



Sociocultural Context and Pre-Clinical Pain Facilitation: Multiple Dimensions of Racialized Discrimination Experienced by Latinx Americans are Associated With Enhanced Temporal Summation of Pain

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Abstract: The experiences of injustice and their impacts on pain among Latinx Americans are overlooked and understudied. Multidimensional and consequential experiences of racialized discrimination are common for Latinx Americans but have not been considered as factors relevant for enhanced pain experience or risk. In this study, we focused on the experiences of Latinx Americans living in Texas by assessing multiple dimensions of racialized discrimination (total lifetime discrimination, racialized exclusion, stigmatization, discrimination in the workplace or school, and racism-related threat and aggression) and a laboratory marker of central sensitization of pain (temporal summation of mechanical pain, MTS). Among 120 adults who did not have chronic pain, nearly all (94.2%) experienced racialized discrimination. Accumulated lifetime experience of racialized discrimination, as well as the frequency of each dimension of discrimination assessed, was associated with greater MTS. Results suggest that a process of discrimination-related central sensitization may start early, and may reflect enhanced pain experiences and pre-clinical chronic pain risk. Though replication is needed, results also indicate the discrimination and pain burden among Latinx Texans, and Latinx Americans broadly, are likely under-represented in the scientific literature.

Perspective: Racialized discrimination is multidimensional. Latinx Texans experience frequent discrimination that is associated with enhanced temporal summation of pain in the laboratory. Results indicate the importance of societal factors in pain processing and may reflect a mechanism of racism-related pre-clinical central sensitization observable before chronic pain onset.

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Key words: Pain disparities, injustice, stigma, racism, quantitative sensory testing.

Introduction

Racism is a primary driver of health inequity.⁶⁷ Interpersonal discrimination is one way that racism patterns health and disease along socially constructed demographic lines.^{33,67} Greater frequency of

racialized discrimination experiences are associated with subclinical markers of morbidity (eg, increased systemic inflammation, elevated blood pressure, blunted cortisol reactivity) as well as increased risk of chronic health conditions (eg, cardiovascular disease)

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and all-cause mortality.^{4,5,16,18,39,51,56,58} Among Black Americans, more frequent and pervasive (ie, across contexts) experiences of racialized discrimination are associated with greater clinical pain severity and interference^{11,19,20,43,45,46,65} and laboratory pain.^{24,43} Specifically, laboratory evidence that discrimination is associated with pain facilitation (ie, temporal summation of pain) among Black Americans with chronic pain implicates racialized discrimination in the inequitable burden of pain experienced by Black Americans.^{43,c.f.10} Other work has either collapsed across discrimination experiences based on any aspect of personal identity (eg, gender, ethnicity)^{9,23,27,46,50,57,60} or aggregated experiences of racialized discrimination across populations (eg, combining experiences of people with diverse minoritized and privileged racialized identities),^{25,70} identifying associations with worse clinical pain outcomes, but precluding specific investigation of racialized discrimination *within* racialized groups.^{44,68} Only 4 prior studies have examined within-group associations between racialized discrimination and pain among Latinx Americans: clinical research indicates an association with greater bodily pain in heterogeneous samples of Latinx Americans,^{3,12,19} although the only laboratory study found an unexpected negative association with mechanical temporal summation.⁵³ However, national or acontextual samples may obscure relevant diversity, and laboratory studies examining the relationship between pain and geographically and historically situated racialized discrimination experienced by Latinx Americans are lacking. Further, all prior studies in pain research have adopted a unidimensional conceptualization of discrimination.

Multi-level and multi-faceted racialized discrimination are a part of everyday life for many Latinx Americans.³⁴ Anti-Latinx discrimination is closely tied to racist and xenophobic attitudes toward immigrants, and harmful stereotypes about Latinx criminality that pervade the dominant American cultural narrative.¹⁴ This is exemplified by othering and dehumanizing labels, such as “illegal”, that are widely applied to Latinx individuals solely based on perceived racialized identity (“racialized illegality”).²¹ The racialized discrimination of Latinx individuals has deep historical roots and is institutionalized – appearing in modern practices, policies, and laws (eg, targeted deportation, restricted access to assistance services, suppression of legal rights). In Texas, despite the fact that many Mexican American families have longer histories on this land than the United States itself,^{6,36} Mexican Americans continue to face high levels of institutionalized racialized discrimination (eg, segregation,⁶⁶ environmental injustice,^{17,32} voter suppression⁵⁹), as well as interpersonal discrimination and racialized violence (most notably the deadly 2019 domestic terrorist attack in El Paso⁵⁵).

Within this critical context, we examined the relationship between experiences of different dimensions of racialized discrimination and a preclinical marker of pain facilitation (ie, temporal summation of mechanical pain; MTS) among Latinx Americans living in Texas. We

intentionally focused on the specific experiences of this population, recognizing the importance of historical and contextual factors that shape racialized discrimination experiences. This focus is consistent with recent calls for antiracist, diversity, and justice approaches to pain research.^{7,31,38,44,47} Our primary aim was to determine the relationship between discrimination and mechanisms of pain facilitation. We hypothesized that, overall, more frequent experiences of racialized discrimination would be associated with enhanced MTS. Although different dimensions of racialized discrimination have emerged as particularly impactful in other health domains (eg, racialized rejection was the strongest predictor of post-traumatic stress among Latinx and Black Americans living in Los Angeles),¹⁵ this is the first study to consider multiple dimensions of discrimination in the context of pain. Thus, our secondary aim to examine the relationship between different dimensions of racialized discrimination and MTS was exploratory.

Method

We conducted a secondary analysis of data collected across 6 cross-sectional studies focused on social factors and pain conducted between 2016–2020. All studies were conducted in the same laboratory, on the same equipment, using the same training and standardized protocols, and the same measures of mechanical temporal summation of pain and discrimination. Four of these studies involved on-campus recruitment and predominantly student samples, 1 study recruited non-student members of the local community, and 1 study involved open recruitment of both people on campus and the broader, local community. Student samples were recruited in 2 ways: via fliers posted on campus and through the undergraduate psychology participant pool. Students in the participant pool voluntarily choose studies in which they would like to participate (using an independent system that is not connected to participant data) and have the option to complete alternative assignments in lieu of research participation. Community samples were recruited using fliers posted in local businesses (eg, laundromats, barber shops, restaurants), Craigslist, and through relationships built with individual community members and community organizations. Individuals were not permitted to participate in more than 1 study, ensuring the independence of samples. Data were extracted to test the specific hypothesis that experiences of racialized discrimination would be associated with mechanical temporal summation amongst Latinx Americans. Therefore, only available data from Latinx participants on these variables are included here.

Participants

Eligibility criteria included being at least 18 years of age, no recent or current chronic or acute pain, and no use of pain medications within the past 3 days. All studies were approved by the Texas A&M University Institutional Review Board, participation was confidential, and participants either received course credit or

monetary compensation at a rate of \$12 to \$20 per hour (depending on the study) for their time. Prior to any study procedures, all participants were screened for eligibility and completed a detailed in-person informed consent process.

One hundred and twenty-one Latinx American adults enrolled and completed studies inclusive of study variables for extraction. However, 1 participant was excluded from the present analysis sample because they did not complete the discrimination questionnaire resulting in a final analysis sample of 120 participants (20.08 ± 3.88 years old, 61.7% female, 38.3% male, 70.8% from studies with on-campus recruitment, 26.7% from a study that included both community and campus recruitment, 2.5% from a study of non-student community members) that completed both the discrimination questionnaire and mechanical temporal summation procedure. Studies conducted later in the data collection window solicited more specific information on Latinx ethnic identity. Of the 68 participants for whom this more detailed information was available, 69.1% identified as Mexican, 4.4% as Salvadorian, 4.4% Brazilian, and <3% ($n \leq 2$) as each of the following: Puerto Rican, Cuban, Argentinian, Bolivian, Columbian, Costa Rican, Nicaraguan, Panamanian, Peruvian, and Venezuelan.

Terminology Statement

We considered several terms to describe the population we aimed to represent in this research (ie, Latinx, Latinu, Latine, and Latin@), prioritizing those that were most inclusive and representative of the diverse identities present in our local community. Consistent with the American Psychological Association's inclusive language guidelines² we ultimately selected Latinx at this time, though acknowledge criticisms and limitations of this term (eg, inconsistent with grammatical norms in Spanish and potential exclusion of indigenous identities) and commit to reexamine and update our language choice in future work.^{61,69}

Measures

Perceived Experiences of Discrimination Questionnaire

One hundred and twenty participants completed all items of the Perceived Experiences of Discrimination Questionnaire-Community Version (PEDQ-CV). The PEDQ-CV is a 17-item self-report survey that assesses experiences of racialized discrimination, which has been previously validated among Latinx/Hispanic American student and community samples.⁸ This questionnaire measures the overall lifetime experiences of racialized discrimination as well as 4 distinct dimensions of discrimination including racialized exclusion/rejection ("...have others ignored or not paid attention to you?"), stigmatization/devaluation ("...have others hinted that you must be lazy?"), workplace/school discrimination ("...have you been treated unfairly by coworkers or classmates?"), and racism-related threat/

aggression ("...have others threatened to hurt you?"). Participants reported the frequency of each experience due to their presumed racialized or ethnic identity on a scale from 1 (never) to 5 (frequently). Higher ratings indicated greater experiences of racialized discrimination. All items were averaged to obtain a total score of overall lifetime experiences of racialized discrimination and subscale items were averaged to obtain subscale scores. The PEDQ-CV demonstrated good internal reliability within our sample (overall lifetime: $\alpha = .90$; racialized exclusion/rejection: $\alpha = .77$; stigmatization/devaluation: $\alpha = .79$; workplace/school discrimination: $\alpha = .75$; racism-related threat/aggression: $\alpha = .84$).

Mechanical Temporal Summation

Stimuli for the MTS procedure were administered to the middle phalange of the middle finger using weighted punctuate probes with a flat contact area of .2mm in diameter. Using a previously reported procedure⁴³ participants first rated their pain in response to a single stimulus, and then their maximum pain in response to a series of 10 stimuli delivered at a rate of 1 stimulus/second, on a 0 (no pain) to 100 (worst pain imaginable) scale. A 128mN probe was used in all 6 studies, and MTS values were available for all 120 participants. MTS was calculated as the difference in pain ratings between the series of 10 stimuli and the single stimulus. Larger positive MTS scores indicate pain sensitization and greater summation of pain.

Other Measures

All participants also provided demographic information including self-identified sex, age, and race. We also extracted data on more specific racialized, ethnic, or cultural identity and/or familial nation of origin to improve the description and representation of the heterogeneity included within this Latinx American sample. Across studies, this was sometimes assessed via open-ended response to one of the following questions ("In terms of ethnic group, I consider myself to be..."; "What ethnic and racial group do you consider yourself?"; "What is your Nationality?"; "I was born in..."; "My mother was born in..."; "My father was born in..."; "My mother's ethnicity is..."; "My father's ethnicity is...") or via a follow-up question given to those identifying as Latinx American (ie, "Do you culturally identify with any of the following: Cuban, Dominican, Mexican, Puerto Rican, Salvadorian, Multiple ethnicities (please specify), Not listed (please specify), No").

Data Analysis

We conducted descriptive statistics on sample characteristics and to quantify the prevalence of discrimination experiences. We specifically examined the percentage of participants who reported no lifetime discrimination or no experience with any of the specific domains of discrimination (average total or subscale score = 1) relative to those who reported discrimination

Table 1. Sample Characteristics and Descriptive Results

	<i>N</i>	<i>MIN</i>	<i>MAX</i>	<i>MEAN</i>	<i>SD</i>	<i>PREVALENCE</i>	
Age	120	18	46	20.08	3.88		
Sex							
Female	74						
Male	46						
Racialized Discrimination [†]						<i>Any discrimination</i>	<i>No experience of this type of discrimination</i>
Overall Lifetime Discrimination	120	1	4.35	1.71	0.59	94.2%	5.8%
Exclusion/Rejection	120	1	4.5	2.28	0.88	87.5%	12.5%
Stigmatization/Devaluation	120	1	5	1.59	0.71	63.3%	36.7%
Workplace/School Discrimination	120	1	4.25	1.73	0.76	71.7%	28.3%
Threat/Aggression	120	1	4.5	1.30	0.57	37.5%	62.5%
Temporal Summation*						<i>Summation</i>	<i>Habituation</i>
128mN stimulus	120	-1	58	6.08	9.32	72.5%	.8%

NOTE. Untransformed (raw) values are presented in the table.

[†]The PEDQ-CV assesses the frequency of experiences of overall lifetime (total score) and 4 distinct dimensions (subscales) of racialized discrimination.

*Positive scores indicate summation/pain facilitation, whereas negative scores represent attenuation/habituation. The remaining participants demonstrated neither summation nor habituation (ie, their pain ratings were identical in response to a single stimulus and repeated stimuli).

experiences (average total or subscale score >1). Before conducting inferential statistics, variables were examined for normality and outliers were identified using graphical plots. The scores for 1 participant were identified as outliers on the following variables: overall lifetime discrimination and the race-related stigmatization/devaluation and threat/aggression subscales. We decided to retain the data from this individual to most accurately represent the range of discrimination experiences and to support external validity, but report results with and without this outlier where applicable. No other outliers were identified. MTS scores were logarithmically transformed for inferential statistical analyses to reduce a positive skew, which resulted in the removal of a single data point (the only negative MTS score) from inferential statistics. Data from this individual are, however, included in all other analyses. Although study procedures for collecting the variables of interest were identical across included studies, to probe for potential history effects or effects of other study components, we explored potential main effects of study (using dummy codes) on MTS prior to primary analyses. No main effect was found, and therefore all data are considered together. We also probed for potential effects of sex and age on MTS and report those relationships in the Results section.

Inferential statistics were conducted using the continuous discrimination frequency scores and log-transformed MTS scores. Bivariate Pearson correlations were conducted between MTS and the overall lifetime experiences of discrimination score, as well as each of the discrimination subscale scores. When indicated, multivariate linear regressions were used to determine the relationship between discrimination and MTS controlling for participant sex and age as potential confounds.

Results

Frequency of Discrimination Experiences

Almost all participants (94.2%) reported experiences of racialized discrimination within their lifetimes

(Table 1). Similarly, all dimensions of discrimination, except for racism-related threat and aggression, were experienced by the majority of participants. Participants in this sample also reported nearly the full range of frequencies of discrimination detectible using the PEDQ-CV (Table 1).

Frequency of Mechanical Temporal Summation of Pain (MTS)

The majority of participants demonstrated temporal summation, and variability in the degree of summation was observed across individuals (Table 1).

Associations With Potential Covariates

Age and sex were not significantly associated with overall lifetime discrimination or any of the specific dimensions of discrimination assessed (Age: $-.060 < r < .021$, $.514 < P < .870$; Sex: $-.590 < t < 1.663$, $.099 < P < .806$) nor MTS (Age: $r = -.015$, $P = .868$; Sex: $t(117) = 1.717$, $P = .089$).

Associations Between Discrimination and MTS

Greater frequency of overall lifetime discrimination experiences was associated with enhanced MTS ($r = .292$, $P = .001$). Exploratory analyses indicate a similar pattern – though varying in magnitude – across separate dimensions of discrimination, such that greater frequency of racialized exclusion/rejection ($r = .215$, $P = .019$), stigmatization/devaluation ($r = .232$, $P = .011$), workplace/school discrimination ($r = .271$, $P = .003$), and racism-related threat/aggression ($r = .262$, $P = .004$) were all associated with greater MTS (Fig 1). This association was stronger when the outlier was excluded from relevant analyses (overall lifetime: $r = .319$, $P < .001$; racialized stigmatization/devaluation: $r = .258$, $P = .005$, and racism related threat/aggression: $r = .305$, $P < .001$) indicating the relationship was not driven by this single

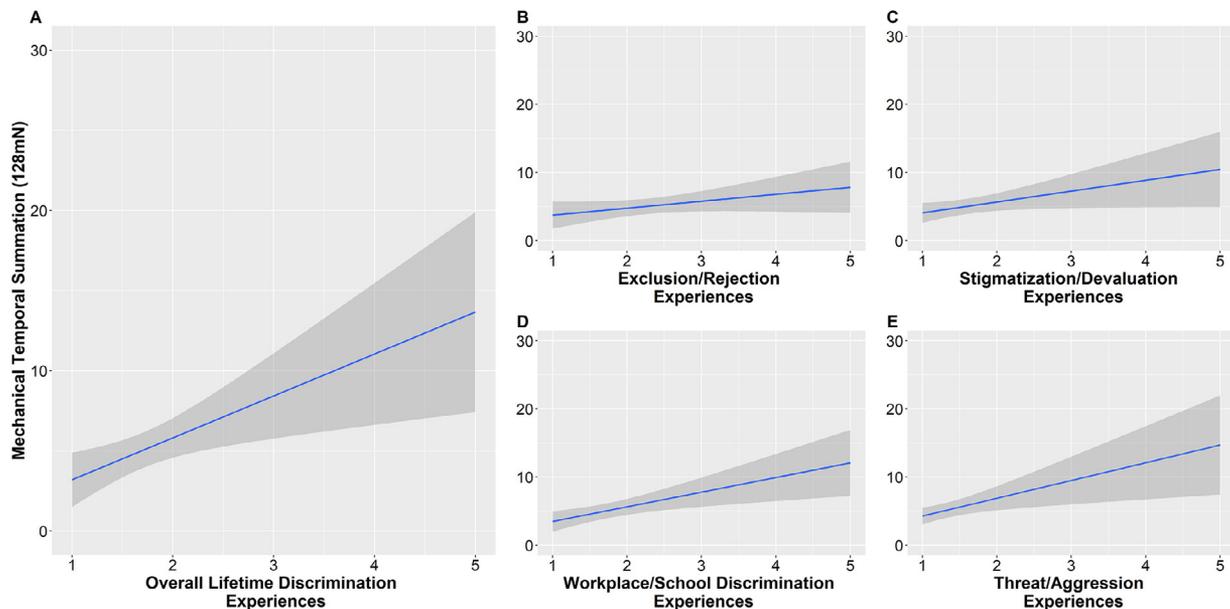


Figure 1. Latinx American experiences of racialized discrimination are associated with enhanced mechanical temporal summation of pain. Overall lifetime (A) and dimensions of discrimination (B–E) were assessed using the Perceived Ethnic Discrimination Questionnaire–Community Version. Raw, untransformed values ($N = 120$) are presented in the figure. The dark gray shaded area depicts the 95% confidence interval. All correlations are statistically significant ($P < .05$).

data point. These relationships also remain after controlling for participant age and sex using the full sample (overall lifetime: $\beta = .284$, $P = .002$; racialized exclusion/rejection: $\beta = .220$, $P = .016$; stigmatization/devaluation: $\beta = .213$, $P = .021$; workplace/school discrimination: $\beta = .276$, $P = .002$; racism-related threat/aggression: $\beta = .249$, $P = .006$), and when excluding the one outlier from relevant analyses (overall lifetime: $\beta = .307$, $P = .001$; stigmatization/devaluation: $\beta = .235$, $P = .012$; threat/aggression: $\beta = .287$, $P = .002$).

Discussion

In this study, we showed that multiple dimensions of the racialized discrimination experiences of Latinx Americans living in Texas are associated with enhanced mechanical temporal summation in a sample of young adults without chronic pain. The results of this study are noteworthy for several reasons.

First, they highlight the magnitude of pain-relevant racialized discrimination experiences among Latinx (predominantly Mexican) Americans within an important historical, sociopolitical, and geographical context. This focus revealed a burden of racialized discrimination greater than previously reported in national samples. Experiences of racialized discrimination in this community were pervasive – nearly all (94.2%) participants experienced racialized discrimination. The local focus of our study decreased the heterogeneity of place and context that is present in national samples, thus it is possible that previous national statistics diluted the prevalence of and obscured regional differences in discrimination experiences of Latinx Americans. Texans, in particular, experience anti-Mexican discrimination that is rooted in

a violent history over the land that is now Texas, shaped by the legacy of this history that has been culturally and structurally maintained.^{13,37,42} Another potential contributing factor is that the present sample included many young, non-immigrant, college students who on average – perhaps due to levels of relative privilege or sense of safety, or due to generational effects – are more likely to disclose racialized discrimination than older adults, immigrants, and people without college educations.⁴⁸ Another important consideration is the sociopolitical climate and historical context during data collection (2016–2020). Policy changes during this time likely exacerbated and enhanced experiences of overt and vicarious discrimination for Latinx Texans (eg, expanded deportation, uncertainty and erosion of the DACA program, family separation at the Texas border). National polls indicated that Latinx Americans experienced more racialized discrimination during this time period and concern or uncertainty about their place in America.^{35,40} Though likely attributable to these and other causes, such a high prevalence of discrimination indicates compounding racialized injustice. Given the relationship with pre-clinical pain facilitation identified in this study, this likely also points to an enhanced pain burden among Latinx Texans that is under-represented in the scientific literature.

Second, results add to the small but growing literature on the pain experiences of Latinx Americans. Although starkly understudied, prior research indicates an average profile of greater risk, yet lower reports, of chronic pain among heterogeneous samples of Latinx Americans as well as Mexican Americans in particular.^{28,29} However, this ostensible paradox is clarified by structural, cultural, and generational factors that influence pain reporting and access to care and

that may ultimately contribute to the underestimation of Latinx American pain burden.^{29,49} Hollingshead and colleagues recently demonstrated that linguistic assimilation (use of English relative to Spanish) and generational status of Mexican Americans were associated with greater chronic pain risk as well as greater insurance coverage and access to care – suggesting that multigenerational Mexican Americans may be more likely to receive a chronic pain diagnosis, and that factors associated with acculturation may increase pain risk.²⁹ Acculturation and generational status are known to also be associated with increased experiences of racialized discrimination and discrimination-related health burden.^{22,52} Prior literature has also demonstrated increased mortality and morbidity with each generation among Latinx Americans living in the United States, compared to first-generation Latinx immigrants; what has sometimes been referred to as the Latino Health Paradox.^{1,41} However, it is important to note that the Latino Health Paradox and preferential attributions to acculturation are often described within harmful narratives of individual responsibility related to “lifestyle choices” – to the exclusion of societal factors such as racism.^{44,62–64} Current results demonstrate accumulated discrimination experiences are associated with temporal summation of pain – a marker of central sensitization – which may reflect an increased risk for chronic pain. Taken together with prior findings, these results may reflect an enhanced pain burden among Latinx Americans that increases over time and across generations as a result of accumulated racialized discrimination exposure.

Third, the current study considers and demonstrates the complexity and multi-dimensional nature of racialized discrimination. This addresses a limitation of the extant literature on racialized discrimination and pain that has relied on unidimensional or disambiguated measures. In the present study, a similar pattern of discrimination-related pain facilitation was observed across dimensions, indicating that all forms of discrimination are associated with enhanced pain. However, differences in the magnitude of this relationship suggest some experiences may more powerfully contribute to enhanced pain. For example, the relationship between frequency of discrimination experiences and mechanical temporal summation was strongest for those reporting experiences of racism-related threat or aggression – the most severe and violent dimension assessed using the PEDQ. However, important future directions may focus less on which types of experiences are the strongest predictors of pain facilitation, and rather on ensuring the multidimensional nature of discrimination is considered, and that relevant experiences are not normalized, erased, or ignored.

Fourth, results add to growing literature on discrimination-related pain facilitation. Temporal summation of mechanical pain has been previously linked with discrimination in clinical contexts among people with chronic pain (ie, Black Americans with sickle cell disease⁴³), but here we demonstrate a similar relationship with multiple dimensions of lifetime racialized discrimination experiences in a non-chronic pain sample of

Latinx Americans. Rhudy and colleagues have recently reported subclinical spinal sensitization associated with experiences of discrimination among Native Americans without chronic pain.^{26,54} However, association with temporal summation of pain evoked using electric stimulation was not observed in their study, attributed to robust descending inhibition in their sample. Nonetheless, taken together, these studies suggest a process of discrimination-related central sensitization may start early and enhance the pain experiences and pre-clinical chronic pain risk of racialized groups.

There are some limitations that should be considered when interpreting the current findings. First, as an exploratory study, replication is needed. Our prioritization of external validity (ie, inclusion and representation of the lived experiences of racialized discrimination within our community) led us to a correlational design; however, this necessarily has lower internal validity than an experimental design, prohibiting causal inferences based on this study alone. Nonetheless, the use of a highly controlled laboratory protocol protects against some potential confounding. Future research may also probe different pain mechanisms using quantitative sensory testing techniques beyond MTS. Additionally, although this study focused on a more specific population in space and time, the experiences of Latinx Americans are not identical, and individual experiences of discrimination within our sample are likely influenced by unexamined factors (eg, colorism).³⁰ There are also limitations to our measurement of racialized discrimination. Although the strength of the PEDQ-CV is its multi-dimensional assessment, we expect important dimensions relevant to our specific population of interest are not included in currently validated measures. As discussed above, vicarious racialized discrimination was likely high for many participants during the time of data collection, however this important dimension is not included in this measure. Future qualitative research and community-informed measure development within context would provide a more comprehensive representation of these and other experiences (eg, generational trauma from histories of structural racism) as well as language diversity and preferences. The current research was limited in that it was conducted exclusively in English.

Finally, it is important to consider racialized discrimination as but one component of a system of multi-level racialized injustice – with patterns of oppression that are repeated and recreated across contexts, interpersonal interactions, structures, and cultural narratives and practices.⁴⁴ Adopting multidimensional and multi-level conceptualizations and assessment of racialized discrimination may support situation of these experiences within the larger system of injustice. Extensions of this conceptual approach will consider intersecting injustice exposures (eg, intersections across levels, and with other forms of injustice based on intersectional identity), that shape lived experiences of pain. Importantly, interventions and solutions to decrease inequity in pain risk and burden must necessarily focus on structural and societal change as upstream factors that permit racialized discrimination.

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