Technical report on bicycle infractions in Seattle (2003-2020): Methodology and preliminary findings on racial disparities[1]

Ethan C. Campbell[2]

Executive summary

In cities around the United States, racial disparities have been identified in police stops and infractions issued to people riding bicycles, with minority individuals and communities receiving tickets at disproportionate rates. Here we examine racial disparities in citations received by cyclists in Seattle, WA using court records of 2,962 bicycle-related infractions from 2003-2020, a partial subset of the approximately 6,000 infractions issued to cyclists over that period. 1,667 (56%) of all infractions examined were issued for violating the King County all-ages bicycle helmet law, which was extended to include Seattle in 2003. We assess that a decreasing rate of bicycle citation issuance (including helmet infractions) from 2012-2020 is most likely unrelated to the advent of station-based and dockless bike share systems in Seattle, the latter of which has not provided helmets to riders.

In contrast to most previous examinations of racial disparities in police stops of cyclists from other cities, we estimate the demographic distribution of cyclists in Seattle on an approximate per-trip basis to compare directly with the infraction records. These estimates are constructed using data from three population surveys of Seattle residents using statistical weighting and compositing techniques. We find that Black, Hispanic/Latino, Asian/Pacific Islander, and Native American/Alaska Native cyclists in Seattle are all underrepresented to varying degrees when compared to their census distributions, while white cyclists are overrepresented on the streets of Seattle.

Comparison of court records with our frequency-weighted estimates of Seattle cyclists reveals severe racial disparities in rates of citation issuance by Seattle police from 2003-2020. Black cyclists receive bicycle-related infractions at a rate 3.3 times higher than white cyclists (3.8 for specifically helmet infractions) and Native American/Alaska Native cyclists at a rate 1.7 times higher (2.2 for helmet infractions), while Asian/Pacific Islander cyclists receive infractions at rates 9 times lower (10 times lower for helmet infractions) than for white cyclists. We compare these racial disparities with those identified in other cities, and discuss opportunities for future investigation.

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Bicycle infraction records: overview

In July 2020, we submitted public records requests to the Seattle Municipal Court asking for tabulated data for all bicycle-related infractions issued under SMC Ch. 11.44 (Bicycle Rules)[3] and the King County Board of Health Code Sections 9.10.010 and 9.15.010 (Bicycle Helmets, Requirements and Enforcement)[4] from 2003-2020. The data fields requested for each infraction were the following: citation number, code, description, date, time, and location (if available); officer name and badge number; and defendant race and gender. While the King County helmet law was established in 1993, the start date of this inquiry was specified as 2003 because the helmet law was extended from King County to include Seattle in August 2003[5].

We received 3,422 records of bicycle infractions in Seattle with the requested data fields. Complete data (*n* = 447) were available from January 2017 to June 2020. Prior to 2017, some records had been purged from the court information system due to its records retention schedule. According to the court[6], the retention schedule specifies that data will be automatically purged

Figure 1. Seattle Municipal Court bicycle infraction records from summary table (2011-2020)

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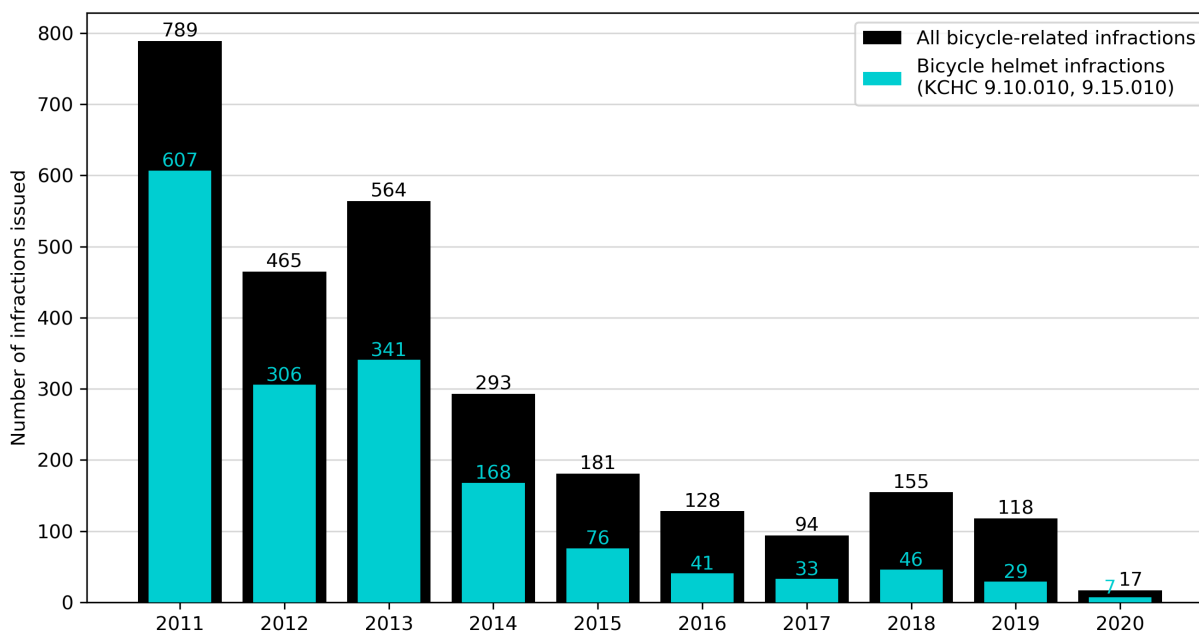
[3] "Chapter 11.44 - Bicycle rules," Seattle Municipal Code (last updated January 25, 2021), https://library.municode.com/wa/seattle/codes/municipal_code?nodeId=TIT11VETR_SUBTITLE_ITRCO_PT4PEHIBIEPMOFOSCRU_CH11.44BIRU.

[4] "Title 9: Bicycle helmets," King County Board of Health Code (last updated November 20, 2013), https://www.kingcounty.gov/depts/health/violence-injury-prevention/traffic-safety/~/media/depts/health/board-of-health/documents/code/BOH-Code-Title-9.ashx.

[5] Susan Gilmore, "Use your head: Wear a helmet," *Seattle Times* (September 21, 2003), https://archive.seattletimes.com/archive/?date=20030921&slug=bumper21m.

[6] Gary Ireland (Seattle Municipal Court public information officer), personal communication, July 20, 2020.

three years after the fine and associated fees are paid. One can expect outliers to result from the court's failure to properly close a violation.

Bicycle infraction records: data cleaning and availability

All analyses described below were conducted using the Python programming language, primarily using the *pandas* library[7].

We find that the provided court records contain instances of duplicate citations, in which the citation number, violation code/description/date/time, and the defendant race/gender are identical. The only difference within these pairs of duplicate citations is the issuing officer. According to the court[8], such pairs of records arise when a single citation is associated with two officers, likely both present at the scene. We therefore remove duplicate entries, which represent 11.3% of all records ($n = 385$, of which $n = 233$ are helmet infractions)[9]. **The removal of duplicates yields $n = 3,037$ records from 2003-2020.** A few instances in which a rider was cited for multiple violations (e.g., for not wearing a helmet and failing to yield the right of way) remain as two or more separate infractions. These occurrences of second, third, fourth, or more distinct infractions issued to a single individual during a police stop represent 6.0% of the remaining records, and are retained.

By combining summary statistics published on the Seattle Municipal Court website[10] for 2011-2016 (Figure 1) and summary statistics on all bicycle-related infractions analyzed by the

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[7] Wes McKinney, "Data structures for statistical computing in Python," *Proceedings of the 9th Python in Science Conference* (2010), 51-56, http://conference.scipy.org/proceedings/scipy2010/mckinney.html.

[8] Gary Ireland (Seattle Municipal Court public information officer), personal communication, February 18, 2021.

[9] Note that earlier versions of this preliminary report released between February 4 and February 18 did not include removal of these duplicate records. While the main findings regarding racial disparities have remained substantially similar after removal of the duplicates, the precise demographics of bicycle infractions have changed somewhat. Statistics from the previous versions were reported on in the following venues, and have been since corrected:

Jack Russillo, "Community bicycling groups hope to get 'arbitrary' and 'troubling' helmet laws on county public health board's agenda in February," *South Seattle Emerald* (February 15, 2021), https://southseattleemerald.com/2021/02/15/community-bicycling-groups-hope-to-get-arbitrary-and-troubling-helmet-laws-on-county-public-health-boards-agenda-in-february/.

Paul Tolmé, "Cascade and Washington Bikes support decriminalizing helmet use," *Cascade Bicycle Club* (February 4, 2021), https://cascade.org/blog/2021/02/cascade-and-washington-bikes-support-decriminalizing-helmet-use.

Ryan Packer, "King County expected to examine helmet law as Cascade Bicycle Club supports repeal," *Seattle Bike Blog* (February 18, 2021), https://www.seattlebikeblog.com/2021/02/18/king-county-likely-to-examine-helmet-law-as-cascade-bicycle-club-supports-repeal/.

[10] "Bicycle infractions," Seattle Municipal Court (obtained via Wayback Machine snapshot from April 29, 2020), http://web.archive.org/web/20200429075514/https://www.seattle.gov/courts/about/data-and-publications/general-data-reports/bicycle-infractions.

Seattle Times[11] for 2003-2010, we calculate the annual fraction of citations issued by Seattle police from 2003-2017 (n = 5,552 in total) that were retained by the court and provided to us (n = 2,653; 47.8% of total; Figure 2)[12]. We find that between 24% and 100% of records were retained annually. Rather than the fraction of available records increasing chronologically, as might be expected, we observe that the values change by year without a clear pattern, with some years (2004-2005, 2013-2016) showing significantly less purging of records. This suggests either a highly irregular pattern of fines remaining unpaid, or more likely, inconsistencies in records retention practices unrelated to fine collection. We examine the effects of the incomplete pre-2017 data by dichotomizing data into incomplete (2003-2016) and complete (2017-2020) groups for analysis purposes, as described below.

Figure 2. Availability of Seattle Municipal Court bicycle infraction records (2003–2020)
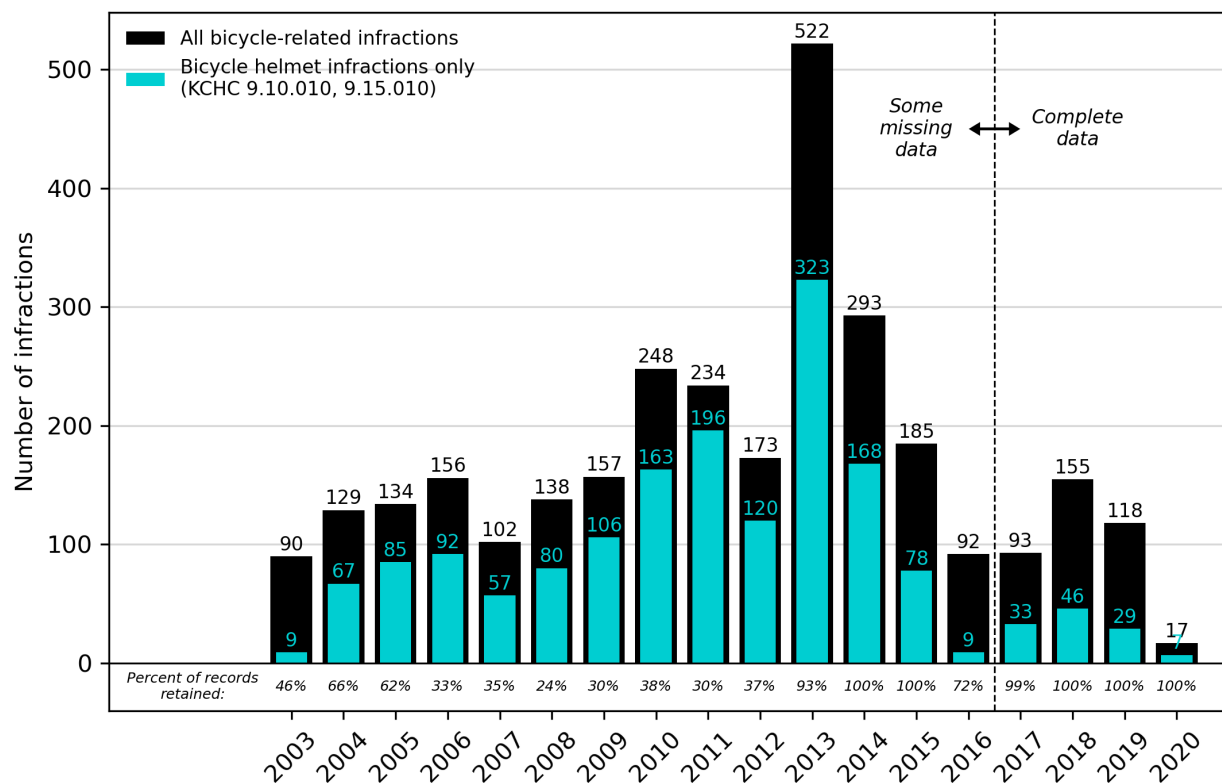
Table 1. Available bicycle-related infractions in Seattle by category (2003-2020)

Infraction	Count
Bicycle helmet required	1668
Rights and duties of riders or roadway rules	986
No/improper lamps/reflectors	213
Yielding right of way in crosswalk or on public path	90
Unsafe pass on right	27
No/improper hand signals	20
No/improper brakes	12
Bike control (one hand minimum required)	8
Others (clinging/attaching to vehicle, failure to ride on seat, excess passengers, etc.)	13

Bicycle infraction records: categories and trends

Helmet infractions represent 54.9% of all bicycle-related infractions in Seattle from 2003-2020 (Table 1). Rider rights and duties violations (issued under SMC Ch. 11.44.020, e.g. for not stopping at a stop sign) and roadway violations (issued under SMC Ch. 11.44.040, e.g. for not riding "as near to the right side of the right through lane as is safe"[13]) together comprise the second most-frequently cited category (30.6% of total). The fraction of total bicycle-related infractions issued for helmet law noncompliance has decreased steadily from 2011-2020 from 77% in 2011 to 25% by 2019, the last complete year of data (Figure 1).

The total bicycle-related infractions by year (Figure 1, or *all bicycle-related infractions ÷ % records retained* from data in Figure 2) show an increasing trend that peaked in 2011 (789 total infractions), as has been previously reported[14]. Annual total infractions decreased sharply thereafter in tandem with decreases in the fraction of total citations issued for helmet law noncompliance. The total infractions per year have averaged 135 from 2015-2019, with no apparent trend over those recent years.

One possible explanation for the recent decrease in both total infractions and the fraction issued for helmet law noncompliance could be the rise of bicycle share programs in Seattle. A station-based, city-operated bicycle share system was first launched in October 2014[15], with helmets initially provided for free, then later on a rental basis. This system shut down in March 2017. In

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[13] "Chapter 11.44 - Bicycle rules," Seattle Municipal Code. As above.

[14] Gene Balk, "The cop and the courier…," *Seattle Times*. As above.

[15] Joshua Trujillo, "Seattle bike share kicks off," *Seattle Post-Intelligencer* (October 13, 2014), https://www.seattlepi.com/local/article/Pronto-Cycle-Share-kicks-off-in-Seattle-5820154.php.

its place, multiple providers implemented a dockless bike share system in July 2017, with helmets not provided[16]. Only 24% of dockless bike share riders in Seattle reported wearing helmets in a 2017 survey[17], which might suggest that helmet enforcement has decreased due to normalization of riding without a helmet and/or changes in policing related to the growing inconsistency between rates of helmet use and the existing law.

However, we regard it as unlikely that this hypothesis can explain the trends observed in the infraction records. Reductions in total bicycle-related infractions compared to the 2011 peak – and the fraction issued for helmet law noncompliance – were already apparent in 2012 (465 total infractions; helmet citations were 66% of total) and 2013 (564 total; 60% of total). Those reductions occurred prior to the launch of the earlier bike share system, which itself provided helmets. By the advent of dockless bike share in 2017, which presumably was accompanied by a rise of helmet-less bike share use, total infractions (128 in 2016) and the fraction issued for helmet law noncompliance (32% in 2016) had already dropped to substantially lower rates than at the 2011 peak.

Thus it is reasonable to conclude that the decrease in all bicycle-related – as well as specifically helmet-related – enforcement by Seattle police from 2012-2020 is more likely related to a shift in department priorities and/or enforcement strategies rather than the rise of bike share systems in Seattle. Seattle police have acknowledged that the helmet law is enforced by officers on a discretionary basis, with officers opting to provide only a warning on some occasions[18]. Reporting has also identified a small number of officers who have accounted for a disproportionate number of bicycle-related infractions in Seattle[19]. It is possible that this could indicate a sensitivity of enforcement rates over time to the personal priorities and habits of individual officers assigned to cyclist-focused "emphasis patrols," rather than larger shifts in departmental practices.

Bicycle infraction records: inconsistencies

The Seattle Municipal Court records classify defendant race using five census-designated labels: white, Black, Asian/Pacific Islander, Native American/Alaskan Native, and unidentified

[16] David Gutman, "Helmets may be Seattle law, but many bike-share riders don't wear them," *Seattle Times* (August 19, 2017), https://www.seattletimes.com/seattle-news/transportation/helmets-may-be-seattle-law-but-many-bike-share- riders-dont-wear-them/.

[17] "2017 free-floating bike share pilot evaluation report," Seattle Department of Transportation (August 2018), https://www.seattle.gov/Documents/Departments/SDOT/BikeProgram/2017_BikeShare_Evaluation_Report_113018.pdf.

[18] David Gutman, "Helmets may be Seattle law…," *Seattle Times*. As above.

[19] Gene Balk, "The cop and the courier…," *Seattle Times*. As above.

(unknown). This is presumably "perceived race," as recorded by the police officer handling the stop[20].

Upon inspecting the data, we noticed that a single Seattle police officer (Ofc. Brooke H. David, badge number #8471, who was hired in September 2016[21]) accounted for a significant fraction (22%) of all records that had defendant race listed as "unknown." Conspicuously, 66 of the 75 (88%) citations that he issued list the defendant race as "unknown," a rate far higher than other officers who appear frequently in the court records. For example, Ofc. Glen A. Mulkey, who featured in previous reporting[22] for issuing the most bicycle-related citations of any officer, has written 549 citations. But just 55 of the citations associated with Ofc. Mulkey (10%, a rate on par with the full set of records) list the defendant race as "unknown." We find the high number of citations issued by Ofc. David without a valid defendant race to be an anomaly that warrants suspicion, particularly given that the nine infractions in which he did record a valid defendant race all list the defendant race as "white." Since our analysis focuses on the race of cyclists ticketed by Seattle police, the 75 infractions issued by Ofc. David after his hire in 2016 (2.5% of all non-duplicate records for 2003-2020) can be considered outliers that would negatively affect the accuracy of our assessment. We therefore discard those 75 records from further analysis, which yields a final sample of 2,962 bicycle-related infractions, of which 1,667 (56%) are helmet infractions.

Census demographic data

Our analysis of Seattle bicycle-related infraction records from 2003-2020 is supplemented by two comparison data sets: (1) race/ethnicity demographic data obtained from the U.S. Census Bureau American Community Survey (ACS), and (2) Seattle cyclist demographics on a per-trip basis estimated from a combination of survey data.

At the time of analysis, one-year ACS census estimates for Seattle[23] were available only through 2018. Consequently, we present the 2017 and 2018 ACS census demographic data averaged between the two years as a comparison to the complete set of court records from 2017-2020 (Figure 3). When processing the data, we make assumptions as to how a police officer would most likely perceive and categorize a subject during a traffic stop. Included in the category

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[20] "Tenth Systemic Assessment: Stops, search, and seizure," Seattle Police Monitor (June 2017), p. 3, https://static1.squarespace.com/static/5425b9f0e4b0d66352331e0e/t/59473ca3b3db2bc40ddf8a6c/1497840805898/Dkt.+394--Stops+Assessment.pdf.

[21] Seattle Police Department, *2019 compensation data* [Microsoft Excel spreadsheet], obtained by public records request for the Center for Open Policing by Twitter user Parity (@pty; September 2020), https://twitter.com/pty/status/1307396391375835136.

[22] Gene Balk, "The cop and the courier…," *Seattle Times*. As above.

[23] U.S. Census Bureau, *2017 and 2018 American Community Survey 1-year estimates for Seattle, WA* [Microsoft Excel spreadsheet], retrieved from https://data.census.gov/cedsci/table?q=Seattle%20city,%20Washington&g=1600000US5363000&tid=ACSDP1Y2018.DP05&hidePreview=true.

"Black" are those listed in "Two or more races" as "Black and white" or "Black and Native American"; included in "Asian/Pacific Islander" are those listed in "Two or more races" as "Asian and white"; and included in "Native American/Alaskan Native" are those listed in "Two or more races" as "Native American and white." While census data distinguishes between the ethnic categories "Hispanic" and "Non-Hispanic" within the racial category of "White," the court records do not make this distinction.

Surveys: overview

To conduct a more direct comparison with the bicycle infraction records, we also estimate Seattle cyclist demographics on a per-trip basis using a combination of data sources. This is a challenging endeavor, as no manual bicycle ridership count in Seattle has included information on rider race/ethnicity, to our knowledge. In any case, such an assessment would likely suffer from methodological issues related to sparse sampling and the inability to accurately infer race/ ethnicity from observations of moving cyclists.

In lieu of observational estimates, we draw from three survey data sets:

1. SDOT/EMC Research's third Bicycle Participation phone survey, conducted in September 2013 ($n = 600$; margin of error ±4.0%)[24]. After exclusions, the sample size of Seattle cyclists is $n = 179$.
2. SDOT/EMC Research's Free-Floating Bike Share Pilot web panel survey, conducted in February 2018 ($n = 601$; margin of error ±4.0%)[25]. After exclusions, the sample size of Seattle cyclists is $n = 306$.
3. SDOT/PRR Research's Free-Floating Bike Share Evaluation Report New Mobility Survey, conducted in November-December 2019 ($n = 2,514$; margin of error ±2%)[26]. After exclusions, the sample size of Seattle cyclists is $n = 1,127$.

Surveys: 2013 SDOT/EMC data

For the 2013 SDOT/EMC survey, Seattle residents of age 16 and older were contacted on both landline and cell phone numbers. Results were weighted to reflect Seattle adult census demographics; it is not clear what demographic categories were used for the weighting. The key limitations of this survey are its age, given the steep increasing trend in bicycling seen in Seattle

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[24] Seattle Department of Transportation/EMC Research, *Third Bicycle Participation phone survey* (September 2013), https://www.seattle.gov/Documents/Departments/SDOT/BikeProgram/13-5004bikesdotcrosstab.pdf.

[25] Seattle Department of Transportation/EMC Research, *2017 Free-Floating Bike Share Pilot web panel survey* [SPSS format] (February 2018). Provided by Ian Stewart (EMC Research), personal communication, August 24, 2020.

[26] Seattle Department of Transportation/PRR Research, *2019 Free-Floating Bike Share Evaluation New Mobility Survey* [SPSS format] (February 2020). Provided by Anne Frugé (PRR Research), personal communication, August 25, 2020.

Table 2. Selected responses from 2013 SDOT/EMC survey

Race/ethnicity	Ride "a few times a year"	Ride "a few times per month or more"	Average
White (non-Hispanic)	72%	80%	76%
White (Hispanic)	2%	2%	2%
Black	5%	4%	4.5%
Asian	18%	11%	14.5%
Other/no answer	3%	4%	3.5%
Total respondents	*n* = 69	*n* = 110	

over recent years[27], and its small sample size. We present cross-tabulated answers for Question 4 (Ethnicity) and Question 9 ("On average, how often do you ride your bicycle?") in Table 2, excluding those who answered that they ride "never / almost never." The remaining sample, representing Seattle residents who ride a bicycle, has a size of *n* = 179.

Given the large margin of error and similarities between the demographics of respondents who ride "a few times a year" and "a few times per month or more," we average the two categories without weighting to produce an approximate, non-trip-weighted view of cyclist demographics in Seattle. **The 2013 survey suggests that, for example, about 4.5% of Seattle cyclists are Black.** Given the limitations of this survey, we use it primarily as an approximate point of comparison. The quantitative data are, however, used directly for a secondary purpose. As described below, the overall, cross-demographic results for Question 9 (not shown here) are used in combination with the 2018 SDOT/EMC survey data to estimate the average cycling frequency of individuals in Seattle who report riding more than 20 times in six months (see Table 3).

Surveys: 2018 SDOT/EMC data

Next, we discuss how the 2018 SDOT/EMC survey data are used to estimate riding frequencies within demographic groups. As detailed in a summary report[28], a publication in which the survey

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[27] Tom Fucoloro, "In final Census survey of the before times, number of Seattle bike commuters hit an all-time high," *Seattle Bike Blog* (October 1, 2020), https://www.seattlebikeblog.com/2020/10/01/in-final-census-survey-of-the-before- times-number-of-seattle-bike-commuters-hit-an-all-time-high/.

[28] Seattle Department of Transportation/EMC Research, *2017 Free-Floating Bike Share Pilot evaluation report, Appendix C (EMC survey report)* (February 2018), https://www.seattle.gov/Documents/Departments/SDOT/BikeProgram/APPENDIXC-EMCreport.pdf.

data are analyzed[29], and a blog post featuring comments from an EMC researcher[30], the survey was conducted using a random sample from an invite-only web panel database. Managed recruitment and weighting were used to achieve a sample reflective of Seattle demographics (gender, age, race/ethnicity, and City region [north, central, and south/west]).

However, due to the selection strategy and web-based nature of the survey, it represents a non-probability sample and likely over-represents internet users. It is unclear whether this is problematic from the perspective of directly estimating the racial demographics of bicycle ridership in Seattle, and so we avoid using these data for that purpose. Instead, the 2018 SDOT/EMC survey responses are used only to infer average bicycling trip frequencies *within demographic categories*, which are then mapped onto the overall racial demographics of Seattle cyclists estimated (presumably more accurately) from the larger, mail-based 2019 SDOT/PRR survey to infer the racial demographics of Seattle cyclists on a per-trip basis.

For analysis of the 2018 SDOT/EMC data, we associate responses to Question 18 ("In the last six months, about how many times have you ridden a bicycle [including your own bike or a bicycle that was part of a bike share program]?") with respondent race/ethnicity (white [non-Hispanic/Latino], white [Hispanic/Latino], Black, Asian/Pacific Islander, and "something else/prefer not to respond"). This reduces the sample size to $n = 306$ respondents who report biking more than once in the last six months.

As detailed in Table 3, we calculate frequency weights for respondents who report riding between 1-20 times in the last six months as the average value in the range chosen as their

Table 3. Cycling frequencies corresponding to 2018 SDOT/EMC survey responses

"In the last six months, about how many times have you ridden a bicycle?"	Estimated average riding frequency per six months	Resultant weight
"I have not biked in the last six months"	0	0.0
1-2 times	average of 1, 2	1.5
3-10 times	average of 3, 4, …, 9, 10	6.5
11-20 times	average of 11, 12, …, 19, 20	15.5
More than 20 times	$(6 \text{ months}) \cdot \dfrac{17\% \cdot (4/\text{month}) + 11\% \cdot (9/\text{month}) + 8\% \cdot (22/\text{month})}{17\% + 11\% + 8\%}$	57.2

[29] Hirsch et al. (2019), "Residents in Seattle, WA report differential use of free-floating bikeshare by age, gender, race, and location," *Frontiers in Built Environment*, 5(17), https://www.frontiersin.org/articles/10.3389/fbuil.2019.00017/ full.

[30] Tom Fucoloro, "Survey: Ahead of bike share permit update, survey says Seattleites are very supportive," *Seattle Bike Blog* (June 6, 2018), https://www.seattlebikeblog.com/2018/06/06/survey-ahead-of-bike-share-permit-update-survey- says-seattleites-are-very-supportive/#footnote.

answer. For respondents who report riding "more than 20 times" in the last six months, we estimate the average riding frequency using the overall responses to Question 9 ("On average, how often do you ride your bicycle?") in the 2013 SDOT/EMC survey previously described[31] within the answer categories "a few times a month" (17% of respondents; approximated as 4 times a month), "a few times a week" (11%; approximated as twice per week, or 9 times a month), and "daily" (8%; approximated as 5 times per week to account for over-reporting, or 22 times a month). Note that a key limitation of this weighting methodology is that it does not account for variations in miles or duration ridden per day. It is effectively assumed that, for example, both white and Black riders who report riding between 3-10 times in the last six months rode, on average, similar total distances and durations on each day that they reported using their bicycle. This uncertainty could be resolved in the future by using an additional weighting step that accounts for these variations, given adequate survey data.

Next, overall weights to account for average cycling frequency *within demographic categories* are calculated using the 2018 SDOT/EMC data. As a first step, all 601 survey responses are weighted using the 2018 ACS Seattle census data[32] to make them representative of the race/ethnicity demographics of Seattle. Demographic weights are shown in Table 4. Little weighting is necessary for most race/ethnicity categories as a result of the managed recruitment strategy used by the researchers. In addition to a demographic weight, each respondent is assigned a cycling frequency weight, chosen by mapping their riding frequency answer to the calculated weights in Table 3. The race/ethnicity distribution of cyclist respondents (those reporting riding one or more times in the last six months) is then calculated in two ways: (1) using only demographic weighting, and (2) using both demographic and frequency weighting.

Table 4. Cycling frequency weights calculated from 2018 SDOT/EMC survey data

Race/ethnicity	Demographic weights calculated using 2018 U.S. Census ACS data	Cyclist demographics from survey *(demographic-weighted only; not frequency-weighted)*	Cyclist demographics from survey *(both demographic- and frequency-weighted)*	Cycling frequency weights
White (non-Hispanic/Latino)	0.94	59.5%	66.0%	1.11
White (Hispanic/Latino)	1.04	9.3%	5.8%	0.62
Black	1.02	11.1%	9.3%	0.84
Asian/Pacific Islander	1.23	17.5%	18.2%	1.04
Native American/ Alaska Native	n/a	n/a	n/a	1
Other ("Something else/ prefer not to respond")	0.77	2.5%	0.7%	0.27

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[31] SDOT/EMC Research, *Third Bicycle Participation phone survey*. As above.

[32] U.S. Census Bureau, *2018 American Community Survey 1-year estimates for Seattle, WA*. As above.

Finally, overall cycling frequency weights for each race/ethnicity category are calculated as the *frequency-weighted ÷ non-frequency-weighted* demographic percentages (Table 4). A weight greater than one indicates cyclists in that race/ethnicity category (White [non-Hispanic/Latino], Asian/Pacific Islander) will be underrepresented on a per-trip basis unless their relatively high reported frequency of riding is taken into account. On the other hand, a weight below one indicates those race/ethnicity categories (Hispanic/Latino, Black, other) will be overrepresented relative to their actual presence on the streets of Seattle when "cyclist" is treated as binary (cyclist/not a cyclist), given that group's relatively low frequency of riding. Since the race/ethnicity options in this survey did not include Native American/Alaska Native, we arbitrarily assign a frequency weight of 1.0 for that group. To emphasize, the cyclist race/ethnicity distributions estimated from the 2018 survey are not used in our analysis except in a *relative* fashion in order to estimate within-demographic cycling frequencies.

Surveys: 2019 SDOT/PRR data

The last element critical to producing a demographic distribution for Seattle cyclists on a per-trip basis is an accurate accounting of who rides bicycles in Seattle. We obtain this from the 2019 SDOT/PRR survey, the methodology of which is detailed in a summary report[33]. Compared to the 2018 SDOT/EMC survey, the 2019 survey was conducted in a way that allows for a more statistically-representative sample of Seattle residents to be constructed after appropriate weighting; the sample size is also substantially larger. Researchers mailed invitations to 20,000 randomly-selected addresses in Seattle, and recruited a small number (28) of youth through in-person outreach in Seattle's Central District neighborhood. Together, this resulted in a sample of $n = 2,514$ Seattle residents who completed the survey online or using a call-in phone option. A key limitation of this survey is that it was offered only in English, likely excluding the approximately 10% of Seattle-area residents who have limited proficiency in English (as of 2012)[34].

We reference respondents' race/ethnicity (white [non-Hispanic/Latino], white [Hispanic/Latino], Black, Native American/Alaska Native, other, and Asian/Pacific Islander, which is aggregated from "Asian or Asian-American" and "Native Hawaiian or Pacific Islander") and their responses to two questions. Question 11 asked, "Which of the following have you used to get around Seattle in the last 12 months? Please select all that apply" and provided as an option, "Bike or e-bike you or someone you know owns." Question 16 asked, "Which new mobility options have

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[33] Seattle Department of Transportation/PRR Research, *2019 Free-Floating Bike Share Evaluation, Appendix B (New Mobility Survey Results)* (February 2020), https://www.seattle.gov/Documents/Departments/SDOT/BikeProgram/ AppendixB_NewMobilitySurvey.pdf.

[34] Jill Wilson, "Investing in English skills: The limited English proficient workforce in U.S. metropolitan areas," *The Brookings Institution* (September 2014), https://www.brookings.edu/wp-content/uploads/2014/09/metro_20140924_investing_in_english_skils_report.pdf.

Table 5. Seattle cyclist demographics estimated from 2019 SDOT/PRR survey data

Race/ethnicity	Demographic weights calculated using 2018 U.S. Census ACS data	Cycling frequency weights (from Table 4)	Cyclist demographics from survey *(demographic-weighted only; not frequency-weighted)*	Cyclist demographics from survey *(both demographic- and frequency-weighted)*
White (non-Hispanic/Latino)	0.88	1.11	64.3%	**70.7%**
White (Hispanic/Latino)	1.40	0.62	8.4%	**5.2%**
Black	2.51	0.84	5.7%	**4.7%**
Asian/Pacific Islander	1.64	1.04	17.2%	**17.8%**
Native American/ Alaska Native	1.49	1	0.5%	**0.5%**
Other	0.39	0.27	3.9%	**1.1%**

you used in Seattle in the last 12 months? Please select all that apply" and provided as an option, "Bike share (Lime, Jump, etc.)." If a respondent selected either answer in the two questions, we consider them to be a cyclist. This yielded a sample size of *n* = 1,127 Seattle cyclists.

Next, in an identical manner to the 2018 SDOT/EMC data, we weight all 2019 survey responses using the 2018 ACS Seattle census data[35] (since 2019 data were not available at the time of analysis) to make the full body of respondents representative of Seattle's demographics. Only white (non-Hispanic/Latino) and "other" respondents are overrepresented; all other groups are underrepresented in the survey data. These demographic weights are shown in Table 5. Compared to the 2018 survey, more extreme weighting is necessary since the original sample recruited is less representative of Seattle residents. In addition to demographic weights, individual cycling frequency weights (from Table 4, and repeated in Table 5) are associated with each respondent based on their race/ethnicity.

Using these weights, the race/ethnicity distribution of cyclist respondents is calculated separately: (1) using only demographic weighting, for evaluation purposes only; and (2) using both demographic and frequency weighting, which is our final estimate of Seattle cyclist demographics on a frequency-weighted (approximate per-trip) basis. **We find that white (both non-Hispanic/Latino and Hispanic/Latino) cyclists comprise an estimated 75.9% of bicycle trips in Seattle, while Black cyclists represent 4.7%, Asian/Pacific Islander cyclists account for 17.8%, and Native American/Alaska Native cyclists represent 0.5%.** Note that these demographic fractions are substantially similar to those estimated from the 2013 SDOT/EMC survey data (Table 2).

As shown in Figure 3 below, these results indicate that Black, Hispanic/Latino, Asian/ Pacific Islander, and Native American/Alaska Native cyclists in Seattle are all

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[35] U.S. Census Bureau, *2018 American Community Survey 1-year estimates for Seattle, WA.* As above.

underrepresented to varying degrees when compared to their U.S. census distributions, while white cyclists are overrepresented on the streets of Seattle. Interestingly, previous reporting[36] that analyzed a proprietary survey of Seattle residents from 2016-2018 found that 55% of adults in Seattle who use a bicycle for transportation are white men, and that white men and men of color (defined there as Asian, Latino, Native American, and "other") are equally likely to bike. While distinct data sets and different definitions for who constitutes a Seattle cyclist preclude a direct comparison, this suggests that the differences that we have found in racial representation within the Seattle cyclist community are at least in part due to even larger racial disparities among women cyclists, masked by smaller disparities among men who bike.

Demographic assessment of bicycle infraction records

Evaluating the Seattle Municipal Court records of bicycle infractions for racial disparities is now straightforward. Figure 3 compares the race/ethnicity of Seattle residents from ACS census data, the race/ethnicity of Seattle cyclists estimated on an approximate per-trip basis (primarily using the 2019 SDOT/PRR survey data but integrating data from both the 2018 SDOT/EMC and 2013 SDOT/EMC surveys), and the race of defendants issued bicycle infractions by Seattle police. This latter statistic is divided into four categories: all bicycle infractions during the periods of complete records (2017-2020) and incomplete records (2003-2016), and the subcategory of helmet infractions only, divided similarly into the two temporal periods.
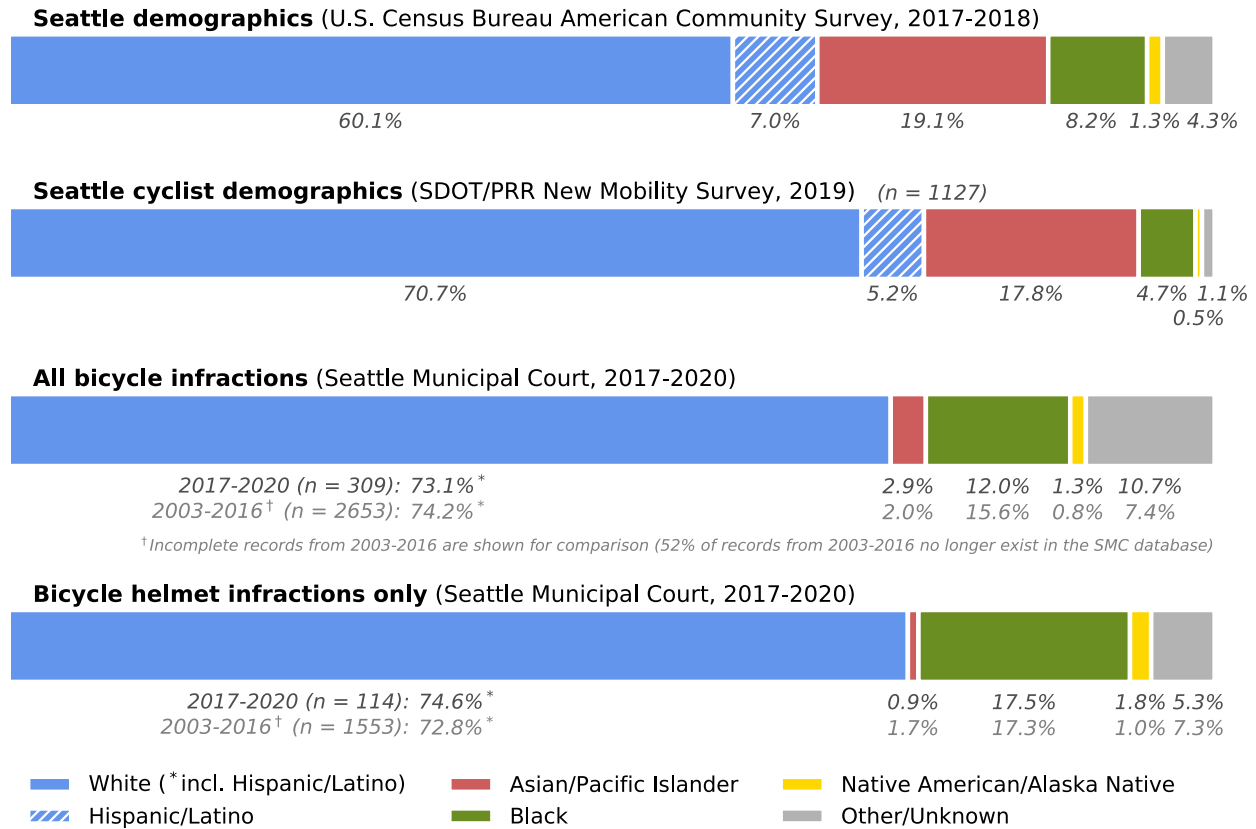
Figure 3 demonstrates that the demographics of cyclists issued infractions are broadly similar between all four categories (all infractions/helmet infractions only, periods of complete/ incomplete records). In particular, the strong similarities between the dichotomized data from 2003-2016 and 2017-2020 bolsters our confidence that the ambiguous court record retention practices that affect records prior to 2017 did not drastically skew results towards a certain racial distribution, which suggests that the full body of available records from 2003-2020 is usable for analysis.

The demographics of the subcategory of helmet infractions are generally similar to those of all bicycle-related citations, with two notable exceptions: the higher rate of helmet infractions issued to Black cyclists and the lower rate issued to Asian/Pacific Islander cyclists. It is not obvious from the data why this contrast exists. One possibility is that rates of helmet law noncompliance *relative to traffic violations* are higher among Black cyclists (relatively more helmet law noncompliance) and lower among Asian/Pacific Islander cyclists (relatively more traffic violations), and thus the difference reflects equitable enforcement practices. Alternatively, helmet law noncompliance may be broadly more ubiquitous than traffic violations and thus more easily used by police to justify pretextual stops specifically of Black cyclists, as discussed below.

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[36] Gene Balk, "Who bikes in Seattle? Bicycling gender gap one of the biggest in the U.S.," *Seattle Times* (June 5, 2019), https://www.seattletimes.com/seattle-news/data/who-bikes-in-seattle-bicycling-gender-gap-one-of-biggest-in-country/.

**Figure 3.** Comparison of bicycle infraction records with Seattle census and cyclist demographics

Seattle demographics (U.S. Census Bureau American Community Survey, 2017-2018)

60.1% *7.0%* *19.1%* *8.2%* *1.3% 4.3%*

Seattle cyclist demographics (SDOT/PRR New Mobility Survey, 2019) *(n = 1127)*

70.7% *5.2%* *17.8%* *4.7% 1.1%*
0.5%

All bicycle infractions (Seattle Municipal Court, 2017-2020)

2017-2020 (n = 309): 73.1%[*] *2.9% 12.0% 1.3% 10.7%*
2003-2016[†] *(n = 2653): 74.2%*[*] *2.0% 15.6% 0.8% 7.4%*

[†]*Incomplete records from 2003-2016 are shown for comparison (52% of records from 2003-2016 no longer exist in the SMC database)*

Bicycle helmet infractions only (Seattle Municipal Court, 2017-2020)

2017-2020 (n = 114): 74.6%[*] *0.9% 17.5% 1.8% 5.3%*
2003-2016[†] *(n = 1553): 72.8%*[*] *1.7% 17.3% 1.0% 7.3%*

■ White ([*]incl. Hispanic/Latino)   ■ Asian/Pacific Islander   ■ Native American/Alaska Native
▨ Hispanic/Latino   ■ Black   ■ Other/Unknown

Table 6. Racial disparities in bicycle infractions (2003-2020)

Race	Seattle cyclist demographics on approximate per-trip basis	Distribution of all bicycle infractions (2003-2020)	Relative rate of all bicycle infractions	Relative rate of all bicycle infractions *compared to white cyclists*	Distribution of helmet infraction subcategory only (2003-2020)	Relative rate of helmet infractions only	Relative rate of helmet infractions only *compared to white cyclists*
White (incl. Hispanic/ Latino)	75.9%	74.1%	0.98	1	72.9%	0.96	1
Asian/ Pacific Islander	17.8%	2.1%	0.12	0.12	1.6%	0.092	0.096
Black	4.7%	15.2%	3.2	3.3	17.3%	3.7	3.8
Native American/ Alaska Native	0.5%	0.9%	1.7	1.7	1.1%	2.1	2.2
Other/ Unknown	1.1%	7.7%	n/a	n/a	7.2%	n/a	n/a

Racial disparities for all minority groups stand out when comparing bicycle-related infractions for the full period 2003-2020 to Seattle cyclist demographics on an approximate per-trip basis. White cyclists receive all infractions at a relative rate (0.98) slightly lower than – but nearly identical to – their share of Seattle cyclist demographics. Compared to their share of Seattle cyclist demographics (*with comparisons to white cyclists presented in parentheses*), Black cyclists receive all bicycle-related infractions at a rate of 3.2 (*3.3 compared to white cyclists*), Native American/Alaska Natives at a rate of 1.7 (*1.7*), and Asian/Pacific Islanders at a rate of 0.12, or 9x less (*0.12, or 9x less*). For the subcategory of helmet infractions only, white cyclists similarly receive all infractions at a rate (0.96) again slightly lower than – but nearly on par with – their share of Seattle cyclist demographics. **Black cyclists receive helmet infractions at a rate of 3.7 relative to their share of Seattle cyclist demographics on an approximate per-trip basis (*3.8 compared to white cyclists*), Native American/Alaska Natives at a rate of 2.1 (*2.2*), and Asian/Pacific Islanders at a rate of 0.092, or 11x less (*0.096, or 10x less*).** These findings are also listed in Table 6 and represented schematically in Figure 4.

Figure 4. Racial disparities in bicycle infractions (2003-2020) presented schematically
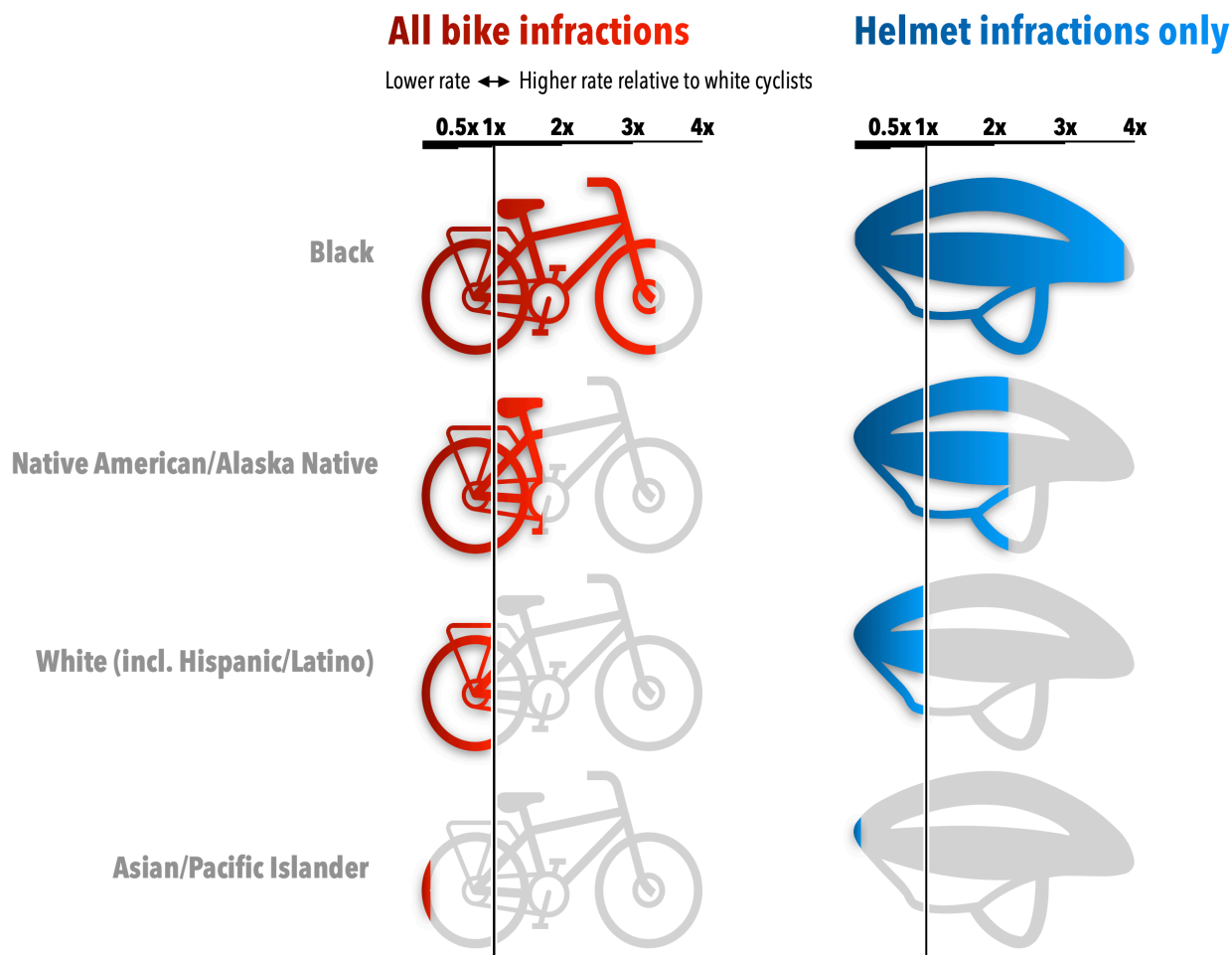
We note that limitations of the data prevent distinctions from being made between rates of infractions issued to Hispanic/Latino and white (non-Hispanic/Latino) cyclists, who are grouped together in the provided court records. If racial disparities similar to those for Black cyclists were to exist for Hispanic/Latino cyclists, the relative rate of citations issued to white cyclists would further decrease, exacerbating disparities for other groups.

It is worth noting that if the "Other/unknown" race/ethnicity category were omitted and the remaining categories increased proportionally, disparities in ticketing would only increase for Black and Native American/Alaska Native cyclists due to the severe overrepresentation of "Other/unknown" race/ethnicity in infractions relative to the population of Seattle cyclists. It may well be, however, that infractions under the "Unknown" portion of this group should be allocated unequally amongst the remaining categories. A systematic tendency of police to under-report race when issuing infractions to individuals of color, for example, would further increase disparities in their rate of citations incurred. Whether such a tendency exists, however, is purely speculative (though the example discussed earlier regarding Ofc. David does raise such suspicions).

Comparison with other cities

The racial disparities we find for bicycle-related infractions in Seattle can be compared to those identified in other cities for bicycle-related (not necessarily helmet-related) police stops and infractions. Previous reporting has shown disparities for police stops of Black cyclists with rates of 2.5 in Oakland, CA (*5.0 compared to white cyclists*), 1.9 in Washington, DC (*9.9 compared to white cyclists*), and 1.1 in New Orleans, LA (*1.4 compared to white cyclists*)[37]. A rigorous examination of Tampa, FL by the U.S. Department of Justice identified a disparity in police stops of Black cyclists of 2.8 (*6.8 compared to white cyclists*), and found that 5.3% of Black cyclists who were stopped received a formal citation, a rate of 1.7 compared to the 3.2% of white cyclists stopped who received citations[38]. On a back-of-the-envelope basis, if the approximate citation issuance rate during police stops of cyclists of 4% suggested by the Tampa data were used to extrapolate from the total number of bicycle-related infractions in Seattle from 2003-2020 (a total of 5,999 citations), this would point to about 150,000 police stops of cyclists in Seattle during this period, or an average of 8,500 per year.

It should be emphasized that none of the aforementioned reports specifically estimated demographics of cyclist populations in the respective cities, instead using U.S. Census population data or comparing with bicycle crash data by race as a proxy for ridership. Most

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[37] Dan Roe, "Black cyclists are stopped more often than whites, police data shows," *Bicycling* (July 27, 2020), https://www.bicycling.com/culture/a33383540/cycling-while-black-police/.

[38] Greg Ridgeway et al., "An examination of racial disparities in bicycle stops and citations made by the Tampa Police Department: A technical assistance report," U.S. Department of Justice Office of Community Oriented Policing Services (2016), https://www.tampa.gov/document/report-23341.

reports assessed racial disparities in police stops, rather than issuance of citations. This suggests two ways in which our methodology and findings are particularly novel.

Other reports have identified stark disparities for tickets issued to cyclists in minority neighborhoods of Chicago, IL[39], Dallas, TX[40], and New York, NY[41], suggesting that disproportionate frequencies of police stops and ticketing of cyclists of color are widespread in the United States, if not yet rigorously quantified. The analysis of police stops of cyclists in Oakland, CA, Washington, DC, and New Orleans, LA[42] also demonstrated that Black cyclists have been stopped substantially more frequently than white cyclists on the basis of suspicion and probable cause (so-called "pretextual stops"), and the data from Oakland, CA show that Black riders are subject to searches and arrests far more often (by a factor of 3.3) than white riders.

Ongoing and future work

The findings detailed in this report are preliminary and warrant further examination. Here we briefly discuss several avenues for planned future research.

1. Recent reporting in *Crosscut* examined a similar compilation of Seattle Municipal Court bicycle helmet infraction records from 2017-2020[43]. By cross-referencing the listed home addresses of defendants with addresses of homeless shelters or organizations and associating defendant names with news or police reports, it was found that at least 43% of helmet citations since 2017 and 60% in 2019 were issued by Seattle police to homeless individuals. This lends significant context to our findings of racial disparities. It is unclear to what degree the homeless individuals cited belong to racial minority groups (Black and Native American/Alaska Native) that we have found are disproportionately ticketed. However, point-in-time counts of the homeless population in King County, which includes Seattle, show that both minority groups are disproportionately impacted by homelessness, with disparities of about 3.6 for Black and 15 for Native American/

39 Mary Wisniewski, "'Biking while black': Chicago minority areas see the most bike tickets", *Chicago Tribune* (March 17, 2017), https://www.chicagotribune.com/news/breaking/ct-chicago-bike-tickets-minorities-0319-20170317-story.html.

40 Tom Benning, "With Dallas bike helmet law, rules of the ride enforced unevenly," *Dallas Morning News* (June 3, 2014), https://www.dallasnews.com/news/2014/06/04/with-dallas-bike-helmet-law-rules-of-the-ride-enforced-unevenly/.

41 Irene Chidinma Nwoye, "Cycling on the sidewalk: the new stop-and-frisk?," *The Village Voice* (October 30, 2014), https://www.villagevoice.com/2014/10/30/cycling-on-the-sidewalk-the-new-stop-and-frisk/.

42 Dan Roe, "Black cyclists are stopped more often than whites…," *Bicycling.* As above.

43 David Kroman, "Nearly half of Seattle's helmet citations go to homeless people," *Crosscut* (December 16, 2020), https://crosscut.com/news/2020/12/nearly-half-seattles-helmet-citations-go-homeless-people.

Alaska Native homeless individuals in Seattle as of 2020[44]. Quantifying the overlap in these populations within the court records merits future study.

2. The penalty for violating the King County bicycle helmet law is $30[45]. However, the full financial burden including Seattle Municipal Court fees is $102, or $154 including default penalties, significantly larger sums[46]. The *Crosscut* analysis mentioned previously found that the majority of helmet infractions from 2017-2020 have gone unpaid[47]. We have obtained data from a follow-up public records request to the Seattle Municipal Court that may allow us to quantify the frequency with which helmet citations go unpaid and are sent to collections, as well as identify racial disparities in these rates.

3. The inability to disaggregate Hispanic/Latino and white (non-Hispanic/Latino) defendants in the court records is a major limitation of our work, as well as police record-keeping practices in general. Our follow-up public records request to Seattle Municipal Court obtained the full names of defendants, which we will attempt to use to estimate rates of citations issued to Hispanic/Latino individuals using algorithmic name-matching classification techniques.

4. Our follow-up public records request to Seattle Municipal Court also yielded defendants' home address zip codes. It may be possible to use these as a reasonable proxy for estimating rates of infraction issuance within different sectors of the City.

5. We have filed public records requests to other municipal courts in King County, the King County Sheriff's Office, and the King County District Court, which have yielded records of helmet infractions in those municipalities. Analysis is in progress. We plan to submit follow-up requests for other bicycle-related infractions and use the collected data to assess rates and disparities in all tickets written to cyclists in King County jurisdictions outside of Seattle.

6. The Seattle Police Department has made public a Use of Force data set with records from 2014 to present[48]. We anticipate that it could be possible to match individual bicycle infraction records with associated instances of use of force, if they exist.

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[44] "Seattle/King County point-in-time count of individuals experiencing homelessness," Vega Nguyen Research and All Home King County (2020), https://regionalhomelesssystem.org/wp-content/uploads/2020/07/Count-Us-In-2020-Final.pdf.

[45] "Title 9: Bicycle helmets," King County Board of Health Code. As above.

[46] We have identified this by searching for citation numbers associated with helmet law violations in the Seattle Municipal Court citation information portal, accessed at https://web6.seattle.gov/courts/ECFPortal/default.aspx. The default penalty of $52 is applied if a defendant fails to respond with 19 days of receiving a citation, according to: "Inventory of criminal and infraction fines and fees at Seattle Municipal Court," Seattle Municipal Court (August 2017), https://www.seattle.gov/Documents/Departments/Court/SMCFineandFeeInventoryCompiledAug2017.pdf.

[47] David Kroman, "Nearly half of Seattle's helmet citations…," *Crosscut*. As above.

[48] Seattle Police Department, *Use of force data* [Microsoft Excel spreadsheet] (last updated February 4, 2021), https://data.seattle.gov/Public-Safety/Use-Of-Force/ppi5-g2bj.