EXAMINING THE LINK BETWEEN DISCRIMINATION AND PAIN PHYSIOLOGY

An Undergraduate Research Scholars Thesis

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ABSTRACT

Examining the Link Between Discrimination and Pain Physiology

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There are well-documented pain disparities across sociodemographic groups (Campbell & Edwards, 2012), however, the physiological mechanisms behind these disparities are not well-known. The proposed research explores whether self- reported experiences of lifetime discrimination is associated with increased pain sensitivity when assessed in a laboratory setting. Participants were 72 Caucasian American, African American, Hispanic American, and Mixed-Race American undergraduate students from Texas A&M University in College Station. We conducted several psychophysical pain testing procedures to quantify pain and administered the Perceived Ethnic Discrimination Questionnaire (PEDQ) and the Experiences of Discrimination Questionnaire (EOD) to better understand the complexity of discrimination.We did not find statistically significant associations between our pain measure and discrimination, however results trended in the expected direction such that Latinx participants showed a pattern of higher pain sensitivity trending with higher discrimination. By understanding how discrimination is linked to pain sensitivity, we can create interventions to reduce pain by targeting the underlying mechanisms that exacerbate pain in specific socioeconomic subgroups.

DEDICATION

I dedicate my thesis to my parents, Deepa Joseph and Babu George, for their endless love and support. Only because of your constant motivation and encouragement to keep faith was I able to complete this writing. Thank you for believing in me when I did not believe in myself.

I also dedicate my thesis to my brother, Nevin George, for serving as my role model despite preceding me three years in age. You constantly push me to work harder, and your constant willingness to look over all of my writing will never be forgotten.

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NOMENCLATURE

B/CS	Bryan/College Station
P	Pressure
T	Time
HPTh	Heat Pain Threshold
HPTo	Heat Pain Tolerance
kPa	Kilopascal
PPTh	Pressure Pain Threshold
mN	millinewton
CPM	Conditioned Pain Modulation
MTS	Mechanical Temporal Summation
PEDQ	Perceived Ethnic Discrimination Questionnaire
Subj. SES	Subjective Socioeconomic Status
OES	Ostracism Experiences Scale

CHAPTER I

INTRODUCTION

In his 1789 letter, Benjamin Franklin famously stated that "in this world nothing can be said to be certain, except death and taxes." However, 230 years later, we know this statement may also relate to pain. Pain is a major public health problem presenting a large personal, economic, and social burden that has affected every individual at one point or another. The inception of pain dates back to the beginnings of mankind, and as our environments changed, our understanding of the nature of pain has transformed from one solely based on overt physical characteristics, to one that is highly malleable and influenced by various social and physical factors. Generally speaking, pain is an experience that is shared among cultures, yet has no clear expression and is still unique to each individual. Once pain was realized as a powerful and pervasive force, investigations into its treatments and mechanisms quickly began in the 1600s (Collier, 2018). By the 1900s pain relievers such as opium, morphine, and heroin as well as anesthetics were used to treat patients with pain conditions (Collier, 2018). The 1900s also welcomed the shift on knowledge on the neural mechanisms of pain, with physicians beginning to realize that pain is not limited to observable anatomical injuries and may in fact be influenced by social factors like threatening environments or emotional constituents like anxiety (Collier, 2018).

Our knowledge of pain has grown extensively from the 1600s, and we are able to see its burdensome effect on people across various societies. Current estimates suggest that 20% of adults suffer from pain globally (Goldberg & McGee, 2011) and roughly 11% of the adult population is affected by chronic pain in the United States (CDC, 2017). Chronic pain can have a

significant impact on an individual's daily function and influence thoughts, feelings, sleep, recollection, and focus (CDC, 2017). Moreover, pain not only impacts the patient, but his/her social circles as well (CDC, 2017). Pain remains under-studied in the context of social science and public health (Goldberg & McGee, 2011), however studies are beginning to investigate the mechanisms of pain. Findings have shown that pain is unique in both its expression and intensity as opposed to other somatic sensations (Price, 2000). Though a protective mechanism, pain is often seen as threatening and therefore feared. If the body area an individual feels pain in continues to be stimulated, the sensation may transform into a chronic presence in an individual's life (Basbaum, 2009). That being said, pain may linger due to a variety of factors that upkeep the sensation's longevity. Pain modulation is directed by neural processes involved in the nociceptive system, and this system changes according to different environmental and bodily factors (Apkarian, 2005). These environmental factors in particular have recently been seen as sources that may influence pain, thereby further illustrating pain's intricate nature. Since pain is so easily influenced by a host of environmental, social, and physical factors, it is vital for research to pinpoint which factors may contribute to the increased or decreased expression of pain to better understand the nature of the sensation.

There are distinct pain disparities among sociodemographic groups (Campbell & Edwards, 2012). For example, we know that certain groups of people such as women, people of color, low SES individuals, and older individuals may suffer more pain in response to the same experience (Anderson, Green, & Payne, 2009). Hatch & Dohrenwood (2007) conducted a review and claimed that stressful life events that contribute to a range of physical and psychiatric health problems are more prevalent in low SES and racial and ethnic minority groups. Findings showed that traumatic and other stressful life events are more frequent in low socioeconomic status

(SES) and racial/ethnic minority groups, serving as a possible explanation on why different minority groups face more adverse physiological reactions like pain (Hatch & Dohrenwood, 2007). Chen and colleagues (2001) also reported a relationship between lower socioeconomic status and greater threat interpretation and increased heart rate during both threatening and non-threatening environmental situations. They asserted that social factors may be involved in physiological outcomes, indicating a relationship between lower socioeconomic status and greater threat interpretation and pain (Chen et al., 2001). Both studies cite social experiences like subjective socioeconomic status and stressful life events as pain influencers, suggesting social factors may exacerbate pain sensitivity. However, the scientific mechanisms behind these group disparities are not very well understood and need to be explored further.

Social factors have been cited as variables that influence health outcomes. Discrimination in particular has been found to have some influence over health outcomes, like pain, among people of color. The impact of discrimination is said to not only serve as a consequence to health, but quite literally altering health outcomes as a whole (Williams & Mohammed, 2009). Wandner et al., (2012) found that people have varying beliefs in terms of others groups' pain perceptions, which then influences both pain assessment and treatment. Nevertheless, it is important to note that though trends between discrimination and general health outcomes have been studied, work into specifically whether discrimination affects pain is still very new, with only a few studies available in the literature that have looked into the phenomenon. Nonetheless, discrimination has been shown to influence health outcomes, and we believe it may have an effect on pain as well. Likewise, observations by medical students and researchers found that pain sensitivity may trend along similar patterns of racial hierarchies within a nation (Bourke, 2014). This indicates that pain disparities can lead to certain groups of people like people of

color, women, or those of low SES bearing higher pain burdens than national majority-groups (Bourke, 2014). Further investigations into this phenomenon lead to more understanding on discrimination-based pain inequalities. Despite discrimination and pain sensitivity serving as a new topic in pain research, the recent evidence does produce hope toward one day understanding this relationship in order to create a more holistic understanding of pain. Therefore, targeting specific social experiences like discrimination may lead to the development of better and more individualized pain interventions in the future.

Mathur and colleagues (2016) addressed the relationship between discrimination and pain by showing how specific discriminatory situations exacerbate physiological sensitizations such as clinical pain outcomes, interference, and laboratory pain. To quantify discrimination and pain, researchers recorded experiences of perceived lifetime discrimination and pain severity in health-care settings, and conducted quantitative sensory testing, a method of psychophysical pain testing, in the laboratory. As a result, they found that discrimination in health-care settings was associated with greater clinical pain severity and laboratory pain; if patients felt discriminated against, they were more likely to experience pain. Their findings also suggested that social experiences may interact with pain pathophysiology as these factors were associated with the pain measures in the study. Racial differences like these often play a significant role in perpetuating health differences, however they are usually not cited as factors that may influence pain perception among various groups of people (Williams, Neighbor & Jackson, 2003). In regards to laboratory settings, Taylor, et al. (2018) further investigated racial disparities in pain by looking at pain perception of older African American women with osteoarthritis. Results indicated that more instances of self-reported racial discrimination were associated with higher pain intensity. These findings also suggested that discrimination and pain may be engaging in an

amensalistic relationship; pain outcomes are negatively impacted while discrimination is left relatively unharmed. While further studies are necessary to establish a possible connection between increased discrimination and heightened pain sensitivity, there seems to be some indication that social factors like discrimination may contribute to the maintenance of pain disparities in our nation.

Racial disparities are maintained by many factors, and emerging research claims that social factors may have the ability to amplify the effects of pain conditions, an added disadvantage to people of color for services such as basic health care. For example, racial and ethnic minorities are at a higher risk for receiving inadequate care for pain treatment in hospitals, and may also be undertreated for the same pain condition as compared to white Americans (Pletcher, Kertesz, Kohn, & Gonzales, 2008). Meghani & Chittams (2009) also claimed that racial disparities in pain are also influenced by socioeconomic status and which creates an unequal distribution of resources and burdens between individuals. Though, social factors may contribute to pain disparities, pain research that studies disparities often lack a balanced racial sample of participants. This leads to the lack of equal ethnic and racial representation in many samples in pain research, which leaves several minority groups unaccounted for in their findings. Due to this issue, this thesis explores a balanced gender and race group in order to look into the pain disparities in a laboratory setting. With a more balanced sample of participants, we can statistically explore a more accurate representation of pain expression across the U.S., and the common neural mechanisms behind this occurrence can be further explored.

Pain is a major public health problem affecting 1 in 4 Americans, yet it is very poorly understood (CDC, 2018). Pain research is a vital contribution to society as it leads to better medical treatment. The nature of pain research allows for a participant's time in the lab to

directly contribute to our overall knowledge of pain, which we can then use to better help people who suffer from conditions known to cause pain. A better understanding of how social experiences affect pain sensitivity can lead to the creation of different interventions that target the underlying mechanisms which exacerbate pain in specific socio-economic subgroups. Medical settings must then restructure treatments to account for these differences and equalize their healthcare systems. Future goals should encompass creating more holistic treatment plans that cater to the needs of every racial and ethnic group. By addressing these factors that affect pain perception, we take a step toward creating a more equalized health care system.

Hypothesis

Our hypothesis is that self-reported experiences of lifetime discrimination may be associated with increased pain sensitivity when assessed in a laboratory setting.

CHAPTER II

METHODS

Procedure

In our study, we collected data using two different approaches. We collected data on psychophysical pain by administering quantitative sensory testing (QST) measures and collected data on social experiences by administering a series of questionnaires. Each participant underwent the same QST procedures and questionnaires. We obtained a gender-balanced sample of Caucasian American, African American, Hispanic American, and Mixed-Race American participants and collected data for 72 participants including each gender in each race group as well. Every participant was subjected to the same standardized procedures and completed the same questionnaires, counterbalanced via randomized order. Collecting this data on both psychophysical pain and discrimination allowed us to examine the relationship between these two factors. Below is a brief summary of each QST measure and questionnaire.

Participants

Our sample consisted of a total of 72 participants (44.4% male and 55.6% female) with a distribution of 27.8% White, 41.7% Hispanic/Latin X, 20.8% African Americans, 2.8% Asian, and 6.9% Americans of mixed-race. Each participant underwent the same QST procedures and questionnaires.

Psychophysical Pain Testing

Participants completed at least one round of each of the following procedures.

1. Pain Ratings

- A numerical rating scale ranging from 0 (no pain) to 100 (worst pain imaginable) was used for each of the pain testing procedures.

2. Heat Pain Threshold (HPTh)/Heat Pain Tolerance (HPTo)
    - HPTh and HPTo were calculated as the average of 3 corresponding trials administered to participants' forearm using an ascending method of limits paradigm. On each trial, the thermode gradually increased or decreased in temperature, from a baseline of 30°C at a 0.5°C/second rate of increase, until the participant indicated through mouse button press that the stimulus first felt painful (HPTh). Between trials, the thermode was moved up the arm slightly to avoid overlapping stimulation sites.
    - In addition to first indicating when they feel pain as a result of the heat/cold, in a series of separate trials participants were also asked to inform us when the pain they perceive from heat was no longer tolerable (HPTo).
3. Pressure Pain Threshold (PPTh)
    - An electronic algometer (Somedic, Sollentuna, Sweden) was used to assess PPTh using a 1-cm^2 probe covered with a 1-mm polypropylene material. Pressure was applied to the muscle belly and increased steadily at a rate of 30 kPa/s until the patient verbally indicated that the pressure first felt painful (PPTh). PPThs were assessed twice, bilaterally at the trapezius muscle. A minimum of 1-minute interval was maintained between applications at the same site. The final PPTh was calculated as the average across all sites and repetitions.
4. Conditioned Pain Modulation (CPM)

- We accessed CPM using pressure applied to the trapezius as the test stimulus, and cold-water bath as the conditioning stimulus. Participants submerged their hand in a cold-water bath for 20 seconds, at which time PPTh was reassessed at the trapezius. If participants remove their hands before 20 seconds, PPTh was immediately assessed upon withdrawal. Cold water temperature is set to at 4°C. CPM was calculated as the difference between the PPThs during and before water submersion.

5. Mechanical Temporal Summation (MTS)
    - Weighted pinprick stimulators with a flat contact area of 0.2 mm diameter were used to deliver stimuli at a 1/second rate to the middle finger. MTS was calculated as the difference between pain ratings in response to a single stimulus compared to a sequence of 10 identical stimuli. Trials were conducted with 3 probes of 128 mN, 256 mN, and 512 mN.

Discrimination Questionnaires

Participants were asked to complete a set of questionnaires related to their health history and life experiences.

1. Perceived Ethnic Discrimination Questionnaire – Self Report (PEDQ): Examines types of discrimination; higher discrimination equates to higher scores
    - The PEDQ can be used across ethnic groups to assess types of perceived racial or ethnic discrimination. The scales measure several subdimensions of racism, allowing us to look at different forms of this race-related stressor. The PEDQ can facilitate knowledge on how discrimination functions in various racial groups.
    - **Ex**: *Because of your ethnicity/race, how often…*

        - *have others made you feel like an outsider because of your dress, speech or characteristics related to your ethnicity/race?*
        - *has your boss or supervisor been unfair to you?*

2. Experiences of Discrimination – Self Report (EOD): Examines context of discrimination; higher discrimination equates to higher scores
    - The EOD can be used across ethnic groups to assess the context of perceived racial or ethnic discrimination. This instrument is conceptualized as a unidimensional measure of discrimination, specifically, self-reported, not perceived, experiences of discrimination because not all perceived experiences are necessarily reported, depending upon individuals' willingness or ability to report them. Prevalence of self-reported racial discrimination and response to unfair treatment.
    - **Ex**: *Have you ever experienced discrimination, been prevented from doing something, or been hassled or made to feel inferior in any of the following situations because of your race, ethnicity, or color?*
        - *at school?*
        - *at work?*

CHAPTER III

RESULTS

A correlation was conducted to examine the association between discrimination, as measured by the Perceived Ethnic Discrimination Questionnaire (PEDQ) and the Experiences of Discrimination Questionnaire (EOD), and multiple measures of pain sensitivity. There were no significant correlations between the PEDQ and EOD with measures of pain sensitivity for the full sample, as seen below (Figure 1).

	$PEDQ_{tot}$	EOD_{tot}	$CPTh_{Avg}$	$HPTh_{avg}$	$HPTol_{avg}$	$PPTh_{Avg}$	$cpmPPT_{Avg}$	cpm_{Avg}
$PEDQ_{tot}$	1	.594**	.068	-.049	.045	.095	.119	.095
EOD_{tot}		1	.037	-.093	.061	.227	.149	.091
$CPTh_{Avg}$			1	-.597**	-.486**	-.394**	.18	.271*
$HPTh_{avg}$				1	.595**	.372**	-.033	-.12
$HPTol_{avg}$					1	.286*	-.217	-.284*
$PPTh_{Avg}$						1	.066	-.181
$cpmPPT_{Avg}$							1	.969**
cpm_{Avg}								1

Figure 1: All Participants

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

We are still collecting data for the study as a whole, but prior studies have primarily looked into African American and not Latinx participants. Therefore, we were also interested in looking within racial groups, and saw that in Latinx participants there was a pattern of higher pain sensitivity (lower HPTh) trending with higher discrimination (higher PEDQ and EOD scores). As such, $HPTh_{avg}$ was negatively associated with the PEDQ (r=-0.254, p = 0.176) and EOD (r=-0.241, p = 0.199) for Latinx participants. For the EOD, self-reported instances of discrimination were mostly at school (n = 11), getting service in a restaurant (n = 7), and on the

street or in public (n = 11). Other instances of self-reported experiences of discrimination were when getting hired = 4, at work = 4, applying for housing = 0, accessing medical care = 0, and applying for credit/bank loan/mortgage = 0.

CHAPTER IV

DISCUSSION

Pain is a phenomenon influenced by the complex interaction of biological, psychological, and social factors, resulting in individual differences in pain expression (Gatchel, Kishino, Noe, Schatman, & Campbell, 2007). While previous literature has attempted to address the biopsycho-aspect of pain, our work aims to address the social aspect of pain that is often overlooked. Prior work has demonstrated that discrimination is a robust predictor of health outcomes (Williams, Neighbor & Jackson, 2003). Our work seeks to contribute to literature that explores how discrimination influences physiological pain severity among sociodemographic groups in the United States.

We decided to focus on our Latinx sample for the purpose of our analysis as they were among the largest racial groups we collected. Despite our focus, the sample sizes were still small; therefore, statistically significant correlations were not observed between discrimination and our pain measure ($HPTh_{avg}$) in the full sample. Results did trend in the expected direction, such that within the Latinx participants there was a pattern of higher pain sensitivity (lower HPTh) trending with higher discrimination (higher PEDQ and EOD scores). Scores between $HPTh_{avg}$ and the PEDQ and EOD also produced small to moderate effect sizes among Latinx participants. There is a pattern in our healthy, young sample that Latinx individuals experienced higher severities of pain following higher reports of life-time discrimination. However, we are underpowered in this study, and we must increase statistical power by collecting larger sample sizes to better evaluate these trends.

Previous research exploring links between discrimination with pain sensitivity and health outcomes showed similar associations as our study. Mathur, et.al (2016) found that discrimination in health-care settings was associated with greater clinical pain severity and laboratory pain; if patients felt discriminated against, they were more likely to experience pain. Haywood and colleagues (2014) also discovered that among patients with sickle-cell disease, perceived discrimination was associated with higher instances of self-reported clinical pain. This indicates that stressors such as discrimination may contribute to added burdens among some patient populations. In general, racial differences in pain perception are becoming key points of interest in pain research, and research involving minority patients show more severe reports of pain as compared to their White counterparts. Edwards, et al. (2001) found higher laboratory pain sensitivity among African–Americans compared to White Americans. Similarly, Goodin, et al. (2013) found that African American individuals had higher sensitivity to heat pain, reported feeling more discrimination, and had less trust in researchers as compared to White participants. Additionally, higher feelings of discrimination were a significant predictor of lower heat pain tolerance for African Americans participants in this sample. Literature is slowly beginning to show the harmful effects racial discrimination can have on pain sensitivity. These results should encourage the creation of future pain research that both acknowledges and accounts for these systematic differences.

Pain can be quantified by various types of psychophysical pain testing, such as the quantitative sensory testing (QST) we conducted in our study. Laboratory heat pain testing in particular began around 50 years ago by applying heat to skin (Yarnitsky, Sprecher, Zaslansky & Hemli, 1995). Now, we have various advanced devices to administer heat, like the contact stimulators we used in our lab. Though we used other psychophysical pain measures in our

study, we focused on Heat Pain Threshold (HPTh) in terms of analysis in order to determine the participant's sensitivity to pain. HPTh seeks to measure the first instance an individual feels pain when inducing heat in the laboratory (Yarnitsky et. al, 1995). HPTh is opposite in nature such that higher pain sensitivity is related to lower heat pain thresholds. Our purpose in determining threshold was to see whether discrimination is associated with decreased thresholds, such that stimuli will produce a higher severity of pain for individuals who have faced this life stressor.

In order to better understand the complexity of discrimination, we quantified experiences of life-time discrimination by means of two different questionnaires (PEDQ and EOD) which allowed us to examine discrimination in multiple facets. Looking at the types (PEDQ) and context (EOD) of discrimination helped us to better understand both how and where discrimination tends to occur. We found that $HPTh_{avg}$ positively trended with measures of discrimination in our Latinx sample. This trend of higher discrimination resulting in increased pain sensitivity suggests that self- reported instances of lifetime discrimination may contribute to higher pain severities among individuals who experience discrimination.

Pain is easily influenced, and stressful life events like discrimination can create strong negative emotions that may affect pain perception. Emerging evidence suggests that difficulties in emotionally regulating pain in stressful situations could increase chances of developing of chronic pain (Rhudy, 2016). Therefore, lifetime experiences of stressful experiences like discrimination could feed into the maintenance of chronic pain conditions. In general, discrimination is an ongoing issue in our nation with Latinx individuals often discriminated against in regards to job acquisition (Reimers, 1983), job performance (Sanchez & Brock, 1996) and pay (Kenney & Wissoker, 1994). Instances of racial discrimination, like the above examples, against the Latinx population may serve as a reason as to why our Latinx sample illustrated

trends of higher discrimination with higher pain sensitivity (lower HPTh). Pain research that encompasses social factors like discrimination is vital to understanding the mechanisms behind various pain experiences among people. Acknowledging these differences may help medical professionals better address pain disparities in our nation and create an equalized health-care system for all.

Study Limitations and Implications

Our study did, however, have limitations that need to be addressed. Generalizations should be made in caution as our overall sample was composed of educated, young students at a single university (Texas A&M University). Students are often exposed to different experiences than for example, a community sample, which needs to be taken into consideration in regards to generalization of the aforementioned pain experiences. Our study was also underpowered due to our decreased sample sizes. To combat this factor, planned future analysis of this dataset will examine if these patterns persist as more observations are collected, increasing statistical power. While we attempted to disentangle the complexity of discrimination through two discrimination questionnaires, additional questionnaires could be included to better incorporate the full concept of discrimination. Despite its limitations, our study provides an example of how discrimination may influence pain sensitivity. By addressing these factors that affect pain perception, we take a step toward combating profound pain disparities in the United States.

The implications of our study suggest that even in healthy, young individuals, experiences of discrimination may associate with more severe pain in response to controlled laboratory pain stimuli. Examining this relationship in a healthy sample allowed us explore a potential underlying mechanism contributing to pain disparities in the absence of confounds seen in clinical samples. For example, pulling participants from a medical setting often equate to

patients who are quite medicated and in severe pain, not allowing us to see if pain disparities persist even among healthy populations. The trends found in our study persisted in a healthy, young population in such a controlled laboratory setting. Therefore, it is probable that these patterns in pain sensitivity are present across the U.S. Our findings take steps toward better understanding how pain functions among certain groups, and expansion on these concepts will result in a broader understanding of pain.

Overall, our findings attempt to show the added burden social factors like discrimination may place on an individual. Results were consistent with with our hypothesis, with experiences of discrimination contributing to increased pain sensitivity among Latinx individuals when assessed in a laboratory setting. Previous literature as discussed in the introduction indicated the presence of social factors behind the maintenance of pain, and our findings support the need for further research on the social factors behind pain. A unique aspect of our study was its focus on expanding pain research to include an understudied population. There is very little pain literature on Latinx individuals, but much on African American individuals that show increased clinical pain and decreased access to appropriate pain care and standard of care medications in this population. Studying how pain functions in different socio-demographic populations will increase the generalizability of research findings.

Conclusions

Our study was a first step to understanding a novel association between a social factor and physiological pain sensations. Pain is a complex phenomenon that cannot be defined in an unidimensional manner. Many factors affect how individuals experience pain, and these factors are often not a part of the standard pain assessment process in medical settings. The best pain care is multifaceted, and pain treatments should take this into account. In general, people of color

seem to endure more severe pain. While discrimination may help increase this burden, the lack of available resources to minority populations may also increase pain disparities. For example, pharmacies in majority African American neighborhoods do not carry enough medication to sufficiently treat patients with severe pain. (Morrison,Wallenstein, Natale, Senzel & Huang, 2000). Therefore, these individuals have to travel far to have their medications filled. Additionally, when Hispanic and black Americans go to the doctor, they are perceived as being drug seeking and have different overall experiences in healthcare settings than their White counterparts (Pérez, Fortuna & Alegria, 2008).To overcome these disparities, we initially must begin by looking at the individual and their pain experiences, but ultimately, move toward identifying the full scope of factors that influence pain among various populations in order to increase the generalizability of these findings.

Trends found in our study show the need for further research into various social factors that influence pain perception. By testing the effects of discrimination as measured by the PEDQ and EOD on HPTh in a population of young, healthy Latinx college students, our study trends with prior research that claims an association between discrimination and pain perception. As pain research expands, it may one day build a knowledge base that can combat social inequalities in health care.

Future studies may benefit from looking at the effects of other social factors on pain sensitivity. These factors could include ostracism, subjective SES, lived experiences, and also discrimination but in a community sample. This would further expand our knowledge on specific factors that influence pain to one day create assessments and treatment methods that take these into account. An individual's race and identity should never be a factor in regards to the rigor of

their treatment, and our research tries to contribute to the knowledge base that will help overcome these factors.

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