSO is concerned about this irregular trend. The MCSO has proposed searches as a topic for a future quarterly report in order to determine the causes of these disparities and how to mitigate them.

Figure 14. Difference in search rates by race/ethnicity (compared to White drivers)

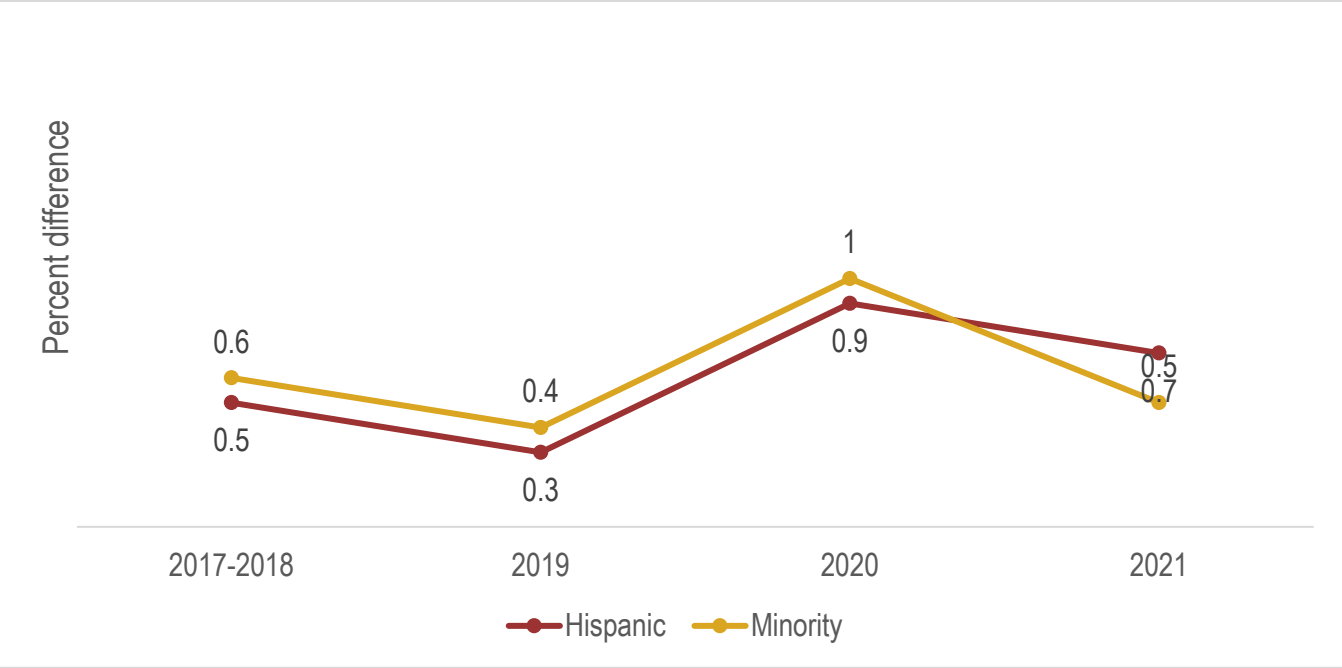
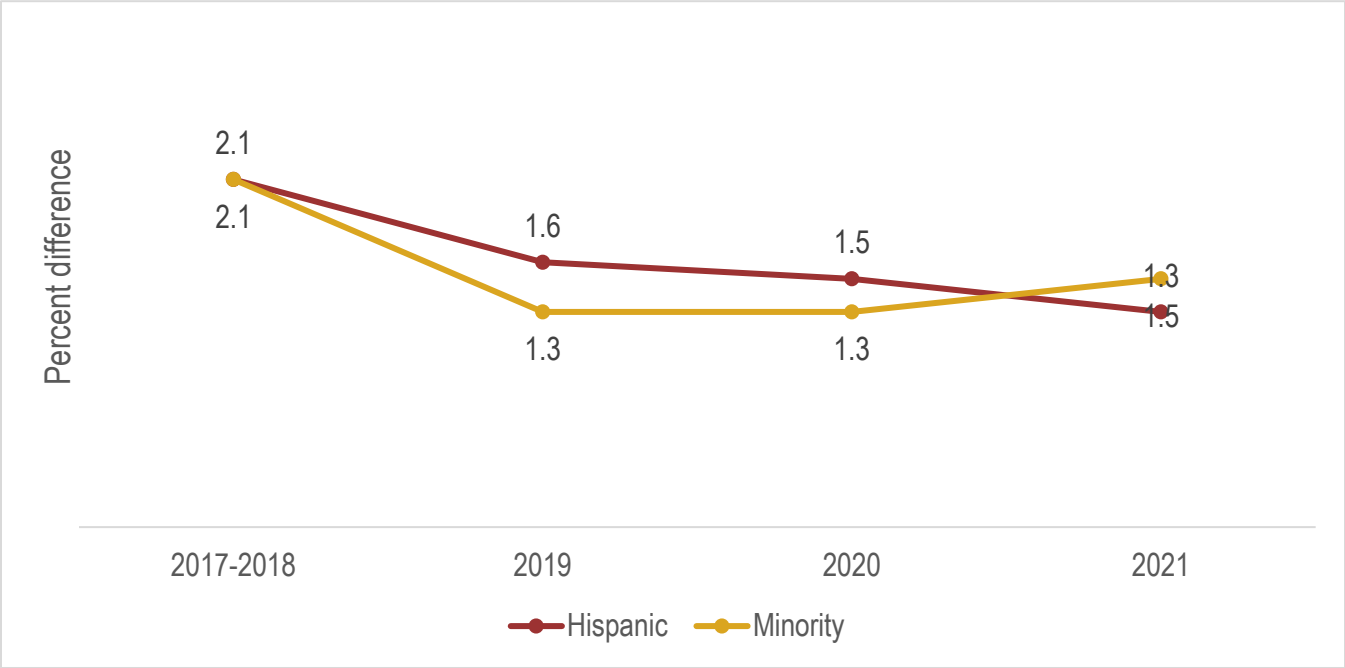


Figure 15 shows the trends in arrest rates for Hispanic and all minority drivers compared with White drivers. The figure documents the overall downward trend in the difference in arrest rates across the last three comparable TSAR reports. This difference for Hispanic drivers was highest in the 2017–2018 analysis and lower in 2019 and 2020. The MCSO remains concerned about these disparate outcomes. At the same time, we are encouraged that the differences are getting smaller.

Figure 15. Difference in arrest rates by race/ethnicity (compared to White drivers)



The MCSO is firmly committed to eliminating bias across its operations. *Critical Policy-8: Preventing Racial and Other Bias-Based Profiling* expressly forbids explicit bias. Trainings on implicit bias have been incorporated into the MCSO's required ongoing training curriculum. In April 2021, the MCSO began a pilot program for the monthly analysis of traffic stop data to look for warning signs or indicia of possible bias-based policing or racial profiling. The monthly analysis of traffic stop data is designed to identify disparities between all minority drivers (i.e., Asian, Black, Hispanic, and Native American) and White drivers at the length of stop, citation rate, search rate, seizures, and arrest rate benchmarks using both comparative and descriptive analyses. Deputies identified by these analyses have an extensive review of their patrol activity. This process allows for the early identification and monitoring of deputies with identified disparities in outcomes across any of the five benchmarks and provides a mechanism for conducting deputy level interventions when appropriate.

MCSO remains vigilant and committed to addressing them because they indicate possible systemic racial bias and because of the effect on the community. For context, and based on propensity score matching estimates, in 2021 Hispanic drivers experienced an estimated one-minute difference in stop length compared to the average stop length of 13 minutes for White drivers, Hispanic drivers estimated 2 percentage point higher citation rate compared to an average 56 percent citation rate for White drivers. Hispanic drivers had an estimated arrest rate 2 percentage point higher compared to the average of 4 percent for White drivers. A small number of traffic stops involved searches not incidental to an arrest or tow, with these searches occurring an estimated 0.7 percentage point more often with stops involving Hispanic drivers compared to the average of 0.4 percent of stops involving White drivers. Although these disparities indicate possible systemic racial bias, they may have other causes that

are not controlled for in this study. The results of the recently published TSQR 6 identify potential differential offending that is not controlled for in this or previous annual analyses. Specific violations, miles per hour over the speed limit, and the number of violations documented during the traffic stop encounter are important factors that contribute to traffic stop outcomes that are not considered in these results. These annual reports and ongoing TSQRs will continue to illuminate the size of the disparities and what may be driving them, allowing the MCSO to identify how to combat them.

The MCSO remains dedicated to its efforts to reduce bias through training, policy, and practice improvements. The MCSO will take reasonable steps to investigate and closely monitor the situation based on these results. The information in this report builds upon MCSO's efforts to implement data-driven approaches to improving the effectiveness and fairness of traffic patrol activity. Additionally, this analysis places the MCSO at the forefront of comprehensive, in-depth studies of traffic stop activity in US law enforcement. The MCSO will use these analyses and other forthcoming analyses to better understand deputy behavior during traffic stops and better serve the residents of Maricopa County.

The MCSO and CNA will continue to work closely to analyze traffic stop activity by MCSO deputies. This work will include developing additional annual analysis reports, monthly analysis reports analyzing individual deputies, and quarterly reports on special topics selected by the MCSO, CNA, and the Monitoring Team, in consultation with the Parties.

Appendix A. References

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Appendix B. Acronyms

Acronym	Definition
ARS	Arizona Revised Statutes
DUI	driving under the influence
MCSO	Maricopa County Sheriff's Office
TraCS	Traffic and Criminal Software
TSAR	Traffic Stop Analysis Report
TSQR	Traffic Stop Quarterly Report

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