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## Ethnic differences in pain and pain management

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### SUMMARY

Considerable evidence demonstrates substantial ethnic disparities in the prevalence, treatment, progression and outcomes of pain-related conditions. Elucidating the mechanisms underlying these group differences is of crucial importance in reducing and eliminating disparities in the pain experience. Over recent years, accumulating evidence has identified a variety of processes, from neurophysiological factors to structural elements of the healthcare system, that may contribute to shaping individual differences in pain. For example, the experience of pain differentially activates stress-related physiological responses across various ethnic groups, members of different ethnic groups appear to use differing coping strategies in managing pain complaints, providers' treatment decisions vary as a function of patient ethnicity and pharmacies in predominantly minority neighborhoods are far less likely to stock potent analgesics. These diverse factors, and others may all play a role in facilitating elevated levels of pain-related suffering among individuals from ethnic minority backgrounds. Here, we present a brief, nonexhaustive review of the recent literature and potential physiological and sociocultural mechanisms underlying these ethnic group disparities in pain outcomes.

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Over the past two decades, a substantial and rapidly growing body of literature focused on disparities in health across racial or ethnic groups has accumulated. Considerable evidence documents that these disparities extend to the prevalence, treatment, progression and outcomes of pain-related conditions. A significant proportion of this research has been carried out in the USA, and reveals that African-Americans, compared to non-Hispanic whites, suffer a greater burden of pain and pain-related suffering. Elucidating the mechanisms underlying these disparities is of crucial importance in reducing and eliminating disparities in the pain experience. Here, we present a brief, nonexhaustive review of this literature, focusing predominantly on the most recent and influential papers within each of the domains discussed. We used 'pain' and 'ethnic or ethnicity or cultural or race or sociocultural' as search terms in PubMed and Google to search the literature. We then examined abstracts to select the ones chosen for this review.

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## Race/ethnicity/culture

The terms ‘race’, ‘ethnicity’ and ‘culture’ are frequently used interchangeably but represent different concepts. Race is used to distinguish groups of people according to physical characteristics, biological disposition or ancestry [1]. The term ethnicity focuses on the distinction between groups of people who share a certain social background, distinguishing behaviors, culture, history, beliefs, conventions and traditions as well as physical characteristics [1]. Culture typically refers to behavioral and attitudinal norms, inherited ideas, beliefs, values and knowledge transmitted and reinforced by members of the group [2]. Culture shapes many aspects of the experience of pain, including pain expression, lay remedies, social roles, expectations, perceptions of the medical system, when/how/where to seek care, healthcare practices, illness beliefs and behaviors, and receptivity to medical care interventions [2]. As described by Edwards and colleagues [1], ‘ethnicity’ is likely the most appropriate term in most research studies on the topic, given the importance of the biopsychosocial model, as ‘ethnicity’ is comprised not only of race, but also refers to social, psychological and cultural characteristics, all inseparable from one’s self-identification as a member of a particular group.

## Clinical pain/laboratory pain studies

Ethnic differences in pain perception have been documented in a variety of clinical pain conditions, generally indicating that, for a given condition that is characterized by persistent pain complaints, African-Americans report greater pain and suffering when compared with whites. For example, African-Americans report greater pain in conditions such as glaucoma, AIDS, migraine headache, jaw pain, postoperative pain, myofascial pain, angina pectoris, joint pain, non-specific daily pain and arthritis, compared with whites (see [3,4] for review). Greater pain-related symptoms and disability in African-American patients relative to white patients have also been reported in multidisciplinary pain centers [5–7] and some evidence suggests that disparities between these groups appear to be independent of other demographic factors such as age, sex, socioeconomic status, education, employment, marital status and other potential confounders, such as medical comorbidities and disease duration [8–12]. In a recent review of ethnic differences in arthritis, Bolen and colleagues found that arthritis-attributable activity, work limitation and severe joint pain were higher for non-Hispanic blacks, Hispanics and ‘multiracial’ or ‘other’ participants with arthritis when compared with their non-Hispanic white counterparts [13]. A recent review by Jimenez *et al.*, focusing on American Indians, Alaska Natives and Aboriginal people of Canada, found that American Indians and Alaska Natives had a higher prevalence of pain symptoms and painful conditions when compared with the general US population [14]. Outside the USA, ethnic differences in pain reporting are also widely documented. For example, in a national survey of Singaporean older adults, participants of Malay descent had lower pain severity compared with Chinese participants, and Indian participants reported greater pain severity when compared with both Malay and Chinese participants [15]. In a cross-continental study, Zhu and colleagues recruited women in both Australia and China to examine differences in menstrual pain and found that Australian women rated menstrual pain as more intense, with the duration of pain lasting 36% longer when compared with Chinese women [16]. In a survey study conducted in Australia with back pain respondents, Italian-born men were more likely to report back pain as frequent, severe and chronic, limiting their behavior and reported having more painful sites when compared with Australian-born men, despite no difference in the prevalence of back pain between the groups [17]. In a Swedish study, pain in the lower back, neck, shoulders, elbows and hands was more frequent among Sami (northern Scandinavian indigenous) men and women compared with the general Swedish population; however, this may be owing to occupational differences [18]. In a German study, the prevalence of temporomandibular disorders (TMD), according to the Research

Diagnostic Criteria for TMD (RDC/TMD), was examined in adolescent German and Chinese young women, the authors found that after controlling for relevant factors, the prevalence of RDC/TMD pain diagnoses were increased in Chinese participants as compared with German participants [19].

Enhanced physiological pain sensitivity in minority groups has been proposed as a contributing factor that might partially explain the observed ethnic differences in clinical pain report [6]. Owing to the potential confounding of group differences in pain report by disease-specific factors, such as severity or duration, disparities in pain management and access to healthcare, controlled laboratory pain testing in healthy individuals is of great value to elucidate potential ethnic differences in the sensory experience of pain. A growing body of experimental pain studies has demonstrated ethnic differences in such systematic, laboratory conditions. Indeed, ethnic identity, part of a person's self-concept derived from one's social group membership, has recently been shown to partially account for ethnic differences observed in experimental pain responses [20].

In the USA, most of this work has been conducted examining the differences between African-Americans and non-Hispanic whites. African-Americans report greater sensitivity (i.e., lower pain threshold) and reduced pain tolerance to a variety of quantitative sensory testing methods when compared with non-Hispanic whites, including thermal pain [21–24], cold pressor pain [25], ischemic pain [6], electrical stimulation [26] and, perhaps most importantly (owing to their dynamic nature), increased temporal summation [12] and reduced diffuse noxious inhibitory controls, more recently labeled conditioned pain modulation [27,28], which is described below. Although less experimental work has been conducted in other groups, such as Hispanic-Americans and Asian-Americans, recent studies suggest lower pain thresholds and tolerance levels in Asian-Americans when compared with non-Hispanic whites [29] and highlight potential ethnic differences in endogenous pain regulatory mechanisms as a contributor to these effects. Ethnic differences in experimental pain have been shown in other countries as well. For example, in a Canadian study, Chinese participants reported greater pain catastrophizing, displayed lower pain tolerance and reported higher affective responses than European Canadians to a cold pressor task [30]. In a cross-continent study by Nayak and colleagues, Indian participants (tested in India) had higher pain tolerance than second-generation (or higher) American participants (tested in the USA) [31]. Watson and colleagues found that South Asians in the UK reported a lower pain threshold, increased pain intensity and greater pain unpleasantness when compared with white British participants [32]. In a Danish study, capsaicin injection to the forehead in healthy volunteers, thought to evoke similar mechanisms as migraine, was found to produce greater pain responses in south Indian participants compared with caucasian participants [33]. In another cross-continent study, Komiyama and colleagues compared Japanese to Belgian healthy college students (tested in Japan and Belgium, respectively); they found that Japanese participants were more sensitive to pressure detection as well as filament prick and pressure pain thresholds when compared with Belgium participants [34]. While these studies appear to suggest differences between majority and minority populations, with minority groups being more sensitive to pain, cross-continental studies have begun to reveal differences that cannot be attributed to majority/minority status. Therefore, ethnic differences in both the clinical and experimental pain experience have been widely reported. In general, these patterns of findings indicate that individuals with an ethnic minority background (relative to the country in which they live) demonstrate increased sensitivity to pain relative to groups representing ethnic majorities.

## Intra-ethnic differences

Studies examining intra-ethnic differences are of clear importance, given the considerable heterogeneity within the broader category of any given ethnic group. Examination of intra-ethnic differences has the potential to elucidate factors and mechanisms that may contribute to disparities and potentially drive or overshadow between-group differences. Differences in experimental pain responses among subgroups within larger ethnic categories have been reported [22,35,36]; although not all studies agree on this point [37]. Approximately 20 years ago, Greenwald examined inter-ethnic variability within participants of European descent and found significant differences in how individuals from different countries expressed pain in emotional terms; however, no differences were observed in pain perception [38]. Bates and colleagues, as reviewed in 1994, also found subgroup differences in emotional responsivity to chronic pain as well as pain intensity within a group of individuals classified as ‘white’ [39]. Specifically, they evaluated pain patients with Hispanic, ‘old American’ (at least third-generation US-born non-Hispanic caucasians), Irish, Italian, French–Canadian and Polish heritage and found significantly higher pain intensity ratings (measured through the McGill Pain Questionnaire’s total pain rating index) and affective ratings, interference in work and daily activities, greater pain expression and increased worry, anger and tension within the Hispanic group. The Italian group was second highest in several of these categories, while the Polish group reported relatively lower levels of many of these variables. Members of the Hispanic and Italian group indicated that emotional expression of pain was appropriate, while members of the Polish and ‘old American’ groups indicated belief that nonexpression was the ‘ideal response.’ The authors found that within-group differences in response to pain were associated with the patient’s generation, heritage and locus-of-control style. In a qualitative comparison of the healthcare context and culture between the USA (New England in particular) and Puerto Rico, Bates and colleagues further found that providers and patients alike shared a mind–body dualism belief that contributed to patient stress and alienation, while a view of mind–body integration in illness shared by Puerto Rican providers and patients contributed to a more supportive patient–provider relationship leading to less treatment-related stress for the patients [40].

## Disparities in treatment

Disparities in the effects of and responses to pain treatment have also been found (see [4] for detailed review). For example, we have found ethnic differences in response to multidisciplinary pain treatment. Specifically, following a 4-week treatment, African–Americans and non-Hispanic whites both improved in depressive symptoms and pain-related interference; however, only non-Hispanic white participants reported reduced pain severity [41]. Thus, the treatment approaches employed in this multi-disciplinary pain treatment study were less effective in improving pain severity in individuals with an ethnic minority background. In addition, Siedlecki found that listening to music in a chronic nonmalignant pain population decreased pain and depression, but was more efficacious in the non-Hispanic white group [42]; thus, this form of therapy may also have differential treatment effects by ethnic group. These findings hint that some nonpharmacologic treatments may be designed and delivered in such a way that they are more likely to benefit non-Hispanic white participants than others and suggest the possibility that culturally tailoring these treatments to patients’ backgrounds may improve outcomes for African–Americans and other minority patients.

While substantial evidence demonstrates the inconsistency in which different groups are prescribed pain medications [43], some data suggest that even when access is equal (e.g., patient-controlled analgesia) different ethnic groups may use different amounts of pain

medications [44]. Moreover, over the past three decades, pharmacogenetic research has found substantial differences among ethnic groups in the metabolism, clinical effectiveness and side-effect profiles of many drugs [45]; however, only a few studies have examined ethnic differences in the effects of pain medications. A pharmacokinetic study found ethnic differences (between non-Hispanic whites, African-Americans and Asian participants) in the effectiveness of codeine [46] and the metabolism of morphine may differ between non-Hispanic whites and Chinese patients [47]. Rabow and Dibble examined ethnic and country-of-origin differences in patients with terminal and end-stage chronic illness and found no differences in pain between Asian, African-American and Latino patients [48], although they reported significantly more pain than non-Hispanic whites. Furthermore, they found no differences in pain or analgesic use between patients born in the USA versus immigrants. By contrast, in a Singaporean study, Tan and colleagues found differences in patient-controlled analgesia (morphine) usage, with Asian Indians having greater pain scores and using the greatest amount of morphine compared with Chinese and Malay participants, even after controlling for demographic and operative variables (however, they did not control for pain severity) [49]. In addition, African-Americans were found to endorse similar analgesia when compared with non-Hispanic whites, despite receiving half the morphine dose [50]. In a study conducted in Hong Kong, Asian patients made 24% fewer demands and had less analgesia consumption during the first 24 h after upper abdominal surgery compared with patients of European descent [51]. These authors suggested pharmacokinetic or pharmacodynamic differences by ethnic group. Anderson *et al.* found that while African-Americans and Hispanic-Americans were prescribed less analgesics than their non-Hispanic white counterparts, they also reported taking their prescribed analgesics less frequently than prescribed and experienced limited pain relief from analgesic medications [52]. However, other researchers have found small, nonsignificant differences in analgesic consumption [43]. The variability in findings across studies suggests the possibility that ethnic group differences in analgesic effects may be subtle, medication-specific and affected by numerous contextual factors. Nevertheless, differences in analgesic consumption may have implications for the effectiveness of different medications. A number of genetic studies have similarly found ethnic differences in analgesic consumption and efficacy based on single nucleotide polymorphisms known to differ by ethnic origin (see [44] for review). For example, in a Chinese Han population, *CYP3A4\*1G* had an impact on the analgesic effect of fentanyl in women undergoing elective abdominal total hysterectomy [44]. In a very recent study, Sibille and colleagues found that African-Americans displayed an increased analgesic response to both morphine and butorphanol (a mixed-action opioid agonist) compared with non-Hispanic whites undergoing experimental pain testing [53]. In combination, these studies suggest altered response to analgesics based on ethnic group membership, although additional studies to elucidate the nature of these differences are warranted.

## Potential mechanisms

### Physiological

Little is known regarding the underlying mechanisms that influence disparities in pain perception. Recent work has examined potentially influential factors from sleep quality [54], to vitamin D deficiency [55] and genetic variability [56] to sociocultural issues (described above). Some differences have been examined in psycho-physiological factors that could play a role in the perceived difference between ethnic groups. For example, in comparison to non-Hispanic whites, African-Americans have reduced nociceptive flexion reflex thresholds [26]; the nociceptive flexion reflex is an electrophysiological, spinally mediated reflex, which is not amenable to voluntary control or subject to issues of response bias that plague self-report of pain experiences. This finding suggests that the observed ethnic differences in pain are unlikely to be fully explainable by sociocultural influences and hints that



neurobiological processes may contribute to such differences. Recently, African–Americans have also displayed increased temporal summation of heat pain when compared with non-Hispanic whites [12]; temporal summation or ‘wind-up’ (in animal models) refers to a method for testing central sensitization in humans, thought to represent CNS hyperexcitability. In addition, we have found that in comparison with non-Hispanic whites, African–Americans experience reduced conditioned pain modulation [27,28] – the phenomenon of one painful stimulus inhibiting the perception of a second pain stimuli to a distant body site. Diffuse noxious inhibitory control/conditioned pain modulation appears to depend on effective functioning of the endogenous opioid system, a descending pain-inhibitory system. Collectively, the findings of enhanced temporal summation of pain and reduced diffuse noxious inhibitory controls in African–Americans suggest the possibility that differential functioning of endogenous pain-regulatory systems may contribute to the ethnic disparities observed in both experimental and clinical pain.

In a novel series of studies, Mechlin and colleagues further examined ethnic differences in pain-related biomarkers. They found that stress-induced pain regulatory mechanisms involving blood pressure, norepinephrine (NE) and cortisol functioned more effectively among whites than African–Americans [57]. They have also documented significant ethnic differences in oxytocin, a neuropeptide associated with social affiliation that has links to pain perception and endogenous opioid/sympathetic nervous system activity. Specifically, they found lower plasma oxytocin levels among African–American women, which accounted for a substantial proportion of the ethnic differences that they observed in experimental pain responses [58]. The observation that oxytocin impacts social affiliation and attachment is particularly important with respect to ethnic differences, as such factors may influence differences in pain perception [20]. They also found differences in  $\beta$ -endorphin, an endogenous opioid neurotransmitter in the central and peripheral nervous systems and allopregnanolone (ALLO), a metabolite that has analgesic properties and modulates the hypothalamic–pituitary–adrenal (HPA) axis. They found that ALLO immunoreactivity, cortisol and  $\beta$ -endorphin concentrations were associated with experimental pain procedures in non-Hispanic whites only [59], such that lower ALLO concentrations and greater HPA-axis factors (both cortisol and  $\beta$ -endorphin concentration levels) were associated with increased pain tolerance. The authors concluded that ethnicity impacts the extent to which cortisol,  $\beta$ -endorphin and ALLO interact with HPA-axis functioning to influence the pain experience. In an extension of this work, they found that higher NE and blood pressure were associated with reduced pain in non-Hispanic whites, while higher NE was associated with increased pain and there was no relationship between blood pressure and pain and in African–Americans, further demonstrating ethnic differences in endogenous pain regulatory mechanisms [12]. These studies combine to suggest that endogenous pain regulatory mechanisms may differ across ethnic groups and that some of these systems may function less efficiently among African–Americans.

### Sociocultural

A variety of sociocultural factors have been examined and found to exert substantial influence over the experience of and response to pain. A number of excellent recent reviews have described these factors in great detail [3,4,60–62]. The interested reader may also find classic reviews in this area, worth investigating (such as [1,63]); here, we describe just a few of the most researched, pertinent factors.

**Patient factors**—Differences in a variety of sociocultural patient-related factors, from family traditions and religious beliefs to patient preference and previous experiences, influence disparities in pain. Ethnicity may have a major influence on the meaning of pain and how it is appraised and responded to emotionally and behaviorally. African–Americans

have been found to have a stronger link between emotions and pain behaviors than non-Hispanic whites and report increased levels of depression and disability, as well as pain severity, from various chronic pain conditions [61]. Ethnic differences have also been widely studied and reported in the use of various pain-coping strategies [3], which can substantially influence the pain experience. Generally, findings suggest that African-Americans are more likely to rely on 'passive' coping strategies that may be maladaptive in relation to pain and may produce increased depression and disability [64], including seeking social support, praying and hoping, and diverting attention away from pain (see [60] or review). For example, in a sample of rheumatoid arthritis patients, caucasians reported ignoring pain and using coping self-statements that potentially produce a greater perceived ability to control pain, while African-Americans reported greater use of the 'passive' pain coping strategies, distraction and praying/hoping [65]. Educational attainment has also been associated with pain response [66,67] and ethnic disparities in education may impact differences in pain responses observed between groups. Cano and colleagues found that education significantly interacted with coping, physical and pain-related psychosocial disability in an ethnically salient manner [9]. Specifically, when controlling for educational attainment, the ethnic differences observed in pain severity, interference and disability were muted. In addition, in a study conducted in Finland, patients with the lowest basic education and people over 60 years of age had more health problems a year after whiplash injury [68]. Limited education has also been associated with a decreased likelihood of pain consultation in a Hispanic population, along with speaking Spanish, being male, young and unemployed, suggesting access to care is dampened by achieving less education [69].

The expression of pain, pain behaviors and communication regarding one's pain are inextricably tied to sociocultural origins (e.g., familial models). In addition, a variety of other important factors shape the pain experience and contribute to disparities between groups, such as locus of control, cultural mistrust, religion, pain models and feelings regarding the meaning of pain; these variables are thoroughly considered in recent reviews of ethnic disparities in pain [60,61]. Collectively, ethnic differences in perceptions of pain and pain-related psychosocial processes may have a substantial health-related impact. Multiple studies have documented lower rates of participation in health-promoting behaviors such as mammography among African-Americans; recent research examining the mechanisms underlying this group difference suggests that one of the primary contributing factors is fear of mammography-related pain, which is more pervasive and intense among individuals from ethnic minority backgrounds [70].

Studies of Hispanic patients have suggested variability in the preference and sources of medical information and medication between patients' home countries and the USA [71]. Moreover, these differences were strongly affected by health insurance status. Studies such as this one highlight the fact that interactions of patients with providers and with the health-care system may differ strongly as a function of the context and country in which those interactions take place. In an intra-ethnic, qualitative, descriptive study, Meghani and Keane investigated the under-treatment of pain among minority cancer patients [72]. They found significant variability in the preference for analgesia; this preference was influenced by fears of medication dependency and tolerance, the meaning of cancer pain treatment and previous experience with pain relief, analgesic side effects, providers and the healthcare system. Personal, patient-level factors such as these, psychological variables, different experiences or environmental stressors may also contribute to disparities in pain. For example, psychological variables or experiences (such as discrimination, discussed below) may influence pain perception and these variables may have a higher prevalence rate in African-Americans. Interpersonal conflict and stressful experiences, for instance, may cause stress-induced physiologic changes [73–75], which may increase pain vulnerability [76–78].

**Provider factors**—Ethnic differences in medical treatment are widely documented and broad in scope, having been observed for dozens of disparate conditions. Most studies examining this challenging occurrence have reported that minorities receive inadequate care, including being less likely to receive pain medications and opioids, receive lower doses of pain medications and have longer wait times in the emergency department (see [61] for review). In the early 1980s, Streltzer and Wade found that caucasians and Hawaiians received significantly more analgesics than Filipinos, Japanese or Chinese patients following surgery [79]. Another author found that, in the context of postoperative pain, non-Hispanic whites received 22 mg of morphine equivalents per day, while Hispanic–Americans and African–Americans received 13 and 6 mg/day, respectively [80]. Cleeland and colleagues conducted a series of studies in cancer patients and found that 62% of patients seeking care at community clinical oncology centers, which predominantly serve minority patients, were undertreated with pain medication by WHO guidelines and were three-times more likely to be under-medicated than patients seen in primarily nonminority settings [81]. In their follow-up study, they found that 74% of Hispanic–Americans and 59% of African–American patients with pain did not receive the WHO-recommended standards for analgesics for their pain [82]. The disparity in opioid prescribing, with non-Hispanic whites more likely to receive pain medications than African–Americans and Hispanic and Asian patients, occurs in different pain complaints, seems to be more pronounced for severe pain and, unfortunately, does not appear to have diminished over time [83]. Remarkably, this under-utilization of opioid analgesics among ethnic minority patients has persisted despite evidence from large-scale, national databases that rates of adverse events such as lethal overdose are actually more frequent among white patients than among those from ethnic minority backgrounds [84].

Treatment may be influenced by the ethnicity of the clinician; for example, in a study examining Arabic-speaking and non-Arabic-speaking nurses conducted in the Middle East (Kuwait), estimates of pain ratings were only comparable between nurse and patient when the nurse shared their patient’s language [85,86]. Empathy has also been found to vary based on skin color, with people exhibiting increased empathic reactivity for others in their own racial/ethnic group, this reactivity was further modulated by racial bias and stereotypes [87]. While some research indicates that physicians underrate pain in African–American patients compared with whites [88], others have found no disparity in physician’s estimates of pain between groups and despite that, noted a difference in analgesics prescribed between groups [89]. These data suggest that even if physicians fairly assess pain, a barrier still occurs between assessment and prescription [3]. As reviewed by Anderson *et al.* [60], healthcare providers acknowledge inadequate training in pain management and cultural competency regarding pain assessment. Of note, in a recent, prospective, multicenter study of pain treatment in the emergency department, nonwhite physicians were more likely to achieve pain intensity reductions that were deemed clinically important in their patients when compared with white physicians [90]. However, nonwhite physicians ordered similar rates of analgesics to white physicians, but had better success in reducing pain intensity. The authors speculate that ethnic minority physicians may be more successful in achieving positive patient–physician interactions, which subsequently enhance the therapeutic effects of analgesic treatment. In the UK, dissatisfaction rates differ among some minority ethnic groups, for example, south Asians report dissatisfaction/poorer experiences as hospital inpatients than their white British counterparts [91]. In a 2003 study, Merrill and Allen examined satisfaction with healthcare in three US states among Hispanic, African–American and non-Hispanic whites. They found that Hispanic participants were more likely to be dissatisfied with overall healthcare and how their physicians treated them compared with non-Hispanic whites, especially on provider dimensions such as ‘listening carefully’ during a treatment encounter [92]. A recent study found that greater waiting time predicted dissatisfaction with healthcare among Latinas [93]. Chiauzzi and colleagues surveyed



healthcare professionals to assess the relationship between provider characteristics and their perception of pain treatment in Hispanic patients. They found that a woefully small percentage of healthcare providers who treat Hispanic patients actually speak Spanish or have undergone cultural competence training [94]. Presumably, treatment in other healthcare systems in other (Spanish) countries, in which the providers are more likely to be fluent in Spanish and culturally competent, satisfaction ratings might be much higher. Variability in satisfaction is not surprising, given the enormous disparities observed, although, it is difficult to discern whether these are patient, provider or systemic factors or some combination of all three.

**Systemic factors**—In addition to these contributions to the inferior quality of care administered to minority groups, the healthcare system itself provides barriers to equality in treatment. While relatively little work has been conducted recently regarding systemic factors inherent to ethnic differences in pain treatment, we believe it is extremely important to discuss this area, despite the dearth of recent research. Unfortunately, disparities in health increase with lower socioeconomic status (SES) despite universal access to care [95]. Countries with the most equitable distribution of wealth have the highest life expectancy, independent of the average income. In the USA, inequality in financial status correlates with mortality [95] and the widening gap between ethnic groups in SES has been paralleled by a widening gap in health [96]. Sadly, the SES gap appears to be holding constant or may even be widening. As reviewed by Williams and colleagues approximately 10 years ago, in 1978, African-Americans earned 59 cents for every dollar earned by non-Hispanic white households and 18 years later, in 1996, that number remained unchanged [96]; in 2009 the sobering number rose to only 59.8 cents on the dollar for African-Americans and 69.8 cents for Hispanic-Americans [97]. In addition, African-Americans have an uninsured rate of 21%, with an even higher rate of 32% for Hispanic-Americans, compared with non-Hispanic whites who have an uninsured rate of 12% [97]. Nevertheless, even when SES is held constant, minority patients remain at risk for disparities in pain care [98]. For example, low SES area pharmacies may be less likely to carry potent analgesics; there may be more limited access to care, insurance and availability of resources to provide quality pain management [60]. SES has been found to account for many of the ethnic differences in health; however, again, there is larger intra-ethnic variability than between-group differences [99]. Regardless, African-American men and women have a lower life expectancy than their non-Hispanic white counterparts at every income level. SES is one proposed mechanism through which ethnic differences in pain treatment may manifest.

SES and discrimination are inextricably tied [99]. Perceived mistreatment is associated with poorer health and may contribute to the initiation and maintenance of disparities in pain and ethnic minorities are at greater risk for experiencing mistreatment or discrimination [100,101]. Johnson and colleagues found that African-American, Hispanic and Asian respondents to a telephone survey believed that they were judged unfairly and/or treated with disrespect owing to their ethnicity and felt as though they would have received improved care if they were of a different ethnicity [102]. Others have found that, even after accounting for SES, perceptions of discrimination makes an incremental contribution to racial differences in self-rated health (see [96] for review). Edwards found that African-Americans reported substantially greater perceptions of discrimination and that discriminatory events were the strongest predictors of back pain reported in African-Americans, despite including a number of other physical and mental health variables in the model [103]. Thus, experiences of mistreatment or discrimination may contribute to the experience and perception of chronic pain in many ways [100,101].

## Conclusion & future perspective

In summary, ethnic differences in pain responses and pain management have been observed persistently in a broad array of settings; unfortunately, despite advances in pain care, minorities remain at risk for inadequate pain control. A number of complex variables combine and help explain the disparities in clinical pain, both in patient perception and treatment. Ethnic disparities exist across a broad range of pain-related factors and are shaped by complex and interacting multifactorial variables. In the future, it would be helpful for more studies to report on and describe the ethnic characteristics of their samples and delve into differences or similarities that exist between groups in order to elucidate the mechanisms underlying these differences. For example, it is typical that only ‘ethnic differences’ studies fully describe their results in terms of disparities and typically only between African-Americans and non-Hispanic whites. As society grows more and more ethnically diverse, the examination of disparities between a wide variety of ethnic groups should increasingly be requested of research studies in a variety of settings. Future research should also focus on both between- and within-group variability, as individual differences in pain responses are generally quite large. Cross-continental studies, which offer the potential to investigate pain sensitivity outside the boundaries of majority/minority status, may also aid in elucidating mechanisms underlying ethnic differences. In addition, previous research rarely examines and reports interactions between ethnic group membership and other important variables, such as gender and age, which are both recognized as factors that influence pain perception. For instance, it may be possible that ethnic differences in pain response fluctuate as a function of age or that ethnic differences are more pronounced among females than males (or vice versa). Research on the mechanisms underlying ethnic differences in pain responses should begin to examine multiple factors known to influence disparities in order to begin elucidating the complex networks, moderating factors and causal relationships between variables of interest that exert influence on pain in individuals of all ethnic backgrounds and must be examined in order to make progress in eliminating disparities in pain treatment and health status in general. Prospective studies involving multifaceted interventions must be undertaken, as well as enhanced medical training focused on pain treatment, potential personal bias that may influence inequitable treatment decisions and the importance and inherent obligation to take action when faced with an individual in pain, regardless of their demographic characteristics.

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### Practice Points

- Ethnic differences in pain responses and pain management are persistent and despite advances in pain care, ethnic minorities remain at risk for inadequate pain control.
- A duty to examine any potential stereotyping, personal prejudice or bias must be present during clinical decision making and consultation should be obtained when inequitable treatment decisions are conceivable.
- Studies should report the ethnic characteristics of their samples.
- Clinicians should make every effort to increase their cultural sensitivity and awareness in order to improve treatment outcomes for minority patients.
- Given that ethnic groups may differ in the outcomes of specific treatments, ethnicity should be one factor that clinicians consider when selecting and recommending treatments.
- Future studies should also examine within-group differences and interactions with other relevant factors (e.g., sex and age).
- The mechanisms underlying ethnic differences in pain response are multifactorial and complex; longitudinal studies examining multiple factors known to influence disparities should be undertaken.