



# Experiences of Discrimination and its Impact on the Intensity of Pain: A Study in the Elderly Brazilian Population

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## Abstract

**Background:** The experience of pain is multifactorial and may be exacerbated by everyday stressors like discrimination leading to a poor quality of life. Perceived discrimination has been associated with the presence and increased intensity of pain. The elderly population may be more likely to experience discrimination making them vulnerable to external stress factors that can make managing pain more difficult. We aimed to explore the influence of discrimination and stress on pain intensity in an elderly Brazilian population.

**Methods:** In this cross-sectional study design, we analyzed the data from the Brazilian Longitudinal Study of Aging (ELSI-Brazil) in which participants answered the revised everyday discrimination questionnaire stating their pain intensity and perceived stress level. The effect of discrimination and stress on pain intensity was assessed using a multivariable-adjusted ordinal logistic regression. Sensitivity analysis with multiple imputations for missing data was also conducted to assess the robustness of the findings.

**Results:** In the elderly Brazilian population, discrimination and perceived stress had a significant association with pain intensity. The odds of experiencing strong intense pain were 7% higher in an adult experiencing everyday discrimination (OR= 1.07, 95% CI: 1.03-1.11,  $p < 0.001$ ). Stress was also significantly associated with pain intensity (OR 1.05, 95% CI 1.05 - 1.06). This finding emphasizes the need to address the influence of such societal factors on the psychological and physical aspects of pain.

**Conclusion:** Our study found that there is a significant association between experiences of discrimination and stress with pain intensity in a large population from Brazil in accordance with previous studies despite differences in population demographics and cultural contexts. These findings provide evidence of the generalizability of these associations and underscores the detrimental health consequences associated with perceived discrimination.

## Introduction

Perceived discrimination occurs when individuals believe they are subjected to unfair or negative treatment based on personal attributes such as age, gender, race, ethnicity, religion, weight, physical disability, appearance, or financial status. Discrimination

may be particularly stressful because it involves judgments or mistreatment directly targeting one's identity and characteristics (Pengpid & Peltzer, 2021). Previous studies have implicated stress-induced changes in the brain cortico-limbic system as partial mediators in pain responses (Meerveld & Johnson, 2018; Vachon-Presseau, 2018). Perceived discrimination has been associated with the presence and increased intensity of pain (Brown et al., 2018; Garcia et al., 2019; Scott et al., 2022; Simmons et al., 2023) and with an increase in chronic stress, sleep disturbances, and slower recovery from pain and disability (Burgess et al., 2009). In particular, racial discrimination is

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considered a risk factor for disease and contributes to racial disparities in health (Williams et al., 2019).

The elderly population has been found to be a subject of discrimination (Biesheuvel et al., 2008) and the association between experiencing discrimination and pain (both the presence and intensity of pain) in older adults has several implications based on the different characteristics described which can negatively affect mental and physical health overall (Mickle et al., 2023).

A prior study by (Cruz-Almeida et al., 2013) found distinct psychological profiles within individuals dealing with knee osteoarthritis (OA) and individuals with unfavorable psychological profiles tend to experience the highest levels of clinical pain and disability. There is a complex interaction between psychological profiles and pain experiences in individuals with knee osteoarthritis illuminating the diverse factors that influence physical pain.

A previous cross-sectional study derived from a large cohort known as the "Understanding Pain and Limitations in Osteoarthritic Disease– Second Cycle" (UPLOAD-2) aimed to explore the factors that contribute to ethnic/racial differences in knee pain among adults with knee OA or at risk of knee OA (Terry et al., 2020). This study found that non-Hispanic black individuals reported higher levels of discrimination and significantly higher levels of clinical pain compared to non-Hispanic whites and perceived stress and pain catastrophizing was found to be mediators in this relationship between discrimination and pain (Terry et al., 2020).

Older adults may be more likely to experience discrimination associated with a significant detrimental impact on their health (Biesheuvel et al., 2008; Chang et al., 2020). Therefore, they might require a more comprehensive approach to pain management that addresses psychological as well as physical factors. Furthermore, perceived discrimination may vary widely across different countries and cultural contexts. According to representative data from Latin America, the majority of respondents did not perceive any type of discrimination and socioeconomic discrimination was the most common type of discrimination perceived in contrast with racial discrimination in the United States (Dixon, 2019). In Brazil, approximately 17% of the elderly reported perceived discrimination (Braga et al., 2019). Therefore, the association between perceived discrimination and the presence and intensity of pain may change.

This study aims to replicate the findings of Terry et al. (2020) who assessed the association of discrimination and stress with the intensity of pain in osteoarthritis (OA) patients from the United States by evaluating a different demographic of older adults

in Brazil and by focusing on a broader scope of the overall perceived pain rather than limited to OA. Replication studies are critical in validating scientific findings (Janz, 2016). Our main objective is to explore if the association of discrimination and stress with pain intensity holds true across a different context and population to assess generalizability, thus contributing to a more inclusive and empathetic approach to healthcare. Understanding the association of discrimination pain in other cultural contexts in the elderly population is essential to address disproportions in health and to develop effective pain management strategies.

## Materials and Methods

In this cross-sectional study, we analyzed data from the second wave (2019-2021) of the Brazilian Longitudinal Study of Aging (ELSI-Brazil), a prospective cohort study funded by the Brazilian Ministry of Health that assesses social determinants of aging in adults 50+ residing in Brazil (Lima-Costa et al., 2023). Data from 9949 participants was available including variables on sociodemographic characteristics, discrimination, life and health history, pain, disability, and activities of daily living amongst many others. Additional information on ELSI-Brazil can be found at <https://elsi.cpqrr.fiocruz.br/en/home-english/objectives/>.

The main outcome was the intensity of pain. To assess the intensity of pain, the database included two variables measuring pain: one for presence/absence and another for intensity (1 = "Soft/weak", 2 = "Moderate", 3 = "Intense/strong"). Participants with no pain were assigned a score of 0. To assess the effect of perceived discrimination, we used the Revised-Everyday Discrimination Scale adapted from the original Experiences of Discrimination Scale (EOD) (Krieger et al., 2005; Williams et al., 1997) and previously validated (Greenfield et al., 2021; Stucky et al., 2011).

This scale evaluates experiences of discrimination (EOD) in five domains by asking: "In your day-to-day life, how often have any of the following things 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.

Participants answer this question according to the frequency of the perceived discrimination as: Never (0), less than once a year (1), a few times a year (2), a

few times a month (3), at least once a week (4), and almost every day (5). Responses to these items were added for a possible score from 0 to 25, with higher scores indicating more experiences of discrimination (Greenfield et al., 2021).

To assess the effect that perceived stress may have on the presence and intensity of pain, we used a variable included in the database that asked the following question: 'In the last 30 days, for how many days would you say your mental health was not good, for example, you felt stressed out or with other emotional issues'. Participants answer this question with a number from 0 (None) to 30 (all days).

### Statistical Analysis

All data was analyzed using STATA 18BE. Descriptive statistics are presented as means and standard deviation (SD), median and interquartile range (IQR), or frequency and percentage depending on the type and distribution of the data for each variable.

A multiple-stage survey data analysis (Stata-Corp.2023) was used according to the ELSI study complex sample design, where the population was partitioned into strata (geographical) and individuals were randomly selected based on stratification of primary sampling units (municipalities), census tracts, and households (Lima-Costa et al., 2023).

To assess the effect of discrimination on the intensity of pain, an ordinal logistic regression was conducted where the outcome variable was pain intensity adjusted by race, sex, age, BMI, and region. Covariates were selected to replicate the study by Terry et al. The variable region was included in the model to simulate the effect of site location used in the original study model by Terry et al. (2020) and not available in the ELSI database. Additionally, the interaction term *race#sex* was included in the model since group differences based on race and sex were found in the Terry et al. (2020) study.

In most variables, missing data was found in less than 5% of participants. However, body mass index (BMI) was missing in 16% of the database since participants were allowed to reject measurements during the prospective data collection. Therefore, a sensitivity analysis was conducted to assess the robustness of the findings from the main model with an imputed dataset accounting for missing data. Multiple imputations (MI) by chained equations were used to impute missing data based on the flexibility of the model and assuming a missing at-random mechanism with missing data independent of the outcome and dependent on observed variables (Huque et al., 2018; Jakobsen et al., 2017; Zhang, 2016). An MI model

was built including the outcome variable, predictors of missing variables, and all variables included in the main analysis model as recommended (Sterne et al., 2009; White et al., 2011) and using predictive mean matching, truncated linear regression, ordinal, multinomial, and logistic regression according to the type and distribution of the data for each variable with 50 added imputations (Bodner, 2008; von Hippel, 2018).

## Results

Table 1 provides an overview of the sociodemographic and clinical characteristics of the sample. The table describes the racial composition of the sample with the largest group being white (46.5%) followed by mestizo (42.2%). Black, Asian descent, and indigenous groups represent a smaller percentage of the sample. The median age for the sample is 65.0 years with minimal variations among the racial groups. Approximately 59.3% of the total sample was female with minimal variations between racial groups. The mean BMI was 27.77. Education presents variability between the groups with 47.2% of the sample having elementary school or less education as the highest level. Marital status shows that the majority of the participants are married or living together (53.1%) and employment status reveals that a considerable number of participants are retired (57.6%). Seventy-eight percent of the population reported having never experienced discrimination in the last year.

The unadjusted analysis revealed a significant association between experience of discrimination (EOD) and pain intensity (OR= 1.07, 95% CI: 1.04-1.11,  $p<0.001$ ) confirmed in the multivariable-adjusted analysis (OR= 1.07, 95% CI: 1.03-1.11,  $p<0.001$ ). These findings suggest that for one unit increase in the EOD scale, the odds of experiencing strong pain compared to moderate, weak, or no pain combined are 7% higher given that the other variables in the model remain constant. Stress was also significantly associated with the intensity of pain (OR 1.05, 95% CI 1.05 - 1.06) as described in the study by Terry et al.; however, neither gender nor race showed a significant association. Body mass index was also found to have a significant association; for every point increase in BMI, there is an increase in pain intensity (OR=1.03, 95% CI: 1.02-1.05,  $p<0.001$ ). No interaction was found between race and gender.

A sensitivity analysis was conducted with an imputed dataset to account for the missing data (Table S1 in the Electronic Supplementary Material) showing similar results (OR 1.06; 95% CI 1.03-1.09,  $p<0.001$ ) and suggesting that the findings from the main analysis of the effect of experiences of discrimination in the intensity of pain are robust. Nevertheless, there was a significant association between the

	Race					
	White	Black	Mestizo	Asian descent	Indigenous	Total
n (%)	4,587 (46.5%)	1,052 (10.7%)	4,169 (42.2%)	27 (0.3%)	38 (0.4%)	9,873 (100.0%)
Age (Median, IQR)	66.0 (15.0)	65.0 (16.0)	64.0 (15.0)	68.0 (15.0)	66.0 (15.0)	65.0 (15.0)
Female	2,756 (60.1%)	630 (59.9%)	2,433 (58.4%)	16 (59.3%)	20 (52.6%)	5,855 (59.3%)
BMI (Mean, SD)	27.84 (5.23)	27.78 (5.67)	27.68 (5.21)	26.88 (5.02)	29.53 (3.77)	27.77 (5.27)
Education (Highest grade in school)						
No Education	557 (12.3%)	263 (25.2%)	732 (17.8%)	2 (7.4%)	10 (27.0%)	1,564 (16.0%)
Elementary School or less	2,165 (47.8%)	469 (45.0%)	1,939 (47.1%)	11 (40.7%)	18 (48.6%)	4,602 (47.2%)
Some High School	789 (17.4%)	135 (12.9%)	668 (16.2%)	1 (3.7%)	3 (8.1%)	1,596 (16.4%)
High School Degree	591 (13.1%)	121 (11.6%)	537 (13.0%)	6 (22.2%)	3 (8.1%)	1,258 (12.9%)
Some College	93 (2.1%)	11 (1.1%)	89 (2.2%)	1 (3.7%)	0 (0.0%)	194 (2.0%)
College Degree	272 (6.0%)	34 (3.3%)	122 (3.0%)	6 (22.2%)	2 (5.4%)	436 (4.5%)
Postgraduate Studies	58 (1.3%)	10 (1.0%)	31 (0.8%)	0 (0.0%)	1 (2.7%)	100 (1.0%)
Marital Status						
Single	512 (11.2%)	167 (15.9%)	516 (12.4%)	4 (14.8%)	4 (10.5%)	1,203 (12.2%)
Married/live together	2,428 (52.9%)	501 (47.6%)	2,283 (54.8%)	13 (48.1%)	21 (55.3%)	5,246 (53.1%)
Divorced or separated	592 (12.9%)	129 (12.3%)	508 (12.2%)	1 (3.7%)	7 (18.4%)	1,237 (12.5%)
Widow(er)	1,055 (23.0%)	255 (24.2%)	862 (20.7%)	9 (33.3%)	6 (15.8%)	2,187 (22.2%)
Employment (In the last 12 months)						
Employed	1,053 (23.0%)	263 (25.1%)	1,176 (28.3%)	7 (25.9%)	14 (36.8%)	2,513 (25.5%)
Not employed	1 (0.0%)	2 (0.2%)	2 (0.0%)	0 (0.0%)	0 (0.0%)	5 (0.1%)
Does not apply	3,521 (77.0%)	784 (74.7%)	2,984 (71.7%)	20 (74.1%)	24 (63.2%)	7,333 (74.4%)
Retired	2,779 (60.8%)	607 (57.9%)	2,245 (53.9%)	19 (73.1%)	25 (67.6%)	5,675 (57.6%)

IQR interquartile range; BMI body mass index; SD standard deviation,  
 \* Number of participants (%)

**Table 1: Sociodemographic and clinical characteristics\*.**

	n = 8,062			
	Odds Ratio	95% Confidence Interval		p-value
<b>Unadjusted Analysis</b>				
Revised-EOD scale	1,07	1,04	1,11	<0.001
<b>Adjusted Analysis*</b>				
	Odds Ratio	95% Confidence Interval		p-value
Revised-EOD scale	1,07	1,03	1,11	<0.001
Stress	1,05	1,04	1,07	<0.001
Race (Reference: Asian Descent)				
White	0,43	0,07	2,62	0,36
Black	0,52	0,09	3,09	0,47
Mestizo	0,49	0,08	2,89	0,43
Indigenous	3,41	0,43	27,04	0,25
Male	0,41	0,02	8,28	0,56
BMI	1,03	1,02	1,05	<0.001
Age	1,00	0,99	1,01	0,69
Region (Reference: North)				
Northeast	1,54	0,99	2,38	0,05
Southeast	1,02	0,66	1,57	0,94
South	0,79	0,43	1,45	0,44
Midwest	1,69	0,88	3,23	0,11

EOD Experiences of Discrimination

\*Multivariate model adjusted by stress, race, sex, BMI, age and region, including interaction term race#sex, using survey data analysis.

**Table 2: Effect of discrimination on pain intensity.**

male gender and indigenous race with the intensity of pain in the imputed dataset limiting the interpretation of the results on the effect of these variables on pain.

## Discussion

Our study found that there is an association between experiences of discrimination and pain intensity after adjustment for age, gender, race, stress, BMI, and region in a population of adults over 50 years in Brazil. Similar results were found in the unadjusted analysis and a sensitivity analysis with an imputed dataset that accounts for the missing data suggesting that the findings are robust. We replicated the methods of the study of Terry et al. (2020) to assess the generalizability and accessibility of their findings in a population of older adults in Brazil. The results of our study are in accordance with their results showing that higher levels of discrimination predicted higher pain intensity after controlling for covariates (Terry et al., 2020).

The relationship between discrimination and pain is of growing interest especially in the context of societal challenges around racial and social equity. Existing literature corroborates our findings indicating perceived discrimination as a stressor that exacerbates pain potentially through heightened psychological distress and leading to maladaptive coping mechanisms (Brown et al., 2018; Garcia et al., 2019; Simmons et al., 2023). Chronic exposure to discrimination stress has been implicated in adverse health outcomes emphasizing the health equity implications of our findings.

Our study confirms previous findings on the association of experiences of discrimination and pain (Brown et al., 2018; Garcia et al., 2019; Scott et al., 2022; Simmons et al., 2023; Terry et al., 2020). Despite the broader scope, the effect size in our study remained comparable reinforcing the robustness of the relationship between discrimination and pain across diverse populations and pain types. Moreover, to our knowledge, it is the first study to describe this association in a population from South America suggesting this effect may be more generalizable and that it is still statistically significant under a different geographical, ethnic, and cultural context when controlled for other relevant factors. However, race and gender were not statistically associated with pain intensity as was found in the study by Terry et al. This could result from cultural and discrimination differences in the diverse Brazilian population compared to the American population in the Terry study. Color discrimination has been found to be less prevalent in Brazil and other Latin American countries with socio-economic discrimination being more important

(Dixon, 2019) in contrast with the predominant racial discrimination present in the United States (Lee et al., 2019). Additionally, race distribution in the Brazilian population was mainly composed of white and mestizo races (88%) with a low proportion of black, Asian, and indigenous populations compared to the Terry et al. study where the population was composed of non-Hispanic whites (48%) and non-Hispanic blacks (52%). The small number of Asian and Indigenous populations might have affected the model performance.

Nevertheless, our study is significantly different from that of Terry et al. First, they focused the research on the ethnic/race differences among adults with clinical knee pain with or without risk of knee OA and used a validated pain scale for OA (WOMAC pain). In contrast, our study extended the investigation to enclose pain conditions in a broader demographic. Given the information in the ELSI database, the pain scale used was a non-specific ranked classification of pain intensity and not a previously validated scale which could limit the validity and generalizability of the results. Instead of the complete Everyday discrimination scale used in the Terry study, we used a shortened version of this scale that has been previously validated in several publications due to the questions of discrimination available in the ELSI database. Additionally, since our study's outcome variable was an ordinal rather than a continuous variable, we did not perform an ANCOVA analysis. However, we conducted a multivariable regression which is mathematically similar. Finally, we did not perform a mediation analysis to assess the indirect effect that perceived stress had in the association of discrimination and pain intensity as was done in Terry et al.; therefore, we do not know if perceived stress also exerts this indirect effect in our Brazilian population. However, although not a validated scale, we included a variable that assessed perceived stress in the last 30 days in the regression model to account for its effect on pain intensity finding a statistically significant association with pain intensity.

Our study has several limitations. It is important to note that observational studies (cross-sectional design) in most cases prevent causal inferences. Furthermore, differences in sampling and modeling between the two studies may contribute to variations in our findings. The study's sample may not fully represent Brazil's aging adult population potentially leading to sampling bias. This could affect the generalizability of the findings to the broader population. The lack of validated scales for perceived stress and pain intensity may affect the generalizability of the findings. There may be important variables not included in the analysis which could confound the

relationship between perceived discrimination and pain intensity. Additionally, although missing data for most variables was considered negligible, BMI was missing in a significant proportion of the population. Since participants were allowed to reject measurements during the prospective data collection, individuals with low or high BMI may have rejected measurements more often. The findings on the effect of this variable might be biased. Nevertheless, sensitivity analysis with multiple imputation accounting for missing data showed similar results. Given the sample size, the statistical power loss was probably insignificant. Another limitation is that this study may not have accounted for all potential confounding factors that could influence the relationship between perceived discrimination and pain intensity such as comorbidities, access to healthcare, or socioeconomic status. Finally, this study relies on self-reported data which may be subject to recall and social desirability biases. Participants' responses to questions about experiences of discrimination and pain intensity may be influenced by their subjective perceptions and memory. Despite these limitations, our study significantly contributes to the literature by replicating and broadening previous findings to a more diverse and inclusive population. It underscores the detrimental health consequences associated with perceived discrimination emphasizing the urgency for societal, systemic, and healthcare interventions to mitigate these inequities. Healthcare providers need to be mindful of these dynamics adopting a holistic approach to pain management that considers the psychological aspects mainly when dealing with marginalized communities. Further research is needed to clarify the causal pathways of discrimination and pain intensity and to assess the effect of the implementation of anti-discrimination policies and adjusted pain management protocols in the presence and intensity of pain.

## Conclusion

Our study found that there is a significant association between experiences of discrimination and pain intensity in a large population from Brazil in accordance with previous studies despite differences in population demographics and cultural contexts. Although this study has important limitations based on self-reported data, sampling bias, and potential missing confounding factors, our findings provide evidence of the generalizability of this association and underscore the detrimental health consequences associated with perceived discrimination. Future efforts should focus on developing and implementing anti-discriminatory education policies and improving current pain assessment and management protocols

including external factors like discrimination in a more individualized manner fostering more effective healthcare interventions.

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## Conflicts of Interest

The authors declare no conflict of interest.

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