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Chicago Police Department Use of Force Data Analysis Project: Results

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This report is the final in a series of deliverables from the Chicago Police Use of Force Data Analysis Project undertaken by the research team at the University of Texas at San Antonio and the University of Pennsylvania. All findings and conclusions are those of the authors.

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BACKGROUND

In January 2019, the City of Chicago entered into a policing Consent Decree in *State of Illinois v. City of Chicago*, N.D. Ill. 17-cv-06260. The Consent Decree sets forth numerous requirements for the Chicago Police Department (CPD) to reform training, policies, and practices to ensure constitutional, effective, and transparent policing. The Consent Decree also requires data collection, analysis, and reporting to provide for ongoing, sustainable self-assessment and data-driven, evidence-based decision making by CPD leadership.

In partial fulfillment of the requirements of the consent decree, researchers from the University of Texas at San Antonio and the University of Pennsylvania (Research Team) was engaged by the CPD and tasked with developing a best practice methodology for analyzing CPD Tactical Response Report (TRR) and related data for patterns and trends in force used against specific demographic groups in Chicago. The *Proposed Methodology Report* went through several drafts and was accepted by CPD and the Independent Monitoring Team (IMT) in its final form on August 15, 2024.

The current report serves as the main analytic work product outlined in the *Proposed Methodology Report* and details the results from the Research Team's analysis of CPD use of force and related data spanning a four year period – January 2020 through December 2023. The analyses contained herein are designed to identify potential patterns of disparity in how force was used by CPD against identifiable racial, ethnic, and gender-based subpopulations in Chicago from 2020 – 2023. The report uses scientifically appropriate benchmarks and statistical modeling to investigate the nature and extent of those disparities, if any, and to examine relevant subject, officer, situational, and area-level factors that are associated with or predictive of observed disparities. This report is offered to CPD and the IMT to assist the parties in their ongoing efforts to monitor compliance with the terms of the Consent Decree.

DATA AND MEASURES

The following primary data sources were used in the analysis:

- TRR data (2020-2023)
- Arrest data (2017-2023)[1]
- Crime data (2020-2023)[2]
- Suspect data (2020-2023)[3]
- 911 data (2020-2023)

[1] Arrest data are included from 2017-2019 to calculate 2-year arrest histories for all subjects in the TRR data.

[2] Crime data includes crimes reported to the Chicago Police Department.

[3] Suspect data includes information on crime suspects provided to the CPD by crime victims or witnesses.

- Mission deployment data (2020-2023)
- Officer assignment data (2020-2023)
- Census data (American Community Survey) estimates for 2022

The primary use of force data consisted of 16,196 tactical response reports (TRR data) completed by CPD officers between January 1, 2020, and December 31, 2023. These reports are structured to capture use of force information during an encounter with an individual where physical force was used by a CPD officer. The term *incident* is used to describe an encounter with a *subject* where force was used. Following the terminology from the TRR, the term *subject is used* to describe the individual against whom force was used.

By design, TRRs capture data on a single officer's use of force against a single subject. By policy, any CPD officer who uses physical force during an encounter is required to complete a TRR. About half of all use of force incidents involved two or more officers who used force against the subject listed on the TRR. Thus, the number of TRRs is greater than the number of unique incidents involving the use of force. Table 1 below summarizes the TRR data after cases with missing data were removed[4]:

Table 1: TRR Data

Data Category	Number of Cases
TRR Data	16,196
Unique use of force incidents/ Subjects against whom force was used	8,595
White	544
Black	6,310
Hispanic	1,347
Other Race	390
Males	6,864
Females	1,355
Single officer, single subject incidents	7,427
Multiple officer, single subject incidents	204

[4] There were a total of 16,205 TRRs in the data set obtained from the CPD. Nine TRRs were duplicates and were removed prior to the analysis. In addition, 3,367 TRRs contained no information on levels of force used by officers. CPD officers are required to complete a TRR in a variety of situations when they do not use force themselves, e.g. force is used *against* them by a subject or the officer or subject was injured or complained of injury. Data of this nature would have contributed to subject resistance or injury analyses. When aggregated to the reporting incident-level, there were 8,595 unique incidents of force. Various incidents were missing data (e.g. subject race, force, or resistance) across one or more fields of interest, leaving 7,179 incidents with complete data on all variables used in the analysis. We make full use of the available data whenever possible and remove incidents only when data are missing from a field being analyzed. Thus, the number of cases shown in the tables below varies somewhat depending upon how many incidents were missing data across the variables of interest.

Using the TRR data, a set of measures was constructed for analysis. These variables were grouped as *outcome of force events*, *incident characteristics*, *officer characteristics*, *subject characteristics*, *subject actions*, and *officer mitigation efforts*. The variables are shown in Table 2 below.

The TRR reports, 911 calls for service, arrests, crime suspects, police assignment, and police mission data were preprocessed and linked to the corresponding police beat. Monthly counts of TRRs, 911 calls for service, arrests, crime suspects, and police presence (assignment combined with missions) were also built in each police beat in Chicago.

Seven dependent variables were constructed to facilitate analysis (see Table 3 below). These include the maximum force used against a subject during a use of force incident and the maximum resistance used by the subject to avoid control. Force and resistance categories from the TRR were coded to correspond with the CPD Force Options Model (see Appendix A). Officer force levels were coded into the categories shown in Table 3, with verbal direction scored as level 1 force and the use of a gun as a level 5 force.

Likewise, subject resistance was coded to match the CPD Force Options Model. Note that subject compliance without the use of force does not result in the completion of TRR. Resistance was coded into the following categories shown in Table 3, with failure to follow directions scored as a level 1 resistance and level 5 reflecting resistance that was likely to cause death or serious injury to officers.

Table 2: Variable Fields

Outcome of Force Events	Incident Characteristics	Officer Characteristics	Subject Characteristics	Subject Actions	Officer Mitigation
Highest level of force (based on CPD continuum)	***Year and month of event***	***Patrol officer***	***Subject race/ethnicity***	***Man with Gun***	***Zone***
Total number of force and resistance actions by officers and subjects	***Time of day*** (daytime 6AM-6PM, nighttime 7PM-5AM)	***Officer rank*** (officer, sergeant, etc.)	***Highest level of subject resistance*** (based on CPD continuum)	***Pursuit Arrest***	***Movement***
Force factor (based on CPD continuum)[5]	***Police beat***	***CIT training***		***Attack, No Weapon***	***Tactical***
Subject injury	***Assignment type*** (call for service, on-view, other)	***Years on force***		***Deadly Force***	***Verbal***
Officer injury	***Indoors***	***Officer age***	***Subject arrest history score***[6]	***Did Not Follow Directions***	***Specialized***
	Member alone	***Officer race/ethnicity*** (Black, Hispanic, White, Other)	***Subject age***	***Fled***	***Additional Other***
	Reason for event (ambush, call for man with gun, traffic stop, pedestrian stop, force incident to arrest)	***Officer gender***	***Subject gender***	***Obtain Off Weapon***	
	Crime type (see below)		***Under the influence of alcohol/drugs***	***Physical Obstruction***	
	Arrest		***Mental illness/emotional disorder***	***Other Actions***	
			Known or perceived disability status	***Pulled Away***	
				Stiffened	

Crime Type: violent offenses, such as assault, battery, robbery, or weapons violation; resisting arrest, such as interference with officer; domestic, such as domestic battery-bodily harm; weapons offenses, such as aggravated assault firearm; other categories; non-specified.

[5] This is commonly referred to as the Force Factor in police research, which is highest force minus highest resistance (Terrill et al., 2003; MacDonald et al., 2003).

[6] Arrest history is based on arrests in the previous two years weighted by offense severity score (1-28) according to the Illinois Uniform Crime Reports hierarchy based on the charge type (Felony Criminal Offense, Misdemeanor Criminal Offense, Motor Vehicle Offense, License Offense, Public Order Offense, Utility Offense) and class (1, 2, 3, 4 degree; A, B, C, U, O, P, Q). The scores were reverse coded so that higher scores reflect more severity. Felony murder, for example, is scored with a value of 28 whereas improper vehicle license is scored with a value of 1.

Table 3: Force & Resistance Levels

Officer Force Levels	Level	Subject Resistance Levels
Member presence/verbal direction	1	Failure to follow or understand verbal direction*
Escort holds, wrist lock, armbar, control instrument, pressure point, handcuffs/restrains, LRAD (sup. app.), OC spray (sup. app.)	2	Verbal threats, stiffened/dead weight, physical obstruction
Open hand strike, takedown, push/redirection, Taser, control instrument, canine, OC spray, LRAD	3	Pulled away, grab/hold/restrain, wrestle/grapple
Elbow strike, closed hand/punch, knee strike, kick, baton, less lethal shotgun/impact munition	4	Imminent threat of battery, attack, strikes of any kind, mouth/teeth/spit, push/pull/shove, thrown object, attempt to obtain police weapon
Revolver, semi-auto piston, rifle, shotgun	5	Use of force likely to cause death or serious injury

*Level 1 only suspect resistance does not require a TRR record.

USE OF FORCE DESCRIPTIVE STATISTICS

The descriptive statistics shown in Table 4 below represent the average and variation (standard error) in each coded TRR measure overall and by race and ethnicity of subjects. Table 4 reflects the 16,196 use of force reports that occurred between 2020 and 2023 and includes an F statistic and associated *p* values. *P* values less than .05 indicate differences across racial and/or ethnic categories that are *not* likely to occur by chance. Statistical significance is represented by asterisks. As previously noted, all reports were weighted by the number of officers involved in each event. This ensures that incidents involving multiple officers, each of whom completed a TRR, are not treated as five separate use of force events. Based on this weighting procedure, the effective sample size was 7,179 use of force incidents after removing all cases with missing data (see Table 4 below).

Dependent Variables

Maximum force and resistance represent the highest levels used during an incident reported on a TRR. As noted, the use of force data were coded based on the maximum force used against a subject on a scale of 1 to 5 based on the CPD continuum. The subject and officer action variables represent the maximum number of force (officer) or resistance (subject) actions taken by the parties, recognizing that the TRR captures multiple categories for subject resistance and officer force that may occur in a single incident. The force factor variable represents net force minus resistance and is calculated by subtracting maximum resistance from maximum force in each encounter (force – resistance = force factor). Finally, officer injuries were coded 1 for injury and 0 for no injury; subject injuries were coded 1 for a *major injury* and 0 for all *minor or no injuries*.

On average, the maximum force used was 2.79 out of 5.0 compared to a maximum subject resistance of 3.54 out of 4.0. The average force factor, or the difference between the maximum force and maximum resistance, was -0.75. The data indicate that, on average, maximum force varies significantly across the racial/ethnic categories of subjects. Maximum resistance was lower for Black (3.53) subjects relative to Hispanic (3.56) and White (3.65) subjects (see Figure 1 below).

The descriptive data also indicate that officers engaged in slightly more use of force actions with Hispanic and White subjects relative to Black subjects. On average, subjects and officers were injured in 22 and 30 percent of use of force events, respectively. Injuries to subjects occurred at a significantly greater rate if the subject was Hispanic (26%), White (26%), or an Other (28%) race and ethnicity relative to being a Black (21%) subject. Consistent with these patterns, injuries were more common when officers confronted White (35%) subjects relative to Black (30%) subjects. These patterns suggest that subject resistance, number of actions, and officer and subject injuries are the least common when the subject is Black relative to other race and ethnic groups.

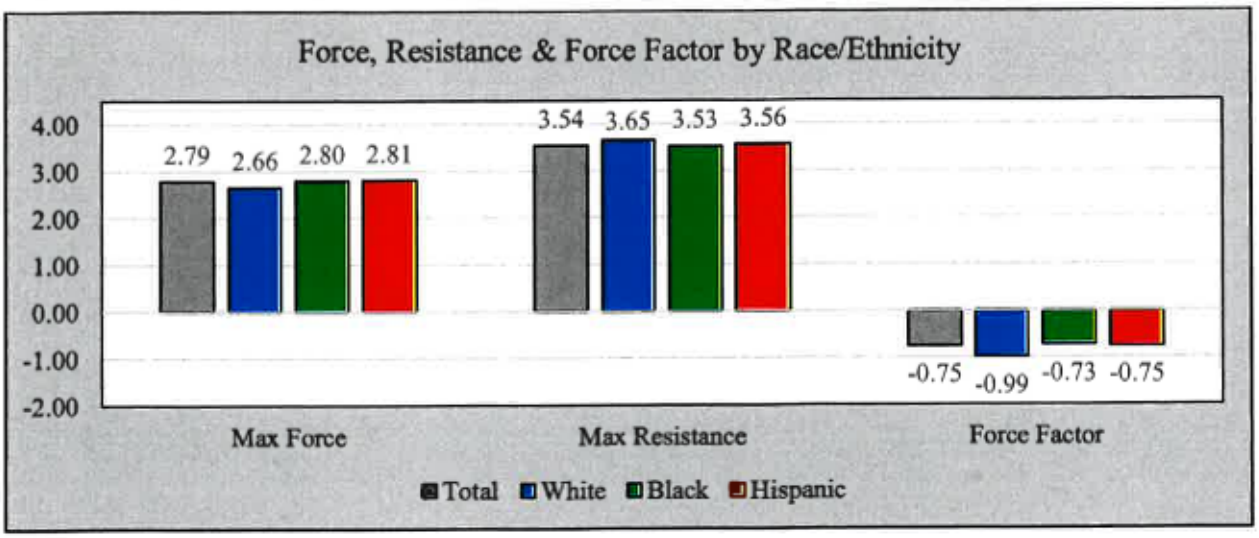
Table 4: Use of Force Descriptive Statistics

	Range		Total		White		Black		Hispanic		Other		F-test
	Min	Max	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	P
Dependent Variables													
Max Force	1	5	2.79	0.01	2.66	0.03	2.80	0.01	2.81	0.02	2.76	0.09	0.02**
Max Resistance	2	5	3.54	0.01	3.65	0.03	3.53	0.01	3.56	0.02	3.66	0.07	0.00***
Subject Actions	0	12	3.44	0.01	3.39	0.05	3.44	0.01	3.42	0.03	3.46	0.15	0.96
Officer Actions	0	9	1.68	0.01	1.71	0.05	1.67	0.01	1.75	0.03	1.76	0.13	0.01**
Force Factor	-4	3	-0.75	0.01	-0.99	0.04	-0.73	0.01	-0.75	0.03	-0.89	0.10	0.00***
Subject Injured	0	1	0.22	0.00	0.26	0.02	0.21	0.00	0.26	0.01	0.28	0.05	0.00***
Officer Injured	0	1	0.30	0.00	0.35	0.02	0.30	0.01	0.31	0.01	0.24	0.05	0.00***
Incident Characteristics													
Year	2020	2023	2021	0.01	2022	0.05	2022	0.01	2022	0.03	2021	0.14	0.00***
Month	1	12	6.61	0.03	6.45	0.13	6.63	0.04	6.58	0.08	6.85	0.38	0.10
Daytime	0	1	0.49	0.00	0.49	0.01	0.52	0.00	0.425	0.01	0.50	0.023	0.00***
Beat Number	1	277	126	0.76	176	2.80	115	0.85	155	1.82	176	9.40	0.00***
Call For Service	0	1	0.44	0.00	0.58	0.02	0.42	0.01	0.52	0.01	0.50	0.06	0.00***
On-view	0	1	0.44	0.00	0.31	0.02	0.47	0.01	0.37	0.01	0.40	0.06	0.00***
Other Call	0	1	0.10	0.00	0.10	0.01	0.10	0.00	0.10	0.01	0.08	0.03	0.15
Supervisor	0	1	0.01	0.00	0.02	0.01	0.01	0.00	0.01	0.00	0.02	0.02	0.00***
Indoor	0	1	0.27	0.00	0.40	0.02	0.26	0.00	0.27	0.01	0.38	0.06	0.00***
Alone	0	1	0.17	0.00	0.27	0.02	0.16	0.00	0.18	0.01	0.15	0.04	0.00***
Ambush	0	1	0.01	0.00	0.01	0.00	0.01	0.00	0.02	0.00	0.04	0.03	0.00***
Invest. Stop	0	1	0.22	0.00	0.09	0.01	0.24	0.00	0.17	0.01	0.14	0.04	0.00***
Traffic Stop	0	1	0.16	0.00	0.06	0.01	0.17	0.00	0.14	0.01	0.11	0.04	0.00***
Violent	0	1	0.06	0.00	0.08	0.01	0.06	0.00	0.07	0.01	0.07	0.03	0.00***
Resisting	0	1	0.12	0.00	0.09	0.01	0.12	0.00	0.12	0.01	0.23	0.05	0.04*
Domestic	0	1	0.25	0.00	0.28	0.02	0.24	0.00	0.29	0.01	0.33	0.05	0.00***
Weapon	0	1	0.19	0.00	0.05	0.01	0.21	0.00	0.16	0.01	0.07	0.03	0.00***
Other Charge	0	1	0.24	0.00	0.28	0.02	0.24	0.00	0.23	0.01	0.18	0.05	0.03*
No Charge	0	1	0.14	0.00	0.21	0.02	0.13	0.00	0.13	0.01	0.12	0.03	0.00***
Arrest	0	1	0.54	0.00	0.30	0.01	0.59	0.00	0.511	0.01	0.07	0.01	0.00**
Officer Characteristics													
Patrol	0	1	0.86	0.00	0.75	0.02	0.87	0.00	0.85	0.01	0.78	0.05	0.00***
Officer	0	1	0.87	0.00	0.81	0.02	0.88	0.00	0.86	0.01	0.82	0.05	0.00***
Sergeant	0	1	0.06	0.00	0.09	0.01	0.06	0.00	0.06	0.01	0.06	0.03	0.12
Other Rank	0	1	0.07	0.00	0.11	0.01	0.06	0.00	0.09	0.01	0.12	0.04	0.00***

CIT Training	0	1	0.24	0.00	0.28	0.02	0.23	0.00	0.23	0.01	0.25	0.05	0.00***
Unit	1	91	18.35	0.22	20.68	0.73	18.13	0.26	18.50	0.46	16.27	1.10	0.00***
Years of Service	-4	38	8.32	0.07	12.25	0.35	7.85	0.08	8.86	0.18	10.26	0.90	0.00***
Officer Age	22	67	35.74	0.08	39.95	0.38	35.21	0.09	36.34	0.21	38.79	0.99	0.00***
White Officer	0	1	0.42	0.00	0.54	0.02	0.41	0.01	0.43	0.01	0.50	0.06	0.00***
Black Officer	0	1	0.17	0.00	0.08	0.01	0.20	0.00	0.09	0.01	0.12	0.04	0.00***
Hispanic Officer	0	1	0.36	0.00	0.33	0.02	0.34	0.01	0.43	0.01	0.30	0.05	0.00***
Officer Sex	1	2	1.89	0.00	1.87	0.01	1.89	0.00	1.90	0.01	1.87	0.04	0.23
Subject Characteristics													
Arrest Score	0	530	29.64	0.42	17.52	1.49	31.51	0.49	26.34	1.02	16.33	3.76	0.00***
Subject Age	4	89	29.80	0.10	34.36	0.47	29.51	0.12	29.19	0.24	32.86	1.34	0.00***
Subject Gender	1	2	1.84	0.00	1.79	0.02	1.84	0.00	1.86	0.01	1.91	0.03	0.02*
Alcohol	0	1	0.22	0.00	0.37	0.02	0.17	0.00	0.41	0.01	0.39	0.05	0.00***
Mental Illness	0	1	0.14	0.00	0.33	0.02	0.13	0.00	0.14	0.01	0.27	0.05	0.00***
Disability	0	1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.09
Subject Actions													
Man with Gun	0	1	0.14	0.00	0.03	0.01	0.15	0.00	0.11	0.01	0.03	0.02	0.00***
Pursuit Arrest	0	1	0.21	0.00	0.12	0.01	0.22	0.00	0.18	0.01	0.18	0.04	0.00***
Attack, No Weapon	0	1	0.28	0.00	0.37	0.02	0.27	0.00	0.29	0.01	0.31	0.05	0.00***
Deadly Force	0	1	0.03	0.00	0.03	0.01	0.03	0.00	0.02	0.00	0.02	0.01	0.00***
Did Not Follow Directions	0	1	0.91	0.00	0.89	0.01	0.91	0.00	0.92	0.01	0.92	0.03	0.00***
Fled	0	1	0.31	0.00	0.19	0.02	0.34	0.01	0.24	0.01	0.16	0.04	0.00***
Obtain Off Weapon	0	1	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.02	0.02	0.38
Physical Obstruction	0	1	0.08	0.00	0.06	0.01	0.08	0.00	0.08	0.01	0.07	0.03	0.07
Other Actions	0	1	0.13	0.00	0.15	0.01	0.12	0.00	0.14	0.01	0.24	0.05	0.01**
Pulled Away	0	1	0.72	0.00	0.66	0.02	0.73	0.01	0.70	0.01	0.63	0.05	0.00***
Stiffened	0	1	0.57	0.00	0.53	0.02	0.58	0.01	0.57	0.01	0.60	0.06	0.00***
Officer Mitigation Actions													
Zone	0	1	0.22	0.00	0.28	0.02	0.22	0.00	0.24	0.01	0.24	0.05	0.00***
Movement	0	1	0.22	0.00	0.33	0.02	0.21	0.00	0.23	0.01	0.27	0.05	0.00***
Tactical	0	1	0.51	0.00	0.53	0.02	0.51	0.01	0.51	0.01	0.57	0.06	0.00***
Verbal	0	1	0.91	0.00	0.93	0.01	0.91	0.00	0.91	0.01	0.94	0.02	0.00***
Specialized	0	1	0.01	0.00	0.02	0.01	0.01	0.00	0.02	0.00	0.01	0.01	0.00***
Additional	0	1	0.68	0.00	0.62	0.02	0.69	0.01	0.67	0.01	0.57	0.06	0.00***
Other	0	1	0.03	0.00	0.04	0.01	0.02	0.00	0.03	0.00	0.02	0.02	0.05*
Observations (Percent)			16,196 (100%)		979 (6.0%)		12,016 (74.2%)		2,507 (15.5%)		694 (4.3%)		
Weighted N			7,179		473		5,492		1,162		52		

***p≤0.001, **p≤0.01, *p≤0.05; Note: Means and standard errors (se) are based on observations weighted by number of officers involved in a given subject event.

Figure 1: Force and Resistance by Subject Race/Ethnicity



Incident Characteristics

The descriptive data also indicate that 44% of use of force events were initiated by a call for service. Calls for service were higher for use of force events involving Hispanics (52%) and Whites (58%) relative to Black (42%) subjects. By contrast, on-view incidents were more common in use of force events involving Black subjects (47%) compared to White (31%) and Hispanic (37%) subjects. Supervisors were rarely involved in force events - only 1% of the time. Most of the use of force events happened outside (73%), with indoor force events most common for White (40%) subjects compared to other racial and ethnic groups. Officers were alone in 17% of use of force events, though being alone was significantly higher for White subjects (27%) compared to other groups. Traffic stops were the source of 16% of use of force events, and these were more common for Black (17%) and Hispanic (14%) subjects than they were for White (6%) subjects.

The crime type precipitating a use of force event predominately involved domestic situations (25%), 'other' charges (24%), or weapons violations (19%) while six percent of incidents were generated from a violent crime. Within each of these categories, the racial/ethnic composition of the subject varied with 'Other' subjects most frequent in domestic situations (33%) and Black subjects most common in weapon-based incidents (21%). Involvement in violence-based incidents varied slightly between White (8%), Black (6%) and Hispanic (7%) subjects.

Officer Characteristics

Eighty-six percent of the time officers were assigned to patrol when a use of force event occurred. An officer was significantly less likely to be on patrol when a use of force event involved a White (75%) relative to Black (87%) or Hispanic (85%) subjects. In terms of rank, most force events involved patrol officers (87%), though this was significantly less likely to be the case when the subject was White (81%) relative to other groups. Other ranks were, as a result, more common at 11% of the use of force events when the subject was White, compared to 6% and 9% of events

when the subjects were Black or Hispanic. Twenty-four percent of use of force events involved an officer with CIT training, and this was the most common when the subject was White (28%). On average, officers involved in use of force events had 8.3 years of service, though years of service were significantly higher when the subject was White (12.3 years), which is also reflected in officers being older by four years in events with White subjects.

Approximately 42% of use of force events involved White officers, and this was highest when the subject was White (54%). Black officers were involved in 17% of use of force events and were more likely to be involved in force with Black subjects (20%) relative to their share of subjects of other race and ethnic groups. Similarly, Hispanic officers were involved in 36% of use of force events and the most likely to be engaged in force with a Hispanic subject (43%) relative to their share of force with other race and ethnic groups.

Subject Characteristics & Actions

Subject characteristics show that on average individuals involved in use of force events had a criminal arrest history score of 29.6, with scores significantly higher for Black (31.5) and Hispanic (26.3) subjects relative to White (17.5) and Other (16.3) subjects. On average, subjects were 29.8 years of age at the time of force, though White subjects (34.24) were older compared to Black (29.5) and Hispanic (29.2) subjects. Subjects were noted as being intoxicated with alcohol in 22% of the use of force events, and this rate was significantly higher at 37-41% when the subject was Hispanic, White, or an Other category relative to being Black (17%). Mental illness cases were noted in 14% of the use of force events, and the rate was more than double for White (33%) and Other (27%) groups relative to Black and Hispanics subjects. Disability was rare, with less than 1% of cases or 27 incidents (a total of 42 reports had a noted case of disability) involving an individual with a disability.

In terms of subject actions, most use of force events involved a subject pulling away (72%), stiffening their body (57%), and not following CPD officer directions (91%). The variation by race and ethnicity in these subject actions is statistically significant but relatively small, showing differences of one to two percentage points between groups. In 28% of use of force events, the subject was reported to have attacked the officer without a weapon, and this was more common among Hispanic (29%), Other (31%), and White (37%) subjects than it was for Black (27%) subjects. Approximately 31% of use of force events involved a subject fleeing, and this was most common among Black (34%) subjects compared to other groups.

Officer Mitigation Efforts

In terms of mitigation efforts, officers report using zone, movement, tactical, and verbal mitigation efforts 22%, 22%, 51%, and 91% of the time respectively. Movement mitigation was the most common (33%) with White subjects. Officers noted using additional mitigation 68% of the time, and that this is the most common when the subject was Black (69%) and the least common when the subject was an Other (57%) category.

Overall, the description of the characteristics shows that the force factor, officer actions, and injuries to officers and subjects varies by the race and ethnicity of subjects. At the same time, there is also statistically significant variation by race and ethnicity of subjects based on the characteristics of the incident, officer, subject, the actions taken by both parties, and the location of the events. This variation underscores why it is important when estimating racial differences in use of force events to statistically control for the confounding effects these factors may play in explaining the disparities.

GENERAL PORTRAIT OF USE OF FORCE

The analysis of the TRR data reveals key patterns in the use of police force across various subpopulations, providing a comprehensive view of how force was applied based on subject resistance levels, subject and officer characteristics, incident characteristics, and location by police beat and district. Initially, a general portrait of the use of force events over time and how they vary by the maximum level of officer force and subject resistance and the number of actions taken by officers and subjects is presented.

Figure 2 shows the monthly trends in use of force by race and ethnicity of subjects from 2020 to 2023, along with the 99.5% confidence interval (CI) reflecting +/- 3 standard deviations around the monthly average. The figure makes it clear that June and July 2020 (post-Floyd protest months) were outliers for Other and Black subjects, and to a lesser extent for White subjects. The June 2020 Other outlier is a result of subjects without a known identity being engaged in use of force with CPD officers during summer 2020 protests and riots. Toward the end of 2023, the monthly rates of force for Black and Hispanic subjects were significantly higher than the expectation from the average monthly rate, indicating that force events rose significantly toward the end of 2023 for the two ethnic groups most likely to be subjects of use of force. Given the monthly changes in force during 2020-2023, all multivariate analyses estimated will control for the month-year of observations.

Figure 2: Use of Force by Race/Ethnicity by Month

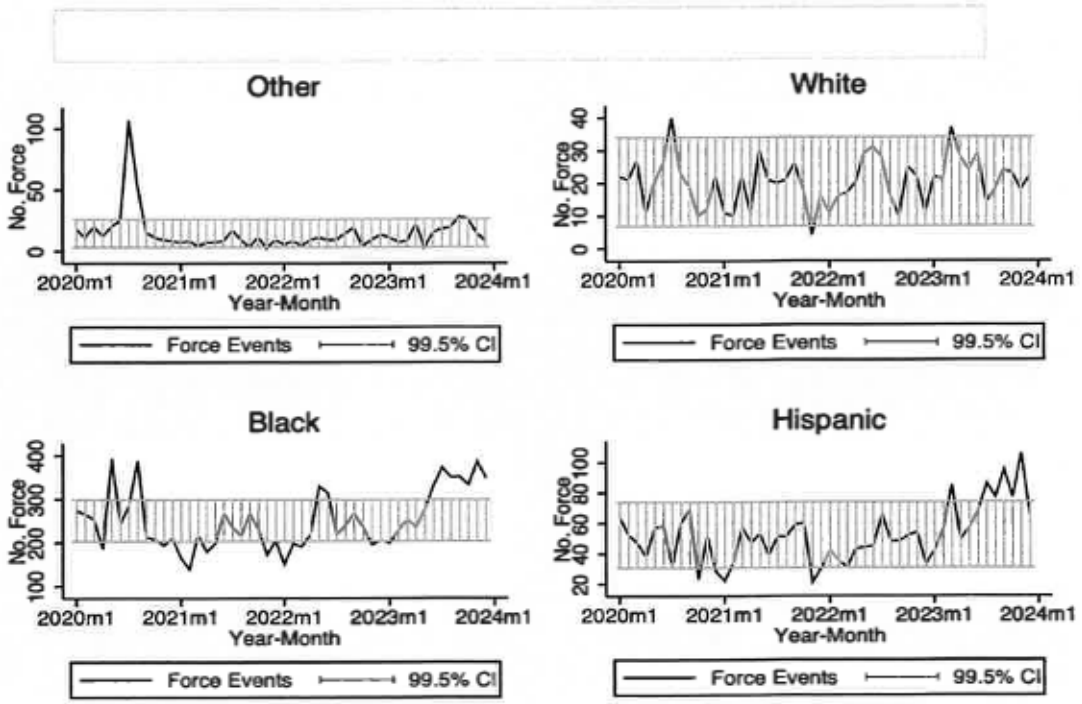


Table 5 and Figures 3 and 4 below show the overall summary for the 16,196 use of force reports recorded between 2020 and 2023. When weighted based on the number of officers involved in an event, the total number of unique force events is equivalent to 8,054 incidents. Variables measured with multiple categories (e.g., maximum level of force) are summarized using the percentage of cases falling into each category. The maximum level of force used within a case was most frequently Level 3 (62.2%), followed by Level 2 (19.2%) and Level 4 (8.2%). The use of Level 1 (7.7%) and Level 5 (2.7%) force was the most infrequent. The F-test at the bottom of the table indicates that the percentage differences across groups were more than predicted by chance alone. This general pattern was also true for each race and ethnic group, apart from those labeled as Other, who had a significantly higher percentage of Level 1 (20.0%) and Level 5 (26.1%) uses of force compared to Black, Hispanic, and White subjects. This pattern may reflect the greater share of this group involved in the summer protests of 2020. However, it is important to underscore that the Other group represents only 242 use of force events or 3.0% of events.

The most common level of subject resistance was Level 4 (53.9%) and Level 3 (34.8%). Level 1 (6.3%) and Level 5 (4.9%) resistance were the least common. The general pattern of maximum resistance was similar across race and ethnic groups, though it varied significantly for the group labeled Other. "Others" had a substantially higher percentage of events with Level 4 (58.6%) or Level 5 (23.1%) resistance compared to Black, Hispanic, and White subjects. Hispanic (57.6%) and White (61.1%) subjects also had a higher percentage of Level 4 compared to Black (52.4%) subjects.

Table 5: Maximum Use of Force and Resistance Levels by Subject Race/Ethnicity

	Total		White		Black		Hispanic		Other	
	N	%	N	%	N	%	N	%	N	%
Force										
1	621	7.7	58	11.1	419	6.9	96	7.7	49	20.0
2	1,545	19.2	107	20.7	1,192	19.8	221	19.2	25	10.3
3	5,007	62.2	312	60.2	3,791	63.0	817	62.2	88	35.9
4	663	8.2	39	7.5	506	8.4	100	8.2	19	7.7
5	219	2.7	2	0.6	115	1.9	37	2.7	64	26.1
Totals	8,054		518		6,022		1,270		244	
F-Test: 68.75**										
Resistance										
2	525	6.3	36	6.7	378	6.1	98	7.4	13	6.3
3	2,894	34.8	153	28.3	2,299	36.9	417	31.4	25	12.1
4	4,480	53.9	329	61.1	3,263	52.4	766	57.6	121	58.6
5	408	4.9	21	3.9	291	4.7	49	3.7	248	23.1
Totals	8,305		539		6,230		1,330		206	
F-Test: 31.61**										

***p≤0.001, **p≤0.01, *p≤0.05

Figure 3: Percentage of Maximum Force Levels by Subject Race/Ethnicity

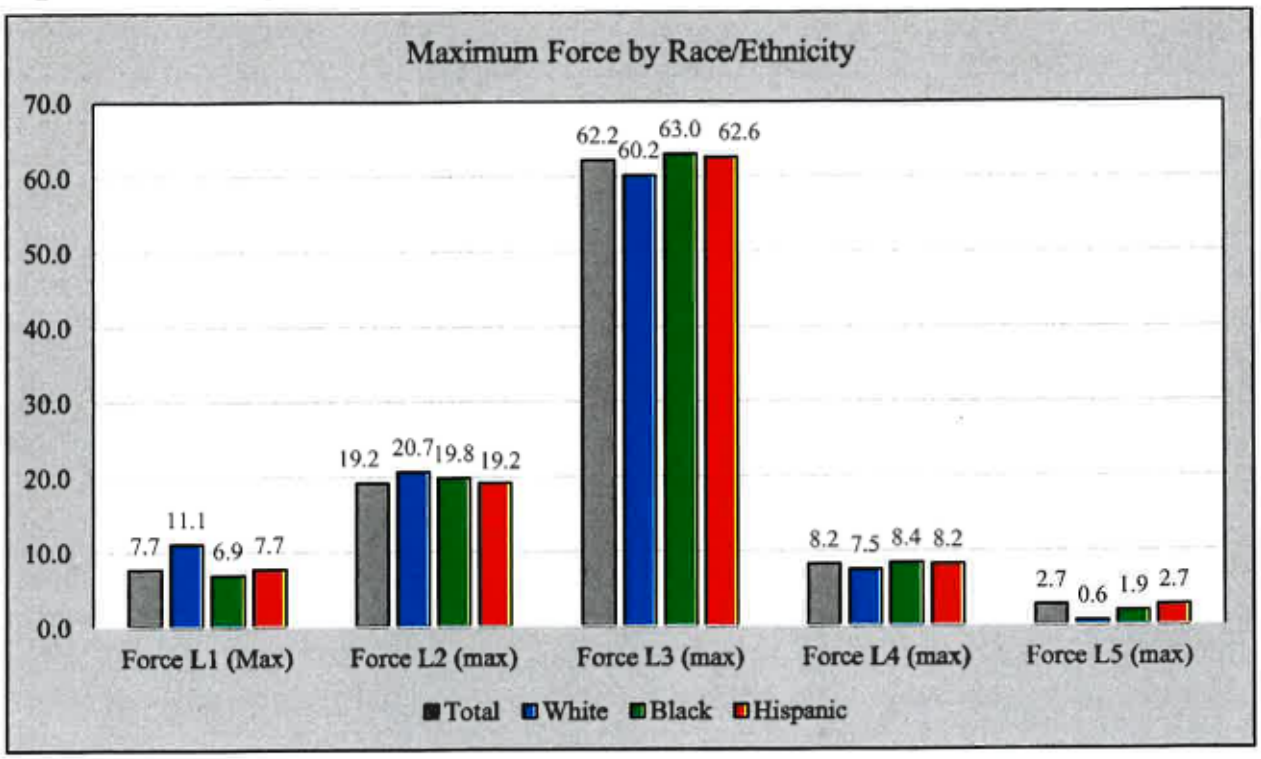
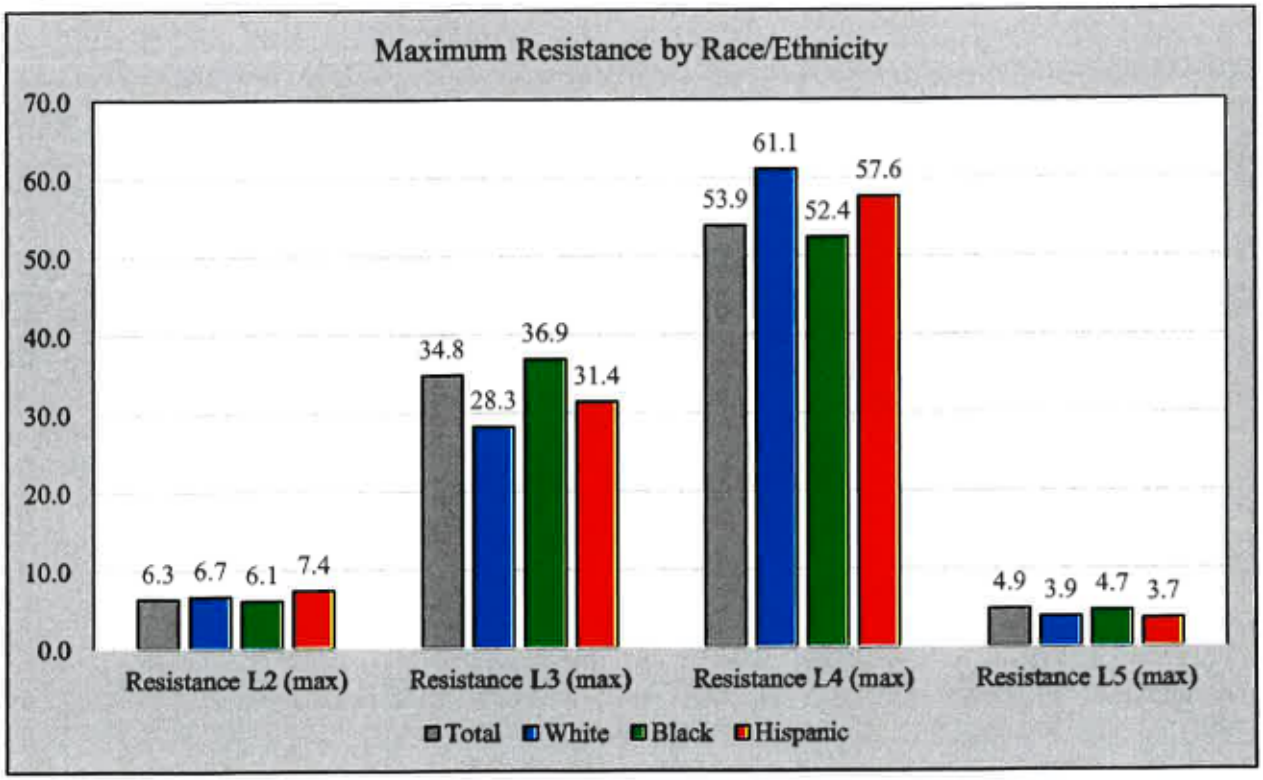


Figure 4: Percentage of Maximum Resistance Levels by Subject Race/Ethnicity



The force factor computes the difference between officer force and subject resistance (see Table 6 and Figure 5 below). The data show that force factor scores of -1 were the most common (40.2%). The next most common score was a 0 for the force factor (35.5%), which indicates force equivalent to subject resistance. Collectively, the distribution suggests that force and resistance were roughly equal in most use of force incidents. The data show that officers used less maximum force than subject resistance 58.5% of the time. Officers used more maximum force than subject resistance only 6.4% of the time. The force factor also varies across race and ethnic group, showing that officers were more likely to use force that was higher than suspect resistance with Black (6.4%) and Hispanic (7.1%) subjects relative to White (4.67%) and Other (5.08%) groups.

Table 6: Force Factor by Race/Ethnicity

	Total		White		Black		Hispanic		Other	
	N	%	N	%	N	%	N	%	N	%
Force										
-4	75	0.9	5	0.9	47	0.8	10	0.8	13	8.0
-3	375	4.7	36	7.0	244	4.1	68	5.4	28	16.7
-2	1,019	12.9	85	16.3	772	12.9	144	11.4	19	11.4
-1	3,178	40.2	233	45.1	2,365	39.6	525	41.7	55	33.5
0	2,809	35.5	137	26.6	2,212	37.1	422	33.5	38	22.7
1	438	5.5	20	3.9	320	5.4	87	6.9	11	6.5
2	14	0.2	0	0.0	9	0.2	3	0.2	2	1.2
3	5	0.1	1	0.2	2	0.0	2	0.2	0	0.0
Total	*7,911*		*517*		*5,970*		*1,259*		*118*	
F-Test: 12.75**										
***p≤0.001, **p≤0.01, *p≤0.05										

Figure 5: Force Factor by Race/Ethnicity

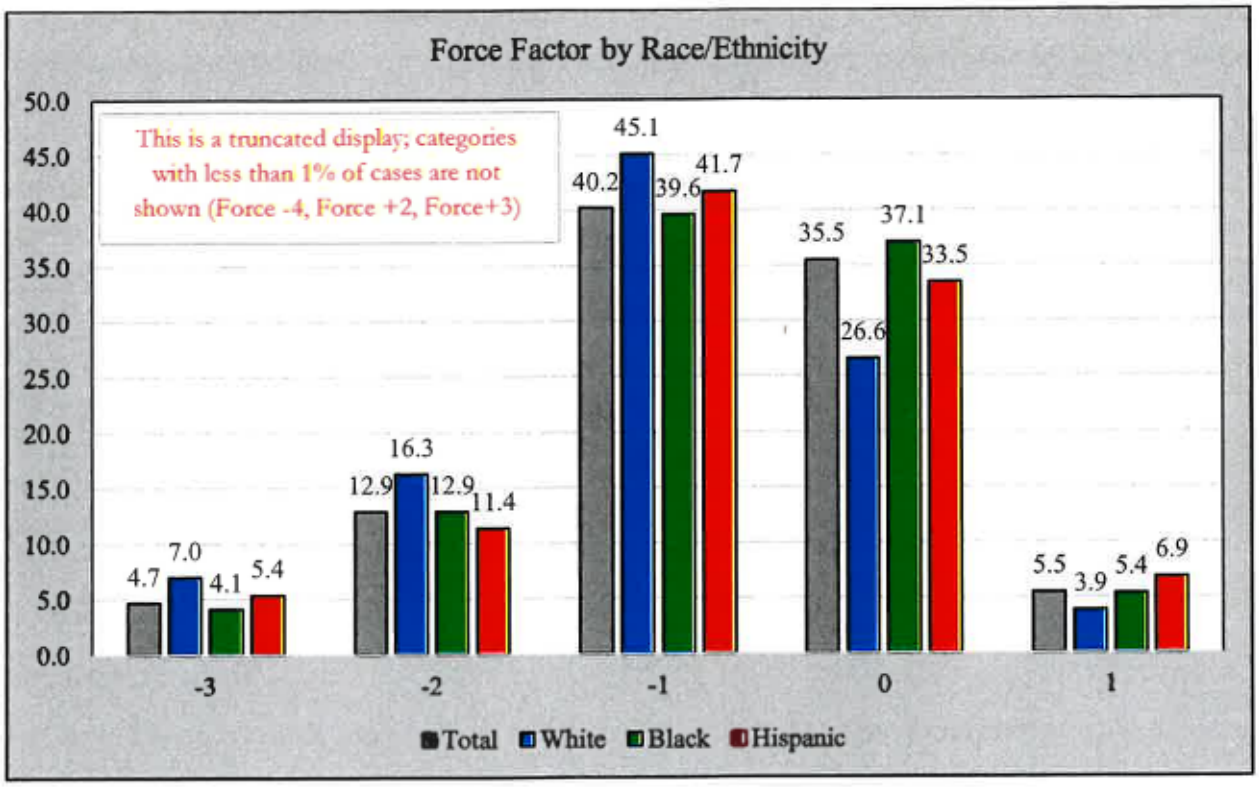


Table 7 shows the number of officer and subject actions reported in TRR data. The most common number of officer actions taken was one (30.6%); however, officers recorded no force response in 23.0% (nearly 2,000) of incidents. In total, officers reported taking three or fewer use of force actions more than 90% of the time, with some relatively minor differences across racial/ethnic groups.

In terms of subject actions, the data show that three actions were the most common and occurred in 30.8% of use of force events. This pattern was true across racial and ethnic groups, though the ethnic group labeled Other showed a lower percentage of cases with more than three subject actions (13.7%) compared to White (41.1%), Hispanic (43.2%), and Black (44.9%) subjects.

Table 7: Total Number of Officer and Subject Actions

	Total		White		Black		Hispanic		Other	
	N	%	N	%	N	%	N	%	N	%
Officer										
0	1,978	23.0	127	23.4	1,356	21.5	282	20.9	213	54.7
1	2,632	30.6	150	27.5	1,995	31.6	389	28.9	98	25.2
2	2,197	25.6	143	26.3	1,630	25.8	366	27.2	57	14.6
3	1,159	13.5	76	13.9	869	13.8	199	14.8	15	3.9
4	448	5.2	29	5.3	330	5.2	85	6.3	4	1.1
5	146	1.7	16	2.9	106	1.7	23	1.7	2	0.4
6	24	0.3	3	0.6	18	0.3	2	0.1	0	0.0
7	8	0.1	1	0.1	5	0.1	2	0.1	0	0.0
8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	*8,591*		*545*		*6,310*		*1,347*		*390*	
F-Test: 16.17**										
Subject										
0	238	2.8	4	0.7	40	0.6	11	0.8	183	46.9
1	639	7.4	47	8.6	448	7.1	98	7.3	47	12.0
2	1,379	16.1	84	15.5	1,009	16.0	226	16.8	60	15.2
3	2,645	30.8	186	34.1	1,981	31.4	432	32.0	47	12.0
4	2,251	26.2	129	23.6	1,741	27.6	350	26.0	32	8.1
5	1,037	12.1	68	12.4	789	12.5	169	12.5	12	3.0
6	315	3.7	22	4.1	283	3.8	47	3.5	8	2.0
7	66	0.8	3	0.6	52	0.8	9	0.7	2	0.5
8	16	0.2	2	0.4	10	0.2	4	0.3	1	0.1
9	1	'0.1	0	0.0	1	0.0	1	0.1	0	0.0
10	2	0.0	0	0.0	1	0.0	1	0.1	0	0.0
11	1	0.0	0	0.0	1	0.0	0	0.0	0	0.0
12	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	*8,591*		*545*		*6,310*		*1,347*		*390*	
F-Test: 158.80**										
***p≤0.001, **p≤0.01, *p≤0.05										

Figure 6 shows the age distribution of subjects of force and how the distributions varied by racial and ethnic groups. The data show that Black and Hispanic subjects were generally younger compared to White individuals involved in force incidents.[7]

[7] Kolmogorov-Smirnov test for equality of distribution functions (D) shows that Black-White =0.1762 (p<.001) and Hispanic-White= 0.1929 (p<.001).

Figure 6: Age Distribution for Force Subjects by Race

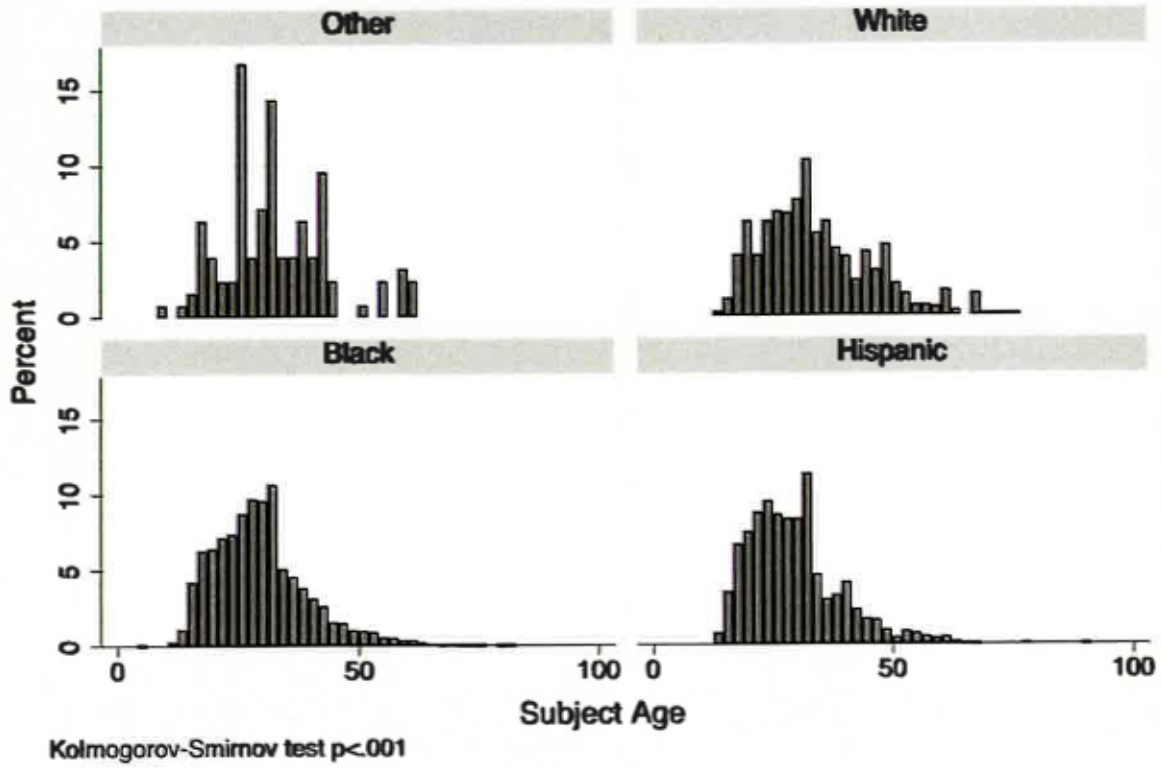


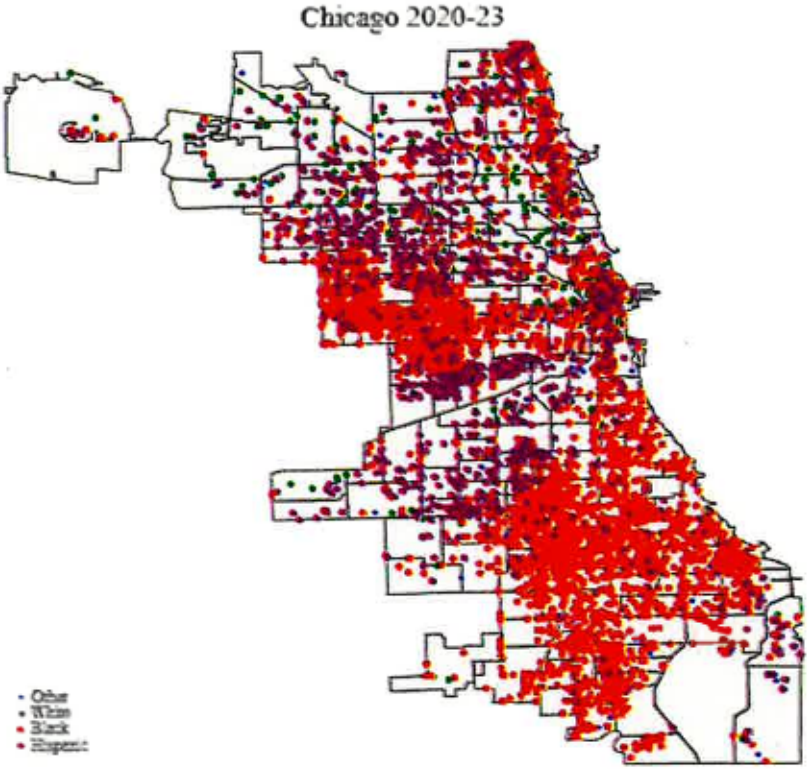
Table 8 shows the type of criminal event or charge type according to the Illinois Uniform Crime Report schema as indicated by officers on the TRRs. From these codes, events were classified into domestic battery, resisting arrest offenses, violent offenses (murder, robbery, aggravated assault, assault), weapons offenses (firearm, weapon, gun), other charge types (burglary, drug possession, etc.), or no crime charges involved. Domestic battery was the most common crime overall, representing 24.0% of events, followed by other crime types at 23.6% of events. Violent crimes were the least common offense that initiated a force event and occurred 7.1% of the time. Other crimes (27.9%) and domestic battery (26.6%) crimes were most common for White subjects, while domestic battery was the most common crime associated with a force incident for Black (23.9%) and Hispanic (28.6%) subjects. The results indicate that a greater share of incidents involving Black subjects were initiated due to a weapons offense (19.9%) compared to Whites (5.1%), Hispanics (15.9%), and Others (5.7%). Resisting arrest related charges were slightly higher for Black (11.4%) and Hispanic (11.8%) subjects compared to White (9.2%) subjects. Incidents without having a crime associated with the event were highest for White subjects (23.4%) compared to Black (14.4%) and Hispanic (13.0%) individuals. The data further underscores that the context of force events varies across racial and ethnic groups.

Table 8: Crime Types Involved in Use of Force Incident by Race

	Total		White		Black		Hispanic		Other	
	N	%	N	%	N	%	N	%	N	%
Crime Type										
Domestic	2,066	24.0	145	26.6	1,509	23.9	385	28.6	27	6.8
Resisting	948	11.0	50	9.2	722	11.4	159	11.8	17	4.3
Violent	612	7.1	43	7.8	419	6.6	95	7.1	56	14.2
Weapons	1,521	17.7	28	5.1	1,256	19.9	215	15.9	22	5.7
Other	2,028	23.6	152	27.9	1,496	23.7	317	23.5	63	16.2
No Charge	1,417	16.5	128	23.4	909	14.4	175	13.0	206	52.7
Total	*8,591*		*545*		*6,310*		*1,347*		*390*	
F-Test: 52.81**										
***p≤0.001, **p≤0.01, *p≤0.05										

Figure 7 shows use of force locations overlayed with police beats in Chicago for White, Black, Hispanic, and Other groups between 2020 and 2023. The map shows that there was some spatial concentration in use of force events in the West, South, and Northshore sections of Chicago. There were few instances of force with White subjects in the South or West side of Chicago. We further explore the concentration of force by race and beat level characteristics in the final section of the report (below) entitled Police Beat Level Analysis.

Figure 7: Force Locations



BENCHMARKING

After seeing the general profile of use of force incidents and the descriptive analysis of their characteristics, a series of statistical benchmarks were estimated to assess city-wide patterns in use of force and how racial disparities in force can be accounted for by location and context in which the events occur. A valid benchmark is a comparison group of similarly-situated persons *at risk* for experiencing the use of force assuming no officer bias exists (Geller et al., 2020; MacDonald & Braga, 2019; Smith et al., 2022). Because the residential population does account for important factors that prior research has demonstrated impact risk of police interactions (e.g. suspect resistance, presence of a weapon, criminal involvement, and police deployment), population-based benchmarks are a poor estimate of individuals at risk for the use of force and likely overestimate potential racial bias in the application of force (Geller et al., 2020). A population benchmark assumes force should be a random sample of the population. Census population figures show that 32.7% of the City of Chicago residents report being White alone, 29.0% Hispanic, 28.8% Black, and 9.5% Other group.[8] If force was just a random sample of the population, then one would expect it to look like the population. However, because individuals involved in force are not a random sample, it is important to compare the demographics of subjects involved in use of force to a population that is most likely to be *at risk of a force event*, such as those involved in criminal behavior or being arrested by the police.

For benchmarking purposes, CPD data on reported crime suspects and arrestees were used to develop race, ethnicity, and gender-based benchmarks to compare against the TRR data. Overall crime suspects (individuals described by crime victims or witnesses to the police) and arrestees, as well as broken out by crime type (e.g. violent crime), serve as the primary benchmarks against which we compared the racial and ethnic composition of use of force subjects (Cesario et al., 2018; Fryer, 2019; Smith et al., 2022; Tregle et al., 2019). Thus, we assess differences in force experienced by minority racial and ethnic groups relative to Whites compared to the racial composition of crime suspects and arrestees in general and by the specific crime types that are the most common in use of force incidents. We also assess differences in force experienced by men and women in relation to arrest and suspect benchmarks.

Table 9 and Figure 8 show the city-wide distribution of force, crime suspects, and arrests by race/ethnic group for each year as well as all years combined. Black individuals represent approximately 73.4% of use of force incidents, 70.4% of arrestees, and 71.7% of crime suspects when race/ethnicity is reported by a Chicago civilian. Hispanic individuals comprise 15.7% of force incidents, 20.4% of arrestees, and 18.4% of suspects. White individuals represent 6.3% of force incidents, 8.1% of arrestees, and 8.8% of crime suspects as reported by Chicago civilians (also see Figure 9 below). Other than the year 2020 when the Other ethnic group had more than

[8] https://www.census.gov/quickfacts/fact/table/chicagocityillinois/PST045222

double the usual percentage for force (likely a reporting artifact of the 2020 summer protests), most years the numbers are relatively stable.

Across the four years of data, Black individuals comprised 72 to 74 percent of subjects in force incidents, 66 to 73 percent of arrestees, and 70 to 74 percent of crime suspects. Hispanic individuals represented 14 to 18 percent of use of force subjects, 18 to 24 percent of arrestees, and 17 to 20 percent of crime suspect descriptions. White individuals represented 6 to 7 percent of subjects involved in the use of force, 8 percent of arrestees, and 9 percent of crime suspects.

Table 9: Citywide Force, Suspects, and Arrests by Race, 2020-2023

	Total		2023		2022		2021		2020	
	N	%	N	%	N	%	N	%	N	%
Force										
White	544	6.3	146	5.7	131	6.8	119	6.6	148	6.3
Black	6,310	73.4	1,826	71.9	1,416	73.6	1,334	74.3	1,735	74.4
Hispanic	1,347	15.7	452	17.8	294	15.3	276	15.4	325	13.9
Other	390	4.5	116	4.6	84	4.4	67	3.7	124	5.3
Total	*8,591*		*2,540*		*1,924*		*1,796*		*2,332*	
Arrests										
White	14,608	8.1	4,033	8.5	3,377	8.1	3,064	8.0	4,134	7.9
Black	126,448	70.4	31,452	66.1	28,904	69.7	27,913	72.7	38,179	73.1
Hispanic	36,721	20.4	11,504	24.2	8,719	21.0	6,997	18.2	9,501	18.2
Other	1,947	1.1	560	1.2	449	1.1	426	1.1	512	1.0
Total	*179,724*		*47,549*		*41,449*		*38,400*		*52,236*	
Suspects										
White	40,680	8.8	10,824	8.8	10,068	8.8	9,556	8.8	10,233	8.6
Black	333,536	71.7	85,957	69.6	81,245	71.3	79,022	72.6	87,312	73.6
Hispanic	85,403	18.4	25,248	20.4	21,245	18.7	19,006	17.5	19,903	16.8
Other	5,264	1.1	1,463	1.2	1,345	1.2	1,216	1.1	1,240	1.0
Total	*464,883*		*123,492*		*113,904*		*108,800*		*118,687*	

With respect to gender, percentages and comparisons were calculated for race/ethnicity by gender combinations for females. A separate analysis of female subjects was conducted, as they represent only 8.4% of use-of-force cases, to determine if their patterns mirrored those of the overall, male-dominated sample. In Table 10, White female, Black female, Hispanic female, and Other female percentages of force, arrests, and suspects are displayed (also see Figure 8 below). Similar to race/ethnicity DRs, these percentages are used as the foundation for the calculation of DRs for each of these sub-female groups (reported in the next section).

White females comprised 8.1% of force incidents involving females, 11.3% of female arrests, and 8.7% of all female suspects. Across the four years, White females represented between 6% (in

2023) and 10% (2021 and 2020) of female force incidents, 11-12% of all female arrests, and 8-9% of all crime suspects.

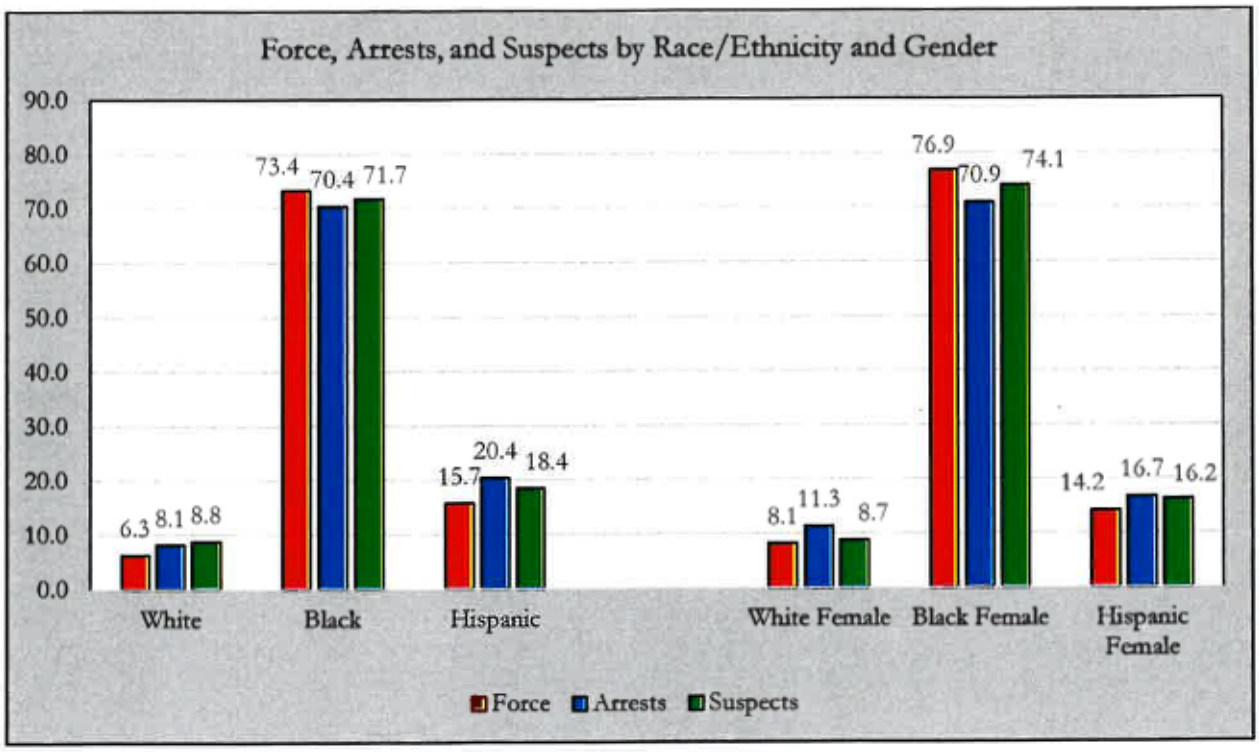
Black females represented 76.9% of force incidents involving females, 70.9% of female arrests, and 74.1% of all female crime suspects. Black female representation in force incidents involving females between 2023 and 2020 ranged from 74% (2020) to 78% (2021), their presence in female arrest incidents ranged from 69% (2023) to 72% (2021 and 2020), and they represented between 73% (2023) and 75% (2021 and 2020) of female crime suspects.

Hispanic females comprised 14.2% of force incidents involving females, 16.7% of female arrestees, and 16.2% of all female crime suspects. Finally, Hispanic female representation in female force incidents between 2023 and 2020 ranged from 11% (2021) to 17% (2023), their presence in females arrests steadily increased from 15% in 2020 to 18% in 2023, and their presence in relation to all female crime suspects ranged between 15% (2020) and 18% (2023).

Table 10: Citywide Force, Suspects, and Arrests by Female-Race Interaction, 2020-2023

	Total		**2023**		**2022**		**2021**		**2020**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Force										
White Fem.	110	8.1	25	5.6	25	8.0	27	10.3	34	10.3
Black Fem.	1,042	76.9	347	77.3	249	79.2	203	77.5	243	73.6
Hisp. Fem.	192	14.2	75	16.7	39	12.4	28	10.7	51	15.5
Other Fem.	10	0.7	3	0.7	2	0.6	3	1.1	3	0.9
Total Fem.	*1,355*		*449*		*314*		*262*		*330*	
Arrests										
White Fem.	3,150	11.3	912	12.0	684	10.7	620	10.9	934	11.5
Black Fem.	19,703	70.9	5,205	68.5	4,512	70.8	4,095	72.0	5,891	72.4
Hisp. Fem.	4,655	16.7	1,396	18.4	1,114	17.5	918	16.1	1,227	15.1
Other Fem.	284	1.0	81	1.1	66	1.0	55	1.0	82	1.0
Total Fem.	*27,792*		*7,594*		*6,376*		*5,688*		*8,134*	
Suspects										
White Fem.	9,516	8.7	2,644	8.7	2,361	8.6	2,112	8.2	2,399	9.2
Black Fem.	81,270	74.1	22,049	72.7	20,209	73.7	19,295	75.1	19,717	75.3
Hisp. Fem.	17,712	16.2	5,327	17.6	4,548	16.6	4,011	15.6	3,826	14.6
Other Fem.	1,131	1.0	321	1.1	288	1.1	261	1.0	259	1.0
Total Fem.	*109,629*		*30,341*		*27,406*		*25,680*		*26,201*	

Figure 8: Percentage of Citywide Force, Suspects, and Arrests by Race



Disproportionality Ratios

Cross-group comparisons make use of disproportionality ratios (DRs) to examine the rates of force experienced by minority group subjects relative to Whites and are intuitive and easily interpretable in relation to 1.0. DRs less than 1.0 indicate *less risk* of force compared to Whites while DRs greater than 1.0 indicate the minority group was at *higher risk* for force relative to Whites (Smith et al., 2019). The DR is computed by comparing the rate of force to arrests (force/arrest) and force to crime suspects (force/suspect) for Black and Hispanic subjects relative to White subjects. This methodology is also used to calculate DRs for Black females and Hispanic females relative to White females using arrest and suspect benchmarks.

The DRs for Black and Hispanic subjects relative to White subjects across all years are 1.39 and 1.07, respectively, suggesting that Black, and to a lesser extent Hispanic, individuals have a higher relative risk of force to *arrest* than White individuals (see Table 11 and Figure 9 below). However, the 95 percent confidence intervals[9] (CI) for these DRs range below and above 1.0 (Black-White, 95% CI=0.06-22.44; Hispanic-White, 95% CI=0.04-24.01), indicating that the groups are not

[9]The 95% confidence intervals calculated using formula provided in Rothman, K. J., Greenland, S., & Lash, T. L. (2008). *Modern epidemiology* (Vol. 3). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

statistically different from each other. However, the large confidence intervals are a function of the relatively small number of Whites in the denominator; Blacks, and to a lesser extent Hispanics, remain at a moderately greater *aggregate* risk for force compared to Whites using total arrests as a benchmark, although these differences could be due to chance. The individual year comparisons largely tell the same story, although in some years, force used against Hispanic subjects was less frequent relative to Whites using arrests as the benchmark.

Table 12 below examines Black and Hispanic females (compared to White females) using female arrests as a benchmark (also see Figure 9 below). The DRs for Black females (1.49) and Hispanic females (1.13) suggest an elevated rate of force used against these sub-groups collectively over the study period. Of note, the Black female DR steadily increased after 2020 culminating with a 2.23 DR in 2023. The Hispanic female DR also was noticeably higher in 2023 at 1.89 compared to previous years. As with the caution outlined in reference to race and ethnicity DRs, these DRs are a product of low Ns and large confidence intervals. In all cases, the confidence intervals range above and below 1.0 indicating that the groups are not statistically significant from one another; however, DRs above 1.0 do suggest an elevated risk of force for those groups even if these results could occur due to chance.

Table 11: Disparity Ratio of Black and Hispanic Force to White, Arrest Benchmark

	Total	2023	2022	2021	2020
Arrests					
Black DR	**1.39**	**1.45**	**1.21**	**1.16**	**1.35**
Standard Error	1.51	1.50	1.45	1.46	1.52
95% CI	0.06-22.44	0.06-22.26	0.07-18.45	0.06-18.62	0.06-22.56
Hispanic DR	**1.07**	**1.00**	**0.82**	**0.95**	**1.04**
Standard Error	1.61	1.63	1.59	1.53	1.62
95% CI	0.04-24.01	0.04-24.55	0.04-20.85	0.05-19.67	0.04-24.23

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at p<.05 level.

Table 12: Female Disparity Ratio of Black and Hispanic Force to White, Arrest Benchmark

	Total	2023	2022	2021	2020
Arrests					
Black Female DR	**1.49**	**2.23**	**1.53**	**1.19**	**1.13**
Standard Error	1.52	1.70	1.51	1.42	1.44
95% CI	0.06-23.20	0.05-39.81	0.06-23.11	0.07-17.53	0.06-17.73
Hispanic Female DR	**1.13**	**1.89**	**0.97**	**0.76**	**1.10**
Standard Error	1.61	1.75	1.67	1.60	1.45
95% CI	0.05-24.73	0.04-40.62	0.04-26.10	0.04-20.31	0.06-17.84

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at p<.05 level.

The DRs for Black and Hispanic subjects relative to White subjects using a *crime suspect* benchmark are 1.52 and 1.33, respectively, suggesting that Black and Hispanic individuals have a higher force risk compared to crime suspects relative to White individuals (see Table 13 and Figure 9 below). Again, the 95 percent confidence intervals show that the DRs all range below and above a value of 1.0 (Black-White, 95% CI= 0.06-26.38; Hispanic-White, 95% CI=0.05-27.13), indicating that the groups are not statistically different from each other. Because of the large confidence intervals, we cannot rule out that chance alone could explain the moderately higher aggregate risk for force experienced by these groups compared to Whites when using an all crime suspects benchmark. However, the stable patterns of disparity across years underscore a potential moderately higher risk for force among Black and Hispanic subjects when using this benchmark.

Female sub-group comparisons are presented in Table 14 (also see Figure 9 below). The Black female DR (1.17) and the Hispanic female DR (0.98) suggest a roughly equal likelihood of force relative to White females when using a crime suspect benchmark. Like the arrest benchmark, the DRs were elevated in 2023 with Black females experiencing a DR of 1.58 and the Hispanic female DR at 1.42. As previously noted, the 95% confidence interval for both groups across all years crosses the 1.0 threshold, suggesting that these results could have occurred by chance.

Table 13: Disparity Ratio of Black and Hispanic Force to White, Suspect Benchmark

	Total	2023	2022	2021	2020
Arrests					
Black DR	**1.52**	**1.54**	**1.34**	**1.30**	**1.50**
Standard Error	1.58	1.57	1.50	1.51	1.58
95% CI	0.05-26.38	0.06-26.31	0.06-21.41	0.06-21.53	0.05-26.45
Hispanic DR	**1.33**	**1.35**	**1.02**	**1.13**	**1.24**
Standard Error	1.62	1.62	1.60	1.56	1.65
95% CI	0.05-27.13	0.05-27.04	0.04-23.05	0.05-22.27	0.04-27.68

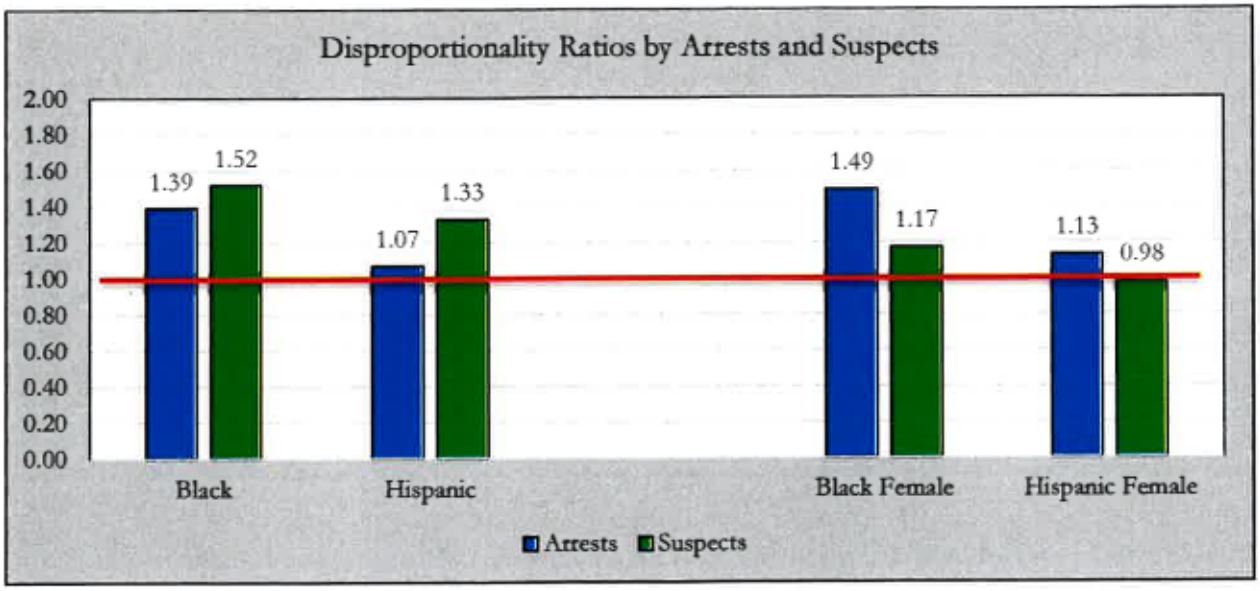
Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at p<.05 level.

Table 14: Female Disparity Ratio of Black and Hispanic Force to White, Suspect Benchmark

	Total	2023	2022	2021	2020
Arrests					
Black Female DR	**1.17**	**1.58**	**1.20**	**0.83**	**0.89**
Standard Error	1.44	1.56	1.44	1.33	1.38
95% CI	0.06-18.16	0.06-26.20	0.06-18.06	0.07-12.45	0.06-14.29
Hispanic Female DR	**0.98**	**1.42**	**0.79**	**0.55**	**0.90**
Standard Error	1.51	1.60	1.59	1.50	1.38
95% CI	0.05-19.01	0.05-26.75	0.04-20.59	0.04-14.63	0.06-14.24

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at p<.05 level.

Figure 9: Disparity Ratio of Race, Ethnicity and Gender



Violent Crime: Percentages & Disproportionality Ratios

Tables 15 and 16 and Figure 10 below assess how DR estimates compare for use of force relative to *arrest* and *suspect descriptions for violent crimes*. Overall, the DRs show that Black subjects in force events initiated for a violent crime were at a lower risk of force (0.93 or -7%) relative to White arrestees when compared to suspects for violent crime (see Table 16 below). However, the confidence interval on this estimate crosses 1.0 indicating these differences are not statistically significant and could be due to chance. For Hispanics involved in force initiated by a violent crime, the DR relative to White arrestees is 0.84, but again the confidence interval crosses 1.0 indicating the differences could be due to chance. For each individual year, the DR estimates all hover around 1.0, suggesting that the rate of force for violent-initiated calls for Black and Hispanic arrestees relative to White arrestees is not disparate in each year or across the entire time span of 2020 to 2023.

When *suspects* are used as a benchmark the DRs are predominately below 1.0. The overall DR of 0.77 for Black and 0.81 for Hispanic subjects relative to Whites suggests a lower risk of force experienced by these groups compared to their rates as suspects in violent crimes. As previously noted, the confidence intervals overall and for each individual year cross 1.0, suggesting differences that could occur by chance. The key takeaway is that use of force involving violent-initiated events for Black and Hispanic subjects is statistically comparable to the numbers in arrests and slightly lower when using crime suspect descriptions as the benchmark.

Table 15: Violent Crime - Disparity Ratio of Black and Hispanic Force to White

	Total	2023	2022	2021	2020
Arrests					
Black DR	**0.93**	**1.15**	**0.93**	**0.96**	**1.06**
Standard Error	1.44	1.48	1.44	1.43	1.51
95% CI	0.06-16.31	0.06-19.21	0.06-16.31	0.06-16.17	0.05-19.63
Hispanic DR	**0.84**	**0.85**	**0.70**	**0.88**	**1.17**
Standard Error	1.48	1.59	1.56	1.46	1.47
95% CI	0.05-16.85	0.04-21.19	0.04-18.17	0.05-16.58	0.06-19.14
Suspects					
Black DR	**0.77**	**0.92**	**0.67**	**0.79**	**0.87**
Standard Error	1.41	1.45	1.37	1.39	1.47
95% CI	0.06-14.00	0.06-16.37	0.06-12.25	0.06-13.86	0.05-16.65
Hispanic DR	**0.81**	**0.84**	**0.62**	**0.80**	**1.06**
Standard Error	1.39	1.48	1.40	1.39	1.39
95% CI	0.06-13.77	0.05-16.85	0.05-12.65	0.06-13.78	0.07-15.75

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at $p<.05$ level.

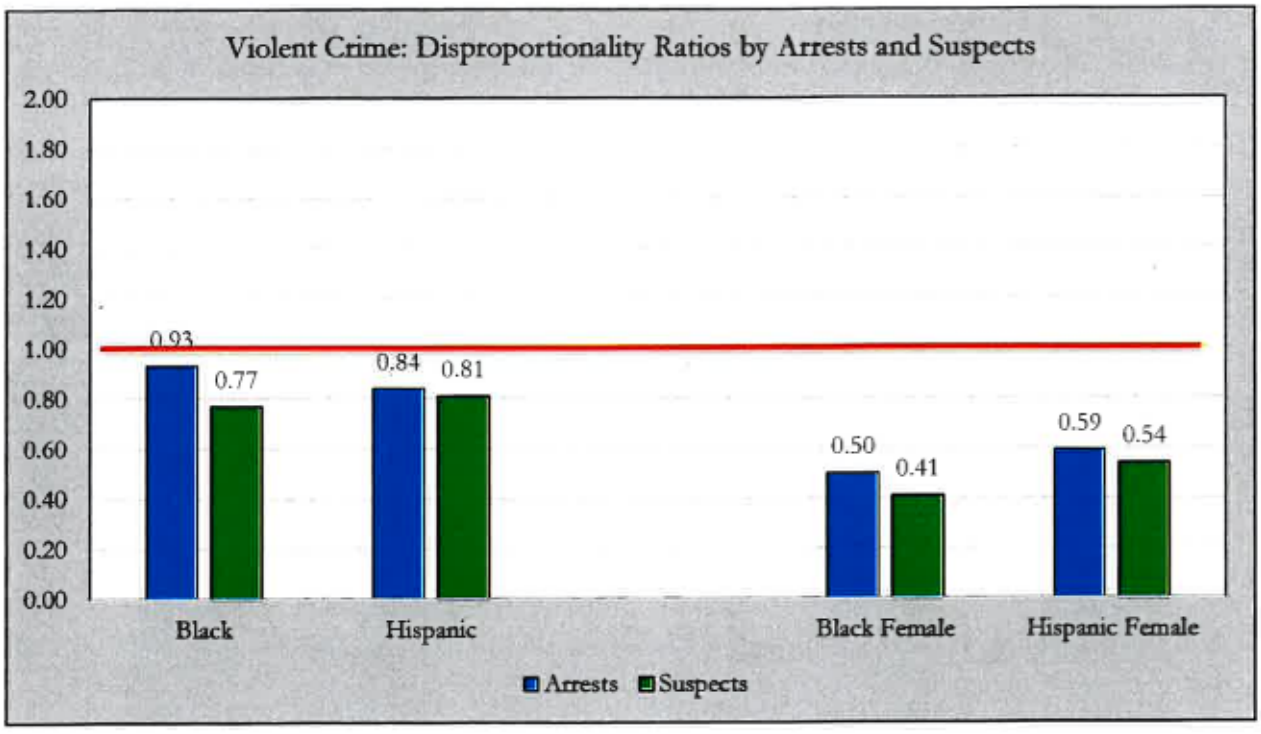
For female sub-groups involved in *violent crime-related incidents*, Table 16 reports DRs noticeably below 1.0, with the Black female DR for arrest at 0.50 and the Hispanic female DR at 0.59 when using *arrest* as a benchmark and White females as the comparison group. The below 1.0 pattern was also consistent across all years for these two groups. When using *crime suspects* as the benchmark, Black females had a DR of 0.41 and Hispanic females had a DR of 0.54 DR compared to White females. Again, this pattern is consistent for yearly results between 2020 and 2023. For all years and comparisons, the CIs cross 1.0 suggesting that these results could be due to chance and should be interpreted with that consideration. Overall, the DR results suggest that Black and Hispanic females experience force at rates much lower than White females and the pattern is consistent whether using arrest or crime suspects as the benchmark.

Table 16: Violent Crime – Female Disparity Ratio of Black and Hispanic Force to White

	Total	2023	2022	2021	2020
Arrests					
Black Female DR	**0.50**	**0.74**	**0.56**	**0.36**	**0.45**
Standard Error	1.28	1.33	1.33	1.27	1.27
95% CI	0.06-9.09	0.07-11.84	0.06-10.58	0.05-7.75	0.06-8.49
Hispanic Female DR	**0.59**	**0.70**	**0.98**	**0.64**	**0.41**
Standard Error	1.21	1.35	1.13	1.05	1.31
95% CI	0.07-8.56	0.06-12.09	0.11-9.15	0.11-6.42	0.05-8.88
Suspects					
Black Female DR	**0.41**	**0.61**	**0.39**	**0.24**	**0.37**
Standard Error	1.25	1.28	1.27	1.22	1.24
95% CI	0.06-7.87	0.07-10.00	0.06-8.01	0.05-5.84	0.06-7.39
Hispanic Female DR	**0.54**	**0.63**	**0.70**	**0.43**	**0.38**
Standard Error	1.14	1.27	1.05	0.98	1.24
95% CI	0.08-7.14	0.07-9.92	0.11-6.71	0.10-4.69	0.06-7.36

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at p<.05 level. DRs should be interpreted with caution as the underlying count of activity in these sub-groups is small and may produce unstable results.

Figure 10: Violent Crime - Disparity Ratio of Race, Ethnicity and Gender



Weapons Crime: Percentages & Disproportionality Ratios

Table 17 and Figure 11 below show the DRs for Black and Hispanic force incidents involving *weapons offenses* relative to White-involved incidents using weapons-related arrests and suspects as benchmarks. The result for Black subjects shows DRs above 1.0 each year and across all years for both the arrest and suspect benchmarks, suggesting an over-representation of Blacks in force events with weapons offenses compared to arrest and crime suspect rates. The confidence intervals cross 1.0 indicating these differences could occur by chance. A similar picture is a true for use of force events related to weapons offenses for Hispanic individuals in most years and overall.

Table 17: Weapons Crime - Disparity Ratios of Black and Hispanic Force to White

	Total	2023	2022	2021	2020
Arrests					
Black DR	**2.13**	**5.20**	**2.05**	**1.08**	**4.46**
Standard Error	1.71	2.44	1.72	1.39	2.21
95% CI	0.05-39.99	0.02-245.08	0.05-40.15	0.07-15.71	0.03-146.44
Hispanic DR	**1.56**	**4.75**	**1.67**	**0.69**	**2.59**
Standard Error	1.81	2.46	1.79	1.57	2.35
95% CI	0.03-42.30	0.02-244.38	0.04-41.60	0.03-18.32	0.01-152.71
Suspects					
Black DR	**1.54**	**2.93**	**1.50**	**1.06**	**3.22**
Standard Error	1.57	2.01	1.58	1.39	1.98
95% CI	0.06-26.33	0.03-81.34	0.05-26.45	0.07-15.76	0.03-80.98
Hispanic DR	**1.31**	**3.56**	**1.41**	**0.73**	**2.06**
Standard Error	1.63	1.96	1.60	1.54	2.11
95% CI	0.05-27.23	0.04-80.93	0.05-26.79	0.04-17.79	0.02-85.72

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at $p<.05$ level.

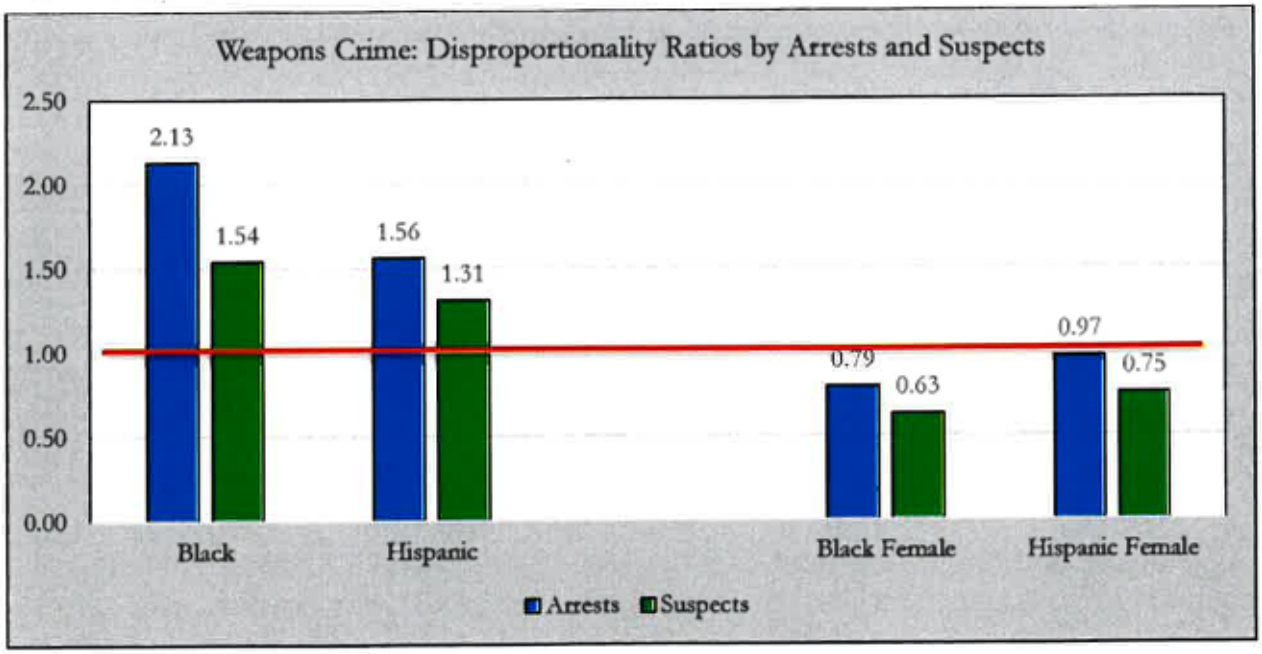
Table 18 and Figure 11 below show the DR values for Black and Hispanic female force incidents involving *weapon offenses* compared to White females using weapon-related arrest and crime suspect benchmarks. For Black females involved in weapons related incidents, their DR is 0.79 when using an arrest benchmark and 0.63 when using a crime suspect benchmark. Of note, the DRs based on these two benchmarks was considerably higher in 2023 at 2.44 and 1.93, respectively. For Hispanic females involved in weapons crime incidents, the arrest benchmark produced a DR of 0.97, and application of the crime suspect benchmark produced a DR of 0.75. Similar to Black females, 2023 showed a noticeable change in the DR value (3.13) when using an arrest benchmark and a 2.50 DR when using the crime suspect benchmark. With the exception of 2023, the DRs for these groups suggest they experience force at lower rates when compared to White females regardless of the benchmark utilized. As previously noted, the CI do cross 1.0 so results should be considered as potentially due to chance. Additionally, some of these calculations are based are a small number of records which could make the results unstable; caution should be used when interpreting these results.

Table 18: Weapons Crime – Female Disparity Ratio of Black and Hispanic Force to White

	Total	2023	2022	2021	2020
Arrests					
Black Female DR	**0.79**	**2.44**	**0.31**	**0.34**	**NA**
Standard Error	1.37	1.88	1.23	1.20	NA
95% CI	0.06-13.32	0.04-58.39	0.05-6.68	0.06-6.56	NA
Hispanic Female DR	**0.97**	**3.13**	**0.42**	**0.36**	**NA**
Standard Error	1.30	1.82	1.10	1.17	NA
95% CI	0.08-12.63	0.05-57.71	0.08-5.93	0.07-6.36	NA
Suspects					
Black Female DR	**0.63**	**1.93**	**0.24**	**0.34**	**NA**
Standard Error	1.32	1.74	1.21	1.19	NA
95% CI	0.06-10.75	0.04-40.49	0.05-5.76	0.06-6.52	NA
Hispanic Female DR	**0.75**	**2.50**	**0.33**	**0.30**	**NA**
Standard Error	1.23	1.67	1.07	1.25	NA
95% CI	0.08-10.08	0.06-39.55	0.08-5.04	0.05-6.91	NA

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at $p<.05$ level. 2020 did not involve any White female suspects or arrestees; therefore, no DR calculation can be estimated. DRs should be interpreted with caution as the underlying count of activity in these sub-groups is small and may produce unstable results.

Figure 11: Weapons Crime - Disparity Ratio of Race, Ethnicity and Gender



Domestic Battery: Percentages & Disproportionality Ratios

Table 19 and Figure 12 below show the DRs for Black and Hispanic force events involving domestic battery offenses relative to White events using domestic battery arrests and suspects as benchmarks. For Black subjects, the results show a DR that is above 1.0 in most years and slightly

above 1.0 across most years for both the arrest and suspect benchmarks, suggesting a Black over-representation in force events from domestic battery offenses. For Hispanic subjects, the results suggest a rate of domestic battery related use of force events that is lower than one would expect based on arrests and crime suspects for domestic battery relative to White subjects. But again, the confidence intervals cross 1.0 indicating these differences could occur by chance.

Table 19: Domestic Battery - Disparity Ratios of Black and Hispanic Force to White

	Total	2023	2022	2021	2020
Arrests					
Black DR	**1.32**	**1.66**	**1.51**	**1.44**	**1.12**
Standard Error	1.42	1.46	1.46	1.48	1.38
95% CI	0.07-18.14	0.07-21.87	0.07-20.99	0.07-21.13	0.07-15.57
Hispanic DR	**0.80**	**0.88**	**0.90**	**0.98**	**0.67**
Standard Error	1.60	1.69	1.65	1.61	1.58
95% CI	0.04-20.98	0.03-25.92	0.04-24.08	0.04-23.37	0.04-18.60
Suspects					
Black DR	**1.04**	**1.25**	**1.06**	**1.03**	**0.90**
Standard Error	1.40	1.45	1.39	1.40	1.36
95% CI	0.07-15.82	0.06-18.85	0.07-15.77	0.06-15.88	0.07-13.71
Hispanic DR	**0.86**	**0.98**	**0.86**	**0.90**	**0.70**
Standard Error	1.47	1.54	1.47	1.45	1.46
95% CI	0.05-16.70	0.05-20.09	0.05-16.70	0.06-16.45	0.05-14.91

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at $p<.05$ level.

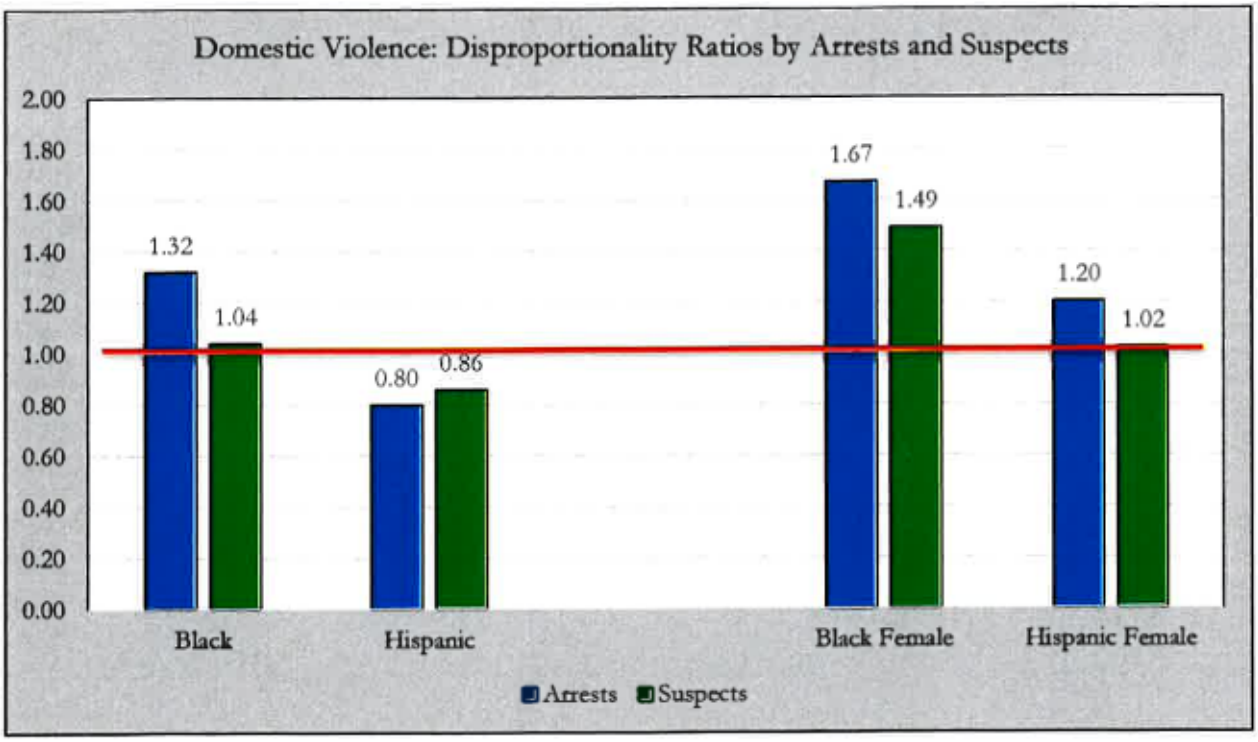
Table 20 and Figure 12 below show the DRs for Black and Hispanic female force events involving *domestic battery* compared to White females using domestic battery related arrests and crime suspect incidents as benchmarks. Black females had DRs of 1.67 when using an arrest benchmark and 1.49 when applying a crime suspect benchmark, indicating an elevated risk of force compared to White females. These DR levels were consistent over the years (except for 2020) but notably higher in 2023. DR values for Hispanic females were closer to equilibrium at 1.20 when using arrest as a benchmark and 1.02 when applying a crime suspect benchmark. Here again, the DR values were elevated in 2023. Consistent with previous results, the confidence intervals cross 1.0 suggesting the results could be due to chance. Additionally, some of these calculations are based are a small number of records which could make the results unstable; caution should be used when interpreting these results.

Table 20: Domestic Battery – Female Disparity Ratio of Black and Hispanic Force to White

	Total	2023	2022	2021	2020
Arrests					
Black Female DR	**1.67**	**3.49**	**1.48**	**2.14**	**0.94**
Standard Error	1.55	1.96	1.45	1.71	1.35
95% CI	0.06-25.99	0.04-80.92	0.07-20.23	0.05-39.96	0.07-13.85
Hispanic Female DR	**1.20**	**2.45**	**0.71**	**1.78**	**0.75**
Standard Error	1.66	2.05	1.74	1.77	1.44
95% CI	0.04-27.92	0.03-82.88	0.03-25.91	0.04-41.05	0.05-14.86
Suspects					
Black Female DR	**1.49**	**3.14**	**1.15**	**1.74**	**0.93**
Standard Error	1.49	1.87	1.37	1.59	1.36
95% CI	0.06-22.18	0.04-64.85	0.07-15.50	0.06-28.56	0.07-13.90
Hispanic Female DR	**1.02**	**2.09**	**0.57**	**1.28**	**0.79**
Standard Error	1.63	1.99	1.66	1.69	1.42
95% CI	0.04-24.41	0.03-67.50	0.03-20.37	0.04-30.45	0.06-14.57

Note: 95% CI=confidence interval. When values range above and below 1, they are not statistically significant at $p<.05$ level. 2020 did not involve any White female suspects or arrestees; therefore, no DR calculation can be estimated. DRs should be interpreted with caution as the underlying count of activity in these sub-groups is small and may produce unstable results.

Figure 12: Domestic Battery - Disparity Ratio of Race, Ethnicity and Gender



MODELING RESULTS

Modeling Individual Use of Force

This section examines five outcomes of use of force incidents: 1) the maximum level of force applied[10], 2) the total force applied[11], 3) the force factor, 4) whether an officer experienced an injury, and 5) if a subject was injured. Model type varies (i.e., linear and non-linear models) depending on the distribution of the dependent variable to ensure the proper functional form of the model is estimated (Greene, 2018). For each outcome, a series of models are estimated as summarized in Table 21.

Model 1 estimates the contribution of race, age, gender, disability status of subjects, and month of the year and serves as a baseline to assess if there are disparities by race and ethnicity in levels of force.[12] The model includes year-month fixed effects to control for unusual months that may generate different individual-level estimates (e.g., summer 2020 protests and other major events). Model 2 estimates the contribution of race, age, and gender on force after including officer and incident characteristics related to the reason for the call and the level of suspect resistance. Model 3 expands upon Model 2 to include police beat-level characteristics where the use of force event took place including measures of monthly crime volume, arrests, and racial demographics of the area. Finally, model 4 estimates the contribution of race, age, and gender on force after including officer, situational characteristics, level of suspect resistance and *beat-level fixed effects* instead of beat-level measures to gauge how much of the variation in the level of force is simply attributable to a given area. Model 5 relies on officer-level fixed effects, which will examine how much of the variation in levels of force by race, age, gender, and incident level factors are explained by the individual officers involved in the event. All model results are presented with statistical tests to demonstrate non-chance-related differences between racial/ethnic groups and the percentage change between the group of interest and White subjects. These sequential models demonstrate the importance of considering the effect of contextual variables on the level of force severity in use of force incidents (see Table 21 below for a summary of all tables).

[10] For example, if CPD officers gave verbal direction (CPD level 2), used an armbar control technique (CPD level 3), and deployed a Taser (CPD level 4) the highest level of force employed would be 4.

[11] For example, if a CPD officers gave verbal direction (CPD level 2), used an armbar control technique (CPD level 3), and deployed a Taser (CPD level 4) the total force level during the event would equal 9.

[12] Age and Age^2 are included in the model to capture the nonlinear relationship, as the age of both officers and subjects involved in use of force incidents increases from the twenties to the thirties, then declines. This decline is due to fewer officers over forty being assigned to patrol or involved in such events, as well as a decrease in the number of subjects involved.

Table 21: Summary of Analytic Models

	Dependent Variables	Model Type	Subject Characteristics	Officer Characteristics	Incident Characteristics	Beat Characteristics
Model 1	*Maximum force* *Total force* *Force Factor* *Officer Injury* *Subject Injury*	Linear and non-linear regression models with fixed effects for month and year of the incident	Subject race/ethnicity Subject age Subject gender Influence of alcohol/drugs Mental illness Disability status *Subject arrest history score	Not Included	Not Included	Not Included
Model 2	*Maximum force* *Total force* *Force Factor* *Officer Injury* *Subject injury*	Linear and non-linear regression models with fixed effects for month and year of the incident	Same as Model 1	Patrol officer Officer rank CIT training Years on force Officer age Officer race/ethnicity Officer gender	Subject resistance Police beat Assignment type Indoors Member alone Reason for event Crime type	Not Included
Model 3	*Maximum force* *Total force* *Force Factor* *Officer Injury* *Subject injury*	Linear and non-linear regression models with fixed effects for month and year of the incident	Same as Models 1 & 2	Same as Model 2	Same as Model 2	Number of crimes Arrests Population by race
Model 4	*Maximum force* *Total force* *Force Factor* *Officer Injury* *Subject Injury*	Beat level fixed effects	Same as Model 3	Same as Model 3	Same as Model 3	Same as Model 3
Model 5	*Maximum force* *Total force* *Force Factor* *Officer Injury* *Subject Injury*	Officer-level fixed effects	Same as Model 4	Same as Model 4	Same as Model 4	Same as Model 4
*Only included in supplemental models; results appear in the Appendix.						

Maximum Force

Table 22 below shows the results from the five regression models that control for the variables previously discussed.[13] Discussion is focused on comparing Black and Hispanic subjects relative to White subjects as these are the most common minority groups and those of most interest. Table 22 highlights the average maximum level of force (while considering other relevant variables), the 95% confidence interval for each of these estimates (used to determine statistical significance[14]), and the percent difference between the group of interest and White subjects. In sum, these three statistics provide an overall average maximum force level for each group, if that difference is statistically meaningful, and the substantive interpretation of the difference.

In Model 1, which includes only subject demographic factors, the predicted average maximum force level for White subjects is 2.69. Black and Hispanic subjects show slightly higher predicted maximum force levels, at 2.79 and 2.80, respectively. These differences are statistically significant, as evidenced by the non-overlapping 95% confidence intervals, and reflect a 3.6% and 3.9% higher level of maximum force compared to White subjects. Model 2 includes officer and incident characteristics with a predicted average maximum force level of 2.70 for Whites compared to 2.79 and 2.81 for Black and Hispanic subjects. These differences remain statistically significant, although the substantive difference reduces slightly to 3.2% for Black subjects. Importantly, Model 2 includes *subject resistance* as an independent variable, which previous research has shown to be an important predictor of police use of force (Alpert & Dunham, 2004). Maximum force levels for Blacks and Hispanics slightly exceed the level for Whites after the inclusion of this variable, among others.

This pattern is similar in Model 3, which includes beat level characteristics, with continued statistically significant differences between White, Black, and Hispanic subjects, although the percent differences from White decrease for Black subjects (2.9% higher) and increase for Hispanic subjects (4.2% higher). Model 4, *controlling* for beat level factors, and Model 5, considering individual officers involved in the events, reveal the predicted values for Black and Hispanic subjects continue to be slightly higher than for White subjects, but the confidence intervals begin to overlap across these models indicating the differences between Black and White subjects may be a result of chance rather than due to statistically meaningful patterns. In Models 4 and 5, the predicted maximum use for force White subjects remains relatively stable (around 2.69 to 2.72), while the predicted maximum use for Black subjects increases slightly from 2.79 to 2.85, and for Hispanic subjects, it rises from 2.84 to 2.86. However, as the confidence intervals overlap, the statistical significance of these differences diminishes. Specifically. the intervals for White and Black subjects overlap, suggesting that the racial and ethnic differences observed in

[13] Full regression models are reported in Appendix B.

[14] Statistically significant results reflect differences between groups that are unlikely due to chance.

Models 1 and 2 may be explained, at least in part, by additional variables included in the later models. This is also the case in Model 5 for Hispanic subjects.

These results suggest that: 1) Black and Hispanic individuals initially show higher predicted maximum force values, 2) even after accounting for all available variables (Model 3), these groups still show slightly elevated force levels compared to White individuals, and 3) when neighborhood-level (beat) and officer-level factors are considered (Models 4 and 5), the differences become less pronounced. Specifically, for Black individuals, both the unique police beat and individual officers explain some of the disparity, as indicated by overlapping confidence intervals. For Hispanic individuals, unique police officers alone appear to account for a share of the difference, again suggested by overlapping confidence intervals. These findings indicate that while race and ethnicity may play a role, other factors also contribute to the observed disparities in predicted maximum force.

Table 22: Maximum Force Models 1 to 5

	Model 1	Model 2	Model 3	Model 4	Model 5
White Subjects	**2.69**	**2.70**	**2.71**	**2.72**	**2.69**
95% CI	2.63-2.75	2.64-2.76	2.64-2.77	2.66-2.79	2.07-3.31
Black Subjects	**2.79**	**2.79**	**2.79**	**2.79**	**2.85**
95% CI	2.77-2.80	2.78-2.81	2.77-2.80	2.77-2.80	2.34-3.35
% Difference from Whites	*3.6%**	*3.2%**	*2.9%**	*2.5%*	*5.6%*
Hispanic Subjects	**2.80**	**2.81**	**2.83**	**2.84**	**2.86**
95% CI	2.77-2.84	2.78-2.85	2.78-2.87	2.80-2.88	2.32-3.40
% Difference from Whites	*3.9%**	*3.9%**	*4.2%**	*4.2%**	*5.9%*
Other Subjects	**2.75**	**2.79**	**2.80**	**2.81**	**2.75**
95% CI	2.58-2.93	2.62-2.96	2.62-2.97	2.63-2.98	2.19-3.31
% Difference from Whites	*2.2%*	*3.2%*	*3.2%*	*3.2%*	*2.2%*

Note: 95% CI=confidence interval; ***p≤0.001, **p≤0.01, *p≤0.05.

Total Force

The results for total force presented in Table 23 follow a different pattern from those for maximum force, with notable differences in predicted values across racial and ethnic groups. [15] In Model 1, White subjects have a predicted average total force of 4.44, compared to 4.76 for Black subjects and 4.71 for Hispanic subjects. These differences are statistically significant, as indicated by the non-overlapping 95% confidence intervals, and represent a 6.7% ad 5.7% higher level of total force for Black and Hispanic subjects, respectively.

Unlike the maximum force models, when we examine Models 2 through 4, the predicted values for Black subjects remain slightly higher than those for White subjects, and the confidence intervals do not overlap. The predicted total force level for Black subjects increases from 4.76 in

[15] Full regression model results are reported in Appendix B.

Model 1 to 4.80 in Model 4, and when compared against White subjects reveals statistically significant differences in total force levels that range from 6.5% to 8.7% higher. The predicted total force level of Hispanic subjects is relatively stable, ranging from 4.71 in Model 1 to 4.79 in Model 4, with the only statistically significant difference from Whites emerging in Model 2, which shows a 6.0% higher total force level. Model 5 reveals no statistically significant differences between groups.

Two key observations are worth noting from these models. First, the average predicted total force level does not change meaningfully in Models 1 to 4, suggesting that the inclusion of additional factors explains little of the variation in total force. Additionally, Model 5 that controls for individual-officer fixed effects reveals no overlap in confidence intervals, suggesting that individual officers explain a larger share of the variation in total force than the situational characteristics of the events.

Table 23: Total Force Models 1 to 5

	Model 1	Model 2	Model 3	Model 4	Model 5
White Subjects	**4.44**	**4.41**	**4.47**	**4.49**	**4.94**
95% CI	4.25-4.62	4.22-4.60	4.27-4.67	4.29-4.69	2.48-7.41
Black Subjects	**4.76**	**4.83**	**4.80**	**4.80**	**5.49**
95% CI	4.70-4.82	4.77-4.89	4.73-4.86	4.74-4.86	3.49-7.50
% Difference from Whites	*6.7%**	*8.7%**	*6.9%**	*6.5%**	*10.0%*
Hispanic Subjects	**4.71**	**4.69**	**4.79**	**4.79**	**4.79**
95% CI	4.58-4.84	4.60-4.82	4.64-4.93	4.63-4.94	3.27-7.55
% Difference from Whites	*5.7%*	*6.0%**	*6.7%*	*6.3%*	*-3.1%*
Other Subjects	**4.85**	**4.77**	**4.87**	**4.84**	**5.47**
95% CI	4.33-5.49	4.22-5.43	4.20-5.54	4.13-5.54	3.25-7.69
% Difference from Whites	*8.5%*	*7.5%*	*8.2%*	*7.2%*	*9.7%*

Note: 95% CI=confidence interval; ***p≤0.001, **p≤0.01, *p≤0.05.

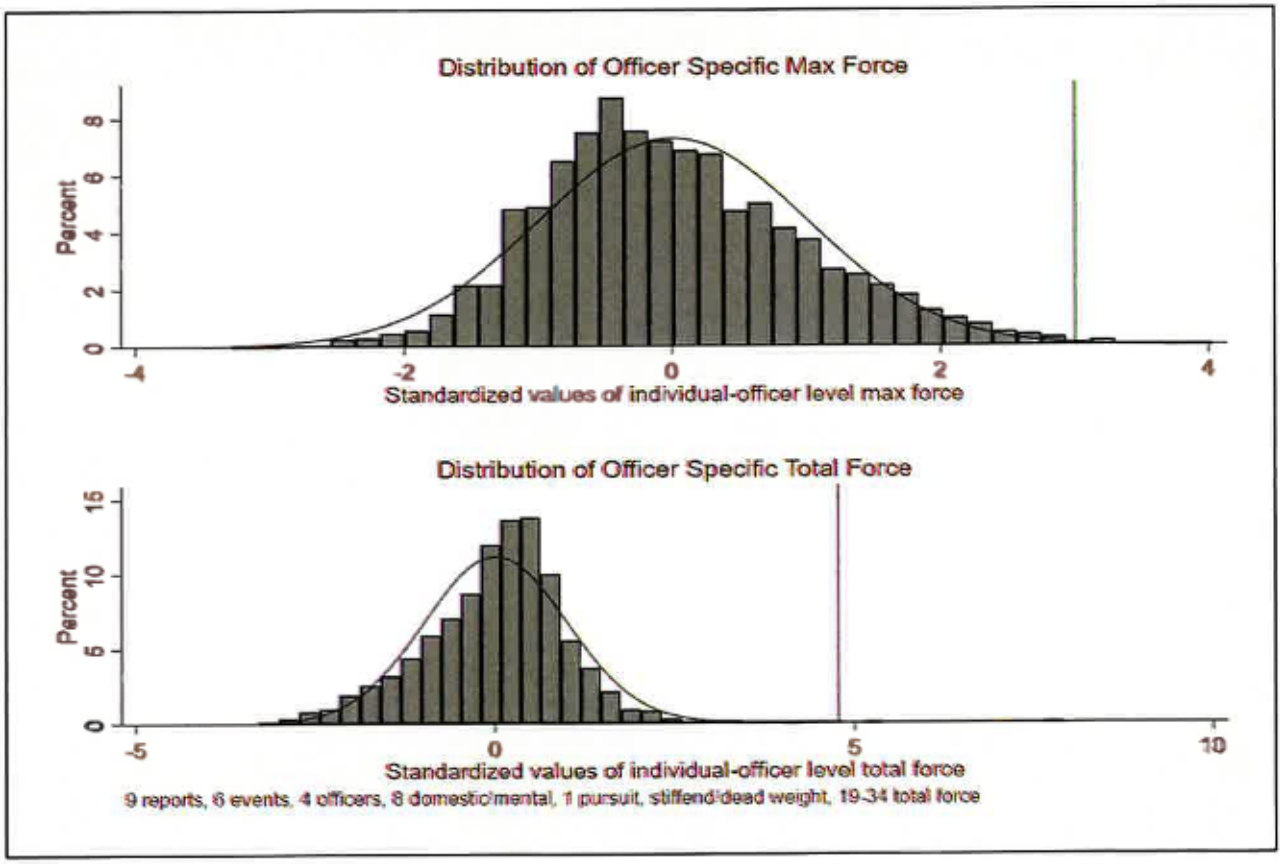
Figure 13 presents officer-specific estimates for maximum force and total force, offering a detailed comparison of the individual officer-specific estimates shown by Model 5. These estimates are converted into standardized scores, which allow for a visualization of how each officer's use of force events differ from their colleagues, based on officers who have more than one TRR report. Only officers involved in more than one use of force incident are included in the analysis. Because we are comparing thousands of officers (hypothesis tests), we only flag officers if their scores are beyond 3.7 standard deviations (Hocherg, 1988).

The graph reveals that the maximum force estimates follow a normal distribution, with no clear outliers. In contrast, the total force data shows six incidents that resulted in nine use of force reports involving four unique officers. These cases have total use of force scores that are significantly higher than what would be expected by chance, ranging from 19 to 34. Five of these incidents were

related to domestic disturbance calls involving individuals with mental health issues, while one involved a pursuit and a weapons offense.

Overall, the estimates from Model 5 suggest that no distinct group of officers stands out for consistently using maximum or total force in a manner that differs from others involved in similar incidents in the same locations.

Figure 13: Model 5 Estimates of Individual Officers Maximum and Total Force



Force Factor

Table 24 presents regression models 1 through 5, using the "force factor" (the ratio of officer force to suspect resistance) as the outcome variable (full results in Appendix B). Model 1, with basic incident characteristics, shows the force factor is significantly lower for White subjects compared to Black and Hispanic subjects (by 22% and 20%, respectively), which suggests that Black and Hispanic subjects experience *higher levels* of force relative to resistance than Whites. While the force factor remains significantly lower for White relative to Black and Hispanic subjects in Model 2 (which adds suspect and officer characteristics), the magnitude of the difference decreases to 11% and 14%. This pattern continues in Model 3 (adding neighborhood characteristics), although the difference between White and Black subjects is no longer statistically significant. However, in Models 4 (controlling for individual beats) and 5 (controlling for individual officers), while Black

and Hispanic subjects still show higher force factor values, the overlapping confidence intervals suggest these differences in most cases may be due to chance; Hispanic subjects remain at higher risk for force relative to resistance compared to Whites in Model 4. In summary, the force factor results mirror those for maximum force, indicating that disparities in force against Black and Hispanic subjects compared to White subjects substantially decrease after accounting for incident and officer characteristics. The largest reduction in disparities occurs when these latter factors are included.

Table 24: Force Factor Models 1 to 5

	Model 1	Model 2	Model 3	Model 4	Model 5
White Subjects	**-0.94**	**-0.84**	**-0.83**	**-0.82**	**-1.0**
95% CI	-1.01,-0.87	-0.90,-0.78	-0.89,-0.77	-0.89,-0.76	-1.62,-0.38
Black Subjects	**-0.73**	**-0.75**	**-0.75**	**-0.75**	**-0.75**
95% CI	-0.75,-0.71	-0.77,-0.73	-0.77,-0.74	-0.77,-0.74	-1.25,-0.25
% Difference from Whites	*22%**	*11%**	*10%*	*9%*	*17%*
Hispanic Subjects	**-0.75**	**-0.72**	**-0.71**	**-0.70**	**-0.73**
95% CI	-0.81,-0.71	-0.77,-0.69	-0.75,-0.67	-0.74,-0.65	-1.27,-0.19
% Difference from Whites	*20%**	*14%**	*14%**	*15%**	*20%*
Other Subjects	**-0.89**	**-0.75**	**-0.75**	**-0.74**	**-1.00**
95% CI	-1.08,-0.71	-0.93,-0.58	-0.93,-0.57	-0.92,-0.56	-1.57,-0.44
% Difference from Whites	*5%*	*11%*	*10%*	*10%*	*11%*

Note: 95% CI=confidence interval; ***p≤0.001, **p≤0.01, *p≤0.05.

Officer and Subject Injuries

These analyses (Models 1-5) use logistic regression (Long, 1997) to examine *injuries* from use of force events to officers and subjects and how the risk of injury varies by race and ethnicity when considering relevant variables. [16] For context, approximately 30.2% of events involved an officer injury, and 11.3% of incidents involved an injury of a subject.

Table 25 shows that officer injuries were significantly more common when the subject was White (35%) compared to being Black (30%) based on Model 1, which represents a statistically significant difference of -16.7%. This pattern diminishes once other relevant variables are included in Models 2 through 4, and there is no longer a statistically significant disparity across groups (as evident from the overlapping 95% confidence intervals) in the later models. Model 5 shows the average prevalence of officer injury is similar when we control for individual officer fixed effects. This suggests that the prevalence of injuries is not driven by specific outlier officers.

[16] Full regression model results are reported in Appendix B.

Table 25: Officer Injury Models 1 to 5

	Model 1	Model 2	Model 3	Model 4	Model 5
White Subjects	**.35**	**.33**	**.31**	**.30**	**.22**
95% CI	.31-.39	.29-.36	.27-.34	.27-.34	N/A
Black Subjects	**.30**	**.30**	**.31**	**.31**	**.29**
95% CI	.29-.31	.29-.31	.30-.32	.30-.32	N/A
% Difference from Whites	*-16.7%**	*-10.0%*	*0.0%*	*3.2%*	*24.1%*
Hispanic Subjects	**.31**	**.30**	**.29**	**.29**	**.30**
95% CI	.29-.33	.28-.32	.27-.31	.26-.31	N/A
% Difference from Whites	*-12.9%*	*-10.0%*	*-6.9%*	*-3.4%*	*26.7%*
Other Subjects	**.25**	**.23**	**.21**	**.23**	**.22**
95% CI	.16-.34	.14-.31	.13-.29	.14-.31	N/A
% Difference from Whites	*-40.0%*	*-43.5%*	*-47.6%*	*-30.4%*	*0.0%*

Note: 95% CI=confidence interval; ***p≤0.001, **p≤0.01, *p≤0.05.
95% confidence intervals are not calculated for Model 5 because the prevalence of being injured multiple times for the same officer or to multiple subjects for the same officer are extremely rare.

Table 26 presents the average predicted likelihood of subject injury during use of force incidents by race and ethnicity across Models 1 to 5, along with 95% confidence intervals (CIs) for Models 1-4.[17] White subject injury rates ranged from 15-18%, while injury rates for Black subjects ranged from 11-12% and Hispanic subjects from 14-16%. These differences were statistically significant between White and Black subjects, with Black subjects experiencing injuries significantly *less often* (25-55% lower) than Whites. Hispanic subjects also experienced lower rates of injury compared to White subjects, but these differences were not statistically significant.

Table 26: Subject Injury Models 1 to 5

	Model 1	Model 2	Model 3	Model 4	Model 5
White Subjects	**.15**	**.17**	**.17**	**.18**	**.16**
95% CI	.12-.17	.13-.20	.14-.21	.14-.21	N/A
Black Subjects	**.12**	**.11**	**.11**	**.12**	**.12**
95% CI	.11-.12	.11-.12	.11.-12	.11-.12	N/A
% Difference from Whites	*-25.0%**	*-54.5%**	*-54.5%**	*-50.0%**	*-33.3%*
Hispanic Subjects	**.14**	**.15**	**.16**	**.16**	**.14**
95% CI	.13-.16	.13-.17	.14-.18	.14-.18	N/A
% Difference from Whites	*-7.1%*	*-6.7%*	*-6.3%*	*-12.5%*	*-14.3%*
Other Subjects	**.14**	**.16**	**.16**	**.16**	**.11**
95% CI	.07-.21	.08-.25	.07-.24	.07-.24	N/A
% Difference from Whites	*-7.1%*	*0.0%*	*-6.3%*	*-12.5%*	*-45.5%*

Note: 95% CI=confidence interval; ***p≤0.001, **p≤0.01, *p≤0.05.

[17] 95% confidence intervals were not calculated for Model 5 because the prevalence of being injured multiple times for the same subject or to multiple subjects by the same officer within a use of force event was extremely rare. Full regression model results are reported in Appendix B.

POLICE BEAT-LEVEL ANALYSIS

The next set of analyses examine how much the characteristics of specific police beats account for racial and ethnic disparities in the reported use of force, and they assess the contribution of outlier beats to overall rates of force in Chicago and by race/ethnic group. Specifically, we estimate that much of the cross-group disparity in force can be accounted for by police beat-level factors. Prior research on Chicago shows that 5% of census block groups in the city account for over 30% of all arrests and 33% of the citywide differences in arrest rates between Black and White individuals (Neil & MacDonald, 2023). The following analysis estimates how much of the rates of force for Black, Hispanic, and White individuals city-wide can be accounted for based on police beat level characteristics. The goal of these analyses is to identify sources for why rates of force by racial group diverge from the general makeup of the Chicago population and to inform any policy or training efforts that seek to minimize differences in rates of force across racial groups. Specifically, the analysis examines how much of the rates of force per police beat for each racial group can be accounted for based on beat level factors such as crime, arrests, distribution of suspected criminals of the same race/ethnicity, police deployment, and poverty.

For each police beat, we overlayed census data based on the percentage of overlap between a police beat and a census block group. Census data on the residential population were extracted from the American Community Survey 2022 (5-year estimates) available at Social Explorer.[18] Census block groups are the primary units of analyses because they represent blocks in the same census tract and are the smallest population enumeration in the census. To account for the demographic makeup of the residential population, measures of population were calculated for percent Black, percent Hispanic, percent White, and percent 'Other' races. Economic characteristics of the residential population were measured by the percentage female headed households, percentage of families in the population living below poverty line, median household income, and the percentage adults without college degrees. These measures were standardized into a composite scale (mean centered at zero) capturing *concentrated disadvantage*.

From CPD, we obtained data on arrests overall and by racial group, crime suspects by racial groups, police deployment based on area assignment for officers (when they were on duty), 911 responding officers, and CPD missions.[19] From these data, we created monthly counts per police beat. With TRR data, we created similar counts of force overall and by racial group for each police

[18] Census data for the ACS obtained from Social Explorer (https://www.socialexplorer.com/explore-tables).
[19] Police missions involve the strategic deployment of police personnel for crime reduction in key sections of the city (e.g., focused deterrence, gang suppression, strategic deployment, support center deployment, long-term deployment, index crime mission, etc.). We include the number of unique missions per month in a police beat.

beat in a given month. The dataset consists of all observations between 2020 and 2023, resulting in police beat information for 274[20] beats over 48 months for a total of 13,152 observations.

Rank order correlations[21] were used to assess how the rates of force for Black, Hispanic, and White individuals per police beat were associated with the number of arrests of each group, crime suspects of each group, and total crimes reported (as well as by type) in each beat. The rank order correlations for use of force rates per police beat for Black individuals were associated with the number of Black suspects (rho=0.885; p<.001) and Black individuals arrested (rho=0.923; p<.001). Similarly, rank order correlations indicated that use of force rates for Hispanic individuals were associated with the number of reported Hispanic suspects (rho=0.816, p<.001) and arrests of Hispanic individuals (rho=0.819; p<.001). The rank order correlations for use force rates per police beat for White individuals also were associated with the number of White suspects (rho=0.763; p<.001) and White individuals arrested (rho=0.749; p<.001). These descriptive analyses highlight the need to assess the contribution of place to use of force rates and how those vary by demographic group.

The spatial concentration of force, arrests, and crime suspects by race/ethnicity is shown in Table 27 using the Moran's I[22] statistic along with the 95% confidence intervals (CI). The level of spatial concentration of force is higher for Black individuals than other groups, consistent with what is visually clear in Figure 14 below. Force is concentrated for Black individuals in the South and Western police beats in Chicago more than it is for other groups. More variation in force rates per police beat for White subjects means there will be mechanically less spatial autocorrelation. This is apparent when examining the 95% CI for each group, where one can see the range of estimates is the largest for White subjects, meaning there is less spatial clustering

[20] We exclude beat no. 3100 that is outside the Chicago city limits.

[21] Spearman's rank order correlations (Spearman's rho coefficient) are used to determine the relationship between two sets of ordinal data. For instance, census block groups were separately ranked on stop rates for Black individuals and on the number of arrests of Black individuals. Rho ranges from – 1 to +1 indicating the direction of the relationship (positive, negative) and the strength of the relationship (0 = null, 1 = perfect).

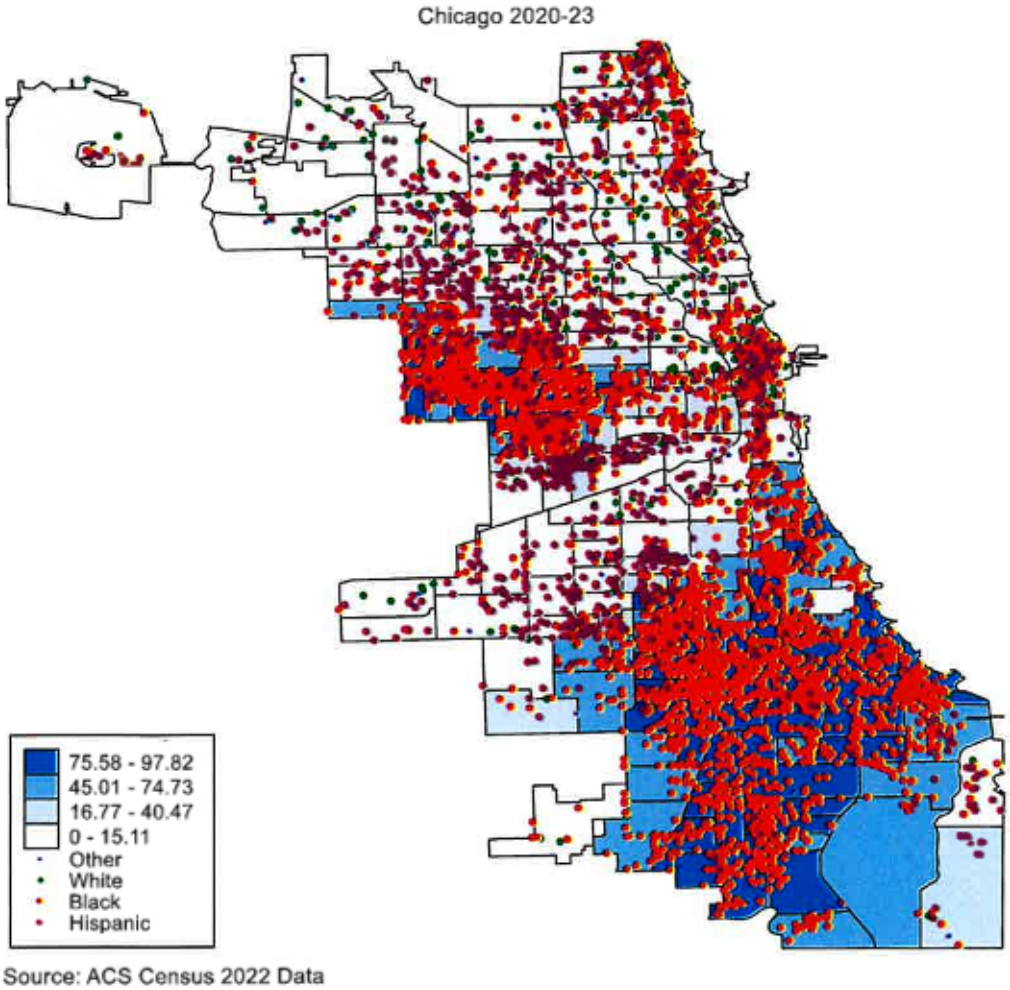
[22] Moran's I measures spatial autocorrelation, or how one police beat is similar to the police beats around it on a specific measure. Moran's I was calculated based on a power function of –distance^2 (kilometers) between focal census block group (i) and other block groups (j).

Table 27: Spatial Concentration of Force, Suspect, and Arrests in Chicago

Measure	Estimate	5%	95%
Black force	.341**	0.303	0.379
Black suspect	.441**	0.404	0.479
Black arrests	.355**	0.315	0.389
Hispanic force	.254**	0.217	0.291
Hispanic suspects	.374**	0.337	0.412
Hispanic arrests	.352**	0.315	0.389
White force	.277**	0.240	0.313
White suspects	.498**	0.461	0.536
White arrests	.391**	0.353	0.428

Note: Larger numbers represent larger correlations.
N = 274 beats
***p≤0.001, **p≤0.01, *p≤0.05.

Figure 14: Force Locations and Proportion of Black Population



These data also indicate that the spatial concentration differences in use of force overlap. The upper 95% CI for White force overlaps with the Moran's I lower 5% estimate for Black force concentration. The spatial concentration of crime suspects and arrests by groups is more closely aligned. The spatial concentration of these outcomes means that a relatively small fraction of police beats produces an outsized share of force, arrests, and crime suspects of each racial and ethnic group.

To address this empirical fact, we will estimate how specific police beats, calls for service patterns, crime patterns, arrest patterns, suspect patterns, police deployment patterns, and the concentration of social disadvantages related to poverty contribute to these disparities (Sampson, 2012). The empirical models below estimate how differences in crime, suspects by race, arrests by race, and concentrated disadvantage explains monthly rates of force per police beat of Blacks, Hispanics, Whites, and other groups. In each model, the Black, Hispanic, or White force rate per block group will be estimated controlling for concentrated disadvantage, number of crimes, calls for service, suspects of the same race/ethnicity in each month, arrests of individuals of the same race/ethnicity in each month, and police deployment (911 responding officers, permanent assignment, and missions). Standard errors are cluster at the beat-level to correct for over-dispersion and unmeasured dependence within cities (Wooldridge, 2010). Each model is displayed in terms of the count of force per month for a given race/ethnic group in a police beat. These models will help assess the contribution that beat-level factors make to explaining force rates for each demographic group in Chicago.

The point of this analysis is to identify outlier beats with high relative rates of force not explained by relevant contextual factors. While a systematic review of research shows that greater police presence and proactive enforcement in an area helps control crime (Weisburd & Majimundar, 2018), it is also likely that the more officers are exposed to crime and situations requiring an arrest, and the more 911 calls they respond to, the more likely they are to be involved in situations that result in force. Those factors are beyond the direct control of individuals officers and CPD as a whole. However, other variables, such as the number of officers with CIT training or the leadership culture within certain districts and beats, may be within the control of the CPD.

We estimated 4 models. First, we estimated a baseline model (1) that includes no beat-level factors. This is simply the average rate of force per month for each race/ethnic group by police beat. The second model (2) includes measures of the fraction of the population in a police beat that is Black, Hispanic, and White and the level of concentrated disadvantage. The third model (3) includes demographic measures and concentrated disadvantage and adds measures of total reported crimes, arrests, and suspect descriptions for the same racial group. The fourth model (4) includes the demographic and crime-level factors and adds in measures of 911 officers and police missions (deployment) in each beat.

Main Results

Tables 28-30 present regression estimates as Incident Rate Ratios (IRRs), showing the percentage change in force rates for each group related to each factor. An IRR greater than 1 means the event happens more often for a given factor, while an IRR less than 1 means it happens less often. The IRR displays the proportional increase or decrease in the count of force per police beat in a given month. The tables provide the average rate from each model to simplify interpretation, indicating how much force rates for each group per beat change after considering beat-level factors.

Table 28 shows that the rate of force for Black individuals decreases across models: from 0.879 per month (11,561 force events) in Model 1, to 0.717 (-18.5%) in Model 2 after including factors like concentrated poverty and racial demographics, to 0.666 in Model 3 with the inclusion of crime and arrest numbers, and finally to 0.659 in Model 4 after incorporating police deployment factors. Overall, the results demonstrate that including all factors reduced the expected number of force events for Black individuals from 11,561 to 8,667, a decrease of 25%. Arrest numbers are the most significant predictor of force rates. For example, the average monthly arrest rate per beat for Black individuals is 6.03, which represents the average arrest rate for Blacks. Hypothetically doubling this rate to 12.06 would increase the expected rate of force for Black subjects from 0.659 to 0.768, leading to an increase in expected force events from 8,667 to 10,099 (a 16.5% increase) and illustrating how higher arrest rates for Black individuals would contribute to higher rates of force against Black subjects.

Table 28: Rate of Force for Black Subjects

Black Force	Model 1: Base	Model 2: Demographics	Model 3: Crime	Model 4: Deployment
Disadvantage		1.133*	1.085*	1.053
		(0.0555)	(0.0449)	(0.0389)
Population Under 18		0.980	0.984*	0.984*
		(0.0103)	(0.00784)	(0.00783)
Black Population		1.009**	1.004	1.004
		(0.00318)	(0.00252)	(0.00252)
White Population		0.997	0.997	0.994*
		(0.00377)	(0.00269)	(0.00282)
Hispanic Population		0.990*	0.993*	0.992*
		(0.00424)	(0.00324)	(0.00330)
Crimes			1.002	1.003*
			(0.00125)	(0.00126)
Black Suspects			1.008**	1.009**
			(0.00317)	(0.00282)
Black Arrestees			1.033***	1.026***
			(0.00595)	(0.00582)
911 Officers				1.000
				(0.000148)
Beat Officers				1.011***
				(0.00214)
Beat Missions				0.999
				(0.000991)
Ave. Black Force	**0.879**	**0.717**	**0.666**	**0.659**
No. Black Force	11,561	9,430	8,759	8,667

Exponentiated coefficients; Standard errors in parentheses are clustered at the beat-level. Models also include year-month fixed effects.
N = 13,152; ***p≤0.001, **p≤0.01, *p≤0.05.

Table 29 shows that the rate of force for Hispanic individuals also decreases across models: from 0.178 per month (2,341 force events) in Model 1, to 0.119 (-33%) in Model 2 after including factors like concentrated poverty and racial demographics, to 0.113 in Model 3 with the inclusion of crime and arrest numbers, and finally to 0.112 in Model 4 after incorporating police deployment factors. Overall, the results demonstrate that including all factors reduced the expected number of force events for Hispanic individuals from 2,341 to 1,473, a decrease of 37.1%. While the inclusion of concentrated poverty and demographics shifted the rates the most, arrest numbers also were the most significant predictor of force rates. For example, the average monthly Hispanic arrest rate per beat was 1.61. Again, hypothetically doubling this rate to 3.22 would increase the expected rate of force for Hispanic subjects from 0.112 to 0.137, leading to an increase in expected force events from 1,473 to 1,802, a 22% rise.

Table 29: Rate of Force for Hispanic Subjects

Hispanic Force	Model 1: Base	Model 2: Demographics	Model 3: Crime	Model 4: Deployment
Disadvantage		1.298**	1.299**	1.293**
		(0.130)	(0.107)	(0.108)
Population Under 18		0.993	0.992	0.992
		(0.0148)	(0.0123)	(0.0121)
Black Population		0.975***	0.979***	0.978***
		(0.00455)	(0.00420)	(0.00409)
White Population		0.996	1.002	1.001
		(0.00461)	(0.00401)	(0.00411)
Hispanic Population		1.011*	1.000	1.000
		(0.00462)	(0.00456)	(0.00437)
Crimes			1.004***	1.003**
			(0.00110)	(0.00127)
Hispanic Suspects			1.015*	1.015*
			(0.00715)	(0.00702)
Hispanic Arrestees			1.135***	1.132***
			(0.0152)	(0.0150)
911 Officers				1.000
				(0.000228)
Beat Officers				1.003
				(0.00382)
Beat Missions				1.000
				(0.00144)
Ave. Hispanic Force	**0.178**	**0.119**	**0.113**	**0.112**
No. Hispanic Force	2,341	1,565	1,486	1,473

Exponentiated coefficients; Standard errors in parentheses are clustered at the beat-level. Models also include year-month fixed effects.
N = 13,152; ***p≤0.001, **p≤0.01, *p≤0.05.

Table 30 shows the rate of force for White individuals per police beat and also shows a decrease in the rate across models. The largest change is between models 1 and 2, where the inclusion of demographics and concentrated disadvantage reduces the expected force rate from 0.068 to 0.039 (a 42.2% decrease), equivalent to moving from 898 to 517 force events with White subjects. Notably, the presence of a higher Black population within a beat is associated with a decreased likelihood of force against White individuals. The addition of crime and arrest numbers in Model 3 has a minimal impact on the force rate, slightly reducing it to 0.037 (a 5.1% decrease from Model 2). Finally, incorporating police deployment factors in Model 4 results in a further minor decrease of 0.8% in the expected force rate for White subjects. The results suggest that demographic factors, particularly the presence of a larger Black population within a beat, have the most substantial impact on reducing the expected force rate for White individuals. Like other models, the most important predictor appears to be arrests; doubling the average number of arrests for White

individuals (from 0.667 to 1.355) increases the expected number use of force events for White subjects by 19% (from a rate of .037 to .044).

Table 30: Rate of Force for White Subjects

White Force	Model 1: Base	Model 2: Demographics	Model 3: Crime	Model 4: Deployment
Disadvantage		1.155	1.176	1.186*
		(0.117)	(0.106)	(0.101)
Population Under 18		0.987	0.993	0.992
		(0.0109)	(0.00993)	(0.00986)
Black Population		0.966***	0.969***	0.968***
		(0.00402)	(0.00415)	(0.00441)
White Population		1.007	1.006	1.006
		(0.00475)	(0.00464)	(0.00458)
Hispanic Population		0.987**	0.988**	0.987**
		(0.00413)	(0.00395)	(0.00413)
Crimes			1.002	0.999
			(0.00148)	(0.00187)
White Suspects			1.017	1.015
			(0.0182)	(0.0188)
White Arrestees			1.282***	1.293***
			(0.0604)	(0.0640)
911 Officers				1.001
				(0.000508)
Beat Officers				1.002
				(0.00628)
Beat Missions				0.998
				(0.00181)
Average White	**0.068**	**0.039**	**0.037**	**0.037**
No. White Force	898	517	491	487

Exponentiated coefficients; Standard errors in parentheses are clustered at the beat-level. Models also include year-month fixed effects.
N = 13,152; ***p≤0.001, **p≤0.01, *p≤0.05.

A comparison across models reveals that while the rate of force decreases across all racial groups (Black, Hispanic, and White) as more factors are considered in the models, **arrest numbers consistently emerge as the most significant predictor of force rates across all groups.** This highlights the critical role of arrest rates in influencing the likelihood of police use of force, regardless of subject race/ethnicity.

Table 31 shows the expected rate and number of use of force events for Black and Hispanic subjects if arrest rates for these groups in police beats were the same as those of White individuals. Here, instead of the arrest rates for Black and Hispanic individuals being 6.03 and 1.61 per police beat as measured, they are constrained at the White rate of 0.677. Under this scenario, one would

expect the average force rate for Black subjects to fall from 0.659 to 0.575 or -12.7%. For Hispanic subjects if the arrest rate were equivalent per police beat to Whites, the Hispanic use of force rate would shift from 0.112 to 0.099 or -11%. These statistics show that while arrest rates are a major contributor to use of force rates in across Black, Hispanic, and White subjects, they do not explain the overall disparity in use of force rates.

Table 31: Force Rates for Blacks and Hispanics if Arrest Rates were Equal to Whites

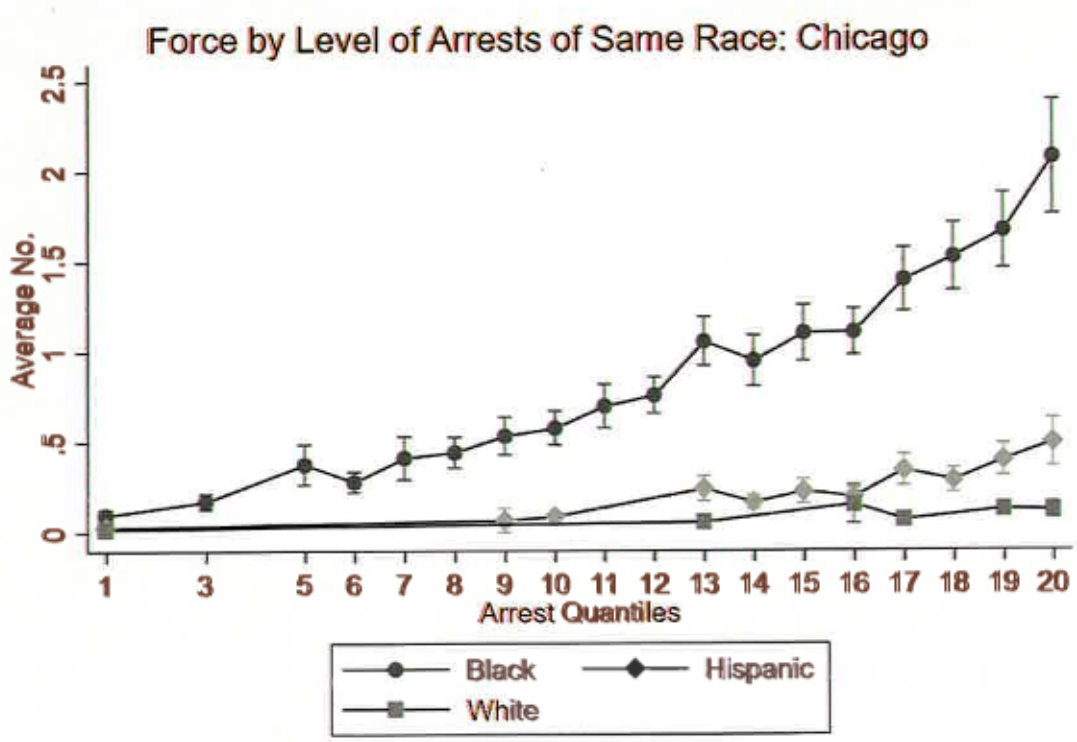
	Black	**Black=White**	**Hispanic**	**Hispanic=White**
Average Rate	0.659	0.575	0.112	0.099
	[0.611,0.707]	[0.517,0.633]	[0.0992,0.125]	[0.0880,0.111]
No. Force	**8,667**	**7,562**	**1,473**	**1,311**

95% confidence intervals in brackets.
N = 13,152

Figure 15 shows this visually through a comparison of what the expected force rate for Black, Hispanic, and White individuals is in a given beat by the level of arrests for each group. The figure shows that force rates climb in areas with higher arrest rates of each group, but the disparity is vastly greater for Black subjects.

One reason for this is due to the vast inequality in crime and arrest rates in general by location in Chicago. There are simply no areas where White subjects have comparable levels of arrest, suspect descriptions, and reported crime to Black subjects.

Figure 15: Force Counts Per Beat by Level of Arrests of Individuals Same Race



Note: Standard errors clustered by police beat.

Table 32 provides the key comparison of force rates for Black, Hispanic, and White individuals per police beat from Model 4. The table also includes the 95% confidence intervals to underscore that the predicted averages are not influenced meaningfully by standard errors of the model estimates. These results show that the average rates of force per police beat remain largely different between Black, Hispanic, and White subjects by group even when controlling for beat-level factors. This suggests that the differences in the rates of force for Black, Hispanic, and White subjects per police beat are not fully a result of crime rates, police deployment, or arrests. Rather, the results suggest that it is the characteristics of the individual incidents themselves that drive the differences in force rates between Black, Hispanic, and Whites per police beat.

Table 32: Force Rates for Blacks, Hispanic, and White Subjects (Model 4 Estimates)

	Black	Hispanic	White
Average Rate	0.659	0.112	0.0370
	[0.611,0.707]	[0.0989,0.126]	[0.0306,0.0434]
Observations	13152	13152	13152

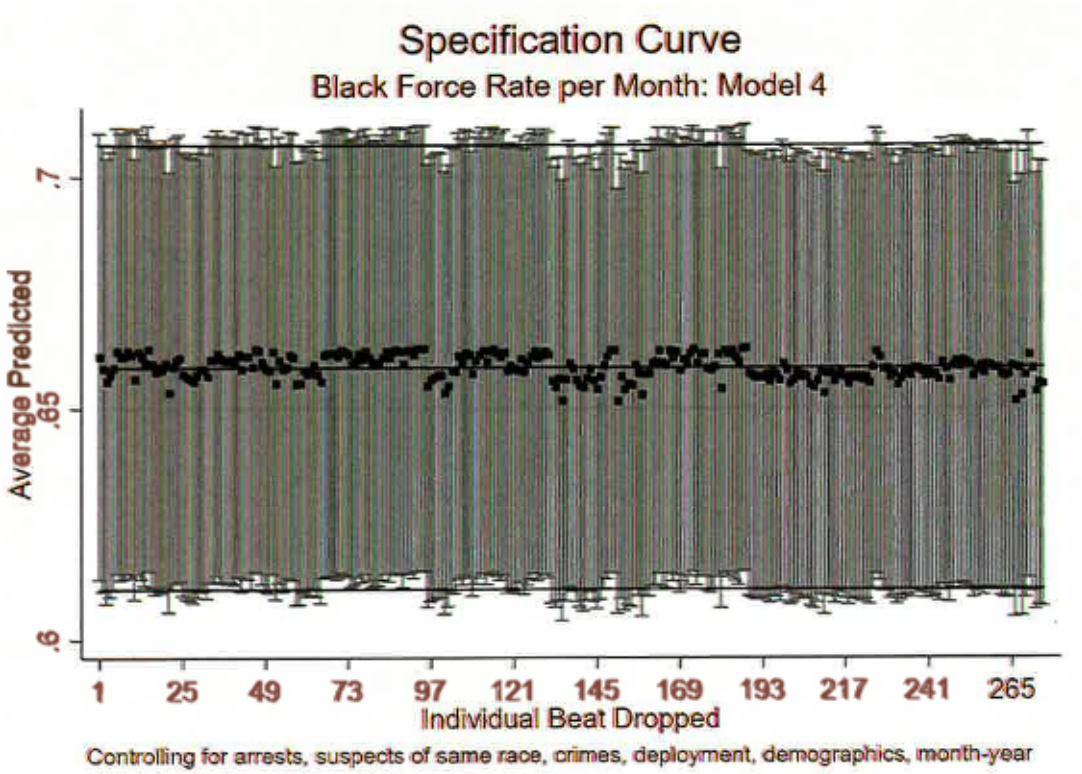
95% confidence intervals in brackets

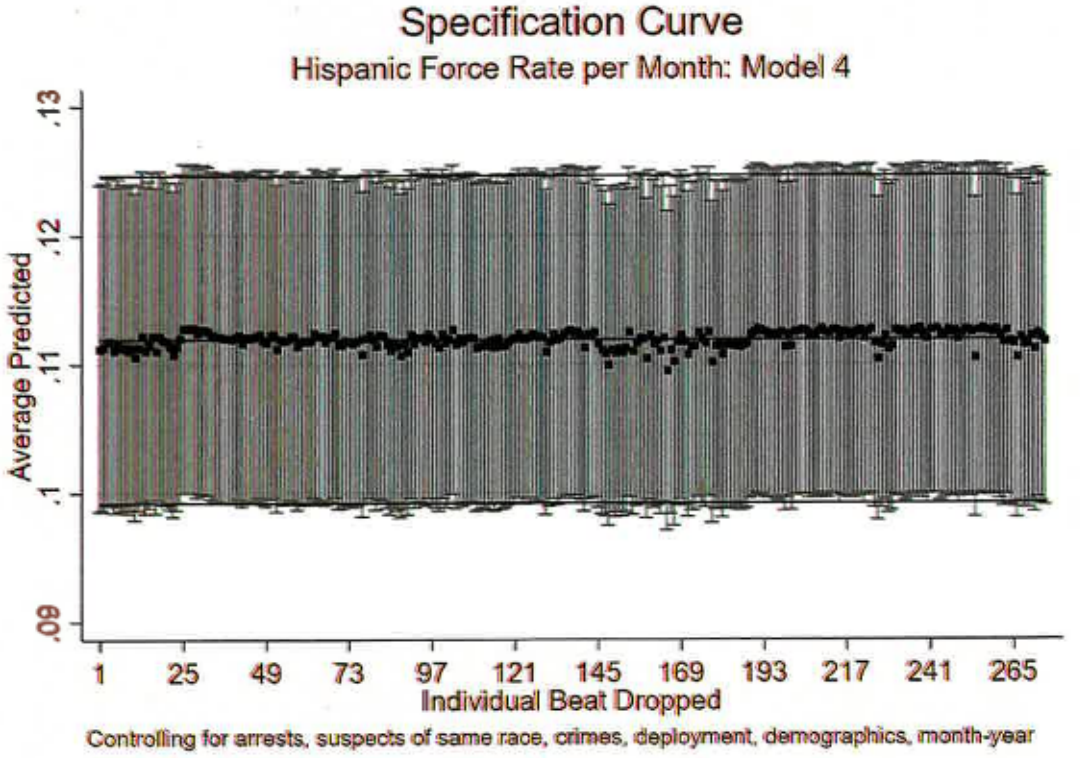
Individual-Police Beat Analysis

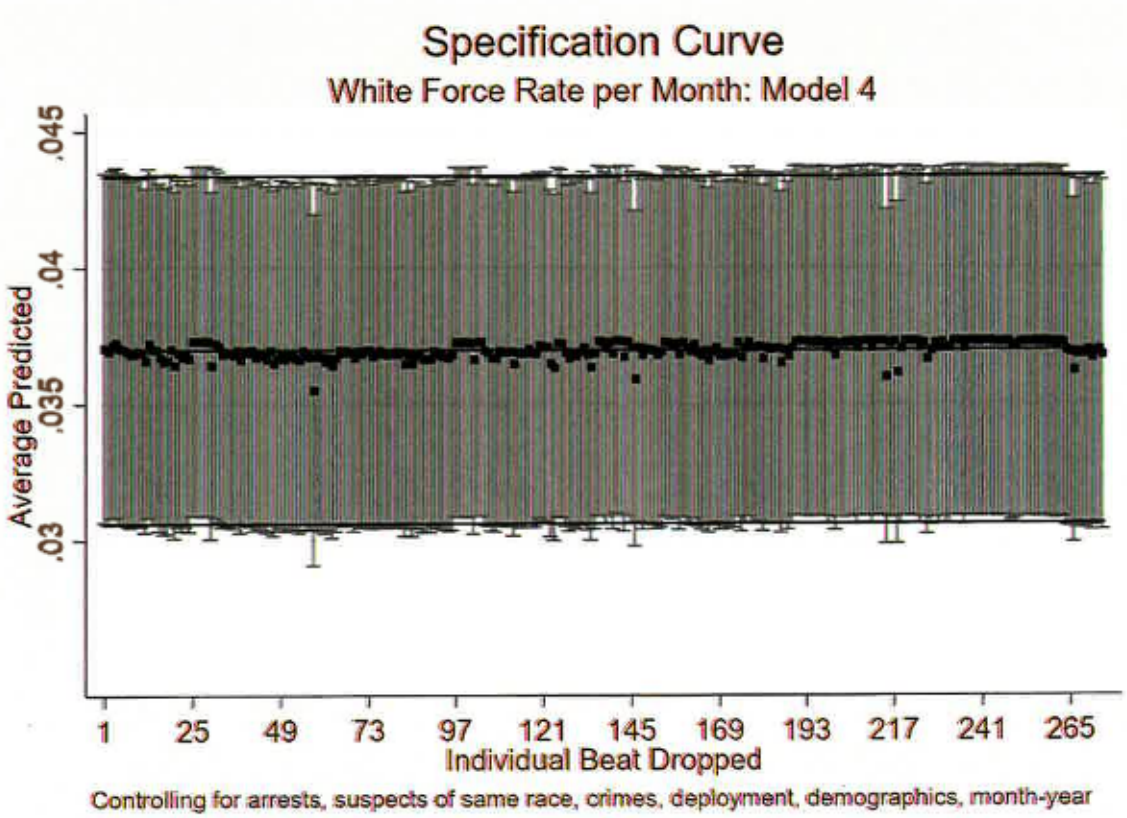
To understand if some police beats significantly impacted use of force rates, we re-ran our best model (Model 4) multiple times (see Figure 16 below). Each time, we excluded one police beat from the analysis. By observing how the results changed with each beat removed, we could identify any beats that appeared to be driving the overall numbers up or down. This helps us determine if there are specific areas or policing practices within certain beats that are disproportionately contributing to the differences in how force is used across different racial groups. In the following figures, we present specification curves (Simonohn et al., 2020), which display the results of these 274 different regressions against the overall Model 4 results. The horizontal main lines on the graph show the average predicted use of force rate and the 95% confidence intervals from Model 4. Each dot represents the estimate after dropping individual police beats, and the bars represent the individual 95% confidence intervals.

The results show that the average prediction of force from Model 4 does not depend on any individual police beat. These results confirm that the main Model 4 is not particularly impacted by a single outlier. The key takeaway is that removing even a beat with the highest or lowest rate of use of force would not impact the overall city picture of difference in use of force rates between Black, Hispanic, and White subjects. While beat level arrest rates certainly matter in the rates of force experienced by all racial groups, *individual* police beats do not have an outsized effect on levels of force in Chicago.

Figure 16: Estimates after Removing Individual Beats


Specification Curve
Black Force Rate per Month: Model 4
Average Predicted
.6
.65
.7
1
25
49
73
97
121
145
169
193
217
241
265
Individual Beat Dropped
Controlling for arrests, suspects of same race, crimes, deployment, demographics, month-year


Specification Curve
Hispanic Force Rate per Month: Model 4
Average Predicted
.09
.1
.11
.12
.13
1
25
49
73
97
121
145
169
193
217
241
265
Individual Beat Dropped
Controlling for arrests, suspects of same race, crimes, deployment, demographics, month-year


Specification Curve
White Force Rate per Month: Model 4
Average Predicted
.03
.035
.04
.045
1
25
49
73
97
121
145
169
193
217
241
265
Individual Beat Dropped
Controlling for arrests, suspects of same race, crimes, deployment, demographics, month-year

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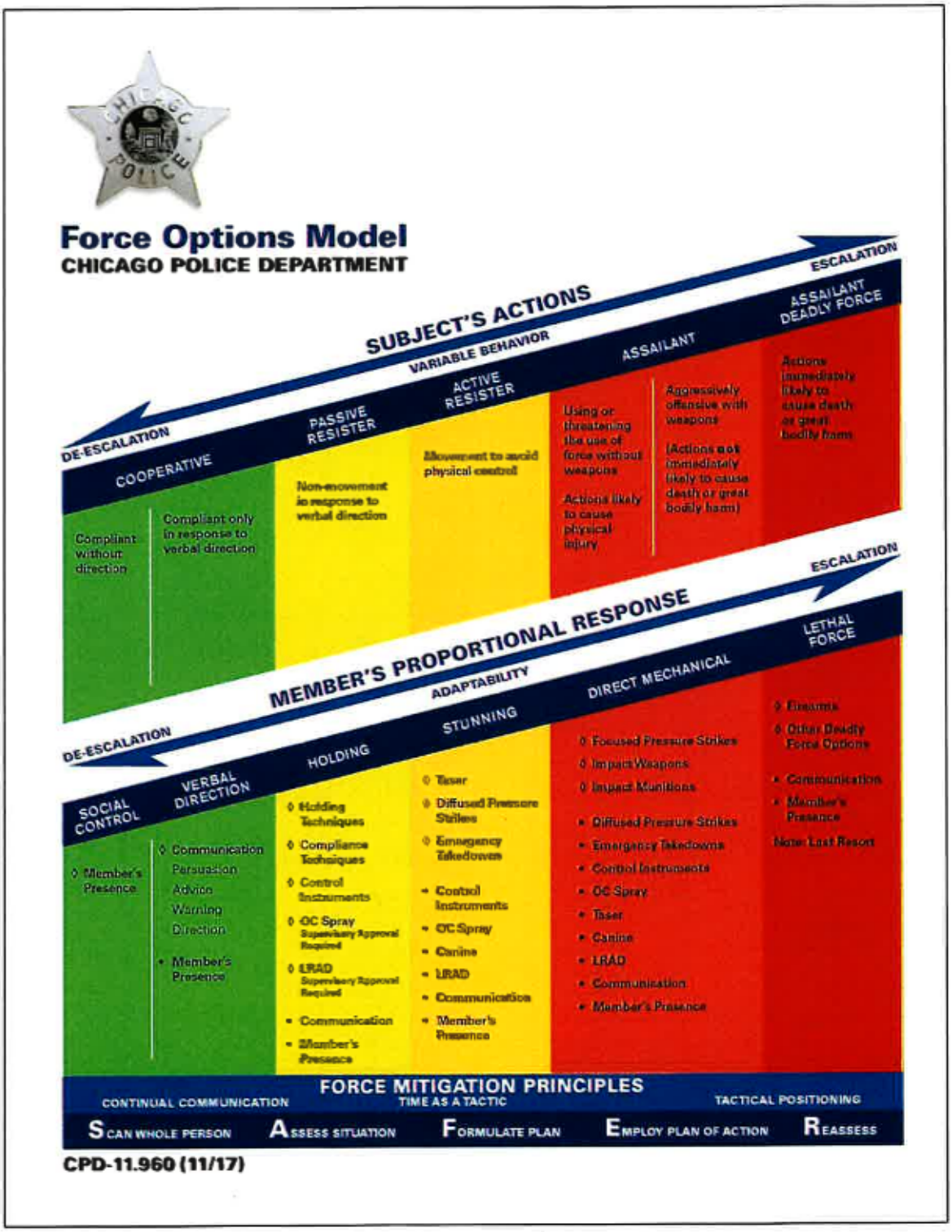
APPENDIX A: CPD FORCE OPTIONS MODEL



APPENDIX B: FULL FORCE & INJURY MODELS

Appendix Table B1: Maximum Force Models 1 to 5

	(1) Maximum Force	(2) Maximum Force	(3) Maximum Force	(4) Maximum Force	(5) Maximum Force
Subject age	-0.00298	0.00112	0.00102	0.00162	-0.000164
	(0.00322)	(0.00325)	(0.00326)	(0.00334)	(0.00414)
Subject age^2	-0.00000630	-0.0000527	-0.0000505	-0.0000595	-0.0000516
	(0.0000453)	(0.0000455)	(0.0000456)	(0.0000469)	(0.0000586)
Black subject	0.0947**	0.0937**	0.0804*	0.0653	0.0576
	(0.0315)	(0.0324)	(0.0342)	(0.0357)	(0.0465)
Hispanic subject	0.113**	0.115**	0.120**	0.120**	0.106*
	(0.0359)	(0.0363)	(0.0376)	(0.0385)	(0.0497)
Other subject	0.0608	0.0899	0.0890	0.0847	-0.117
	(0.0942)	(0.0933)	(0.0953)	(0.0959)	(0.106)
Male subject	0.312***	0.288***	0.286***	0.290***	0.259***
	(0.0202)	(0.0217)	(0.0217)	(0.0217)	(0.0262)
Disability=1	-0.195	-0.214	-0.212	-0.246	-0.101
	(0.143)	(0.128)	(0.129)	(0.126)	(0.166)
Mental illness=1		-0.0377	-0.0350	-0.0322	-0.00872
		(0.0231)	(0.0232)	(0.0235)	(0.0290)
Other officer		-0.0123	-0.0116	-0.0103	0
		(0.0337)	(0.0338)	(0.0328)	(.)
Black officer		0.0924***	0.0848***	0.0848***	0
		(0.0216)	(0.0217)	(0.0225)	(.)
Hispanic officer		0.00498	0.00487	0.0108	0
		(0.0170)	(0.0170)	(0.0170)	(.)
Police officer age		-0.00228	-0.00199	-0.00236	-0.0930
		(0.00743)	(0.00745)	(0.00742)	(0.0637)
Police officer age^2		0.0000148	0.0000119	0.0000166	0.000213
		(0.000101)	(0.000101)	(0.000101)	(0.000582)

APPENDIX B: FULL FORCE & INJURY MODELS

Appendix Table B1: Maximum Force Models 1 to 5

	(1) Maximum Force	(2) Maximum Force	(3) Maximum Force	(4) Maximum Force	(5) Maximum Force
Subject age	-0.00298	0.00112	0.00102	0.00162	-0.000164
	(0.00322)	(0.00325)	(0.00326)	(0.00334)	(0.00414)
Subject age^2	-0.00000630	-0.0000527	-0.0000505	-0.0000595	-0.0000516
	(0.0000453)	(0.0000455)	(0.0000456)	(0.0000469)	(0.0000586)
Black subject	0.0947**	0.0937**	0.0804*	0.0653	0.0576
	(0.0315)	(0.0324)	(0.0342)	(0.0357)	(0.0465)
Hispanic subject	0.113**	0.115**	0.120**	0.120**	0.106*
	(0.0359)	(0.0363)	(0.0376)	(0.0385)	(0.0497)
Other subject	0.0608	0.0899	0.0890	0.0847	-0.117
	(0.0942)	(0.0933)	(0.0953)	(0.0959)	(0.106)
Male subject	0.312***	0.288***	0.286***	0.290***	0.259***
	(0.0202)	(0.0217)	(0.0217)	(0.0217)	(0.0262)
Disability=1	-0.195	-0.214	-0.212	-0.246	-0.101
	(0.143)	(0.128)	(0.129)	(0.126)	(0.166)
Mental illness=1		-0.0377	-0.0350	-0.0322	-0.00872
		(0.0231)	(0.0232)	(0.0235)	(0.0290)
Other officer		-0.0123	-0.0116	-0.0103	0
		(0.0337)	(0.0338)	(0.0328)	(.)
Black officer		0.0924***	0.0848***	0.0848***	0
		(0.0216)	(0.0217)	(0.0225)	(.)
Hispanic officer		0.00498	0.00487	0.0108	0
		(0.0170)	(0.0170)	(0.0170)	(.)
Police officer age		-0.00228	-0.00199	-0.00236	-0.0930
		(0.00743)	(0.00745)	(0.00742)	(0.0637)
Police officer age^2		0.0000148	0.0000119	0.0000166	0.000213
		(0.000101)	(0.000101)	(0.000101)	(0.000582)

Male officer	0.102***	0.103***	0.0978***	0
	(0.0265)	(0.0266)	(0.0260)	(.)
Rank: police officer	0.0823*	0.0790*	0.0870*	-0.0203
	(0.0348)	(0.0349)	(0.0350)	(0.0745)
Rank: sergeant	0.0372	0.0277	0.0221	-0.0306
	(0.0474)	(0.0475)	(0.0478)	(0.172)
Citi training=yes	-0.00800	-0.00711	-0.00821	-0.0746
	(0.0202)	(0.0202)	(0.0199)	(0.0527)
Years of service	0.00143	0.00172	0.00191	0.000790
	(0.00236)	(0.00238)	(0.00239)	(0.0297)
Call for service	0.0776	0.0667	0.0679	0.0934
	(0.0700)	(0.0697)	(0.0681)	(0.0780)
On View	0.0216	0.00733	0.0143	-0.00238
	(0.0709)	(0.0707)	(0.0685)	(0.0785)
Other	0.114	0.0961	0.0921	0.115
	(0.0736)	(0.0733)	(0.0713)	(0.0822)
Indoor	0.00371	0.00224	0.0172	0.0370
	(0.0177)	(0.0179)	(0.0181)	(0.0220)
Alone	0.00695	0.00528	0.0114	0.000668
	(0.0253)	(0.0253)	(0.0250)	(0.0347)
Ambush	0.224*	0.232*	0.238*	0.142
	(0.110)	(0.111)	(0.107)	(0.114)
Investigatory stop	0.0547**	0.0549**	0.0510**	0.0391
	(0.0196)	(0.0197)	(0.0194)	(0.0243)
Traffic stop	-0.0186	-0.0182	-0.0183	-0.0324
	(0.0229)	(0.0230)	(0.0233)	(0.0277)
Violent	-0.0853*	-0.0898*	-0.0840*	-0.0117
	(0.0425)	(0.0428)	(0.0420)	(0.0501)
Resisting	-0.127***	-0.129***	-0.115***	-0.109**
	(0.0307)	(0.0307)	(0.0308)	(0.0377)

Domestic		-0.0914***	-0.0903***	-0.0826**	-0.0169
		(0.0265)	(0.0265)	(0.0263)	(0.0317)
Weapons		0.0847**	0.0852**	0.0905**	0.0994**
		(0.0284)	(0.0284)	(0.0283)	(0.0348)
Other charge		0.0114	0.0118	0.0190	-0.00359
		(0.0261)	(0.0261)	(0.0260)	(0.0329)
Max resistance		0.154***	0.152***	0.157***	0.160***
		(0.0146)	(0.0146)	(0.0144)	(0.0172)
Daytime		-0.00990	-0.0129	-0.0133	-0.0457*
		(0.0152)	(0.0152)	(0.0152)	(0.0208)
Total crimes in beat			0.0000845		-0.000367
			(0.000262)		(0.000348)
Total arrests in beat			0.0000812		0.000646
			(0.00103)		(0.00135)
% Black pop. in beat			0.0000435		0.000732
			(0.000465)		(0.000731)
% White pop. in beat			-0.000362		-0.0000983
			(0.000600)		(0.00100)
% Hisp. pop in beat			-0.000552		0.000863
			(0.000539)		(0.000875)
Constant	2.589***	1.856***	1.887***	1.981***	4.949**
	(0.0821)	(0.185)	(0.190)	(0.200)	(1.675)
Observations	14280	13824	13744	13824	11209
No. Events	7441.6	7179.4	7140.2	7179.4	

Appendix Table B2: Total Force Models 1 to 5

	(1) Total Force	(2) Total Force	(3) Total Force	(4) Total Force	(5) Total Force
Subject age	0.0458***	0.0497***	0.0484***	0.0547***	0.0392*
	(0.0111)	(0.0115)	(0.0115)	(0.0119)	(0.0161)
Subject age^2	-0.000775***	-0.000821***	-0.000799***	-0.000891***	-0.000764***
	(0.000151)	(0.000157)	(0.000157)	(0.000163)	(0.000223)
Black subject	0.326***	0.400***	0.312**	0.300**	0.358*
	(0.0982)	(0.103)	(0.109)	(0.113)	(0.171)
Hispanic subject	0.271*	0.281*	0.314**	0.299*	0.196
	(0.114)	(0.117)	(0.121)	(0.123)	(0.186)
Other subject	0.417	0.368	0.404	0.351	-0.0171
	(0.338)	(0.347)	(0.352)	(0.369)	(0.459)
Male subject	0.885***	1.141***	1.131***	1.146***	1.133***
	(0.0654)	(0.0722)	(0.0725)	(0.0733)	(0.103)
Disability=1	-1.318***	-1.327***	-1.321***	-1.567***	-0.845
	(0.362)	(0.324)	(0.326)	(0.330)	(0.529)
Mental illness=1		0.0537	0.0692	0.0911	-0.0426
		(0.0871)	(0.0874)	(0.0878)	(0.119)
Other officer		0.210	0.209	0.186	0
		(0.134)	(0.134)	(0.131)	(.)
Black officer		-0.186*	-0.220**	-0.147	0
		(0.0731)	(0.0741)	(0.0777)	(.)
Hispanic officer		0.0102	0.0112	0.0440	0
		(0.0607)	(0.0609)	(0.0617)	(.)
Police officer age		-0.0355	-0.0318	-0.0321	0.414
		(0.0265)	(0.0266)	(0.0268)	(0.249)
Police officer age^2		0.000413	0.000370	0.000383	-0.000487
		(0.000356)	(0.000358)	(0.000360)	(0.00228)
Male officer		-0.120	-0.114	-0.141	0
		(0.0909)	(0.0910)	(0.0901)	(.)

Rank: police off.	0.526***	0.506***	0.541***	0.588
	(0.112)	(0.113)	(0.114)	(0.301)
Rank: sergeant	1.055***	0.995***	1.034***	0.471
	(0.153)	(0.154)	(0.157)	(0.650)
Citi training=yes	-0.132	-0.130	-0.133	-0.176
	(0.0696)	(0.0697)	(0.0700)	(0.217)
Years of service	-0.00216	-0.00154	-0.00157	0.0106
	(0.00843)	(0.00853)	(0.00865)	(0.118)
Call for service	0.257	0.225	0.170	0.262
	(0.256)	(0.256)	(0.254)	(0.345)
On View	-0.239	-0.282	-0.288	-0.220
	(0.257)	(0.257)	(0.255)	(0.345)
Other	0.533*	0.506	0.441	0.816*
	(0.270)	(0.271)	(0.268)	(0.362)
Indoor	0.258***	0.249***	0.303***	0.373***
	(0.0656)	(0.0660)	(0.0670)	(0.0897)
Alone	-0.839***	-0.821***	-0.771***	-0.766***
	(0.0764)	(0.0767)	(0.0778)	(0.119)
Ambush	-0.818**	-0.805**	-0.757**	-0.802*
	(0.251)	(0.251)	(0.258)	(0.347)
Invest. stop	-0.0602	-0.0585	-0.0728	-0.111
	(0.0675)	(0.0677)	(0.0684)	(0.0935)
Traffic stop	0.00746	-0.00277	-0.0569	-0.0636
	(0.0775)	(0.0780)	(0.0790)	(0.102)
Violent	-0.528***	-0.533***	-0.542***	-0.426*
	(0.144)	(0.144)	(0.145)	(0.194)
Resisting	-0.243*	-0.237*	-0.257*	-0.167
	(0.108)	(0.108)	(0.109)	(0.147)
Domestic	-0.0937	-0.0980	-0.0874	0.0751
	(0.0965)	(0.0966)	(0.0962)	(0.129)

Weapons		-0.0351	-0.0325	-0.0400	0.0653
		(0.102)	(0.102)	(0.102)	(0.137)
Other charge		-0.214*	-0.209*	-0.215*	-0.233
		(0.0927)	(0.0928)	(0.0931)	(0.128)
Max resistance		0.759***	0.758***	0.774***	0.878***
		(0.0425)	(0.0426)	(0.0432)	(0.0572)
Daytime		0.201***	0.189***	0.202***	0.0349
		(0.0540)	(0.0542)	(0.0552)	(0.0822)
Total crimes in beat			-0.00219*		0.000168
			(0.000900)		(0.00139)
Total arrests in beat			0.00454		-0.00150
			(0.00350)		(0.00527)
% Black pop. in beat			-0.000634		-0.00120
			(0.00166)		(0.00291)
% White pop. in beat			-0.00366		-0.00557
			(0.00213)		(0.00389)
% Hisp. pop in beat			-0.00424*		-0.000705
			(0.00198)		(0.00349)
Constant	2.543***	-0.0112	0.316	0.151	-14.17*
	(0.266)	(0.657)	(0.678)	(0.747)	(6.607)
Observations	14680	14171	14089	14171	11567
No. Events	7771.9	7465.4	7425.2	7465.4	

Appendix Table B3 Force Factor: Models 1 to 5

	(1) Force Factor	(2) Force Factor	(3) Force Factor	(4) Force Factor	(5) Force Factor
Subject age	0.000739	0.00112	0.00102	0.00162	-0.000164
	(0.00427)	(0.00325)	(0.00326)	(0.00334)	(0.00414)
Subject age^2	-0.0000616	-0.0000527	-0.0000505	-0.0000595	-0.0000516
	(0.0000601)	(0.0000455)	(0.0000456)	(0.0000469)	(0.0000586)
Black subject	0.208***	0.0937**	0.0804*	0.0653	0.0576
	(0.0398)	(0.0324)	(0.0342)	(0.0357)	(0.0465)
Hispanic subject	0.182***	0.115**	0.120**	0.120**	0.106*
	(0.0454)	(0.0363)	(0.0376)	(0.0385)	(0.0497)
Other subject	0.0467	0.0899	0.0890	0.0847	-0.117
	(0.103)	(0.0933)	(0.0953)	(0.0959)	(0.106)
Male subject	0.509***	0.288***	0.286***	0.290***	0.259***
	(0.0259)	(0.0217)	(0.0217)	(0.0217)	(0.0262)
Disability=1	-0.252	-0.214	-0.212	-0.246	-0.101
	(0.137)	(0.128)	(0.129)	(0.126)	(0.166)
Mental illness=1		-0.0377	-0.0350	-0.0322	-0.00872
		(0.0231)	(0.0232)	(0.0235)	(0.0290)
Other officer		-0.0123	-0.0116	-0.0103	0
		(0.0337)	(0.0338)	(0.0328)	(.)
Black officer		0.0924***	0.0848***	0.0848***	0
		(0.0216)	(0.0217)	(0.0225)	(.)
Hispanic officer		0.00498	0.00487	0.0108	0
		(0.0170)	(0.0170)	(0.0170)	(.)
Police officer age		-0.00228	-0.00199	-0.00236	-0.0930
		(0.00743)	(0.00745)	(0.00742)	(0.0637)
Police officer age^2		0.0000148	0.0000119	0.0000166	0.000213
		(0.000101)	(0.000101)	(0.000101)	(0.000582)
Male officer		0.102***	0.103***	0.0978***	0
		(0.0265)	(0.0266)	(0.0260)	(.)
Rank: police off.		0.0823*	0.0790*	0.0870*	-0.0203
		(0.0348)	(0.0349)	(0.0350)	(0.0745)
Rank: sergeant		0.0372	0.0277	0.0221	-0.0306
		(0.0474)	(0.0475)	(0.0478)	(0.172)

Citi training=yes	-0.00800	-0.00711	-0.00821	-0.0746
	(0.0202)	(0.0202)	(0.0199)	(0.0527)
Years of service	0.00143	0.00172	0.00191	0.000790
	(0.00236)	(0.00238)	(0.00239)	(0.0297)
Call for service	0.0776	0.0667	0.0679	0.0934
	(0.0700)	(0.0697)	(0.0681)	(0.0780)
On View	0.0216	0.00733	0.0143	-0.00238
	(0.0709)	(0.0707)	(0.0685)	(0.0785)
Other	0.114	0.0961	0.0921	0.115
	(0.0736)	(0.0733)	(0.0713)	(0.0822)
Indoor	0.00371	0.00224	0.0172	0.0370
	(0.0177)	(0.0179)	(0.0181)	(0.0220)
Alone	0.00695	0.00528	0.0114	0.000668
	(0.0253)	(0.0253)	(0.0250)	(0.0347)
Ambush	0.224*	0.232*	0.238*	0.142
	(0.110)	(0.111)	(0.107)	(0.114)
Investigatory stop	0.0547**	0.0549**	0.0510**	0.0391
	(0.0196)	(0.0197)	(0.0194)	(0.0243)
Traffic stop	-0.0186	-0.0182	-0.0183	-0.0324
	(0.0229)	(0.0230)	(0.0233)	(0.0277)
Violent	-0.0853*	-0.0898*	-0.0840*	-0.0117
	(0.0425)	(0.0428)	(0.0420)	(0.0501)
Resisting	-0.127***	-0.129***	-0.115***	-0.109**
	(0.0307)	(0.0307)	(0.0308)	(0.0377)
Domestic	-0.0914***	-0.0903***	-0.0826**	-0.0169
	(0.0265)	(0.0265)	(0.0263)	(0.0317)
Weapons	0.0847**	0.0852**	0.0905**	0.0994**
	(0.0284)	(0.0284)	(0.0283)	(0.0348)
Other charge	0.0114	0.0118	0.0190	-0.00359
	(0.0261)	(0.0261)	(0.0260)	(0.0329)
Max resistance	-0.846***	-0.848***	-0.843***	-0.840***
	(0.0146)	(0.0146)	(0.0144)	(0.0172)
Daytime=1	-0.00990	-0.0129	-0.0133	-0.0457*
	(0.0152)	(0.0152)	(0.0152)	(0.0208)

Total crimes in beat			0.0000845		-0.000367
			(0.000262)		(0.000348)
Total arrests in beat			0.0000812		0.000646
			(0.00103)		(0.00135)
% Black pop. in beat			0.0000435		0.000732
			(0.000465)		(0.000731)
% White pop. in beat			-0.000362		-0.0000983
			(0.000600)		(0.00100)
% Hisp. pop in beat			-0.000552		0.000863
			(0.000539)		(0.000875)
Constant	-1.239***	1.856***	1.887***	1.981***	4.949**
	(0.103)	(0.185)	(0.190)	(0.200)	(1.675)
Observations	14213	13824	13744	13824	11209
No. Incidents	7380.6	7179.4	7140.2	7179.4	

Appendix Table B4 Officer Injury: Models 1 to 4

	(1) Officer Injured	(2) Officer Injured	(3) Officer Injured	(4) Officer Injured
Subject age	0.0237*	0.0333**	0.0306**	0.0329**
	(0.0104)	(0.0109)	(0.0109)	(0.0113)
Subject age^2	-0.000440**	-0.000574***	-0.000540***	-0.000559***
	(0.000149)	(0.000155)	(0.000155)	(0.000161)
Other subject	-0.247**	-0.140	-0.00710	0.0278
	(0.0846)	(0.0890)	(0.0944)	(0.102)
Black subject	-0.181	-0.146	-0.0864	-0.0710
	(0.0961)	(0.0995)	(0.103)	(0.110)
Hispanic subject	-0.460	-0.559*	-0.552*	-0.441
	(0.258)	(0.274)	(0.277)	(0.292)
Male subject	-0.359***	-0.103	-0.110	-0.116
	(0.0560)	(0.0609)	(0.0614)	(0.0637)
Disability=1	-0.863	-0.976	-0.903	-0.765
	(0.469)	(0.566)	(0.561)	(0.548)
Mental illness=1	0.244***	0.248***	0.235***	
	(0.0674)	(0.0680)	(0.0710)	
Other officer	0.0128	-0.00869	-0.0171	
	(0.102)	(0.103)	(0.106)	
Black officer	-0.200**	-0.155*	-0.162*	
	(0.0674)	(0.0683)	(0.0719)	
Hispanic officer	0.00970	0.0210	0.0102	
	(0.0503)	(0.0506)	(0.0528)	
Police officer age	0.0372	0.0297	0.0437	
	(0.0222)	(0.0224)	(0.0229)	
Police officer age^2	-0.000445	-0.000356	-0.000572	
	(0.000298)	(0.000300)	(0.000306)	
Male officer	-0.331***	-0.320***	-0.331***	
	(0.0672)	(0.0675)	(0.0696)	

Rank: police officer	-0.121	-0.114	-0.146
	(0.0977)	(0.0979)	(0.0998)
Rank: sergeant	-0.359**	-0.309*	-0.321*
	(0.135)	(0.136)	(0.135)
Citi training=yes	-0.0337	-0.0387	-0.0341
	(0.0599)	(0.0602)	(0.0614)
Years of service	0.00994	0.00737	0.00859
	(0.00683)	(0.00691)	(0.00716)
Call for service	-0.0969	-0.0721	-0.0673
	(0.186)	(0.187)	(0.192)
On View	-0.0414	-0.0164	0.0144
	(0.188)	(0.190)	(0.194)
Other	-0.0577	-0.0325	0.00266
	(0.196)	(0.198)	(0.202)
Indoor	-0.0323	-0.0477	-0.0235
	(0.0529)	(0.0534)	(0.0559)
Alone	0.174*	0.156*	0.169*
	(0.0705)	(0.0710)	(0.0727)
Ambush	0.613***	0.626***	0.704***
	(0.175)	(0.176)	(0.178)
Investigatory stop	0.168**	0.170**	0.160**
	(0.0594)	(0.0598)	(0.0618)
Traffic stop	0.263***	0.287***	0.285***
	(0.0662)	(0.0668)	(0.0694)
Violent	0.789***	0.810***	0.853***
	(0.102)	(0.103)	(0.106)
Resisting	-0.457***	-0.458***	-0.420***
	(0.0982)	(0.0990)	(0.100)
Domestic	0.641***	0.664***	0.688***
	(0.0756)	(0.0760)	(0.0782)

Weapons	0.0355	0.0816	0.0984	
	(0.0862)	(0.0868)	(0.0889)	
Other charge	-0.209*	-0.206*	-0.205*	
	(0.0816)	(0.0821)	(0.0840)	
Max resistance	0.377***	0.380***	0.391***	
	(0.0360)	(0.0363)	(0.0374)	
Daytime	0.113*	0.119**	0.140**	
	(0.0457)	(0.0461)	(0.0475)	
Total crimes in beat		0.000255		
		(0.000793)		
Total arrests in beat		-0.000188		
		(0.00308)		
% Black pop. in beat		-0.00258		
		(0.00139)		
% White pop. in beat		0.00183		
		(0.00181)		
% Hisp. pop in beat		-0.00153		
		(0.00164)		
Constant	-0.676**	-3.091***	-2.953***	-3.140***
	(0.233)	(0.541)	(0.561)	(0.613)
Observations	14680	14171	14089	14169
No. Incidents	7771.9	7465.4	7425.2	7464.4

Appendix Table B5 Subject Injury: Models 1 to 4

	(1) Subject Injured	(2) Subject Injured	(3) Subject Injured	(4) Subject Injured
Subject age	0.00218	0.0158	0.0186	0.0212
	(0.0125)	(0.0133)	(0.0135)	(0.0140)
Subject age^2	0.0000516	-0.0000831	-0.000124	-0.000152
	(0.000169)	(0.000180)	(0.000182)	(0.000190)
Black subject	-0.273*	-0.445***	-0.536***	-0.527***
	(0.116)	(0.121)	(0.130)	(0.142)
Hispanic subject	-0.0383	-0.106	-0.110	-0.123
	(0.130)	(0.134)	(0.140)	(0.148)
Other subject	-0.0632	-0.000678	-0.130	-0.156
	(0.337)	(0.342)	(0.354)	(0.360)
Male subject	0.823***	0.666***	0.663***	0.693***
	(0.103)	(0.111)	(0.111)	(0.114)
Disability=1	-0.394	-0.821	-0.844	-0.840
	(0.557)	(0.539)	(0.536)	(0.568)
Mental illness=1		0.137	0.138	0.168
		(0.0971)	(0.0973)	(0.101)
Black officer		0.213*	0.190*	0.131
		(0.0885)	(0.0905)	(0.0949)
Hispanic officer		0.0318	0.0467	0.00143
		(0.0695)	(0.0698)	(0.0720)
Other officer		0.0130	0.00675	0.00996
		(0.0346)	(0.0344)	(0.0350)
Police officer age		-0.000334	-0.000235	-0.000262
		(0.000478)	(0.000474)	(0.000483)
Police officer age^2		-0.000349	-0.000251	-0.000284
		(0.000476)	(0.000472)	(0.000481)
Male officer		0.352**	0.343**	0.346**
		(0.114)	(0.115)	(0.117)

Rank: police officer	0.121	0.0939	0.103
	(0.145)	(0.145)	(0.149)
Rank: sergeant	0.127	0.106	0.0753
	(0.187)	(0.187)	(0.191)
Citi training=yes	0.111	0.110	0.106
	(0.0822)	(0.0828)	(0.0846)
Years of service	0.00352	0.00320	0.00297
	(0.00976)	(0.00989)	(0.0103)
Call for service	-0.0300	-0.0642	-0.116
	(0.305)	(0.304)	(0.311)
On View	-0.0533	-0.0870	-0.101
	(0.309)	(0.307)	(0.315)
Other	-0.149	-0.203	-0.251
	(0.319)	(0.318)	(0.324)
Indoor	-0.0983	-0.0860	-0.0642
	(0.0752)	(0.0759)	(0.0809)
Alone	0.167	0.182	0.177
	(0.0962)	(0.0965)	(0.0988)
Ambush	0.444*	0.455*	0.524*
	(0.219)	(0.219)	(0.220)
Investigatory stop	0.366***	0.370***	0.344***
	(0.0759)	(0.0763)	(0.0784)
Traffic stop	0.210*	0.214*	0.222*
	(0.0856)	(0.0858)	(0.0898)
Violent	-0.000270	-0.0589	0.0341
	(0.156)	(0.158)	(0.164)
Resisting	-0.00843	-0.0110	0.00831
	(0.135)	(0.136)	(0.140)
Domestic	0.0400	0.0431	0.0783
	(0.114)	(0.114)	(0.118)

Weapons		0.499***	0.490***	0.562***
		(0.119)	(0.119)	(0.124)
Other charge		0.334**	0.337**	0.383**
		(0.114)	(0.115)	(0.119)
Max resistance		0.294***	0.295***	0.295***
		(0.0529)	(0.0530)	(0.0550)
Daytime		0.143*	0.142*	0.157*
		(0.0637)	(0.0640)	(0.0658)
Total crimes in beat			0.000594	
			(0.00106)	
Total arrests in beat			-0.00423	
			(0.00417)	
% Black pop. in beat			0.00142	
			(0.00196)	
% White pop in beat			-0.00137	
			(0.00255)	
% Hisp pop in beat			-0.000416	
			(0.00231)	
Constant	-0.676**	-3.091***	-2.953***	-3.140***
	(0.233)	(0.541)	(0.561)	(0.613)
Observations	14680	14171	14089	14169
No. Incidents	7771.9	7465.4	7425.2	7464.4

APPENDIX C: DOUBLY ROBUST FORCE AND INJURY MODELS

We also estimated a "doubly robust" (DR) model that compares the maximum force, total level of force, subject injuries, and officer injuries for Black and Hispanic use of force incidents when they are identical on average to incidents involving White subjects on all observable factors estimated in model 3. This approach helps address the potential concerns that factors that are correlated with race, such as the suspected crime and police beat level factors, are not adequately adjusted for in a regression model alone (Zhao & Percival, 2017). The results from these models are shown in Table C1 in terms of average predicted maximum and total force for Black and Hispanic subjects relative to White subjects involved in force that were identical on average based on age, disability status, gender, incident and officer characteristics, and the population of beats, crime, and arrests and the year and month of the incident.

The results in Table C1 show that the average predicted maximum force for White subjects was 2.62, compared to 2.80 for Black subjects, with case characteristics on average being similar between the two groups. This difference of 0.18 (an absolute approximate difference of 7%) is statistically significant, as the 95% confidence intervals do not overlap, indicating that this difference would occur by chance less than 5 times out of 100. Regarding total force, the results show that Black subjects experienced an average total force level of 4.75, while similarly situated White subjects had an average total force of 3.68. This difference of 1.07 (an absolute approximate difference of 22%) is also statistically significant as the 95% confidence intervals do not overlap, suggesting the difference is unlikely due to chance.

Turning to the columns on officer and subject injuries, we observe that officer injury rates were comparable for events involving Black subjects (0.303) compared to White subjects (0.298) that are identical on characteristics. This suggests there is no statistically significant difference between the two groups in terms of officer injury, as the confidence intervals overlap. In contrast, for subject injuries, Black subjects experienced a significantly lower rate of injury (0.121) compared to White subjects (0.223). The 95% confidence intervals of [0.112, 0.129] for Black subjects and [0.181, 0.265] for White subjects do not overlap, indicating a statistically significant difference between the two groups in terms of subject injury rates, with White subjects experiencing higher injury rates.

Table C1: Estimates Comparing White and Black Use of Force with Similar Features

	Maximum Force	Total Force	Officer Injury	Subject Injury
White	2.616	3.680	0.298	0.223
	[2.531,2.701]	[3.469,3.890]	[0.257,0.338]	[0.181,0.265]
Black	2.803	4.747	0.303	0.121
	[2.785,2.822]	[4.680,4.814]	[0.292,0.314]	[0.112,0.129]

95% confidence intervals in brackets. Cases identical on number of officers and all factors noted in model 3.

The results in Table C2 show that the average predicted maximum force for White subjects was 2.61, compared to 2.81 for Hispanic subjects, with case characteristics on average being similar between the two groups. This difference of 0.20 (an absolute approximate difference of 8%) is statistically significant, as the 95% confidence intervals do not overlap, indicating that this difference would occur by chance less than 5 times out of 100. Regarding total force, the results show that Hispanic subjects experienced an average total force level of 4.75, while similarly situated White subjects had an average total force level of 3.58. This absolute difference of 1.17 (approximately 33%) is also statistically significant, with the same confidence level suggesting the difference is unlikely to be due to chance.

The results in Table C2 further indicate that the differences between White and Hispanic subjects extend to officer and subject injury outcomes as well. Specifically, the data reveals that use of force incidents involving White subjects resulted in slightly higher officer injury rates, with an average of 0.326 compared to 0.311 for Hispanic subjects. However, this difference of 0.015 was not statistically significant, as the 95% confidence intervals for the two groups overlap ([0.285, 0.366] for White vs. [0.289, 0.332] for Hispanic).

Subject injury rates showed a noteworthy disparity, albeit one that was not statistically significant. White subjects had an average injury rate of 0.194, while Hispanic subjects had a lower average of 0.142. This absolute difference of 0.052 (approximately 26%) was not, however, statistically significant, with the confidence intervals for these groups overlapping.

These results suggest that while the maximum and total force differences between White and Hispanic subjects are notable, the injury outcomes presented a more complex picture, with officer injury rates being similar across the two groups and subject injury rates favoring Hispanic subjects. The subject injury rates for Hispanic subjects were lower than similarly situated White subjects but the differences may have been due to chance.

Table C2: Estimates Comparing White and Hispanic Use of Force with Similar Features

	Maximum Force	Total Force	Officer Injury	Subject Injury
White	2.608 [2.531,2.684]	3.575 [3.390,3.760]	0.326 [0.285,0.366]	0.194 [0.154,0.235]
Hispanic	2.807 [2.768,2.847]	4.746 [4.616,4.876]	0.311 [0.289,0.332]	0.142 [0.125,0.159]

95% confidence intervals in brackets. Cases identical on number of officers and all factors noted in model 3.

The results from these models suggest that the average difference in maximum force and total force experienced by Black and Hispanic subjects is larger than it would be for White subjects with similar average age, disability, situational, officer, and incident characteristics, beat level factors (population racial demographics, total crime, and total arrests), and year of the month. The

results are also slightly different from Model 4, suggesting if anything that the predicted maximum force is slightly lower for White subjects with situational characteristics similar to Black or Hispanic subjects. In other words, the level of maximum force is lower for White subject use of force incidents that are more similar to Black and Hispanic force events.

The results also imply that individual officer factors, which we cannot directly observe, account for a significant share of the Black-White and Hispanic-White gap in maximum and total force. The models that control for individual officer fixed effects show that the disparities between groups largely disappear, suggesting that officer-specific factors play a meaningful role in these differences. Some of this may be due to reduced precision in the estimates, as the coefficients for Black subjects (see Appendix B) shrink when moving from models with fewer variables to those incorporating more controls, particularly in Model 5, which includes officer fixed effects. This suggests that situational and police officer-specific factors contribute significantly to the variation in maximum force per event.

The analysis of officer injury rates remained relatively consistent between Black, White, and Hispanic groups that were similarly situated. Officers were injured at rates that did not statistically vary according to the race and ethnicity of the subject. However, Black subjects tended to experience lower injury rates than similarly situated White subjects. Hispanic subjects likewise had injury rates that were lower than Whites, but the differences were not statistically significant.

APPENDIX D: FORCE MODELS WITH ARREST HISTORY

Arrest Comparison

We also estimated model 4 of maximum and total force for individuals after including arrest histories in the prior two years leading up the event. Each use of force subject was linked to an arrest history based on the weighted seriousness of the crime according to the Illinois Uniform Crime Report hierarchy. The examination of subject arrest history is important for understanding whether or how a subject's prior history of arrest influences resistance and the use of force, and this is true regardless of whether CPD officers were aware of the subject's arrest history *before* using force. In some cases, it is likely that officers may have had prior contact with the subject against whom force was used, arrested the individual in the past, or were aware that the subject had an outstanding warrant(s) for his or her arrest. Such knowledge is highly relevant to officer decision-making and is likely to influence how officers approach and manage the situation. In cases where officers *were not* aware of a subject's prior arrest history before using force, knowing whether arrest history influences the use of force is still an important piece of information for the CPD to have

We also estimated Model 4 for maximum and total force, incorporating individuals' arrest histories from the two years preceding the incident. Each use-of-force subject was linked to their arrest history, weighted by the seriousness of the crime according to the Illinois Uniform Crime Report hierarchy. Examining subjects' arrest histories is crucial for understanding their influence on resistance and the use of force, regardless of whether Chicago Police Department (CPD) officers were aware of these histories before the force event. Officers may have had prior contact with the subject, made a previous arrest, or been aware of outstanding warrants, all of which could influence their approach. Even when officers were unaware of a subject's prior arrests, this information remains valuable for the CPD to understand potential influences on force.[23]

The results for the model with arrest histories are shown in Appendix Table D1 and Figure D1. The results show that average maximum force is predicted to be 2.73 for White, 2.78 for Black, and 2.84 for Hispanic subjects when controlling for the seriousness and number of prior arrests in the previous two years. For total force, the results are 4.52 for White, 4.79 for Black, and 4.81 for Hispanic subjects. These findings indicate a slight increase in both maximum and total force for Black and Hispanic subjects compared to White subjects, even after controlling for arrest histories. However, the results also indicate that confidence intervals overlap for White and Black on maximum force and close to overlap for Hispanic. Similar results appear in the force factor model:

[23] As stated by the IMT in its August 13, 2024 memo to the Chicago Law Department, "a major purpose of the ¶572 assessment is to 'identify and address any trends that warrant changes to policy, training, tactics, equipment, or Department practice.' Analyzing the possible influence of subject arrest history on use of force outcomes may inform future CPD use of force data collection practices, data analysis, and officer training protocols. Moreover, it also accords with best scientific practice to avoid a potential omitted variable bias in the models.

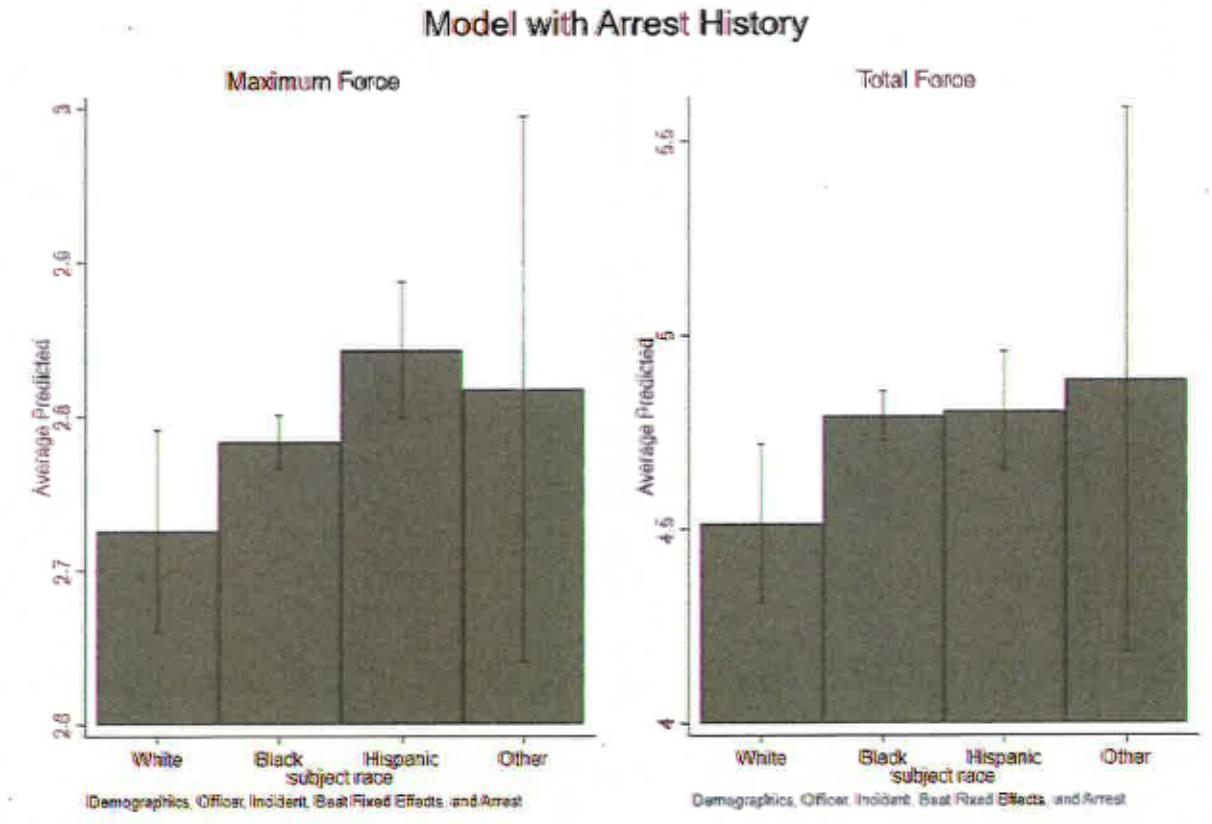
overlapping confidence intervals for White and Black subjects and nearly overlapping confidence intervals for Hispanic and White subjects.

Table D1. Average Maximum, Total Force, and Force Factor Model 4 with Arrest History

	Maximum Force	Total Force	Force Factor
White	2.726 [2.660,2.791]	4.515 [4.311,4.720]	-0.817 [-0.882,-0.752]
Black	2.784 [2.766,2.801]	4.793 [4.730,4.856]	-0.759 [-0.776,-0.742]
Hispanic	2.843 [2.799,2.887]	4.806 [4.653,4.958]	-0.699 [-0.743,-0.655]
Other	2.818 [2.641,2.995]	4.886 [4.185,5.587]	-0.725 [-0.902,-0.548]

95% confidence intervals in brackets

Figure D1: Model 4 of Force with Arrest History



Source: TRR data 2020-2023

Table D2: Model 4 After Including Arrest History

	Maximum Force	Total Force	Force Factor
Subject age	0.000878	0.0530***	0.000878
	(0.00335)	(0.0119)	(0.00335)
Subject age^2	-0.0000503	-0.000871***	-0.0000503
	(0.0000470)	(0.000163)	(0.0000470)
Other subject	0.0579	0.277*	0.0579
	(0.0356)	(0.113)	(0.0356)
Black subject	0.117**	0.291*	0.117**
	(0.0384)	(0.123)	(0.0384)
Hispanic subject	0.0920	0.371	0.0920
	(0.0948)	(0.368)	(0.0948)
Male subject	0.279***	1.116***	0.279***
	(0.0218)	(0.0735)	(0.0218)
Disability=1	-0.235	-1.532***	-0.235
	(0.126)	(0.330)	(0.126)
Mental illness=1	-0.0127	0.145	-0.0127
	(0.0238)	(0.0885)	(0.0238)
Other officer	-0.0132	0.179	-0.0132
	(0.0325)	(0.130)	(0.0325)
Black officer	0.0881***	-0.139	0.0881***
	(0.0225)	(0.0777)	(0.0225)
Hispanic officer	0.0112	0.0449	0.0112
	(0.0170)	(0.0617)	(0.0170)
Police officer age	-0.00331	-0.0349	-0.00331
	(0.00740)	(0.0268)	(0.00740)
Police officer age^2	0.0000296	0.000420	0.0000296
	(0.000100)	(0.000359)	(0.000100)
Male officer	0.0982***	-0.139	0.0982***
	(0.0260)	(0.0901)	(0.0260)
Rank: police officer	0.0878*	0.543***	0.0878*

	(0.0350)	(0.114)	(0.0350)
Rank: sergeant	0.0211	1.031***	0.0211
	(0.0477)	(0.157)	(0.0477)
Citi training=yes	-0.00739	-0.130	-0.00739
	(0.0199)	(0.0700)	(0.0199)
Years of service	0.00195	-0.00134	0.00195
	(0.00238)	(0.00864)	(0.00238)
Call for service	0.0643	0.156	0.0643
	(0.0680)	(0.253)	(0.0680)
On View	0.0118	-0.300	0.0118
	(0.0684)	(0.254)	(0.0684)
Other	0.0876	0.424	0.0876
	(0.0712)	(0.267)	(0.0712)
Indoor	0.0162	0.300***	0.0162
	(0.0180)	(0.0670)	(0.0180)
Alone	0.0113	-0.770***	0.0113
	(0.0250)	(0.0777)	(0.0250)
Ambush	0.227*	-0.790**	0.227*
	(0.107)	(0.258)	(0.107)
Investigatory stop	0.0515**	-0.0701	0.0515**
	(0.0194)	(0.0684)	(0.0194)
Traffic stop	-0.0168	-0.0508	-0.0168
	(0.0233)	(0.0790)	(0.0233)
Violent	-0.0958*	-0.573***	-0.0958*
	(0.0419)	(0.145)	(0.0419)
Resisting	-0.121***	-0.273*	-0.121***
	(0.0307)	(0.109)	(0.0307)
Domestic	-0.0910***	-0.112	-0.0910***
	(0.0263)	(0.0964)	(0.0263)
Weapons	0.0744**	-0.0855	0.0744**

	(0.0285)	(0.103)	(0.0285)
Other charge	0.00640	-0.250**	0.00640
	(0.0261)	(0.0935)	(0.0261)
Max resistance	0.155***	0.771***	-0.845***
	(0.0144)	(0.0431)	(0.0144)
Daytime	-0.0201	0.183***	-0.0201
	(0.0152)	(0.0553)	(0.0152)
Arrest history	0.00105***	0.00293***	0.00105***
	(0.000178)	(0.000688)	(0.000178)
Constant	2.010***	0.236	2.010***
	(0.199)	(0.744)	(0.199)
Observations	13824	14171	13824
No. Incidents	7179.4	7465.4	7179.4

Note: Model includes beat number fixed effects.