

JUDGMENT AND DECISION-MAKING IN THE CONTEXT OF HEALTH AND  
LAW

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# JUDGMENT AND DECISION-MAKING IN HEALTH AND LAW

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## ABSTRACT

### JUDGMENT AND DECISION-MAKING IN THE CONTEXT OF HEALTH AND LAW

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This dissertation focuses on three main subject areas for applied judgment and decision making: Vaccine uptake, the effects of concussions, and discretionary parole hearings. Vaccination is a key component of maintaining community health. Nevertheless, there has been a recent trend of people refusing vaccines, causing many dangerous diseases to return to modern society. Using a sample of 722 college students, we constructed theory-based measures to determine why people vaccinate (or not). Using hierarchical linear and logistic regressions, we predicted whether participants intended to get vaccinated in the future and whether they got vaccinated last year, respectively. We found that, as predicted, endorsement of bottom-line gist principles predicted vaccination intentions and behavior but in opposite directions. These results were significant while controlling for potential confounds and suggest that decision making theories, particularly FTT, may help explain why some individuals vaccinate, while others choose not to.

Turning to concussions, research suggests that concussions may alter decision-making, specifically with respect to intertemporal choice, increasing discounting of larger later rewards relative to sooner smaller rewards. The objective of this study was to illuminate the relationships between concussions, as well as sub-concussive injuries, and temporal discounting in a non-clinical sample of college-aged athletes. We hypothesized

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that the length of time a person spends participating in a high-impact sport and the number of recent concussions a person sustains would predict greater discounting. We found that more years playing a high-impact sport (American football) and a higher number of diagnosed concussions within the past year were independently associated with greater discounting of delayed rewards, controlling for trait measures of impulsivity. Together, these results are consistent with predictions that recent concussive and cumulative sub-concussive trauma among young, nonprofessional athletes increase discounting of delayed rewards, with potentially deleterious effects on health.

The U.S. prison system is one of the largest in the world, and it comes as no surprise that this system comes with its share of biases. However, although there is a large literature which has examined bias that may lead a person to prison, there is little research on what bias might exist to prevent someone from leaving prison, often through parole. Existing research on whether race plays a role in parole hearings is scarce, and most of the work is outdated and/or has been conducted without using data from real hearings. Further, there are no studies on potential sex bias using real parole data nor participants from the United States. Using data from all of South Carolina's parole hearings from 2014 to 2016, we analyze, using chi-square and regression analyses, whether race and sex play a role in parole board decisions. Results indicated a bias in favor of women compared to men and against minorities compared to Whites. Further, an interaction indicated a possible effect akin to the defeminization of minority women and dehumanization of minority men. These results are the first of their kind and support the unfortunate notion that race and sex may be determining factors in whether an inmate is allowed to serve their sentence outside of the confines of prison.

David Garavito received his B.A. in Political Science and Psychology from the University of Michigan in 2015. He immediately began his studies at Cornell University as a J.D./Ph.D. student, finishing his M.A. in Human Development in 2017 and his J.D. from Cornell Law School in 2020. By August 2021, barring cataclysmic events, he will also be a barred attorney in New York.

I dedicate this to my sister, Elizabeth, for being the ultimate example of strength,  
intelligence, and kindness.

I would like to thank my entire committee for the tremendous support during my program. I would especially like to thank Dr. Valerie Reyna, my advisor, who is constantly encouraging me to improve my scientific abilities and providing me with the resources to do so. I would like to thank bureaucracy for making everything five times more difficulty than it had to be, especially regarding theses and money. Lastly, I would be nowhere without my family and friends.

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## Paper 1

### **Values and Vaccines: A fuzzy-trace theory approach to influenza vaccination intentions and behavior**

Vaccination is an essential aspect of public health that protects both individuals and communities (Brewer et al., 2017). The development of safe and effective vaccines to prevent formerly common (and serious) illnesses is considered one of the greatest achievements of modern medicine (WHO, 2019). Immunization efforts have achieved global eradication of smallpox, while the childhood vaccine series is estimated to prevent 14 million infections, avoid 33,000 premature deaths, and save \$9.9 billion for each fully vaccinated US birth cohort (Schuchat, 2011). Nonetheless, the WHO estimates that 1.5 million lives are lost each year due to failure to vaccinate, often as a result of voluntary decisions to decline available vaccines. Poor vaccination compliance has led to recent outbreaks of entirely preventable diseases. In 2014 and 2019, for example, there were outbreaks of measles, mostly among unvaccinated people, even though measles had been virtually eliminated from the United States in the year 2000 (Patel et al., 2019).

In spite of the major risks of not vaccinating, vaccination refusal rates are alarmingly high. People often die from preventable diseases even though there is scientific consensus that vaccines are safe and generally effective in preventing serious diseases (WHO, 2020). Vaccination rates for some diseases have gone down in recent decades, with a major example being reduction of MMR vaccination rates in children during the past two decades, likely a result of the infamous Wakefield study falsely claiming a link between the MMR vaccine and child autism (Dubé et al., 2013). This concerning trend has been most recently seen in the slowing

vaccination rates against COVID-19, which has partly resulted in proliferation of dangerous variants (Niesen et al., 2021).

Vaccination rates for the seasonal flu are persistently poor. The flu vaccine is recommended for everyone aged 6 months and older, but vaccine uptake generally does not exceed 50% in the United States (CDC, 2020b). Adults aged 18-64 are particularly likely to be unvaccinated against flu, as well as people from minority groups (Kini et al., 2021). Vaccination is particularly important for older people and people with chronic illnesses, who are particularly likely to suffer from severe manifestations of the illness. Thousands of people are hospitalized or die annually from the flu (CDC, 2021).

Because of this mounting health crisis, a growing literature has developed to try to explain why individuals may (or may not) get vaccinated. One major focus of the existing literature is on the ability for people to gain access to vaccines (Brewer et al., 2017). For example, vaccination rates are lower among people who do not have health insurance (Abbas et. al., 2018; Jerant et. al., 2013). Other barriers to vaccination may center around the transportation or time required, language barriers, or socioeconomic status (Logan, 2009). Within this literature, there has been a particular interest in racial disparities. Generally, there are higher vaccination rates among white people (Abbas et. al., 2018). Reasons for differences by race have been attributed to different factors, including access, socioeconomic status, and lower trust in the medical community due to historical maltreatment (Quinn et al., 2017).

A lack of information regarding vaccine safety, along with the proliferation of misinformation on the internet, also appears to be related to low vaccination uptake. Exposure to misinformation has been linked to the rise of “anti-vaccination” beliefs and vaccine hesitancy (Dubé et. al., 2013). People who oppose mandatory vaccination are less likely to trust reliable

sources of information like their doctors, and more likely to have used the internet to find information about vaccines for themselves (Dib et. al., 2021; Jones et. al., 2012). Internet searches for vaccine health information are very likely to yield inaccurate or false information or links to websites with anti-vaccination sentiments (Elkin et. al., 2020; Madden et al., 2012). When people have correct information about vaccines and infectious diseases, or trust their doctors, they are more likely to comply with vaccination recommendations (Chang & Chou, 2021; Iliyasu et. al., 2021; Zhang et. al., 2010). However, providing detailed scientific information has been found to be unhelpful in improving vaccination rates in several studies (Cassell et. al., 2006).

There has also been some prior work examining the role of risk perception and other aspects of decision making. In the United States in particular, the perceived risk of vaccination is much larger than the actual risk of adverse side-effects (Song, 2013). One meta-analysis, which also aimed to distinguish different aspects of risk perception that are often conflated (perceived likelihood of the risk occurring, severity of that risk, and personal susceptibility to that risk), found that risk perception, in all forms, was related to actual vaccination behavior (Brewer et. al. 2007). Specifically, perceived likelihood of getting the flu had the highest effect size. Although this prior literature has begun to elucidate the relationship between risk perception and vaccination, it falls short in several key areas which this study aims to rectify. First, although recent studies have included vaccine safety as an additional variable in analyses (see Bruine de Bruin et al., 2019, as an example), few studies have included risk perceptions for both the flu and the flu vaccine. Second, this research has not taken into account how different mental representations of information impact the relationship between risk perception and behavior and decision making overall (see Mills et al., 2008). Such mental representations may

be particularly relevant for theoretical explanations of decision making regarding vaccines. Although some studies on vaccination have used applied theory-based approaches, few have used theories of judgment and decision making, let alone those incorporating mental representations. For example, Gerend and Shepherd (2012) applied both the theory of planned behavior (TPB) and health belief model to predict HPV vaccination uptake in a large sample of college-aged women in the United States. Using structural equation modeling, the theories accounted for less than 40% of the variance separately and 43% of the variance when aspects of both were combined. A more recent study by Wolff (2021) applied TPB to COVID-19 vaccine uptake. Here, TPB variables accounted for more than half of the variance but still left a substantial amount unexplained. Thus, to attempt to account for this unexplained variance, it may be useful to apply contemporary theories of judgment and decision. Although there has been some discussion of applying theories of judgment and decision making to flu vaccination uptake (Wagner et al., 2020), studies actually involving such theories are scarce. Accordingly, we aim to apply fuzzy-trace theory (FTT), a theory of judgment and decision making to the issue of vaccine uptake.

Unlike traditional theories of decision making, FTT introduces the idea that mental representations of information can shape decision making by emphasizing different features of a choice (precise details vs. categorical distinctions) and cuing (or failing to cue) relevant values in the decision making process. According to FTT, individuals simultaneously encode and process information at differing levels of specificity, ranging from detailed, precise, verbatim mental representations to those that emphasize categorical distinctions and the bottom-line meaning. For example, if someone was told that there was a 40% chance of having a side-effect from vaccinating (such as soreness at the injection site), a verbatim representation of that risk would

be 40% but a gist representation might be “there is a medium chance.” Although people typically form and process these different representations in parallel, there are individual and developmental differences in reliance on verbatim vs. gist representations (Broniatowski & Reyna, 2018; Reyna & Brainerd, 2011).

Individuals who rely more heavily on verbatim mental representations tend to trade off risks and benefits of decisions, which can promote risk taking especially in public health contexts, where objective risks tend to be low and perceived benefits tend to be high (e.g., Reyna, Estrada et al., 2011; Reyna & Mills, 2014). In contrast, thinking categorically about risk, in conjunction with endorsement on risk-protective gist principles or values tends to do just that, as these principles are stored in a gisty form in memory. Accordingly, reliance on gist better cues such values during decision making. However, gist is inherently subjective—it is influenced by background, knowledge, and worldview—therefore, two people experiencing the same information might form very different gists and tap into different gist principles (Reyna, 2021). For example, while one person might view the decision to vaccinate as “It’s better to be safe than sorry when it comes to these diseases”, which favors getting vaccinated, while another might view it as “I feel fine now, so it is unnecessary to get the flu vaccine” (i.e., maintaining an already good status quo), which favors refusing vaccination (Reyna, 2021).

In this study, we used FTT to identify cognitive determinants of vaccination intentions and behavior. In order to incorporate FTT, we made two separate scales to gauge relevant bottom-line principles: One was focused on responsibility and getting vaccinated to benefit oneself, loved ones, and the community. Another set of principles was focused on maintaining a status quo and not getting a vaccine “if I feel fine.” These scales were designed to mimic similar scales in FTT literature (e.g., Garavito et al., 2021). To build off of existing literature on risk

perception, we also constructed several measures of risk perception based on previous FTT literature (Mills et al., 2008). These measures (described below) varied in the level of precision required to answer, ranging from a gisty “low, medium, or high” of overall risks and benefits to an exact percentage estimate of how likely a participant is to experience a negative outcome on a 0-100 scale. These scales, based off of previous studies on FTT, are designed to cue gist or verbatim processing (see Reyna & Mills, 2014).

Additionally, we controlled for other variables that have been used to explain these outcome measures. First, as mentioned above, knowledge has been used to explain variance in vaccination rates. Thus, we created a knowledge test to control for how knowledgeable participants were of the flu and flu vaccine. Additionally, to help control for other potential confounds such as lack of access, we included a perceived lack of access measure in our analyses. We also controlled for race and sex in our analyses given group disparities in vaccination (discussed above). We used hierarchical regressions to identify significant predictors and also determine the additional variance that our FTT variables controlled for compared to the other variables we were controlling for. Accordingly, we have several hypotheses:

1. Greater endorsement of bottom-line principles that are pro-vaccination (i.e., emphasizing responsibility and the communal benefits of vaccines) will result in higher intentions to vaccinate in the future and greater likelihood to have vaccinated in the past year. The opposite will be true for greater endorsement of bottom-line principles that are anti-vaccination (i.e., status quo).
2. Similarly, gistier measures the perception of risks (and benefits), also related to gist cognition, will be significantly associated with vaccine intentions and behavior.

3. The above associations will be significant while controlling for sex, knowledge, race and ethnicity, and perceived accessibility. Further, the models including our FTT variables will account for a significantly larger amount of variance compared to the control models.

## Methods

### Participants

Participants were 722 undergraduate students enrolled at an Ivy League university in upstate New York. All participants took an online survey and received course credit for participation. Ages in the sample ranged from 17 to 28 ( $M = 19.50$ ,  $SD = 1.39$ ). The sample was composed of mostly women (506, 70.1%). The majority of participants were White/Caucasian (427, 59.1), but there were also groups of participants identifying as Asian (197, 27.3%), Black/African American (47, 6.5%), Native American (3, 0.4%), Mixed (28, 3.9%), and Other (20, 2.8%). Participants identifying as Hispanic comprised 10.8% (78) of the sample. The Institutional Review Board of Cornell University approved the study, and all participants provided informed consent.

### Measures

Items included demographic questions as well as vaccination-related scales and measures (described below). Descriptives and reliabilities for each measure can be found in Table 1.

#### ***Gist of Principles of the Status Quo.***

Three items were devised to evaluate endorsement of bottom-line principles related to vaccinating and not deviating from one's status quo (see Table A1 in Appendix). Higher scores on the scale indicate more agreement with not choosing options that may involve deviating from a good status quo. An example item is "I feel fine now, so it is unnecessary to get the flu

vaccine.” Participants responded on a 5-point Likert scale ranging from *Completely Disagree* to *Completely Agree*.

### ***Gist Principles of Responsibility.***

Participants also completed an 11-item scale evaluating their endorsement of bottom-line principles related to the communal benefits of vaccination (see Table A2 in Appendix). Higher scores indicated that participants agreed with values that promoted feeling responsibility to vaccinate for the sake of protecting oneself and others. An example item is “I have a responsibility to my family to get the flu vaccine.” Participants responded on a 5-point Likert scale ranging from *Completely Disagree* to *Completely Agree*.

### ***Categorical Thinking.***

Three items assessed participants’ tendency to think categorically about flu vaccine-related decisions (see Table A3 in Appendix; e.g., “Getting the flu is inevitable so it makes sense to get the flu vaccine.”). Responses were given on a 5-point Likert scale from *Completely Disagree* to *Completely Agree*.

### ***Perceived Specific Risk of Getting the Flu.***

A 7-item scale was used to assess perceived specific risks of getting the flu (see Table A4 in Appendix). Five items were used to investigate perceived likelihood of contracting the flu or an upper respiratory illness within specific timeframes, such as “I am likely to get the flu by 30.” Responses to these items were given on a five-point Likert scale from *Completely Disagree* to *Completely Agree*. An additional two items phrased the specific risks as questions (e.g., “Do you believe you will get the flu this flu season?”), which had response options from *Extremely Unlikely* to *Extremely Likely*.

### ***Quantitative Risk of Getting Sick From the Flu Vaccine.***

Participants provided exact estimates of the probability of experiencing illness after getting the flu vaccine, either due to the vaccine itself or due to the vaccine failing to protect against illness (11 items; e.g., “Probability of getting the flu if you do get a flu vaccine?”; see Table A5 in Appendix). Responses were on a scale from *0% risk* to *100% risk*.

***Quantitative Risk of Getting Sick From Not Vaccinating.***

An additional seven items asked participants to estimate the probability that they would become sick if they chose not to get vaccinated against the flu (see Table A6 in Appendix; e.g., “Probability of getting the flu if you do not get a flu vaccine?”). Responses were on a scale from *0% risk* to *100% risk*.

***Global Risks of Getting Sick From the Flu Vaccine.***

In parallel to the *Quantitative Risks of Getting Sick from the Flu Vaccine*, participants estimated the likelihood of experiencing illness after getting the flu vaccine but were prompted to provide simplified, global estimates of the risks rather than specific verbatim probabilities (see Table A7 in Appendix; e.g., “Probability of getting the flu if you do get a flu vaccine?”). Responses were on a 3-point Likert scale with scale points *Low*, *Medium*, and *High*.

***Global Risks of Getting Sick From Not Vaccinating.***

Similar to the above, participants again estimated the probability of experiencing illness due to not receiving a flu vaccine but were prompted to provide simplified, global estimates of the risks rather than specific verbatim estimates (7 items; see Table A8 in Appendix). An example item is “Probability of getting the flu if you do not get a flu vaccine?” Responses were on a 3-point Likert scale with scale points *Low*, *Medium*, and *High*.

***Global Risks of Getting the Flu Vaccine.***

A single item was used to investigate participants' overall, global assessment of the risks associated with the flu vaccine: "Overall, for YOU which of the following best represents the RISKS of getting a flu vaccine?" Responses were on a 4-point Likert scale with scale points *None, Low, Medium, and High*.

#### ***Global Benefits of Getting the Flu Vaccine.***

Similar to the above, a single item was used to investigate participants' overall, global assessment of the benefits associated with the flu vaccine: "Overall, for YOU which of the following best represents the BENEFITS of getting a flu vaccine?" Responses were on a 4-point Likert scale with scale points *None, Low, Medium, and High*.

#### ***Perceived Lack of Accessibility.***

In order to measure whether participants felt that they did not have access to vaccines, we gave participants a 5-item scale assessing their confidence in the ability to get a flu vaccine should they desire to (see Table A9 in Appendix; e.g., "I would find it difficult to obtain a flu vaccine."). Higher scores indicated a greater perceived lack of accessibility. Responses were on a 5-point Likert scale from *Completely Disagree* to *Completely Agree*.

#### ***Vaccination Knowledge.***

Knowledge of scientific and practical facts about the flu and the flu vaccine were measured with a 51-item scale (see Table A10 in Appendix). Areas of knowledge about the flu that were assessed include methods of treating the flu, facts about flu transmission and the flu season, and health consequences of the flu. Areas of knowledge about the flu vaccine that were assessed include knowledge of how to get the vaccine, financial issues related to vaccinating (i.e., vaccine cost and effect of vaccinating on future healthcare costs), health effects of getting a vaccine, flu vaccine efficacy and contents. An example item is "Getting the vaccine protects

people from getting the flu.”, and responses were on a 5-point Likert scale: *False, Probably False, Could Either be True or False, Probably True, or True*. As seen in Table 1, we also provided reliability and statistics for this scale if the items were binary. To calculate this, we converted each item such that agreement with true items or disagreement with false items were marked as correct; all other responses were marked as incorrect. For our statistical analyses, however, we used the non-binary version of the scale.

### ***Intentions to Get Vaccinated.***

Six items assessed participants' intentions to receive the flu vaccine (see Table A11 in Appendix). Each item indicated a different time frame for the decision (e.g., “Do you intend to get a flu vaccine at the start of the next flu season?”). Responses were provided on a 5-point Likert scale from *Extremely Unlikely to Extremely Likely*.

### ***Past Year Vaccination Behavior.***

Vaccination behavior was assessed with one item: “In the past year have you had a flu vaccination (i.e., a shot, spray, drop or mist)?” The response options were “yes”, “no”, and “I don't know”. The 20 participants who indicated that they did not know were coded as “no”.

### **Analyses**

To test our hypotheses, we first ran bivariate correlations between all variables. Next, to assess the efficacy of our FTT variables, we ran hierarchical linear regressions predicting intentions to vaccinate and hierarchical logistic regressions predicting past vaccination behavior. For each dependent variable, we ran two models: a control model and a model including FTT-based variables. In the control model, we included biological sex, knowledge about vaccinations, perceived lack of accessibility, and dummy variables for whether a participant was White (or not), Black (or not), and Hispanic (or not) as predictors. In the second model, we

added our FTT-based predictors to this control model: gist principles, categorical thinking, perceived risks, quantitative risks, and global risks and benefits. Additional analyses were run to increase power: one set without race and ethnicity and another set without race and ethnicity nor perceived lack of accessibility. These analyses did not change our results (see Supplemental Material).

## Results

Bivariate Pearson correlations can be found in Figure 1. Being female, being White, greater knowledge, endorsing bottom-line principles associated with responsibility and communal benefits of the flu vaccine, greater categorical thinking, higher perceived risk of getting the flu, higher quantitative risk of getting sick from not vaccinating, higher global risk of getting sick from not vaccinating, and higher global benefits of the flu vaccine all were associated with significantly higher intentions to get vaccinated. The opposite was true for being Black, endorsing bottom-line principles associated with maintaining a status quo, higher quantitative risk of getting sick from the vaccine, global risk of getting sick from the vaccine, global risks of the flu vaccine, and higher perceived lack of accessibility.

Regarding past vaccination behavior, getting the flu vaccine last year was significantly associated with being White, greater knowledge, endorsing bottom-line principles associated with responsibility and communal benefits of the flu vaccine, greater categorical thinking, higher quantitative risk of getting sick from not vaccinating, higher global risk of getting sick from not vaccinating, and higher global benefits of the flu vaccine. Conversely, not getting the flu vaccine last year was associated with being Black, endorsing bottom-line principles associated with maintaining a status quo, global risks of the flu vaccine, and higher perceived lack of accessibility.

Our first set of models predicted intentions to vaccinate (see Table 2). In our control model predicting vaccination intentions, there were only two significant predictors. Greater knowledge of the flu and the flu vaccine was associated with significantly greater intentions to vaccinate in the future. By contrast, being Black, compared to being any other race, was associated with significantly lower intentions to vaccinate. When adding FTT variables to the model, both of these predictors lose significance. Instead, greater endorsement of bottom-line principles related to responsibility and the communal benefits of vaccination was associated with significantly higher intentions to vaccinate. Additionally, greater perceived specific risks of getting the flu, higher quantitative risks of getting sick from not vaccinating, and higher global benefits of getting the flu vaccine were all associated with significantly higher intentions to vaccinate. By contrast, greater endorsement of bottom-line principles related to maintaining a status quo, as well as higher global risks of getting the flu vaccine, were associated with significantly lower intentions to vaccinate. Lastly, the model with FTT variables was a significant improvement compared to the control model,  $F(10, 705) = 79.469, p < .001$ .

Our second set of models predicted whether a participant got vaccinated last flu season (Table 3). In our control model, again, there were only two significant predictors. The more participants knew about the flu and flu vaccine, the significantly more likely they were to get vaccinated. Conversely, if participants were black, they were significantly less likely to get vaccinated. Once again, these predictors lost significance when adding the FTT variables. Mirroring our results with intentions to vaccinate, greater endorsement of bottom-line gist principles associated with responsibility and the communal benefits of vaccination made one significantly more likely to get vaccinated. Further, also mirroring our earlier results, greater endorsement of bottom-line principles related to maintaining a status quo made one significantly

less likely to get vaccinated. Additionally, higher global benefits of getting the flu vaccine was associated with significantly greater odds of getting vaccinated, whereas higher global risks of getting the flu vaccine was associated with significantly lower odds of getting vaccinated.

Model statistics are shown in Table 4; overall, the full model including FTT variables explained a higher amount of variance compared to the control model.

### **Discussion**

In this study, we applied FTT to predict whether a person got vaccinated last year or intends to get vaccinated in the future. We found that our FTT-based variables were successful in predicting both past behavior and future intentions. Specifically, endorsement of our two sets of bottom-line principles was the largest predictor. Endorsing bottom-line principles which focused on responsibility and the communal value of vaccination was associated with a greater likelihood of vaccinating in the past and higher intentions to vaccinate in the future. Conversely, endorsing bottom-line principles which focused on not taking a “risk” by deviating from one’s status quo (“I feel fine now, so it is unnecessary to get the flu vaccine.”) was associated with a smaller chance of vaccinating in the past and lower intentions to vaccinate in the future. These results confirm our primary hypothesis and highlight how gist principles and gist representations may affect decision making. Indeed, this aspect of FTT may particularly important given a common paradox concerning vaccination: Although diseases are eradicated, the communal memory of the disease fades as well, undermining the perceived benefits of the vaccine compared to possible side-effects (Wagner et al., 2020). As the sense of threat from diseases fade, encouraging a pro-vaccination bottom-line gist may help to prevent reemergence of that same threat.

There were several other significant predictors for both past behavior and future intentions. First, the higher percentage chance that participants thought they would get sick from *not* vaccinating, the greater their chances of having gotten vaccinated in the past and the higher their intentions of vaccinating in the future. Secondly, the higher that participants thought the overall risks of the flu vaccine were, the lower their chances of having gotten vaccinated in the past and the lower their intentions of vaccinating in the future. Lastly, the higher that participants thought the overall benefits of the flu vaccine were, the higher their chances of having gotten vaccinated in the past and the higher their intentions of vaccinating in the future. There was one more result of note with the FTT variables: Perceived specific risks of getting the flu was associated with higher vaccination intentions but not a greater likelihood of getting vaccinated in the past. These results support our second hypothesis.

To control for possible confounds, we included several additional predictors in our models. There were no effects of sex, Hispanic ethnicity, nor perceived lack of access to vaccines. By contrast, being Black compared to all other races was associated with lower intentions to vaccinate and a lower chance of getting vaccinated in the past. There was no effect of being White compared to all other races. Knowledge was also a significant predictor; higher knowledge was associated with higher intentions and a higher chance of having been vaccinated. Nevertheless, the effects of both race and knowledge did not remain significant when including our FTT predictors. Similar to previous FTT research, this effect may suggest an interaction, such that relevant gist principles may mediate the effect of knowledge and other variables on intentions and behavior (Fraenkel et al., 2016). Further, it is important to note that the model predicting intentions to vaccinate in the future was significantly improved with the addition of the FTT-based variables. The logistic model predicting past vaccination behavior was also

considerably improved with the FTT variables. These results confirm our final hypothesis that FTT-based variables significantly improve models of vaccine-related behavior that may only factor in variables such as knowledge, perceived access, and demographics

This study is not without limitation. Our sample consisted entirely of undergraduates from an Ivy League University. Although studies incorporating components of FTT have produced similar effects in various populations and contexts (e.g., Garavito et al., 2021; for a recent review, see Blalock & Reyna, 2016), future studies specifically examining vaccination decisions and intentions using different age groups, regions of the country, education, etc. may be worthwhile, particularly when studying vaccine-hesitant groups. Additionally, although our gist principles measures were significant predictors of past behavior and future intentions, the same could not be said for our measure of categorical thinking. With this specific measure, it is important to keep in mind how the context of the decision may alter the effect of gist-based categorical thinking. Unlike, for example, unprotected sex, there may be no sole categorical distinction (i.e., have unprotected sex and take a risk or do not and take no risk; Reyna & Mills, 2014). With vaccine hesitant groups, the choice may be between different risks (or the risks might be associated with choosing to vaccinate). Accordingly, categorical thinking, by itself, may have less of a protective effect, unless paired with a pro-vaccination gist and gist principles. Future studies using FTT-based predictors may help further illuminate the relationship between categorical thinking and vaccination.

In conclusion, both intentions to get vaccinated in the future and past vaccination behavior can be predicted by agreement with bottom-line gist principles, as predicted by FTT. These relationships were significant, despite controlling for age, race and ethnicity, knowledge, and perceived access to the flu vaccine. Additionally, including FTT measures significantly

improved the models overall, suggesting that these traditional predictors, such as knowledge, may be necessary to include but not sufficient to explain vaccination behavior and intentions. Future studies may further elucidate the precise relationship between the theoretical measures and these outcomes. Future studies may also want to explore these relationships with vaccines other than the flu vaccine. Especially given the recent news about slowing vaccination rates against COVID-19, studying the causes and solutions to vaccine hesitancy are important. Finally, FTT-based interventions have been developed and produced positive results in other contexts (Fraenkel et al., 2015; Wolfe et al., 2015). Accordingly, future interventions seeking to improve vaccination rates may consider incorporating FTT.

## Paper 2

### **Repercussions of concussions: Concussions and years playing football are independently associated with temporal discounting in young adults**

Participation in contact sports is associated with a variety of risks, including the risk of sustaining head injuries that can have both short- and long-term neurological effects (McAllister & McCrea, 2017). Given the popularity and prevalence of playing sports especially among youth, it is imperative to better understand the impact of such injuries, especially on processes that potentially influence future well-being, such as decision making. Concussions, defined by the American Medical Society for Sports Medicine as “traumatically induced transient disturbance[s] of brain function” (Harmon et al., 2013), are a common consequence of head injuries. Concussions result in a variety of short- and long-term symptoms affecting physical, cognitive, and emotional health (Khurana & Kaye, 2012). Moreover, sustaining repeated concussions carries additional risks, especially when they are sustained before prior brain injuries have healed. Beyond concussions, the effect of sub-concussive impacts has also garnered recent attention because of their prevalence and potential danger of not being diagnosed. As explained below, recent research has linked brain injury to steeper temporal discounting, often in clinical samples (Gunnarson et al., 2018; Ozga et al., 2018). In this paper, we examine whether this relationship extends self-reported concussions and sub-concussive impact among a non-clinical sample of college student athletes.

Temporal discounting is a critical area of decision making that has been associated with important health consequences (e.g., Chabris et al., 2008). Temporal discounting can be thought of as the extent to which the present value of a reward (often money) declines as receipt of the reward is delayed. Often discounting is assessed using a series of questions that systematically

varies amount of reward and amount of time delay in order to identify the point at which subjects are indifferent between receiving the sooner smaller or larger later reward (Kirby, 2009). Higher discounting rates for delayed rewards have been associated with increased impulsivity, decreased inhibition, and a proclivity towards unhealthy risk-taking and poor choices concerning one's own health (Bickel & Mueller, 2009; Johnson & Bruner, 2011; Weller et al., 2008).

Recent research has identified potential connections between brain injury and temporal discounting, despite some initial mixed results (see Bjork & Grant, 2009, Gunnarson et al., 2018, and Ozga et al., 2018 for reviews on this topic). For example, McHugh and Wood (2008) found that TBI participants discounted at a higher rate than control participants, and TBI participants also scored higher on self-reported measures of impulsivity, which is important to note, because higher self-reported impulsivity was related to steeper discounting in this study. A subsequent study by these two researchers revealed similar results (Wood & McHugh, 2013). In addition, Sellitto et al. (2010) found that individuals with damage to the medial orbitofrontal cortex (mOFC) exhibited higher discounting of future rewards compared to individuals with injuries to other parts of their brains as well as participants without brain injuries. In this study, individuals with mOFC damage did not significantly differ in self-reported trait impulsivity compared to the other two groups. Further, an experiment with rats suggested that mild and severe TBI to frontal regions results in steeper delay discounting (Vonder Haar et al., 2017). Of course, it is important to note that some studies have report potentially conflicting findings, suggesting that the specific attributes of tasks matter (e.g., Dixon et al., 2005; Shlund, 2002).

These effects on temporal discounting are likely to do the relationship between concussions and brain function. A growing literature has demonstrated that abnormalities exist among people with a history of concussions, particularly with regards to brain connectivity

(possibly due to damage from diffuse axonal injury) and the function of frontoparietal areas associated with cognition and executive functioning, such as the dlPFC (Bahrami et al., 2016; Honce et al., 2016; Koerte et al., 2015). Further, research has also demonstrated a link between participation in collision sports such as American football and neurological changes or injury, sometimes connected to sustaining a concussion but sometimes not. For example, Talavage and colleagues (2014) found neurological impairment, specifically in areas associated with decision making or inhibition such as the dlPFC, in high school football players who experienced a greater number of head impacts yet did not display clinical symptoms of a concussion. In a related study, Breedlove et al. (2012) found significant neurological changes in high school football athletes in multiple brain areas, including the frontal lobe, regardless of whether they displayed “clinically observed impairment” (i.e., symptoms of concussions). Other studies found similar links between sub-concussive brain injuries and executive function (see, e.g., Poole et al., 2014; Poole et al., 2015; Montenigro et al., 2017). More recently, Manning et al. (2020) found increased white matter diffusion and hyperconnectivity in the default mode and visual networks when comparing female rugby players to age-matched athletes from non-contact sports. These effects of sub-concussive impacts are noteworthy, especially given that sub-concussive injuries are less likely to lead to clinical evaluation and treatment compared to concussions (Talavage et al., 2014). However, despite evidence suggesting a connection between cognition and sub-concussive brain injuries, there is a lack of consistent evidence linking sub-concussive injury to frequently evaluated neuropsychological changes in memory, attention, and executive function (Mainwaring et al., 2018).

Because of the link between brain injury and temporal discounting, and evidence suggesting that playing contact sports can also result in neurological changes and/or injury, we

hypothesized that the length of time participating in a collision sport such as American football—used as a proxy for sub-concussive injury—in addition to the number of concussions, would be positively associated with discounting future rewards. This hypothesis builds on clinical research relating TBI and temporal discounting, discussed above. However, this relationship between TBI and discounting has yet to be specifically extended to self-reported concussions among college athletes, or participation on contact sports overall (which importantly may include participants who have suffered sub-concussive injury).

### *The present study*

This study examined the relationship between concussions/sub-concussive hits and temporal discounting in a non-clinical sample of college-aged athletes. Given the nature of concussions and sub-concussive injuries and their impact on the brain, we hypothesized that there is a subtle dose-response relationship between temporal discounting and concussions/sub-concussive hits, such that length of time participating in a collision sport (e.g., American football), in addition to the number of concussions one has been diagnosed with, would be positively associated with the rate at which one discounts future rewards. Further, we hypothesized that concussion history and participation in collision sports would explain unique variance even when controlling for measures that assess trait impulsivity.

A key feature of the study design was to measure temporal discounting and trait impulsivity separately, so the impact of concussive and sub-concussive injury on decision making could be evaluated controlling for stable personality factors that could reflect self-selection into collision sports. This is also important because prior studies have also shown that clinical TBI samples show higher impulsivity as a personality trait measured using self-report scales, which might reflect pre-existing traits that predisposed to injury (Rebetez et al., 2015;

Rochat et al., 2010; Wood & McHugh, 2013). For example, Wood and McHugh found that the TBI group scored higher than the comparison group on the Barratt Impulsiveness Scale (BIS 11), which measures attentional, motor, and non-planning impulsiveness, indicating that the TBI group was significantly more impulsive than the control group. Using ratings provided by patients diagnosed with a moderate or severe TBI (in addition to ratings from the patients' caregivers), Rochat et al. (2010) found significant increases in impulsivity when comparing pre-injury and post-injury scores on certain sub-scales of the Urgency-Premeditation-Perseverance-Sensation seeking (UPPS) Impulsive Behavior scale (e.g., positive urgency). Similarly, using ratings from a close family member, partner, or friend, Rebetz and colleagues (2015) also found significant increases in impulsivity for patients diagnosed with a severe TBI when comparing pre-injury and post-injury scores on sub-scales of the UPPS. Therefore, here, we sought to separate effects of concussive and sub-concussive injuries on temporal discounting from those on trait impulsivity. By doing this, we seek to isolate the former and control for the effects of concussive and sub-concussive injuries on trait impulsivity, as well as possible self-selection effects. Controlling for trait impulsivity addresses alternative explanations for findings regarding TBI and temporal discounting, including the potential self-selection problem that individuals with more impulsive personality traits might be more drawn to participate in collision sports such as American football compared to less impulsive peers, thus increasing their exposure to potential concussive or sub-concussive hits. Further, we specifically administered both the BIS-11 and UPPS-P so that we could additionally control the effects of concussions on trait impulsivity found in the aforementioned prior work using either scale.

As American football is a collision sport with a high rate of concussions, it is also associated with a high number of sub-concussive impacts (Zuckerman et al., 2015). Our

hypotheses, therefore, centered on subtle cumulative effects of sub-concussive impacts on temporal discounting as well as effects of recent concussive impacts, separating these from one another statistically and controlling for related constructs that reflect pre-existing traits.

## **Method**

### **Participants**

Participants were 270 college students (71.5% female; 193 participants) who were college athletes recruited from various states, including Colorado, New York, New Jersey, and Rhode Island. Participants' ages ranged from 17 to 25 years old ( $M_{age} = 19.72$ ,  $SD = 1.32$ ). Most participants were Caucasian (67.4%; 182 participants), but our sample also included Black/African Americans (11.5%; 31 participants), Asians (13.0%; 35 participants), and mixed race or "other" (8.1%; 22 participants). Additionally, 8.9% (24 participants) identified as Hispanic. Specifically relevant to temporal discounting, 59 (21.9%) participants were smokers, 197 (73.0%) participants were alcohol drinkers, and 109 (40.4%) participants were recreational drug users. The Institutional Review Board of Cornell University approved the study, and all participants provided informed consent. For participants under the age of 18, parental consent and child assent were obtained.

### **Materials and Procedure**

Each participant completed a survey through the online platform Qualtrics. Psychometrically validated and reliable measures were used. Descriptive statistics for this sample are reported in Table 5. Distributions can be found in the Appendix. First, to assess athletic history, participants were asked to self-report the number of years they have played American football along with give other demographic information. Next, to assess concussion history, participants reported the number of times they have been medically diagnosed with a

concussion both in (1) the past year and (2) in their entire lives. We subtracted the former from the latter to produce two distinct measures (past year vs. modified “lifetime” concussions). The number of years spent playing American football served as a proxy for exposure to sub-concussive impacts. Participants were then asked to “[a]nswer these questions according to how often you have DONE the following” for “Smoking (tobacco)”, “Getting drunk”, and “Taking drugs (including marijuana)”. They responded on a 5-point Likert scale ranging from “Never” to “Very Often”. Participants who did not indicate “Never” were categorized as a smoker, alcohol drinker, or recreational drug user. Finally, the survey also included questions from several scales, the order of which was randomized, including the following:

The 27-item Monetary Choice Questionnaire (MCQ; Kirby et al., 1999) is a series of questions in which participants choose between a monetary reward offered immediately and a larger reward offered after a variable delay. A hyperbolic discounting function is assumed to derive discount rate parameters. That is, typical temporal discounting models calculate the discount parameter ( $k$ ) based on a hyperbolic relationship between subjective (discounted) value and time (Mazur, 1987) using the following formula:  $V = A/(1 + kD)$ , where  $V$  is the subjective value of  $A$  after a delay of  $D$ , and  $k$  is a free parameter linked to the discounting rate as a function of delay (Koffarnus et al., 2013). A larger  $k$  indicates that the participant has a greater preference for the smaller, immediate option over the larger, delayed one. Participants’ responses to the MCQ can also be used to calculate the proportion of sooner options chosen, which has desirable measurement properties. Thus, both the discount parameter  $k$  and the proportion of sooner choices were used in analyses. The MCQ has a high test-retest reliability, with stability in discount rates in this population over the course of one year (Kirby, 2009).

The Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995;  $\alpha = .86$ ) is composed of 30 items and measures impulsivity using three subscales: attentional impulsiveness, motor impulsiveness, and non-planning impulsiveness. Participants responded on a 4-point Likert scale ranging from “never” to “always” to statements such as “I plan tasks carefully.”

The UPPS-P (Whiteside & Lynam, 2001;  $\alpha = .93$ ) is a 59-item scale that measures impulsivity across five subscales: negative urgency, (lack of) premeditation, (lack of) perseverance, sensation seeking, and negative and positive urgency. Participants responded to statements such as “I usually think carefully before doing anything” on a 4-point Likert scale ranging from “disagree strongly” to “agree strongly.” The UPPS-P was developed using items from multiple existing impulsivity scales, including the BIS-11 (Whiteside & Lynam, 2001). Both BIS-11 and UPPS-P were administered so that these results could be related to prior work using either scale.

Finally, in order to ensure that our sample, due to brain injury or random chance, was not abnormal in terms of processing numeric information, we had participants complete the 15-item Objective Numeracy Scale (ONS;  $\alpha = .80$ ). This scale is the expanded version of the Lipkus et al. (2001) 11-item general numeracy scale, including four more difficult items added by Peters and colleagues (2007). An example of an item from this scale is as follows: “If Person A's risk of getting a disease is 1% in 10 years, and person B's risk is double that of A's, what is B's risk?”. Each item on the scale required participants to input a numerical response. Correct responses were assigned a value of one point and were then averaged for data analysis with a range from zero to one. Higher scores were indicative of higher numeracy.

## **Analyses**

To test our hypotheses, we first ran bivariate Pearson correlations between predictors, outcomes, and demographic variables such as biological sex. This analysis allowed us to see whether any variables were associated with discounting without controlling for other variables. Next, in order to determine how much independent variance each variable accounted for, we ran multiple regressions to examine whether years spent playing American football and self-reported diagnosed concussions either in the past year or lifetime (excluding past year) were associated with temporal discounting among young athletes. This analysis allowed us to identify unique variance accounted for by each of our predictors. Due to the fact that the UPPS-P contains items from the BIS-11 which could cause multicollinearity issues, the BIS-11 and UPPS-P were controlled for in separate regressions. Thus, we examined three models predicting the discount parameter  $k$ : one without controlling for measures of trait impulsivity, one controlling for BIS-11, and one controlling for UPPS-P. The proportion of sooner, smaller options to total questions on the MCQ, an alternative measure of temporal discounting that has been used in prior studies (Benningfield et al., 2014) was also evaluated, and performed the best in terms of skewness and kurtosis (Table 5). Accordingly, the original regression models were also run with the proportion of sooner, smaller options chosen as the outcome variable. Supplemental regressions were run with only males in order to remove possible a possible confound of sex with our effect of years spent playing football; this effect was also seen in these regressions (see Supplemental Materials). There were no missing data to account for before running our analyses. All analyses were executed using IBM SPSS Statistics Version 23.

## **Results**

Bivariate Pearson correlations can be seen in Figure 2. Scatterplots between each of our predictors (aside from our measures of trait impulsivity) and our two outcome measures are

included in Appendix C. Having a higher discounting rate measured by Kirby  $k$  was significantly correlated with being male, being a smoker, being diagnosed with more concussions in the past year, spending more years playing American football, having higher trait impulsivity (as measured by either the BIS-11 or UPPS-P), and having lower objective numeracy. By contrast, choosing a higher proportion of smaller sooner choices was significantly associated with being male, being a recreational drug user, being diagnosed with more concussions in the past year, spending more years playing American football, and having higher trait impulsivity as measured by the BIS-11 (but not the UPPS-P).

Turning to our regressions, concussions diagnosed in the past year and years spent playing American football were significantly associated with overall discount rate in all models. The number of concussions in the past year and years spent playing American football were positively associated with the discount rate, even when controlling for either the UPPS-P or BIS 11 (Table 6). However, self-reported diagnosed lifetime concussions (exclusive of concussions in the past year) were not significantly associated with discount rate when the other predictors were entered. Trait impulsivity according to either measure also accounted for additional unique variance in discounting rate.

With the proportion of sooner options as the outcome variable, the same results for concussions in the past year and years playing American football were obtained. Again, diagnosed lifetime concussions (exclusive of the past year) were not significantly associated with discount rate, whereas diagnosed concussions in the past year were, as were years playing American football, even when controlling for scores on either the BIS 11 or UPPS-P (Table 6).

## **Discussion**

The primary aim of this study was to examine the relationship between concussive and sub-concussive impacts on temporal discounting among college student athletes. Self-reported concussions and years spent playing American football were used, respectively, to capture such injuries. Specifically, we investigated whether both recent diagnosed concussions and a history of playing collision sports, independent of each other, would be related to difficulties in waiting for future rewards—a crucial life skill in young adulthood (Duckworth, Milkman, & Laibson, 2019).

Prior research suggests that brain injury impacts decision making skills, including the ability to defer sooner rewards in order to obtain larger later ones. Researchers have found increased temporal discounting in clinical sample of patients who experienced TBI (Gunnarson et al., 2018; Ozga et al., 2018; Wood & McHugh, 2013). Additionally, research has shown that concussions and sub-concussive injury can affect brain areas associated with executive functioning and decision making, as well as disrupting connections between the prefrontal cortex and reward areas of the brain (Koerte et al., 2015; Honce et al., 2016; see also Figner et al., 2010). This study's results, that both concussions, specifically those in the past year, and years playing American football independently predict steeper temporal discounting, expand on the findings by Wood and McHugh (2013) using a sample of college student athletes while controlling for personality measures of impulsivity, which are related to but distinct from measures of delay discounting.

Choosing to wait for future larger rewards, rather than accept immediate but smaller ones, can be a marker of healthy decision making in many domains, as previously shown in comparable young adults (e.g., Reyna & Wilhelms, 2016), although important differences in preferences regarding time have been observed certain groups (Farah & Hook, 2017). Although

changes in discounting and impulsivity have been observed for clinical populations who experience serious TBIs, far more athletes participate in professional and nonprofessional sports that expose them to concussive and sub-concussive hits, representing a larger public health problem. Furthermore, observing relationships between exposure to concussive and sub-concussive trauma and decision making in young athletes is especially troubling. Although, in our sample, athletes reported up to ten years playing football, most had relatively low levels of exposure. Nevertheless, relationships with delay discounting and personality measures of impulsivity were detectable.

Our results support hypotheses that recency of concussions (in the last year) as well as cumulative sub-concussive hits both contribute to delay discounting—recent and repeated blows to the head seem to matter, even when trait impulsivity that might draw athletes to collision sports is accounted for (e.g., Kerr et al., 2012b). Additional arguments against self-selection bias include the fact that all of the participants were athletes, and that we observed a dose-response relationship with both acute and chronic exposure to potential trauma. These findings using a valid and reliable measure of temporal discounting highlight the potential impact of concussive and sub-concussive impacts on healthy decision making at an important point in life. As examples, young adults make pivotal decisions about education, careers, health habits, and crime that shape later stages of life (e.g., Romer et al., 2017).

Recency effects of concussion, but not lifetime effects, are consistent with studies that have found that the effects of concussions can heal over time (McCrea et al., 2003). In particular, McCrea and colleagues found that after 90 days, no significant differences in symptoms and functional impairments were detected between those who had and had not been concussed. However, other research indicates that symptom severity and length of recovery may

become worse and longer with a greater number of concussions, raising concerns that chronic exposure to brain trauma as part of nonprofessional sports should be monitored and minimized (Guskiewicz et al., 2003; Sahler & Greenwald, 2012). This study suggests that even subclinical exposures in young people to repeated hits could have independent deleterious effects on healthy decision making.

A limitation of this study was the use of self-reporting to measure the number of concussions. The consistency and reliability of this method has been studied in different populations. In professional football players, moderate reliability of self-reported concussions was found by asking participants to estimate the number of concussions they have experienced on two occasions, separated by nine years (Kerr et al., 2012a). A similar method of asking participants to self-report the number of concussions during baseline and repeated testing was examined in adolescent high school athletes, in which high consistency was found (Wojtowicz et al., 2017). Further, although there are shortcomings with subjective measures, we attempted to account for this in part by asking participants to self-report *diagnosed* concussions instead of perceived concussions. Additionally, another limitation was the number of participants who participate in recreational smoking, drinking, and drug use. Although this may make the sample more representative of college athletes, these characteristics also are related to temporal discounting rates (e.g., Bickel & Mueller, 2009; Johnson & Bruner, 2011). In our correlational results, smoking and drug use were both related with higher discounting rates, albeit inconsistently. Additional studies with larger sample sizes may be able to parse out separate effects of concussions, sub-concussive hits, and substance abuse, all of which may be relevant to college athletes. However, our sample scored within typical ranges for numeracy (see, e.g., Reyna & Brust-Renck, 2020), which suggests that other cognitive confounds may not be present.

Finally, it is important to note that we had a majority female sample, which may lead some to think that the effect of years spent playing football was simply an effect of gender. However, our supplementary analysis with only males replicated that effect, suggesting the opposite.

As TBI and temporal discounting have both been associated with negative health choices (e.g., substance abuse; Bjork & Grant, 2009; Bickel et al., 2018; Bickel & Mueller, 2009; Johnson & Bruner, 2011; Story et al., 2014; Weller et al., 2008), this study highlights the need for additional research on the effect that concussive and sub-concussive impacts may have on decision processes that impact health outcomes. In addition, further research is needed regarding the development of interventions that might mitigate the effect of concussions or sub-concussive injury on temporal discounting and impulsivity. Effective interventions during young adulthood may ultimately help improve health outcomes and quality of life.

### Paper 3

#### **Caged Birds and Those That Hear Their Songs: Effects of Race and Gender in South Carolina Parole Hearings**

The US prison system is one of the largest in the world, with over 1.3 million people incarcerated in state prisons alone.<sup>1</sup> Because of the sheer size of the prison population in the United States, a large focus has been placed on discrepancies in the groups that make up that population. At the end of the past decade, Blacks were imprisoned at five times the rate of Whites in the United States.<sup>2</sup> For Hispanics, the rate was about twice that of Whites.<sup>3</sup> This disparity is nothing new, and similar trends are seen regarding sex differences in imprisonment. Men still compose the overwhelming majority of incarcerated individuals.<sup>4</sup> That being said, women are the fastest growing group in prisons, and some states have seen greater rates of incarceration for women than for men.<sup>5</sup> Social justice and policy reform groups have used facts such as these as key points in arguments for changes in the prison system and within the criminal justice system as a whole.<sup>6</sup> Academics, for their part, have provided ammunition for these groups, conducting research or describing policy shifts that may fuel change. Most of this research focuses on the front end of criminal procedure, such as bias in prosecution or predatory policing.<sup>7</sup> However, despite these group differences in imprisonment, very little contemporary

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<sup>1</sup> Wendy Sawyer & Peter Wagner, *Mass Incarceration: The Whole Pie 2020*, PRISON POLICY INITIATIVE, Mar. 24, 2020, <https://www.prisonpolicy.org/reports/pie2020.html>.

<sup>2</sup> BUREAU OF JUSTICE STATISTICS, *Prisoners in 2019*, 1 (2020), [https://www.bjs.gov/content/pub/pdf/p19\\_sum.pdf](https://www.bjs.gov/content/pub/pdf/p19_sum.pdf)

<sup>3</sup> *Id.*

<sup>4</sup> Wendy Sawyer, *The Gender Divide: Tracking Women's State Prison Growth*, PRISON POLICY INITIATIVE, Jan. 9, 2018, [https://www.prisonpolicy.org/reports/women\\_overtime.html](https://www.prisonpolicy.org/reports/women_overtime.html).

<sup>5</sup> *Id.*

<sup>6</sup> *See, e.g.*, THE DECARCERATION COLLECTIVE, <https://www.thedecarcerationcollective.org/> (last visited Nov. 28, 2020).

<sup>7</sup> *See, e.g.*, Devon W. Carbado, *Article: Predatory Policing*, 85 UMKC L. REV. 545 (2017).

research has been conducted on post-incarceration events. What happens after a person has entered prison and starts trying to earn their way back into society via parole hearings? Given that 1 in 55 adults in the United States were either on parole or probation in 2016,<sup>8</sup> this blind spot in empirical research is glaring and requires further investigation in order to shed light on the prison system in its entirety.

*Parole* is a state-level legal process involving the release of a prisoner after a term of imprisonment but before the end of their sentencing period.<sup>9</sup> A parolee is technically still serving out their sentence, however, so it is different from a *commutation* (the shortening of a sentencing period via an order from the head of the government) or *probation* (court-imposed supervision in place of imprisonment).<sup>10</sup> *Parole* plays an interesting part in our criminal justice system for several reasons. First, *discretionary parole*—that is, a system where a board of people vote, at their discretion, on whether an inmate deserves to leave confinement—is not guaranteed in the United States.<sup>11</sup> Of the 50 states, 16 have no form of discretionary parole whatsoever.<sup>12</sup> The other states have systems with widely heterogeneous requirements, thereby leading to wide-ranging difficulty for an inmate trying to justify their release.<sup>13</sup> Given this variation, it is no surprise that parole hearing advocacy has emerged as a viable form of legal work.<sup>14</sup> Despite this, almost 1 million adults in the United States were on parole in 2016.<sup>15</sup> And the trends in both race and sex bias that are observed in incarceration statistics directly translate into probation and parole

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<sup>8</sup> PEW, *Probation and Parole Systems Marked by High Stakes, Missed Opportunities*, Sep. 25, 2018, <https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2018/09/probation-and-parole-systems-marked-by-high-stakes-missed-opportunities>.

<sup>9</sup> *Id.*

<sup>10</sup> *Id.*

<sup>11</sup> Sawyer, *supra* note 1.

<sup>12</sup> *Id.*

<sup>13</sup> *Id.*

<sup>14</sup> See, e.g., Strom Law Firm, Parole Board Representation in South Carolina, <https://stromlaw.com/parole-board-representation/> (last visited Nov. 29, 2020).

<sup>15</sup> PEW, *supra* note 8.

systems: People of color are overrepresented, and men overall are also overrepresented, although the number of women has doubled over the past decades, making women one eighth of all parolees.<sup>16</sup>

When evaluating the research that has been done on this stage of criminal procedure, it is important to note that the majority of this work is decades old.<sup>17</sup> Even in more recent publications, the data that was used came from the turn of the 21st century or earlier.<sup>18</sup> Perhaps more important than the age of the data, however, few studies have been able to use the data from actual cases.<sup>19</sup> For example, a study in 1999 conducted by Turpin-Petrosino aimed to elucidate the effects of plea bargaining, type of crime (violent versus non-violent), and aggravating factors.<sup>20</sup> The researcher found that the odds of being granted parole were significantly worse for those who committed violent crimes, (but found no effects of aggravating factors or plea bargaining), these results came from an experimental design using fictional cases.<sup>21</sup> In those studies that used real cases, sample size issues were common.<sup>22</sup> A recent study, specifically focusing on racial bias in parole board decisions, sought to overcome limitations that were present in previous studies.<sup>23</sup> Anwar and Fang used real data from Pennsylvania and found no evidence of racial bias.<sup>24</sup> However, this study had several major limitations of its own. Primarily, they only used data from those who were released from prison; they had no data about those who had a hearing and were denied parole, and thus, did not measure disparity in parole

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<sup>16</sup> *Id.*

<sup>17</sup> Joel M. Caplan, *What Factors Affect Parole: A Review of Empirical Research*, 71 FED. PROB. (2007).

<sup>18</sup> See, e.g., Shamena Anwar & Hanming Fang, *Article: Testing for Racial Prejudice in the Parole Board Release Process: Theory and Evidence*, 44 J. LEGAL STUD. 1 (2015); Stéphane Mechoulan & Nicolas Sahuguet, *Article: Assessing Racial Disparities in Parole Release*, 44 J. LEGAL STUD. 39 (2015).

<sup>19</sup> See Caplan, *supra* note 17.

<sup>20</sup> *Id.*

<sup>21</sup> *Id.*

<sup>22</sup> *Id.* See also Anwar, *supra* note 18 at 6.

<sup>23</sup> Anwar, *supra* note 18.

<sup>24</sup> *Id.* at 4–5.

decisions more broadly.<sup>25</sup> Additionally, their data were from 1999 to 2003, over a decade old at the time of their publication and two decades ago now.<sup>26</sup> A similar study using data from across the United States suffered from the same issues, but also failed to adequately account for different parole and sentencing schemes between states.<sup>27</sup> Because of these shortcomings, a study using a large set of recent and real parole board hearings is necessary, particularly when studying the effects of race-based and sex-based biases.

In this Article, we use data from the South Carolina Department of Probation, Parole, and Pardon Services from the years 2014–2016. These data included information about each inmate who had a parole hearing during those years. With these data, we examined the effects of both race and sex in parole board decisions. Our research shows that parole boards discriminate, subconsciously or otherwise, between men and women and between different races when determining whether a person is granted parole. These results suggest the defeminization of Black women and dehumanization of Black men in the eyes of those deciding the state of their confinement. White women were given the most favorable treatment, whereas White men and women of color were treated similarly. Lastly, and perhaps least surprising, men of color were the least likely to be granted parole, even while controlling for age at the time of the offense, sex offender status, the number of violent and nonviolent felonies committed, and the month that the hearing took place.

This Article proceeds in four parts. In the first part, we provide background on the parole system in South Carolina and on existing research concerning parole board decisions. That section reviews existing evidence for (or against) the influence of sex-based or race-based biases

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<sup>25</sup> *Id.* at 2.

<sup>26</sup> *Id.*

<sup>27</sup> Stéphane Mechoulan & Nicolas Sahuguet, *Article: Assessing Racial Disparities in Parole Release*, 44 J. LEGAL STUD. 39 (2015).

in this area of criminal procedure. At the end of that part, we state our specific hypotheses regarding the effects of an inmate's race and sex on parole board decisions. In the second part, we describe our data and the analyses we performed to test our hypotheses. We also describe propensity score matching, a method of matching inmates from different racial groups so as to simulate an experimental design and strengthen the interpretation of the results. In the third part, we examine the results of our tests. We find effects of racial and sex-based biases throughout. Finally, in the fourth part, we interpret our results within the context of previous research and draw several conclusion. Overall, sex and race play a major role within South Carolina parole board decisions, even when controlling for other important factors such as an inmate's felony count. We also list several limitations and future directions.

### **An Overview of Parole Board Hearings and the Existing Research on the Effects of Race and Sex**

#### ***Parole in the state of South Carolina.***

The South Carolina Department of Probation, Parole and Pardon Services (SCDPPPS) is in charge of approximately 60,000 inmates.<sup>28</sup> Last year, approximately 1600 of those inmates were granted parole.<sup>29</sup> Further, in 2016, 1 in every 105 people in South Carolina were on probation or parole. In South Carolina, the Board of Pardons and Paroles makes all decisions regarding paroles and pardons.<sup>30</sup> They also make recommendations to the governor regarding commutations.<sup>31</sup> The Board is composed of seven members, including a chairman, vice-chairman, and secretary.<sup>32</sup> Each member comes from a separate congressional district in the state

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<sup>28</sup> S.C. DEP'T OF PROB., PAROLE, AND PARDON SERV., *Annual Statistical Report - Fiscal Year 2019*, 3 (2019), <https://www.dppps.sc.gov/content/download/215091/5020508/file/Annual+Statistical+Report++FY2019.pdf>.

<sup>29</sup> *Id.* at 26.

<sup>30</sup> S.C. DEP'T OF PROB., PAROLE, AND PARDON SERV., *Parole Board*, <https://www.dppps.sc.gov/Parole-Pardon-Hearings/Parole-Board>.

<sup>31</sup> *Id.*

<sup>32</sup> *Id.*

and serves a six-year term.<sup>33</sup> Typically, the members of the Board have backgrounds in law or criminal justice, though the governor may appoint a person from any background.<sup>34</sup>

A person is eligible to apply for parole if they have served a certain proportion of their sentence depending on the type of crime committed and when the crime occurred.<sup>35</sup> When an inmate is within 90 days of meeting the threshold for parole eligibility, the Board will meet to decide whether the inmate is eligible for parole and, depending on the case, assigning a hearing officer to compile and submit relevant information.<sup>36</sup> Any order granting parole must be signed by a simple majority of the board for non-violent offenses and at least two-thirds of the board members for violent crimes.<sup>37</sup> If an inmate in South Carolina has a parole hearing scheduled, South Carolina does not make the process easy for the inmate. South Carolina is not a state that allows for presumptive parole—a policy that allows for the automatic early release of an inmate given the satisfaction of certain conditions.<sup>38</sup> For all inmates who are eligible for parole and who have been denied at their first hearing, future reviews are held every 1 to 2 years thereafter, depending on the crime(s) they were convicted of.<sup>39</sup> All hearing dates are scheduled 30 days in advance,<sup>40</sup> and the board decides each case as a full board (i.e., with all of its members participating).<sup>41</sup> South Carolina mandates inclusion of input from any surviving victims of the

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<sup>33</sup> *Id.* These terms are staggered, and members can be reappointed. *Id.*

<sup>34</sup> *Id.* Currently there are six seats filled on the Board, half of which come from legal or criminal justice backgrounds. *Id.*

<sup>35</sup> S.C. CODE ANN. § 24-21-610; S.C. CODE ANN. § 24-21-640; S.C. DEP'T OF PROB., PAROLE, AND PARDON SERV., ORIENTATION MANUAL (2019), <https://www.dppps.sc.gov/content/download/209320/4885043/file/Board+of+Paroles+and+Pardons+11062019.pdf>.

<sup>36</sup> S.C. CODE ANN. § 24-21-620

<sup>37</sup> S.C. CODE ANN. § 24-21-650.

<sup>38</sup> Jorge Renaud, *Grading the parole release systems of all 50 states: Appendix A*, PRISON POLICY INITIATIVE, Feb. 26, 2019, [https://www.prisonpolicy.org/reports/parole\\_grades\\_table.html](https://www.prisonpolicy.org/reports/parole_grades_table.html).

<sup>39</sup> *Id.*

<sup>40</sup> S.C. DEP'T OF PROB., PAROLE, AND PARDON SERV., *Parole & Pardon Hearings*, <https://www.dppps.sc.gov/Parole-Pardon-Hearings>.

<sup>41</sup> S.C. CODE ANN. § 24-21-650.

crime(s), in addition to input from the original prosecutor.<sup>42</sup> By contrast, family members of the inmate, prison staff, or past or future employers of the inmate may only add input on behalf of the inmate at the discretion of the parole board.<sup>43</sup> Additionally, South Carolina does not have a set of statutory criteria for the parole board to follow in order to decide cases.<sup>44</sup> Instead, the parole board is instructed to create their own criteria for the release or denial of parole.<sup>45</sup> The relevant statute does, however, give some conclusions that the board must draw when deciding to grant parole:

[N]o such prisoner may be paroled until it appears to the satisfaction of the board: that the prisoner has shown a disposition to reform; that in the future he will probably obey the law and lead a correct life; that by his conduct he has merited a lessening of the rigors of his imprisonment; that the interest of society will not be impaired thereby; and that suitable employment has been secured for him.<sup>46</sup>

This lack of statutory oversight prevents the construction of viable legal challenges to parole decisions, increasing the necessity of examining the system for potential biases. Finally, should an inmate wish to appeal their denial of parole, such an appeal happens within the context of administrative law.<sup>47</sup> That is, the decision is reviewed based on an arbitrary and capricious standard. Unless a court finds that the board decided purely based on its own will, and not based on the law or guidelines, the decision would be upheld.<sup>48</sup> All this being said, South Carolina's

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<sup>42</sup> Renaud, *supra* 38.

<sup>43</sup> *Id.*

<sup>44</sup> S.C. CODE ANN. § 24-21-640 (2020). *See also* Renaud, *supra* 37.

<sup>45</sup> S.C. CODE ANN. § 24-21-640. For the Board's criteria, see pages 26–27 of S.C. DEP'T OF PROB., PAROLE, AND PARDON SERV., ORIENTATION MANUAL (2019), <https://www.dppps.sc.gov/content/download/209320/4885043/file/Board+of+Paroles+and+Pardons+11062019.pdf>.

<sup>46</sup> S.C. CODE ANN. § 24-21-640.

<sup>47</sup> Renaud, *supra* 38.

<sup>48</sup> *Hatcher v. S.C. Dist. Council of Assemblies of God, Inc.*, 267 S.C. 107, 117, 226 S.E.2d 253, 258 (1976) (quoting *Turbeville v. Morris*, 203 S.C. 287, 26 S.E.2d 821 (1943)).

system does have some positive aspects. For example, South Carolina allows for the presence of an attorney during the board meeting, unlike New York.<sup>49</sup> Furthermore, inmates in South Carolina, in theory, are provided all of their records without having to file a request.<sup>50</sup> However, South Carolina does not provide for a formal method of challenging information in the record that an inmate claims is factually incorrect.<sup>51</sup> Last, before inmates can be released on parole, they must agree to be subjected to a warrantless search of their person, any vehicle they own or operate, and all of their possessions.<sup>52</sup> Overall, of those states that have discretionary parole systems, South Carolina's system has received lukewarm reviews by policy groups such as the Prison Policy Initiative.<sup>53</sup>

The onset of the COVID-19 pandemic brought additional challenges to South Carolina's parole system this past year. At the start of April 2020, the SCDPPPS suspended all parole board hearings.<sup>54</sup> This decision was made so that the hearings could use technology to reduce the risks caused by COVID-19.<sup>55</sup> However, the local chapter of the ACLU heavily criticized the decision because of the tremendous risk of contracting COVID-19 while in prison.<sup>56</sup> The ACLU had previously called for the release of vulnerable inmates due to the dangers that COVID-19 posed to prisoners, who often found themselves in close quarters with others and with limited protective health precautions.<sup>57</sup> However, South Carolina was not one of the handful of states

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<sup>49</sup> Renaud, *supra* 38.

<sup>50</sup> *Id.*

<sup>51</sup> *Id.*

<sup>52</sup> S.C. CODE ANN. § 24-21-640.

<sup>53</sup> Jorge Renaud, *Grading the parole release systems of all 50 states*, PRISON POL'Y INITIATIVE, Feb. 26, 2019, [https://www.prisonpolicy.org/reports/parole\\_grades\\_table.html](https://www.prisonpolicy.org/reports/parole_grades_table.html).

<sup>54</sup> Emily Bohatch, *SC parole hearings postponed due to the coronavirus. Lawmakers, ACLU decry decision*, THE STATE, Apr. 3, 2020, <https://www.thestate.com/news/coronavirus/article241711431.html>.

<sup>55</sup> *Id.*

<sup>56</sup> *Id.*

<sup>57</sup> *Id.*

that considered releasing inmates early.<sup>58</sup> On June 2, 2020, South Carolina resumed parole hearings in a fully-virtual format.<sup>59</sup> About 175 inmates had their hearings delayed during this hiatus.<sup>60</sup> While the legal (and ethical) implications of delaying parole hearings during a deadly pandemic have yet to be fully revealed, South Carolina's parole system has done nothing to improve its reputation.

### ***Existing research on race and sex biases in parole decisions and our hypotheses***

This is not the first study to examine bias with regards to parole board decisions, although research on the subject is often dated, scarce, and (understandably) region-specific.<sup>61</sup> One of the earliest studies examined the outcomes for 243 inmates of the Eastern Correctional Institution in Maryland.<sup>62</sup> Conducted using data from 1970-1971, this study found no overt evidence of racial discrimination.<sup>63</sup> However, they did find that Black inmates were subject to additional criteria in order to be paroled, and that this treatment resulted in racial inequities.<sup>64</sup> Another study from this time period examined the Illinois parole board's decisions from 1970 to 1972.<sup>65</sup> This study had similar findings: Although race did not directly predict parole outcome, parole rates were largely different between Black and White inmates.<sup>66</sup> Further, they found major differences in records and other characteristics which *were* predictive of parole decision between Black and White inmates.<sup>67</sup> Thus, they concluded that “[t]he differences in the parole rates of Blacks and Whites,

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<sup>58</sup> *Id.*

<sup>59</sup> Emily Bohatch, *SC reschedules parole hearings that were canceled due to the coronavirus*, THE STATE, May 14, 2020, <https://www.thestate.com/news/politics-government/article242737246.html>.

<sup>60</sup> *Id.*

<sup>61</sup> Anwar, *supra* note 18, at 5.

<sup>62</sup> Leo Carroll & Margaret E. Mondrick, *Racial Bias in the Decision to Grant Parole*, 11 L. & SOC. REV. 93, 93 (1976).

<sup>63</sup> *Id.* at 104.

<sup>64</sup> *Id.*

<sup>65</sup> Anne M. Heinz et al., *Sentencing by Parole Board: An Evaluation*, 67 J. CRIM. L. & CRIM. 1 (1976).

<sup>66</sup> *Id.* at 16.

<sup>67</sup> *Id.*

therefore, seem . . . to be due to more fundamental differences either in the behavior of Blacks and Whites or in the treatment of them by society at large (including, e.g., employers) and by institutions and officials who control earlier stages of the criminal.”<sup>68</sup>

After these first studies, there was little research regarding race and parole decisions until the late 2000’s. In 2008, one study, using 762 inmates from 1993-1994, found that Black people were slightly less likely to be paroled, but race was not a statistically significant predictor of parole decisions in either stage of Alabama’s two-step parole hearing process.<sup>69</sup> Instead, the researchers found that factors such as time served and recommendations from staff were predictive of parole board decision making.<sup>70</sup> That being said, the authors noted that the findings are inconclusive and that generalizability was limited given Alabama’s unique process and the focus on only one specific type of felony.<sup>71</sup> Another study in 2008 examined how race (and interactions between race and other variables) might predict how long it takes from an inmate to go from parole eligible to a parolee.<sup>72</sup> Overall, they found that Black men waited longer for parole compared to Hispanics and Whites and that there were no significant interactions with race.<sup>73</sup> Thus, they concluded that race may serve as a general cue for risk and dangerousness for parole boards, particularly when there is a lack of information.<sup>74</sup>

Finally, within the past decade, there have been several additional studies on parole decision making. One such study, conducted by Shamena Anwar & Hanming Fang, found no influence of race on parole decisions.<sup>75</sup> However, as mentioned in the Introduction, there were,

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<sup>68</sup> *Id.* at 17.

<sup>69</sup> Kathryn D. Morgan & Brent Smith, *The Impact of Race on Parole Decision-Making*, 25 JUST. Q. 411, 431 (2008).

<sup>70</sup> *Id.* at 425–29.

<sup>71</sup> *Id.* at 433.

<sup>72</sup> Beth M. Huebner & Timothy S. Bynum, *The Role of Race and Ethnicity in Parole Decisions*, 46 CRIM. 907 (2008)

<sup>73</sup> *Id.* at 925.

<sup>74</sup> *Id.* at 926–27.

<sup>75</sup> Anwar, *supra* note 18.

similar to other studies, problems with the study design and the data: The authors did not use data from parole hearings, instead comparing data about releases to recidivism rates, and those data were from 1999 to 2003.<sup>76</sup> This particular comparison fails to measure the true effects of racial prejudice, and the authors acknowledge as much, highlighting, for example, the effects of biased policing.<sup>77</sup> These results (and associated limitations) were similar to those in a nationwide study examining bias in those released from prison.<sup>78</sup> In that study, Mechoulan and Sahuguet examined data from the National Corrections Reporting Program, which compiles data across the nation on prison admissions and releases.<sup>79</sup> These authors found not only a *lack* of bias against Black inmates but evidence of a bias *in favor* of them.<sup>80</sup> Again, however, these authors used data prior to 2003 and did not have data regarding those inmates who were denied parole and kept in prison.<sup>81</sup> Further, they did not control for differences in the 10 states which they determined had consistent and reliable data, in either sentencing scheme, parole scheme, or other important parts of the criminal justice system.<sup>82</sup> It is also noteworthy that none of the states which the authors included were from the Deep South, the hub of slavery and Jim Crow.<sup>83</sup> Lastly, a very recent study conducted in 2019 examined how a number of variables, including one's race, might affect juvenile parole decisions in California.<sup>84</sup> The author found that Black parole candidates typically were granted parole at a lower rate when compared to other racial and ethnic groups, even while controlling for education, participation in prison programs, and time without a disciplinary

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<sup>76</sup> *Id.* at 2.

<sup>77</sup> *See id.*

<sup>78</sup> *See* Mechoulan, *supra* note 27.

<sup>79</sup> *Id.* at 56–57.

<sup>80</sup> *Id.* at 43–44.

<sup>81</sup> *Id.* at 58.

<sup>82</sup> *Id.* at 57–58.

<sup>83</sup> *Id.*

<sup>84</sup> Kristen Bell, *A Stone of Hope: Legal and Empirical Analysis of California Juvenile*, 54 HARV. CIV. RTS-CIV. LIBERTIES L.REV. 2, 455(2019).

infraction.<sup>85</sup> In a regression analysis, being Black lowered one's chance of being granted parole by about 63%, even while controlling for disciplinary history, education, program participation, etc.<sup>86</sup>

Regarding research examining sex-based biases *or* interactions between race-based and sex-based biases, there is no existing literature on actual parole decision that we are aware of at the time of this study. While there are studies that have examined women's behavior with regards to parole violations after they have been released,<sup>87</sup> there are none examining discrepancies between men and women in parole board outcomes. However, there was one study that gave parole board members from New Zealand and Canada fictional parole cases to decide.<sup>88</sup> Their results suggested that women were twice as likely to be granted parole compared to male offenders.<sup>89</sup> However, no study to date has expanded on these findings with real parole decisions. Further, there has been no study incorporating an intersectional<sup>90</sup> approach to bias in this stage of criminal procedure and examining a possible interaction between race and sex. This is not surprising, given that men have been massively overrepresented in the criminal justice system for years<sup>91</sup> and that the use of intersectionality in approaches to criminal justice are relatively new, even with regards to crime victimhood.<sup>92</sup> This approach is particularly important

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<sup>85</sup> *Id.* at 486–87.

<sup>86</sup> *Id.* at 544.

<sup>87</sup> See, e.g., Rebecca Stone et al., *Women on Parole, Identity Processes, and Primary Desistance*, 13 FEMINIST CRIMINOLOGY 382 (2018)

<sup>88</sup> Renee Gobeil & Ralph C. Serin, *Preliminary Evidence of Adaptive Decision Making Techniques Used by Parole Board Members*, 8 INT'L J. FORENSIC MENTAL HEALTH 2, 97 (2009).

<sup>89</sup> *Id.* at 101.

<sup>90</sup> See Kimberlé Williams Crenshaw, *Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine Feminist Theory and Antiracist Politics*, 1989 U. CHI. LEGAL F. 139, 140 (1989)

<sup>91</sup> Sawyer, *supra* note 4.

<sup>92</sup> See, e.g., Hadar Dancig-Rosenberg & Noa Yosef, *Crime Victimhood and Intersectionality*, 47 FORDHAM URB. L.J. 85 (2019). See also Stone *supra* note 58; Wyatt Brown, *An Intersectional Approach to Criminological Theory: Incorporating the Intersectionality of Race and Gender into Agnew's General Strain Theory*, 4 RALPH BUNCHE J.PUB. AFF. 229 (2015).

for women of color, as they are typically seen as more masculine compared to White women, a phenomenon known as the “defeminization” of women of color.<sup>93</sup>

This leads to the main hypotheses of this paper: We predicted that both race and sex will have a significant relationship to parole board decisions. Racial prejudice affects many aspects of the criminal justice system and to the detriment of people of color. People of color face more frequent stops and arrests,<sup>94</sup> unrepresentative and hostile juries,<sup>95</sup> and more severe sentencing.<sup>96</sup> Because of this, and because of the major limitations in the existing literature, we predicted that the parole board would grant parole for Whites at a disproportionately higher rate than for minorities. Similarly, we predicted that the parole board will grant parole for women at a disproportionately higher rate than for men. This is mostly due to gender stereotyping and the association of males with aggressiveness and criminality, especially with regards to men of color.<sup>97</sup> This leads into our final prediction: We predicted that sex and race would interact, with White women given the most favorable treatment by the parole board and men of color given the worst treatment. In line with the “defeminization” phenomenon, we predicted that women of color would be treated most similarly to White men and men of color, rather than White women.

## Methods

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<sup>93</sup> See, e.g., Phillip Atiba Goff et al., “*Ain’t I a Women?*”: Towards an Intersectional Approach to Person Perception and Group-based Harms, 59 *SEX ROLES* 392 (2008).

<sup>94</sup> John Knowles et al., *Racial Bias in Motor Vehicle Searches: Theory and Evidence*, 109 *J. POL. ECON.* 203 (2001). See also Shamena Anwar et al., *An Alternative Test of Racial Profiling in Motor Vehicle Searches: Theory and Evidence*, 96 *AMER. ECON. REV.* 127 (2006); Neil Hester & Kurt Gray, *For Black men, being tall increases threat stereotyping and police stops*, 115 *PROC. NAT’L ACAD. SCI.* 2711 (2018).

<sup>95</sup> Shamena Anwar et al., *The Impact of Jury Race in Criminal Trials*, 127 *Q. J. ECON.* 1017 (2012).

<sup>96</sup> David Abrams et al., *Do Judges Vary in Their Treatment of Race?* 41 *J. L. STUD.* 347 (2012). See also Darrell Steffensmeier et al., *Ethnicity and Judges’ Sentencing Decisions: Hispanic-Black-White Comparisons*, 39 *CRIMINOLOGY* 145 (2001).

<sup>97</sup> See Luis M. Rivera & Bonita M. Veysey, *Criminal Justice System Involvement and Gender Stereotypes: Consequences and Implications for Women’s Implicit and Explicit Criminal Identities*, 78 *ALB. L. REV.* 1109 (2015). See also Kelly Welch, *Black Criminal Stereotypes and Racial Profiling*, 23 *J. CONTEMP. CRIM. JUST.* 276 (2007).

Through the SCDPPPS, we obtained the information and parole outcomes for all parole-eligible inmates in 2016, a total of 3378 records. This dataset included demographic data (such as an inmates identification number, name, age, race, and sex), the date of their parole hearing, the outcome of their hearing (as well as the associated reason for denial or release date), an inmate's date of admission to SCDC, and information about the crime(s) that the inmate was convicted of (including the inmate's indictment number, the dates of the offense and sentencing, the length of sentence, the date the sentence started, the classification of crime(s),<sup>98</sup> and the maximum penalty allowed for the crime(s)). After removing records that had impossibly young ages or unknown races, this resulted in 3366 inmates.<sup>99</sup> Finally, 298 non-felony offenders were removed from our analyses to limit potential confounds and because the group was relatively small, resulting in 3068 inmates in total.<sup>100</sup>

## Participants

The age of our sample ranged from 18 to 86 ( $M_{age} = 39.34$ ,  $SD = 12.72$ ). Of our 3068 parole-eligible felony offenders, 7.7% (237 inmates) were female. Further, the racial breakdown of the group was as follows: 39.2% White (1203 inmates), 59.1% Black (1813 inmates), 0.2% Native American (9 inmates), < 0.1% Asian (1 inmate), and 1.4% Other (42 inmates).<sup>101</sup> The

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<sup>98</sup> The SCDC and SCDPPPS use separate codes and descriptions for each crime, with the SCDPPPS providing information that more directly matched with language in South Carolina's laws. Although SCDPPPS information was not always provided, the information from both departments matched the overwhelming majority of the time.

<sup>99</sup> Participants were removed for having missing or nonsensical information. For example, two had no information about their offenses, two had ages indicated as 6 and 9 at the time of committing multiple felonies, and one was listed as having committed his offense in 1929, despite being 40 years old in 2016.

<sup>100</sup> In order to ensure which offenders had committed felonies, all SCDPPPS offense codes (which were not listed for some inmates), SCDC offense codes, and offense descriptions were manually checked with the South Carolina legal codes that were relevant at the time of the offense. People who were classified as "non-felony" offenders for the purposes of this study included those who committed crimes which were not listed as felonies but may have been tried as felony offenses due to aggravating circumstances (also known as "wobbler" crimes).

<sup>101</sup> The code used to classify natives was "I" for "Indian." It is important to note that, in its official reports, the SCDPPPS classifies Asian, Hispanic, Native American inmates as "Other" due to the small number of inmates in those racial and ethnic groups. SOUTH CAROLINA DEPARTMENT OF PROBATION, PAROLE AND PARDON SERVICES, *Annual Statistical Report - Fiscal Year 2019*, 7 (2019), <https://www.dpps.sc.gov/content/download/215091/5020508/file/Annual+Statistical+Report++FY2019.pdf>.

dataset did not indicate whether an inmate was ethnically Hispanic, so this could not be reliably accounted for. Overall, 27.2% (833 inmates) of this sample were granted parole.

## Analyses

All measures were correlated with each other to determine significant associations. To examine the effects of both race and sex on parole outcome, we first ran two chi-square tests of independence: one with race and parole outcome and another with sex and parole outcome. Because of the low cell sizes for races and ethnicities that were neither White nor Black, particularly when those groups were further broken down by sex, we collapsed racial data based on whether they were a White or not. Demographics, broken down by group, can be found in Table 8. Second, we ran a logistic regression predicting whether a given inmate was granted parole. In addition to race, sex, and an interaction term between the two, we also controlled for the age at the time of the inmate's first offense for which they were currently imprisoned, how many violent felonies that person had committed in the current conviction, how many nonviolent felonies that person had committed in the current conviction, whether the inmate was a sex offender, and the month that the parole hearing was taking place.<sup>102</sup> These variables were included in our analyses for three key reasons: First, and foremost, several of these variables have been used as controls when examining the effects of race in previous literature.<sup>103</sup> Secondly, several of these, and related, variables have been found to be significant predictors of parole outcomes in general based on the previous literature.<sup>104</sup> Thirdly, each these variables (aside from the month of the hearing) are important with regards to advocacy; it is a common practice for

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<sup>102</sup> Violent and nonviolent felonies were distinguished by manually checking an inmates convictions to the relevant legal statutes. *See, e.g.*, S.C. CODE ANN. § 16-1-60. Sexual offender status was confirmed by checking convictions against S.C. CODE ANN. § 44-48-30.

<sup>103</sup> Carroll, *supra* note 61, at 432. *See also* Mechoulan, *supra* note 27 at 59; Anwar, *supra* note 18 at 19.

<sup>104</sup> *See* Caplan, *supra* note 17.

legal advocates, when addressing a parole board, to highlight their client's youth at the time of the crime or their (hopefully) lack of a long criminal history with a number of serious crimes. Lastly, the month of the hearing was included to account for possible timing effects that may exist in when an inmate (and perhaps an attorney) submits and application for a parole hearing and when the Board holds the hearing.

Finally, to serve as a robustness check, we incorporated propensity score matching (PSM) to estimate the effect of race in a quasi-experimental design. PSM attempts to reduce selection bias in observational data by matching participants on their propensity score, or the probability of being in the "experimental group" (i.e., being a minority in this case).<sup>105</sup> This probability is typically generated via logistic modeling using observed covariates in the data.<sup>106</sup> These covariates are those which may be associated with being in either group within the quasi-experimental design.<sup>107</sup> In the end, the propensity score indicates the likelihood of being in the experimental group (i.e., a minority).<sup>108</sup> By matching subjects on their propensity score, the design mimics a large experiment design.<sup>109</sup> Here, we matched each White inmate with their nearest neighbor, in terms of the propensity score, in the minority group. As recommended by the literature, we used a caliper at or below 0.2 standard deviations as the limit for finding the nearest neighbor in propensity score.<sup>110</sup> Unfortunately, PSM typically requires removal of

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<sup>105</sup> Melissa M. Garrido, *Methods for Constructing and Assessing Propensity Scores*, 49 HEALTH SERVICES RESEARCH 1701, 1701–03 (2014).

<sup>106</sup> *Id.* at 1705.

<sup>107</sup> *Id.*

<sup>108</sup> Paul R. Rosenbaum & Donald B. Rubin, *The central role of the propensity score in observational studies for causal effects*, 70 BIOMETRIKA 41, 41–42 (1983).

<sup>109</sup> In large experimental designs, researchers aim to balance the experimental and control groups on most, if not all, confounding variables.

<sup>110</sup> Peter C. Austin, *Optimal caliper widths for propensity-score matching when estimating differences in means and differences in proportions in observational studies*, 10 PHARMACEUTICAL STAT. 150, 161 (2011).

subjects that do not have a match in order to avoid covariate imbalance between the groups.<sup>111</sup> Because of this, we did not have enough statistical power to include females in our analyses after PSM. Thus, we ran an additional two logistic regressions predicting parole outcome before and after PSM using only males. The predictors in these regressions were race, how long the person had been incarcerated at the time of the parole hearing, age at the time of the offense, and how many felonies that person had committed when they were sentenced. During PSM, these predictors, aside from race, were used to generate the propensity score. Balance of the covariates between the racial groups after PSM was assessed using standardized mean differences in the covariates (the most common metric<sup>112</sup>) and the prognostic score, which has been found to outperform other metrics.<sup>113</sup>

These analyses were conducted in the statistical programming language R.<sup>114</sup> In addition to the year 2016, these analyses were also conducted for the years of 2014 and 2015; the figures and tables of those analyses can be found in the Supplemental Materials.

## Results

Descriptive statistics, broken down by sex and racial group, are provide in Table 9. All bivariate correlations can be found in Figure 3. Being a minority; being a juvenile offender; being older; having greater time served; being a sex offender; and having a higher violent felony, life sentence, or murder count were all associated with not being granted parole. By contrast, being female, being older at the time of your first offense, and having a higher non-violent felony count were associated with being granted parole.

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<sup>111</sup> Elizabeth A. Stuart, *Matching methods for causal inference: A review and a look forward*, 25 STAT. SCI. 1, 10 (2010).

<sup>112</sup> Zhongheng Zhang et al., *Balance diagnostics after propensity score matching*, 7 ANNALS TRANSLATIONAL MED. 16, 18 (2019).

<sup>113</sup> *Id.* at 21.

<sup>114</sup> R: A LANGUAGE AND ENVIRONMENT FOR STATISTICAL COMPUTING, <https://www.R-project.org/> (last visited July 19, 2021).

### **Chi-Square tests**

Our first chi-square test of independence was performed to examine the relationship between race and parole outcome. The relationship between these variables was significant,  $\chi^2(1, n = 3068) = 26.46, p < .001$ . Parole boards were less likely to grant parole to minority inmates compared to White inmates. Observed and expected frequencies are shown in Table 10.

Our second chi-square test of independence was performed to examine the relationship between sex and parole outcome. The relationship between these variables was significant,  $\chi^2(1, n = 3068) = 92.20, p < .001$ . Parole boards were less likely to grant parole to male inmates compared to female inmates. Observed and expected frequencies are shown in Table 11.

### **Logistic regressions with males and females**

Our logistic regression with both male and female inmates supported our hypotheses (see Table 12). Even while controlling for other predictors, race and sex were significant predictors. Being a female significantly *increased* the odds of an inmate being granted parole. Conversely, being a minority significantly *decreased* an inmate's odds of being granted parole. There was also a marginally significant interaction term. Being female significantly increased the effect of race (or, alternatively, being a minority significantly decreased the effect of sex). In addition to these predictors, the older inmates were when committing their first offense significantly increased their odds of getting parole, whereas committing a greater the number of violent felonies and being a sex offender significantly decreased their odds of getting parole.

### **Logistic regressions with males and using propensity score matching**

Prior to propensity score matching, our logistic regression with only male inmates showed similar results to our previous logistic regression and supported our hypotheses (see Table 13). Race significantly predicted whether the board granted an inmate parole; being a

minority significantly decreased an inmate's odds of being granted parole. In addition to these predictors, and identical to the previous logistic regression, committing more violent felonies and being a sex offender both significantly decreased odds of being granted parole. Additionally, and slightly different from the previous regression, the older the inmates were when they committed their first crime and the greater the number of nonviolent felonies, the more likely they were to be granted parole.

The results during of our logistic model that was used during PSM can be seen in Table 14. The only significant predictor in this model was age at the first offense; the younger an inmate was at the time of committing their first offense, the more likely they were to be a minority. After using this model to generate the propensity score, participants were matched to their nearest neighbor in the opposite racial group, resulting in a new sample size of 1988.<sup>115</sup> This sample was balanced according to both standardized mean differences in the covariates and the prognostic score (see Table 15).

The results of our logistic regression using this matched sample were identical to those of our previous logistic regression (see Table 16). As in the previous regressions, being a minority significantly decreased an inmate's odds of being granted parole. Similarly, being a sex offender and committing more violent felonies significantly lowered an inmate's chances of being granted parole. Lastly, being older when committing their first crime and committing a greater number of nonviolent felonies both significantly increased odds of being granted parole.

### **Results with years 2014 and 2015**

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<sup>115</sup> Originally, a propensity score caliper of .2 was used to match participants, which resulted in a sample size of 2016. However, this sample was not balanced on all predictors. Thus, a caliper of .1 was used, resulting in a sample size of 2012.

All tables and figures for the years 2014 and 2015 can be found in the Supplemental Materials. In the year 2014, results were identical to those of 2016 aside from having hearings later in the year being associated with significantly higher odds of being granted parole. However, post-PSM results did not replicate 2016. In the year 2015, all effects replicated in all regressions aside from one: Nonviolent felony count never predicted parole outcome. Additionally, the interaction between sex and race was significant, not marginally so, and having hearings later in the year were associated with significantly lower odds of getting parole.

### Discussion

Each year, thousands of parole board hearings take place across the nation. Inmates do their best to demonstrate to the board that they are reformed individuals who deserve freedom. However, every state differs in its parole schemes,<sup>116</sup> and the factors that determine whether a parole board will decide to release an inmate are not always clear.<sup>117</sup> Several states have even abolished discretionary parole entirely, removing the option for inmates to prove that they deserve freedom.<sup>118</sup> Nevertheless, in states that have discretionary parole as an option, one cannot understate the significance of this opportunity for those seeking to move on from a low point in their life. Consequently, the power that parole boards have is immense. A group of people, sanctioned by the state, are able to validate the efforts of those who prove themselves to be reformed members of society by freeing them from confinement. However, a discretionary parole system comes with its own dangers, the most concerning being that of bias.

In this study, we specifically focused on whether an inmate's race, sex, or both played a significant role in whether a parole board granted that inmate their freedom. We found evidence

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<sup>116</sup> Renaud, *supra* note 38.

<sup>117</sup> See Caplan, *supra* note 17.

<sup>118</sup> Renaud, *supra* note 38.

of discrimination in the parole system of South Carolina, particularly against men and women of color, even while controlling for potential confounds such as an inmate's felony count, the age at which the inmate committed their original crime, and the amount of time an inmate had served. Men of color were least likely to earn their freedom in the eyes of the parole board. In contrast, White women had the greatest odds of being released. In the middle, White men and women of color were treated similarly. These findings are even more concerning given the previously mentioned response to COVID-19 within the state of South Carolina.<sup>119</sup> Given the deadly circumstances surrounding these crises,<sup>120</sup> particularly within prisons, the effects of biases can have fatal outcomes, especially for aging inmates.

These results expand on previous work in several key areas. As of this study, no research examining bias in parole outcomes have used data from within the past decade. Further, this study used real parole hearing data across 3 years and had a large sample size, unlike some previous work.<sup>121</sup> Although there is a scarce amount of research on race-based bias in the literature, the most recent studies have suggested that there are no negative effects of race or that there may be a bias *in favor* of Black Americans.<sup>122</sup> However, this previous work had multiple shortcomings. The data were from inmates who had already been granted parole.<sup>123</sup> In essence, these researchers were examining whether race explained any differences between those inmates who were released. In our study, about half of each racial group were released, which, on its face, would appear to be fair if not for the observation that minorities (and Blacks in particular)

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<sup>119</sup> Bohatch, *supra* note 54; Bohatch, *supra* note 59.

<sup>120</sup> *A State-by-State Look at Coronavirus in Prisons*, THE MARSHALL PROJECT, <https://www.themarshallproject.org/2020/05/01/a-state-by-state-look-at-coronavirus-in-prisons> (last visited Nov. 29, 2020); Katrina Pross, 'Is it a death sentence being here?': COVID sweeps through Stillwater prison, TWIN CITIES PIONEER PRESS, Nov. 29, 2020, <https://www.twincities.com/2020/11/29/is-it-a-death-sentence-being-here-coronavirus-outbreak-sweeps-through-stillwater-prison/>.

<sup>121</sup> See Anwar, *supra* note 18 at 6. See also Caplan, *supra* note 17.

<sup>122</sup> See Mechoulan, *supra* note 27 at 69; Anwar, *supra* note 18 at 30–31.

<sup>123</sup> Mechoulan, *supra* note 27 at 56–57; Anwar, *supra* note 18 at 2.

composed the overwhelming majority of the inmates who had hearings. The real problem, according to our results, was with whom the board felt should remain in prison. The time and place that this previous data came from presents significant problems as well. Most of this earlier data were decades old and state-centric.<sup>124</sup> The closest thing to a nationwide survey included only 10 states, most of which were in the Midwest or Western United States.<sup>125</sup> It has been half a century since there has been a study conducted on the parole practices in a state within the Deep South, the historical home of slavery and Jim Crow. Lastly, and perhaps most significantly, this study examined the interaction between race and sex using real parole hearing data. This intersectional approach is the first of its kind in this line of research, and the results are startling, yet not unexpected. These results demonstrate, in a disheartening way, a common interaction between race and sex: The defeminization of women of color and dehumanization of men of color.

One potential limitation of this study was that we did not factor in the reasons that the parole board gave for denying an inmate parole. However, these reasons were given after an inmate is denied parole and may be a product of post-hoc reasoning. Additionally, there were only six potential reasons that a parole board may offer to justify denial, four of which concern either the nature or elements of the crime or the inmate's past criminal record, none of which the inmate could mitigate the effect of while incarcerated. Nevertheless, additional analyses factoring in issues such as disciplinary records and failure to complete rehabilitative programs may be worthwhile. Further, additional information, such as disciplinary history, work credits, and whether the inmate had an attorney were not present in our dataset. Additional analyses including this information would be invaluable.

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<sup>124</sup> See, e.g., Mechoulan, *supra* note 27; Anwar, *supra* note 18 at 4–6.

<sup>125</sup> Mechoulan, *supra* note 27 at 57–58.

Regarding our effects of race, analyzing if different groups get different reasons for denial may provide additional insight into the effects of race and sex in parole board hearings. Another limitation of this study was the grouping of multiple minority groups into one larger group. There may be effects that are stronger or weaker for members of different non-White racial groups. This type of limitation is common in parole research,<sup>126</sup> and it may be hard to parse out the effects of racial subgroups in regions that do not have a large amount of racial diversity. Relatedly, our lack of a reliable way to identify Hispanic inmates may have resulted in an underestimation of overall minorities, which may have had an effect on our results and PSM.

PSM also comes with its own share of limitations and criticisms.<sup>127</sup> Although many of these criticisms can be addressed by having a large sample and by checking balance metrics after PSM (both of which we occurred in this study),<sup>128</sup> additional work using other matching methods may be worthwhile in this type of research. Additionally, as PSM can only address imbalance issues in observed confounds, there may be other variables of interest that were neither included in these models nor in the dataset as a whole, such as the presence and quality of victim statements or supportive briefs drafted by legal counsel. However, despite these limitations, the fact that we found consistent results between each statistical test, before and after PSM, supports our conclusions.

Lastly, in future analyses, it would be worthwhile to attempt to replicate these findings in a sample of inmates convicted of egregious crimes, such as murder, or sexual crimes.

Unfortunately, additional analyses which attempted to examine biases within murder cases,

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<sup>126</sup> See, e.g., Huebner & Bynum, *An Analysis of Parole Decision Making Using a Sample of Sex Offenders: A Focal Concerns Perspective*, 44 CRIMINOLOGY 961, 979 (2006).

<sup>127</sup> See Gary King & Richard Nielsen, *Why Propensity Scores Should Not Be Used for Matching*, 27 POL. ANALYSIS 435 (2019).

<sup>128</sup> See *id.*

sexual offenders, or cases where an inmate was sentenced to over 30 years were drastically underpowered. In each set of analyses, fewer than ten White or non-White inmates were granted parole. However, there is support for the idea that race may play less of a role in crimes of increasing severity. For example, in 2006, Huebner & Bynum conducted a study using 511 male sex offenders who were sentenced in 1998.<sup>129</sup> Using information from the pre-sentencing investigation reports,<sup>130</sup> the authors created proportional hazard models to determine what factors affected the timing of parole releases.<sup>131</sup> This study found that race played a limited role for sex offenders; that is, non-Whites had significantly worse chances of being parole in their model until they included measures assessing parole readiness and community protection.<sup>132</sup> Thus, there may be support for the idea that, as severity of crime increases, race (and perhaps sex) may play less of a role. Interestingly, having a greater number of less serious, nonviolent felonies seemed to be predictive of a greater likelihood to being granted parole in our results. This effect may be due to crimes like drug possession, particularly with marijuana, the punishment for which have become less of a public focus in the past years,<sup>133</sup> though future research may be able to piece apart this effect.

This study was the first of its kind: A statistical examination of both race-based and sex-based biases in actual parole board decisions. In this study, we found that race and sex had a significant influence over whether an inmate was granted parole. Based on these findings, some may argue that discretionary parole should be abolished in order to prevent the unequal distribution of justice. This type of claim is not a new one in the world of criminal law. In fact,

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<sup>129</sup> Huebner, *supra* note 126, at 967–98.

<sup>130</sup> *Id.* at 968.

<sup>131</sup> *Id.* at 969.

<sup>132</sup> *Id.* at 979.

<sup>133</sup> Associated Press, *New Washington State Law Makes Drug Possession a Misdemeanor*, US NEWS & WORLD REP., May 13, 2021, <https://www.usnews.com/news/politics/articles/2021-05-13/new-washington-state-law-makes-drug-possession-a-misdemeanor>.

the death penalty was temporary abolished in the United States because the United States Supreme Court felt that it was being arbitrarily distributed, mostly to the detriment of minority defendants.<sup>134</sup> However, the solution is not necessarily to do away with discretionary parole, which 16 states have already done.<sup>135</sup> That not only disincentivizes inmates from bettering themselves but also does nothing to solve racial disparities given that minorities make up a disproportionate amount of the prison population.<sup>136</sup> Instead, new ideas must emerge that attempt to remove the effects of race from the equation altogether. Although this may be hard to implement in terms of parole hearings, this type of work has already begun in several areas of the criminal justice system, including those areas affecting parole hearings.<sup>137</sup> Additional research and effective policy-making could, together, illuminate and eliminate the effects of race-based and sex-based biases. This work would, of course, require an abundance of time and resources from many different actors (researchers, lawyers, politicians, etc.). However, this work is undoubtedly worthwhile; as the late Maya Angelou famously said “[E]qual rights, fair play, justice, are all like the air: we all have it, or none of us has it. That is the truth of it.”<sup>138</sup>

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<sup>134</sup> *Furman v. Georgia*, 408 U.S. 238 (1972). Some may argue that this is still true today. See Scott W. Howe, *Article: Repudiating the Narrowing Rule in Capital Sentencing*, 2012 B.Y.U.L. Rev. 1477 (2012)

<sup>135</sup> Renaud, *supra* note 38.

<sup>136</sup> Sawyer, *supra* note 1.

<sup>137</sup> See, e.g., Crystal S. Yang & Will Dobbie, *Article: Equal Protection Under Algorithms: A New Statistical and Legal Framework*, 119 MICH. L. REV. 291 (2020).

<sup>138</sup> Ellen Rolfes, *Maya Angelou, renaissance woman, dies at 86*, PBS, May 28, 2020, <https://www.pbs.org/newshour/arts/maya-angelou-renaissance-woman-dies-86>

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## Tables

**Table 1**

*Descriptive statistics for outcome and predictor variables*

Scale Name	Cronbach's Alpha	# of items	<i>M</i>	<i>SD</i>	Obs. Min.	Obs. Max.	Theo. Min.	Theo. Max.
Gist Principles of the Status Quo	.853	3	1.371	0.830	0.000	4.000	0	4
Gist Principles of Responsibility	.914	11	2.583	0.653	0.000	4.000	0	4
Categorical Thinking	.511	3	2.198	0.654	0.000	4.000	0	4
Perceived Specific Risk of Getting the Flu	.745	7	1.815	0.612	0.000	4.000	0	4
Quantitative Risk of Getting Sick From the Flu Vaccine	.907	11	16.288	13.244	0.000	75.182	0	100
Quantitative Risk of Getting Sick From Not Vaccinating	.806	7	29.280	14.204	0.000	73.570	0	100
Global Risks of Getting Sick From the Flu Vaccine	.787	8	0.391	0.333	0.000	2.000	0	2
Global Risks of Getting Sick From Not Vaccinating	.721	7	0.670	0.345	0.000	2.000	0	2
Global Risks of Getting the Flu Vaccine	N/A	1	1.110	0.603	0.000	3.000	0	3

Global Benefits of Getting the Flu Vaccine	N/A	1	2.181	0.812	0.000	3.000	0	3
Perceived Lack of Accessibility	.906	5	1.020	0.766	0.000	4.000	0	4
Knowledge	.828	51	2.630	0.366	1.714	3.524	0	4
Knowledge (scored as right/wrong)	.911	51	0.585	0.193	0.000	0.882	0	1
Intentions to Get Vaccinated	.944	6	2.476	1.017	0.000	4.000	0	4
Past Year Vaccination Behavior	N/A	1	0.547	0.498	0.000	1.000	0	1

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*Note.* Obs. Min./Max. is the observed minimum or maximum for the sample. Theo. Min./Max. is the theoretical minimum or maximum for the sample.

**Table 2***Hierarchical Linear Regressions Predicting Intentions to Get Vaccinated*

	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	VIF
Model 1: Control Model for Behavioral Intentions (adj- $R^2$ = 0.134)					
(Constant)	0.469	0.340		1.382	
Sex	0.125	0.078	0.056	1.598	1.029
Knowledge	0.758	0.114	0.273	6.644**	1.409
White	0.122	0.077	0.059	1.598	1.144
Black	-0.395	0.151	-0.096	-2.611**	1.126
Hispanic	-0.031	0.115	-0.009	-0.270	1.024
Perceived Lack of Accessibility	-0.106	0.055	-0.080	-1.930 <sup>†</sup>	1.423
Model 2: Full Model for Behavioral Intentions (adj- $R^2$ = 0.587)					
(Constant)	0.783	0.324		2.417*	
Sex	0.052	0.056	0.023	0.933	1.094
Knowledge	-0.172	0.095	-0.062	-1.802 <sup>†</sup>	2.067
White	0.099	0.054	0.048	1.845 <sup>†</sup>	1.182
Black	-0.137	0.107	-0.033	-1.283	1.177
Hispanic	0.023	0.080	0.007	0.284	1.034
Perceived Lack of Accessibility	0.028	0.039	0.021	0.713	1.499
Gist Principles of the Status Quo	-0.322	0.038	-0.263	-8.401**	1.711
Gist Principles of Responsibility	0.572	0.057	0.367	9.997**	2.357

Categorical Thinking	0.073	0.048	0.047	1.525	1.655
Specific Risks of Getting the Flu	0.114	0.045	0.069	2.550*	1.264
Quantitative Risk of Getting Sick From the Flu Vaccine	-0.001	0.003	-0.017	-0.453	2.513
Quantitative Risk of Getting Sick From Not Vaccinating	0.005	0.003	0.075	2.031*	2.384
Global Risk of Getting Sick From the Flu Vaccine	0.092	0.116	0.030	0.799	2.507
Global Risk of Getting Sick From Not Vaccinating	0.040	0.106	0.014	0.378	2.249
Global Risks of Getting the Flu Vaccine	-0.170	0.045	-0.101	-3.764**	1.258
Global Benefits of Getting the Flu Vaccine	0.286	0.038	0.229	7.527**	1.613

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*Note.* †  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

**Table 3***Hierarchical Logistic Regressions Predicting Past Vaccination Behavior*

	<i>B</i>	<i>SE</i>	Wald	Odds Ratio
Model 1: Control Model for Vaccination Behavior in Past Year				
(Constant)	-1.668	0.739	-2.258*	0.189
Sex	-0.063	0.169	-0.371	0.939
Knowledge	0.761	0.249	3.050**	2.140
Perceived Lack of Accessibility	-0.098	0.119	-0.824	0.907
White	0.156	0.165	0.942	1.168
Black	-0.664	0.334	-1.988*	0.515
Hispanic	-0.408	0.247	-1.654 <sup>†</sup>	0.665
Model 2: Full Model for Vaccination Behavior in Past Year				
(Constant)	-0.681	1.179	-0.578	0.506
Sex	-0.247	0.199	-1.241	0.781
Knowledge	-0.587	0.344	-1.707 <sup>†</sup>	0.556
Perceived Lack of Accessibility	0.111	0.141	0.786	1.117
White	0.145	0.192	0.757	1.156
Black	-0.532	0.400	-1.330	0.587
Hispanic	-0.429	0.279	-1.534	0.651
Gist Principles of the Status Quo	-0.798	0.146	-5.471**	0.450
Gist Principles of Responsibility	0.795	0.213	3.723**	2.214
Categorical Thinking	0.271	0.179	1.513	1.311

Perceived Specific Risks of Getting the Flu	-0.088	0.169	-0.519	0.916
Quantitative Risk of Getting Sick From the Flu Vaccine	-0.011	0.011	-1.068	0.989
Quantitative Risk of Getting Sick From Not Vaccinating	0.036	0.010	3.616**	1.036
Global Risk of Getting Sick From the Flu Vaccine	0.600	0.419	1.433	1.822
Global Risk of Getting Sick From Not Vaccinating	-0.060	0.386	-0.154	0.942
Global Risks of Getting the Flu Vaccine	-0.492	0.167	-2.947**	0.611
Global Benefits of Getting the Flu Vaccine	0.284	0.134	2.123*	1.329

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*Note.* †  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

**Table 4***Model Statistics for the Hierarchical Logistic Regressions Predicting Past Vaccination Behavior*

	<i>-2 Log likelihood</i>	<i>Cox &amp; Snell R<sup>2</sup></i>	<i>Nagelkerke R<sup>2</sup></i>
Model 1: Control Model for Vaccination Behavior in Past Year	30.824	0.042	0.056
Model 2: Full Model for Vaccination Behavior in Past Year	222.71	0.265	0.355

**Table 5***Descriptive Statistics for Scales and Predictors*

	<i>n</i>	<i>M</i>	<i>SD</i>	Obs. Min.	Obs. Max.	Theo. Min.	Theo. Max.	Sk.	Ku.
Kirby k	270	0.028	0.044	0.000	0.249	0.000	0.250	3.027	10.482
Kirby SSP	270	0.508	0.211	0.000	1.000	0.000	1.000	-0.452	0.153
CPY	270	0.111	0.338	0.000	2.000	0.000	N/A	3.022	8.892
CL	270	0.422	0.813	0.000	5.000	0.000	N/A	2.276	5.820
YSPF	270	0.993	2.729	0.000	11.000	0.000	N/A	2.827	6.774
BIS-11	270	1.650	0.425	0.400	3.133	0.000	4.000	-0.026	-0.229
UPPS-P	270	1.209	0.339	0.322	2.017	0.000	3.000	-0.281	-0.319
ONS-15	268	0.753	0.197	0.067	1.000	0.000	1.000	-1.369	1.714

*Note.* Obs. Min./Max. is the observed minimum or maximum for the sample. Theo. Min./Max. is the lowest possible minimum or highest possible maximum for the respective scale/measure. Sk. = Skewness, Ku. = Kurtosis, YSPF = Years spent playing football, CPY = Concussions in the past year, CL = Concussions in the participant's lifetime. Concussion in the participant's lifetime excludes the number of concussions in the past year.

**Table 6***Regressions Predicting Kirby k, With and Without Controls for Trait Impulsivity for Paper 2*

		<i>B</i>	<i>SE(B)</i>	Beta	<i>t</i>	VIF
Model 1	Constant	0.022	0.003		6.745***	
	YSPF	0.003	0.001	0.190	3.176**	1.007
	CL	0.001	0.003	0.020	0.333	1.005
	CPY	0.019	0.007	0.148	2.471*	1.008
Model 2	Constant	-0.009	0.011		-0.826	
	YSPF	0.003	0.001	0.174	2.937*	1.015
	CL	0.000	0.003	0.008	0.132	1.010
	CPY	0.021	0.008	0.161	2.727**	1.014
	BIS-11	0.019	0.006	0.180	3.045**	1.018
Model 3	Constant	-0.023	0.017		-1.336	
	YSPF	0.003	0.001	0.180	3.044**	1.011
	CL	0.001	0.003	0.011	0.180	1.009
	CPY	0.021	0.008	0.157	2.641**	1.011
	UPPS-P	0.021	0.008	0.157	2.653**	1.010

*Note.* YSPF = Years spent playing football, CPY = Concussions in the past year, CL = Concussions in the participant's lifetime. Concussion lifetime excludes the number of concussions in the past year. Model 1:  $R^2 = 0.054$ ,  $F(3, 266) = 5.098$ ,  $p < .01$ ; Model 2:  $R^2 = 0.086$ ,  $F(4, 265) = 6.260$ ,  $p < .001$ ; Model 3:  $R^2 = 0.079$ ,  $F(4, 265) = 5.670$ ,  $p < .001$ . \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

**Table 7***Regressions Predicting Kirby Proportion of Sooner, Smaller Choices for Paper 2*

		<i>B</i>	<i>SE(B)</i>	Beta	<i>t</i>	VIF
Model 1	Constant	0.490	0.015		31.560***	
	YSPF	0.015	0.005	0.200	3.350***	1.007
	CL	-0.014	0.015	-0.054	-0.910	1.005
	CPY	0.095	0.037	0.153	2.560*	1.008
Model 2	Constant	0.383	0.051		7.559***	
	YSPF	0.015	0.005	0.188	3.163**	1.015
	CL	-0.016	0.015	-0.063	-1.062	1.010
	CPY	0.101	0.037	0.162	2.732**	1.014
	BIS-11	0.064	0.030	0.130	2.179*	1.018
Model 3	Constant	0.403	0.082		4.865***	
	YSPF	0.015	0.005	0.196	3.281**	1.011
	CL	-0.015	0.015	-0.058	-0.969	1.009
	CPY	0.097	0.037	0.156	2.614**	1.011
	UPPS-P	0.038	0.037	0.062	1.032	1.010

*Note.* YSPF = Years spent playing football, CPY = Concussions in the past year, CL = Concussions in the participant's lifetime. Concussion lifetime excludes the number of concussions in the past year. Model 1:  $R^2 = 0.062$ ,  $F(3, 266) = 5.832$ ,  $p < .001$ ; Model 2:  $R^2 = 0.064$ ,  $F(4, 265) = 5.622$ ,  $p < .001$ ; Model 3:  $R^2 = 0.051$ ,  $F(4, 265) = 4.641$ ,  $p = .001$ . \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

**Table 8***Demographics Broken Down by Race and Sex Using the Full Sample for Paper 3 (n = 3068)*

			<i>M</i>	<i>SD</i>	<i>n</i>	<i>%</i>
White	Male ( <i>n</i> = 1038)	Age	41.47	13.08		
		Juvenile Offender			79	7.6
		Sexual Offender			75	7.2
	Female ( <i>n</i> = 165)	Granted Parole			290	27.9
		Age	38.59	10.25		
		Juvenile Offender			4	2.4
Minority	Male ( <i>n</i> = 1793)	Sexual Offender			1	0.6
		Granted Parole			99	60.0
		Age	38.17	12.61		
	Female ( <i>n</i> = 72)	Juvenile Offender			274	15.3
		Sexual Offender			100	5.6
		Granted Parole			415	23.1
Female ( <i>n</i> = 72)	Age	39.26	11.60			
	Juvenile Offender			6	8.3	
	Sexual Offender			0	0.0	
		Granted Parole			29	40.3

*Note.* Units for time served is years.

**Table 9**

*Descriptive Statistics Broken Down by Race and Sex Using the Full Sample for Paper 3 (n = 3068)*

			<i>M</i>	<i>SD</i>	Minimum	Maximum
White	Male ( <i>n</i> = 1038)	Age at First Offense	28.67	9.86	15.44	73.45
		Time Served	10.91	10.79	0.27	47.72
		Violent Felony Count	0.77	1.26	0.00	16.00
		Nonviolent Felony Count	2.60	2.92	0.00	27.00
	Female ( <i>n</i> = 165)	Age at First Offense	30.33	8.15	16.01	54.01
		Time Served	6.27	8.03	0.53	38.26
		Violent Felony Count	0.45	0.76	0.00	4.00
		Nonviolent Felony Count	2.18	2.88	0.00	18.00
Minority	Male ( <i>n</i> = 1793)	Age at First Offense	24.63	7.52	13.82	68.78
		Time Served	11.90	10.41	0.33	57.53
		Violent Felony Count	0.76	1.42	0.00	22.00
		Nonviolent Felony Count	2.62	2.70	0.00	34.00
	Female ( <i>n</i> = 72)	Age at First Offense	26.39	7.50	16.09	47.34
		Time Served	10.40	9.78	0.53	44.67
		Violent Felony Count	0.47	0.86	0.00	4.00
		Nonviolent Felony Count	2.69	4.85	0.00	37.00

*Note.* Units for time served is years.

**Table 10**

*Observed and Expected Frequencies and Percentages in the Chi-Square Test for Independence with Race and Parole Outcome*

		Parole Granted	Parole Denied
Observed	White	389 (46.7%)	814 (36.4%)
	Minority	444 (53.3%)	1421 (63.6%)
Expected	White	326.63 (39.2%)	876.37 (39.2%)
	Minority	506.37 (60.8%)	1358.63 (60.8%)

*Note.* Percentages are calculated with regards to parole outcome.

**Table 11**

*Observed and Expected Frequencies and Percentages in the Chi-Square Test for Independence with Sex and Parole Outcome*

		Parole Granted	Parole Denied
Observed	Male	707 (84.6%)	2133 (95.1%)
	Female	129 (15.4%)	109 (4.9%)
Expected	Male	777.36 (92.3%)	2068.64 (92.3%)
	Female	64.64 (7.7%)	173.36 (7.7%)

*Note.* Percentages are calculated with regards to parole outcome.

**Table 12***Logistic Regression Predicting Parole Outcome Using the Full Sample (n = 3068)*

Predictor	Estimate	SE	95% CI		z	OR
			LL	UL		
Intercept	-1.370	0.193	-1.749	-0.993	-7.105**	0.254
Sex	1.229	0.176	0.886	1.578	6.979**	3.418
Race	-0.216	0.093	-0.398	-0.033	-2.321*	0.806
Sex X Race	-0.550	0.305	-1.155	0.044	-1.802 <sup>†</sup>	0.577
Age at First Offense	0.017	0.005	0.007	0.027	3.475**	1.017
Sex Offender Status	-2.468	0.512	-3.655	-1.593	-4.817**	0.085
Violent Felony Count	-0.249	0.050	-0.348	-0.154	-5.026**	0.780
Nonviolent Felony Count	0.026	0.015	-0.003	0.055	1.796 <sup>†</sup>	1.027
Hearing Month	0.016	0.012	-0.007	0.040	1.370	1.016

*Note.* Sex was coded with males as 0 and females as 1. Race was coded such that Whites were 0 and minorities were 1. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; OR = odds ratio; VIF = variance inflation factor. <sup>†</sup>  $p < .1$ ; \*  $p < .05$ ; \*\*  $p < .01$ .

**Table 13***Logistic Regression Predicting Parole Outcome Using Only Males (n = 2831)*

Predictor	Estimate	SE	95% CI		z	OR
			LL	UL		
Intercept	-1.395	0.203	-1.794	-0.998	-6.876**	0.248
Race	-0.217	0.093	-0.400	-0.034	-2.326*	0.805
Age at First Offense	0.017	0.005	0.007	0.027	3.251**	1.017
Sex Offender Status	-2.446	0.512	-3.633	-1.570	-4.773**	0.087
Violent Felony Count	-0.247	0.051	-0.351	-0.149	-4.811**	0.781
Nonviolent Felony Count	0.035	0.016	0.004	0.066	2.248*	1.036
Hearing Month	0.018	0.013	-0.007	0.042	1.410	1.018

*Note.* Race was coded such that Whites were 0 and minorities were 1. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; OR = odds ratio; VIF = variance inflation factor. \*  $p < .05$ ; \*\*  $p < .01$ .

**Table 14**

*Logistic Regression Predicting Race Using Only Males During Propensity Score Matching (n = 2831)*

Predictor	Estimate	SE	95% CI		z	OR
			LL	UL		
Constant	2.295	0.169	1.967	2.629	13.597**	9.926
Age at First Offense	-0.056	0.005	-0.066	-0.047	-11.627**	0.945
Sex Offender	-0.155	0.173	-0.493	0.186	-0.898	0.856
Violent Felony Count	-0.017	0.031	-0.077	0.045	-0.545	0.983
Nonviolent Felony Count	-0.035	0.015	-0.064	-0.007	-2.411*	0.965
Hearing Month	-0.024	0.011	-0.046	-0.002	-2.091*	0.977

*Note.* Race was coded such that Whites were 0 and minorities were 1. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; OR = odds ratio; VIF = variance inflation factor. \*  $p < .05$ ; \*\*  $p < .01$ .

**Table 15***Standardized Mean Differences in Prognostic Score and Covariates After Propensity Score**Matching (n = 1942)*

	<i>SMD</i>
Prognostic score	< 0.001
Age at First Offense	-0.092
Sex Offender	-0.009
Violent Felony Count	-0.010
Nonviolent Felony Count	0.009
Hearing Month	-0.037

*Note.* SMD = standardized mean difference. Per empirical literature, balance is thought to have been achieved when standardized mean differences are less than  $\pm 1$ .

**Table 16***Logistic Regression Predicting Parole Outcome Using Only Males After Propensity Score**Matching (n = 1942)*

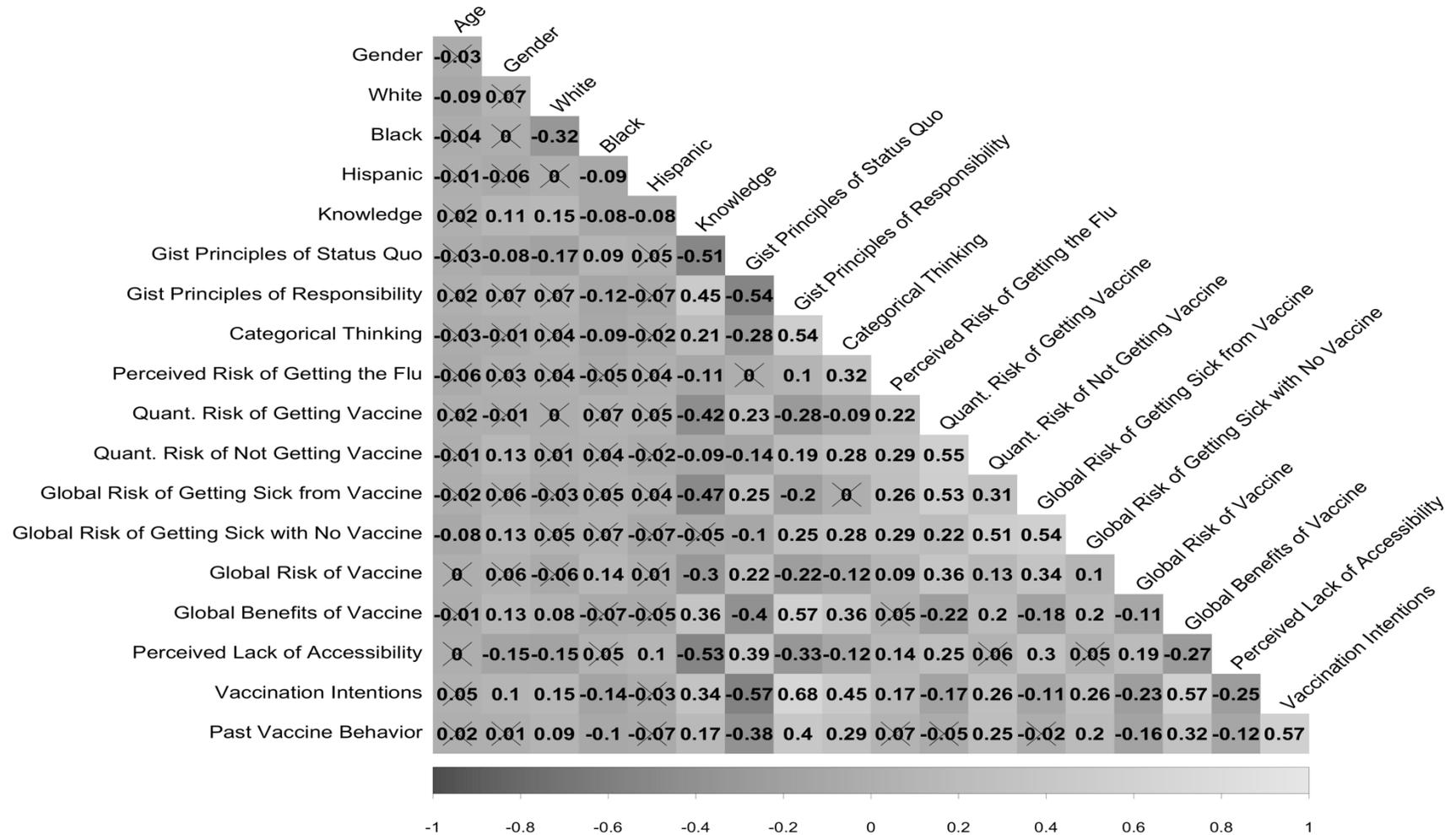
Predictor	Estimate	SE	95% CI		z	OR
			LL	UL		
Intercept	-1.535	0.229	-1.987	-1.087	-6.691**	0.215
Race	-0.294	0.105	-0.500	-0.088	-2.789**	0.746
Age at First Offense	0.025	0.006	0.013	0.037	4.058**	1.025
Sex Offender Status	-2.211	0.516	-3.404	-1.325	-4.281**	0.110
Violent Felony Count	-0.260	0.061	-0.384	-0.143	-4.225**	0.771
Nonviolent Felony Count	0.041	0.017	0.007	0.075	2.378*	1.042
Hearing Month	0.010	0.015	-0.019	0.039	0.679	1.010

*Note.* Race was coded such that Whites were 0 and minorities were 1. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; OR = odds ratio; VIF = variance inflation factor. \*  $p < .05$ ; \*\*  $p < .01$ .

Figures

Figure 1

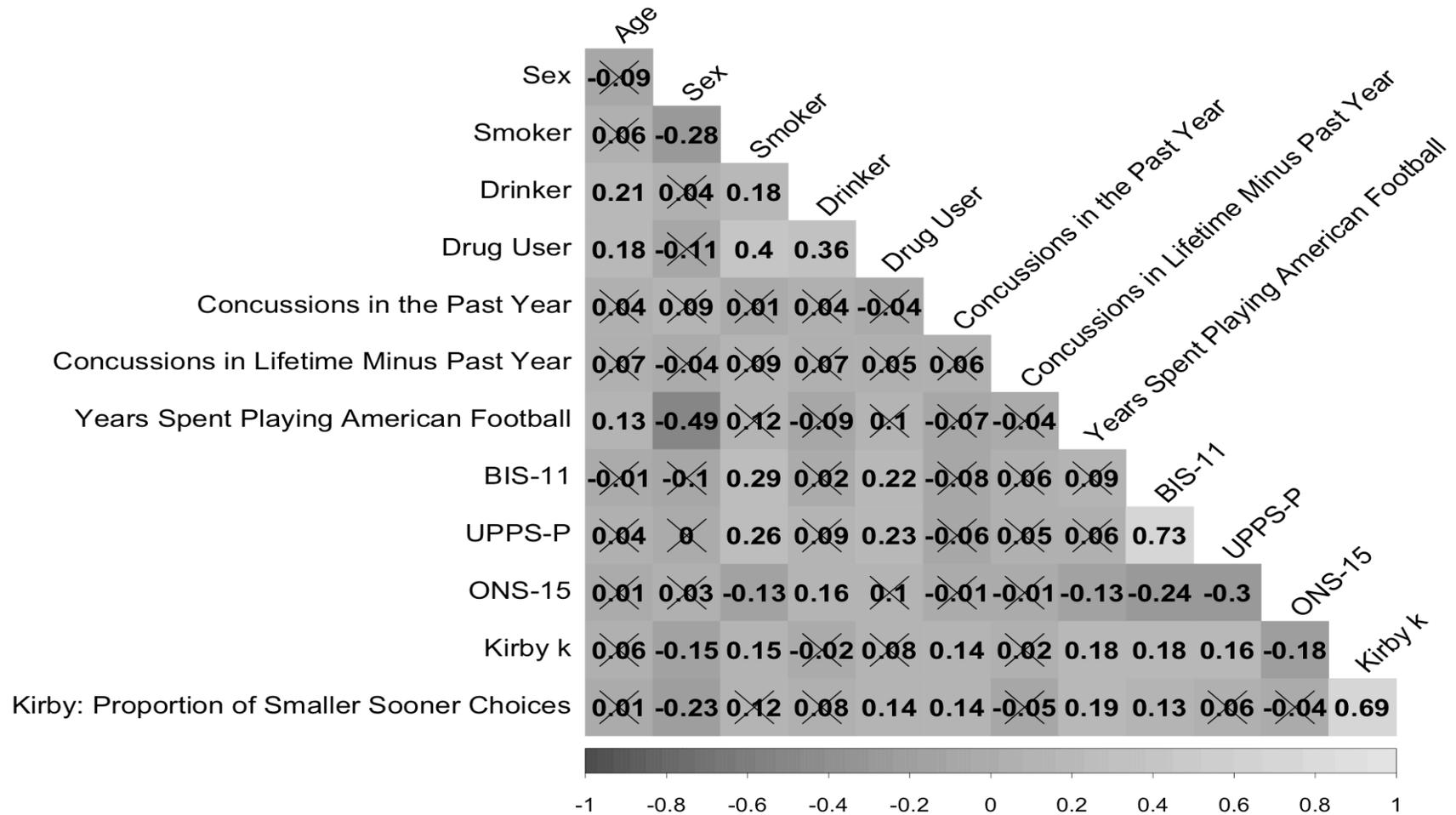
Pearson Correlations Between All Variables for Paper 1



Note. An X indicates that the correlation was not significant at the  $p = .05$  level.

**Figure 2**

*Pearson Correlations Between All Variables for Paper 2*

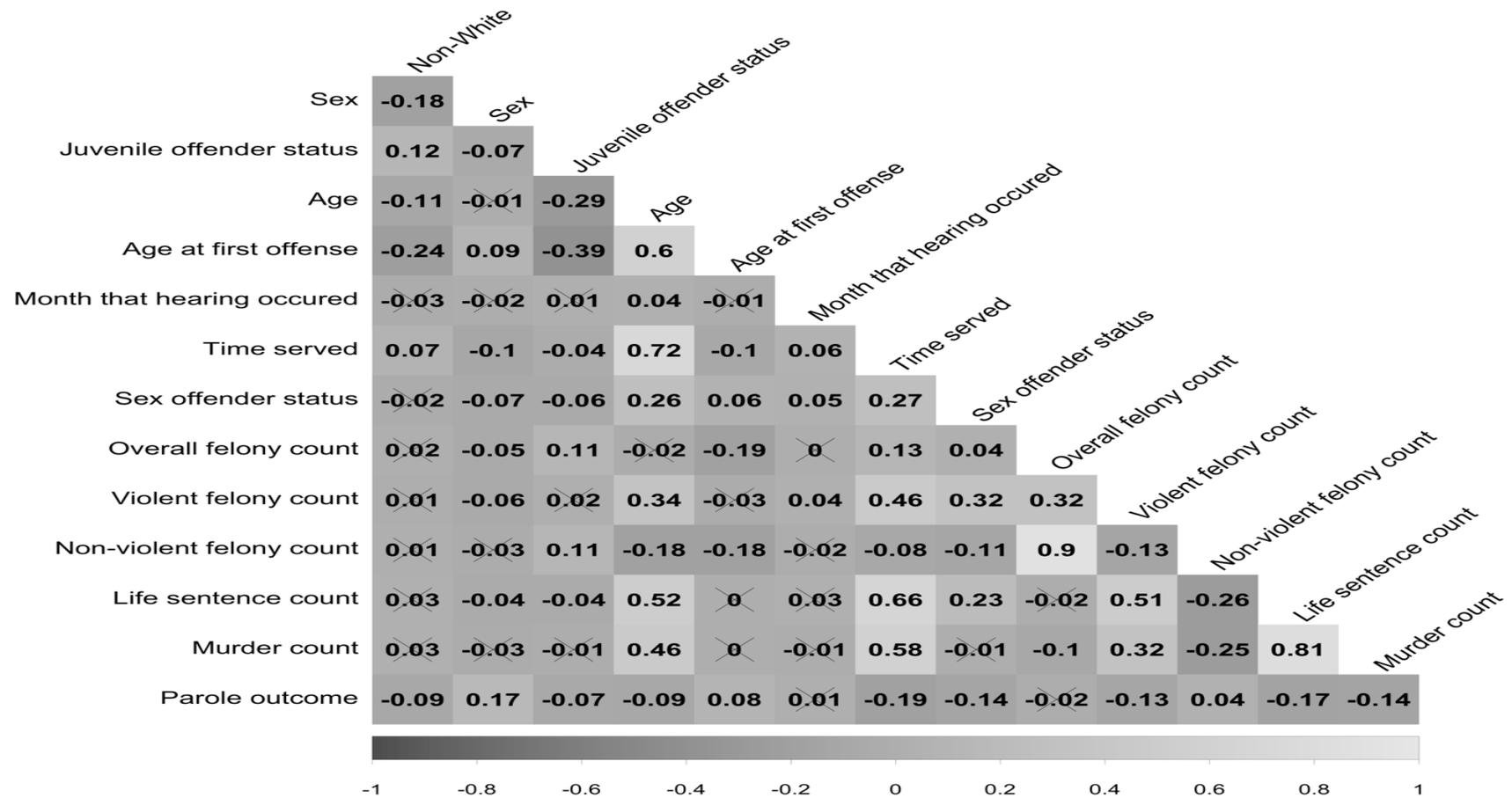


*Note.* An X denotes that the correlation was not significant at the  $p < .05$  level.

Figures

Figure 3

Correlogram Visualizing the Bivariate Pearson Correlations for the Overall Sample for Paper 3 (n = 3068)



Note. Sex was coded with males as 0 and females as 1. Race was coded such that Whites were 0 and minorities were 1. Correlation coefficients that were not significant at  $p < 0.05$  are denoted by an X. Pairwise deletion was used to minimize the loss of data.



## Appendix A

### Items for All Scales

**Table A1**

*Gist Principles of the Status Quo*

#	Item
1	I feel fine now, so it is unnecessary to get the flu vaccine.
2	I feel fine now, so there is no reason to be screened for a disease.
3	I feel fine now, so there is no reason to get the flu vaccine.

*Note.* The prompt for these items was the following: “I believe...”. All items were answered on a 5-point scale with scale points *Completely Disagree*, *Disagree*, *Neither Agree nor Disagree*, *Agree*, and *Completely Agree*.

**Table A2***Gist Principles of Responsibility*

#	Item
1	Better to get the flu vaccine than risk getting a loved one sick
2	I have a responsibility to myself to get the flu vaccine
3	I have a responsibility to my family to get the flu vaccine
4	I have a responsibility to my child to not put him/her at risk
5	I have a responsibility to my elderly family members to not put them at risk
6	Getting vaccinated benefits my society
7	Getting vaccinated protects those around me
8	People who get the flu vaccine are protecting at-risk populations
9	You should not hurt other people by giving them the flu
10	My community would really benefit from a flu vaccine
11	Young adults have a responsibility to their families to get the flu vaccine

*Note.* \* indicates the item was reverse-coded. All items were answered on a 5-point scale with scale points *Completely Disagree*, *Disagree*, *Neither Disagree nor Agree*, *Agree*, and *Completely Agree*.

**Table A3***Categorical Thinking*

---

#	Item
1	Getting the flu is inevitable so it makes sense to get the flu vaccine.
2	If I don't get vaccinated I will eventually get the flu.
3	There is a chance I'll get the flu every year I avoid getting vaccinated.

---

*Note.* All items were answered on a 5-point scale with scale points *Completely Disagree*, *Disagree*, *Neither Agree nor Disagree*, *Agree*, and *Completely Agree*.

**Table A4***Perceived Specific Risks of Getting the Flu*

#	Item
1	I am likely to get the flu by age 30.
2	I am likely to get the flu in the next 12 months.
3	I am likely to get an upper respiratory illness by age 30.
4	I am likely to get an upper respiratory illness in the next 12 months.
5	I will get the flu within the next year.
6	Do you believe you will get the flu this flu season?
7	Do you think you will get the flu before you graduate from college?

*Note.* Items 1-5 were answered on a 5-point scale with scale points *Completely Disagree*, *Disagree*, *Neither Agree nor Disagree*, *Agree*, and *Completely Agree*. Items 6-7 were answered on a 5-point scale with scale points *Extremely Unlikely*, *Unlikely*, *Undecided*, *Likely*, and *Extremely Likely*.

**Table A5***Quantitative Risk of Getting Sick From the Flu Vaccine*

#	Item
1	Probability of getting the flu if you do get a flu vaccine?
2	Probability of death if you do get a flu vaccine?
3	Probability of getting sick if you do get a flu vaccine?
4	Probability of getting pneumonia if you do get a flu vaccine?
5	Probability of getting an upper respiratory illness if you do get the flu vaccine?
6	Probability of having a negative reaction to the flu vaccine?
7	Probability of having a mild side effect from the flu vaccine?
8	Probability of dying from the flu vaccine?
9	Probability of an allergic reaction to the flu vaccine?
10	Probability of an allergic reaction and getting sick if I get the flu vaccine?
11	Probability of a negative reaction and getting the flu if I get a flu vaccine?

*Note.* All items were answered on a 100-point scale from 0% risk to 100% risk.

**Table A6***Quantitative Risk of Getting Sick From Not Vaccinating*

#	Item
1	Probability of getting the flu if you do not get a flu vaccine?
2	Probability of death if you do not get a flu vaccine?
3	Probability of getting sick if you do not get a flu vaccine?
4	Probability of getting pneumonia if you do not get a flu vaccine?
5	Probability of getting an upper respiratory illness if you do not get the flu vaccine?
6	Probability of infecting another person with the flu, if I get sick?
7	Probability of dying from the flu?

*Note.* All items were answered on a 100-point scale from *0% risk* to *100% risk*.

**Table A7***Global Risks of Getting Sick From the Flu Vaccine*

#	Item
1	Probability of getting the flu if you do get a flu vaccine?
2	Probability of death if you do get a flu vaccine?
3	Probability of getting sick if you do get a flu vaccine?
4	Probability of getting pneumonia if you do get a flu vaccine?
5	Probability of getting an upper respiratory illness if you do get the flu vaccine?
6	Probability of having a negative reaction to the flu vaccine?
7	Probability of having a mild side effect from the flu vaccine?
8	Probability of dying from the flu vaccine?

*Note.* All items were answered on a 3-point scale with scale points *Low*, *Medium*, and *High*.

**Table A8***Global Risks of Getting Sick From Not Vaccinating*

#	Item
1	Probability of getting the flu if you do not get a flu vaccine?
2	Probability of death if you do not get a flu vaccine?
3	Probability of getting sick if you do not get a flu vaccine?
4	Probability of getting pneumonia if you do not get a flu vaccine?
5	Probability of getting an upper respiratory illness if you do not get the flu vaccine?
6	Probability of infecting another person with the flu, if I get sick?
7	Probability of dying from the flu?

*Note.* All items were answered on a 3-point scale with scale points *Low*, *Medium*, and *High*.

**Table A9***Perceived Lack of Accessibility*

#	Item
1	I would find it difficult to obtain a flu vaccine.
2	I would find it difficult to afford a flu vaccine this flu season.
3	I would find it difficult to afford a flu vaccine this flu season.
4	I would find it difficult to obtain a flu vaccine this flu season.
5	I am not sure I could obtain a flu vaccine this flu season.

*Note.* All items were answered on a 5-point scale with scale points *Completely Disagree*, *Disagree*, *Neither Agree nor Disagree*, *Agree*, and *Completely Agree*.

**Table A10***Vaccination Knowledge*

#	Item
1	Getting the vaccine protects people from the flu.
2	Getting the vaccine is a very time consuming activity.*
3	Flu vaccines are expensive.*
4	There are very few locations which have flu vaccines available for people.*
5	There are often flu vaccine shortages.*
6	Getting the flu vaccine would increase the number of physician visits each year for recipients.*
7	The seasonal flu often turns into a pandemic.*
8	The flu season ranges from September to April.
9	It is possible to get the flu more than once in one flu season.
10	Flu vaccines are inexpensive.
11	The flu vaccine saves recipients an average of \$50 a year in health care costs.
12	Getting the flu vaccine would reduce the number of physician visits each year for recipients.
13	One way to REDUCE the risk of getting the flu is to get the flu vaccine each year.
14	Cold medicine can be used to treat the symptoms of the flu.
15	Cold medicine can be used to treat the cause of the flu.*



33 The flu vaccine is most necessary for those with weakened immune systems,  
like the elderly and children under 6.

34 Even if I do not get the vaccine, if enough people around me get it, I will be  
protected by "herd immunity".

35 Death is a common side effect of the flu vaccine.\*

36 Getting the vaccine will weaken my immune system and make me more  
susceptible to other illnesses.\*

37 Young adults do not need the flu vaccine, as they are not at risk from suffering  
from complications from the flu.\*

38 The flu vaccine has toxic metals and can cause people to develop mental  
illnesses such as autism.\*

39 The flu vaccine is introducing a virus into my system, and so it makes sense to  
avoid it, especially if I am already sick or pregnant.\*

40 Getting the flu vaccine will prevent my body from creating natural immune  
defenses.\*

41 Getting the flu vaccine will introduce the virus into my system, thus allowing  
me to spread it to others.\*

42 The flu vaccine contains toxic metals which can lead to or exacerbate the  
effects of progressive degenerative diseases such as Multiple Sclerosis.\*

43 Getting the flu vaccine would increase my chances of getting sick with the  
flu.\*

44 Getting the flu vaccine would increase my chances of getting sick with a  
fever.\*

45 Getting the flu vaccine would decrease my productivity and my ability to work  
effectively.\*

46 If I were pregnant, it would be placing my unborn baby at risk if I were to get  
the flu vaccine.

47 Your chances of getting the flu are influenced by your behavior, such as going  
out with wet hair.\*

- 48 Getting the flu is an inevitable part of life.\*
- 49 Getting the flu is the same as getting a cold.\*
- 50 Getting the flu is not the same as getting a cold.
- 51 To treat the flu, I should take antibiotics\*

---

*Note.* \* indicates the item was reverse-coded. Items 1-42 were answered on a 5-point scale with scale points *False, Probably False, Either be True or False, Probably True, True*. Items 43-51 were answered on a 5-point scale with scale points *Completely disagree, Disagree, Neither Disagree nor Agree, Agree, Completely Agree*.

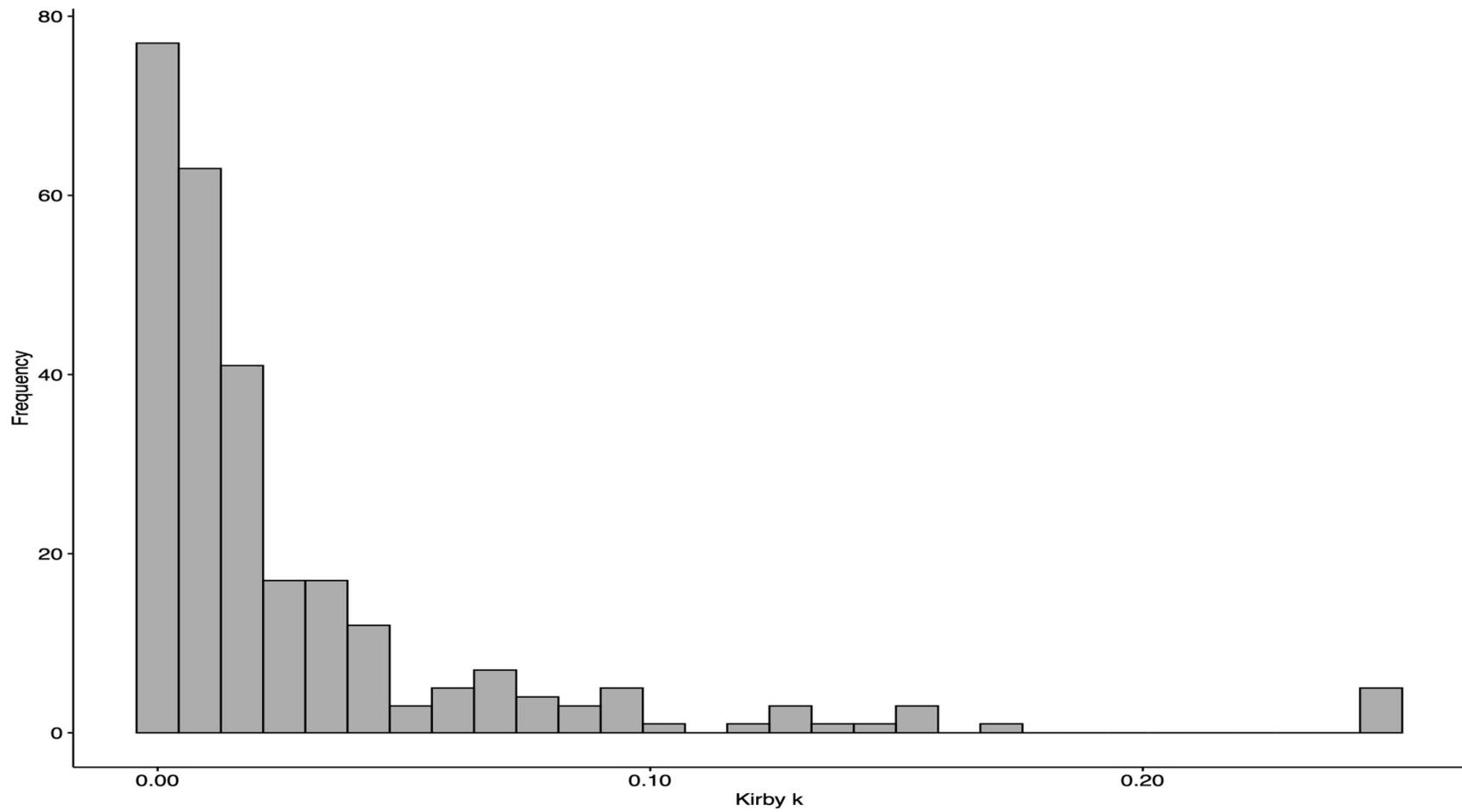
**Table A11***Intentions to Get Vaccinated*

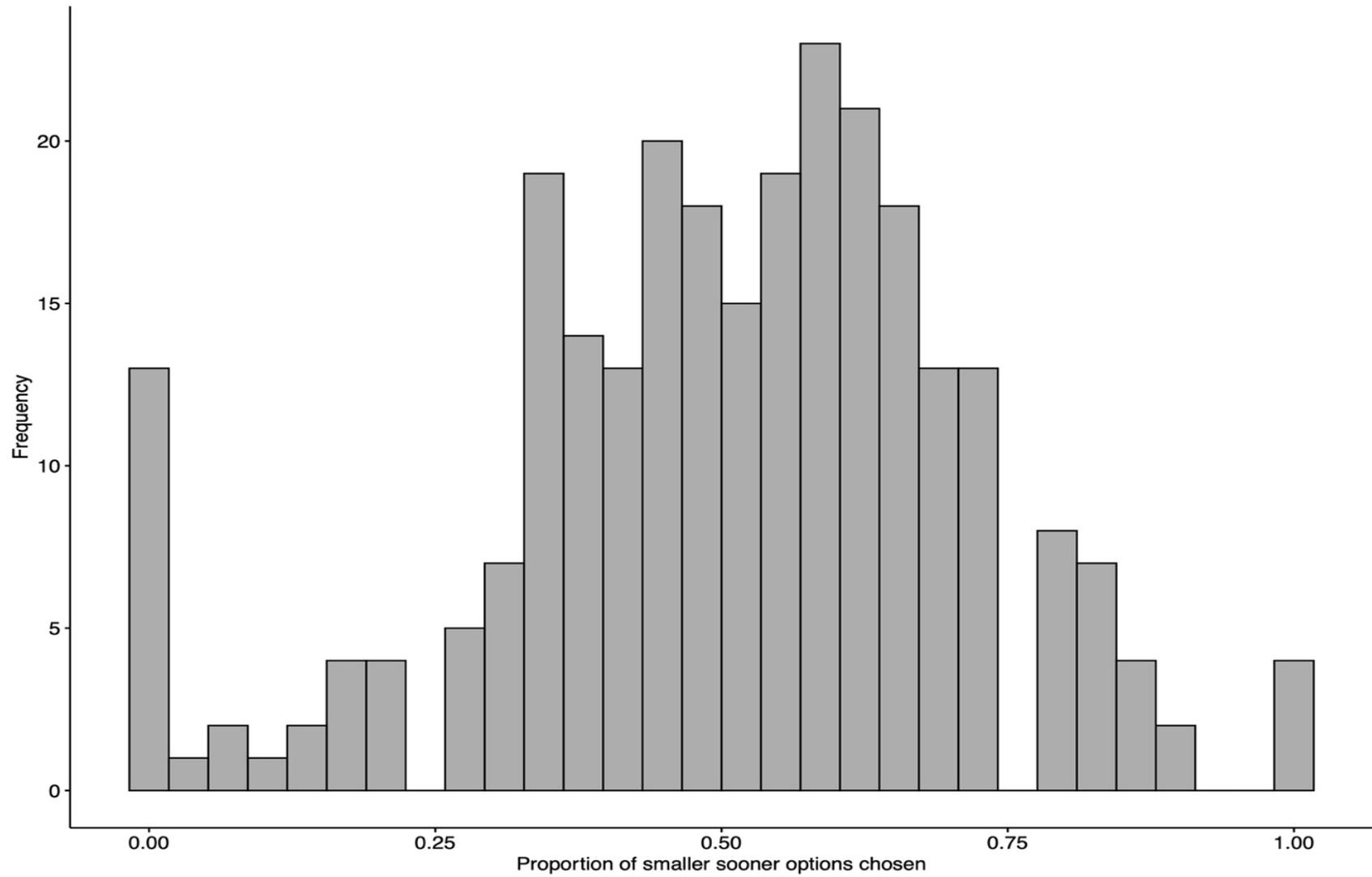
#	Item
1	Do you intend to get a flu vaccine at the start of the next flu season?
2	Do you think you will actually get a flu vaccine during the next flu season?
3	Do you intend to get a flu vaccine this flu season?
4	Do you think you will get a flu vaccine at the start of every flu season?
5	Do you plan to get a flu vaccine at the start of most flu seasons?
6	Do you think you will get the flu vaccine at least once in your lifetime?

*Note.* All items were answered on a 5-point scale with scale points *Extremely Unlikely*, *Unlikely*, *Undecided*, *Likely* and *Extremely Likely*.

**Appendix B**

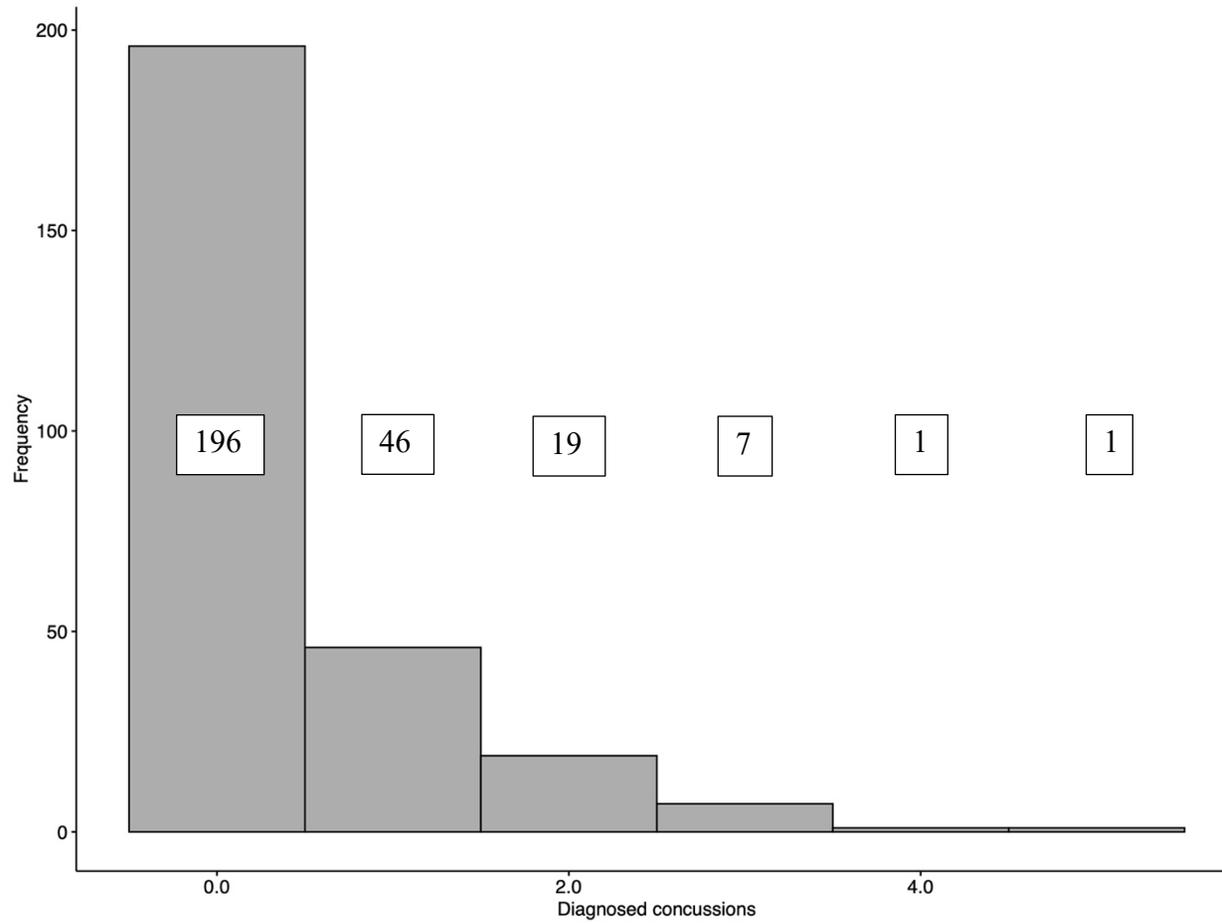
## Distributions for All Predictors

**Figure B1***Distribution for Kirby k*

**Figure B2***Distribution for Kirby SSP*

**Figure B3**

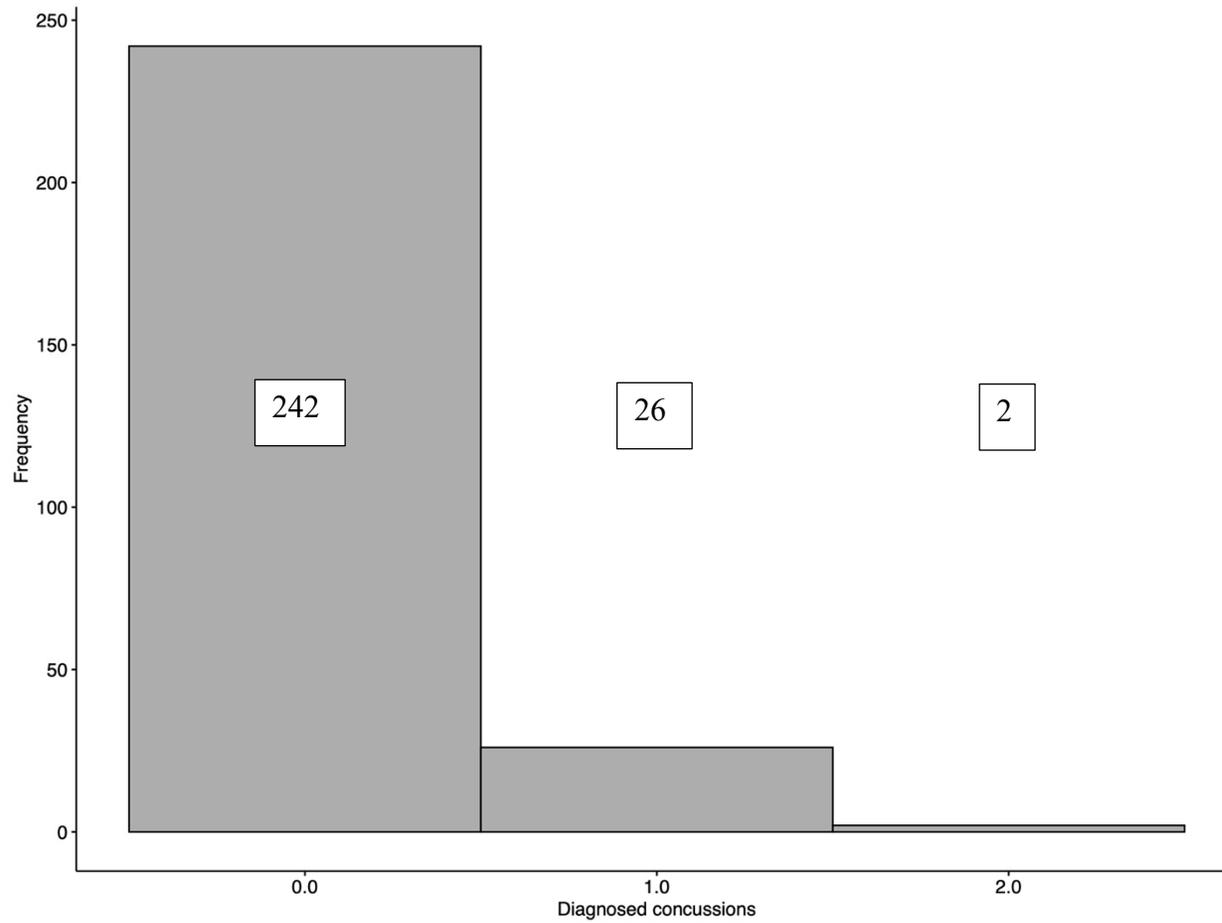
*Distribution and Frequencies for Diagnosed Concussions in the Lifetime Minus the Past Year*



*Note.* Numbers indicate the exact number of participants in each bin.

**Figure B4**

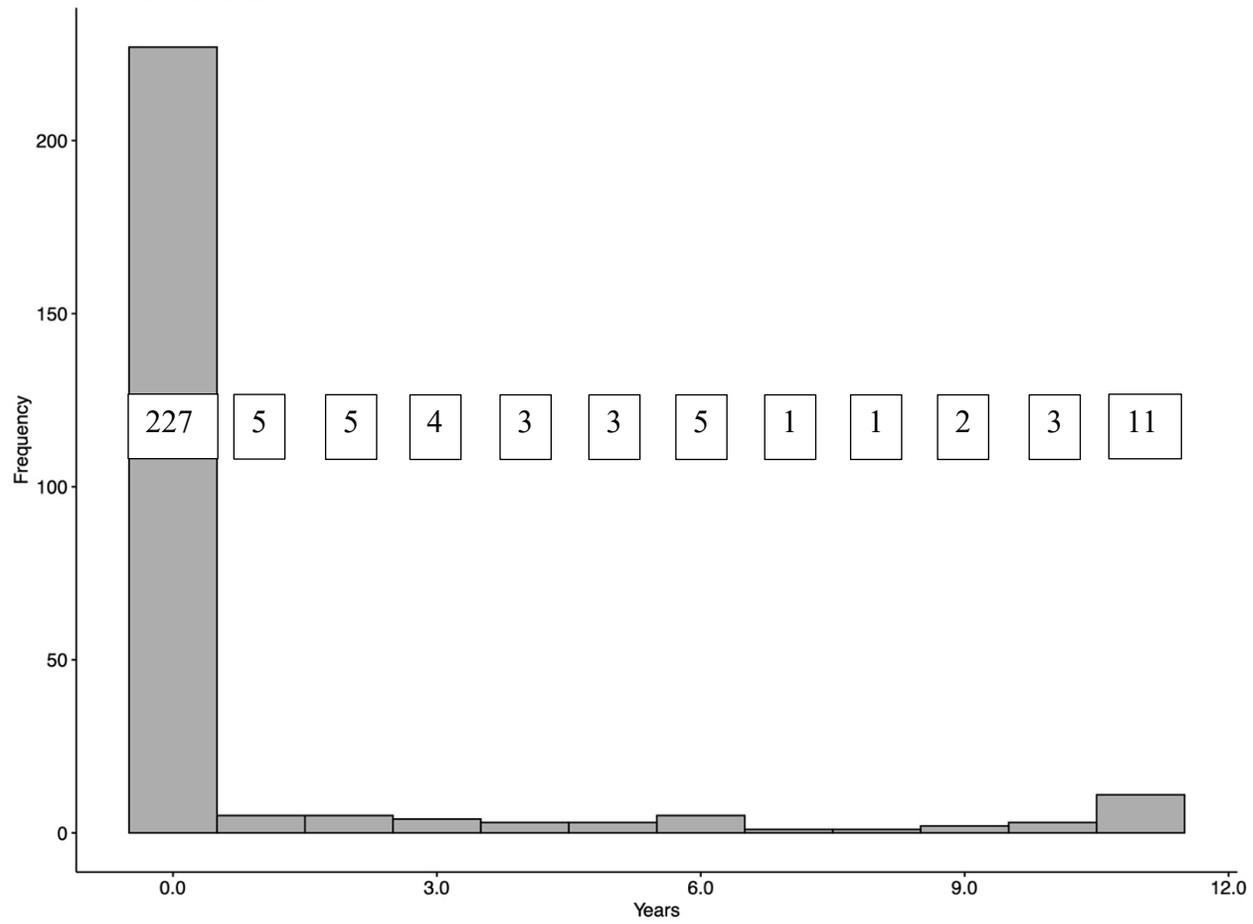
*Distribution and Frequencies for Concussions in the Past Year*



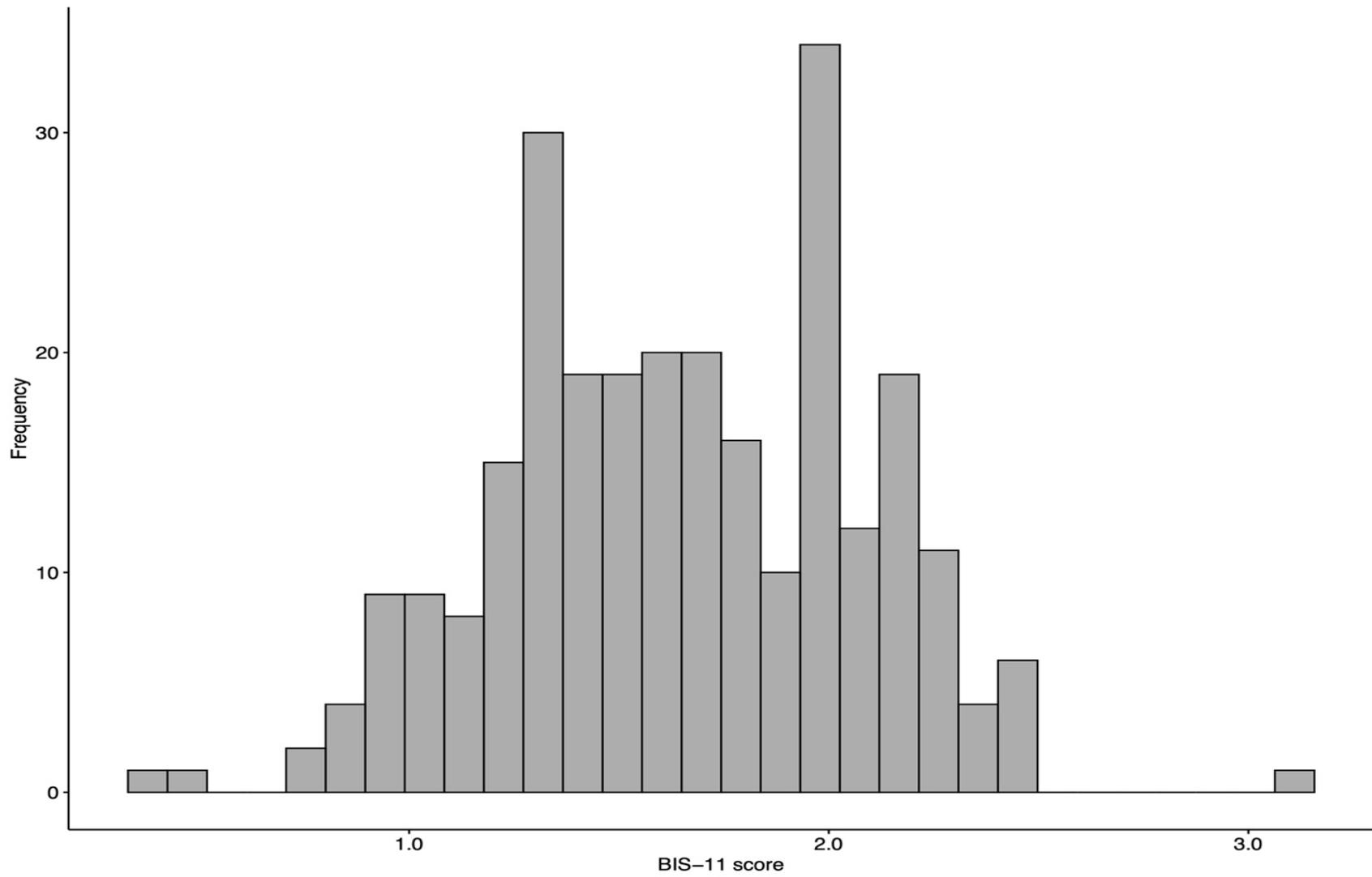
*Note.* Numbers indicate the exact number of participants in each bin.

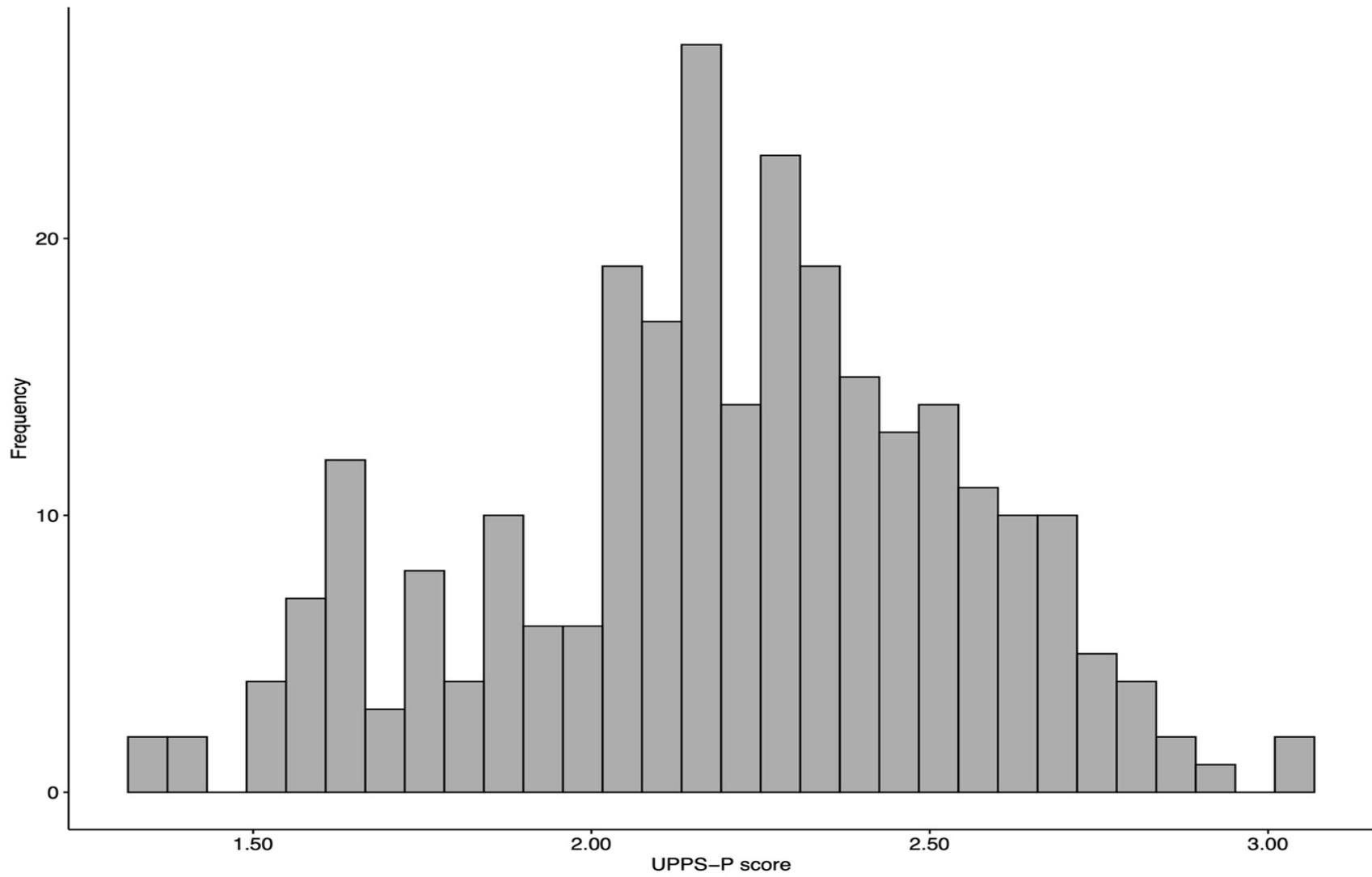
**Figure B5**

*Distribution and Frequencies for Years Spent Playing American Football*



*Note.* Numbers indicate the exact number of participants in each bin.

**Figure B6***Distribution for BIS-11*

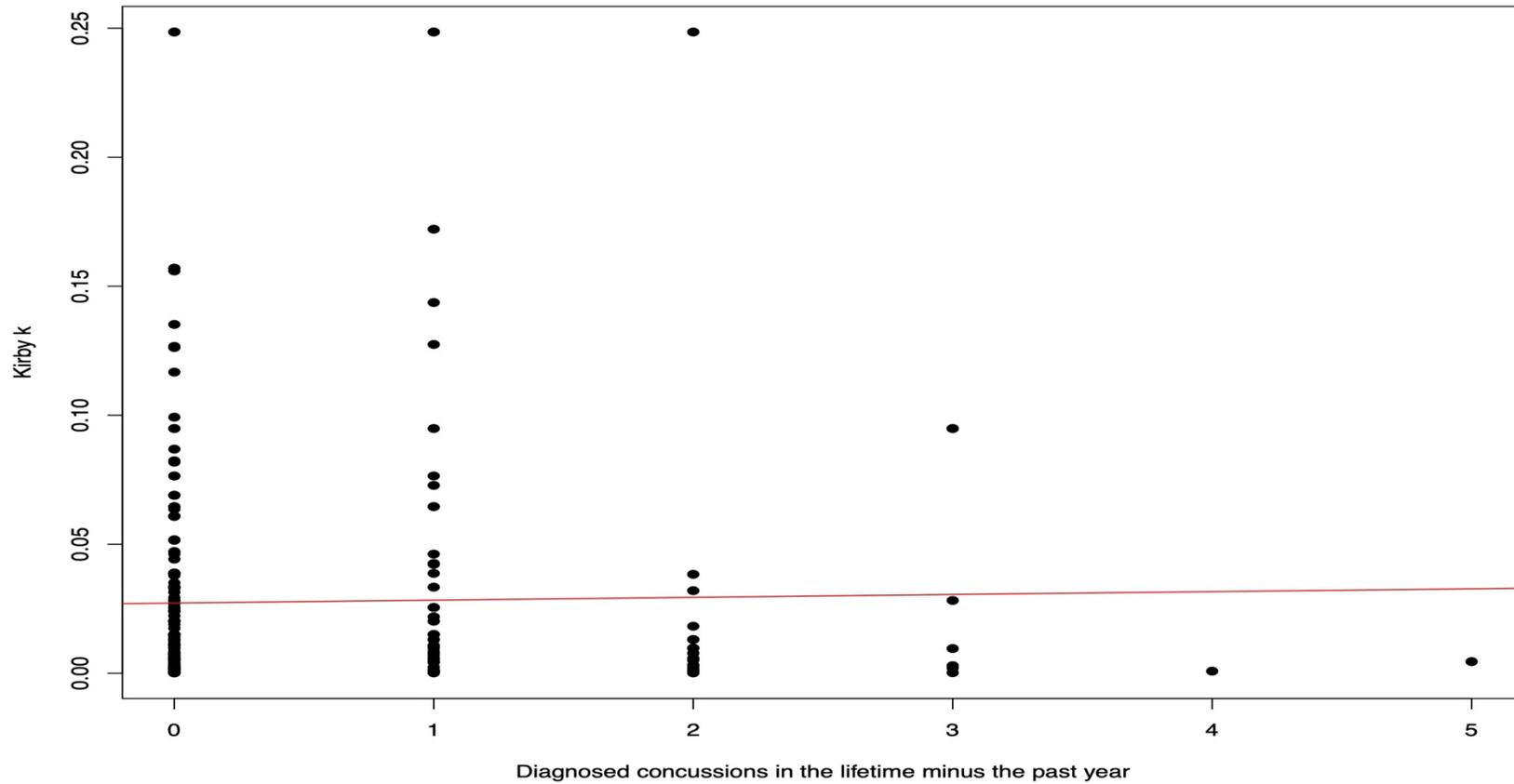
**Figure B7***Distribution for UPPS-P*

## Appendix C

## Scatterplots Between Predictors and the Two Measures of Discounting

Figure C1

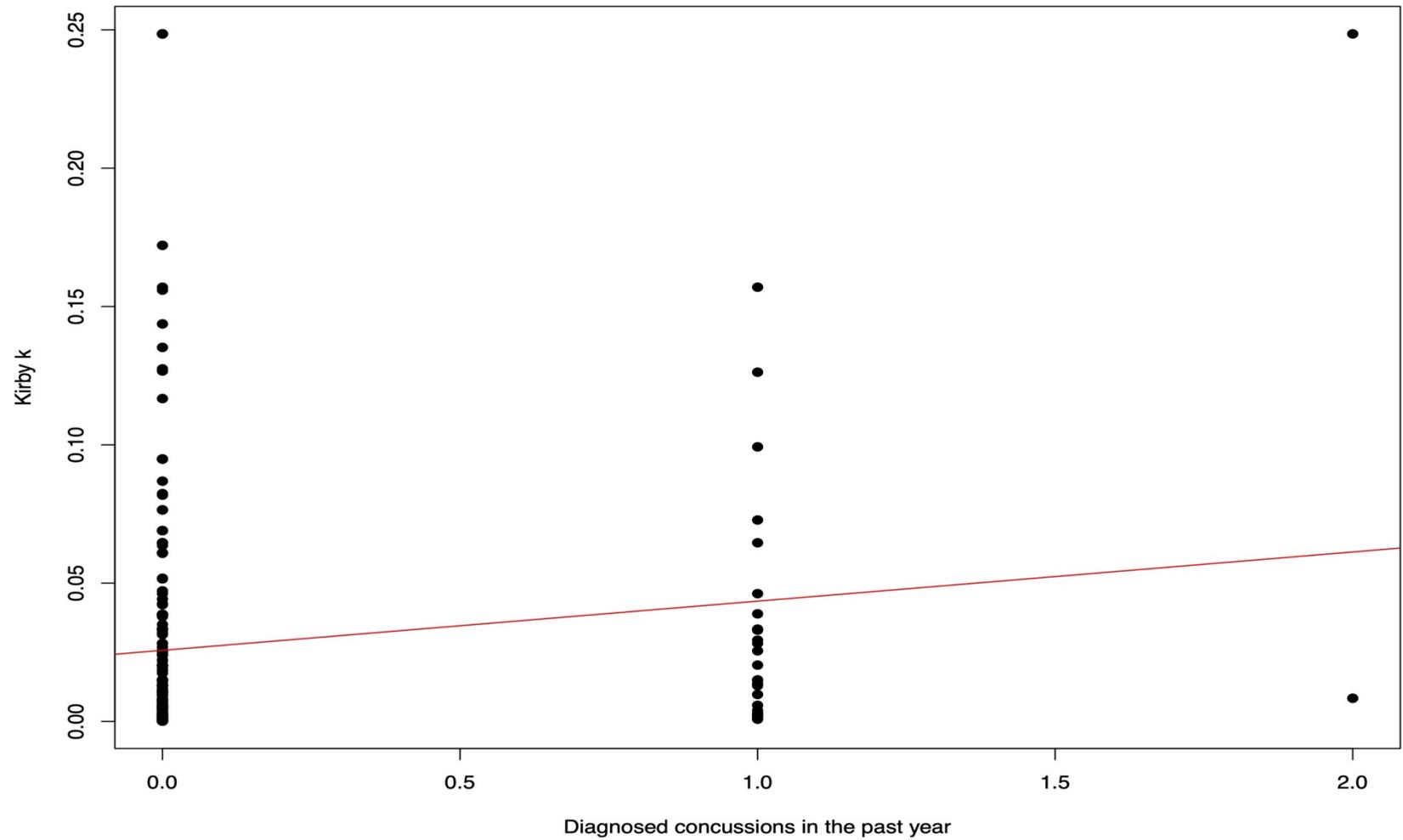
Scatterplot Between Diagnosed Concussions in the Lifetime Minus the Past Year and Kirby  $k$



Note. Each dot is an individual participant, and the red line is a regression line added to plot.

**Figure C2**

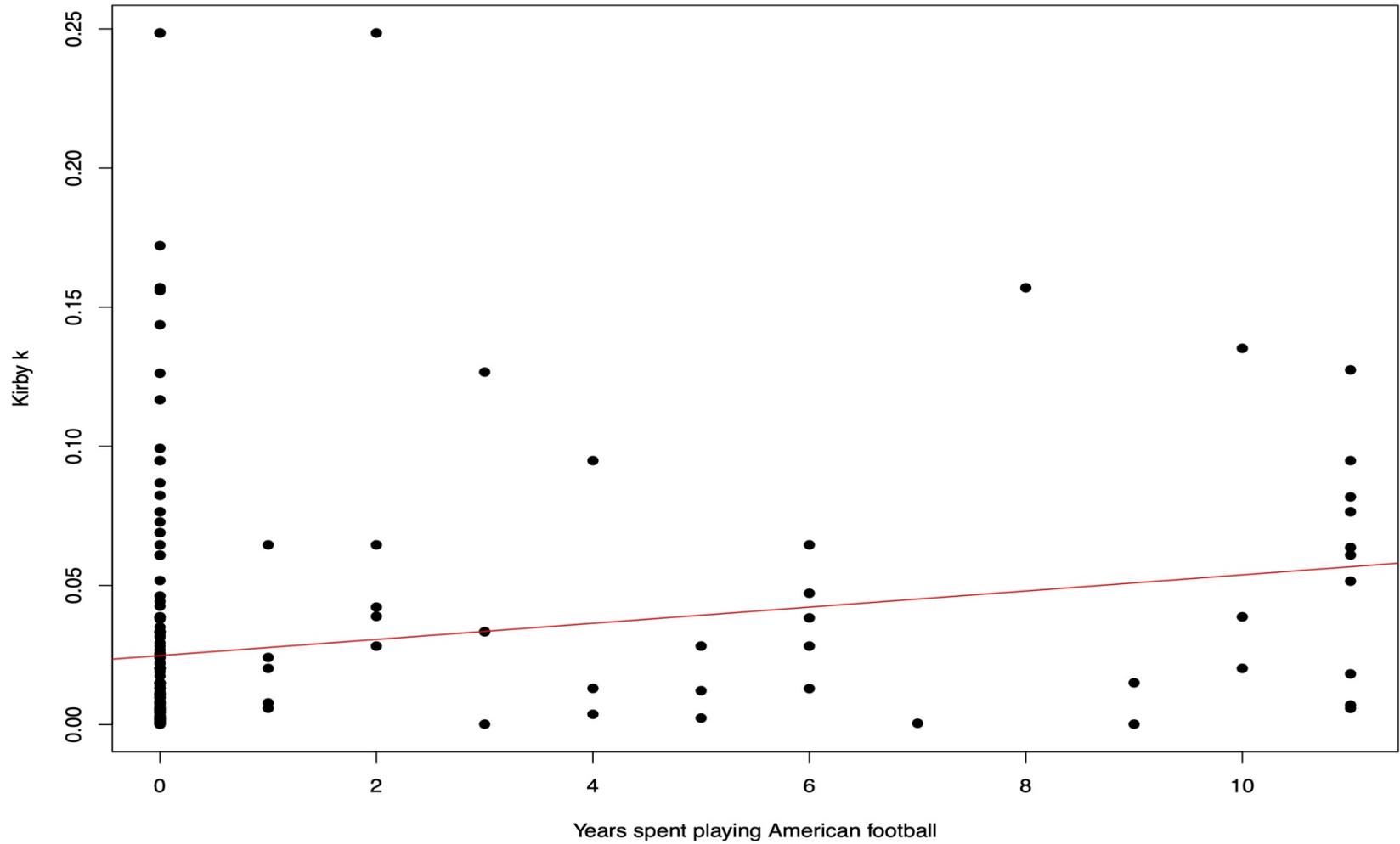
*Scatterplot Between Diagnosed Concussions in Past Year and Kirby k*



*Note.* Each dot is an individual participant, and the red line is a regression line added to plot.

**Figure C3**

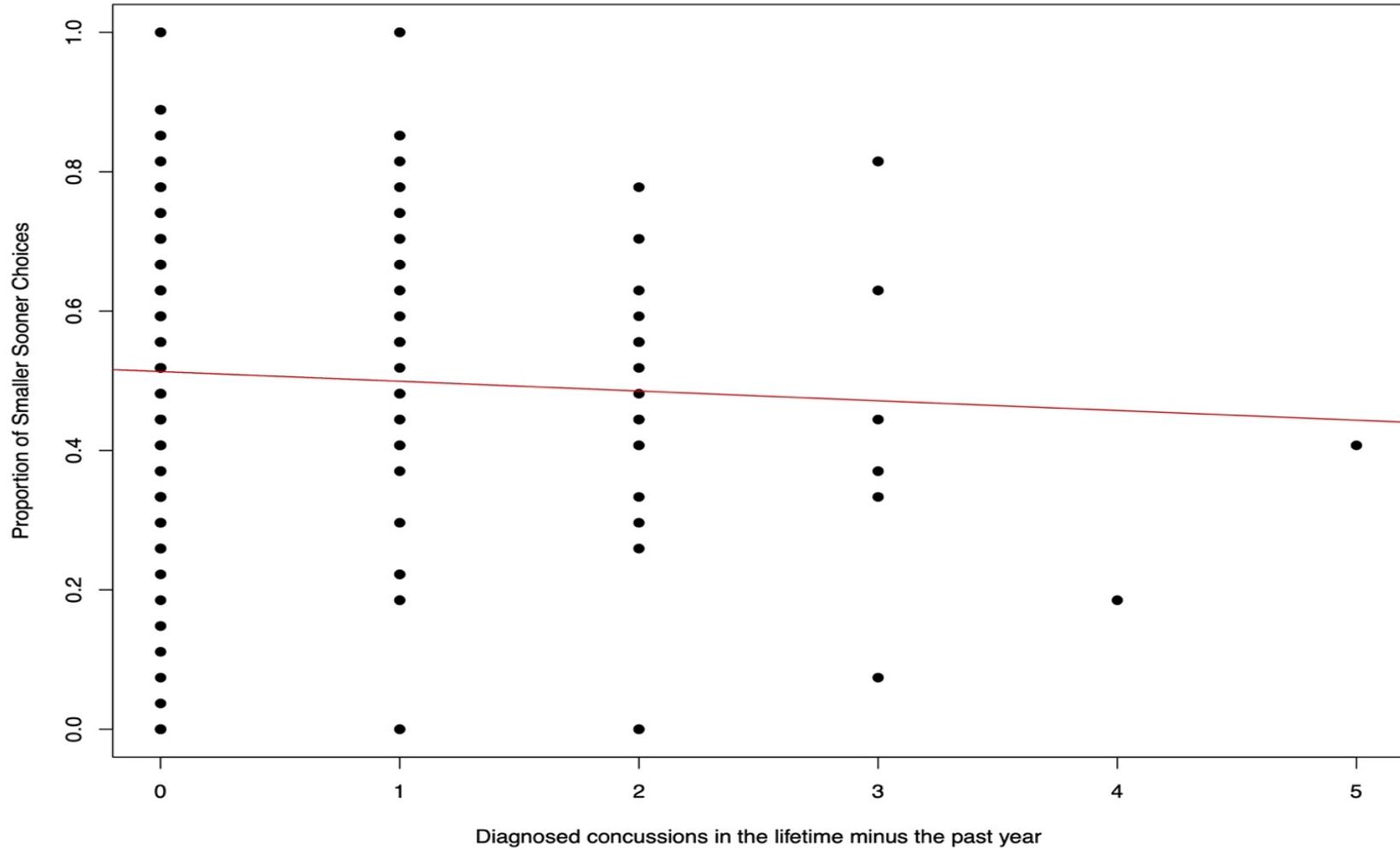
*Scatterplot Between Years Spent Playing American Football and Kirby k*



*Note.* Each dot is an individual participant, and the red line is a regression line added to plot.

**Figure C4**

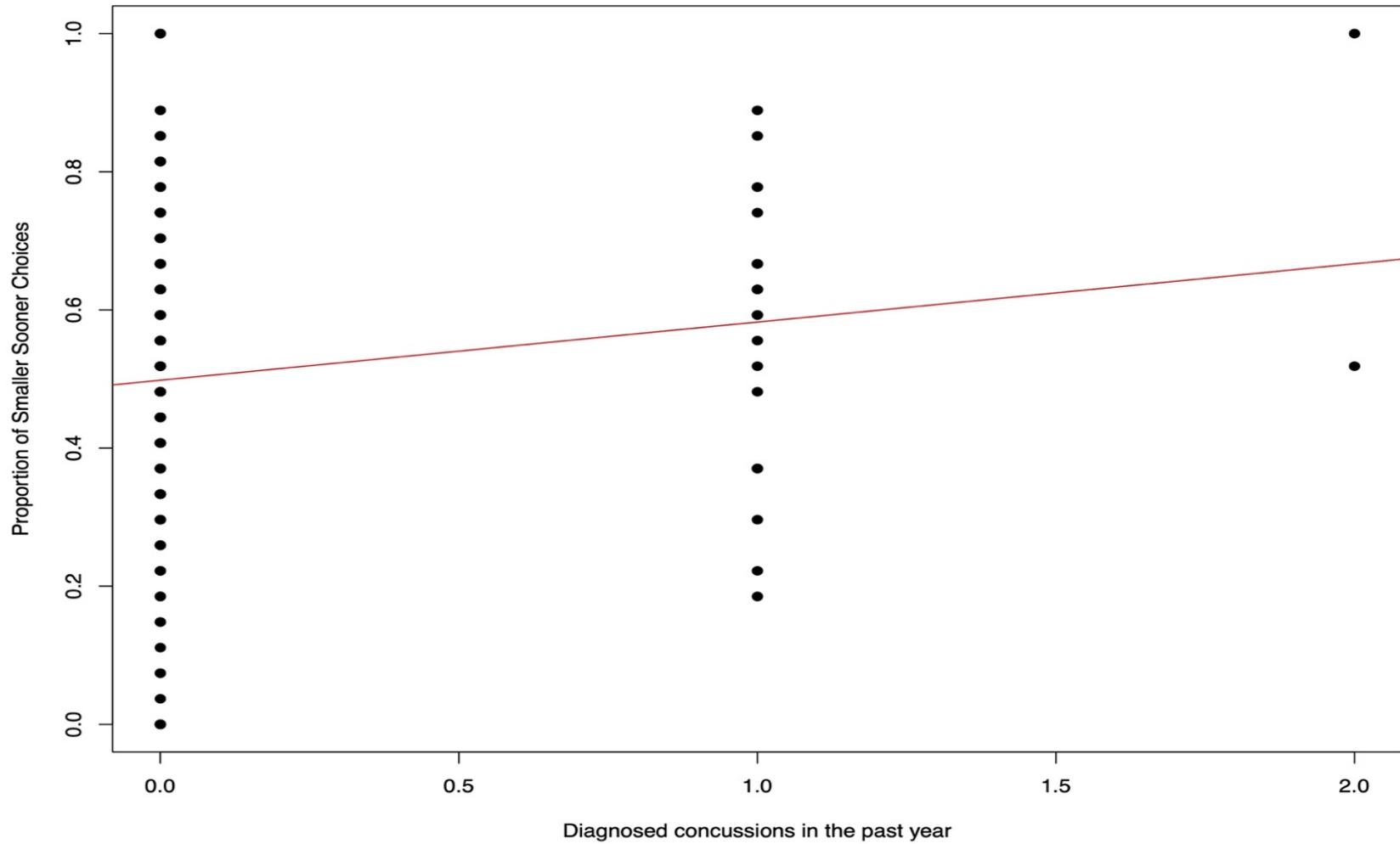
*Scatterplot Between Diagnosed Concussions in the Lifetime Minus the Past Year and Proportion of Sooner Smaller Choices*



*Note.* Each dot is an individual participant, and the red line is a regression line added to plot.

**Figure C5**

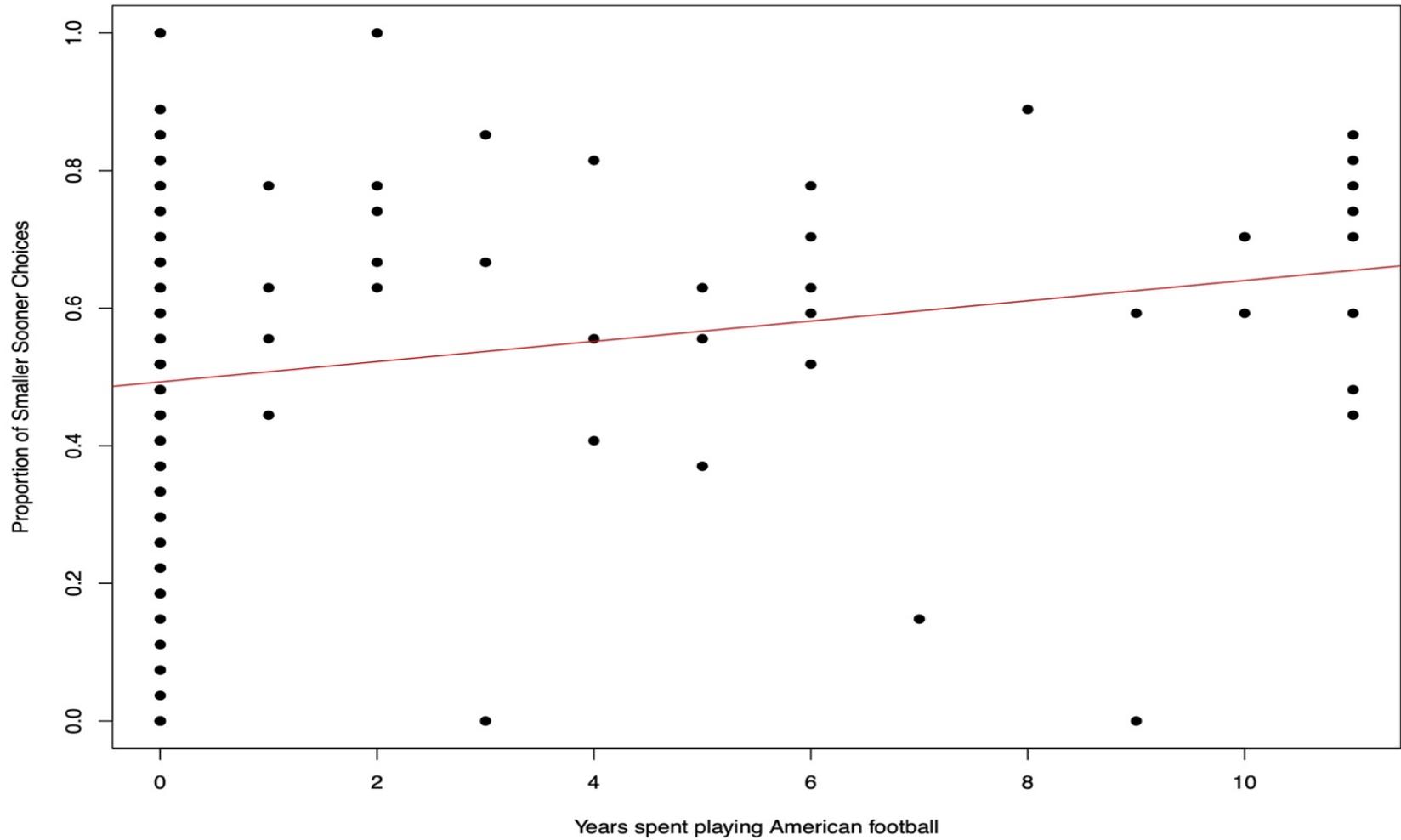
*Scatterplot Between Diagnosed Concussions in the Past Year and Proportion of Sooner Smaller Choices*



*Note.* Each dot is an individual participant, and the red line is a regression line added to plot.

**Figure C6**

*Scatterplot Between Years Spent Playing American Football and Proportion of Sooner Smaller Choices*



*Note.* Each dot is an individual participant, and the red line is a regression line added to plot