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Everyday discrimination and satisfaction with nature experiences

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Introduction: There is growing interest in creating public green spaces to promote health. Yet, discussions about these efforts often overlook how experiences of chronic discrimination—which may manifest as racism, sexism, or homophobia, and more—could undermine satisfaction with nature experiences.

Methods: Using data from the 2018 wave of the National Opinion Research Center (NORC) General Social Survey (GSS), we quantified associations of frequency of everyday discrimination, operationalized using the Everyday Discrimination Scale (EDS, the primary independent variable), with respondents' perceptions of nature experiences and with their reported time spent in nature. Specifically, we quantified associations with the following three variables: (1) dissatisfaction with day-to-day experiences of nature, (2) not spending as much time as they would like in natural environments, and (3) usually spending at least one day per week in nature. We used survey-weighted robust Poisson models to estimate overall associations, and also stratified analyses by racial/ethnic and gender identity categories.

Results: Of 768 GSS respondents, 14% reported dissatisfaction with nature experiences, 36% reported not spending as much time as they would like in nature, and 33% reported that they did not spend at least one day per week in nature. The median non-standardized EDS, coded such that a higher value indicates greater frequency of discrimination, was 11 (interquartile range: 8, 15). Prevalence of reporting dissatisfaction with day-to-day experiences in nature was 7% higher in association with every one unit increase in EDS score above the median (PR: 1.07, 95% CI: 1.02–1.11). The prevalence of reporting not spending as much time as one would like in nature was 2% higher for every unit increase in higher than median everyday discrimination frequency (PR: 1.02, 95% CI: 1.00–1.05). Higher than median frequency in everyday discrimination was not associated with spending less than one day per week in nature. Race/ethnicity and gender identity did not modify associations.

Conclusion: Greater frequency of everyday discrimination is associated with less satisfaction with experiences in nature. This relationship could undermine efforts to promote health equity through green interventions.

KEYWORDS

green space, nature-based solutions, everyday discrimination, discrimination, parks

Introduction

Across the world, cities are investing in green infrastructure—planting trees, creating parks, and more—to promote population and planetary health (1, 2). These initiatives are supported by mounting evidence that green space availability supports well-being and health equity (3, 4). Scholars posit that green spaces can promote health through a

myriad of pathways, such as by enhancing physical activity (5), social cohesion (6), and immune function (7). Other pathways include mitigating environmental hazards [e.g., storm water (8), heat (9, 10), noise (11)] and reducing stress (12, 13). Yet, to date, most environmental health research has overlooked the impacts of sociocultural contexts and personal identities (e.g., race and gender) on green space use and satisfaction. Without consideration of these contexts, green space creation may fail in its goals to support health and justice.

Systems and structures of inequities and discrimination have impacted the spatial distribution of green spaces, as well as perceptions and patterns of their use. For example, more vegetation is often found in wealthier and Whiter neighborhoods than in poorer, minoritized communities (14–17). This is a situation of distributive injustice (18), which has been linked to historical systems of racism and marginalization, including mortgage discrimination (19, 20) and Jim Crow era separate-but-equal policies (21). Early efforts to create, manage, and conserve parks were instilled with eugenic and racist ideologies; the “great outdoors” was conceptualized by and for cisgender White American men (22). Indigenous knowledge was ignored when decisions about natural resource management and regulation were made (23), and park creation efforts perpetuated the exclusion of minoritized groups (22). Leadership, practices, and policies concerning park creation and management resulted in minimal park and outdoor space for marginalized people to enjoy safely. Despite the passage of the Civil Rights Act in 1964, exclusionary and discriminatory practices, including policing and enforcement of racial boundaries and racially restrictive covenants persist (24).

The intermingling of these policies with historical and contemporary violence may have important implications for green space quality, availability, and accessibility (16, 24–26). These practices may also overlap with experiences of everyday discrimination, defined as subtle and chronic forms of discrimination that are directed against those holding marginalized identities (27), including ones defined by race, ethnicity, gender, sexual orientation, age, socioeconomic position, and disability status. Everyday discrimination manifests in different ways. For example, in the case of gender identity, everyday discrimination may manifest as naive assumptions about a woman’s preferences or abilities; their work or caretaking roles, or by offering different gender-stratified opportunities (27). Racialized everyday discrimination may be subtle and indirect and manifest in ways such as increased surveillance or expectations about intelligence or preferences (27).

Everyday discrimination may lead to feelings of exclusion or dissatisfaction in public natural spaces (27, 28). Prior experiences of everyday discrimination may cause individuals to limit social interactions (29); this may include limiting time in public parks or natural spaces (30). Women have been found to be less represented in public parks as compared to men (28, 31, 32), potentially explained by concerns over safety or harassment in public green spaces (33). Social and cultural norms and expectations around gender roles, such as family caregiving and prioritizing the needs of others, may also explain more frequent park use among men than women (34). For example, in one study, women noted that, beyond work and family care responsibilities, they had little time left for

personal activities such as park visitation (34). Transgender or non-binary individuals may avoid visiting public green spaces because of concerns over safety. They may also change their behaviors in anticipation of harassment and discrimination (e.g., preparing an exit strategy, altering their usual clothing), though in some cases, they may actively resist and exist despite these concerns (35, 36). Perceptions of discrimination and exclusion, fear of crime, or policing (33) could also explain under-representation of racially or ethnically minoritized groups (22, 24, 37). The intersection of multiple marginalized identities may intensify these strategies (27, 32, 36, 38). Yet, there has been little consideration of how sociocultural contexts and chronic experiences of oppression give rise to inequities in green exposures, experiences, and perceptions. Failure to address and acknowledge these critical questions may unintentionally perpetuate and reinforce inequities and cause public health and environmental health scientists to fall short in their antiracist and social justice commitments (29, 39–43).

We leveraged data from the National Opinion Research Center (NORC) General Social Survey (GSS) of American households to quantify associations between everyday discrimination and satisfaction with experiences in nature. In 2018, a subset of GSS participants provided data on perceptions of nature experiences and chronic discrimination. We hypothesized that respondents who reported high levels of chronic discrimination in everyday life would also be dissatisfied with their experiences and time spent in nature. This investigation responds to recent calls for environmental health researchers to explicitly consider the role of social conditions and systems of marginalization in creating and perpetuating environmental exposures and health inequities (40).

Methods

Study design and data

We conducted a cross-sectional study using data from the 2018 wave of the National Opinion Research Center (NORC) General Social Survey (GSS) administered at the University of Chicago. The GSS is a biannual, household-based, multistage cluster-sampled survey of a representative sample of non-institutionalized adults ages 18 and older in the continental United States. Computer-assisted personal interviews were conducted with the 2018 survey participants ($N = 1,173$, response rate = 59.5%) (39, 44). After the computer-assisted personal interviews were conducted, GSS participants responded to additional questions in a self-administered questionnaire (45). The GSS administers questions in three different “ballot” forms; some questions are unique to a single ballot. Because respondents do not have to respond to the complete survey, the three-tiered ballot design reduces respondent burden. We limited our analysis to Ballot 3 respondents (46), which contains the subsample that responded to questions about experiences in nature (i.e., public parks, gardens, or trails). The original GSS was approved by the IRB of the University of Chicago. Given the use of publicly available and deidentified data from the GSS in the present analysis, it is considered non-human subjects research and did not require additional IRB approval.

Everyday discrimination

We operationalized everyday discrimination using the abbreviated version of the Everyday Discrimination Scale (EDS), administered by GSS investigators (42). The abbreviated EDS includes five items that assess frequency of day-to-day experiences of interpersonal discrimination. GSS participants responded to the following: In your day-to-day life, how often have any of the following happened to you: (1) You are treated with less courtesy or respect than other people; (2) You receive poorer service than other people at restaurants or stores; (3) People act as if they think you are not smart; (4) People act as if they are afraid of you; (5) You are threatened or harassed. For each item, participants selected one of the following options: (1) Almost every day, (2) once/week, (3) a few times per week, (4) a few times per year, (5) less than once a year, or (6) never. We calculated a single EDS by reverse coding the scores and summing them, such that a higher value represents greater frequency of discrimination. After this coding, the maximum possible unstandardized EDS value is 30. This score would represent the highest possible frequency of discrimination. We also calculated a standardized EDS by *z*-score standardizing the reverse-coded responses to each question and summing the *z*-scores together.

Nature experiences

Three variables representing perceived experiences and time spent in nature served as the primary dependent variables. These variables were ascertained from the following responses to questions in the 2018 wave of the NORC GSS: (1) I am satisfied with my day-to-day experience of nature; (2) I spend as much time as I would like in natural environments; and (3) Usually, I spend time in natural environments, such as public parks, gardens or trails, at least once a week. Response options were the following: (1) strongly agree, (2) somewhat agree, (3) somewhat disagree, and (4) strongly disagree. We created binary variables, coded 1 = somewhat disagree/strongly disagree, 0 = strongly agree/somewhat degree.

Additional variables

We created a three-level marginalized gender identity variable using responses to the following question asked of participants in the self-administered questionnaire version of the 2018 GSS: "What is your current gender?" Response options (using GSS terminology) were the following: (1) "woman", (2) "man", (3) "transgender", and (4) "a gender not listed here". We combined the woman ($n = 375$), transgender ($n = 1$), and other/not listed ($n = 1$) categories to create a variable capturing marginalized gender identities (compared to those who identified as a man). Of the 789 respondents of the 2018 GSS Ballot 3, 83 were missing responses to this question. We created a third, missing gender category for these 83 Ballot 3 respondents. We coded race/ethnicity using self-reported race from the 2018 GSS. To account for small cell counts within individual categories, we created a binary variable, coded 1 to indicate having a marginalized racial or ethnic identity (Black/African American, American Indian/

Alaska Native, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian, Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander, other race, Hispanic) and 0 to represent having a privileged identity (i.e., non-Hispanic White identifying individuals). Five of the Ballot 3 participants were missing data on self-reported racial/ethnic identity; we excluded these five people from the analysis.

To capture occupational status of the GSS sample, we created a categorical variable from the following question: "Last week, were you working full-time, part-time, going to school, keeping house, or what?" We coded the categorical variable as follows: (1) Working for pay, part or full time; (2) Unemployed, retired, not working due to illness/vacation/strike; (3) In school; (4) Keeping house; and (5) Other.

Analysis

We used survey weights provided by GSS investigators to account for the complex survey design. In analyses, we ran separate models for each of the primary dependent variables, each coded as a binary term; 1 indicated dissatisfaction with nature experiences, inability to spend as much time as they would like in nature, or spending <1 day per week in nature, and 0 indicated satisfaction with nature experiences, ability to spend as much time as they would like in nature, and usually spending at least once per week in nature. The independent variable in all analyses was the standardized EDS score. Because nearly every member of a marginalized population likely experiences some form of discrimination, a reference value of zero may not reflect an absence of experiences of discrimination. Indeed, studies have found that, compared to those who report experiences of discrimination, those who report no discrimination experience worse or similar levels of adverse health outcomes (47–50). For example, in one study, Black women who reported that they usually tolerated unjust treatment had over four-fold higher prevalence of hypertension as compared to Black women who respondents who responded (47). Others have found that marginalized identities deny having experienced discrimination, even when it has occurred (51). These studies have posited other processes affecting the report of discrimination, like inability to perceive discrimination at the personal level, suppression of reactions to discrimination due to societal expectations and restrictions, avoidance of discomfort owing to recognition of having been the target of discrimination, or internalization of unfair treatment (47–50). Thus, we operationalized the EDS by centering the standardized score at the median of the distribution in the Ballot 3 sample. We modeled the median-centered EDS score as a linear term. We identified linear coding as optimal by running and comparing sets of models with the variable coded as a natural cubic spline term with 3 and 2 degrees of freedom, and then again coded as linear. We identified the parameterization that was associated with the smallest AIC statistic, taking into account all three dependent variables (Supplementary Materials S1). We also preferred a linear parameterization because it simplifies translation of results.

Because the three dependent variables in this analysis were binary and prevalent, we attempted to estimate associations

between the EDS and the three nature experience variables using log-binomial models. Log binomial, rather than logistic regression models, are appropriate in contexts such as this with a common outcome. By contrast, logistic models overestimate prevalence or risk ratios (52). However, the log-binomial models failed to converge. Thus, we used survey-weighted Poisson regressions with robust variance to estimate associations, which are an appropriate alternative to log-binomial approaches (53–55).

We developed a directed acyclic graph (DAG) to conceptualize relationships among measured and unmeasured confounders and identify a minimally sufficient adjustment set for the analyses. In addition, the DAG illustrates hypotheses about the ways by which marginalized identities might be related to green space availability, nature experiences, and everyday discrimination (56) (Supplementary Materials S2). As depicted in the DAG, we conceptualize race as a social construct that is the product of historical and present-day processes, policies, and practices. We consider individual-level race/ethnic identity as a variable that captures people who, because of social, cultural, economic, and/or historical processes and systems (56, 57), may experience high levels of everyday discrimination. We conceptualize gender identity as a social construct that has implications for experiences of discrimination, and for gendered norms and cultural expectations (58). Based on the DAG and *a priori* hypotheses, we adjusted all models for working status (coded working part time/full time for pay, unemployed/retired, keeping house, in school, other), US Census region (categories presented in Table 1), and age.

We explored effect measure modification of associations by categories of racial/ethnic and gender identity. To do so, we reran models with additional inclusion of interaction terms between the EDS score term and either gender or racial/ethnic identity (as well as single covariates gender or racial/identity). While we recognize that individuals hold multiple identities, we did not have sufficient statistical power to explore modification by intersectional identities. We quantified statistical evidence of heterogeneity across strata of the modifiers by conducting regression-based likelihood test of interactions, comparing nested models with and without interaction terms (59).

From all model output, we interpret the exponentiated Beta coefficients as the change in the prevalence of the nature experience variable associated with every one-unit increase in higher than median everyday discrimination frequency. All analyses were conducted using the survey package in R (Version 4.2.2) (60, 61).

Results

Table 1 presents descriptive statistics on the study population. GSS Ballot 3 participants were located across the United States, with the largest proportions living in the South Atlantic, Pacific, and Eastern North Central Census regions. The median age of participants was 40 years [Interquartile Range (IQR): 28, 58]. A slightly higher proportion of participants identified as a marginalized gender identity than as a man (Proportions: 0.50 and 0.42, respectively). Most participants identified as White (Proportion: 0.73) and were working for pay (either part or full

TABLE 1 Survey weighted descriptive statistics for ballot 3 respondents included in the analysis.

Variable	Median and interquartile range or proportion (N = 768)	SE
Age (years)	40 (28, 58)	1.26 ^a
Discrimination scale, standardized	-0.47 (-2.6, 2.16)	0.13 ^a
Discrimination scale, unstandardized	11 (8,15)	0.25 ^a
Gender identity ^b		
Man	0.42	0.02
Marginalized gender identity	0.50	0.02
Not reported	0.08	0.01
Racial/ethnic identity		
Non-Hispanic White	0.73	0.02
Non-Hispanic Black	0.16	0.01
Other	0.06	0.01
Hispanic/Latinx	0.05	0.01
Employment status		
Working for pay	0.61	0.02
In school	0.06	0.01
Keeping house	0.10	0.01
Other	0.02	0.01
Unemployed, not working due to illness/vacation/strike, or retired	0.22	0.02
Region		
Eastern North Central	0.16	0.02
Eastern South Central	0.07	0.02
Middle Atlantic	0.09	0.01
Mountain	0.06	0.02
New England	0.06	0.02
Pacific	0.17	0.02
South Atlantic	0.22	0.03
Western North Central	0.04	0.01
Western South Central	0.13	0.02
Satisfied with experience in nature		
Yes	0.86	0.02
No	0.14	0.02
Spend as much as time would like in nature		
Yes	0.64	0.02
No	0.36	0.02
Spend at least one day per week in nature		
Yes	0.67	0.02
No	0.33	0.02

SE, standard error.

^aStandard error is associated with the median of the distribution.

^bRespondents were asked to report their current gender identity and given the options of man, woman, transgender, or other gender not listed. Here, the marginalized gender identity category includes respondents who reported their gender identity as either woman, transgender, or "other/not listed".

time, Proportion: 0.61). Many participants said that they were satisfied with their time in nature, that they experience as much time as they would like in nature, and that they spend at least one day per week in nature (Proportions: 0.86, 0.64, 0.67, respectively). The median of the unstandardized EDS score, coded such that higher values indicate greater frequency of discrimination was 11 [Interquartile Range (IQR): 8–15, Table 2]. The unstandardized mean of frequency of everyday discrimination was modestly higher among people who reported being a member of a marginalized racial group as compared to non-Hispanic White (Mean: 11.9, SE: 0.4 for individuals with

TABLE 2 Distribution of the standardized and unstandardized everyday discrimination score, reverse coded such that higher values indicate more frequent every discrimination.

	Unstandardized		Standardized	
	Median (IQR)	Mean (SE)	Median (IQR)	Mean (SE)
Overall	11 (8, 15)	11.6 (0.2)	-0.47 (-2.57, 2.16)	0.16 (0.13)
Race/ethnicity				
Non-Hispanic White race/ethnicity	11 (8,14)	11.6 (0.2)	-0.47 (-2.44, 1.99)	0.11 (0.15)
Hispanic, Black, and other race/ethnicities	11 (8, 15)	11.9 (0.4)	-0.42 (-2.68, 2.31)	0.26 (0.30)
Gender identity				
Identified as a man	11 (9, 15)	11.9 (0.3)	-0.21 (-1.88, 2.44)	0.31 (0.19)
Identified as a woman, trans, or other gender identity	11 (8, 14)	11.6 (0.3)	-0.51 (-2.62, 2.00)	0.11 (0.21)
Did not report a gender identity	9 (7, 14)	11.0 (0.5)	-1.52 (-3.09, 1.97)	-0.36 (0.40)

IQR, interquartile range; SE, standard error.

marginalized racial/ethnic identities, Mean: 11.6, SE: 0.2 for non-Hispanic White individuals) and the median was the same (11). Everyday discrimination was reported to occur more frequently by respondents who identified as men (Mean of the unstandardized score: 11.9, SE: 0.3) as compared to participants who identified as members of marginalized gender groups (Mean of unstandardized score: 11.6, SE: 0.3).

Association between everyday discrimination and nature experiences

Prevalence of dissatisfaction with nature experiences was 7% higher in association with every one unit increase in frequency of everyday discrimination above the median (PR: 1.07, 95% CI: 1.02–1.11, Table 3). The prevalence of reporting not spending as much time as one would like in nature was 2% higher in association with every one-unit increase in the frequency of everyday discrimination above the median (PR: 1.02, 95% CI: 1.00–1.05). Frequent everyday discrimination beyond the median was not associated with spending less than one day per week in nature (PR: 1.00, 95% CI: 0.97–1.04). Neither race nor gender identity modified associations.

Discussion

In this analysis of a nationally representative sample of U.S. adults, a higher proportion of respondents reporting higher frequency of everyday discrimination also reported low levels of satisfaction with their day-to-day experiences in nature, relative to respondents who reported lower frequency of discrimination. Higher frequency of discrimination was also modestly associated with respondents' reporting that they did not spend as much

TABLE 3 Prevalence ratio (PR) estimates of associations between everyday discrimination and poor nature experiences, overall and stratified by marginalized gender and racial/ethnic identities^a.

	PR	LL	UL	p for LRT
Not satisfied with experience in nature				
Overall	1.07	1.02	1.11	
<i>Racial/ethnic identity</i>				
Non-Hispanic White	1.08	1.03	1.14	0.4
Marginalized racial/ethnic group	1.03	0.93	1.13	
<i>Gender identity</i>				
Men	1.02	0.95	1.10	0.4
Marginalized gender identity	1.09	1.03	1.15	
Gender identity not given	1.18	0.90	1.56	
Do not spend as much time as you want in nature				
Overall	1.02	1.00	1.05	
<i>Racial/ethnic identity</i>				
Non-Hispanic White	1.03	1.00	1.06	0.6
Marginalized racial/ethnic group	1.02	0.96	1.07	
<i>Gender identity</i>				
Men	1.01	0.97	1.05	0.7
Marginalized gender identity	1.04	1.00	1.07	
Gender identity not given	0.97	0.88	1.07	
Do not spend at least one day per week in nature				
Overall	1.00	0.97	1.04	
<i>Racial/ethnic identity</i>				
Non-Hispanic White	0.99	0.94	1.04	0.2
Marginalized racial/ethnic group	1.04	0.99	1.09	
<i>Gender identity^b</i>				
Men	1.01	0.96	1.06	0.3
Marginalized gender identity	1.01	0.97	1.07	
Gender identity not given	0.91	0.80	1.04	

PR, prevalence ratio; LL, lower limit; UL, upper limit, LRT, likelihood ratio test.

^aPR estimates are derived from survey-weighted Poisson regression models with robust standard errors. Models are adjusted for occupational status, age, and US Census region. The primary independent variable was the everyday discrimination score, standardized and centered at the median of the distribution. PR estimates can be interpreted as the incremental increase in prevalence associated with every one-unit increase in the everyday discrimination score above the median of the distribution of the score within the study population.

^bRespondents were asked to report their current gender identity and given the options of man, woman, transgender, or other gender not listed. Here, the marginalized gender identity category includes respondents who reported their gender identity as either woman, transgender, or "other/not listed".

time as they would like in nature. However, more frequent discrimination was not associated with absolute amount of time spent in nature, assessed using respondents' self-reports of spending time in nature at least once per week. These results suggest that everyday discrimination has greater implications for subjective satisfaction with nature experiences, rather than with ability to spend at least one time per week in nature.

From this study, we cannot ascertain if respondents' reports of experiences of discrimination occurred in natural settings, nor can we establish a causal link between having experienced discrimination in a natural setting and subjective satisfaction with nature experiences. In fact, some may seek out nature experiences as a refuge (62). It is possible, however, that at least a few of the reported experiences of discrimination occurred when respondents were visiting nature. There have been reports of such incidents in the media. For example, in 2020, Amy

Cooper, a White woman walking her dog without a leash in Central Park, made false claims to the police of violence from Christian Cooper, a Black birdwatcher, after he asked that she leash her pet per the park rules (37). Experiences of everyday discrimination have been documented in other public spaces, including metro platform benches in Milan, Italy (63).

Racism manifests at institutional, personally mediated, and internalized levels (64). These levels are interrelated (65) and may reinforce one another to produce adverse outcomes (66), including dissatisfaction with nature experiences. For example, qualitative interviews with Black community members living near Cedar Hill State Park, Texas revealed that prior experiences of racialized discrimination, perceptions of the public park as a “White space”, and a long history of institutional racism that resulted in segregation from public spaces contributed to negative perceptions of the park (67). The lower levels of satisfaction with nature experiences, expressed by respondents who reported greater everyday discrimination, may be explained, at least in part, by a lack of amenities [e.g., picnic tables, shade trees, drinking fountains (68)] or a preponderance of “disamenities” (e.g., litter, crime) (69, 70) in green spaces most accessible to them. Indeed, racialized, ethnic, or income based spatial disparities in the prevalence of positive (or negative) park characteristics have been observed in some, though not all, geographic areas (71–73). The lack of amenities, or the preponderance of “disamenities”, could undermine satisfaction with nature experiences. For example, in a study based in the Netherlands, higher availability of green spaces was associated with greater satisfaction with one’s neighborhood. However, the association was mediated by self-reported green space quality (74).

Race/ethnicity is only one identity that may contribute to experiences of discrimination. There is a small body of evidence suggesting that fear makes women modify their behaviors in urban settings (75, 76) and contributed to reduced park use among women and marginalized racial/ethnic groups (77). Research has also shown that green interventions contribute to feelings of fear in women (32) but less so among men (78). Also, those who identify as transgender or non-binary have been shown to avoid public green spaces because of concerns over safety or harassment (35, 36).

Creation of green spaces has been posited to be a promising intervention to support health and well-being (79). However, previous research has suggested that satisfaction with local green spaces is a more important predictor of well-being than its availability or use (80). However, in our analysis, we found that a higher proportion of individuals reporting more frequent everyday discrimination also reported modestly lower levels of satisfaction with their experiences in nature. Thus, everyday discrimination and its association with satisfaction with nature experiences may limit green spaces in their full potential for health promotion.

We acknowledge several limitations in this analysis. First, because of a relatively small sample size, we were underpowered to explore effect measure modification of associations by intersectional marginalized identities. Also, we acknowledge two limitations related to the coding of gender identity. First, the GSS included transgender as a separate category from man and woman,

rather than including this with the self-identified gender category and adding a non-binary option (i.e., men, women, or non-binary) (45). Second, based upon the methods used to collect gender, we grouped together what we assume are cis-gendered women and transgender respondents to capture the experiences of marginalized gender identities. We combined these categories because of small sample sizes and to allow comparison of associations with presumably cis-gendered men. However, this may not reflect the true identities of people within these categories. As such, we cannot disentangle the unique experiences of trans-men, trans-women, non-binary individuals, and cis-gendered women separately, for whom discrimination may manifest differently (51). For example, transgender people may experience rejection by their own family, or discrimination in healthcare settings (81), while women may experience disproportionately high expectations with respect to caregiving (82). This is also an issue for the grouping of racial/ethnic groups into marginalized vs. communities. Each marginalized group may have unique experiences, perceptions, or relationships with nature, reflecting distinct cultural, historical, and contextual backgrounds. Nevertheless, in the current analysis, because of low statistical power, we grouped a variety of racial/ethnic identities together. This grouping may have inadvertently obscured important relationships within each racial/ethnic group, which remains an important consideration for future research that explores questions such as the current one. Next, we did not have data on experiences of discrimination in parks or natural spaces, themselves. Instead, we used a measure of everyday discrimination that reflects experiences that may be recurrent but, in comparison to measures that explicitly assess other forms of interpersonal discrimination (e.g., traumatic experiences or major but acute events like wrongful termination or inhibition from accessing resources like housing), provides little insight into the context of severity or domain (83). Additionally, the GSS did not include the follow-up EDS question that asks respondents to report their perceptions for the reasons for inequitable treatment. Therefore, we cannot attribute experiences of discrimination to a specific identity. Also, the EDS does not capture all items that may be relevant to all forms of discrimination, nor do all respondents interpret the measure similarly. Previous work has shown that the interpretation of items on the EDS may vary according to sociodemographic or social-psychological factors and experiences (84–87). Additionally, some items within the EDS may not be as salient for all forms of discrimination. Other measures capturing manifestations of discrimination, such as gender or intersectional forms, for example, may also assess being treated with less courtesy or respect but may also ask about expectations of gender conformity, having your identity used as an insult, or experiencing sexual harassment (85, 88). This lack of specificity may mask important relationships that are salient to understand associations within specific identities. Further, the GSS defined nature as “parks, trails, and gardens”, only. This definition excludes many other types of green spaces, such as trees and forests, which may lead to considerable misreporting. We were also unable to determine whether reports of “nature experience” are related to experiences in public parks, or to wild forests or trails. The GSS also did not ascertain information

on perceptions of green space quality or amenities, or safety features (e.g., lighting) in green spaces, which could mediate the association between discrimination and nature satisfaction. Finally, because we did not have access to small-area residential location data for the GSS respondents, we were unable to ascertain or adjust analyses for spatial measures of institutional or structural racism, such as present-day segregation or historical redlining, nor could we explore synergistic relationships between these measures with everyday discrimination.

Despite these limitations, we highlight several strengths of this work. To our knowledge, this is the first study to analyze the association of everyday discrimination with perceptions of nature experiences. Other strengths include the use of nationally representative survey data and our ability to adjust for several potential confounders, including employment status, age, and geographic region. In this study, we used a self-reported measure of everyday discrimination. Because this measure reflects respondents' perceptions of the world, it offers important insights into their personal interpretation of the lived experiences that may be intermediates on the pathway between structural determinants of oppression (e.g., historical redlining, medicalizing gender non-conformity) and experiences in nature (68, 69).

Conclusion

There is increasing interest in creating opportunities for people to interact with nature; these efforts are often motivated by interest in promoting population health (89). In previous work, scholars have identified inequities in green or natural space availability across neighborhoods as a critical issue of distributive injustice and a consequence of historical, institutional, and structural systems of oppression (15, 16, 19, 20). Here, we moved beyond the question of nature availability to consider whether frequent discrimination is associated with perceptions of nature experiences. This work responds to recent calls for environmental researchers to make good on promises—made by non-profit, academic, professional societies, and governmental agencies in the wake of the racial reckoning that occurred in the U.S. in 2020—to interrogate racism and other systems and structures of social oppression that perpetuate disparities (40). Our results also highlight the importance of efforts that normalize the presence of historically marginalized groups in nature. For example, following widely publicized racist event in Central Park, New York, and in the wake of protests over police brutality against Black Americans, a group of scientists, nature lovers, and students established Black Birders Week. This is week-long series of events dedicated to promoting diversity in birding and nature experiences, and to dismantling perceptions that people of color do not belong in natural spaces (90). Results from our analysis suggest that people who experience more frequent everyday discrimination are less satisfied with their experiences in nature and with the amount of time spent there. Further research is needed to elucidate the attributions of experiences of discrimination, mechanisms underlying associations between everyday discrimination and nature

experiences, and the intersecting and reinforcing impacts of different levels of societal marginalization on nature experiences. In addition, further research is needed to elucidate nature satisfaction as a causal intermediate on the pathway between discrimination and health outcomes. Results from this analysis point to the importance of considering the person-, cultural, and area-level contexts in which green spaces are situated and the need to dismantle systems of marginalization and oppression to build towards justice and equity when it comes to nature-based solutions.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <https://gss.norc.org/get-the-data>.

Ethics statement

The original GSS was approved by the IRB of the University of Chicago. Because we used publicly available and deidentified data from the GSS, our secondary data analysis was considered non-human subjects research and did not require additional IRB approval.

Author contributions

LS conceived of the research question and analysis plan, performed the statistical analyses, and led manuscript writing. JL contributed to analysis planning and decision-making, and wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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