Associations between Bike Score and frequency of bicycle ridership among women of reproductive age in the Puget Sound Region of Washington state

Anna Harrington

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Public Health

University of Washington

2021

Committee:

Stephen Mooney

Daniel A. Enquobahrie

Program Authorized to Offer Degree:

Epidemiology

University of Washington

Abstract

Associations between Bike Score and frequency of bicycle ridership among women of reproductive age in the Puget Sound Region of Washington state

Anna Harrington

Chair of the Supervisory Committee:

Stephen Mooney

Department of Epidemiology

Background

Physical activity is linked to countless health benefits, including reduced risk for chronic disease. Women, minority groups, and persons with lower socioeconomic status are at increased risk for physical inactivity. Chronic disease during pregnancy is associated with increased risk for adverse pregnancy and neonatal outcomes. Bicycling is uniquely positioned to mitigate risk of developing chronic disease. Nonetheless, few Americans bicycle, and ridership is lower among women than men. Prior research indicates that women of reproductive age may increase ridership with the development of bicycle infrastructure. Scant research has examined this theory on a wide scale in practice, however. Our study aimed to address this gap in research.

Methods

The centroid of the residential census tract of eligible women of reproductive age who participated in the 2017 or 2019 Puget Sound Regional Council Household Travel Survey was matched with Redfin's Bike Score, a proxy for infrastructure. We fit a log-linear regression model to investigate the association between Bike Score and bicycle ridership for 15 minutes or more at least once in the past 30 days (versus less than that) among women of reproductive age in the Puget Sound Region of Washington state, adjusting for age and seasonality. We assessed this association for effect modification by race/ethnicity, a proxy for structural and interpersonal racism.

Results

The study population comprised 3,204 women of reproductive age. This included 1,582 participants who lived in regions with Bike Scores less than 70 (the median Bike Score in this study population) and 1,622 participants who lived in regions with Bike Scores greater than or equal to 70. The risk of having ridden a bicycle recently was 33% higher for each 20 points of Bike Score, adjusting for age and seasonality (RR=1.33; 95% CI: 1.21, 1.45). None of the interaction terms were statistically significant at alpha-level=0.05. Excluding participants who identified as non-Hispanic White alone, the risk of having ridden a bicycle recently was 35% higher for each 20 points of Bike Score, adjusting for age and seasonality (RR=1.35; 95% CI: 1.11, 1.64).

Conclusion

Bike Score was positively associated with bicycle ridership among women of reproductive age, including women of reproductive age of color. The development of bicycle infrastructure may

foster an increase in ridership among women of reproductive age that may result in reduced incidence of chronic disease and adverse pregnancy and neonatal outcomes. The lower baseline probability of riding among women of reproductive age of color compared to non-Hispanic White alone women of reproductive age was not explained by infrastructure. This finding highlights the need for additional research on non-infrastructural barriers and facilitators to bicycle ridership among women of reproductive age of color, with a focus on anti-racism work and police reform, to reduce the racial disparity in ridership.

Introduction

The health benefits of physical activity are far-reaching. Overwhelming scientific evidence suggests that regular physical activity is associated with a lower risk for over two dozen chronic medical conditions, all-cause mortality and all-cancer mortality.[1, 2] On the other hand, physical inactivity is associated with a higher risk for many chronic diseases, such as cardiovascular disease, type 2 diabetes, certain cancers, anxiety and depression.[3]

Women, minority groups and persons with lower socioeconomic status (as well as elderly persons) tend to lead less active lifestyles and are at higher risk for physical inactivity.[2] Cardiovascular disease is the leading cause of death among females overall and is the third leading cause of death among females 20 to 44 years of age in the U.S.[4] Chronic disease during pregnancy is associated with increased risk for adverse pregnancy and neonatal outcomes, such as pregnancy complications, low birth weight, preterm birth, and birth defects.[5] Further, chronic disease and risk factors for cardiovascular disease disproportionately impact low-income and racial minority women.[6, 7] Given these findings, it is imperative to develop a systems-level strategy that appeals to low-income and racially diverse groups to increase physical activity and improve health outcomes among women of reproductive age.

Encouraging bicycling may be a particularly effective and economical strategy to achieve this task. First, evidence suggests that bicycling promotes physical and emotional health.[8, 9] Lusk and colleagues found that for a 30 minute/day increase in physical activity from 1989 to 2005 among premenopausal women in the Nurses' Health Study II, bicycling—similar to brisk walking—was associated with less weight gain.[10] In contrast, slow walking was not associated

with less weight gain. Further, Lusk et al. discovered that a dose-response relationship existed between bicycling and less weight gain, especially among overweight and obese women.[10]

Second, bicycling may be a particularly effective physical activity to promote on a systems-level due to its time-saving qualities.[11] This may be especially important among women, low-income, and racial minority populations, who tend to experience higher rates of time poverty, lack of time available after engaging in necessary activities like sleep and in the committed activities of paid and unpaid work.[12-15] Bicycling may alleviate some of the barriers to physical activity associated with time poverty because bicycling could replace time spent in a vehicle or on public transit for necessary travel to work, grocery stores, schools, and other activities of daily living. Rather than needing to carve out time for physical activity, women of reproductive age could integrate physical activity into their daily living by bicycling.

Third, bicycling is affordable. Households that earn less than $50,000, including many that earn less than $10,000, are the single largest group of Americans who bicycle to work.[16] Lastly, bicycling, rather than driving, promotes a host of environmental benefits, such as land conservation, energy savings, and a reduction in noise and air pollution.[17]

Despite these benefits to bicycling, ridership in America remains low. In 2018, approximately 26% of Americans 18 and older rode a bike at least once in the past year. Of the American adults who rode, 41% rode fewer than six days in the past year.[18] Further, ridership is lower among American women than among American men.[17] According to the 2019 American Community Survey, under a third (30%) of bike commuters are women.[19] Similarly, Hosford and Winters found that women made approximately a quarter of all bicycle share trips from 2014-2018.[20] In the Seattle-metro region in 2016-2018, a little under 3% of women in the Seattle-

metro region indicated that they had “used a bike for transportation for any purpose in the past 7 days” while a little over 9% of men in the Seattle-metro region endorsed this statement.[21] In contrast, ridership among females is much higher in many European countries where bicycle infrastructure (e.g., bicycle lanes) tends to be more robust. In Denmark, for example, women account for 53% of all cyclists.[22]

Safety and infrastructure are primary concerns among women who bicycle in the U.S.[23] Investigators in Maryland discovered that women were more sensitive to infrastructure and the environment than men were.[24] In a before-and-after study, researchers found that ridership increased 133% among adult female riders post-painting the first on-street bike lane in New Orleans, Louisiana.[25] These findings suggest that women of reproductive age may be more likely to bicycle if infrastructure is built to separate bicyclists from automobiles and decrease risk of injury resulting from collision with automobiles. In 2016, the Community Preventive Services Task Force released a recommendation for built environment approaches, with a focus on bicycle or pedestrian transportation systems, to increase physical activity.[26] To our knowledge, no study to date has investigated the association between bicycle infrastructure and ridership behavior among women of reproductive age on a larger scale in practice, however.

This study aimed to fill this gap by using Bike Score[27] as a proxy for infrastructure and 2017 and 2019 Puget Sound Regional Council (PSRC) Household Travel Survey[28] data to investigate the association between infrastructure and ridership frequency among women of reproductive age in the Puget Sound Region (King, Kitsap, Pierce, and Snohomish Counties) of

Washington state. We hypothesized that ridership frequency among women of reproductive age would be positively associated with Bike Score.

As a secondary aim, we investigated whether the relationship between Bike Score and frequency of ridership among women of reproductive age varied due to structural and interpersonal racism associated with traffic violence. In 2019, Lubitow and colleagues conducted qualitative research with persons of color to explore barriers to bicycling in Portland, Oregon, and found that many feared violence and police harassment while bicycling.[29] Given these findings, we hypothesized that structural and interpersonal racism, proxied by racial-ethnic identity, would modify the association between Bike Score and ridership frequency. Specifically, we suspected that the positive association between Bike Score and ridership would be weaker among women of reproductive age who also identified as being of color in contrast to women of reproductive age who identified as being non-Hispanic White alone.

Methods

Study Setting and Study Populations

This cross-sectional study used 2017 and 2019 PSRC Household Travel Survey data. The study setting included the Puget Sound Region (King, Kitsap, Pierce, and Snohomish Counties) of Washington state. The PSRC Household Travel Survey study subjects were recruited using address-based sampling and were mailed letters and postcards inviting them to participate. Block groups that contained high proportions of travel and household attributes that are especially crucial for transportation planning (e.g., low-income, zero-vehicle and young households in addition to non-auto commuters) were oversampled. Gift card incentives were offered to households that completed the entire study.

The present study included participants who endorsed “female,” reported being between the ages of 18 and 54 years, and responded to the question, “In the past 30 days, how often have you ridden a bike for 15 minutes or more?” in the 2017 or 2019 PSRC Household Travel Survey. Participants missing data on sex, age, or race/ethnicity, were excluded. The final analytic population included 3,204 participants. The University of Washington Human Subjects Division determined that this study was exempt from full IRB review.

Data Collection

The primary exposure was Bike Score, a metric developed by the company Redfin, that measures the “bikeability” of a specific location on a scale of 0-100. Bike Score is based on four equally weighted components: the density and quality of bike infrastructure, topography, amenities and road connectivity, and bicycle commuting mode share. The centroid of the residential census tract of participants was matched with Bike Score, a proxy for infrastructure, to investigate whether Bike Score was associated with ridership among women of reproductive age in the Puget Sound Region.

In addition to using Redfin data, this study used PSRC Household Travel Survey Program data collected in 2017 and 2019. Participants completed an online survey for a one-day travel period or by smartphone app for a seven-day travel period. Post data-collection, survey data were weighted to ensure representation and alignment with census totals across key socio-demographic dimensions. We pooled the 2017 and 2019 survey data to create a repeated cross-sectional study design. Notably, Bike Score was assessed in 2020. While these time periods do not match perfectly, bicycle infrastructure has not changed considerably at the

neighborhood level in the Puget Sound Region since 2017. Thus, this level of time mismatch is tolerable.

The outcome was frequency of bicycle ridership among women of reproductive age defined as responses to the PSRC Household Travel Survey question, “In the past 30 days, how often have you ridden a bike for 15 minutes or more?” Participants had the option to endorse “6-7 days per week,” “5 days per week,” “2-4 days per week,” “1-3 times in the past 30 days,” “I do this but not in the past 30 days,” or “I never do this.” Frequency of bicycle ridership was dichotomized into categories of “at least 1 time in the past 30 days” versus less than that.

Age and seasonality were included as confounders in both the Aim 1 and Aim 2 analyses. Age was a categorical variable in which participants endorsed the age group with which they identified while completing the PSRC Household Travel Survey. Only participants who endorsed one of the following age categories were potentially eligible to participate in this study: “18-24,” “25-34,” “35-44,” or “45-54” years. Seasonality was based on the date on which participants reported their travel information as part of the PSRC Household Travel Survey. Spring was defined as having a travel date from March 1 to May 31 while Summer was defined as June 1 to August 31. All travel dates were in the Spring and Summer.

Race-ethnicity was included as a main effect term and in an interaction term with Bike Score to assess whether structural and interpersonal racism, proxied through racial identity, modified the association between Bike Score, a proxy for infrastructure, and frequency of ridership among women of reproductive age under our Aim 2. Participants were presented with the following categories and asked to select all that apply when completing the PSRC Household Travel Survey: “African American or Black,” “American Indian or Alaska Native,”

"Asian," "Native Hawaiian or Pacific Islander," "Hispanic," "White," "Other," or "Prefer not to answer." We collapsed 38 unique racial-ethnic identities into 6 categories (non-Hispanic White alone, non-Hispanic African American or Black alone, non-Hispanic Asian alone, non-Hispanic Some Other Race alone, non-Hispanic Two or More Races, and Any Hispanic) to increase study power. We present **Table 1** to reflect the racial diversity of participants in this study and acknowledge that participants with different racial identities may experience racism differently.

Statistical Analysis

To assess the comparability of demographic characteristics among participants with relatively high Bike Scores versus low Bike Scores, we presented the distribution of age, race/ethnicity, household income, and education ascertainment by the median Bike Score in this study population in **Table 2**. To explore the distribution of Bike Scores associated with the centroid of the residential census tracts of all participants in this study, we presented **Figure 1**. **Figures 2-7** reflect the distribution of Bike Scores associated with the centroid of the residential census tracts of participants in each of the six racial-ethnic categories.

To investigate the primary aim, we fit a log-linear regression model to examine the association between Bike Score and frequency of bicycle ridership for 15 minutes or more in the past 30 days. Bike Score ranges from 0-100. We modeled a 20 point difference in Bike Score, roughly the difference between Portland, Oregon, (a national leader in bike friendliness) and Albuquerque, New Mexico (a moderately bike friendly city).[30] We assigned Bike Scores of 0 for the centroids of participant residential census tracts for which Redfin did not assign Bike Scores under the assumption that Redfin deprioritized scoring these locations due to lack of bicycle infrastructure.

We adjusted for age and seasonality. Other covariates for which we considered adjusting but decided against included income, education, and neighborhood-level crime. We decided against adjusting for income because research suggests that bicycling rates vary little by income. It is the purpose for bicycling that varies by income, with persons of lower income biking for utilitarian purposes and persons of higher income biking for recreational purposes.[31] We decided against adjusting for education because education is directly linked to income. We decided not to adjust for neighborhood-level crime due to concern about the validity and reliability of reported crime statistics. Prior to conducting the inferential analysis, we subset the primary model by season to assess for inconsistent or unexpected findings that would implicate the presence of a data artifact, such as an outlier, that would skew results.

Additionally, we conducted three sensitivity analyses as part of our Aim 1. The first sensitivity analysis included women of reproductive age who were missing race/ethnicity data (who were excluded in the primary analysis). The second sensitivity analysis excluded women of reproductive age who lived in census tracts with centroids lacking Bike Scores (which were assumed to be 0 in the primary analysis). The third sensitivity analysis excluded participants in the non-Hispanic White alone racial/ethnic category to assess whether women of reproductive age in the non-Hispanic White alone category, the largest racial/ethnic category in this study, was the only racial/ethnic category driving the result in Aim 1.

To investigate whether experiences of racism modified the association between Bike Score and frequency of bicycle ridership among women of reproductive age under our secondary aim, we fit a log-linear model including race/ethnicity (a proxy for structural and interpersonal racism) as a main effect, in addition to an interaction term involving

race/ethnicity and Bike Score. As with Aim 1, we adjusted for age and seasonality. We performed a likelihood ratio test to examine whether the interaction term was statistically significantly different from 1 at alpha-level 0.05. Lastly, we conducted a sensitivity analysis to exclude women of reproductive age who lived in census tracts with centroids lacking Bike Scores (which were assumed to be 0 in the primary analyses of Aims 1 and 2). All data analyses were conducted using R version 4.0.4.

Results

A total of 3,204 women of reproductive age had complete information on sex, race/ethnicity, and age. This included 1,582 women of reproductive age who lived in regions with Bike Scores less than 70 (the median Bike Score in this study population) and 1,622 women of reproductive age who lived in regions with Bike Scores greater than or equal to 70 (**Table 2**). The age distribution skewed younger for the higher Bike Scores. Approximately 60% of participants with Bike Scores greater than or equal to 70 were aged 18-34 years while only approximately 43% of participants with Bike Scores less than 70 were aged 18-34 years. The distribution of race/ethnicity and household income was comparable between participants with residential census tracts with centroids associated with Bike Scores greater than or equal to 70 and participants with residential census tracts with centroids associated with Bike Scores less than 70.

Figure 1 shows that the distribution of Bike Scores associated with the centroid of the residential census tracts of all participants in this study is generally left-skewed. Looking at **Figures 2-7**, aside from the histogram depicting the frequency of Bike Scores associated with the centroid of the residential census tracts of persons in the non-Hispanic African American or

Black alone racial-ethnic category, the histograms reflecting the Bike Scores of the five other racial-ethnic categories are generally left-skewed, with the histogram of Bike Scores associated with persons who are non-Hispanic White alone being the most left-skewed. The Bike Scores associated with persons in the non-Hispanic African American or Black alone racial-ethnic category were nearly bimodal, with 36 of 65 surveyed persons in this racial category living in census tracts with centroids associated with Bikes Scores less than 70, the median Bike Score in this study.

After accounting for age and seasonality, the risk of having ridden a bicycle recently was 33% higher for each 20 points of Bike Score (RR=1.33; 95% CI: 1.21, 1.45) (**Table 3**). None of the interaction terms under Aim 2 were statistically significant (**Table 5**). We present **Table 6** to show the proportion of women of reproductive age who rode a bicycle for 15 minutes or more at least once in the past 30 days by Bike Score greater than or equal to 70 or less than 70 (the median Bike Score in this study population) and race/ethnicity. The greatest difference in proportion of women of reproductive age who reported having ridden a bike for 15 minutes or more at least once in the past 30 days when comparing persons with Bike Scores greater than or equal to 70 to persons with Bike Scores less than 70 was in the Any Hispanic category (16.36%). However, the racial-ethnic group with the greatest proportion of women of reproductive age who rode a bicycle at least once for 15 minutes or more in the past 30 days, regardless of residence location, was the non-Hispanic White alone group.

When we restricted the primary analysis of Aim 1 by season, the findings were similar. The first sensitivity analysis including women of reproductive age who were missing race/ethnicity data (RR=1.30; 95% CI: 1.19, 1.42), as well as the second sensitivity analysis

excluding women of reproductive age who lived in census tracts with centroids lacking Bike Scores (RR=1.35; 95% CI: 1.23, 1.48), were not considerably different from the results of the primary Aim 1 analysis. We present **Table 4** to show that the estimate of the Aim 1 log-linear regression analysis comparing two participants who did not identify as non-Hispanic White alone and whose centroids of their residential census tracts differ in Bike Score by 20 points was not meaningfully different from the estimate of the Aim 1 log-linear regression analysis presented in **Table 3** that included all women of reproductive age (RR=1.35; 95% CI: 1.11, 1.64). We conducted a sensitivity analysis to exclude women of reproductive age who lived in census tracts with centroids lacking Bike Scores and found no major difference compared to the results of our secondary Aim.

Discussion

To our knowledge, this is the first study to investigate whether Bike Score, a proxy for infrastructure, is associated with frequency of ridership among women of reproductive age. This study also is the first to consider whether structural and interpersonal racism, proxied by racial-ethnic identity, modify the association between Bike Score and frequency of bicycle ridership among women of reproductive age. Results from our study indicate that the risk of having ridden a bicycle recently was 33% higher for each 20 points of Bike Score, adjusting for age and seasonality. This finding remained significant when we excluded participants who identified as non-Hispanic White alone (the largest racial-ethnic category in this study) from the Aim 1 analysis. We did not observe significant effect modification by race-ethnicity, a proxy for structural and interpersonal racism.

The findings of our primary aim support work by Le and colleagues, who surveyed 1,868 women cyclists in the U.S. and Canada about cycling skills, attitudes, perceptions of safety and the surrounding environment. They found that lack of infrastructure was one of the top concerns surrounding the decision to bicycle and that, regardless of the cyclist's comfort level, most women preferred cycling on facilities separated from vehicular traffic.[23] Also congruent with our study was the finding by Abasahl et al. that females on Baltimore, Maryland college campuses reported being more likely to bicycle with access to bike infrastructure that is separate from motorized traffic.[24] While the studies of Le et al. and Abasahl et al. relied on self-reported preferences for riding conditions, a strength of our study is that it measured self-reported bicycling behavior to assess whether Bike Score, a proxy for infrastructure, indeed is associated with increased ridership among women of reproductive age. The results of our primary aim are similar to the findings of Parker and colleagues, who measured bicycling behavior among adult female riders pre- and post-painting the first on-street bike lane in New Orleans, Louisiana and found that ridership increased 133%.[25] Our research, coupled with the findings of prior research, suggest that developing and increasing access to infrastructure may serve as an effective strategy to increase frequency of bicycling among women of reproductive age in the Pacific Northwest. Additionally, our work provides further evidence to support the 2016 recommendation of the Community Preventive Services Task Force to improve bicycle (and pedestrian) transportation systems as a means for increasing physical activity to improve population health outcomes.[26]

The null findings of our secondary aim prevent us from concluding that structural and interpersonal racism, proxied through racial identity, modified the association between Bike

Score and frequency of bicycle ridership among women of reproductive age. Future research should include larger sample sizes of racial-ethnic minority populations, along with specific measures of structural and interpersonal racism (as well as internalized racism), to parse out how different forms of racism may impact the effect of infrastructure on frequency of ridership among different racial-ethnic groups. Such data will help the public health community better understand how to intervene and work to undo the harms of racism as they relate to bicycling and mobility justice.

Despite the null findings of Aim 2, the Aim 1 sensitivity analysis excluding women of reproductive age who identified as non-Hispanic White alone sheds light on how infrastructure may impact ridership among women of reproductive age who identify as racial-ethnic minorities. The Aim 1 sensitivity analysis affirmed that Bike Score, a proxy for infrastructure, was positively associated with frequency of ridership for 15 minutes or more in the past 30 days among women of reproductive age from racial-ethnic minority groups overall.

These findings coincide with the work of Schneider et al., who conducted research on barriers to bicycling among overweight adults in low-income Latino and Black communities in Milwaukee, Wisconsin and found that 68% of participants reported not feeling safe from car traffic as a barrier to bicycling.[32] Similarly, Lubitow and colleagues conducted in-depth qualitative interviews with 20 people of color, the majority of whom were women, in Portland, Oregon and found that participants frequently discussed lack of infrastructure as a common deterrent to routine bicycling.[29] Blickstein and Brown conducted focus groups with Black and Hispanic women in New Jersey and found that the majority were not comfortable riding on roads with traffic, particularly high volume and/or high-speed traffic. Nearly all women

supported the development of protected bicycle lanes, and for the participants who didn't know how to ride, protected bicycle lanes seemed to offer an incentive to learn to ride.[33] Lastly, Lusk et al. mailed surveys to residents who were both bicyclists and non-bicyclists of Roxbury, Massachusetts and found that 74% of Hispanic-identifying participants and 64% of Black-identifying participants (as well as 90% of White-identifying participants) thought that they would feel extremely safe/very safe biking on a cycle track shown in a picture. Further, 67% of Hispanic-identifying participants and 78% of Black-identifying participants (as well as 94% of White-identifying participants) thought that biking safety would increase if the cycle track were to be built on Malcolm X Boulevard.[34] These findings imply that infrastructure may help curb perceptions of danger from car traffic while bicycling by creating separation between cyclists and car traffic and, consequently, increase ridership among racial-ethnic minority populations. While these studies investigated bicycling preferences among racial minority populations, our research is the first, to our knowledge, to demonstrate that Bike Score, a proxy for infrastructure, is positively associated with frequency of bicycle ridership behavior among racial-ethnic minority populations overall.

Additionally, in our sample, Bike Score was most strongly associated with frequent biking among women who identified as Any Hispanic. This finding is consistent with Lusk et al.'s finding that more Hispanic (81%) and Black (54%) bicyclists and non-bicyclists in Roxbury, Massachusetts thought that they would bicycle more if they could bicycle with their family and friends compared with Whites (40%).[34] Lusk's and colleagues' finding corroborates that of the Community Cycling Center, who found that 33% of Latinx (and Somali) women participants in a study in Portland, Oregon, expressed interest in learning how to ride a bicycle to be able to bike

with their children.[35] Lusk et al. argued that to comfortably bicycle with someone, cyclists would prefer to ride side-by-side, rather than behind or in front of one another. Infrastructure, especially wide infrastructure, may foster safer social riding with friends and family compared to riding in the street with motorized traffic.[34] If Hispanic women of reproductive age tend to value social biking more than women of reproductive age who identify as non-Hispanic, access to infrastructure that lends itself well to safe social biking may serve as an explanation for Bike Score being most strongly associated with frequent biking among women who fell into the Any Hispanic category in this study.

Despite this finding, the racial-ethnic group with the highest proportion of women of reproductive age who rode a bike for 15 minutes or more at least once in the past 30 days, regardless of Bike Score, was the non-Hispanic White alone racial-ethnic group. This finding mirrors the work of Firth and colleagues, who found that Canadians bicycling for leisure were more likely to identify as White than as any other racial group in 2013/2014. However, Firth and colleagues also found little difference in bike commuting across racial identity among Canadians.[36] Future research should attempt to disentangle purposes (recreational versus utilitarian) for bicycle ridership among persons of color in the United States to better characterize how to meet their mobility needs.

Nonetheless, our finding of higher ridership among women of reproductive age who identify as non-Hispanic White alone provides preliminary evidence that structural and interpersonal racism, proxied through racial identity, may inhibit ridership among minority racial-ethnic populations in the Puget Sound Region of Washington state. This postulation is congruent with the qualitative research of Lubitow and colleagues, who conducted in-depth

interviews with 20 people of color, the majority of whom identified as women, in Portland, Oregon. Lubitow et al. found that participants were concerned about experiencing microaggressions, or intimidating driving behavior that they perceived to be racially motivated, such as failing to allow sufficient stopping distance, while bicycling. Participants of color also voiced worries of violence and police surveillance while bicycling.[29] Brown and Sinclair conducted quantitative and qualitative research in New Jersey with exclusively Black and Hispanic participants and cited fear of being profiled by the police as a notable barrier to cycling.[37] Research on the inequitable enforcement of helmet laws in numerous cities in the United States,[38, 39] including Seattle, Washington,[40] illustrates that the over-policing of persons of color, rooted in structural racism, is likely a salient barrier to riding for racially minoritized women of reproductive age, especially Black and indigenous women, in the Puget Sound Region.

Other potential barriers to ridership among racially minoritized women of reproductive age that are rooted in structural racism and may help explain the observed lower ridership among women of color in this study include: lack of access to a bicycle and/or a place to store a bicycle where it would not get stolen, fear of crime and violence, destinations being too far to ride to, and extreme time poverty. For instance, the Community Cycling Center in Portland, Oregon conducted research in in 2012 and found that costs of purchasing a bicycle was a major obstacle to cycling among 60% of participants in focus groups of African, African American and Hispanic residents.[35] Additionally, 35% of these participants reported that they did not have a place to store a bicycle where it would not be stolen.[35] Blickstein and Brown held focus groups with exclusively Black and Hispanic women in New Jersey and cited concern for personal safety

and fear of crime and violence as notable barriers to bicycling among a portion of the women.[33] Similarly, Schneider et al. conducted research on barriers to riding among low-income Latino and Black communities in Milwaukee, Wisconsin and found that 72% reported not having a bicycle to use while 65% reported not feeling safe from crime as a barrier to bicycling. Further, 38% reported work, stores, parks, and other activities as being too far to ride to while 50% cited being too busy and not having time to ride as barriers.[32] Bicycling, for some, may serve as an effective time-savings strategy for integrating physical activity into daily living, but for others (such as low-income women of color, who tend to experience higher rates of time poverty),[12-15] their lives may be so busy, it's impossible to use bicycling as a means for running errands to integrate physical activity into the day. While we hypothesize that these barriers to bicycling rooted in structural racism are relevant to women of reproductive age of color in the Puget Sound Region, additional research conducted in partnership with communities of color is needed to identify the specific local barriers to bicycling among women of reproductive age of color and strategies to work to undo the harms of racism.

This study had seven key limitations. First, the PSRC Household Travel Survey data were collected in 2017 and 2019. It is unclear when the data used to calculate Bike Score were collected, and it is possible that they did not reflect the conditions that 2017 and 2019 survey participants encountered. However, infrastructure tends to change slowly overtime and in small scale. Therefore, we do not believe that any measurement error that may have existed would have changed the results in a meaningful way. Second, the dichotomization of the study outcome (responses to the PSRC Household Travel Survey question, "In the past 30 days, how often have you ridden a bike for 15 minutes or more?") into categories of "at least 1 time in the

past 30 days" versus less than that resulted in a loss of information. For instance, this dichotomization prevented us from discerning whether ridership was more frequent among certain racial-ethnic groups than others.

Third, in this study, Bike score was used as a proxy for infrastructure. Bike Score was an imperfect measurement of infrastructure, however, because the Score comprises equally weighted data reflecting three environmental attributes in addition to infrastructure: 1.) topography, 2.) destinations and road connectivity, and 3.) bike commuting mode share. The imperfect proxy of Bike Score for infrastructure muddied the implications of study findings, as it was challenging to discern whether a statistically significant association between Bike Score and ridership was due to infrastructure or, rather, topography, destinations and road connectivity, or the bike commuting road share. Further, bike commuting mode share was a particularly concerning construct of Bike Score because it captures the number of persons who reported bicycling as their commute mode in the U.S. Census. Redfin included this construct in the calculation of Bike Score to attempt to incorporate the "safety in numbers" philosophy, the ideology that more cyclists on the road makes drivers more aware of cyclists, and, in turn, more drivers are likely to have experienced cycling, increasing the safety of bicycling. The inclusion of bike commuting mode share in the calculation of Bike Score was problematic for this study, however, due to the circularity. In other words, the exposure (Bike Score) and outcome (ridership) were not clearly distinct from one another because Bike Score was based partially on ridership, which was also the outcome of this study.

Fourth, the measure of the exposure (Bike Score associated with the centroid of the participant's residential census tract) likely did not represent all infrastructure that the

participants encountered while bicycling, which may have impacted bicycling choices. For example, participants may have resided in a census tract with a centroid associated with a low Bike Score (indicating worse "bikeability") but knew that they would spend the majority of their riding time outside of their census tract, in census tracts with high Bike Scores (indicating better "bikeability"). This knowledge may have led to them deciding to ride, despite residing in a census tract with a centroid associated with a low Bike Score. Such tendencies would have attenuated the observation of the true association between Bike Score and bicycle ridership among women of reproductive age, such that the true association was greater than the observed relative risk of 1.33.

Fifth, there could have been misclassification of the potential effect modifier, race/ethnicity (a proxy for structural and interpersonal racism), that we examined as part of our secondary aim. Participants were required to classify their racial identity (specifically, they were asked to "select all that apply") using 7 race/ethnicity categories with which they may not always have identified, depending on time and place. Further, because there were 38 unique racial-ethnic categories with insufficient sample sizes, we decided to collapse the 38 racial categories into 6 broader categories to attempt to increase study power. This collapse may have masked important differences in frequency of ridership that would have provided further insight on potential places to intervene to mitigate the harms of structural and interpersonal racism as they relate to bicycling.[41]

Sixth, to report gender identity, participants were asked to select 'Male,' 'Female,' 'Another,' or 'Prefer not to answer' when completing the PSRC Household Travel Survey. Only participants who endorsed "female" were included in this study. Trans and gender-

nonconforming participants who did not endorse “female” may experience many of the same conditions that self-identified females do; however, they were excluded from the study.

Seventh, unmeasured confounding, such as by BMI and residential self-selection (in which persons may choose to live in neighborhoods based on their bicycling preferences), may exist. Unmeasured confounding may have driven the observed estimate further from the null value and spuriously demonstrated a relationship between Bike Score and ridership when no real relationship between them exists. Ninth, this study may include selection bias. Specifically, persons experiencing homelessness are often transient or receive mail at homeless shelters. Due to difficulties locating reliable mailing addresses for persons experiencing homelessness, it is likely that this study included few to no persons experiencing homelessness, despite this being a group for whom bicycling may be a particularly powerful tool for promoting exercise. Consequently, we likely cannot apply the findings to persons experiencing homelessness.

Future research is necessary to understand which type of bicycle infrastructure, such as painted buffer lanes versus bike paths separated from automobile traffic, women of reproductive age tend to prefer to foster the greatest increase in ridership. Other potential non-infrastructural barriers and facilitators to bicycling to explore include sexual harassment while riding, access to employment that permits bike friendly work attire, the role of parental demands, and the use of trailers to transport children or carry items among women of reproductive age.

To better characterize how interpersonal and structural racism impact ridership among women of reproductive age, we recommend that researchers design studies to sufficiently oversample persons of color and disaggregate race and ethnicity data to the fullest extent

possible. Doing such will help expose racial health inequities and prevent the erasure of subpopulations.[41] Similarly, we recommend that researchers collect data using specific measures, rather than proxies, for interpersonal and structural racism (as well as internalized racism) to improve understanding of how to intervene and mitigate the harms of racism as they relate to bicycling and mobility justice. Lastly, exploration of intersecting identities—such as identifying as genderqueer or non-binary, having a physical disability that may necessitate special infrastructure design, and/or experiencing homelessness—and how these identities impact ridership will help us further identify points of intervention to increase ridership among marginalized communities.

Conclusion

We found that Bike Score as a proxy for bicycle infrastructure was positively associated with frequency of ridership among women of reproductive age, including racial-ethnic minority women of reproductive age, in the Puget Sound Region of Washington state. Our research indicates that women of reproductive age may increase the frequency of bicycle ridership with the development of new infrastructure. This finding aligns with the 2016 policy recommendation of the Community Preventive Services Task Force to adopt built environment approaches, such as bicycle (and pedestrian) infrastructure, to increase physical activity. To implement this recommendation, we advise the public health community to partner with women and communities of color to advocate for the development of bicycle infrastructure. While the burden of advocating for bicycle infrastructure should not fall upon communities of color,[42] residents should be given a voice and control decision-making.[43] The development of infrastructure may lead to increases in bicycle ridership among women of reproductive age and,

subsequently, meaningful improvements in population health outcomes, including reduced incidence of chronic and cardiovascular disease, maternal morbidity and mortality, and adverse pregnancy and neonatal outcomes.

Nevertheless, the failure to observe effect modification by race/ethnicity on the Bike Score-ridership relationship suggests that infrastructure was not the source of the observed baseline differences in probability of riding among the different racial-ethnic groups. Focusing on the development of infrastructure as the sole strategy to increase bicycle ridership among all women of reproductive age, regardless of race-ethnicity, may miss the mark. Additional qualitative research is needed to better characterize the barriers to ridership among racially minoritized women of reproductive age. Other mechanisms, such as anti-racism work and police reform, may be more effective strategies for reducing the racial disparity in ridership.

References

1. Pedersen BK, Saltin B. Exercise as medicine - evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scand J Med Sci Sports*. 2015;25 Suppl 3:1-72.

2. Warburton DER, Bredin SSD. Health benefits of physical activity. *Curr Opin Cardiol*. 2017;32(5):541-556.

3. Risks of physical inactivity. Accessed May 30, 2021. https://www.hopkinsmedicine.org/health/conditions-and-diseases/risks-of-physical-inactivity

4. CDC. Leading causes of death-females-all races/origins. Published February 3, 2020. Accessed May 30, 2021. https://www.cdc.gov/women/lcod/2017/all-races-origins/index.htm

5. Johnson K, Posner SF, Biermann J, et al. Recommendations to improve preconception health and health care--United States. A report of the CDC/ATSDR Preconception Care Work Group and the Select Panel on Preconception Care. *MMWR Recomm Rep*. 2006;55(RR-6):1-23.

6. Bombard JM, Dietz PM, Galavotti C, et al. Chronic diseases and related risk factors among low-income mothers. *Matern Child Health J*. 2012;16(1):60-71.

7. Graham G. Disparities in cardiovascular disease risk in the United States. *Curr Cardiol Rev*. 2015;11(3):238-245.

8. Pucher J, Dijkstra L. Promoting safe walking and cycling to improve public health: lessons from The Netherlands and Germany. *Am J Public Health*. 2003;93(9):1509-1516.

9. Dill J. Bicycling for transportation and health: the role of infrastructure. *J Public Health Policy*. 2009;30 Suppl 1(S1):S95-110.

10. Lusk AC, Mekary RA, Feskanich D, Willett WC. Bicycle riding, walking, and weight gain in premenopausal women. *Arch Intern Med*. 2010;170(12):1050-1056.

11. Spinney J, Millward H. Time and money: A new look at poverty and the barriers to physical activity in Canada. *Soc Indic Res*. 2010;99(2):341-356.

12. Kalenkoski CM, Hamrick KS. Time poverty thresholds in the USA. In: *Encyclopedia of Quality of Life and Well-Being Research*. Springer Netherlands; 2014:6650-6653.

13. Hyde E, Greene ME, Darmstadt GL. Time poverty: Obstacle to women's human rights, health and sustainable development. *J Glob Health*. 2020;10(2):020313.

14. U.S. Census Bureau. Poverty rates for blacks and Hispanics reached historic lows in 2019. Accessed May 30, 2021. https://www.census.gov/library/stories/2020/09/poverty-rates-for-blacks-and-hispanics-reached-historic-lows-in-2019.html

15. Emanuel G. Time poverty. Published September 3, 2013. Accessed May 30, 2021. https://stateofopportunity.michiganradio.org/post/time-poverty

16. Jaffe E. The Poor Bike, the Rich Bike-Share. Bloomberg CityLab. Published October 30, 2015. Accessed May 30, 2021. https://www.bloomberg.com/news/articles/2015-10-30/cycling-s-equity-gap-divides-low-income-bike-riders-and-high-income-bike-share-users

17. Le HTK, West A, Quinn F, Hankey S. Advancing cycling among women: An exploratory study of North American cyclists. *J Transp Land Use*. 2019;12(1). doi:10.5198/jtlu.2019.1461

18. Corona Insights. *U.S. Bicycling Participation Study: Report of findings from the 2018 survey*. PeopleForBikes; 2019:1-105. https://prismicio.s3.amazonaws.com/people forbikes/ 2a399be4-8bda-4e2a-b47a8e7e06e65385_2018_Participation_Study.pdf

19. U.S. Census Bureau. Commuting Characteristics by Sex. 2015-2019 American Community Survey 5-Year Estimates. Accessed June 21, 2021. https://data.census.gov/cedsci/table ?q=commuting+characteristics+by+sex&tid=ACSST5Y2019.S0801

20. Hosford K, Winters M. Quantifying the Bicycle Share Gender Gap. *Transport Findings*. November 2019. doi:https://doi.org/10.32866/10802

21. Balk G. Who bikes in Seattle? Bicycling gender gap one of the biggest in the U.S. The Seattle Times. Published June 5, 2019. Accessed May 30, 2021. https://www.seattletimes.com/seattle-news/data/who-bikes-in-seattle-bicycling-gender-gap-one-of-biggest-in-country/

22. Facts about Cycling in Demark. Cycling Embassy of Denmark. Accessed May 30, 2021. https://cyclingsolutions.info/embassy/danish-cycling-statistics/

23. Le HTK, West A, Quinn F, Hankey S. Advancing cycling among women: An exploratory study of North American cyclists. *J Transp Land Use*. 2019;12(1). doi:10.5198/jtlu.2019.1461

24. Abasahl F, Kelarestaghi KB, Ermagun A. Gender gap generators for bicycle mode choice in Baltimore college campuses. *Travel Behav Soc*. 2018;11:78-85.

25. Parker KM, Gustat J, Rice JC. Installation of bicycle lanes and increased ridership in an urban, mixed-income setting in New Orleans, Louisiana. *J Phys Act Health*. 2011;8(s1):S98-S102.

26. Omura JD, Carlson SA, Brown DR, et al. Built environment approaches to increase physical activity: A science advisory from the American heart association. *Circulation*. 2020;142(11):e160-e166.

27. Bike Score Methodology. Accessed May 30, 2021. https://www.walkscore.com/bike-score-methodology.shtml

28. Household travel survey program. Published March 30, 2017. Accessed May 30, 2021. https://www.psrc.org/household-travel-survey-program

29. Lubitow A, Tompkins K, Feldman M. Sustainable cycling for all? Race and gender–based bicycling inequalities in Portland, Oregon. *City Community*. 2019;18(4):1181-1202.

30. Most walkable cities in the United States, Canada, and Australia on walk Score. Accessed May 30, 2021. https://www.walkscore.com/cities-and-neighborhoods/

31. Pucher J, Buehler R, Seinen A. Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. *Transportation Research Part A.* 2011; 45(6):451-475.

32. Schneider RJ, Kusch J, Dressel A, Bernstein R. Can a twelve-week intervention reduce barriers to bicycling among overweight adults in low-income Latino and Black communities? *Transp Res Part F Traffic Psychol Behav*. 2018; 56:99-112.

33. Blickstein, S, Brown, C. *Bicycling Among Black and Latino Women: Focus Group Summary Report.* New Jersey: Rutgers University; 2016. http://njbikeped.org/wp-content/uploads/Bicycling-Among-Black-and-Hispanic-Women_Web.pdf

34. Lusk AC, Anastasio A, Shaffer N, Wu J, Li Y. Biking practices and preferences in a lower income, primarily minority neighborhood: Learning what residents want. *Prev Med Rep*. 2017;7:232-238.

35. Saunders M. Understanding Barriers to Bicycling Report. Community Cycling Center. Published July 2012. Accessed May 30, 2021. https://communitycyclingcenter.org/wp-content/uploads/2012/07/Understanding-Barriers-Final-Report.pdf

36. Firth CL, Branion-Calles M, Winters M, Harris MA. Who Bikes? An Assessment of Leisure and Commuting Bicycling from the Canadian Community Health Survey. *Transport Findings.* May 2021.

37. Brown, C, Sinclair, J. Abstract of *Removing Barriers to Bicycle Use in Black and Hispanic Communities.* Transportation Research Board. 2017. https://trid.trb.org/view/1438326

38. Mitchell O, Ridgeway G. Assessing the fairness and effectiveness of bicycle stops in Tampa. *Police Q*. 2018;21(4):461-485.

39. Hoffmann M, Kmiecik A. *Bicycle Citations and Related Arrests in Minneapolis, 2009-2015*. Minneapolis Bicycle Coalition; 2016.

40. Baruchman M. Racial disparities prompt calls to repeal King County's bicycle helmet law. The Seattle Times. Published February 19, 2021. Accessed May 30, 2021. https://www.seattletimes.com/seattle-news/transportation/racial-disparities-prompt-calls-to-repeal-king-countys-bicycle-helmet-law/

41. Kaufman JD, Hajat A. Confronting Environmental Racism. *Environmental Health Perspectives*. 2021;129(5):051001. doi:10.1289/ehp9511

42. Kumanyika S, Taylor WC, Grier SA, et al. Community energy balance: a framework for contextualizing cultural influences on high risk of obesity in ethnic minority populations. *Prev Med*. 2012;55(5):371-381.

43. van Stokkum SRMALR. Making bicycling equitable: Lessons from sociocultural research. Published online April 1, 2019. doi:10.7922/G22R3PWK

APPENDIX

Table 1. Summary of racial identities endorsed in the PSRC Household Travel Survey among study participants (n=3,204)

Race/Ethnicity Categories Endorsed	Number of Participants
White	2,143
White and Other	13
Hispanic	98
Hispanic and Other	1
Hispanic and White	62
Native Hawaiian or Pacific Islander	13
Native Hawaiian or Pacific Islander and Other	1
Native Hawaiian or Pacific Islander and White	5
Native Hawaiian or Pacific Islander, Hispanic, and White	1
Native Hawaiian or Pacific Islander, Hispanic, White, and Other	1
Asian	572
Asian and Other	2
Asian and White	67
Asian, White, and Other	2
Asian and Hispanic	4
Asian, Hispanic, and Other	1
Asian, Hispanic, and White	1
Asian and Native Hawaiian or Pacific Islander	7
Asian, Native Hawaiian or Pacific Islander, and Other	1
Asian, Native Hawaiian or Pacific Islander, and White	7
American Indian or Alaska Native	5
American Indian or Alaska Native and White	23
American Indian or Alaska Native and Hispanic	2
American Indian or Alaska Native, Hispanic, White, and Other	1
American Indian or Alaska Native, Hispanic, and White	4
American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and White	1
American Indian or Alaska Native and Asian	2
American Indian or Alaska Native, Asian, and White	3
American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, and White	1
African American or Black	65
African American or Black and White	26
African American or Black and Hispanic	2
African American or Black, Hispanic and White	2
African American or Black and Asian	4
African American or Black, Asian, and White	3
African American or Black and American Indian or Alaska Native	1
African American or Black, American Indian or Alaska Native, and White	1
Other	56

Note: The 38 unique racial identities were collapsed into 6 categories (non-Hispanic White alone, non-Hispanic African American or Black alone, non-Hispanic Asian alone, non-Hispanic Some Other Race alone, non-Hispanic Two or More Races, and Any Hispanic) to increase study power.

Table 2. Distribution of demographic and baseline characteristics of women of reproductive age who completed the 2017 and 2019 PSRC Household Travel Survey and were included in study analysis, stratified by median Bike Score of 70 (n=3,204)

Characteristics	**Bike Score $<$ 70 n=1,582**		**Bike Score $\geq$ 70 n=1,622**	
	Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**
Age				
18-24	124	7.84%	159	9.80%
25-34	566	35.78%	828	51.05%
35-44	507	32.05%	406	25.03%
45-54	385	24.34%	229	14.12%
Race/Ethnicity				
Non-Hispanic White alone	1,080	68.27%	1,063	65.54%
Non-Hispanic Black alone	36	2.28%	29	1.79%
Non-Hispanic Asian alone	250	15.80%	322	19.85%
Non-Hispanic Some Other Race alone	40	2.53%	34	2.10%
Non-Hispanic Two or More Races	87	5.50%	83	5.12%
Any Hispanic	89	5.63%	91	5.61%
Household Income				
Under $25,000	99	6.26%	131	8.08%
$25,000-$49,999	202	12.77%	214	13.19%
$50,000-$74,999	241	15.23%	232	14.30%
$75,000-$99,999	248	15.68%	197	12.15%
$100,000 or more	719	45.45%	787	48.52%
Prefer Not to Answer	73	4.61%	61	3.76%
Education				
Less than high school	25	1.58%	5	0.31%
High school graduate	123	7.77%	48	2.96%
Associates degree	120	7.59%	71	4.38%
Some college	193	12.20%	91	5.61%
Bachelor's degree	649	41.02%	772	47.60%
Graduate/Post-graduate degree	435	27.50%	613	37.80%
Vocational/Technical training	37	2.34%	22	1.36%

Note: Column percentages may not add up to exactly 100% due to rounding.

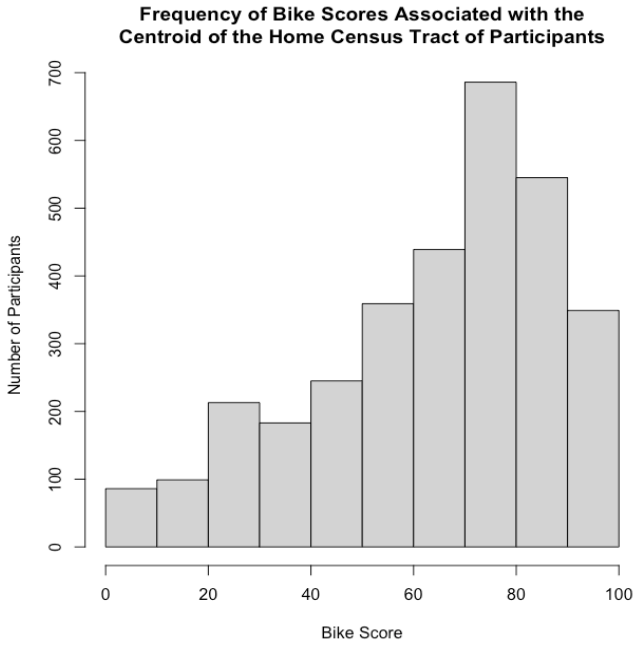

Figure 1. Distribution of Bike Scores associated with the centroid the residential census tracts of participants (n=3,204).

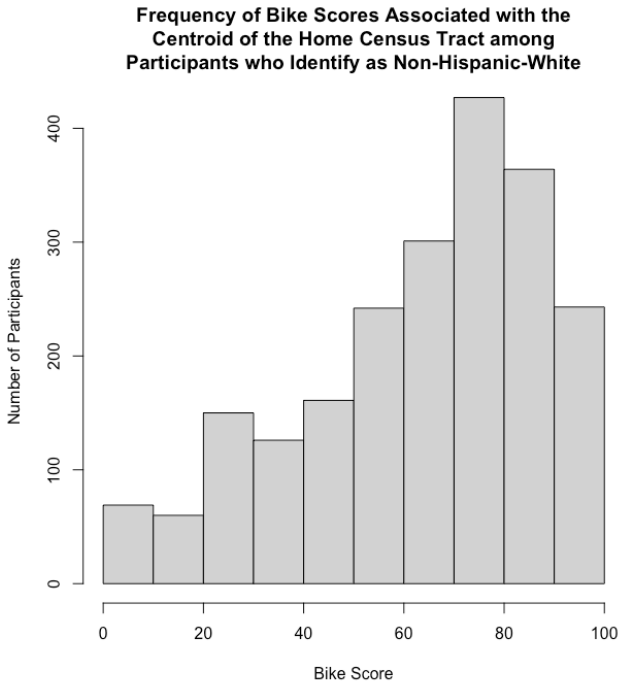

Figure 2. Distribution of Bike Scores associated with the centroid of the residential census tracts of participants in the Non-Hispanic White alone racial-ethnic category (n=2,143).

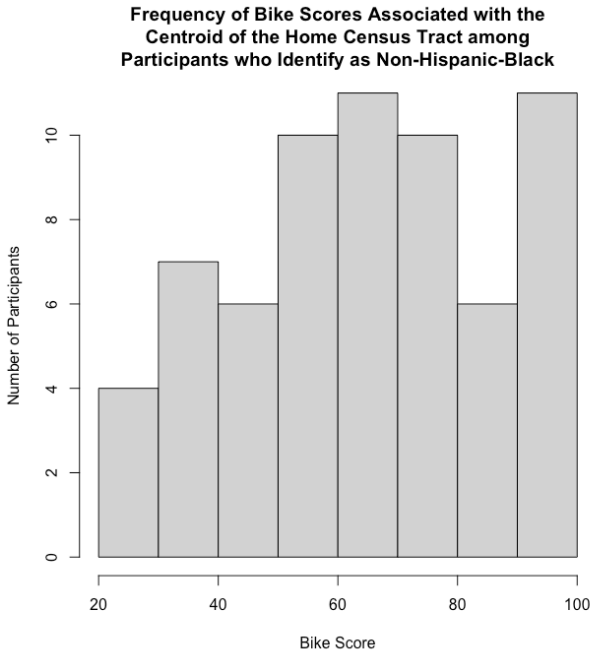

Figure 3. Distribution of Bike Scores associated with the centroid of the residential census tracts of participants in the Non-Hispanic African American or Black alone racial-ethnic category (n=65).

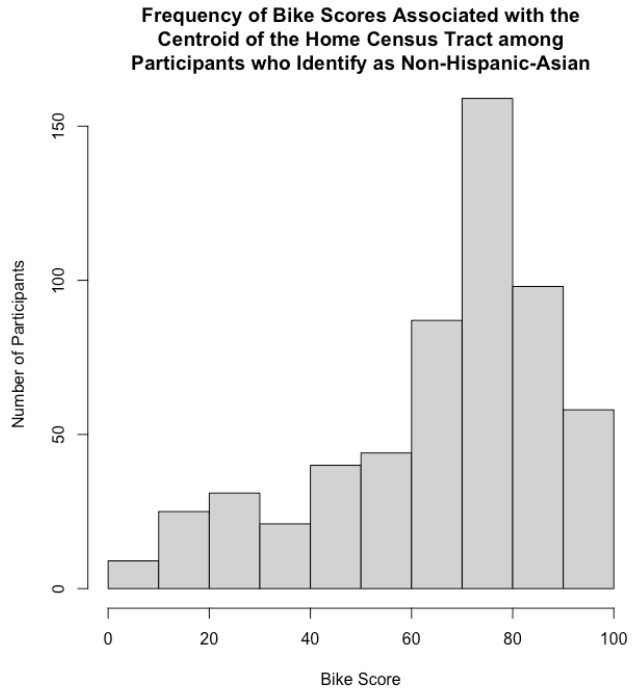

Figure 4. Distribution of Bike Scores associated with the centroid of the residential census tracts of participants in the Non-Hispanic Asian alone racial-ethnic category (n=572).

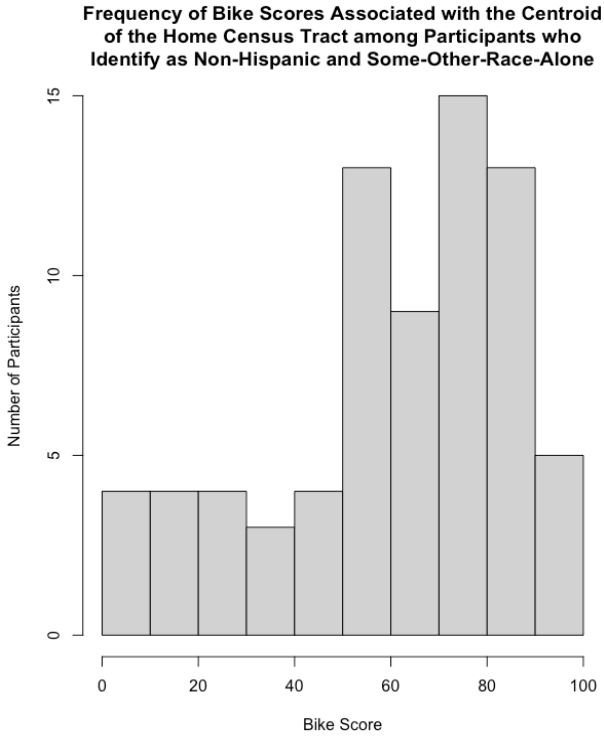

Figure 5. Distribution of Bike Scores associated with the centroid of the residential census tracts of participants in the Non-Hispanic and Some Other Race alone racial-ethnic category (n=74).

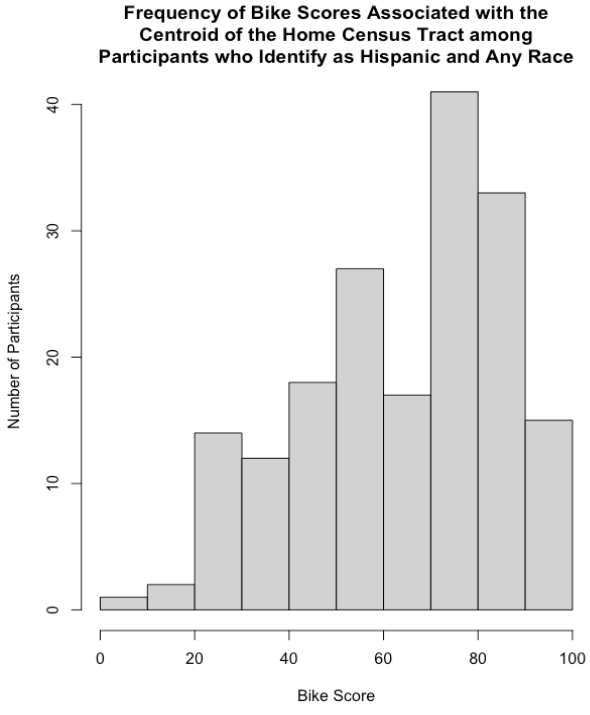

Figure 6. Distribution of Bike Scores associated with the centroid of the residential census tracts of participants in the Hispanic and Any Race racial category (n=180).

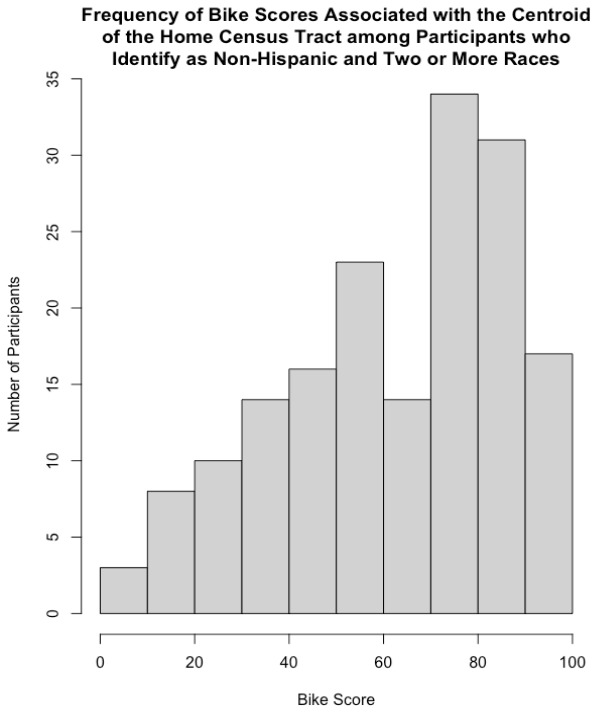

Figure 7. Distribution of Bike Scores associated with the centroid of the residential census tracts of participants in the Non-Hispanic and Two or More Races racial-ethnic category (n=180).

Table 3. Results of log-linear regression of frequency of bicycle ridership for 15 minutes or more in the past 30 days among women of reproductive age associated with a 20-point increase in the Bike Score at centroid of residential census tract, controlling for age and seasonality (n=3,204)

Variable	RR per Change of 20 Points in Bike Score	95% confidence interval
Bike Score	**1.33**	**(1.21, 1.45)**
Age		
18-24	ref.	ref.
25-34	1.10	(0.79, 1.52)
35-44	1.13	(0.81, 1.59)
45-54	0.74	(0.50, 1.10)
Season		
Summer	ref.	ref.
Spring	0.95	(0.74, 1.22)

Table 4. Results of log-linear regression of frequency of bicycle ridership for 15 minutes or more in the past 30 days among women of reproductive age who are racial minorities associated with a 20-point increase in the Bike Score at centroid of residential census tract, controlling for age and seasonality (n=1,061)

Variable	RR per Change of 20 Points in Bike Score	95% confidence interval
Bike Score	**1.35**	**(1.11, 1.64)**
Age		
18-24	ref.	ref.
25-34	0.76	(0.44, 1.32)
35-44	0.89	(0.50, 1.60)
45-54	0.60	(0.28, 1.30)
Season		
Summer	ref.	ref.
Spring	1.08	(0.61, 1.91)

Table 5. Results of log-linear regression of frequency of bicycle ridership for 15 minutes or more in the past 30 days associated with a 20-point increase in the Bike Score at centroid of residential census tract, controlling for age and seasonality and assessing for interaction between Bike Score and Race (n=3,204)

Variable	**RR per Change of 20 Points in Bike Score**	**95% confidence interval**
Bike Score	**1.32**	**(1.19, 1.46)**
Age		
18-24	ref.	ref.
25-34	1.07	(0.77, 1.48)
35-44	1.07	(0.76, 1.50)
45-54	0.69	(0.46, 1.02)
Season		
Summer	ref.	ref.
Spring	0.98	(0.77, 1.25)
Race/Ethnicity		
Non-Hispanic White alone	ref.	ref.
Non-Hispanic African American or Black alone	0.41	(0.02, 8.31)
Non-Hispanic Asian alone	0.48	(0.15, 1.57)
Non-Hispanic Some Other Race alone	0.000001	(0,∞)
Non-Hispanic Two or More Races	1.60	(0.47, 5.51)
Any Hispanic	0.40	(0.07, 2.14)
Interaction between Bike Score & Race		
Bike Score*Non-Hispanic White alone	ref.	ref.
Bike Score*Non-Hispanic Black alone	1.12	(0.50, 2.50)
Bike Score*Non-Hispanic Asian alone	1.02	(0.74, 1.40)
Bike Score*Non-Hispanic Some Other Race alone	0.76	(0, 2.17e+167)
Bike Score*Non-Hispanic Two or More Races	0.84	(0.59, 1.19)
Bike Score*Any Hispanic	1.25	(0.81, 1.93)

Table 6. Proportion of women of reproductive age who rode a bicycle for 15 minutes or more at least once in the past 30 days by Bike Score greater than or equal to 70 or less than 70 and race/ethnicity (n=3,204)

Race/Ethnicity	**Proportion of women of reproductive age who rode a bicycle for 15 minutes or more at least once in the past 30 days**	
	Bike Score $<$ 70 n=1,582	**Bike Score $\geq$ 70 n=1,622**
Non-Hispanic White alone	116/1,080 (10.74%)	208/1,063 (19.57%)
Non-Hispanic African American or Black alone	2/36 (5.56%)	4/29 (13.79%)
Non-Hispanic Asian alone	14/250 (5.60%)	33/322 (10.25%)
Non-Hispanic Some Other Race alone	0/40 (0%)	0/34 (0%)
Non-Hispanic Two or More Races	11/87 (12.64%)	12/83 (14.46%)
Any Hispanic	5/89 (5.62%)	20/91 (21.98%)

Note: Numerator is the number of women of reproductive age who rode a bicycle for 15 minutes or more at least once in the past 30 days. Denominator is the total number of persons in relevant racial/ethnic category who live in a census tract with a centroid associated with a Bike Score either <70 or $\geq$ 70, depending on the column.