

Iowa City Police Department Traffic Study

2005, 2006, 2007, 2010, 2011 & 2012

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CITY OF IOWA CITY MEMORANDUM

Date: June 20, 2014
To: Mr. Thomas Markus
From: Chief Sam Hargadine
Re: St. Ambrose Study on ICPD Traffic Stops

Background

In response to some community concerns of racial profiling the ICPD started to collect demographic data on traffic stops in July of 1999. The results of the traffic stop data collection were analyzed in a January 2004 report titled "Traffic Stop Practices of the Iowa City Police Department: January 1 – December 31, 2002." The research team was from the University of Louisville and this report was frequently referred to as the Louisville study.

On or about 2006 the Command Staff was approached by Dr. Christopher Barnum, Associate Professor of Sociology and Criminal Justice and Director of Graduate Studies Masters in Criminal Justice at St. Ambrose University. Dr. Barnum was familiar with the Louisville study and became interested in analyzing ICPD traffic stop data utilizing a differing approach. Dr. Barnum initially indicated a desire to study the data for a six month period of time.

After an initial review of the six months period of time, both Dr. Barnum and I determined that a more in-depth analysis was needed in order to better understand operational trends in the department. I maintained the working relationship with Dr. Barnum and provided him data for the years 2005, 2006, 2007, 2010, 2011 and 2012. Unfortunately, a transition to a new data management system resulted in conversion problems that prevent us from analyzing 2008 and 2009 data. Throughout this partnership with Dr. Barnum, our officers were not advised of the study due to the potential of changing behavior patterns.

In June of 2013 the City Council passed Resolution 12-320 establishing an Ad Hoc Diversity Committee to study City transit and law enforcement operations as they relate to minority populations. Over the course of six months the Ad Hoc Diversity Committee held 22 Committee meetings. Several community discussion forums were held with community members from diverse backgrounds to discuss and receive feedback about transit and law enforcement operations. During this time a renewed conversation on disproportionate contact with minority populations was sparked. The ICPD took the Ad Hoc Diversity Committee process very seriously and is working hard to implement each of the recommendations of the committee.

Based on the community conversation generated by the Ad Hoc Diversity Committee, I worked with Dr. Barnum to incorporate more traffic stop data and finalize his analysis. While this study was initially intended for internal and academic purposes, I now believe it is appropriate to have a public discussion on the topic. By participating in the study, I hope it sends a clear message that the ICPD has taken the issue of disproportional minority contact very seriously in the past and will continue to do so in the future.

The Study

Attached is a study of ICPD traffic stop data from the years 2005, 2006, 2007, 2010, 2011 and 2012. It is an in depth analysis supervised by Dr. Chris Barnum of St. Ambrose University. He was assisted by graduate students Robert Perfetti and Matt Lint.

It is important to note that the interpretation of the data is very complex and best explained by Dr. Barnum. The methodology used included observational baseline studies. Over 20 trained observers were stationed at various locations within Iowa City to determine the racial makeup of Iowa City's drivers. These surveys occurred at different times of the day and over multiple years.

Dr. Barnum discusses at length the difference in disproportionality from the data in 2005 – 2007 and 2010 – 2012. Dr. Barnum's report indicates a notable increase in the disproportionate contacts in particular on the South East side between the two time periods. The numbers jump considerably both among a few officers that were assigned to that area and by the department as a whole. As this was occurring the department was responding to a dramatic increase in violent calls that included two riots, multiple shots fired calls and one homicide. To combat the problem ICPD created a new concentrated zone within the existing beat and patrolled that area extensively.

In 2009 reported crime was a significant concern for residents in the Pepperwood, Wetherby, and Grant Wood neighborhoods. A juvenile gang calling themselves the Broadway Goons was believed to be responsible for a significant amount of the reported crime. This area is also well known for its high volume of drug trafficking and weapons offenses.

Incidents, many of which gained a lot of media attention, began in the early spring and lasted until late summer. Information gained from arrestees was that the gang was actively recruiting and trying to grow in size. Increased assertive foot patrol efforts were started and directed to the area in an attempt to thwart problems. In October 2009 landlord John Versypt was murdered while working in the hallway of his rental property located in the 1900 block of Broadway. Numerous neighborhood meetings were held to address the issue which included several members of the City Council at that time. These issues were a major factor that led to the passing of the Juvenile Curfew Ordinance and the establishment of the South East Substation.

There is no doubt that we intensified directed patrols in the south east portion of town during the later time period. We also asked neighboring jurisdictions to drive through that area if they were driving by anyway. The Iowa State Patrol and Johnson County Sheriff's Office assisted us with creating a sense of continuous law enforcement presence. The officers with the highest likelihood of disproportionate contact in Dr. Barnum's study were there because they were assigned there by supervisory staff to solve a significant crime problem. It is important to note that crime in this area of town has dropped dramatically as a result of our intensified patrols over the last several years.

Presently the Pheasant Ridge/Bartelt Road area saw three very violent shots fired incidents one of which has led to significant injury to an innocent person who was hit as a bullet went through the exterior wall inside to where party goers were assembled. The violence seen this spring on the West side and the concern of residents and neighborhood associations is very much like the concerns expressed by the residents of the South East side of town a couple of years ago. The police department remains committed to see that it does not rise to the level that it did a couple of years ago. Our commitment has included similar resource devotion, including extra patrols and overtime details. While we hope to bring stability to this area, we are certainly more cognizant of the tendency for disproportionate minority contact to occur when engaging in hot spot policing. Ideally, we can bring stability without seeing similar jumps in disproportionate contacts.

There are several additional items to keep in mind that are not included in the study but are significant at looking at the entire picture. These include:

- Complete CALEA® assessments in 2007, 2010 and 2013. The 2013 assessment team was provided with Dr. Barnum's report. CALEA® is the Commission on Accreditation for Law Enforcement Agencies. The accreditation process requires compliance with

rigorous standards that meet the best practices for police agencies in the U.S. and Internationally. Proof of compliance is also required and continually monitored over three year periods.

- All traffic stops are videotaped and routine and continued random audits by supervisors have not shown any pattern of biased based policing or unprofessional behavior.
- Complaints that have come in claiming racial bias have been taken seriously and are fully investigated by supervisory staff. Any inappropriate behavior has resulted in personnel action.

Recommendations Going Forward

Going forward the department has reviewed Dr. Barnum's report with the officers and reiterated that biased based policing is illegal, immoral and if discovered can lead to discipline to include termination. Officers receive legal training once per year specifically on race based traffic stops which outlines the legal and civil penalties they could be exposed to if they engage in racial profiling. Officers have also been through diversity training provided by Chad Simmons of Diversity Focus. It is recommended that this relationship with Diversity Focus be ongoing.

Supervisory staff members will continue to randomly review the videos of officers throughout the year for indications of unprofessional, biased based or even unsafe habits. Any violations of policy require documentation and at a minimum corrective counseling. All complaints will continue to be fully investigated.

It is recommended that Dr. Barnum be hired to analyze 2013 traffic stop data and compare the data with previous years. Future studies should be conducted to ensure that measures put in place are effective and the disproportionate statistics lowers. I would recommend that at least for the next few years we publish this data as part of the City's Annual Equity Report. This will help demonstrate to the community our commitment to this issue and hopefully will show meaningful progress in the years to come.

It is imperative that all officers from the newest recruit to the Chief realize that perceptions are viewed differently based on life's experiences. Police have to remain vigilant to find unprofessional behavior and take seriously all complaints that are brought to light.

Lastly, I want to express my full confidence in the officers and staff in the ICPD. I am personally very proud of their dedication, professionalism and high level of performance. The numbers in Dr. Barnum's study do raise concerns, which I am taking with the utmost seriousness. However, I do not for a minute think the numbers indicate ill motivations. I believe the release of the data is an opportunity for the department to grow and outwardly express our commitment to build relationships and protect all persons in the community with the same high standards of professionalism. I look forward to starting this process with the City Council on June 16th and will make myself available to community groups who may wish to further discuss this issue with me in the coming weeks and months.

Acknowledgments

We wish to thank the members of the Iowa City Police Department for their cooperation and invaluable assistance with the transfer of data and the other information they provided. We especially thank Chief of Police Sam Hargadine, Administrative Services Captain Rick Wyss, Field Operations Captain Jim Steffen and Jim Baker from Information and technology. This report would not be possible without their tremendous cooperation and support. We also thank the many St. Ambrose University students who participated in various aspects of data collection and analyses.

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Executive Summary

In response to concerns about the potential for racial bias in the Iowa City Police Department's traffic stop activity, the PD began systematically collecting data on traffic stops in approximately 2001. Recently the City retained our research team to analyze their data. The focus of our investigation was an assessment of racial disproportionality in the ICPD's traffic stop activity for stops made in 2005, 2006, 2007, 2010, 2011 and 2012—more than 60,000 stops. The investigation evaluated two broad categories of police data: (i) the demographic information of drivers stopped by the ICPD and (ii) the outcome or disposition of a stop.

The methodology used to analyze ICPD's traffic stop demographics employed a driver-population *baseline* fashioned from roadside observations, census data and school enrollment information. A baseline should be thought of as the proportion of minority drivers on the roads in a given location. The analysis process is straight forward. It centers on identifying differences between the percentages of various groups stopped by the ICPD and the baseline information. Any difference between baseline values and police data signifies *disproportionality*.

The results of baseline analyses suggested that roughly 10% of the drivers on Iowa City roads were minority members during the study period. Results also show that between 2005 and 2007 levels of disproportionality in ICPD stop activity were comparatively low. During this time-period, roughly 14% of the Iowa City Police Department's traffic stops involved minority drivers.

However, disproportionality increased in 2010 and then remained stable through 2012. Analyses show that in 2010 the percentage of minority drivers stopped by ICPD officers increased to roughly 19% and remained near this level in 2011 and 2012. The analyses also show that the minority-driver baseline remained essentially constant during this time-frame.

A close examination of ICPD patrol practices suggests that in part, the increase in disproportionality stemmed from an escalation of patrols in a portion of southeast Iowa City. After a review of various sources it seems likely that the Iowa City Police Department modified patrol procedures following an increase in violent crime in the city in 2008 and 2009. These modifications included the establishment of a new patrol beat located in southeast Iowa City in an area with a comparatively high minority resident concentration. This new patrol area called "beat-2-A" is rather small. It consists of an area no larger than few blocks and is geographically much smaller than other ICPD beats. However, the minority baseline in beat 2-A is significantly higher than in other Iowa City beats.

Individual officer analyses indicate that the officers exhibiting the most disproportionality in traffic stops were frequently assigned to patrol areas located on the southeast side of Iowa City, or were "float" officers who were tasked with patrolling high crime areas. Both groups of officers tended to stop higher proportions of minority drivers than did most of their colleagues. Officers assigned to patrol the small 2-A beat also tended to stop higher proportions of minority drivers than did officers in other areas of town. However, this result is expected because the proportion of minority members on the roads in this area is much higher than in other areas of town and much higher than the 10% minority baseline used for analysis. Consequently, higher proportions of minority stops for beat 2-A officers do not necessarily indicate disparity or bias.

The examination of stop *outcomes* assessed disproportionality in citations, arrests, consent searches and *hit-rates* or seizures from consent searches. Univariate odds ratio analyses showed consistent

patterns—Iowa City officers disproportionately arrested and (consent) searched minority drivers. On average across all years of the study the odds were about three times greater that minority drivers would be arrested on a traffic stop in comparison to others. Likewise, the average odds for consent searches were about three and a half times greater that ICPD officers would request a search from minority drivers compared to others, this despite hit rates that were actually *lower* on average for minority drivers. In other words, in comparison to others, ICPD officers were more likely to make a seizure from a nonminority driver as the result of a consent search even though officers were more likely to request a such a search from a minority driver. Findings also suggest that minority drivers and nonminority drivers were ticketed at equivalent rates. Multivariate logistic regression analyses show parallel results. The regression odds ratios were similar in size to those from univariate analyses even after controlling for officer's race, officer's gender, officer's years of service, officer's duty assignment, the time of day, type of traffic violation and the driver's gender. It should be noted that our analyses show that many officers were inconsistent in entering information about voluntary consent search requests with about 50% of officers incorrectly inputting data. This level of inconsistency likely negatively affects the validity of the findings in this area.

Care should be used when evaluating findings for arrest outcomes. Several important control variables were not available for inclusion in logistic regression models. Consequently, it's not possible to evaluate whether disproportionality in arrest rates was a product of other factors like differences in offense types or offending rates between demographic categories. Likewise, it is important to emphasize that the number of cases used for analyses of consent search requests and seizures was much smaller than the number of cases used in analyses of other stop- outcome variables. This small "n" can affect the validity of the findings and should be taken into consideration when evaluating results.

Recommendations in Brief

- (1) ICPD should continue collecting traffic stop data and repeat this study in one year's time to assess trends in disproportionality once officers know their behavior is being monitored. This analysis should include department level measures of disproportionality as well as an assessment of individual officers' traffic stop activity across time and location.
- (2) The ICPD should closely monitor officer compliance of data collection to reduce the number of unknown and missing cases.
- (3) ICPD should increase officer training in regards to the proper collection and inputting of data especially for voluntary search requests
- (4) ICPD should modify data collection software so that it becomes practical to collect and analyze the geographical location of individual stops.
- (5) ICPD should also modify data collection software so that it becomes practical to track the reason for an arrest on traffic stops.

Chapter One: Levels of Disproportionality

Introduction

In recent years, US citizens have expressed increasing apprehension about racially biased policing (sometimes called profiling) in traffic stop activity. Although, many definitions of racially biased policing exist, most researchers agree that the event occurs when the police use race or ethnicity as a proxy for suspiciousness when deciding whether to stop or sanction potential targets. Of late, some Iowa City constituents have communicated concerns that the Iowa City Police Department may be profiling when interacting with minority members. These concerns generally stem from personal accounts and anecdotal evidence but persist despite a 2001 University of Louisville study that found no systematic bias in ICPD officers' conduct (Edwards, Grossi, Vito & West, 2001). To address this issue the City of Iowa City asked our research team to develop and implement an analysis of Iowa City Police traffic stop conduct.

In what follows, we use a two-prong approach to assess ICPD traffic stop activity by focusing on traffic stop demographics *and* on the outcome of the stop. The ICPD has been collecting data on officers' traffic stop behavior for over a decade and has accumulated a substantial amount of raw data. Interpretation of raw data however can be tricky because the nature of police work is characterized by a complex array of factors that may legitimately account for disproportionality in police-minority contacts. In fact, these factors can present issues that cloud interpretation of analyses. Our approach in dealing with this complexity is straightforward. First, to analyze disproportionality in traffic stops we compare police stop demographic data to a valid and representative baseline. A baseline is best thought of as the proportion of minority drivers present on the roads. Second, to assess disproportionality in the outcome of a stop, we use two statistical techniques, a disparity index predicated on odds-ratios and logistic regression analyses. The outcome of a stop includes things like whether a citation was issued, an arrest was made or a search conducted etc. We also look closely at individual officer's conduct by analyzing how an officer's traffic stop information may be affected by work schedules, duty assignments and neighborhood characteristics.

Background¹

Racial disparity within the criminal justice system is an enduring feature of the American experience. For most of this country's history, minority members, especially African-Americans have been overrepresented at nearly all stages of the criminal justice process (Drummond, 1999; Kennedy, 1997; for a contrasting opinion, see DiLulio, 1996; Wilbank, 1987). However, studies conducted over the past 20 years suggest change. These studies show that the overt use of race in police decision-making behavior is steadily decreasing (Engel et al., 2002; Sherman, 1980). This trend is likely due in part to community outrage and legislative action but also it's partly the result of efforts by police supervisors. Today most research indicates that police discretionary decision making is predicated more on legal and situational factors than *solely* on race (Engel et al., 2002; Mastrofski, Worden, & Snipes, 1995; Riksheim & Chermak, 1993). Nevertheless, race remains one of the most reliable predictors of attitudes toward

¹ Much of this section is adapted from Barnum and Perfetti 2010.

the police in America today (Weitzer & Tuch, 2005). African Americans are consistently more likely to hold negative opinions of the police than are other groups (Hurst, Frank, & Browning, 2000).

Why then, at a time when overt racism by the police seems to be decreasing, do minority members cling to negative perceptions of the police? In part, the answer may lie in a perception of double disproportionality—an opinion by minority members that the police tend to energetically enforce the law against them but fail to adequately enforce the law for them. Certain police and law enforcement practices may have served to heighten this suspicion. The notable forms of drug courier profiling that began in the last quarter of the 20th century provide an example.

Profiling in various forms has existed for decades in the United States. However, the practice became particularly salient in the 1980s when some of the first federally subsidized drug courier profiling methods were developed and used to train local law enforcement officials. An example of this activity includes tactics developed in a Drug Enforcement Administration sponsored profiling strategy called *Operation Pipeline*. This program was originally designed to stem the flow of drugs that were being transported from Florida to the metropolitan areas of the Northeast along interstate highways. Officers participating in this training were taught guidelines for identifying the typical characteristics of drug couriers. One of these guidelines included race. Using race as an identifier lead to unfortunate consequences including increased levels of fear and resentment among minority members toward police, and ultimately to lawsuits and litigation.

The source of the recent interest in racially biased policing in traffic stops is generally traced to two court cases in the 1990s. Defendants in a New Jersey criminal case, the *State of New Jersey vs. Soto* (1996), and plaintiffs in a Maryland civil case, *Wilkins vs. Maryland State Police* (1993), argued that they were stopped because of their race rather than their driving. This litigation sparked scholarly interest in this subject and a spate of other court cases across the country. As a result of this legal action, many police departments began collecting data on police–citizen contacts. Unfortunately, much of this data remains untouched.

The Baseline Problem

A key reason for this neglect in data analysis is difficulty in identifying and developing the essential characteristics of the data. The question of how to develop an effective baseline is one of these problems. A baseline is a standard for determining the percentage of minority drivers in a given police jurisdiction who are on the roads at a given time. Investigators compare this benchmark to police traffic stop data to determine whether the driver's race was a factor in the officer's decision to make a traffic stop. Some methods of benchmarking include using census or DOT information to establish baselines. These techniques are often ineffective for various reasons, including differences between races in the amount of time spent driving (driving quantity), racial differences in offending rates and thus police attention (driving quality), and the racial composition of neighboring communities whose citizens may travel through the population of interest (driver mobility). More recent innovations, however, use mixed methodological approaches that combine direct observation with census and other data. These

methods have generally established more valid baselines than earlier attempts (e.g., Alpert et al., 2007; Alpert, Smith, & Dunham, 2004; Lamberth, 2006).

Methodology

In what follows we use a combination of methodologies to evaluate officers' traffic stop behavior. First, to establish a baseline we use an applied technique that includes traffic observations and census data. As noted, the baseline should be thought of as the percentage of minority drivers on the road in a given area of town. In plain terms, the baseline is a standard that can be used to judge the percentage of minority drivers that should be stopped by the police when no bias is occurring. Second, we evaluate post stop outcomes using statistical techniques including logistic regression, hierarchical linear modeling and a disparity index that is predicated on odds ratio analyses. Finally, we assess individual officers' conduct using in-depth analyses of stop outcomes specific to a given officer.

Data Sources

This study examines several years of data that has been collected by the ICPD. The data were selected from years falling within a period ranging from 2005 through 2012. The ICPD experienced difficulties with their data collection system in 2008 & 2009. Less than a hundred cases are available for analyses during these years and we consider this information unreliable so they are not included in the examination. Our strategy is as follows: we will first analyze older data from 2005 - 2007 and use this information as a comparison standard when evaluating the more recent data from 2010-2012.

Iowa City street officers record information relevant to self-initiated traffic activity as part of their regular duties. As noted, the Iowa City Police Department has been collecting traffic stop data for over a decade. Officers are very familiar with the data-collection routine. When stopping a vehicle, officers contact the dispatch center who then logs the stop. The officers use their in-car computers to enter pertinent information at the completion of the stop. The data are then transmitted to the station where they are centrally stored. For each stop, officers enter data regarding the driver of the vehicle, the reason for the stop, and demographic information. Officers were unaware that their discretionary traffic stop behavior was being examined by outside researchers. Consequently, it seems unlikely then that officers modified their level of discretionary traffic stop behavior during the analysis period over concerns of increased scrutiny.

Observational Baseline Information.

During the study period, over 20 trained observers monitored traffic in Iowa City. These individuals were stationed at various locations within each of Iowa City's four police beats. Several intersections were designated for observations within each beat. These intersections were chosen at random prior to the beginning of the study, after being screened for traffic volume and visibility (the selected intersections were chosen from a pool of relatively busy intersections). The choice of intersections proved to be less complex than initially thought because the city is comparatively uniform in terms of the racial composition of neighborhoods. In plain terms, there are no *large* predominately minority sections or neighborhoods in town.

In fact, an initial examination of data from the 2000 U.S. census (and a reanalysis using 2010 census data) for the percentage of African Americans by block group reveals the following. Iowa City is made up of roughly 40 block groups. Three of these block groups are populated with the highest concentrations of African Americans. Two of these areas are located on the southeast side of Iowa City and one is located on the southwest side. However, in Iowa City the police beats are much larger geographical areas than are census block groups. Consequently, even in these highest minority concentration areas, the percentage of African Americans residing in areas located on the rest of the beat does not exceed 12%. In all other areas of the community, the percentage of African Americans populating any block group was less than 15.0%. A simultaneous examination of all block groups strongly suggests that with the exception of the three previously mentioned neighborhoods, on the whole, African American homes are more or less evenly distributed throughout the community.

We utilized three waves of observations. The initial cohort monitored traffic in 2007, followed by two more groups that surveyed traffic in 2011 and 2013. For each selected intersection, every traffic observer made between 200 and 400 traffic observations. Depending on traffic volume, this took approximately 45 minutes. For the initial rounds of observations, the observers generally examined traffic in at least one intersection on all four beats in a given session. Consequently, each observation session lasted roughly 3 or 4 hours. The observers surveyed vehicles to discern the race and gender of the drivers and conducted their inspections periodically all hours of the day—mornings, afternoons, evenings, and late nights.

The initial round of observations included data from 14 trained observers. All observers used a systematic sampling strategy that was dependent on traffic volume. For example, when traffic volume was light, the observers would attempt to assess race and gender for each vehicle passing through the intersection. However, when volume was heavier, an assessment was made for a set number of cars (e.g., every third car) passing through the intersection. Generally, traffic volume was much lighter late at night than during daytime or evening hours. Therefore, the length of observation periods tended to be longer at night than during daylight hours. Because the observers worked independently of one another, the correlation coefficient r was used to assess inter-observer reliability. The assessments from each observer were compared across all beats. Accordingly, each observer's observations were compared to all others. For example, the correspondence of assessments of race across all observation points from Observer A were compared to those same observation points for Observer B. Observer B's data were next compared to observer C's and so on. This was done for all possible contrasts, for a total of 91 comparisons. The average correlation of assessments between observers was extremely high ($r \approx .9$). This strongly suggests that the roadside observers were independently seeing very similar percentages of minority and nonminority drivers pass through each observation site.

Table 1* Census and observer information

Observations	Total	Percentage	2010 Census %
White	19,391	88.14	82.5
Black	843	3.83	5.8
Asian	854	3.88	6.9
Other	912	4.15	4.8
Grand total	22,000	100.00	100.00

* $\chi^2 = 148.68$. $p = .999$, $r = .989$

In the analyses that follow whites and Asians are grouped together and are compared to all other groups called, “minorities.” We group whites and Asians because previous research strongly suggests that Asians tend to be disproportionately *underrepresented* in traffic stops (Novak, 2004; Sheldon, 2001; Barnum and Perfetti 2010). In other words, the police tend to stop too few Asians in comparison to their baseline values in the population. And as we shall see shortly, this was indeed the case for Iowa City as well. Grouping Asians with other minority members then would tend to suppress or hide potential disproportionality in minority traffic stops.

In the initial round, the observers made an assessment of race for 22,000 drivers between June and December 2007. Table 1 depicts the findings as well as the parallel 2010 census figures. The correspondence between the percentages witnessed by the roadside observers and the 2010 census population percentages is striking; 92.02% of observers’ assessments were of White or Asian drivers, whereas 7.98% were minority group members. This closely resembles the 2010 census figures, which report that 89.4% of Iowa City residents were white or Asian, and 10.6% were members of other racial groups. In addition, observers found that on each of Iowa City’s four police beats, the *average* percentage of whites and Asians was at least 90%, and there was no significant difference in percentages between daytime and nighttime hours. Based on these findings and the high inter-observer reliability, it seems reasonable to conclude that at least for initial analyses a valid baseline for Iowa City driver demographics is 90% white and Asian, and 10% minority. We will have much more to say about the baseline in the southeast side of town (called beat-two) in subsequent sections of this paper. We will also soon describe how the baseline is used in a disparity index to examine traffic stop data.

Summary

- White & Asian = 90% of the driving population on Iowa City roads
- Minority members = 10% of the driving population on Iowa City roads

ICPD Traffic Stop Demographic Analyses 2005 & 2007

We begin the analyses by looking at demographic information of data resulting ICPD self-initiated traffic stops in 2005 - 2007. Table 2 gives this information for 2005.

Table 2 Demographic Traffic Stop Information from 2005

Race	Total Stops	Percentage
White	8394	84%
Black	892	9%
Hispanic	320	3%
Asian	242	2%
Other	127	1%
Unknown	19	.1%
Native	7	.1%
Grand Total	10001	100%

In 2005, the ICPD initiated 10001 traffic stops.² Of these, roughly 14% involved minority drivers. This value is moderately higher than the 10% observational/census baseline, meaning that in 2005 the ICPD stopped about 4% “too many” minority drivers in comparison to baseline values. Keep in mind that baseline values are *estimates* of the percentages of drivers on the roads, so 4% over the baseline is not necessarily a meaningful amount. In order to assess this level of disproportionality further, we use a series of steps. First, we analyze stops across police beats. Map 1 gives the locations of the four Iowa City police beats.

² Only stops where all information was known about driver and stop location were included in the analyses

Map 1 Iowa City Police Beats



Three of the four Iowa City police beats are similar size. Only beat number one which is located in the downtown area of town is smaller than the others. Table 3 below gives the number and percentage of traffic stops broken out by the race of the driver and the beat where the stop occurred. In the table we have included an additional *beat-five* which is used to represent officers who are not assigned to a specific beat but instead were allowed to “float” city-wide. This designation includes special enforcement street crime action team (SCAT) officers as well as k-9 patrols and regular patrol officers who are not assigned to specific beats or areas of responsibility.

Table 3 Driver Demographic Traffic Stop Percentages by Beat in 2005*

Race	Beat Number					Totals	
	1	2	3	4	5	Stops	Percentage
White	1064	2888	2410	1117	693	8394	84%
Black	117	357	142	165	95	892	9%
Hispanic	42	130	56	54	32	320	3%
Asian	45	73	51	40	26	242	2%
Other	20	50	27	18	10	127	1%
Unknown	4	5	3	1	6	19	0%
Native	1	3	2		1	7	0%
Grand Total	1293	3506	2691	1395	863	10001	100%
Min. Percentage	14%	16%	9%	17%	17%	14%	

*Does not include 254 traffic stops made by command staff personnel or data where race is unidentified

The bottom row of the table gives the percentages of minority drivers stopped on each beat. The total percentage for all stops irrespective of beat is highlighted in red. In 2005, disproportionality in traffic stops was greatest among beat-five officers who floated city wide and those who worked on beats four and two (and to a lesser degree on beat one). No disproportionality was found for officers working on beat three. In general levels of disproportionality are relatively modest and more or less evenly dispersed across the beats. We now evaluate traffic stop information from 2006 and 2007 in a similar fashion.

Table 4 Demographic Traffic Stop Information from 2006

Race	Total Stops	Percent
White	9941	82%
Black	1148	9%
Hispanic	463	4%
Asian	289	2%
Native	5	.1%
Other	230	2%
Unknown	27	.1%
Grand Total	12,103	100%

Table 5 Minority Stop Percentages by Beat in 2006*

Race	Beat Number					Totals	
	1	2	3	4	5	Stops	Percentage
White	2177	3745	1960	1008	906	9796	82%
Black	249	499	129	112	148	1137	10%
Hispanic	100	198	53	42	59	452	4%
Asian	54	87	52	53	38	284	2%
Other	56	71	38	37	24	226	1%
Unknown	7	8	8		4	27	<1%
Native		1	1		3	5	<1%
Grand Total	2643	4609	2241	1252	1182	11927	100%
Min. Percentage	15%	17%	10%	15%	20%	15%	

* Does not include 176 traffic stops made by command staff personnel or data where race is unidentified

The information from 2006 is similar to 2005. Disproportionality in stops is generally evenly distributed across beats, although officers on beat-five have higher levels than others.

Table 6 Demographic Traffic Stop Information from 2007

Race	Total Stops	Percent
White	7105	83%
Black	734	9%
Hispanic	341	4%
Asian	227	3%
Native	3	.1%
Other	105	1%
Unknown	11	.1%
Grand Total	8526	100%

Table 7 Minority Stop Percentages by Beat in 2007*

Race	Beat Number					Totals	
	1	2	3	4	5	Stops	Percentage
White	930	2776	1213	1089	745	8394	83%
Black	121	251	131	89	104	892	9%
Hispanic	38	148	43	34	61	320	4%
Asian	425	66	47	50	25	242	3%
Other	13	31	14	23	21	127	1%
Unknown	2	1	5	1	2	19	<1%
Native			1		2	7	<1%
Grand Total	1129	3273	1454	1286	960	8102	100%
Min. Percentage	15%	13%	13%	11%	19%	14%	

*Does not include 424 traffic stops made by command staff personnel or data where race is unidentified

The overall patterns of the 2005 – 2007 data are similar. In each year the levels of disproportionality are relatively low and disproportionality is greatest among beat-five officers who floated city wide. ³

Two Generalizations from 2005 - 2007

- Overall Levels of disproportionality are low
- Beat-five officers exhibit highest levels of disproportionality

We use these generalizations to evaluate 2010, 2011 & 2012 ICPD traffic stop data.

ICPD Traffic Stop Demographic Analyses 2010

Table 8 Demographic Traffic Stop Information from 2010

Race	Total Stops	Percent
White	9311	77%
Black	1527	13%
Hispanic	593	5%
Asian	372	3%
Native	6	.1%
Other	173	1%
Unknown	66	.1%
Grand Total	12048	100%

³ For 2007 data were only available from January 1st – November 12th 2007.

Table 9 Minority Stop Percentages by Beat in 2010

Race	Beat Number					Totals	
	1	2	3	4	5	Stops	Percentage
White	1677	1729	1758	1869	1588	8621	77%
Black	183	451	323	190	285	1432	13%
Hispanic	72	181	118	73	121	565	5%
Asian	60	73	85	62	59	339	3%
Other	26	19	29	42	54	170	2%
Unknown	6	33	1	2	7	49	<1%
Native	1	2			2	5	<1%
Grand Total	2025	2488	2314	2238	2116	11181	100%
Beat Percentage	14%	26%	20%	14%	22%	19%	

*Does not include 867 traffic stops made by command staff personnel or data where race is unidentified

The information in the 2010 traffic stop data departs from results seen in earlier years in two important ways. First, overall levels of disparity have increased from roughly 14% to 19%. Second, disproportionality on beat-two has noticeably increased by roughly ten percentage points. These trends continue in the 2011 and 2012 data.

ICPD Demographic Analyses 2011

Table 10 Demographic Traffic Stop Information from 2011

Race	Total Stops	Percent
White	10124	76%
Black	1489	11%
Hispanic	627	5%
Asian	419	3%
Native	25	.1%
Other	165	1%
Unknown	485	4%
Grand Total	13334	100%

Table 11 Minority Stop Percentages by Beat in 2011*

Race	Beat Number					Totals	
	1	2	3	4	5	Stops	Percentage
White	2262	2663	1599	1993	254	8771	76%
Black	232	682	222	159	65	1360	12%
Hispanic	122	242	100	62	21	547	5%
Asian	94	121	74	68	14	371	3%
Other	34	46	29	18	5	132	1%
Unknown	40	77	86	98	4	305	3%
Native	3	5	1	11	1	21	<1%
Grand Total	2787	3836	2111	2409	364	11507	100%
Min. Percentage	14%	25%	17%	10%	25%	18%	

* Does not include 1827 traffic stops made by command staff personnel or data where race is unidentified

ICPD Demographic Analyses 2012

Table 12 Demographic Traffic Stop Information from 2012

Race	Total Stops	Percent
White	9122	74%
Black	1385	11%
Hispanic	579	5%
Asian	528	4%
Native	52	.1%
Other	194	2%
Unknown	507	4%
Grand Total	12367	100%

Table 13 Minority Stop Percentages by Beat in 2012

Race	Beat Number					Totals	
	1	2	3	4	5	Stops	Percentage
White	2273	1863	2422	1843	181	8771	75%
Black	251	427	272	284	60	1360	11%
Hispanic	88	172	144	126	19	547	5%
Asian	143	89	125	118	15	371	4%
Other	44	50	58	27	4	132	2%
Unknown	141	40	78	47	2	305	2%
Native	13	8	10	17	2	21	<1%
Grand Total	2953	2469	3109	2462	283	11412	100%
Min. Percentage	13%	25%	15%	18%	29%	18%	

* Does not include 955 traffic stops made by command staff personnel or data where race is unidentified

Discussion of 2010 – 2012 ICPD Traffic Stop Demographic Data

The information from the tables for 2010 – 2012 diverges from the demographic data from 2005 - 2007 in at least two important ways. First, the overall percentages of minority drivers stopped by the police were higher in 2010-2012 than the earlier years. For the more recent data, minority stops comprised roughly 18% or 19% of all stops made by the ICPD. In 2005 - 2007 this percentage equaled roughly 14%. Given a 10% minority baseline, this suggests that in 2010 – 2012, overall levels of disproportionality increased from roughly 4% to about 8%. Logistic regression shows this difference is statistically significant. For this analysis, logistic regression is a statistical technique that evaluates whether specific “independent variables” are associated with a driver’s race, given that a stop has occurred. Results show that irrespective of the area of town where a stop occurred, the reason for the stop or the age and gender of the driver, the year of the stop was associated with an increase in the odds that the driver was a minority member (given a stop was made). Specifically, results show that a stop made during the 2010 – 2012 timeframe was associated with a roughly 35% increase in the odds that the driver was a minority member in comparison to 2005-2007 ($z = -12.57$ $p < .001$). See appendix B for tables of results.

Second, the percentage of minority drivers stopped dramatically increased in beat-two and to a lesser extent among beat-five and beat-three officers in 2010-2012 when compared to the earlier years. In 2005 - 2007 the average percentage of minority drivers stopped on beat-two equaled roughly 15%. It increased by about 10 percentage points during 2010 -2012. The levels of disproportionality on Beat-five and beat-three increased by about 6% during the same period. Logistic regression shows these changes were significant (see appendix B for details). Results also show that minority driver stops on the other beats did not increase in a similar fashion.

Two Important Generalizations from 2010 – 2012

- The percentage of minority drivers stopped significantly increased from 2005 – 2007 levels
- The increase in the percentage of minority drivers stopped was chiefly driven by significant increases in minority driver stops on beat-two, beat-three and among officers not assigned to a beat (designated as beat-five officers).

Beat-Two

As noted, the largest increase in the percentage of minority drivers stopped occurred on beat-two. This increase may stem from changes in the baseline population—that is, the percentage of minority members living and driving in the area, or the increase may stem from changes in police conduct. In what follows we evaluate the likelihood of each of these potential explanations.

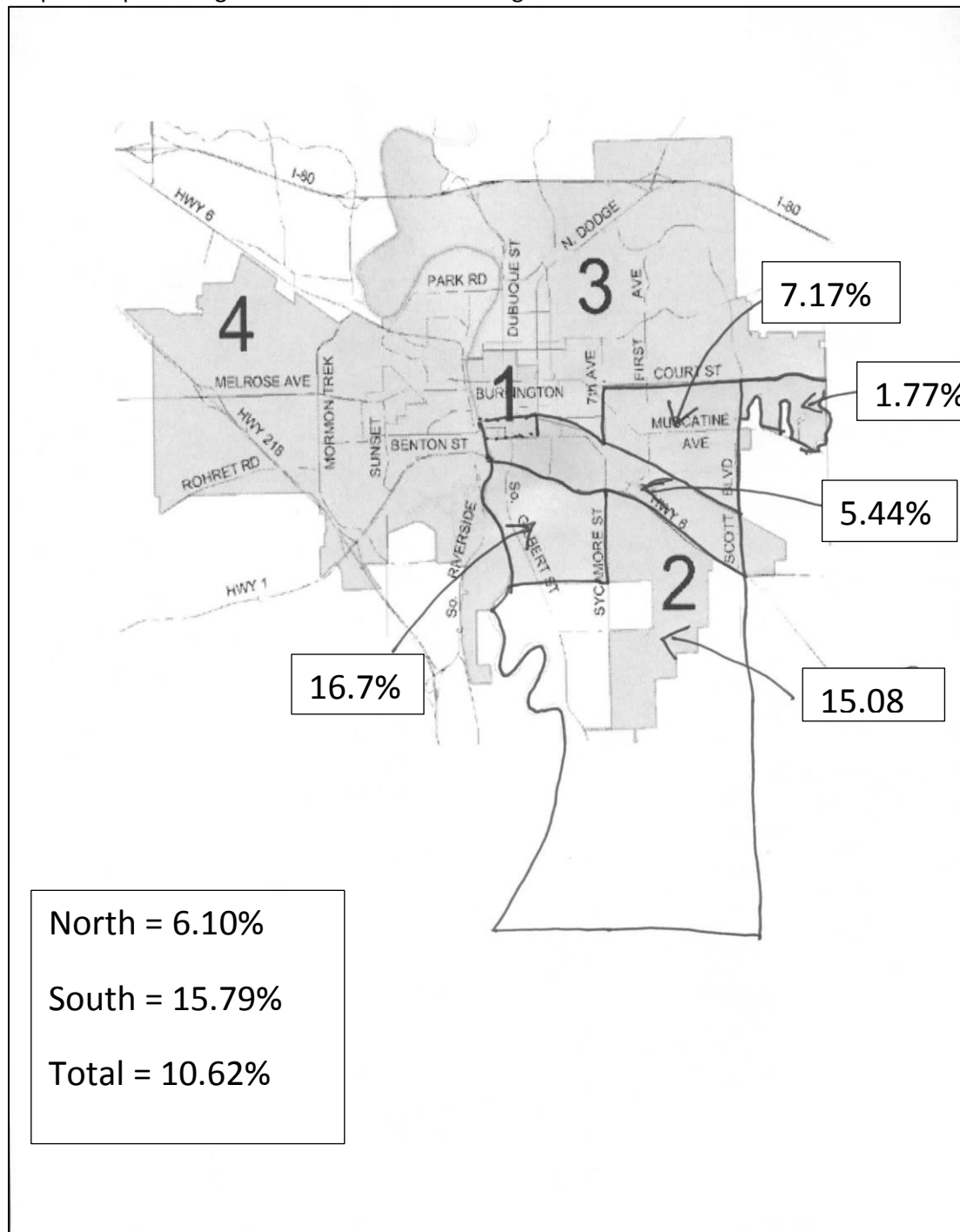
Beat-two Baseline Recalibration

In order to assess minority population change we recalibrated the baseline for beat-two. We began with an examination of the 2010 U. S. Census data for beat-two. Map 2 below gives the percentage of African-Americans living in each of the five census *tracks* located within beat-two. It’s clear from map 2

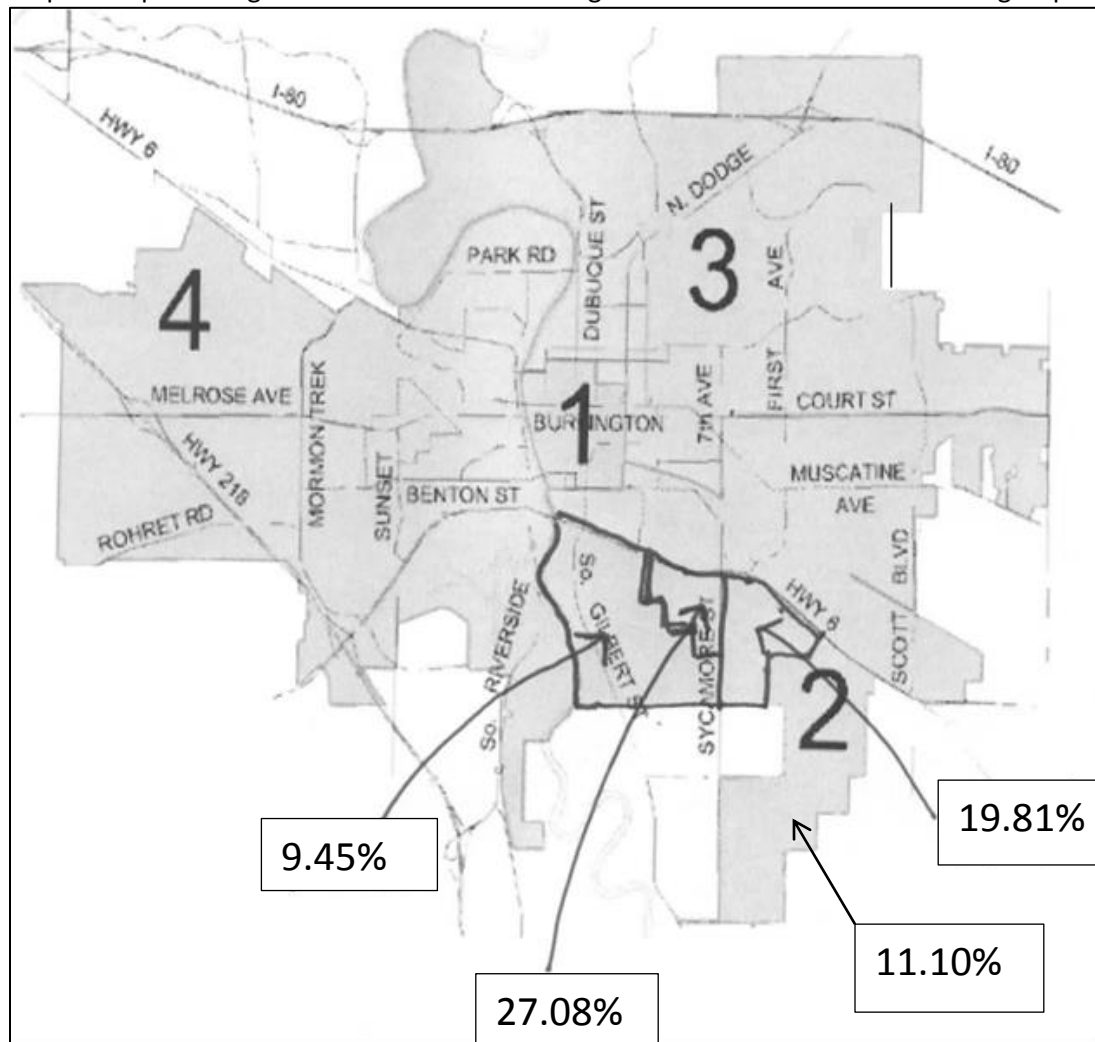
that not all the census tracts match-up with beat-two boundaries. The tracts do however give a good rough estimate of the percentage of African-Americans living on the beat. Map 2 shows that the majority of African-Americans who reside in beat-two live on the south end of the beat. Approximately 15.79% of the residents living south of US Highway 6 on beat-two are African-American. On the north side of this demarcation line roughly 6.10% of residents are African-American. The total percentage of African-Americans living on beat-two equals approximately 10.62%

Given that most of the African-American residents on beat-two live south of Highway 6 we used US Census *block-group* data to examine this area more closely. A block-group is a much smaller area than a census tract. Specifically, a block-group consists of clusters of blocks (usually 20 -30) within a given census tract. Map 3 below gives the census block-groups for the area of beat-2 south of Highway 6.

Map 2 The percentage of African-Americans living in beat-two 2010 census tracts



Map 3 The percentage of African-Americans living in selected 2010 beat-two block-groups



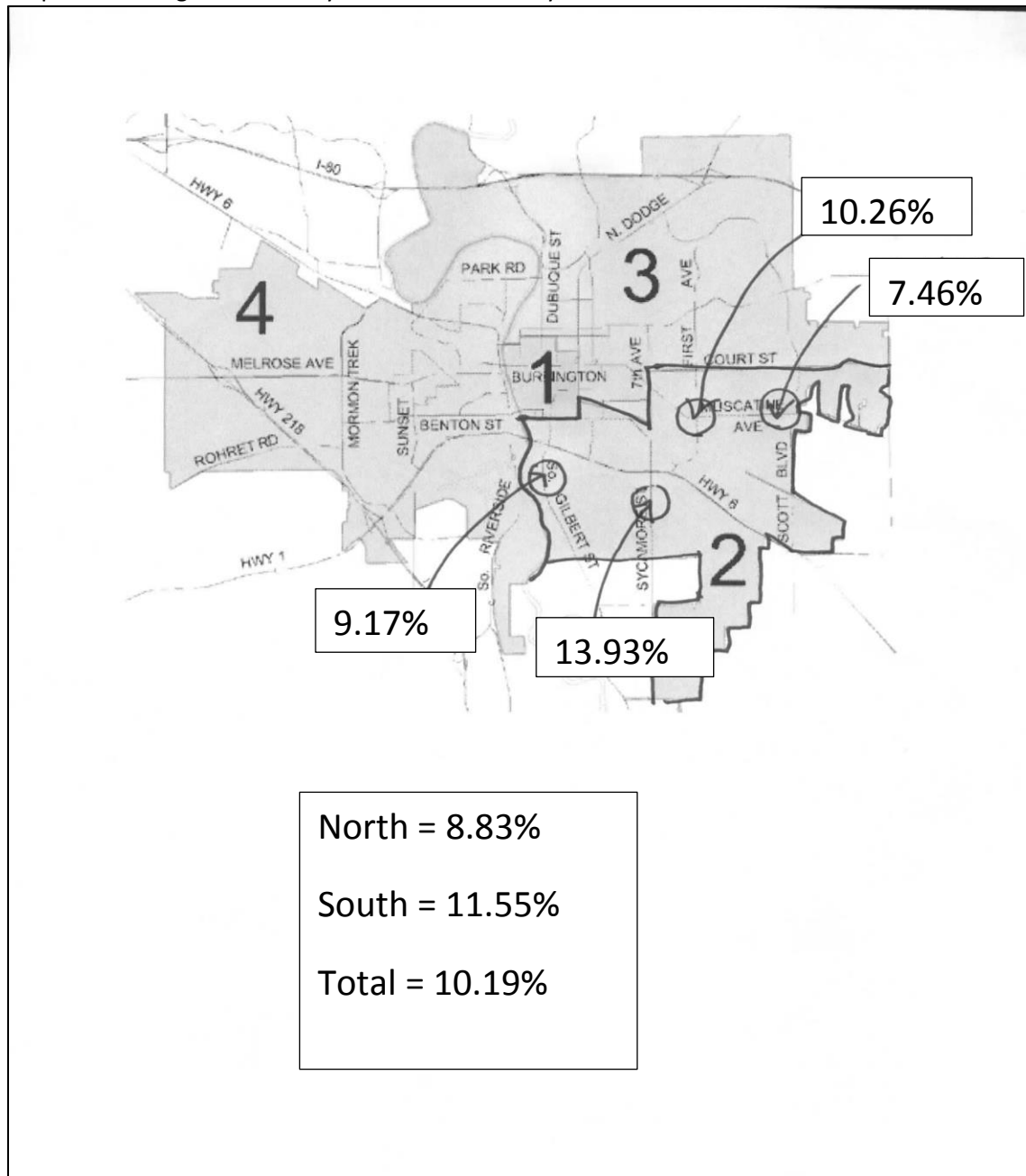
Map 3 shows that the location of the majority of African-American who reside in beat-two generally live in an area that is centered around two block-groups located just south and adjacent to US Highway 6. These two block groups are intersected by Sycamore street. Note the block-group located in the extreme southeast corner of the map is partially located outside city limits.⁴

Observation Recalibration: As mentioned earlier, using census data to establish a baseline can be problematic because the characteristics of the driving population in a given location may not match the demographics of the residents who live in the area. Research suggests that observational techniques

⁴ Note: The percentages in maps 2 and 3 are for African-Americans, not all minority members. The percentages for all minority members would be higher. We chose to use African-Americans rather than all minority members because US census data do not completely conform with our definition of a minority. For example, a person who is classified as “two or more races” under the US census and who Asian and white would not be a minority member using our classification.

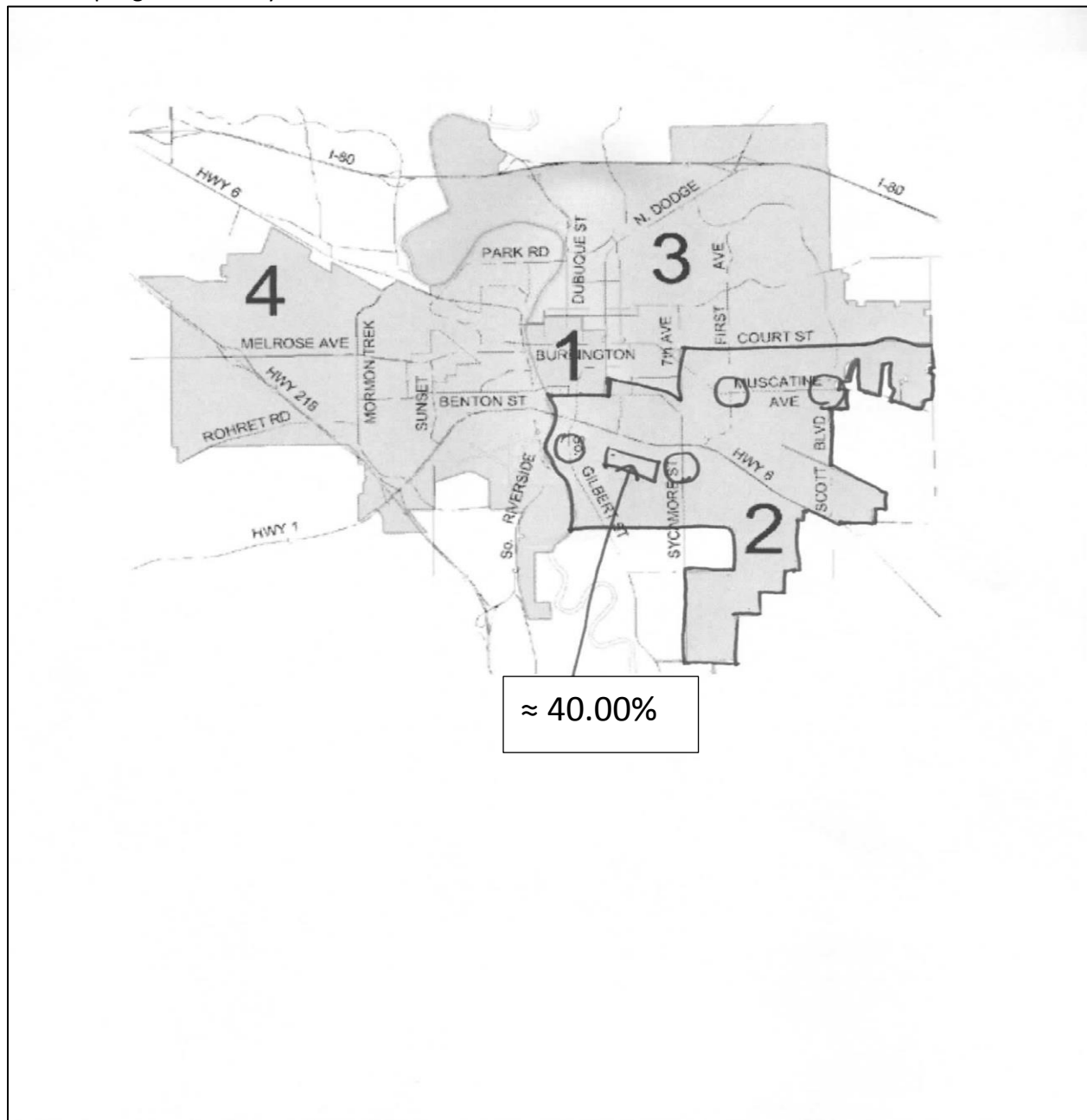
generally provide superior baselines to census data (Alpert et al., 2007; Alpert, Smith, & Dunham, 2004; Lamberth, 2006). Consequently, we developed a supplemental baseline for beat-two. Subsequent the original 2007 observation study we conducted two additional rounds of roadside observations in beat-two. The first of these occurred in April and May 2011 and focused mainly on the north side of the beat (1100 observations) and the second, was conducted in June and July 2013 on the south end of the beat and included oversampling in an area near the Broadway apartments (3200 total observations across the beat). The second study consisted of a total of five observation sites. Maps 4 and 5 give results of these analyses.

Map 4 Percentages of minority drivers identified by roadside observers in 2011 & 2013



The circled areas in map 4 indicate the observation zones. This map shows that about 10% of all roadside observations were minority drivers. This value is consistent with the earlier 2007 observation study. Analyses also show that observers saw more minority drivers on the south side of the beat (11.55%) than on the north side (8.86%). An additional observation area was conducted within the block-group exhibiting the highest minority resident percentage (see map 3). This zone is located near the Broadway area of beat-two. Observations here found roughly 40% of all drivers were minority members, see map 5 below.

Map 5 Percentages of minority drivers identified by roadside observers in 2011 & 2013 including oversampling in Broadway area



Iowa City Public School Data

The information from the supplemental observation studies and census analyses is very consistent with the original baseline and census findings from 2007. The 2011-13 observation information suggests that for beat-two as a whole, about 10 or 11% of the drivers are minority members on average across the entire beat. The census analyses also suggest that the population demographics in beat-two did not change in a significant way between the years 2007 – 2012.

To further investigate whether minority resident percentages changed on beat-two during the study period we analyzed Iowa City Public School Enrollment. Table 14 gives the percentages of African-American students enrolled at Iowa City public schools for beat-two students.⁵ The table shows that with the exception of Grant Wood Elementary, African-American enrollment in beat-two generally remained steady or decreased between the school years of 2005/06 and 2010/11. These findings are consistent with information from census and observational analyses. Together, the findings suggest that it's unlikely that population demographics on beat-two changed in a dramatic way during the study period.

Table 14 Percentage of African-America students in Beat-Two schools

Year	SE	NW	NC	Wood	Twain	Lucas	Dist. Total
2005-2006	16.13	14.04	16.02	28.61	45.71	17.81	13.38%
2006-2007	14.39	17.26	10.06	31.89	44.21	19.25	14.42%
2007-2008	19.97	17.54	10.89	36.26	50.38	15.42	16.55%
2008-2009	18.72	18.97	9.75	31.96	45.02	14.86	15.96%
2009-2010	19.17	18.97	11.84	38.23	41.77	15.35	16.16%
2010-2011	17.48	17.58	12.00	39.35	38.68	16.55	16.22%

Map 6 below gives the location of Grant Wood School and summarizes the information from the census, observation and school analyses. Based on the totality of this information it seems reasonable to conclude that for most areas of beat-two the minority population and percentage of drivers on the road equaled roughly 10% during the study period. However, an area located in a southern portion of the beat (and as indicated in map 5) had a much higher percentage of minority residents and drivers. It seems likely that in this area 20% or more of the drivers on the roads were minority members.

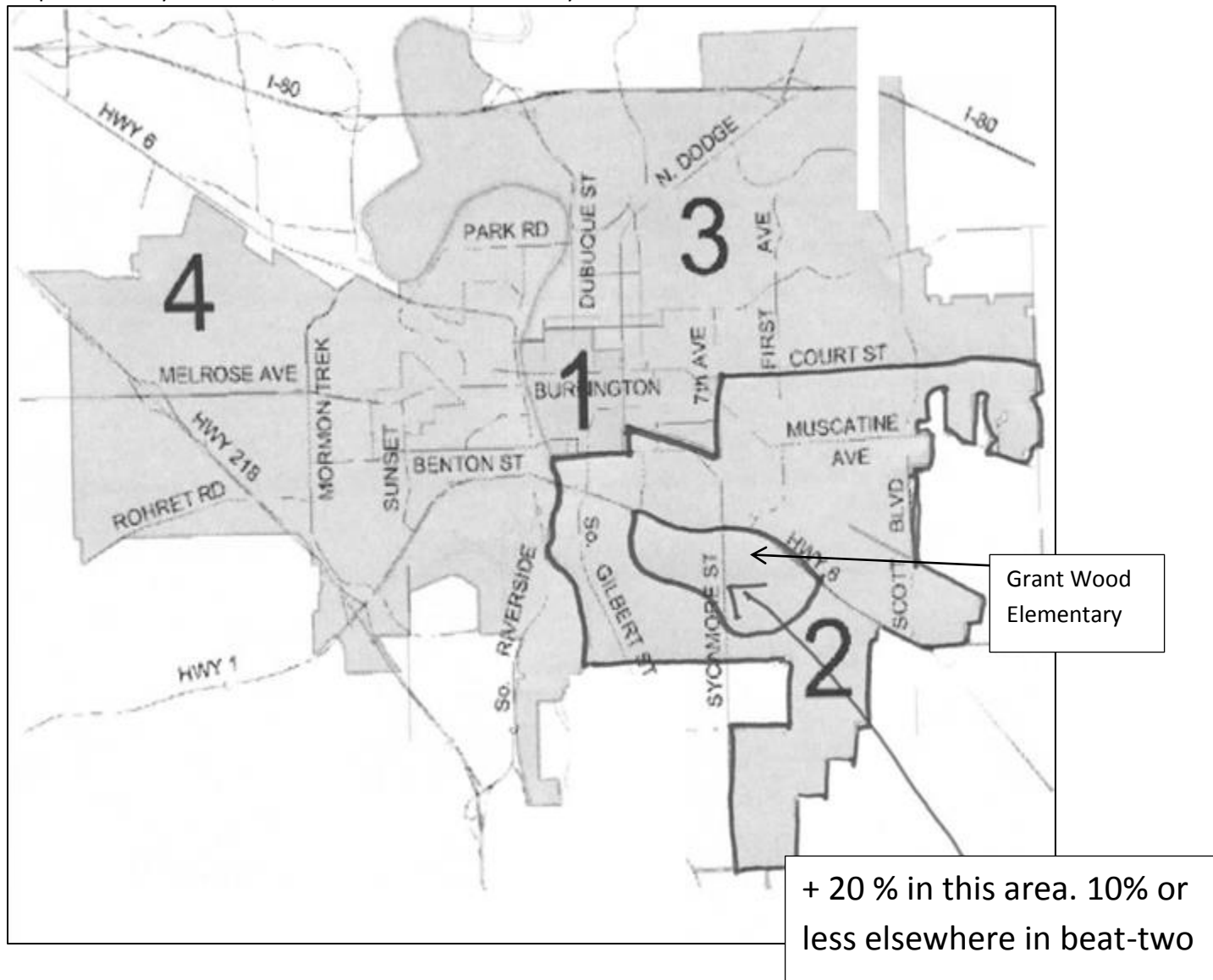
Summary so far

- It's unlikely that the baseline percentage of minority drivers on the road increased in a significant way during the study period in beat-two.
- Consequently, increases in disproportionality for ICPD traffic stops on beat-two likely stem from changes in patrol procedures.

⁵ The results from NW Junior High should not be given as much weight as other listed schools because the boundaries for NW Junior High include only a few blocks of beat-two.

As will be outlined below, modifications in patrol procedures likely accounts for changes in the percentage of minority drivers stopped on beat-two during the study period. These changes include increased use of focused patrols in the higher minority concentration areas of beat-two. A key question at this point is, why were ICPD patrol procedures modified? We turn to this question in the next section.

Map 6 Summary of census, observation and school analyses



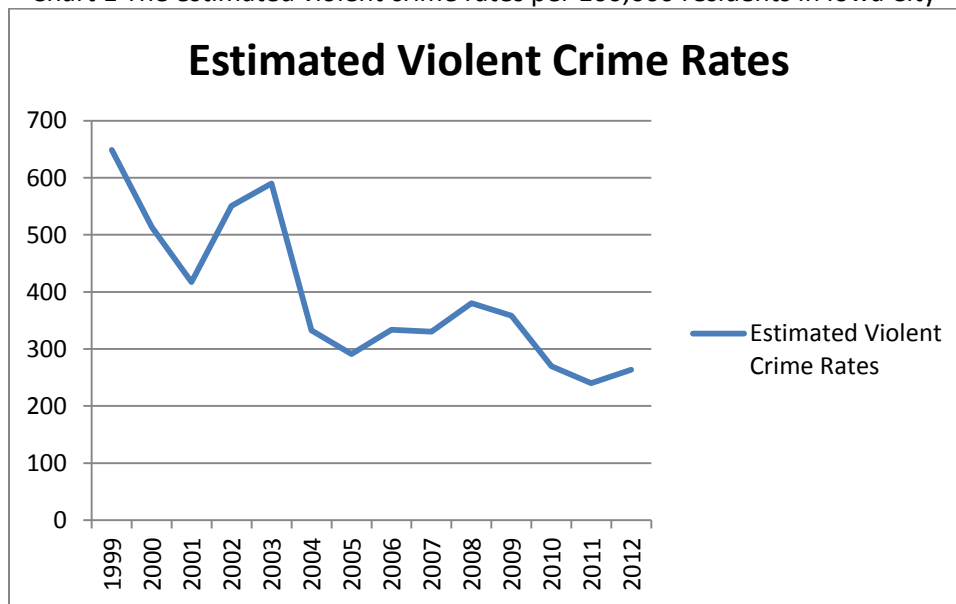
Crime rates and Patrol Procedures

As noted, the analyses thus far suggest that it's unlikely that the observed increase in disproportionality of minority drivers stopped by the ICPD that occurred during the study period resulted from a significant rise in the percentage of minority drivers on the roads. Instead other factors seem more likely to be responsible for the change.

We believe that a modification of ICPD patrol procedures and tactics—especially on beat-two—generated increased levels of disproportionality. This change in policing occurred between 2007 and 2010 and was concurrent with a spike in violent crime that occurred in 2008 and 2009.

Chart 1 below gives the rates of violent crime per 100,000 residents in Iowa City between 1999 and 2011. It's clear that the overall trend in the crime rate during this period is downward. However, in 2008 and 2009 the crime rate sharply increased for a brief period and then resumed its downward trend through the rest of the decade.⁶

Chart 1 The estimated violent crime rates per 100,000 residents in Iowa City*



*Source City-Data.com, estimates calculated using decennial census population values estimates

Although the increase in crime in 2008-09 was not large or long lasting, research suggests the spike was accompanied by a disproportional amount of media coverage (Barnum and Perfetti, 2012; 2013; Perfetti 2013).⁷ Much of this media coverage framed the “crime problem” in Iowa City as predominately a

⁶ The following crimes were included as violent crimes in the analyses for chart 1: aggravated assault, murder, rape, robbery.

⁷ Here are links that provide a sampling of media stories about increases in Iowa City crime on beat-two during 2008-09. See appendix A for a graph of newspaper coverage of crime that occurred during this time.
<http://www.kcrg.com/news/local/44973862.html>

product of illegal activity occurring on the southeast side of town. Additionally, a substantial amount of anecdotal evidence suggests that the increase in crime and accompanying media coverage affected law enforcement behavior. For instance, the ICPD instituted a new patrol beat during this time period. This new beat (called “beat 2-A”) is formed from a subsection of the original beat-two and is located on the south side of the beat. The area designated as +20% concentration of minority residents on map 6 roughly corresponds to beat “2-A.” Secondly, the ICPD opened a police substation in 2010 on beat-two near this same area. The sub station opened in part to address crime problems in the area. Further, the City of Iowa City instituted a curfew ordinance in December 2009 which according to many media accounts was enacted in part to deal with the violent crime trend in town especially on the southeast side.⁸ Consistent with this, violent crime data for neighborhoods located in beat-two do show higher rates of violent crime for neighborhoods located on the south side of beat-two than the north side (see tables 15 and 16 below).⁹

Table 15* Violent crime rate for neighborhoods located in the south side of beat-two

South Neighborhoods Violent Crime	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Wetherby	35	16	16	8	18	27	25	10	15	13
South Pointe	0	1	0	0	0	0	1	0	0	2
Pepperwood	7	0	0	1	0	0	1	0	0	0
Hilltop	0	0	0	0	0	0	0	0	2	2
Grant Wood	23	11	9	13	25	20	26	19	19	22
South 2 Totals	65	28	25	22	43	47	53	29	36	39
Crime rate for year	746.27	321.47	287.03	252.58	493.69	539.61	608.50	332.95	413.32	447.76

* South-side beat-two estimates are based on a population estimate that equals 8,710

Table 16* Violent crime rate for neighborhoods located in the north side of beat-two

North Neighborhoods Violent Crime	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Village Green	1	1	1	4	1	1	2	2	1	1
Lucas farms	15	6	5	10	8	9	8	6	4	6
South East	21	11	5	7	9	7	7	7	12	7
Longfellow	5	3	0	3	1	2	3	2	0	2
Creek Side	5	6	3	5	7	0	7	6	3	4
Friendship	12	4	7	4	8	5	3	6	1	8
Morningside	5	3	0	2	0	1	2	1	2	1
North 2 totals	64	34	21	35	34	25	32	30	23	29
Crime rate for year	529.23	281.15	173.65	289.42	281.15	206.73	264.62	248.08	190.19	239.81

* North-side beat-two estimates are based on a population that equals 12,093

<http://www.press-citizen.com/article/20090512/NEWS01/90512001/Man-arrested-rioting-assault-during-large-fight>

<http://coralvillecourier.typepad.com/community/2009/05/five-more-charged-for-mothers-day-brawl---violence-spills-over-to-city-high.html>

⁸ <http://www.kwwl.com/story/11602573/iowa-city-council-to-make-decision-on-curfew-ordinance>
<http://www.kcrg.com/news/local/59413962.html>
<http://www.radioiowa.com/2009/09/16/first-reading-of-curfew-ordinance-passed-in-iowa-city/>

⁹ Source *IC Press Citizen*. The following crimes were included as violent crimes in the analyses for tables 15 & 16: aggravated assault, arson, forcible rape, kidnapping, murder and robbery.

Tables 15 and 16 show that the violent crime rate was notably higher for neighborhoods located on the south side of beat-two than those located on the north side during the study period.

Suppositions

Based on the analyses so far, our supposition is that the ICPD changed its patrol procedures in response to perceived increased levels of violent crime on beat-two. The analyses show that the south side of the beat, especially the Wetherby neighborhood had higher violent crime rates than most other areas of the city, and that the rates of violent crime in this area were higher in 2008 and 2009 than in the other years included in the analysis. Moreover, it was during this time frame when the changes in police tactics occurred. These changes took the form of focused patrols—with more officers patrolling in higher minority concentration areas (beat 2-A) than had been the case prior to 2008. It seems likely that these police tactics account for some of the increased minority disproportionality found ICPD traffic stops. It also seems likely that float officers, including SCAT and k-9 officers concentrated their patrols in these higher minority population neighborhoods. We will investigate these claims more deeply in the next section.

Summary for this Section

- Observation and census analyses show that the baseline of the percentage of minority drivers on the roads of Iowa city equaled roughly 10% during the study period
- In 2005 - 2007 levels of disproportionality in ICPD stops were comparatively low
- Levels of disproportionality significantly increased in 2010 and remained stable through 2012
- The increase was not likely due to changes in the proportions of minority drivers on the roads of Iowa City
- Disproportionality increased more on beat-two than other beats during the study period.
- ICPD modified patrol procedures in 2008-09 in response to perceived increased violent crime in Iowa City. These modifications include the formation of a new sub-beat located within beat-two. This sub-beat is located in an area characterized by a higher percentage of minority residents than other areas of beat-two (or Iowa City).

Chapter 2: Individual Officer Data

In this section we breakout individual officer traffic stop information by beat assignment. A disparity index, odds ratios and graphs are used to identify officers with higher levels of disproportionality than their coworkers. Comparisons are made across time, across the entire department and across beat assignment.

The Odds Ratio

In much of what follows we measure disproportionality using one of two estimators that are predicated on an *odds ratio*. Given this, it's valuable to spend some time becoming acquainted with this estimator. The odds ratio is a measure of effect size and association. It is useful when comparing two distinct groups. We use a measure called a *disparity index* when analyzing traffic stops. This measure compares stops to baseline values. When assessing the outcome of a stop we use a *standard odds ratio* measure which compares the odds of something happening in one group to the odds of it happening in another group.

Before proceeding let's define a few terms. A **baseline** is a standard used to judge disproportionality. It should be thought of as the percentage of minority drivers who are on the road in a given area, and consequently as the percentage of minority drivers that should be stopped by the police when no bias is occurring. If the percentage of minority drivers stopped is either higher or lower than the baseline percentage then **disproportionality** is said to occur. The term disproportionality does not necessarily imply bias or discrimination. In what follows we analyze two essential types of police data: (i) traffic **stop** data and (ii) **outcome** data. As the name implies, stop data deals with comparing the number of stops made by the police to baseline values. Outcome data gives information about the consequence of a stop. For example, did the driver receive a ticket? Was s/he arrested? How about searched?

The *disparity index* used to analyze traffic stops measures the difference in ratios between two groups and their respective baselines. To illustrate let's focus on a made-up example. Let's say the baseline for a given area of town equals 10%, meaning that we can expect that about 10% of the drivers in this area are minority members. This value represents the proportion of minority drivers who should be stopped by the police. It follows then, that the baseline value for white drivers in this area equals 90%. To make this more concrete, let's say a given officer makes 100 traffic stops in this area. Further, let's say that forty-five of the drivers stopped were minority members while fifty-five were not. Given these values, the disparity index for this officer equals

$$(.45/.10) \div (.55/.90) = 7.36$$

This number suggests that for our fictional officer, the odds were more than seven (7.36) times greater that she would stop a minority driver as a non-minority driver given the baseline values. Please note *that higher odds ratio values signal more minority disproportionality and that a score equal to one suggests no disproportionality.*

Now let's look at the outcome of the stop. Here we'll use the *standard odds ratio* to evaluate disproportionality. To illustrate let's say that our fictional officer wrote a single ticket to 80 of the 100 drivers she stopped. Let's also say that forty of these tickets went to minority drivers while forty were issued nonminority drivers. Given this information, computing the odds ratio for stop outcomes is straightforward.

Citation			
	No	Yes	Total
Minority	5	40	45
W & A	15	40	55
Total	20	80	100

The odds ratios for citations equals $(40/5) \div (40/15) = 3$, meaning that the odds were three times greater that this officer issued a citation to a minority driver as a white driver. This value is meaningfully greater than one and so suggests significant disproportionality.

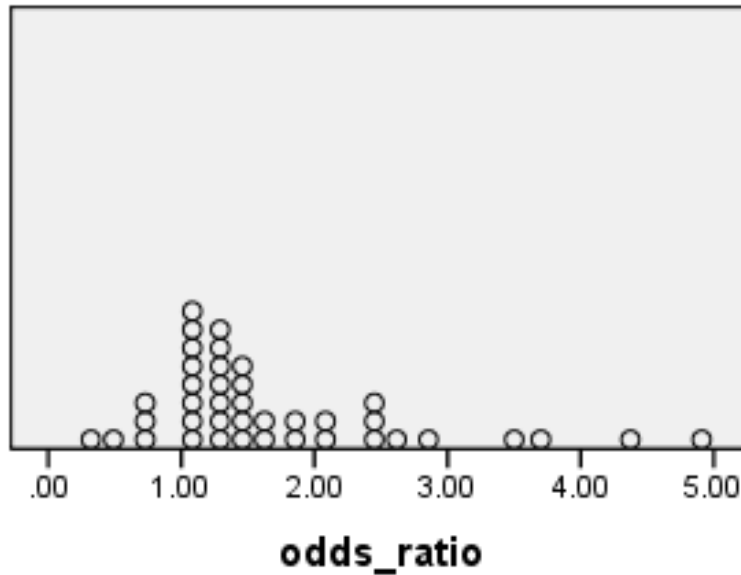
In the charts that follow each officer is represented as a circle. Disparity index values are located on the horizontal axis. As values move from left to right along this axis levels of disproportionality increase. An effective strategy to use in examining the charts is to identify officers who: (i) are located on the right side of the horizontal axis, (ii) who stand out from other officers (iii) who have higher disparity index values than others and (iv) who consistently have comparatively high values across time and on different beats.

An important warning: Please keep in mind is that the disparity index is based on an observational baseline and that the baseline is simply an estimate of the proportion of minority drivers on the roads of Iowa City. The actual percentages of drivers may be significantly different than the baseline.

Consequently, **when evaluating an individual officer's data, it's important to evaluate the officer over time and in comparison to colleagues. This practice is much better than simply focusing on the specific value of a single disparity index score. In other words, in isolation of context—in particular other officers' scores, as well as the target officer's scores across time and place—a single disparity index score is not a good indicator of bias.** Also, please note that the index values become more valid and reliable as the number of stops made by the officer increases.

Disparity Index Ratios for Stops

Chart 2, disparity index ratios for officers working in 2005



The chart above shows the value of the disparity index score for each ICPD officer making at least fourteen traffic stops in 2005. This table is useful for identifying officers who stopped disproportionate percentages of minority drivers (given observational zone baseline values). The estimator is calculated as described above. Each circle represents an individual officer. The values for the index are given on the horizontal axis. Higher values suggest more disproportionality and a score equaling one suggests no disproportionality, meaning that the odds of stopping minority and white/Asian drivers are equal. As a general rule of thumb a score equal to or greater than **three** should draw your interest and be examined more closely. Likewise, scores that appear to be dissimilar from others should also be given special scrutiny. **Also it is very important to remember that disparity values that are based on a large number of stops are more valid and reliable than those based on fewer stops.** On the next page we present a table that gives the values for officers with a disparity index value greater than three. Interpretation is direct, for example, the odds are the first officer listed in the table is roughly five times (disparity index = 4.91) more likely to stop a minority driver than a W & A driver given the observational baselines. These same claims apply for all charts that follow.

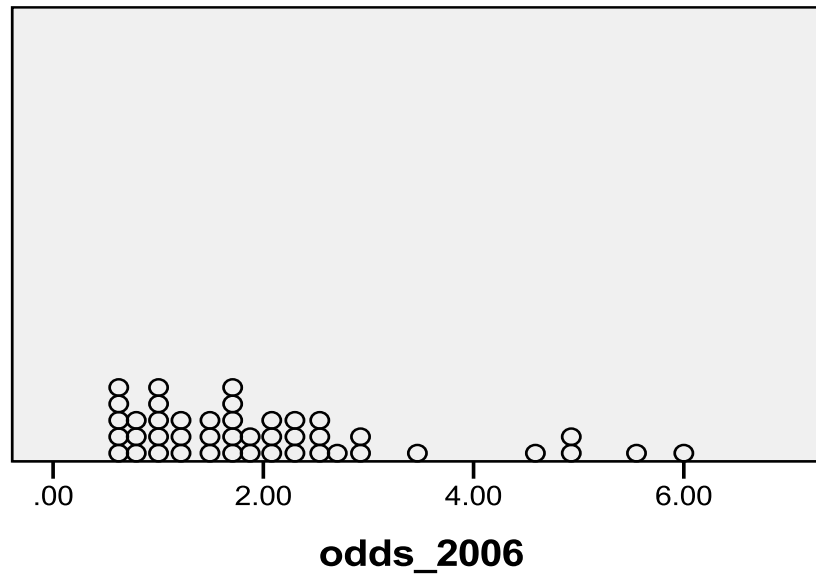
2005 Descriptives	
Mean	1.71
σ	1.03
Skew	1.45

Table 17, officers, disparity index values and beats for 2005

Odds Ratio	Beat	Stops
4.91	5	51
4.37	2	263
3.70	2	508
3.50	2	50
2.86	4	83
2.55	2	181
2.51	2	261

The data for 2005 show relatively modest amounts of disproportionality. In chart 2 the majority of officers' disparity index values cluster around 1.00 (mean = 1.7). Recall that a value equaling one suggests no disproportionality. Additionally, only four officers have disparity odds ratio values larger than three.

Chart 3, disparity index ratios for officers working in 2006



2006 Descriptives	
Mean	2.00
σ	1.44
Skew	1.56

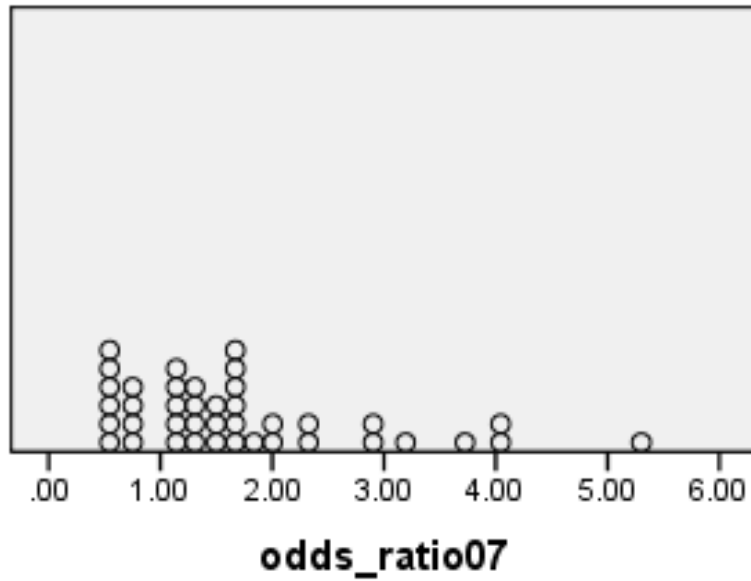
Table 18, officers, disparity index values and beats for 2006

Odds Ratio	Beat	Stops
6.0	5	25
5.5	2	776
4.95	5	31
4.91	1	51
4.6	2	77
3.5	2	223
3.0	4	40
2.8	1	445
2.7	4	144
2.6	2	417

The disparity index values for 2006 are moderately higher than those for 2005 (mean = 2.0). Several officers disparity index scores are above three. However of the officers with high values, only one is based on a large number of stops (n > greater than 100) so caution should be used when interpreting results.

The disparity index information for 2007 is given on the following page.

Chart 4, disparity index for officers working in 2007



2007 Descriptives	
Mean	1.75
σ	1.07
Skew	1.31

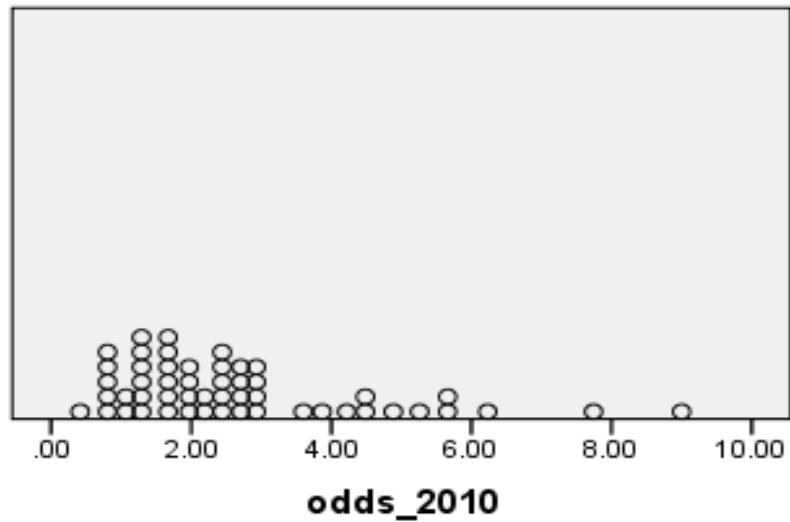
Table 19, officers, disparity index scores and beats for 2007

Odds Ratio	Beat	Stops
5.17	2	359
3.98	1	186
3.78	3	216
3.77	2	159
3.29	4	56
2.94	1	65
2.83	5	380

The data for 2007 are very similar to those for 2005. The 2007 information shows only modest levels of disproportionality with most officers' values clustered around 1.0 (mean = 1.75). Only five officers' disparity odds ratios were larger than three. Incidentally, no officers in 2007 with odds ratio scores above three had similarly high scores (disparity index values over three) in 2005 or visa-versa.

2010-2012 Stop Data

Chart 5, disparity index for officers working in 2010



2010 Descriptives	
Mean	2.56
σ	1.81
Skew	1.52

Table 20, officers, disparity index values and beats for 2010*

Odds Ratio	Beat	Stops
9.00	5	70
7.41	2	186
6.14	2	69
6.03	2	137
5.75	3	231
5.31	4	264
4.91	2	266
4.53	5	233
4.42	2	367
4.22	2	47
3.78	3	493
3.60	2	35

* Officers highlighted in red were assigned to beat 2A; officers highlighted in green worked the beat occasionally

The data from 2010 show a marked increase in disproportionality compared to data from 2005 – 2007. Examination of chart 5 shows twelve officers have disparity index values greater than three. The arithmetic mean of the entire distribution of disparity index values equals 2.56 and is clearly higher than those from 2005 – 2007. Table 20 above lists the officers whose disparity index values are greater than three. Nine of these twelve officers were assigned to beat-two or as beat-five float officers.

These data make apparent that much of the increase in disproportionality in 2010 disparity index is driven by those assigned to beat-two. It is important to note that the officers whose information is highlighted in red were assigned to beat 2-A fulltime. Information highlighted in green is from officers who worked beat-2A at least some of the time. Recall that beat 2-A is a special beat that was developed in 2010 to deal with perceived increases in crime on the southeast side of Iowa City. Six officers listed in table 17 were assigned to this beat at least some of the time in 2010.

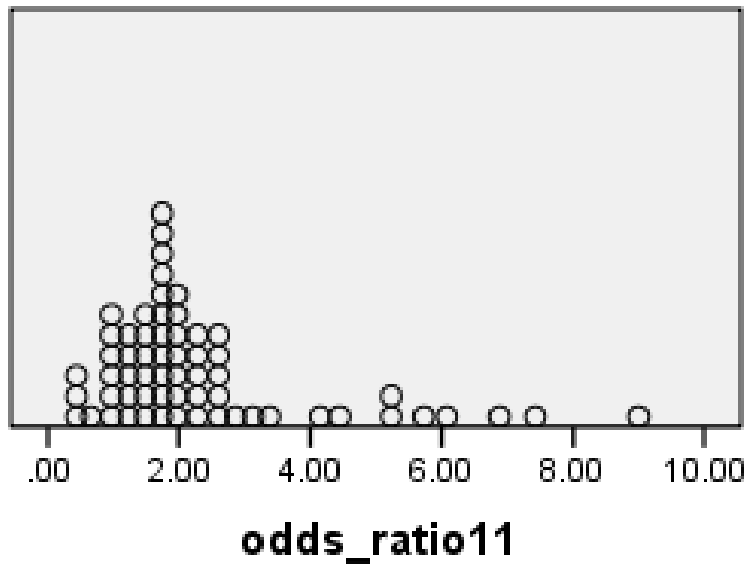
As noted, the census and observational baseline analyses show that the percentage of minority residents and drivers in the area demarcated by beat 2-A were significantly higher than in other areas of beat-two. In fact, observational analyses suggest that minority baseline values for beat 2-A were as high as 40%. **Consequently, the 10% minority driver baseline used for other areas of beat-two is not valid or appropriate for officers making stops solely in beat 2-A.** Simply put, using the 10% baseline for an officer working only in this area would dramatically increase the officer's odds ratio value and give a false impression of levels of disproportionality

Limitations of the Data

There are two important limitations with the ICPD traffic stop data: first, is it is not possible to determine the location of individual traffic stops and second, although we know the beat assignments of officers, it is not possible to know where on the beat an officer spent most of his/her time. Consequently, we cannot know the proportion of stops an officer made in a specific location or area of a beat or know how much time the officer spent in an area looking for a stop. This means that for beat-two officers it is not possible to know the percentage of time a given officer spent patrolling beat 2-A or the number of stops the officer made in this area.

The individual officer data for 2011 and 2012 follow. Summary and interpretation will follow the presentation of results for both years.

Chart 6, disparity index for officers working in 2011



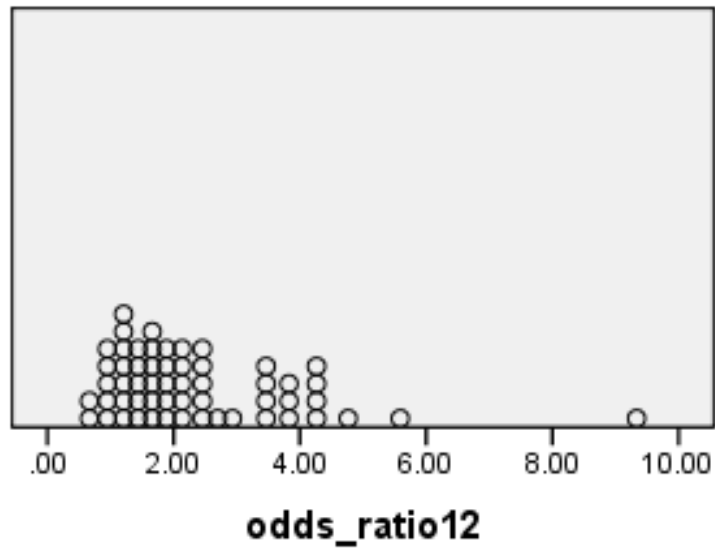
Descriptives 2011	
Mean	2.31
σ	1.74
Skew	2.03

Table 21, officers, disparity index values and beats for 2011

Odds Ratio	Beat	Stops
9.00	5	22
7.43	2	418
6.88	2	337
6.08	3	129
5.73	5	18
5.27	2	203
5.20	3	112
4.45	2	248
4.15	5	171
3.38	1	22
3.13	2	190

* Officers highlighted in red were sometimes assigned to beat 2A

Chart 7, disparity index for officers working in 2012



Descriptives 2012	
Mean	2.32
σ	1.54
Skew	1.99

Table 22, officers, disparity index values and beats for 2012

Odds Ratio	Beat	Stops
9.33	2	55
5.59	2-A	261
4.76	5	52
4.37	2	266
4.29	3	96
4.22	1	144
4.16	2	313
3.90	5	139
3.82	2	218
3.76	†	112
3.61	2	199
3.50	‡	26
3.38	4	461
3.38	2	282

* Officers highlighted in red were sometimes assigned to beat 2A

† investigator, ‡ deidentified

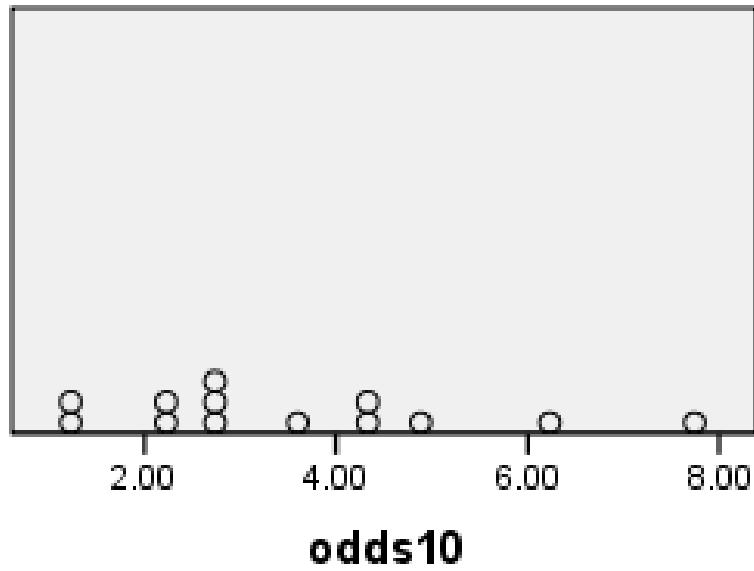
The disparity index data for 2010 – 2012 show a clear pattern. The mean disparity index values for each year are appreciably higher than those from 2005 – 2007 (see Appendix D HMLM section for a statistical analysis of differences). An examination of individual officers with the highest disparity index values (greater than three) shows that the majority of these officers were assigned to beat-two or beat-five.

Summary of 2005 – 2012 Analyses so far:

- Levels of disproportionality among ICPD officers were comparatively low in 2005 – 2007
- Levels of disproportionality significantly increased in 2010 and remained stable in 2011 and 2012 (see appendix D).
- In general, officers assigned to beat-two or beat-five demonstrated the highest levels of disproportionality in 2010 – 2012 traffic stops.

Next, we look more closely at beat-two and beat-five officers' disparity index values for 2010 – 2012.

Chart 8, disparity index for beat 2 officers working in 2010



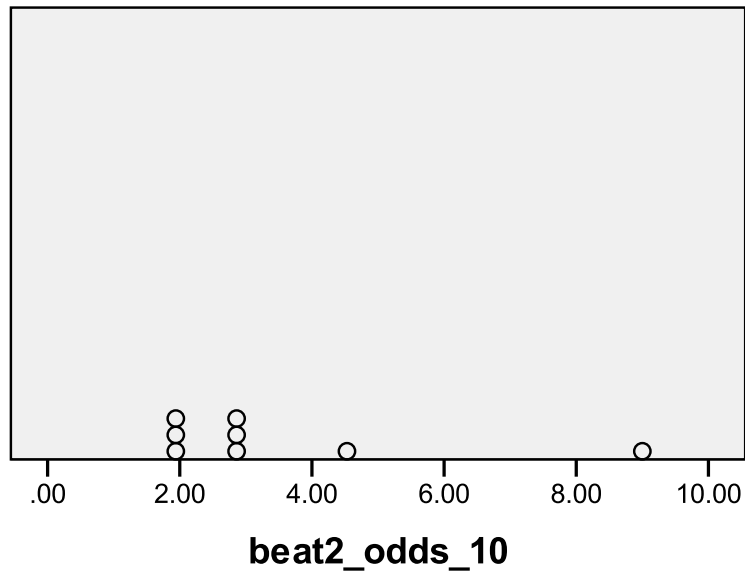
Descriptives 2010 beat 2	
Mean	3.89
σ	1.83
Skew	.48

Table 23, officers, disparity index values for beat 2 in 2010*

Odds Ratio	Beat	Stops
7.41	2-A	186
6.15	2-A	69
6.03	2-A	137
4.91	2-A	266
4.42	2-A	367
4.22	2	47
3.60	2	35
2.76	2	196
2.66	2-A	269
2.33	2	102
2.12	2	291
1.75	2	159
1.29	2	183

* Officers highlighted in red were sometimes assigned to beat 2A

Chart 9, disparity index for beat 5 officers working in 2010



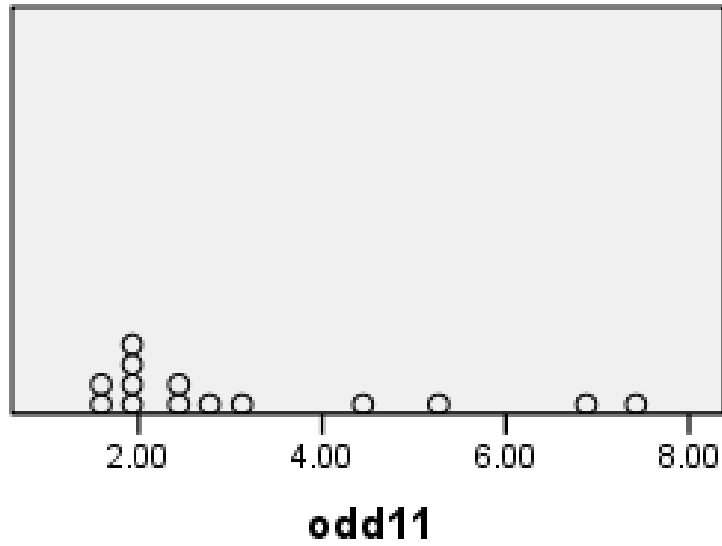
Descriptives 2010 beat 5	
Mean	3.69
σ	2.50
Skew	1.55

Table 24, officers, disparity index values for beat 5 in 2010

Odds Ratio	Beat	Stops
9.00		70
4.53		233
3.06		323
2.79		283
2.66		35
2.2		56
2.12		189
1.68		918

Analyses show that in 2010 the disparity index values for officers assigned to work beat 2-A were higher than other beat-two officers who were not designated to work solely in this area.

Chart 10, disparity index for beat 2 officers working in 2011



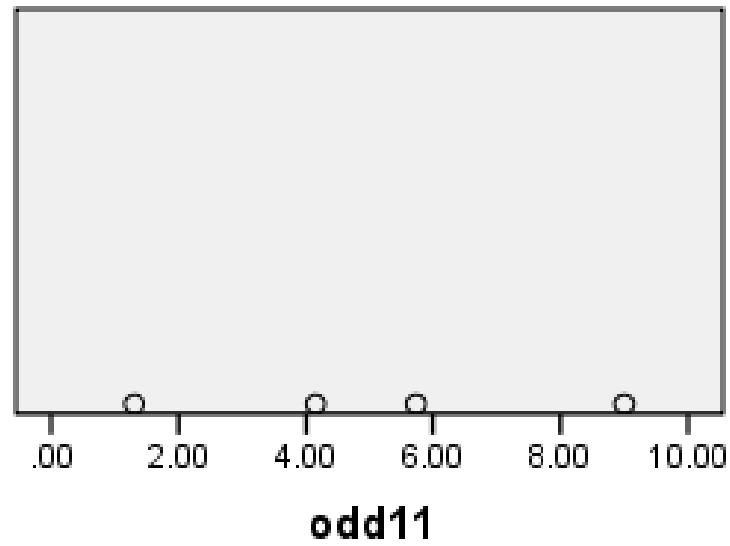
Descriptives 2011 beat 2	
Mean	3.26
σ	1.96
Skew	1.15

Table 25, officers, disparity index values for beat 2 in 2011*

Odds Ratio	Beat	Stops
7.427948	2-A	418
6.879581	2-A	337
5.273438	2	203
4.445783	2	248
3.12766	2	190
2.616279	2	333
2.595092	2	210
2.273684	2	238
2.076923	2	128
2.076923	2	80
1.979253	2	294
1.774038	2	249
1.738636	2	210
1.431818	2	204

* Officers highlighted in red were sometimes assigned to beat 2A

Chart 11, disparity index for beat 5 officers working in 2011



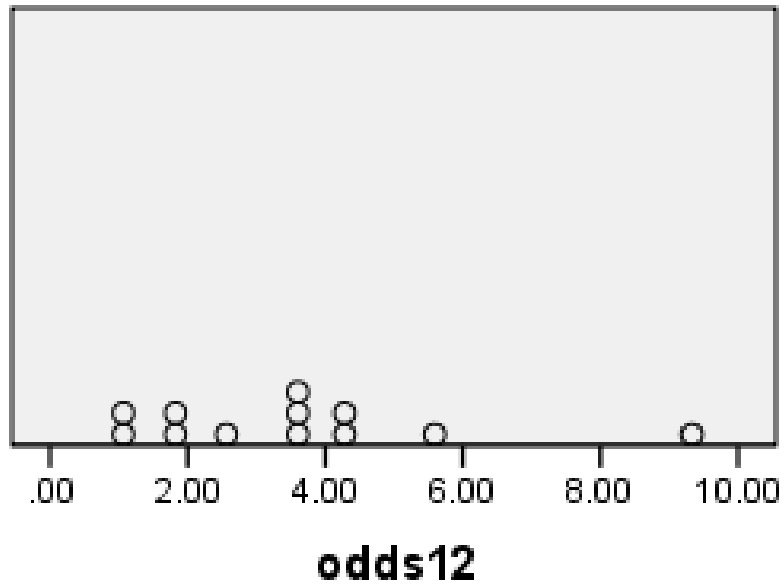
Descriptives 2011 beat 5	
Mean	5.04
σ	3.21
Skew	.107

Table 26, officers, disparity index values for beat 5 in 2011

Odds ratio	Beat	Stops
9.0	22	
5.73	18	
1.30	142	
4.15	171	

Again the 2011 data make clear that the disparity index values for beat 2-A officers were higher than the ratios for beat-two officers not designated to work beat 2-A and the values for some beat-five were also higher than other beat-two officers.

Chart 12, disparity index for beat 2 officers working in 2012



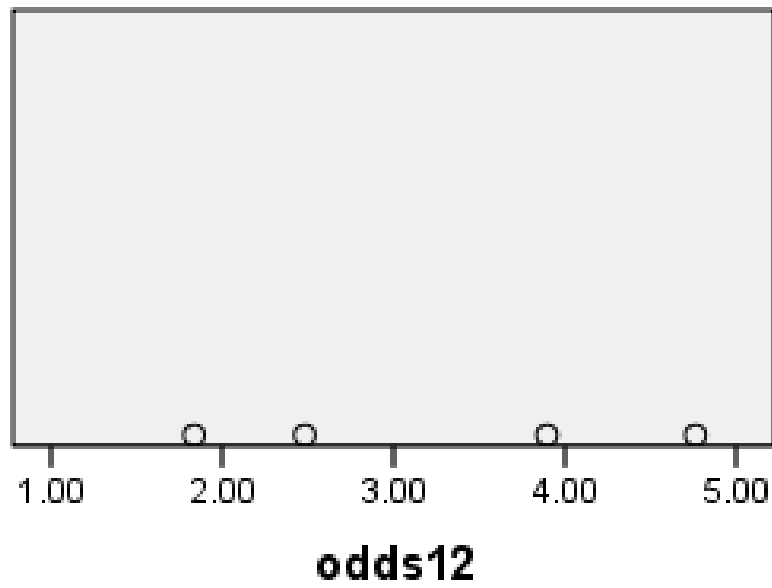
Descriptives 2012 beat 2	
Mean	3.55
σ	2.29
Skew	1.25

Table 27, officers, disparity index values for beat 2 in 2012

Odds Ratio	Beat	Stops
9.33	2	55
5.59	2-A	263
4.37	2	270
4.16	2	315
3.82	2	219
3.61	2	202
3.38	2	284
2.56	2	293
1.94	2	126
1.69	2	171
1.10	2	302
1.02	2	149

* Officers highlighted in red were sometimes assigned to beat 2A

Chart 13, disparity index for beat 5 officers working in 2012



Descriptives 2012 beat 5	
Mean	3.24
σ	1.32
Skew	.089

Table 28, officers, disparity index values for beat 5 in 2012

Odds Ratio	Beat	Stops
4.76		52
3.90		139
2.48		74
1.84		59

Summary of 2010 – 2012

ICPD traffic stop disproportionality for 2010-2012 data increased in comparison with 2005 – 2007 levels. The analyses suggest that much of this increase stemmed from an intensification of focused patrols in an area of southeast Iowa City characterized by higher minority-resident concentrations than other areas of town. This location is known as beat 2-A and was implemented as a patrol area in 2010. Since then, a small number of officers have been assigned to patrol only this beat. Additionally, evidence suggests that beat-five officers (especially street crime action team or SCAT officers) have frequently focused their patrols in this area. SCAT officers are tasked with patrolling high crime areas.

Data for individual officers shows that in general, the disparity index values for officers assigned to beat 2-A and many beat-five SCAT officers are higher than the values for officers not designated to work solely in this area of town. As noted previously, the percent of minority drivers and residents in beat 2-A is considerably higher than in other areas of town. **Consequently, the 10% baseline value used to calculate individual officer disparity index values is not valid for officers whose patrol areas are limited to this beat.** In fact, using the 10% baseline for officers whose patrol areas are circumscribed by beat 2-A would significantly inflate their disparity index values.

However, it's also important to emphasize that several officers not assigned to beat 2-A or SCAT demonstrated high levels of disproportionality in comparison to their colleagues. Although many of these officers were assigned to beat-two, some were assigned to beats located in other areas of the city.

It's also important to mention that not all beat-two or beat-five officers demonstrated high levels of disproportionality in traffic stops in comparison to colleagues. In fact, the disparity index values for roughly one half of all beat-two and beat-five officers were lower than 3.0.

Knowing that some beat-two officers exhibited disparity index values while others did not begs an important question. Why the difference? Two possibilities seem reasonable. First, perhaps beat-two officers with low values tended to avoid the locations on their beat with high minority concentrations (like beat 2-A) and simply focused their attention elsewhere. If so, these officers would be making traffic stops solely in locations where baseline values for minority drivers were lower. Or second, perhaps although not specifically assigned to beat 2-A, the beat-two officers with higher disparity index values may have focused their attention on the small area known as beat-2A which is located within their beat (perhaps because they believed crime was more likely to occur in 2-A). More analysis is needed to adjudicate between these two possibilities. However, in order to effectively evaluate the likelihood of each possibility it is necessary to know the precise location of each traffic stop made by officers working in beat-two. This information is needed to determine if officers with higher disparity index values were stopping cars more frequently in beat 2-A than other officers. As noted above, this type of analyses is not possible with these data because exact locations of stops were not provided.

Chapter 3 Outcome Data Analyses

In this chapter we examine traffic stops outcomes by looking for disproportionality in citations, searches, arrests and seizures. The analyses include both univariate odds ratios and multivariate regression techniques (see appendix A for detailed logistic regression. See Appendix C for detailed univariate odds ratio analyses).

Outcome analysis provides information about the consequence of a stop. In basic terms, it tells us what happened to drivers once they were stopped. Our focus is on whether minority drivers were more likely to receive some sort of sanction (like a ticket) than white/Asian drivers. Assessments include analyses for citations, arrests, search requests and *hit rates*—or the rate that a seizure of contraband or evidence occurred during a consent search.

Unlike the analyses for traffic stops, an investigation of stop outcomes is not dependent on population baseline characteristics. Outcome assessment simply compares two or more groups using the proportion of traffic stops as the comparison benchmark. So as an example, let's say a given officer stopped ten drivers all for the same offense—running a red light. Here the benchmark is the ten stops. Let's also say that five of these drivers were white/Asian and five were minority members. The analysis simply compares the officer's outcomes to the stop baseline. Since in this example five drivers from each demographic violated the law, we'd expect the officer to issue an equal number of tickets to each group. However, if the officer issued only one ticket to white/Asian drivers but five to minority drivers, this disparity may suggest bias.

In nearly all instances however, the situation is not as simple as the example above. Officers do not generally stop drivers for just one type of offense. Instead, officers usually stop drivers for a variety of reasons, including moving violations, equipment violations, reasonable suspicion and so forth. This adds a degree of complexity to the analyses. Multivariate statistical techniques like logistic regression and HMLM are useful in these contexts. These techniques enable researchers to statistically control (or set aside) potential explanatory variables that are not of interest.

The tables below present summary data for the odds ratio analyses, appendix A provides tables from logistic regression analyses for outcomes.

Our presentation strategy is as follows. Immediately below we present an example of a complete odds ratio analyses of data from 2005 to illustrate the process. Following this we present a summary table of the final results for all years followed by a discussion of the findings. A detailed analysis of odds ratios for all years can be found in appendix C.

2005 Outcomes

Citations

Citations	No	Yes	Total	Percent of Stops
Minority	831	530	1361	14%
W & A	4592	4044	8636	86%
Total	5423	4574	9997	100%

* 5 cases missing data

2005 Odds Ratio for citations = .724 (1.38)

Received Citations	No	Yes
Minority Percent Cited	61%	39%
W & A Percent Cited	53%	47%

Interpretation: in 2005 given that a citation was issued, the odds were 1.35 times higher that a white/Asian driver would receive a ticket than would a minority driver.

Arrests

Arrests	No	Yes	Total
Minority	1230	131	1361
W & A	8288	348	8636
Grand Total	9518	479	9997

* 5 cases missing data

2005 Odds Ratio for arrests = 2.54

Arrests	No	Yes
Minority Percent Arrested	90%	10%
W & A Percent Arrested	96%	4%

Interpretation: given that an arrest was made, the odds were 2.5 times greater that a minority driver would be arrested during a traffic stop than would a W & A driver in 2005.

Searches

Consent Request	No	Yes	Total
Minority	1299	61	1360
W & A	8479	157	8636
Grand Total	9778	218	9996

* 6 cases missing data

2005 Odds Ratio for consent search requests = 2.54

Consent Search Requests	No	Yes
Minority Percent Requested	96%	4%
W & A Percent Requested	98%	2%

Interpretation: given that a search request was made, the odds were 2.5 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2005.

2005 Odds Ratio for hit rates = .624 (1.60)

Search Hits	No	Yes	Total
Minority Hits	54	7	61
W & A	130	27	157
Grand Total	184	34	218
Minority Hits	89%	11%	
W & A Hits	83%	17%	

Interpretation: given that an item was seized, compared to W & A drivers, the odds were 2.5 times greater that an officer would request a search from a minority driver during a traffic stop in 2005; however in the same year the odds were 1.60 times greater that an officer would seize evidence or contraband as a result of the search requested of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests but when voluntary searches were conducted, the hit rates were higher when requested from W & A drivers.

A summary table for each year of the study follows. See appendix C for individual tables for the data analyzed during 2005 -2012.

Summary Table of Outcomes

Odds ratios for outcomes by year

Citations	Minority Odds
2005	0.72
2006	0.67
2007	0.86
2010	1.18
2011	1.38
2012	1.44
Arrests	----
2005	2.54
2006	2.82
2007	2.61
2010	3.08
2011	3.18
2012	2.55
Search Requests	----
2005	2.54
2006	3.42
2007	5.62
2010	2.75
2011	3.89
2012	2.44
Hit Rates	----
2005	0.62
2006	1.20
2007	0.34
2010	0.44
2011	0.78
2012	0.87

Stop Outcome Summary

The purpose of the analyses of stop *outcomes* was to evaluate disproportionality in citations, arrests, consent searches and seizures from consent searches. The univariate odds ratio analyses showed consistent patterns—Iowa City officers disproportionately arrested and asked for consent to search minority drivers across all years of the study. On average the odds were about 2.80 times greater that minority drivers would be arrested on a traffic stop in comparison to others. Likewise, the odds were roughly 3.45 times greater that ICPD officers would request a search from minority drivers compared to others, this despite “hit rates” that were actually higher for non-minority drivers. Results also suggest that white/Asian and minority drivers were ticketed at similar rates. Multivariate logistic regression show similar results. The regression odds ratios are similar in size to those from univariate analyses even after controlling for officer’s race, officer’s gender, officer’s years of service, officer’s duty assignment, the time of day, moving violation, equipment violation and the driver’s gender.

It’s important to emphasize that across most years of the study the hit rates that resulted from consent searches were actually lower for minority drivers than for a white/Asian driver. So although officers were more likely to ask minority drivers for permission to search, they were more successful in seizing contraband and evidence from white/Asian drivers.

A final word about searches: We recently surveyed officers to check compliance and accuracy of the inputting of search request data. The results suggest that ICPD officers were inconsistent in entering information about search requests. Specifically, roughly 50% of officers correctly input each search request made. These officers input data each time they made a search request. However, about 50% of the officers incorrectly entered this information. Instead of entering a request each time an attempt was made, these officers input a search request only after being granted consent for the search by the driver. Moreover, it is not possible to know which type of search requests are present for a given search in this data set. This information should be considered when interpreting search request information.

A final word about arrests: the findings show that across the study period the odds were greater that a minority driver would be arrested on traffic stop than a white/Asian driver. However, caution should be used when interpreting this result because important control variables could not be included in logistic regression models. Most importantly, information was not available for the reason for arrest during a traffic stop. Consequently, it is unknown whether minority drivers were more likely to be arrested for low discretion offenses such as bench warrants, driving while under suspension and operating while intoxicated. Officers have very little discretion when deciding whether to affect an arrest for these types of offenses. It was not possible to test for differences in offending rates between racial groups for these types of offenses—which could theoretically account for some of the observed disproportionality—because the data set does not include this information.

Final Summary

This study looked for disproportionality in traffic stops made by the Iowa City Police Department during 2005, 2006, 2007, 2010, 2011 and 2012—more than 60,000 stops. The investigation analyzed two broad categories of discretionary police conduct: (i) a made traffic stop and (ii) the outcome or disposition of a stop. The methodology used to analyze ICPD traffic stops employed a driver-population baseline fashioned from roadside observations, census data and school enrollment information. The observational portion of the baseline centered on observations from people who surveyed traffic in Iowa City to determine the race and gender of drivers on the roads. These observers monitored traffic at various times between 2007 and 2013 and made roughly 25,000 total observations. The methodology used in assessing ICPD officers' traffic stop data is straight forward. It centered on identifying differences between the PD's traffic stop information and the baseline. Any difference between baseline values and police data signified disproportionality.

The results of baseline analyses suggested that roughly 10% of the drivers on Iowa City roads were minority members during the study period. Results also show that between 2005 and 2007 levels of disproportionality in ICPD stop data were comparatively low. During this time-period, roughly 15% of the Iowa City Police Department's traffic stops involved minority drivers.

However, disproportionality significantly increased in 2010 and then remained stable through 2012. Analyses show that in 2010 the percentage of minority drivers stopped by ICPD officers increased to roughly 19% and remained near this level in 2011 and 2012. The analyses also show that the minority-driver baseline remained constant during this time-frame.

A close examination of ICPD patrol practices suggests that the increase in disproportionality stemmed from an intensification of directed patrols in a portion of southeast Iowa City. After a review of various sources it seems likely that the Iowa City Police Department modified patrol procedures following an increase in violent crime in the city in 2008 and 2009. These modifications included the establishment of a new patrol beat located in southeast Iowa City in an area with a higher minority resident concentration than other areas of town. This beat—called "2-A" is rather small. It consists of an area no larger than few blocks and is geographically much smaller than other ICPD beats. However, the minority baseline in beat 2-A is significantly higher than in other Iowa City beats.

Individual officer analyses indicate that the officers exhibiting the most disproportionality in traffic stops were frequently assigned to patrol areas located on the southeast side of Iowa City, or were "float" officers who were tasked with patrolling high crime areas. Both groups of officers tended to stop higher proportions of minority drivers than did most of their colleagues. Officers assigned to patrol the small 2-A beat also stopped higher proportions of minority drivers than did other officers. However, for these officers this result should be discounted because of the higher minority baselines in this area. Consequently, higher proportions of minority stops for beat 2-A officers do not necessarily indicate disproportionality or bias.

The examination of stop *outcomes* assessed disproportionality in citations, arrests, consent searches and *hit-rates* or seizures from consent searches. Univariate odds ratio analyses showed consistent patterns—Iowa City officers disproportionately arrested and (consent) searched minority drivers. On average across all years of the study the odds were about 2.80 times greater that minority drivers would be arrested on a traffic stop in comparison to others. Likewise, the odds were roughly 3.45 times greater that ICPD officers would request a search from minority drivers compared to others, this despite hit

rates that were actually on average higher for non-minority drivers. Findings also suggest that minority drivers and others were ticketed at equivalent rates. Multivariate logistic regression analyses show parallel results. The regression odds ratios were similar in size to those from univariate analyses even after controlling for officer's race, officer's gender, officer's years of service, officer's duty assignment, the time of day, moving violation, equipment violation and the driver's gender.

Care should be used when evaluating findings for arrest outcomes. Several important control variables were not available for inclusion in logistic regression models. Consequently, it's not possible to evaluate whether disproportionality in arrest rates was a product of differential offending rates between demographic categories. Likewise, it is important to emphasize that the number of cases used for analyses of consent search requests and seizures was much smaller than the number of cases used in analyses of other stop- outcome variables. This small "n" should be taken into consideration when evaluating results.

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Appendix A
Logistic Regression Analyses of Stop Outcomes

2005 Logistic Regression Analyses (minority coded as 0)

Citations	B	S.E.	Exp(B)
Officer's race*	-0.638	0.172	0.529
Officer's gender*	0.505	0.115	1.657
Years of service*	0.03	0.003	1.031
Assignment*	0.01	0.003	1.011
Daytime stop*	1.605	0.048	4.976
Moving violation	0.025	0.074	1.025
Equip violation*	-0.714	0.077	0.49
Male driver	0.071	0.047	1.073
W & A driver	-0.028	0.067	0.972
Constant	-1.11	0.22	

* $p < .01$

Arrests	B	S.E.	Wald	Exp(B)
Officer's race **	-0.62	0.246	6.359	0.538
Officer's gender*	0.554	0.281	3.893	1.741
Years of service**	-0.02	0.007	7.455	0.98
assignment	0.007	0.006	1.22	1.007
Daytime stop	-1.687	0.132	163.483	0.185
Moving violation	-0.184	0.155	1.405	0.832
Equip violation**	-0.484	0.162	8.969	0.616
Male driver**	0.49	0.109	20.076	1.632
W & A driver**	-0.747	0.111	44.956	0.474
Constant	-1.644	0.406	16.436	

** $p < .01$, * $p < .05$

Consent Request	B	S.E.	Wald	Exp(B)
Officer's race	17.241	3.23E+03	0	3.08E+07
Officer's gender**	-0.991	0.211	22.026	0.371
Years of service**	-0.117	0.015	62.443	0.889
Assignment	0.012	0.008	2.02	1.012
Daytime stop**	-0.792	0.159	24.939	0.453
Moving violation*	-0.494	0.221	4.993	0.61
Equip violation	0.138	0.22	0.395	1.148
Male driver**	0.531	0.16	10.943	1.7
W & A driver**	-0.582	0.158	13.582	0.559
Constant	-18.613	3.23E+03		

** $p < .01$, * $p < .05$

Interpretation: the results of logistic regression are consistent with odds ratio analyses. Even after controlling for several important alternative explanations, results show that in comparison to W & A drivers, the odds were essentially equal that minority drivers would receive a ticket. However, the odds were greater minority drivers would be arrested (2.11) and have an officer ask to search the vehicle (1.78).

2006 Logistic Regression Analyses (minority coded as 0)

Citations	B	S.E.	Exp(B)
Assignment***	-.1299	.0165	.878
Daytime stop***	1.348	.0149	3.851
Moving violation*	.128	.063	1.137
Equip violation***	-.555	.0633	.574
Male driver	-.005	.0408	.994
W & A driver***	.221	.0555	1.246
Constant	-.6634	.0954	

* $p < .05$. *** $p < .001$

Arrests	B	S.E.	Exp(B)
Assignment	-.031	.0301	.964
Daytime stop***	-1.258	.0996	.248
Moving violation***	-1.308	.1291	.270
Equip violation***	-1.04	.1306	.352
Male driver***	.3724	.0971	1.451
W & A driver***	-0.8583	.0971	.4238
Constant	-.8981	.1741	

*** $p < .001$

Consent Request	B	S.E.	Exp(B)
Assignment**	-.121	.0431	.885
Daytime stop***	-.590	.1093	.554
Moving violation*	.374	.167	1.454
Equip violation***	.838	.167	2.312
Male driver***	.953	.137	2.595
W & A driver***	-1.092	.111	.335
Constant	-3.28	.249	

*** $p < .001$, ** $p < .01$, * $p < .05$

Interpretation: the results of logistic regression are consistent with odds ratio analyses. Even after controlling for several important alternative explanations, results show that in comparison to W & A drivers, the odds were slightly greater that a white/Asian driver would receive a ticket (1.24) but the odds were greater that a minority driver would be arrested (2.33) and have an officer ask to search the vehicle (2.98).

2007 Logistic Regression (*minority code as 1*)

Citations	B	S.E.	Exp(B)
Officer's race	-0.348	0.225	0.706
Officer's gender**	0.704	0.145	2.021
Years of service**	0.062	0.004	1.064
Assignment*	-0.028	0.012	0.972
Daytime stop**	1.127	0.069	3.087
Moving violation**	0.616	0.107	1.851
Equip violation	0.095	0.108	1.1
Male driver	-0.014	0.063	0.986
W & A driver**	0.262	0.091	1.3
Constant	-2.744	0.199	

* $p < .5$, ** $p < .01$

Arrest	B	S.E.	Exp(B)
Officer's race	-0.634	0.732	0.53
Officer's gender	-0.207	0.26	0.813
Years of service**	-0.049	0.01	0.952
Assignment	-0.047	0.033	0.954
Daytime stop**	-1.069	0.155	0.343
Moving violation**	-0.712	0.224	0.491
Equip violation**	-0.999	0.232	0.368
Male driver**	0.853	0.162	2.346
W & A driver**	0.747	0.153	2.111
Constant	-1.625	0.411	

* $p < .5$, ** $p < .01$

Search Request	B	S.E.	Exp(B)
Officer's race	0.33	0.632	1.391
Officer's gender**	-1.07	0.358	0.343
Years of service**	0.035	0.016	1.036
Assignment*	0.031	0.013	1.032
Daytime stop**	-1.7	0.287	0.183
Moving violation	-0.203	0.368	0.816
Equip violation**	-0.177	0.373	0.838
Male driver**	1.531	0.356	4.623
W & A driver**	1.501	0.228	4.484
Constant	-4.374	0.584	

* $p < .5$, ** $p < .01$

Interpretation: the results of logistic regression are consistent with odds ratio analyses. Even after controlling for several important alternative explanations, results show that in comparison to W & A drivers, the odds were roughly equal minority driver would receive a ticket (1.3) but the odds were

greater that a minority driver would be arrested (2.11) and have an officer ask to search the vehicle (4.84).

2010 Logistic Regression (*minority coded as 0*)

Citations	B	S.E.	Exp(B)
Officer's race	0.047	0.118	1.048
Officer's gender	-0.066	0.138	0.936
Years of service**	0.033	0.003	1.033
Assignment**	-0.01	0.001	0.99
Daytime stop**	-0.867	0.054	0.42
Moving violation**	0.329	0.087	1.39
Equip violation**	-0.332	0.087	0.718
Male driver	0.047	0.048	1.049
W & A driver**	-0.423	0.059	0.655
Constant	-0.777	0.201	

* $p < .05$; ** $p < .01$

Arrests	B	S.E.	Exp(B)
Officer's race**	-0.63	0.198	0.532
Officer's gender	0.185	0.306	1.203
Years of service**	-0.021	0.008	0.979
Assignment	0	0.003	1
Daytime stop**	0.657	0.118	1.93
Moving violation**	-1.54	0.148	0.214
Equip violation**	-1.72	0.149	0.179
Male driver*	0.276	0.113	1.318
W & A driver**	-0.951	0.109	0.386
Constant	-1.025	0.393	

* $p < .05$; ** $p < .01$

Search Requests	B	S.E.	Exp(B)
Officer's race*	1.775	0.714	5.902
Officer's gender	-0.104	0.319	0.901
Years of service*	-0.021	0.01	0.979
Assignment	-0.001	0.003	0.999
Daytime stop**	0.817	0.15	2.264
Moving violation**	-0.796	0.217	0.451
Equip violation**	-0.636	0.21	0.53
Male driver**	0.721	0.154	2.057
W & A driver**	-0.856	0.135	0.425
Constant	-4.856	0.818	

* $p < .05$; ** $p < .01$

Interpretation: the results of logistic regression are consistent with odds ratio analyses. Even after controlling for several important alternative explanations, results show that in comparison to W & A drivers, the odds were greater that minority drivers would receive a ticket (1.52) would be arrested (2.6) and would have an officer ask to search the vehicle (2.354).

2011 Logistic regression (*minority coded as 0*)

Citation	B	S.E.	Exp(B)
Officer's race	0.154	0.089	1.166
Officer's gender**	0.677	0.168	1.967
Years of service**	0.031	0.003	1.031
Assignment **	-0.016	0.001	0.984
Daytime stop**	0.454	0.051	1.574
Moving violation**	0.209	0.08	1.232
Equip violation**	-0.782	0.082	0.458
Male driver**	-0.003	0	0.997
W & A driver**	-0.583	0.056	0.558
Constant	-1.597	0.21	

** $p < .01$

Arrests	B	S.E.	Exp(B)
Officer's race	-0.318	0.19	0.728
Officer's gender	0.266	0.346	1.305
Years of service	0.012	0.007	1.012
Assignment	-0.001	0.002	0.999
Daytime stop**	-1.035	0.115	0.355
Moving violation**	-1.149	0.14	0.317
Equip violation**	-1.099	0.139	0.333
Male driver*	0.003	0.001	1.003
W & A driver**	-0.928	0.1	0.395
Constant	-1.334	0.422	

** $p < .01$

Search requests	B	S.E.	Exp(B)
Officer's race*	0.76	0.326	2.139
Officer's gender	0.049	0.346	1.05
Years of service	-0.008	0.008	0.992
Assignment	-0.003	0.003	0.997
Daytime stop**	-0.646	0.127	0.524
Moving violation	-0.012	0.179	0.988
Equip violation	0.016	0.177	1.016
Male driver	0.001	0.001	1.001
W & A driver**	-1.284	0.112	0.277
Constant	-3.134	0.514	

* $p < .05$; ** $p < .01$

Interpretation: the results of logistic regression are consistent with odds ratio analyses. Even after controlling for several important alternative explanations, results show that in comparison to W & A drivers, the odds were greater that minority drivers would receive a ticket (1.79) be arrested (2.53) and have an officer ask to search the vehicle (3.61).

2012 Logistic Regression (*minority coded as 0*)

Citations	B	S.E.	Exp(B)
Officer's race	0.083	0.108	1.087
Officer's gender**	0.589	0.121	1.803
Years of service	0.005	0.003	1.005
Assignment**	-0.01	0.002	0.99
Daytime stop**	0.649	0.055	1.914
Moving violation**	-0.371	0.087	0.69
Equip violation**	0.363	0.088	1.437
Male driver**	0.181	0.048	1.199
W & A driver**	-0.49	0.056	0.613
Constant	-2.104	0.197	

** $p < .01$

Arrest	B	S.E.	Exp(B)
Officer's race**	-0.506	0.183	0.603
Officer's gender	0.443	0.329	1.557
Years of service	0.003	0.009	1.003
Assignment	0.002	0.003	1.002
Daytime stop**	-1.318	0.137	0.268
Moving violation**	-1.161	0.14	0.313
Equip violation**	-1.367	0.146	0.255
Male driver**	0.425	0.104	1.529
W & A driver**	-0.764	0.1	0.466
Constant	-1.286	0.411	

** $p < .01$

Search Request	B	S.E.	Exp(B)
Officer's race**	1.564	0.583	4.776
Officer's gender	0.413	0.39	1.511
Years of service	0.014	0.011	1.014
Assignment	-0.01	0.007	0.99
Daytime stop**	-1.234	0.18	0.291
Moving violation	-0.345	0.21	0.708
Equip violation	-0.103	0.21	0.902
Male driver**	0.661	0.142	1.937
W & A driver**	-0.754	0.128	0.471
Constant	-4.998	0.744	

** $p < .01$

Interpretation: the results of logistic regression are consistent with odds ratio analyses. Even after controlling for several important alternative explanations, results show that in comparison to W & A drivers, the odds were greater that minority drivers would receive a ticket (1.63) be arrested (2.15) and have an officer ask to search the vehicle (2.12).

Appendix B

Logistic Regression Analyses: Comparing Racial Differences in Traffic Stops 2005-2007 to 2010-2012

Logistic Regression for all Beats Comparing 2005-2007 to 2010-2012

Driver's Race=DV	B	S.E.
Year of Study***	-.3059	.024
Male Driver***	-.195	0..24
Assignment	.003	.0009
Moving violation***	.523	.0398
Equip violation	.098	.0400
Male driver***	0.071	0.047
Daytime Stop***	.277	.0243
Constant	1.413	
n	53100	

*** $p < .001$ (DV=minority driver coded as 0) Note: year of study is an indicator variable with 2010-2012 coded as 1

Logistic Regression for individual beats comparing 2005-2007 to 2010-2012

Driver's Race=DV	B	S.E.	Exp(B)	n
Year of Study Beat-1	0.0841	0.0576	1.087	9821
Year of Study Beat-2***	-0.5121	0.0258	0.599	16314
Year of Study Beat-3***	-0.5791	0.0564	0.560	11592
Year of Study Beat-4	-0.1371	0.0627	0.871	8212
Year of Study Beat-5***	-0.3569	0.0893	0.693	4876

*** $p < .001$ (DV=minority driver coded as 0) Note: year of study is an indicator variable with 2010-2012 coded as 1. The control variables used are the same as the analysis above but are not listed in this table

Appendix C
Detailed Information for Odds Ratio Analyses

2005 Citations

Citations	No	Yes	Total	Percent of Stops
Minority	831	530	1361	14%
W & A	4592	4044	8636	86%
Total	5423	4574	9997	100%

* 5 cases missing data

2005 Odds Ratio for citations = .724 (1.38)

Received Citations	No	Yes
Minority Percent Cited	61%	39%
W & A Percent Cited	53%	47%

Interpretation: in 2005 given that a citation was issued, the odds were 1.35 times higher that a white/Asian driver would receive a ticket than would a minority driver.

Arrests

Arrests	No	Yes	Total
Minority	1230	131	1361
W & A	8288	348	8636
Grand Total	9518	479	9997

* 5 cases missing data

2005 Odds Ratio for arrests = 2.54

Arrests	No	Yes
Minority Percent Arrested	90%	10%
W & A Percent Arrested	96%	4%

Interpretation: given that an arrest was made, the odds were 2.5 times greater that a minority driver would be arrested during a traffic stop than would a W & A driver in 2005.

Searches

Consent Request	No	Yes	Total
Minority	1299	61	1360
W & A	8479	157	8636
Grand Total	9778	218	9996

* 6 cases missing data

2005 Odds Ratio for consent search requests = 2.54

Consent Search Requests	No	Yes
Minority Percent Requested	96%	4%
W & A Percent Requested	98%	2%

Interpretation: given that a search was requested, the odds were 2.5 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2005.

2005 Odds Ratio for hit rates = .624 (1.60)

Search Hits	No	Yes	Total
Minority Hits	54	7	61
W & A	130	27	157
Grand Total	184	34	218
Minority Hits	89%	11%	
W & A Hits	83%	17%	

Interpretation: compared to W & A drivers, the odds were 2.5 times greater that an officer would request a search from a minority driver during a traffic stop in 2005; however in the same year the odds were 1.60 times greater that an officer would find evidence or contraband as a result of the search requested of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests but when voluntary searches were conducted, the hit rates were higher when requested from W & A drivers.

2006 Outcomes

Citations

Citations	No	Yes	Total	Percent of Stops
Minority	1137	718	1855	15%
W & A	5302	4928	10230	85%
Total	6439	5646	12085	100%

2006 Odds Ratio for citations = .67 (1.49)

Received Citations	No	Yes
Minority Percent Cited	62%	38%
W & A Percent Cited	52%	48%

Interpretation: in 2006 given that a citation was issued, the odds were 1.49 times higher that a white/Asian driver would receive a ticket than would a minority driver.

Arrests

Arrests	No	Yes	Total
Minority	1675	180	1855
W & A	9855	375	10230
Grand Total	11530	555	12085

2006 Odds Ratio for arrests = 2.82

Arrests	No	Yes
Minority Percent Arrested	90%	10%
W & A Percent Arrested	96%	4%

Interpretation: given that an arrest was made, the odds were 2.8 times greater that a minority driver would be arrested during a traffic stop than would a W & A driver in 2006.

Searches

Consent Request	No	Yes	Total
Minority	1714	141	1855
W & A	9990	240	10230
Grand Total	11530	381	12085

* 6 cases missing data

2006 Odds Ratio for consent search requests = 3.42

Consent Search Requests	No	Yes
Minority Percent Requested	92%	8%
W & A Percent Requested	98%	2%

Interpretation: given that a search request was made, the odds were 3.4 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2006.

2006 Odds Ratio for hit rates = 1.20

Search Hits	No	Yes	Total
Minority Hits	121	20	141
W & A	211	29	240
Grand Total	332	49	381
Minority Hits	86%	14%	
W & A Hits	87%	13%	

Interpretation: compared to W & A drivers, the odds were 3.4 times greater that an officer would request a search from a minority driver during a traffic stop in 2006 and in the same year the odds were 1.20 times greater that an officer would find evidence or contraband as a result of the search requested of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests and when voluntary searches were conducted, the hit rates were higher when requested from minority.

2007 Outcomes

Citations

Citations	No	Yes	Total	Percent of Stops
Minority	690	493	1183	13.8%
W & A	3949	3383	7332	86.2%
Total	4639	3876	8515	100%

2007 Odds Ratio for citations = .979 (1.02)

Received Citations	No	Yes
Minority Percent Cited	58%	42%
W & A Percent Cited	54%	46%

Interpretation: given that a citation was issued, the odds were 1.02 times greater that W & A drivers would receive a citation during a traffic stop than would a minority driver in 2007.

Arrests

Arrests	No	Yes	Total
Minority	1085	98	1183
W & A	7073	259	7332
Grand Total	8158	357	8515

2007 Odds Ratio for arrests = 2.47

Arrests	No	Yes
Minority Percent Arrested	92%	8%
W & A Percent Arrested	96%	4%

Interpretation: given that an arrest was made, the odds were 2.47 times greater that a minority driver would be arrested during a traffic stop than would a W & A driver in 2007.

Searches

Consent Request	No	Yes	Total
Minority	1120	63	1183
W & A	7249	83	7332
Grand Total	8369	146	8515

2007 Odds Ratio for consent search requests = 5.67

Consent Search Requests	No	Yes
Minority Percent Requested	95%	5%
W & A Percent Requested	99%	1%

Interpretation: given that a search request was made, the odds were 5.67 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2007.

2007 Odds Ratio for hit rates = .735 (1.37)

Search Hits	No	Yes	Total
Minority Hits	53	10	63
W & A	66	17	83
Grand Total	119	270	146
Minority Hits	84%	16%	
W & A Hits	80%	20%	

Interpretation: compared to W & A drivers, the odds were 5.67 times greater that an officer would request a search from a minority driver during a traffic stop in 2007; however in the same year the odds were 1.37 times greater that an officer would find evidence or contraband as a result of the search requested of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests but when voluntary searches were conducted, the hit rates were higher when requested from W & A drivers.

2010 Outcomes

Citations

Citations	No	Yes	Total	Percent of Stops
Minority	1680	619	2299	19.2%
W & A	7395	2288	9683	80.8%
Total	9075	2907	11982	100%

2010 Odds Ratio for citations = 1.19

Received Citations	No	Yes
Minority Percent Cited	73%	27%
W & A Percent Cited	76%	24%

Interpretation: given that a citation was issued, the odds were 1.19 times greater that minority drivers would receive a citation during a traffic stop than will a W & A driver in 2010.

Arrests

Arrests	No	Yes	Total
Minority	2124	175	2299
W & A	9435	248	9683
Grand Total	11559	423	11982

2010 Odds Ratio for arrests = 3.13

Arrests	No	Yes
Minority Percent Arrested	92%	8%
W & A Percent Arrested	97%	3%

Interpretation: given that an arrest was made, the odds were 3.13 times greater that a minority driver would be arrested during a traffic stop than a W & A driver in 2010.

Searches

Consent Request	No	Yes	Total
Minority	2190	109	2299
W & A	9509	174	9683
Grand Total	11699	283	11982

2010 Odds Ratio for consent search requests = 2.72

Consent Search Requests	No	Yes
Minority Percent Requested	95%	5%
W & A Percent Requested	98%	2%

Interpretation: given that a search request was made, the odds were 2.72 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2010.

Search Hits (Requests)	No	Yes	Total
Minority Hits	96	13	109
W & A	137	37	174
Grand Total	233	50	283
Minority Hits	88%	12%	
W & A Hits	79%	21%	

2010 Odds Ratio for hit rates = .50 (1.99)

Interpretation: compared to W & A drivers, the odds were 2.72 times greater that an officer would request a search from a minority driver during a traffic stop in 2010; however in the same year the odds were 1.99 times greater that an officer would find evidence or contraband as a result of the search of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests but when voluntary searches were conducted, the hit rates were higher when requested from W & A drivers.

2011 Outcomes

Citations

Citations	No	Yes	Total	Percent of Stops
Minority	1627	679	2306	18.0%
W & A	8093	2450	10543	82.0%
Total	9720	3129	12849	100%

*485 cases missing data

2011 Odds Ratio for citations = 1.38

Received Citations	No	Yes
Minority Percent Cited	71%	29%
W & A Percent Cited	77%	23%

Interpretation: given that a citation was issued, the odds were 1.38 times greater that minority drivers would receive a citation during a traffic stop than would a W & A driver in 2011.

Arrests

Arrests	No	Yes	Total
Minority	2111	195	2306
W & A	10245	298	10543
Grand Total	12356	493	12849

* 485 cases missing data

2011 Odds Ratio for arrests = 3.18

Arrests	No	Yes
Minority Percent Arrested	92%	8%
W & A Percent Arrested	97%	3%

Interpretation: given that an arrest was made, the odds were 3.18 times greater that a minority driver would be arrested during a traffic stop than a W & A driver in 2011

Searches

Consent Request	No	Yes	Total
Minority	2144	162	2306
W & A	10342	201	10543
Grand Total	12486	363	12849

*485 cases missing data

2011 Odds Ratio for consent search requests = 3.89

Consent Search Requests	No	Yes
Minority Percent Requested	93%	7%
W & A Percent Requested	98%	2%

Interpretation: given that a search request was made, the odds were 3.89 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2011.

Search Hits (Requests)	No	Yes	Total
Minority Hits	109	53	162
W & A	124	77	201
Grand Total	233	130	363
Minority Hits	67%	33%	
W & A Hits	62%	38%	

2011 Odds Ratio for hit rates = .78 (1.27)

Interpretation: compared to W & A drivers, the odds were 2.89 times greater that an officer would request a search from a minority driver during a traffic stop in 2011; however in the same year the odds were 1.27 times greater that an officer would find evidence or contraband as a result of the search requests of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests but when voluntary searches were conducted, the hit rates were higher when requested from W & A drivers.

2012 Outcomes

Citations

Citations	No	Yes	Total	Percent of Stops
Minority	1681	597	2278	19.0%
W & A	7736	1914	9650	81.0%
Total	9417	2511	11928	100%

*439 cases missing data

2012 Odds Ratio for citations = 1.44

Received Citations	No	Yes
Minority Percent Cited	74%	26%
W & A Percent Cited	80%	20%

Interpretation: given that a citation was issued, the odds were 1.44 times greater that minority drivers would receive a citation during a traffic stop than will a W & A driver in 2012.

Arrests

Arrests	No	Yes	Total
Minority	2097	181	2278
W & A	9334	316	9650
Grand Total	11431	497	11928

* 439 cases missing data

2012 Odds Ratio for arrests = 2.55

Arrests	No	Yes
Minority Percent Arrested	92%	8%
W & A Percent Arrested	97%	3%

Interpretation: given that an arrest was made, the odds were 2.55 times greater that a minority driver would be arrested during a traffic stop than a W & A driver in 2012.

Searches

Consent Request	No	Yes	Total
Minority	2176	102	2278
W & A	9468	182	9650
Grand Total	11644	284	11928

*439 cases missing data

2012 Odds Ratio for consent search requests = 2.44

Consent Search Requests	No	Yes
Minority Percent Requested	96%	4%
W & A Percent Requested	98%	2%

Interpretation: given that a search request was made, the odds were 2.44 times greater that an officer would request to search a car driven by a minority member than a car driven by a W & A driver in 2012.

Search Hits (Requests)	No	Yes	Total
Minority Hits	35	67	102
W & A	57	125	182
Grand Total	92	192	284
Minority Hits	34%	66%	
W & A Hits	31%	69%	

2012 Odds Ratio for hit rates = .87 (1.15)

Interpretation: compared to W & A drivers, the odds were 2.44 times greater that an officer would request a search from a minority driver during a traffic stop in 2012; however in the same year the odds were 1.15 times greater that an officer would find evidence or contraband as a result of the search requested of W & A drivers as opposed to minority drivers. In plain terms minority drivers were subjected to more search requests but when voluntary searches were conducted, the hit rates were higher when requested from W & A drivers.

APPENDIX D

HMLM

We use hierarchical multivariate linear modeling (HMLM) to investigate the effects of time on levels of disproportionality in individual officers' disparity indexes. Statistical hierarchies are common in data and usually consist of units grouped at different levels. For the present analysis, this structure came about because the same individuals were measured on more than one occasion during the study period. Consequently, we treat multiple observations on each officer as nested within the officer.

When measurements are repeated on the same participants the measurement repetitions (called occasions) are *level-1* units and the participants are *level-2* units. We model a linear relationship between the year of the study and a given officer's disparity index. This simple model is appropriate for data like ours because there are only a few observations per officer and the time period between observations is short (Bryk & Raudenbush, 1992). The model takes the form of a linear growth model, where the year of the study is treated as an age metric. This variable is grand-mean-centered so it describes the difference in years between a given year of the study period and the midpoint of the study (2009). Both the intercept and the time parameter vary at level-2 as a function of characteristics of the officer.

Equation 1 specifies the level-1 model for this investigation.

$$Y_{ij} = \pi_{0j} + \pi_{1j}(\text{time})_{ij} + \pi_{2j}(\text{beat}) + r_{ij} \quad (1)$$

This equation models a linear relationship between time elapsed during the study period, the beat or area of the town and a given officer's disparity index. In equation 1, the symbol Y_{ij} represents the value of officer j 's disparity index at time i , π_{0j} is the average level of disparity across occurrences for a given officer, it represents the officer's effect on the disparity index, π_{1j} is the change in levels of disparity across occurrences that is due to time period for a given officer, π_{2j} is the change in levels of disparity across occurrences that are due to the area of town an officer is working, this is a time varying covariate and r_{ij} is the unique effect of a given occurrence for a particular officer. We assume that the errors are independent and normally distributed with a common variance. Equations 2, 3 and 4 model how the stage of an officer's career mediates the effect of time on disparity. The seniority variable is defined as the maximum number of years an officer has worked on the street at the end of the study period.¹⁰

$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{years of service})_j + u_{0j} \quad (2)$$

At level-2 the average level of disparity across occurrences of the study for an officer (π_{0j}) is a function of the average level of disparity across all officers (β_{00}); plus the amount of disparity that is a function of the officers' years of service, (β_{01}); and a unique individual component of disparity that is due to a given officer (u_{0j}) this is formulated as the difference between the officer's mean change in disparity and β_{00} .

¹⁰ It was unreasonable to include other officer level characteristics such as age or race for this analysis because nearly all the officers were white males. This limited the variance in the data and made estimates unreliable.

$$\pi_{1j} = \beta_{10} + \beta_{11}(\text{years of service})_j + u_{1j} \quad (3)$$

The parameter β_{10} represents the average **change** in disparity across all officers that is a function of the time period of the study. This coefficient denotes the effect of time on disparity. The parameter β_{11} is the amount of change in disparity that results from an interaction between an officer's years of service and time period. Finally, u_{1j} is an error term representing the unique portion of the change in disparity that is due to a given officer.

$$\pi_{2j} = \beta_{20} + u_{2j} \quad (4)$$

The parameter β_{20} represents the average **change** in disparity across all officers that is a function of area of town. This coefficient denotes the effect of a beat on disparity. The parameter u_{2j} is an error term representing the unique portion of the change in disparity that is due to a given officer.

The table below gives the estimated fixed effects results of HMLM analysis. The table includes results of estimates of three models: (i) a control model consisting of the intercept parameter only, (ii) a restricted model consisting of the intercept and slope parameters and (iii) a full model that includes all the parameters.

Summary for HMLM analysis

Fixed Effects	Model 1	Model 2	Model 3
	Coefficients	Coefficients	Coefficients
Net Effects Officers (intercept)			
β_{00}	0.582 (0.057)***	0.566(0.059)***	0.818(0.099)***
β_{01}	--	--	-0.0229(0.006)***
Net Effects of Time (slope)			
β_{10}	--	0.317(0.080)***	0.579(0.163)***
β_{11}	--	--	-0.0223(0.0104)*
β_{20}	-	0.0421(0.058)	0.0412(0.057)
Deviance	376.8	366.2	349.1
n	76	76	76

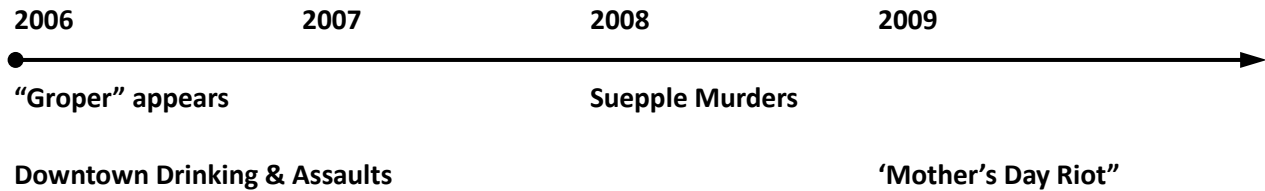
* $p < .05$, ** $p < .01$, *** $p < .001$

The results of HMLM suggest the following: changes in time during the study period are associated with significant increases in levels of disproportionality, as reflected by officers' disparity indexes net of area of town. In the control model the estimated mean disparity across all officers (β_{00}) is significantly different from zero at 0.582. This result serves as a rough and ready indicator that can be used to see if there is traffic stop disparity in the data, β_{00} 's value suggests there is. Model 2, the restricted model, is used as a preliminary test of a change in disparity levels across occasions of the study. This model is analogous to independent t-tests, but this test takes into consideration the nested nature of the data. Results show that that the intercept β_{00} equals 0.566 and is significantly different from zero. This value represents the logged average level of disparity across all officers when the difference between the year of the study and the grand mean equals zero (the mid-point of the study). The slope parameter β_{10} is also significant. This implies that the level of disparity increases over the occasions of the analysis, for a unit change in year of the study the logged disparity index increases 0.317 units. The slope

parameter β_{20} which indicates the net effects of a beat or area of town on officers' disparity indexes is not significant. Finally, the full model tests the net effects of time and officer seniority on disparity. The two of the three slope parameters in this model are significant. β_{10} , represents the degree to which the average level of disparity changes as a function of time across occasions of the study, a year change in time brings a 0.818 unit increase in the average logged level of disparity units net the other variables. β_{11} , is the coefficient for an interaction effect. It indicates whether the stage of an officer's career mediates the effect of time on disparity. Results show that a one year increase in seniority reduces the effect of time by 0.022 logged units. This implies that the year of the study (before or after 2009) had more impact on less experienced officers than veteran officers. The parameter β_{20} is not significant. This suggests that the area an officer worked did not have a net significant effect on levels of disproportionality. Finally, the analysis for the intercept coefficients, β_{00} and β_{01} show that net baseline levels of disparity across officers are not affected by job seniority. The value of β_{00} , indicates that a significant amount of disparity remains even after the effects of seniority and news stories are taken into account. The significant parameter β_{01} , implies that seniority has a net effect on levels of disparity, meaning that less senior officers have higher disparity indexes than more seasoned officers regardless of the time period of the study.

Appendix E

Adapted Time Line of Some Important Events Affecting ICPD during Study Period



October 2006, increasing September 2007 with an arrest made July 19, 2008 —The "Groper," an assailant who sneaks up behind women, pushes them down, and gropes them before fleeing. Almost 40 cases reported. "Law-enforcement authorities have stressed that they're pouring resources into solving these cases."

"Local police deal with open cases, some take years," Daily Iowan, REGINA ZILBERMINTS, MARCH 11, 2009, <http://www.dailyiowan.com/2009/03/11/Metro/10537.html>

2006-2010—Downtown underage drinking and violence crackdown. "In response to a string of random and seemingly unrelated assaults involving men in the downtown area, Iowa City and UI police are collaborating to assign more officers to the Pedestrian Mall, where many attacks have occurred.

"Violence tests police," BY REGINA ZILBERMINTS | APRIL 15, 2009 7:38 AM, <http://www.dailyiowan.com/2009/03/11/Metro/10537.html>

2008—Suepple Murders. "Iowa banker facing federal embezzlement and money laundering charges murdered his wife and four young children in their home before killing himself. . . ."

"Indicted Banker's Desperate Murder-Suicide," ABC News, DAVID SCHOETZ March 26, 2008, <http://abcnews.go.com/US/story?id=4521545&page=1>

May, 2009—The "Mothers Day Riot." Violent fights that broke out in Southeast Iowa City later dubbed the Mother's Day riot.

A1 Number of crime stories published in *IC Press Citizen* during the study period*