Public Safety and Police Traffic Stops

Working Draft

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Abstract

Traffic stops are a multipurpose policing tool. They are used to promote roadway safety, but also to raise revenue for local municipalities and as a tool in the war on crime, allowing officers to interact with motorists they deem suspicious, conduct searches, and make arrests. These latter purposes are controversial and have been linked to racial inequities and erosion of civic trust. Given these steep costs, we ask: how many high-value convictions result from a traffic stop? If there is high crime-fighting value to traffic stops, then searches brought about by traffic stops should routinely lead to meaningful contraband discoveries and arrests. Moreover, a significant proportion of all criminal convictions should stem from traffic stops, and these should be associated with serious, not small, infractions. We assess this by looking at every criminal arrest in North Carolina during the period of 2013 to 2018, isolating those that were made subsequent to a traffic stop. We then determine if these arrests resulted in criminal convictions and the sentencing severity. We find that traffic stops rarely produce arrests of any kind, when they do the arrests rarely lead to convictions, and those convictions are rarely on serious charges. We follow by examining the mixed evidence for the contribution of police traffic stops to driving safety (speeding, running red lights) and crash prevention. We present small-area analyses that demonstrate neighborhood level dynamics, critical frameworks that decouple the concepts of harm and crime, highlight the discretionary nature of traffic stop programs, and enumerate multiple pathways of public harm from conventional traffic stop programs.

Introduction

The routine police traffic stop is the most common form of involuntary interaction between citizens and the police, with more than 20 million such encounters each year (DOJ 2018). Traffic stops can keep us safe by signaling to drivers that there is a penalty for unsafe and risky driving, by keeping dangerous drivers off the roads, and by teaching citizens the importance of safe driving habits. Traffic stops can reduce crashes, injury severity, and fatalities (NHTSA, 2020). Police officers and agencies argue that traffic stops also have the potential to make communities safer, as these interactions allow the police the opportunity for conversations and questions that might reveal suspicious or illegal activity. In other words, traffic stops might reduce crime. Because of this idea that interactions beginning with a traffic stop can be a useful tool in the fight against crime, a large share of traffic stops, about half, are in fact unrelated to moving violations. If half of the traffic stops are related to the war on crime rather than the war on dangerous driving, it is certainly worth assessing the value of each.

Traffic stops may be conducted fairly without respect to the demographics of the driver, or they can be used as a pretext to interview people who fit a stereotype that makes officers want to have such conversations. Just like traffic stops can enhance traffic safety or potentially enhance community safety by allowing legally valid justifications for informal investigations of those who appear suspicious, they can also enhance feelings of either belonging or alienation. Socially marginalized citizens may recognize that their identity or the demographics of their neighborhood are causing the police to surveil them, and that the traffic stop, whatever the stated reason and regardless of its immediate or researched evidence base, is nothing more than a pretext for this surveillance and social control.

Decades of police practice have permeated through the culture of virtually every police agency in the US with the lesson and norm that the traffic stop provides the legal justification needed for any number of conversations with individuals that officers identify as people of interest, and that these legally justified, but pretextual, traffic stops are good public policy. We question this assumption, echoing recent shifts in approaches to policing in a small number of states.

We do this by first gaining a better understanding of *how* traffic stops are used and then by assessing two questions. First, what are the crime-fighting values associated with traffic stops? That is, how many illegal guns are removed from the community and how many serious crimes are interdicted?

Second, what are the costs of using traffic stops as a multipurpose tool to address multiple problems? Here we focus on two types of costs. The first is opportunity costs, as each pretextual traffic stop represents one traffic stop not focused on a dangerous driver. Essentially we ask: What is the injury prevention value and costs of traffic stops programs? The second are social costs, as investigatory traffic stops are highly targeted on marginalized communities and generate strong reactions leading to alienation and disaffection, reducing individuals' feeling of full citizenship.

Our investigation presented here into the multifaceted use of traffic stops is made possible by two state-of-the-art datasets from the state of North Carolina to examine the same time frame: 2013 through 2019. We focus on North Carolina as it is the only state to collect and make public information of this kind for two points of contact with the criminal legal system. The first is a

record of almost every traffic stop made by NC police officers, including information on the purpose of the stop and any resulting criminal enforcement such as tickets or arrests. This dataset is maintained by the NC Department of Justice. The second is a comprehensive database covering every criminal arrest from 2013 through 2019 in NC, including information on the circumstances of the arrest and the charges filed. These datasets allow us to map the multifaceted use of traffic stops across a range of departments and estimate racial disparities in their execution and use.

Further, we use these two databases to paint a rough statistical portrait of the usefulness of traffic stops as a mechanism for stopping and apprehending criminals. In this regard, the numbers are not promising: in the vast majority of instances where police used a traffic stop as a springboard to search a motorist, those searches failed to recover serious contraband; moreover, only a tiny fraction of total arrests for serious crimes were precipitated by a traffic stop. We then proceed to look at variance in traffic stop usage patterns by police agency, dividing stops into those that are most likely to be about on driving safety versus criminal investigations or poverty crimes. Law enforcement agencies are nearly unaccountable to maintaining certain traffic stop type profiles, which can be so varied and discretionary that crash prevention may play second fiddle to efforts at criminal abatement or local revenue generation. Moreover, as we present in the driving safety and injury prevention sections, these traffic stop profiles are so widely spread across similar cities (some agencies make three times the driving safety stops as other agencies with similar crash rates), that they call into question the efficacy of even safety stops in crash prevention.

These descriptive findings call out for further study but unfortunately relevant information is painstaking and time-consuming to collect. North Carolina has gone much further than other states in making policing data publicly available, but even here we can observe only snapshots of the entire process because, for example, we are unable to directly link individual stops to resulting criminal prosecutions or societal consequences.

Moreover, though we focus on these two databases for this paper, we emphasize in the public health benefits and next steps sections that, in order to more fully map the effects of traffic stop programs, a fuller ecosystem of datasets must be assembled. Though our research team has experience across this breadth of datasets, the preparation and linkage of these datasets is resource intensive. We therefore conclude with a discussion for next steps, outline strategies for collecting detailed datasets that can help answer more nuanced research questions, and describe how data collection efforts can proceed through FOIA requests and strategic partnerships with data vendors and law enforcement. Finally, we demonstrate the utility of policing datasets that possess geographic location tags (longitude/latitude coordinates) by conducting a short analysis with publicly available data from Durham, NC between 2006 and 2020. In this short analysis, we assess the direct effects of traffic stops on (i) traffic accidents and (ii) violent crimes (as proxied by 911 calls). For this case study example, we find that traffic stops do not serve a roadway safety function (they do not reduce traffic accidents) nor do they serve a crime deterrence function (they do not reduce the number of violent crime reports).

Background: The Evolving Purpose of Police Traffic Stops

Driving is one of the most complex activities that people undertake on a regular basis. It is also one of the most dangerous. On average, around 40,000 Americans die in traffic accidents each year, making it one of the leading causes of death in the United States, and is the leading cause

of work related deaths across industries (NHTSA, 2022). Most recently, though crashes and vehicle miles traveled (VMT) decreased during the COVID-19 pandemic, crash fatalities increased. These deaths are the tip of the crash injury iceberg; all told, the economic cost of these traffic crashes and crash fatalities is measured in the hundreds of billions of dollars each year (Blincoe et al, 2015).

Not surprisingly, governments at every level have enacted laws to stipulate safe driving behaviors, and, generally, it falls to police officers – and sometimes traffic cameras – to enforce these laws. It is no exaggeration to say that the modern police state was created in response to the automobile. As driving became a central part of American life, demand for traffic enforcement, and the associated revenue, led to a massive growth in police departments (Seo 2016, 2019). By far the most common traffic stop is for speeding. In the North Carolina database, speeding stops are 54% of the total.

Automobiles – much like cell phones today – also represented a new frontier of jurisprudence as the courts debated how exactly 4th Amendment protections would be applied to motorists. Today, the inside of your car exists as neither a public nor an entirely private space: police officers need either probable cause or permission to search your vehicle but these are relatively easy to come by, especially compared to a warrant allowing for search of a residence. Enforcing traffic laws therefore created a commonplace avenue for police officers to interact with members of the public and investigate them for criminal activities (see Seo 2019 for more on this transformation).

Traffic enforcement also created an opportunity for municipalities to raise revenue by imposing fees on unlawful drivers. Of course, as the traffic code grew the potential to levy these fees increased and the ability of drivers to avoid them through their own behaviors diminished. If you are behind the wheel of an automobile and the vehicle is in motion, you are very likely in violation of a law. Modern policing has therefore always been multifaceted: featuring elements of public safety mixed with the exercise of racial power through criminal enforcement and revenue generation (Seiler 2009). Note also that for many jurisdictions with traversing highways, income from traffic violations can effectively shield local taxpayers from financial burdens by shifting that burden to people who do not live in the community; potentially a politically attractive choice for local elected officials and citizens alike.

Modern Controversies

In the 1990s, following a multi-decade increase in violent crime, policymakers from the political left and right remade the criminal justice system around broken windows theories of crime (Murakawa 2014). These call for a proactive approach to fighting crime where officers, rather than responding to calls for service or reacting to crimes in progress, actively seek out criminals by investigating as many pedestrians or motorists as possible. The idea is that law enforcement can deter crime by maintaining a visible and active presence, intervening in minor offenses before they escalate, and confiscating dangerous contraband (Michener, 2013; Corman and Mocan, 2005).

To facilitate these efforts, officers leverage small infractions such as loitering or changing lanes without signaling as an excuse to make a stop, open a line of questioning, and, whenever possible, conduct a search. Indeed, use of the traffic code for these purposes preceded the “broken windows” mode of policing and may have provided some of the model for it; using the traffic code as a tool

to investigate those looking suspicious became common in the 1970s (see Baumgartner et al. 2018; Webb 2007) The twin legal pillars buttressing this crime-fighting strategy are found with *Terry v. Ohio* (1968), in which the Supreme Court lowered the threshold of evidence needed to search a pedestrian from probable cause to reasonable suspicion, and *Whren v. United States* (1996) when the Court ruled that police could target specific types of motorists for traffic stops reasoning that selective enforcement is inevitable to policing (Alexander 2012).

To what extent has the broken windows approach succeeded in reducing crime? Scholarly evidence is mixed. Research on New York City, which was an early adopter of broken windows strategies, suggests that these strategies can modestly reduce non-violent and property crimes but not violent offenses (Corman and Mocan, 2005; Kane, 2006; Rosenfeld, Fornango, and Rengifo, 2007). Experimental evidence suggests that proactive policing works best at reducing crime when officers tailor their activities to the needs of different neighborhoods, for example, maintaining a presence near abandoned buildings (Braga and Bond 2008).

In contrast to the mixed evidence about the value of these programs, there is scholarly consensus that they have been implemented unevenly by class and race. Early efforts at broken windows policing embraced the use of profiles that encouraged the targeting of young, minority men. Even though training has moved away from explicit profiles, these criminal archetypes are exceedingly durable and are reinforced by latent media and societal cues (Epp, Maynard-Moody, and Haider-Markel 2014; Fagan and Geller 2015). Consequently, African American men are much more likely to be stopped and searched by police officers than their White counterparts (Rosenfeld and Fornango 2017; Pierson et.al. 2020; Baumgartner, Epp, and Shoub 2018). This is one of the clearest and most robust findings in the criminal justice literature.

Moreover, concentrating low-level police stops within certain neighborhoods generates negative externalities as community members are routinely subjected to interrogations, citations, fines, fees, and forfeitures (Sampson and Loeffler 2010; Tonry 2011). Municipalities generate more revenue through these judicial mechanisms in communities where a greater proportion of the population is African American and where there is no African American representation in local elected offices (Sances and You 2017). The types of low-level crimes that proactive policing strategies leverage can be found in abundance in virtually any neighborhood given enough surveillance, so, in effect, broken windows policing can be understood as yet another NIMBY issue foisted onto communities with the least political resources to resist.

Not surprisingly, uneven policing strategies can deeply alienate members of the neighborhoods subjected to them. Researchers document that motorists and pedestrians are highly sensitive to the reasons they were pulled over or stopped. No amount of after-the-fact politeness from police officers can disguise an investigative stop from what it is: a signal of state-sanctioned suspicion and scrutiny (Epp, Maynard-Moody, and Haider-Markel 2014). Communities where these stops are concentrated are less likely to trust the police and to engage in pro-social civic activities like voting (Burch 2013). The U.S. Department of Justice's investigation of the Ferguson Police Department (2015) concluded that the raucous protests that followed the killing of Michael Brown were caused in part because "the utilization of ordinary policing mechanisms, such as warrants, arrests, and citations, to generate revenue for municipalities and police departments" had driven a wedge between the police department and the community it was meant to be serving.

Though not yet evaluated systematically (see following section on Avenues for Research), high levels of state-sanctioned security may be associated with increased opportunity for police violence; as example, before Philandro Castile was killed by police following a traffic stop, he had been stopped nearly 50 times in 15 years (Peralta and Croley 2016). Mistrust of police, such as that following high profile police violence, is associated with hesitancy to call 911 (Desmond et al., 2016) and may contribute to health disparities in engaging emergency, government services, and government engagement (e.g. voting, holding office, etc.).

What is the Crime-Fighting Value of Traffic Stops?

How many dangerous criminals are apprehended in a traffic stop? Perhaps most famously, Timothy McVeigh was detained in such an incident after the Oklahoma City bombing on April 19, 1995. The state trooper who pulled him over, Charlie Hanger, did so because the vehicle had no license plate, then Hanger grew suspicious of McVeigh's answers and behavior, still not knowing he was about to make the biggest arrest of his law enforcement career. When Hanger found a gun, he booked McVeigh into the local jail. Hanger was aware that the bombing had just occurred but had received no description of the suspects in the case. In an interview many years later, he summarized a widely held view: "'I have always tried to let the public know that when an officer is out making a traffic stop, they are looking for things other than that traffic violation because criminals come up and down our roads each and every day, especially on the interstate system,' Hanger said. 'So that officer is looking for activity other than just the traffic violation and that is not just to save lives, but to catch any illegal activity'" (Bishop 2020).

Fishing expeditions: charges, arrests, and convictions

The law enforcement community is fully aware of the "fishing expedition" aspect of using traffic stops to interdict criminals and contraband; from the beginning it has been understood that "you have to kiss a lot of frogs before you find your prince" (see Baumgartner et al. 2018). Here, we take a first step in assessing the odds of an arrest and conviction for a felony crime stemming from a traffic-related incident. There are some caveats to these estimates so this should be understood as a first, rough cut, a methodology on which we and others can likely improve in the future. Most importantly, our courts data shows only what types of crimes were alleged at the time of the arrest, and we can assess whether any of these were traffic-related, which is what we do here. Still, we do not know that this was the reason for the stop in the first place. Some incidents may be initiated for a reason other than a traffic infraction, but then a traffic infraction is charged after the fact. The most important such cases are following a tragic death; the driver at fault may be charged with a felony death by automobile, for drunk driving, or for other charges, but the incident did not derive from a routine traffic stop. In fact, many of the most serious crimes connected with traffic-related incidents, as we discuss below, derive from stolen vehicles, using the vehicle as a weapon against a police officer, or accidents in which deaths occur. With these caveats in mind, Table 1 gives some basic numbers.

Category	Total, 2013-19
Traffic stops (SBI-122 data)	9,536,987
Charges for traffic-related offenses (AOC data)	6,391,614
Charges as a percentage of traffic stops	67.02
Non-traffic charges stemming from traffic-related incidents	526,947
--- (of which, misdemeanors)	333,283
--- (of which, felonies)	114,537
Felony charges as a percent of traffic stops	1.20
Felony charges as a percent of traffic-related charges	1.79
Non-traffic convictions stemming from traffic-related incidents	90,466
--- (of which, misdemeanors)	61,248
--- (of which, felonies)	21,592
Felony convictions as a percent of traffic stops	0.23
Felony convictions as a percent of traffic-related charges	0.34
Total number of felony charges	1,952,310
Felony charges stemming from a traffic-related incident	114,537
Percent stemming from a traffic-related incident:	5.87
Total number of felony convictions	369,949
Felony convictions stemming from a traffic-related incident	21,592
Percent stemming from a traffic-related incident	5.84

Table 1. Non-Traffic Criminal Charges Stemming from Traffic-Related Incidents, 2013-2019. Traffic-related incidents are defined as those where at least one charge stemming from the incident is a traffic or vehicle violation.

We start with over 9.5 million traffic stops conducted in North Carolina, drawn from the SBI-122 database maintained by the state and reported in Baumgartner et al. 2018. From there we see 6.4 million traffic-related offenses charged against an unknown number of individuals in the same time period. These charges may be speeding, driving without a license, and so on. They derive

from the NC-AOC database containing every record of arrest in the state from 2013 through 2019. Note that a single incident can lead to many arrests (that is, charges, with each individual charge constituting a separate arrest in the database). More than 13 million charges were made in this period, so 6.4 million is a large share of total charges.

Following from the same arrest-incidents where these 6.4 million traffic-related charges occurred, an additional 527 thousand charges were leveled for non-traffic related offenses. These might be possession of contraband, resisting arrest, or any other charge that is not designated a traffic offense. Of these 527 thousand additional charges, 333 thousand were misdemeanors and 115 thousand were felonies. (The bulk of the others were infractions.) Felony charges therefore derive from approximately 1.20 of all traffic stops (114,537 / 9.5 million traffic stops) and represent approximately 1.79 percent of all traffic-related charges (114,537 / 6.4 million charges).

Convictions follow only in a small share of all charges. From the 527 thousand ancillary (e.g., non-traffic) charges stemming from traffic-related incidents, 90 thousand convictions ensued. Of these, 61 thousand were misdemeanors, and 22 thousand were felonies. (Again, the bulk of the remainder were infractions.) Felony convictions therefore followed in about 0.23 percent of all traffic stops, and 0.34 percent of all traffic-related charges.

To put these numbers in some further context, the AOC database on which we base our analysis contains 1.95 million felony changes, so the 115 thousand traffic-related felony charges represent somewhat less than six percent of all felony charges in the state over the period of study from 2013 to 2019. Similarly, there was a total of almost 370,000 felony convictions overall, of which those connected with traffic violations were 21,592, or just under six percent.

Convictions by type vary, but are few

These may be considered low numbers or high ones depending on one's perspective. Twenty-two thousand felony convictions is significant, after all. But what are those convictions? Table 2 gives a breakdown of each of them occurring more than 100 times in the database. The AOC database includes the specific offense code of which the individual was convicted, and Table 2 shows the most common offense codes among the 22 thousand felony convictions deriving from an incident that also involved a traffic-related charge. (Note, the table excludes the traffic offense itself.) North Carolina distinguishes among felonies by their Class, with Class A being first degree murder and Class I being the lowest level of felony, punishable by a period of probation. The Table shows the offense class of each offense code.

Offense Class	Offense Code	Description	Number of Convictions, 2013-2019
F - I	2216	BREAK OR ENTER A MOTOR VEHICLE	1,243
F - I	3465	POSSESS METHAMPHETAMINE	1,219
F - I	3560	FELONY POSSESSION OF COCAINE	1,215

F - H	2391	LARCENY OF MOTOR VEHICLE (F)	1,186
F - G	5224	POSSESSION OF FIREARM BY FELON	1,082
F - H	2212	BREAKING AND OR ENTERING (F)	740
F - I	3568	POSSESS HEROIN	681
F - I	3523	FELONY POSSESSION SCH II CS	631
F - I	3544	PWISD MARIJUANA	466
F - H	2321	FELONY LARCENY	465
F -	9922	HABITUAL FELON	407
F - H	3555	PWISD COCAINE	381
F - I	9968	MAINTN VEH/DWELL/PLACE CS (F)	376
F - F	1356	AWDW GOVERNMENT OFFICIAL	336
F - H	2632	OBTAIN PROPERTY FALSE PRETENSE	294
F - H	2356	LARCENY AFTER BREAK/ENTER	293
F - I	3522	FELONY POSSESSION SCH I CS	280
F - I	3549	FELONY POSSESSION MARIJUANA	254
F - H	2337	POSSESS STOLEN FIREARM	248
F - H	2341	POSS STOLEN GOODS/PROP (F)	242
F -	2635	IDENTITY THEFT	215
F - H	3516	PWIMSD SCH II CS	202
F - G	1220	COMMON LAW ROBBERY	168
F - D	1222	ROBBERY WITH DANGEROUS WEAPON	166
F - H	3409	POSS CS PRISON/JAIL PREMISES	147
F - I	3545	PWIMSD MARIJUANA	141

F - E	1346	AWDW SERIOUS INJURY	130
F - F	0922	INVOLUNTARY MANSLAUGHTER	127
F - H	3471	PWIMSD METHAMPHETAMINE	124
F - H	3565	PWIMSD HEROIN	100

Table 2. Most Common Felony Convictions Associated with a Traffic-Related Incident.

Note: The table is limited to incidents in which at least one traffic-related offense was charged, and shows only the non-traffic related offenses of which the individual was convicted. Offense codes with fewer than 100 convictions not shown.

Table 2 shows 10 Class I offenses with a total of 6,506 convictions; 12 Class H offenses with 4,422 convictions; two Class G offenses with 1,250 convictions; two Class F offenses with 463 convictions; one Class E offense with 130 convictions; one Class D offense with 166 convictions; and two offenses that could potentially apply to multiple felony classes involving 622 convictions. In other words, the vast majority of the felonies listed in Table 2 are Class H or I, the two lowest level felony Classes, and a simple glance at the Table shows the preponderance of drug possession crimes. Others, such as felony larceny and assault with a deadly weapon, obtaining property by false presence, and robbery related charges may involve the automobile itself, and thus may not be separate charges from the traffic incident. Thus, the idea that traffic stops are routinely generating high-level arrests and convictions similar to that of Timothy McVeigh is a myth. To the extent that these arrests generate felony convictions, the vast bulk are drug possession, for stealing cars or for using the car as a weapon, not separate felonies uncovered by police working the highways looking for other types of illicit behaviors or contraband. Of course, a few are. We see possession of a firearm by a felon (1,082 convictions), habitual felon (407 cases), possession of a stolen firearm (248 cases), and so on. Mostly, we see drugs.

Table 3 shows the total number of traffic-related misdemeanor and felony convictions as a share of all such convictions. The numbers are typically on the order of five percent.

Misdemeanor Convictions	Total	Traffic-Related	Percent Traffic Related
Class Unspecified	63,043	1,538	2.4
Class 3	208,794	24,798	11.9
Class 2	123,856	14,422	11.6
Class 1	318,357	22,076	6.9
Class A1	74,798	3,037	4.1

Felony Convictions			
Class Unspecified	19,606	936	4.8
Class I	77,119	7,144	9.3
Class H	124,558	5,148	4.1
Class G	21,781	1,387	6.4
Class F	13,170	716	5.4
Class E	10,765	425	3.9
Class D	5,804	233	4.0
Class C	2,072	72	3.5
Class B2	350	58	16.6
Class B1	1,730	46	2.7
Class A	261	9	3.4

Table 3. Misdemeanor and Felony Convictions Overall and from Traffic-Related Incidents, 2013-2019.

The myth of Timothy McVeigh looms large in the police strategy of traffic stops. There is no question that police find the traffic and the vehicle codes to be very useful tools in initiating conversations with those individuals the police choose. Clearly, a certain number of these conversations lead to the detention of individuals concealing contraband or engaged in some kind of criminal activity. However, these numbers are low. These low numbers are apparent whether we look at them as a share of all traffic stops that lead to such apprehensions, or whether we look at all felony or misdemeanor convictions and determine what share derived from a traffic incident.

Hotspotting: small area mapping of stops, crime & crashes

We dive deeper into investigating the crime-fighting benefits of traffic stops using a rich dataset from Durham, NC. Geolocated administrative datasets are an underutilized resource in assessing traffic stop program effectiveness. In using these datasets, organizations can generate and track city-specific policy recommendations on policing and their effect on social outcomes not just overall, but within their effects and associations within neighborhoods.

This small-area data is doubly important. First, neighborhoods are hard pressed to bring feedback to data that only exists at the city-level (not street- or neighborhood-level) scale. Second, a common challenge in driving “point-level” dynamics (including stop, crash, and street/home level crime events) vs. residential “area-level” dynamics is that main roadways are often the boundary of residential geographies. Point-events (stops, crashes, crime events) happening on these borders

can be miscoded, making analysis challenging. Instead, small-area analyses can capture street, intersection, and neighborhood dynamics.

We use publicly available data from Durham, NC between 2006 and 2020 to investigate (a) the effect of traffic stops on traffic accidents and (b) the effect of traffic stops on violent crime reports (as proxied by 911 calls). We selected these two outcomes because they reflect public health arguments in support of traffic stops - traffic stops reduce traffic accidents and prevent serious injury or death - and public safety arguments in support of traffic stops - traffic stops expose wannabe criminals and deter crimes. Figure 1 illustrates the average intensity (events per square mile) for traffic stops, traffic accidents, and violent crimes. For Durham, these events commonly occur in the city's central downtown region. Across the city, traffic stops are highly correlated with traffic accidents (0.79) and violent crimes (0.77); however, it is unclear whether these high correlations exist because of coordinated police strategies, where the police conduct traffic stops in certain neighborhoods to deter traffic accidents (or violent crimes), or random chance.

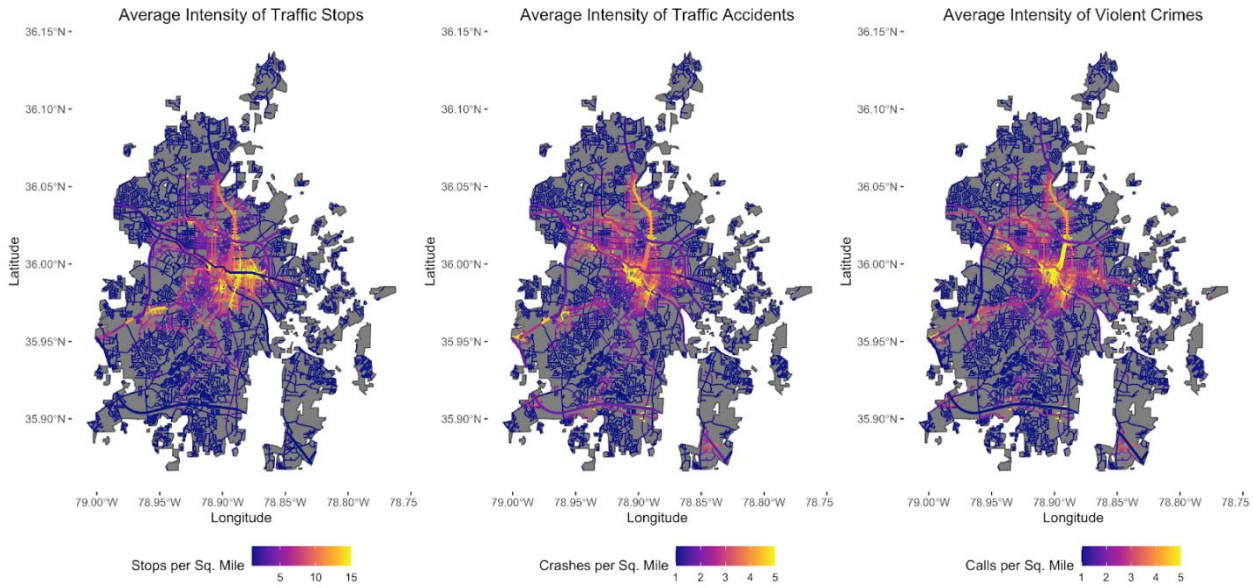

Figure 1. Average Intensity for Traffic Stops, Traffic Accidents, and Violent Crimes

One approach to disentangling correlation from causation is to use inverse probability of treatment weighting (IPTW) (Robins et al., 2000). This approach measures and removes confounding that biases the direct relationship between (a) traffic stops and traffic accidents and (b) traffic stops and violent crime reports. The first-stage models geographic patterns of traffic stops using the longitude/latitude coordinates of stops. It removes time-varying (random correlations due to time) and time-invariant confounding that arise from ***previous patterns of policing*** - neighborhoods where the police already have a large presence and regularly conduct surveillance and enforcement acts, ***traffic stops*** - neighborhoods where the police regularly conduct traffic stops regardless of intent to deter accidents or crime, ***directed patrols*** - neighborhoods where the police regularly surveil the community, ***commercial regions*** - commercial common spaces where the police regularly conduct surveillance acts, and ***traffic accidents*** - regions where residents regularly call the police about traffic accidents.

The first-stage's model generates a set of propensity scores that we use to inverse weight two spatial models that predict the density (events per square mile) of traffic accidents and violent crimes using the longitude/latitude coordinates of traffic stops. Figure 9 illustrates the relative risk (exposure of the outcome given the presence a traffic stop) of these traffic stops on the density of traffic accidents (left) and violent crime reports (right). For added comparison, we illustrate the relative risk of these traffic stops using an ordinary (unweighted) spatial model that does not adjust for the previously mentioned confounders.

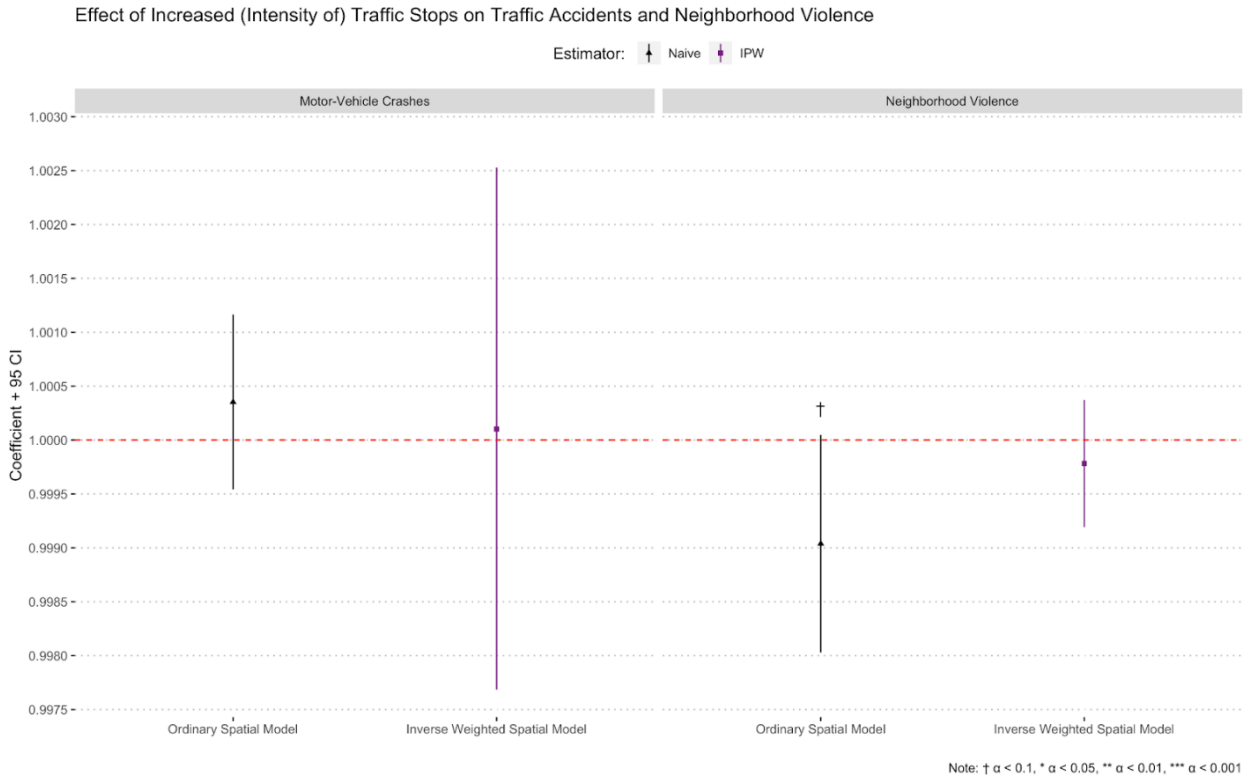

Figure 2. Effect of Increased Traffic Stops on Vehicular Accidents and Violent Crime

If traffic stops produced a deterrent effect, then they would reduce the relative risk of traffic accidents and violent crimes across the entire city. This means density (events per square mile) of traffic accidents and violent crimes is smaller in regions where traffic stops emerged versus regions where they did not. In graphical form, a deterrent effect means that the point estimates in Figure 2 would be below the red dotted line. With the exception of the ordinary spatial model on neighborhood violence, which signals a slight deterrent effect ($\boldsymbol{\alpha} < 0.1$), none of the models are significant. The significant results for the ordinary spatial model, however, are likely due to the time-varying and time-invariant confounders that were left unadjusted.

Using the fitted models, we can calculate the total number of traffic accidents and violent crimes that would have occurred if the Durham city police conducted zero traffic stops between 2006 and 2020. If traffic stops served a social good, then the counterfactual scenario where the police do not conduct traffic stops would possess a greater number of traffic accidents and violent crimes. As Figure 10 illustrates, the total number of traffic accidents (left) and violent crimes (right) in the counterfactual scenario is indistinguishable from the observed dataset. In short, Durham city

residents would have reported the same number of traffic accidents and violent crimes in a world where the police did not engage in traffic stops.

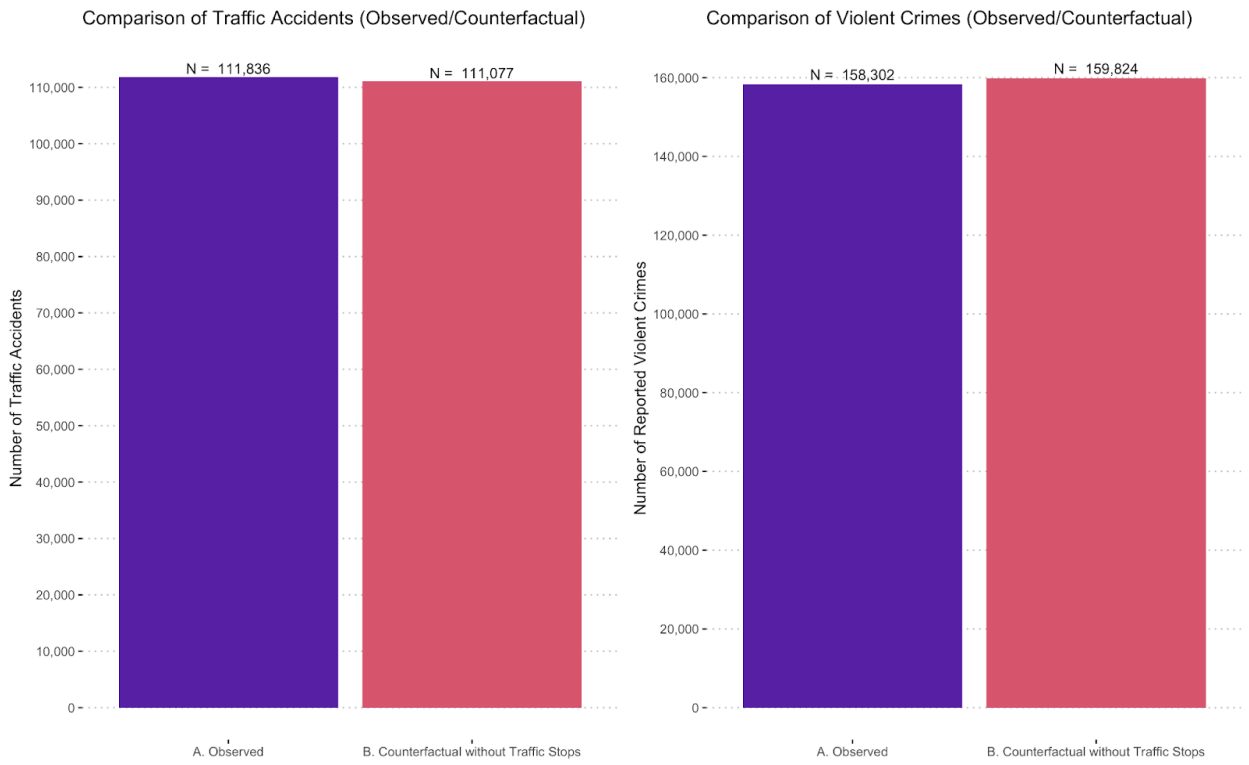

Figure 3. Comparison observed to counterfactual traffic accidents and violent crimes

This limited study illustrate how geolocated administrative datasets can generate city-specific policy recommendations on policing and its effect on social outcomes. We were able to conduct this analysis because Durham's publicly available police dataset possessed (a) longitude/latitude coordinates on traffic stops and (b) longitude/latitude coordinates on traffic accidents and 911 calls about violent crimes. We can replicate this type of analysis for any jurisdiction that provides administrative datasets with geolocation tags.

As a second example, the Fayetteville Police Department also made stark changes to their traffic stop programs. While North Carolina does not yet require traffic stop data to be geocoded, like Durham, Fayetteville elected to supplement their standard forms with this essential, point-specific information. Because Fayetteville used a weekly, small-area traffic crash and fatality review process to nimbly redirect traffic stop enforcement to dangerous intersections, they were able to both reduce traffic fatalities and measures of racial disparities (Fliss, 2020).

Even simple models can support community teams and law enforcement in directing select traffic stop types to areas that community consent to focused enforcement efforts. Below shows a grid system of traffic crashes, reported incidents, and injury-severity weighted incidents. Small-area mapping tools like these - which may take funding support to provide to communities or law

enforcement programs - can help not only direct programs as they are run, but enable community members to understand, evaluate, and maintain accountability of these traffic stop programs.

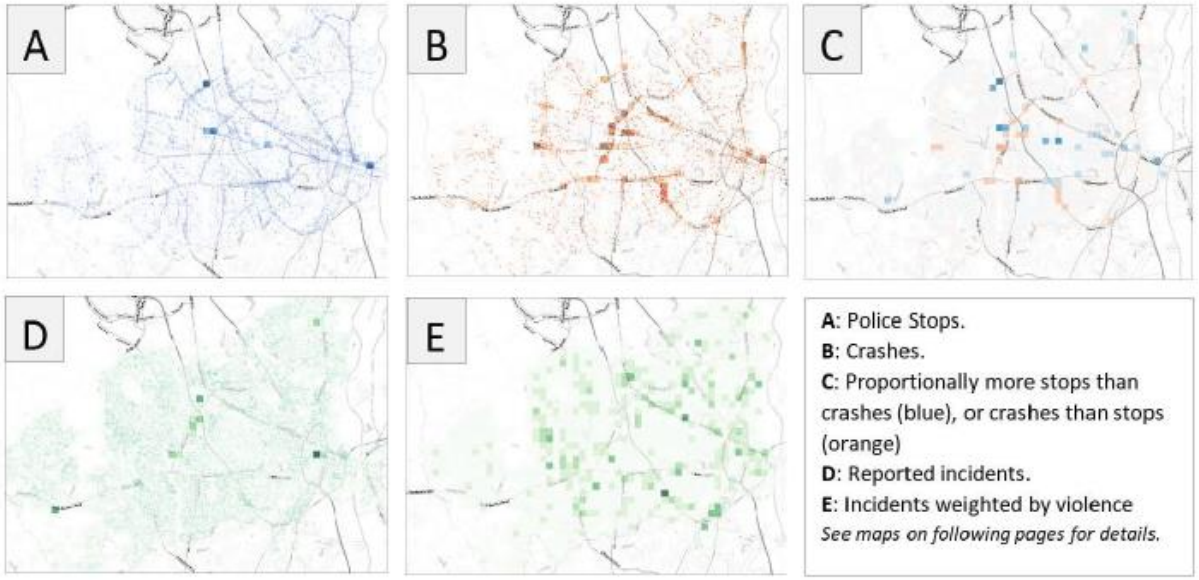

Figure A3-4. Police stops for moving violations (A), traffic crashes (B), raster subtraction of A and B (C), reported incidents (D), and injury severity weighted incidents (E).

Figure 4. Police stops for moving violations (A), traffic crashes (B), raster subtraction of A and B (C), reported incidents (D), and injury severity weighted incidents (E).

As a final small-area example, traffic stop programs can also be critically evaluated using small area tools like these. Below, the percent Black in the block group population (as dots for >60% and >80% black) is layered over the percent of stops that were income-related, demonstrating a remaining neighborhood-level association between demographics and the proportion of stops by type. Should Fayetteville, like NC as a state, have racial disparities by income, then income demographics may partly describe this phenomenon. Regardless, Black residents' experience of policing in their neighborhoods is associated with proportionally more regulatory and equipment related stops than whiter neighborhoods.

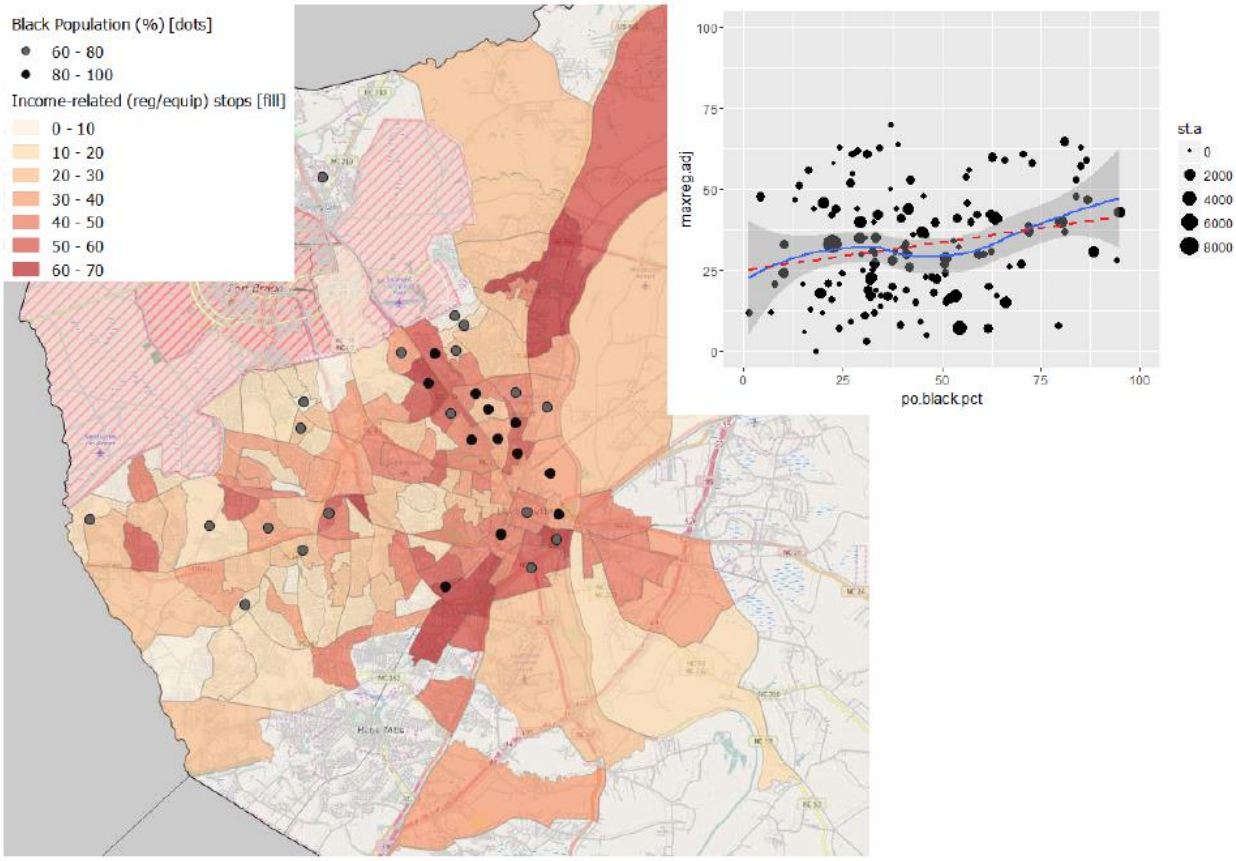

Figure 5. A3-1 Neighborhood-specific percent income related stops and % black population. Preliminary analysis suggests higher percent Black communities seem to be largely the same ones where a high percent of regulatory stops occur. Each 5% increase in neighborhood percent Black corresponds to an additional 1% increase in the percent of people pulled over for regulatory reasons (above right).

Traffic stops and stop programs are discretionary, with mixed efficacy

There is little to no oversight of law enforcement traffic stops and traffic stop programs. On traffic stops themselves, given the combined *reasonable suspicion* and *selective enforcement* legal doctrines, nearly all drivers can be interpreted to break some driving law on nearly all trips. Drivers may drive too slow or too fast, an officer may suggest he didn't see a worn seatbelt, or drivers may waver too much or too little (suspiciously perfect driving) in a lane.

Traffic stop programs themselves are similarly discretionary. City police departments, county sheriffs, school and hospital security and police forces, state highway patrols, and other law enforcement agencies are largely free to design the size, location distribution, and traffic stop type priority profile of their traffic stop programs with little to no oversight and accountability. For communities with historically marginalized populations and low political power, this influence on traffic stop programs is even smaller.

As an example of this traffic stop program design discretion, Figure 6 demonstrates the variability in moving and safety violation traffic stops for the ten largest NC municipal police agencies. Larger agencies that make more stops are toward the upper right; smaller city agencies that make fewer stops are at the bottom left. Raleigh made 361,000 total traffic stops, 157,000 (43%) of which were driving safety stops (a research created stop type group made up of these four specific stop types: speeding, running stop lights / signs, DWI, and other safe movement violations). Raleigh had 190,000 reported crashes in this same time period, meaning 0.8 driving safety traffic stops for every motor vehicle crash.

In contrast, during this time period, Fayetteville Police Department made 3.6 driving safety traffic stops for every crash. They had a similarly sized traffic stop program (322,000 total traffic stops, about 90% of Raleigh's program), but only 44% of the population of Raleigh (US Census, 2020). They also made driving safety traffic stops at a much higher proportion (75%) than Raleigh (43%), amounting to 3.6 safety traffic stops per crash. This example demonstrates the discretion in both the size of traffic stop programs and the kinds of traffic stops prioritized.

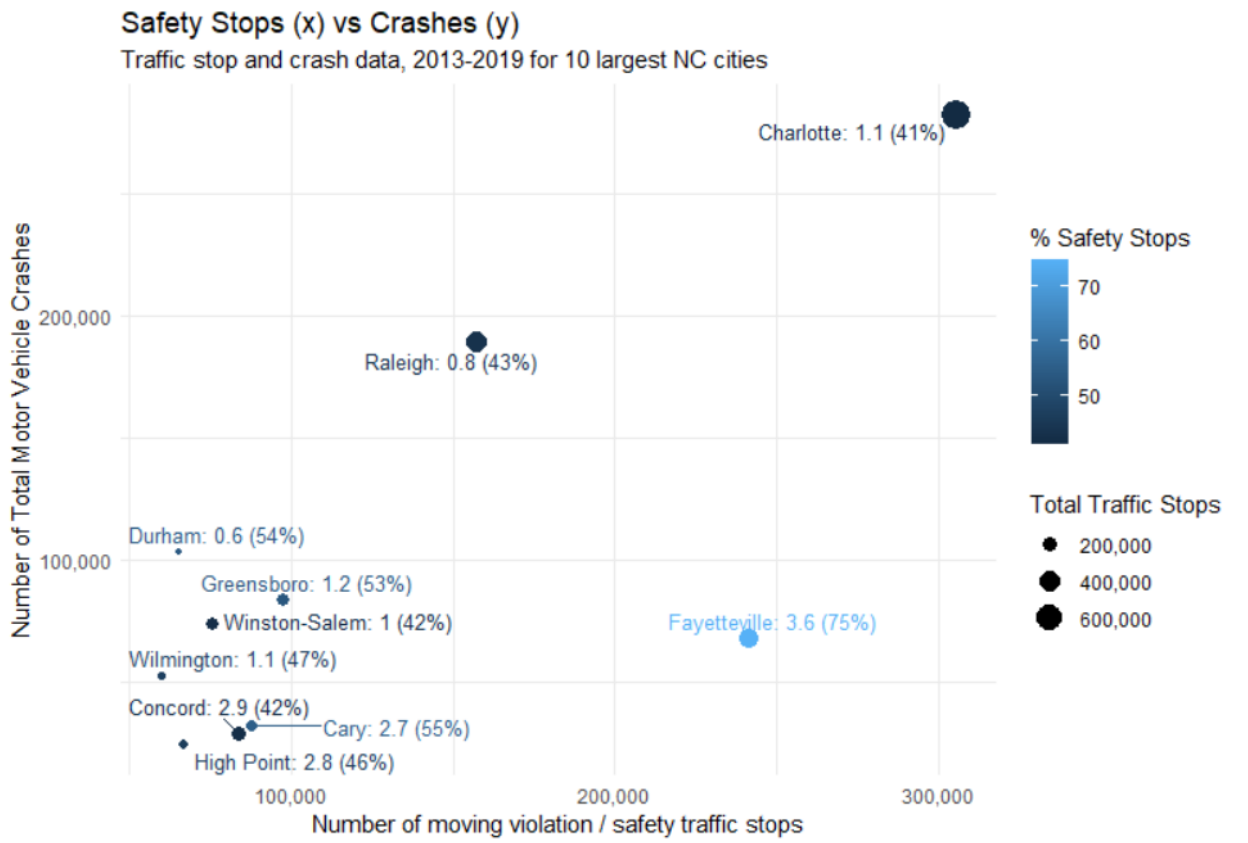

Figure 6. Moving & safety violation traffic stops vs. total traffic crashes for 10 large NC cities.

The lack of accountability and discretionary implementation of traffic stop programs decouples individual traffic stop programs to their generalized evidence base. Though law enforcement programs celebrate programs like Data Driven Approaches to Crime and Traffic Safety (DDACTS) (McClure et al., 2012), there is insufficient oversight and community accountability required data to inform (and, critically, limit) inefficient programs. Checkpoints for impaired driving can be used to arrest nonviolent, undocumented immigrants. Seatbelt programs can be used as a pretext for investigation and car searches; though some studies have documented unbiased application of seatbelt programs, outlier agencies and our own research has suggested seatbelt demographic distributions can also look strikingly similar to investigatory stop demographic distributions (Baumgartner, 2018). Automated enforcement cameras, though promising in some respects, can be disproportionately placed in under-resourced and marginalized communities leading to apparently "race-neutral" policies ticketing Black and Latino drivers most (Hopkins & Sanchez, 2022). Even with speed limit enforcement, an evidence-based approach, NHTSA acknowledges "speed limits on many road segments are frequently not obeyed, and average travel speeds on these segments substantially exceed the speed limit" (p 3-17).

Framed more positively, this decoupling, discretion, and lack of accountability also provides an opportunity for intervention and change. Fayetteville's stark and fast changes to their traffic stop program allowed them to significantly reprioritize driving safety traffic stops and relatively

deprioritize investigatory stops and poverty policing. These changes led to measurable reductions in some measures of traffic stops racial disparities without increased in crime effects (Fliss et al., 2020). When supported by funding, resources, and research, community groups and / or law enforcement, either working together or at odds, can restructure their local traffic stop programs and evaluate their changes. These efforts, including both (1) process support and activity targeting efforts on the monthly level (e.g. monthly crash, stop maps, and other process measures) and (2) interim and final evaluations on the yearly level, may take only a few years of committed funding for large changes.

Conclusion

Traffic stops expose drivers and passengers to law enforcement. This exposure is not without consequence. In the extreme, law enforcement have escalated routine and nonviolent traffic stops into the murder of unarmed drivers many times (Feldman et al., 2017). By increasing the number of opportunities for police escalation (i.e. number of traffic stops), static risks of police harm are multiplied (NPR, 2022). Fatalities aside, police use of force during traffic stops further injures drivers. However, even without putting hands on drivers, law enforcement traffic stops exact a costly toll on individuals and communities.

Experiences of discrimination, perhaps especially by law enforcement, have real and newly measurable health harms. Research in the last two decades has shows that experiences of stress have verifiable pathways to causing cellular damage (McGowan & Roth, 2015) and precipitating negative health events. Discrimination, even so-called microagressions, causes measurable stress effects. This stress effect compounds the biological effects of the oppressed cultures, economic disparities, and hazardous working and living conditions of marginalized populations (Krieger, 2021). Such experiences of stress, discrimination, epigenetic factors, and socioeconomic disparities are highly plausible pathways of severe disparities in public health outcomes, such as Black-White disparities in preterm birth (Braveman et al., 2021).

Even when police do not use force to injure or kill drivers, traffic stops, specifically, damage the mental health of young urban men (Geller et al., 2014), likely in part through these stress and discrimination pathways. Police routinely make measurably “race-sensitive choices” in traffic stops (Barnum and Perfetti, 2010). Police use less respectful language with Black drivers when novel body worn camera (BWC) footage is transcribed and analyzed (Voigt et al., 2017). Given the real stress and health pathways of perceived and experienced discrimination, it is not a trivial cost to stop 100, or 1,000, or 10,000 drivers in the hopes of rare positive outcomes or prevented rare events.

Traffic stops still perpetuate a war on (largely Black) people and poverty, not a winnable war on drugs. Even though, in the US, illicit drug use is similarly common by race-ethnicity (NSDUH), Black, Indiginous, and other People of Color (BIPOC**)** still make up a disproportionately high percentage of those in prisons (Bobo & Thompson, 2006). Even as the prescription opioid (now Fentaly laced illicit opioid) epidemic was largely White, that disparately White population did not received the same “war on drugs” framing as Black communities struggling with illicit drug epidemics in the 80s and 90s (Netherland & Hansen, 2017). Law enforcement agencies still use traffic stops to disparately arrest BIPOC using illicit drugs, even as this approach has no public

health evidence. In fact, this “arrest out way out of overdose and drug use epidemic” framework has severe risks: people just released from prison, an already dangerous setting, have 40 times the overdose rate of the general population (Ranapurwala, 2018).

Traffic stops where no one is obviously injured are not without injury. These costs must be weighed against any evidence of benefit or harm prevention. We have attempted to that here using the AOC data for NC. Evidence suggests that crime fighting benefits are minimal. At least, very few serious criminals are apprehended as a result of a traffic stop.

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