Explaining the Relationship between Pain and Depressive Symptoms in African-American and White Women with Arthritis

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Arthritis is a common chronic illness that disproportionately affects women and African Americans and is often associated with depression. The mechanisms through which arthritis-related pain are associated with depression remain unclear. This study examined the relationship between arthritis-related pain and depressive symptoms to determine if functional impairment and sense of mastery mediated this relationship. Participants included 77 African-American and 98 white women with arthritis (aged 45–90) who completed structured questionnaires assessing pain, functional impairment, sense of mastery and depressive symptoms. Regression analyses showed that sense of mastery and functional impairment partially mediated the relationship between pain and depressive symptoms for whites such that the previously significant pain-depression relationship (ß=0.40, p<0.001) was no longer significant (ß=0.05, p=0.62). Only sense of mastery partially mediated between pain and depressive symptoms for African Americans. Again, the previously significant pain-depression relationship (ß=0.32, p<0.01) was reduced (ß=0.16, p=0.19). Implications of the study suggest that it is important for service providers and healthcare professionals to be aware of different lifetime experiences and perceptions of illness in order to better serve the needs of women from different race groups.

Key words: race/ethnicity ■ pain ■ depression

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Chronic illness has replaced infectious disease as one of the most pressing public health problems in the United States. This turn of events has significant implications for an increasingly diverse aging population. In particular, arthritis is the most common chronic condition and a leading cause of disability in adulthood.[1] By the year 2030, 67 million people are expected to have arthritis, 40.9 million of which will be women.[2] Arthritis disproportionately affects women at all ages throughout adulthood. Women also have a higher prevalence of arthritis-related pain and disability compared to men.[3] Thus, women are likely to experience a greater impact of arthritis across the life span. Some of the most common risk factors and consequences for arthritis include pain, joint stiffness and functional limitations, which may interfere with performing daily life activities and diminish quality of life. This is particularly relevant for African Americans, who are at a greater risk of having arthritis[4] and experiencing more severe arthritis-related symptoms such as pain and activity limitations compared to whites.[5]

People with arthritis are also more likely than the general population to report depressive symptoms.[6] In particular, women with arthritis are at a greater risk for depression than similarly diagnosed men with arthritis.[3] Extant data also show pervasive race differences in reports of pain and depression among older adults with a pain-related chronic illness, such as arthritis.[5,7,8] Specifically, African Americans with arthritis or chronic pain report more severe pain[5,7] and less control over their pain than whites.[7] In addition, older African Americans with chronic pain report having more depressive symptoms than older whites.[7] Likewise, older African Americans with arthritis report lower perceived quality of life compared to older whites.[8] Past research has established a link among pain, functional impairment and depressive symptoms,[9,10] and recognizes the relationship between pain and depression among different race groups;[7,11] however, the mechanisms through which this occurs are unclear. Moreover, there is a lack of research addressing these issues for African-American women in particular. Understanding the mechanisms through which pain is related to depression will be important for service providers as well as for guiding educational efforts and arthritis interventions that meet the unique needs of older adults from different race groups. To date, the majority of arthritis interventions have included mostly white participants.[12] Before we can design informed interventions for African-American women, who have

largely been overlooked in past research, it is important to first examine whether relationships among these variables are the same for African Americans and whites.

One factor that may explain the pain-depression relationship is functional impairment. According to the activity restriction model,[13,14] health-related stressors such as pain are related to poor well-being (e.g., depression) to the extent that they interfere with everyday activities. The model suggests a direct relationship between pain and well-being as well as an indirect relationship through restricting activities. The activity restriction model is particularly applicable in the context of arthritis since people with arthritis often report experiencing difficulty performing daily activities in multiple domains such as home and work, interpersonal relationships and leisure-related activities, which can be distressing.[15] Specifically, individuals with arthritis may reduce or discontinue daily life activities in response to the stress of the illness (e.g., pain) and the extent to which these activities can no longer be performed may then lead to depression. Past research confirms that functional impairment at least partially explains the relationship between pain and depression in older adults,[9,10] chronic pain patients[16,17] and middle-aged women with osteoarthritis (OA).[18]

Other studies find that additional factors, such as social functioning and sense of control, partially explain the pain-depression relationship in older adults,[19] older OA patients[18,20] and chronic pain patients.[16,17] Therefore, we consider sense of mastery as an alternate mediator in the pain-depression relationship. Defined as having a sense of control over one's life and environment,[21] sense of mastery (e.g., personal control) is a psychological resource that benefits both health and well-being.[22,23] For individuals with a painful chronic illness such as arthritis, personal control can be threatened by feelings of personal responsibility for illness, the unpredictable nature of illness and by feeling dependent on other people to maintain daily activities.[24] On the other hand, past research suggests that having a high sense of control or mastery may be an important psychological resource for coping with stress in the context of a painful chronic illness such as arthritis[24] and that sense of mastery influences health outcomes, disability and depression.[25-27]

It is also unclear whether functional impairment and sense of mastery will be explanatory factors in the pain-depression relationship for African-American women compared to white women. Past research shows that African Americans perceive less control over their pain,[7] and have a lower sense of mastery[28] and personal control in general.[29] One study found evidence that sense of mastery and functional impairment were related to depressive symptoms for older African Americans and whites, but that sense of mastery served as a stress buffer for chronic conditions only for African Americans.[26] On the other hand, a recent study found that increases in functional limitations were related to increases in depressive symptoms over time for older whites with low socioeconomic status (SES) but not for older African Americans.[30] Given these varying relationships, it is uncertain whether pain is directly related to depressive symptoms or whether other factors, such as sense of control or functional impairment, explain this relationship for African-American and white women with arthritis.

Current research confirms the existing relationship among pain, disability and depression. However, it is unclear how these variables are related and whether psychosocial factors play a role in addition to physical factors. Research has not adequately addressed this association among African-American and white women with arthritis. We examined whether functional impairment and sense of mastery explain the relationship between pain and depressive symptoms in African-American and white women with arthritis. The objectives of the current study are to determine: 1) whether there is a direct relationship between pain and depressive symptoms, 2) whether functional impairment mediates the pain-depression relationship, 3) whether sense of mastery mediates the pain-depression relationship, and 4) whether associations among these variables varies by race.

METHODS

Participants and Procedure

Participants included 77 (44%) African-American and 98 (56%) white women with arthritis, aged 45–90, with an average age of 66.74 (SD=10.68) years. Participants were recruited from clinics (e.g., rheumatology clinic, community clinics), senior centers, church groups and other community groups (e.g., Foster Grandparents, Black Nurse's Association) in the Tampa, FL, metropolitan area. Approximately 25% of participants were recruited from clinics [1 rheumatology clinic (22%) and 2 community clinics that serve individuals with low SES (3%)], and the remainder was recruited from community and church groups (75%). In the rheumatology clinic, participants were recruited with the assistance of nurses and rheumatologists, who introduced the study to patients with OA during a clinic visit. Participants were recruited from community groups and clinics through flyers, community contacts and presentations in the community.

Potential participants were screened for eligibility either in person or by phone, and an interview was scheduled for all eligible participants. All potential participants, including both clinic and community participants, responded to the following questions in the initial screening: "What is the main kind of arthritis that you have?;" "Do you have any other kinds of arthritis such as rheumatoid arthritis, psoriatic arthritis or lupus?;" "Are you age 45 or older?" Eligibility criteria included self-reporting having OA, ≥45 years of age, being female and being cognitively intact. If a potential participant did not report that they had OA, then they were not included

in the study. In the clinic, we only approached patients if the doctor or nurse confirmed the OA diagnosis. In the community, we tried to confirm the OA diagnosis by contacting each participant's doctor. Including both clinic and community participants, we were able to access participants' rheumatologist or physician for confirmation of their diagnosis for the majority of the sample (63%). However, the remainder of participants, who were recruited from the community, did not have a doctor or their doctor did not respond to our request for OA diagnosis confirmation. On several occasions (n=3), potential participants were cognitively unable to either complete the screening or the interview (e.g., were not able to answer basic questions such as age, education). In this situation, we did not complete the interview.

Interviews lasted approximately 1 hour. Informed consent was obtained for all participants, and respondents received $20 for their participation. Most interviews (96%) were conducted by trained interviewers at the rheumatology clinic, community site (e.g., senior center) or the participant's home. In the remaining 4% of cases (n=7), participants were not able to participate in the study due to time constraints unless they self-administered the questionnaire at home and mailed it back to the research office. In this situation, we included a letter with instructions for completing the questionnaire. Upon receiving the completed questionnaires in the mail, the researchers made follow-up phone calls with these participants, if necessary, to clarify any answers that were unclear. The 7 self-administered interviews were evenly distributed across the 2 race groups. Of the 7 who completed the interview on their own, 4 were white and 3 were African American.

Measures

The structured questionnaire assessed functional impairment, sense of mastery, pain, depressive symptoms and demographics.

Functional impairment was measured using the Arthritis Impact Measurement Scale 2 (AIMS2).[31] The AIMS2 is a 28-item measure of functional impairment assessing difficulty in the past month with mobility, walking and bending, hand and finger function, arm function, self-care and household tasks [ranging from all days (1) to no days (5)]. Items are responded to on a 5-point scale, recoded and summed to produce a raw score, then normalized to produce standard scores ranging from 0–10 for all subscales. Scores range from 0–60, with high scores indicating poor functional status. Cronbach's alpha for this scale was 0.92 for African Americans and 0.91 for whites.

Pain was assessed with the AIMS2 5-item scale, which asks respondents to rate pain severity [ranging from severe (1) to none (5)], as well as frequency of severe pain, pain in ≥2 joints, morning stiffness and interference with sleep during the past month [ranging from all days (1) to no days (5)]. Scores range from 0–10, with high scores indicating greater pain. Reliability was 0.77 for African Americans and 0.79 for whites for the pain subscale.

Sense of mastery, which is defined as having a sense of control over one's life and environment, was measured using Pearlin and Schooler's 7-item mastery scale.[21] Example items include "I have little control over the things that happen to me" and "I can do just about anything I really set my mind to do." Negatively worded items were reverse coded. Items were responded to on a 4-point scale [ranging from strongly disagree (1) to strongly agree (4)], the possible range is 7–28, and high scores indicate high sense of mastery. Reliability was 0.74 for African Americans and 0.77 for whites for the sense of mastery scale.

Depressive symptoms were measured using the Center for Epidemiological Studies-Depression (CES-D)[32] scale, which assesses depressive affect, positive affect, somatic activity and interpersonal distress during the past week. The measure yields a composite score ranging from 0–60; higher scores indicate more depressive symptoms. Reliability was 0.90 for African Americans and 0.90 for whites for the CESD.

Demographics were also assessed. Age was measured as a continuous variable. Race was self-reported. Participants responded to the question: "Please tell me your ethnicity or race. Do you consider yourself to be white/Caucasian, Black/African American, Latina/Hispanic, Asian/Pacific Islander, native American or other?"

Statistical Analyses

Descriptive statistics and bivariate correlations were examined to determine the extent of association among the study variables for African-American and white women. Following the mediation guidelines set forth by Baron and Kenny,[33] a series of regression analyses were conducted, to determine if functional impairment and sense of mastery mediated the relationship between pain and depressive symptoms while controlling for age. We first conducted the mediation analyses for the sample as a whole and then we conducted mediation analyses separately for whites and African Americans. According to Baron and Kenny, the following conditions must be met to establish mediation: first, the independent variable (pain) must be related to the dependent variable (depressive symptoms). Second, the independent variable should be related to the mediator (functional impairment or sense of mastery). Third, the mediator should be related to the dependent variable while controlling for the independent variable. Finally, the relationship between the independent variable and the dependent variable should be reduced to 0 when controlling for the mediator. We tested the models for the 2 mediators simultaneously[34] since functional impairment and sense of mastery are distinct concepts and moder-

ately correlated for both groups. Prior studies examining mediators in the pain-depression relationship have examined physical functioning and other cognitive/psychosocial variables as mediators in the same model.[16,20] The Sobel test[35,36] was used to confirm partial mediation. This occurs when the relationship between the independent and dependent variables is decreased but not reduced to 0 (i.e., full mediation only occurs when the effect is reduced to 0). For all analyses, we used the standard p value of 0.05 as the cut-off point, indicating statistical significance.

RESULTS

Descriptive statistics for the 2 groups and t test results are shown in Table 1. African Americans reported more functional impairment compared to whites. There were no significant group differences in age, pain, sense of mastery or depressive symptoms. Table 2 reports correlations among study variables. The study variables were moderately correlated for both groups in the expected direction, with the exception of pain and sense of mastery, which were unrelated for African-American women. It is also interesting to note that older age was related to less pain and less sense of mastery for African-American women.

Mediation Results for the Entire Sample

First, we examined whether functional impairment and sense of mastery mediated the relationship between pain and depressive symptoms for the sample as a whole. All analyses controlled for age. We first established that there was a significant relationship between pain and depressive symptoms (ß=0.36, p<0.001). Next, we found that pain was related to functional impairment (ß=0.55, p<0.001) and that pain was related to sense of mastery (ß=-0.38, p<0.001). In the next step, functional impairment was related to depressive symptoms while controlling for pain and sense of mastery (ß=0.17, p<0.05), and sense of mastery was related to depressive symptoms while controlling for pain and functional impairment (ß=-0.42, p<0.001). In the final step, we found that the previously significant relationship between pain and depressive symptoms was reduced and no longer significant when controlling for functional impairment and sense of mastery (ß=0.10, p=0.17). Finally, partial mediation was confirmed using the Sobel test, which showed that the reduction due to both functional impairment (z=2.28, p<0.05) and sense of mastery (z=4.00, p<0.001) was significant.

Mediation Results for Whites

Next, we examined whether functional impairment and sense of mastery mediated the relationship between pain and depressive symptoms for the white sample. All analyses controlled for age. Results showed that functional impairment and sense of mastery partially mediated the relationship between pain and depressive symptoms (Figure 1). First, we found a significant relationship between pain and depressive symptoms (ß=0.40, p<0.001). We then established that pain was related to functional impairment (ß=0.54, p<0.001) and that pain was related to sense of mastery (ß=-0.47, p<0.001). Next, functional impairment was related to depressive symptoms when controlling for pain and sense of mastery (ß=0.28, p<0.01), and sense of mastery was related to depressive symptoms when controlling for pain and functional impairment (ß=-0.43, p<0.001). Finally,

Table 1. Descriptive characteristics for study variables

	African Americans	Whites	
Variable	**Mean ± SD**	**Mean ± SD**	**t**
Age	66.1 ± 11.1	67.0 ± 10.5	0.55
Pain	5.7 ± 2.0	5.2 ± 2.2	-1.69
Functional impairment	21.0 ± 9.4	16.9 ± 7.8	-2.80**
Sense of mastery	20.2 ± 3.8	20.4 ± 3.4	0.29
Depressive symptoms	11.5 ± 10.0	11.7 ± 9.6	0.17

* p<0.05; ** p<0.01; *** p<0.001

Table 2. Correlations for study variables by race

Variable	1	2	3	4	5
1 Age	–				
2 Pain	-0.22*/-0.13	–			
3 Functional impairment	-0.09/0.02	0.54***/0.53***	–		
4 Sense of mastery	-0.32**/-0.07	-0.19/-0.46***	-0.40***/-0.50***	–	
5 Depressive symptoms	0.21/-0.22*	0.35**/0.42***	0.37***/0.51***	-0.40***/-0.59***	–

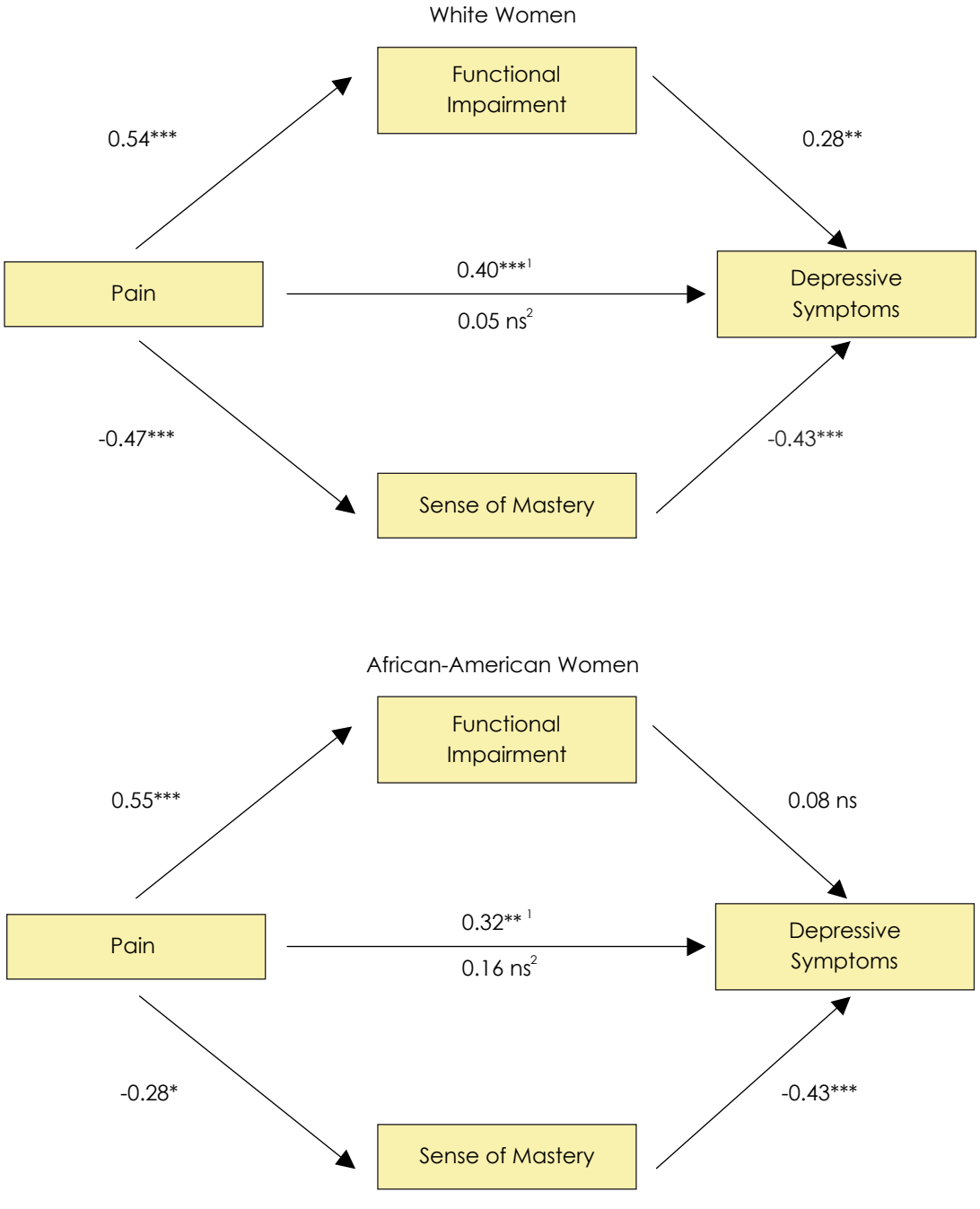
Correlations are presented for African-American women and white women, respectively (African American/white); * p<0.05; ** p<0.01; *** p<0.001

while controlling for functional impairment and sense of mastery, the relationship between pain and depressive symptoms was reduced and no longer significant (ß=0.05, p=0.62). Using the Sobel test, the reduction due to functional impairment was significant (z=2.70, p<0.01) as well as the reduction due to sense of mastery (z=3.44, p<0.001), which confirmed partial mediation for both variables.

Mediation Results for African Americans

We conducted the same set of analyses to examine whether functional impairment and sense of mastery mediated the relationship between pain and depressive symptoms among African Americans. Again, all analyses controlled for age. Results showed that functional impairment was not a mediator between pain and depression, but sense of mastery did partially mediate

Figure 1. Functional impairment and mastery as mediators between pain and depressive symptoms



1: Bivariate correlation; 2: Partial correlation

the relationship between pain and depressive symptoms for African Americans (Figure 1). First, pain was significantly related to depressive symptoms (ß=0.32, p<0.01). Pain was related to functional impairment (ß=0.55, p<0.001), however, functional impairment did not meet the conditions for mediation because it was not related to depressive symptoms when controlling for pain and sense of mastery (ß=0.08, p=0.52). Next, pain was related to sense of mastery (ß=-0.28, p<0.05), and sense of mastery was related to depressive symptoms when controlling for pain and functional impairment (ß=-0.43, p<0.001). Finally, the relationship between pain and depressive symptoms was reduced and no longer significant (ß=0.16, p=0.19). Results showed that sense of mastery met the conditions for mediation and that there was a reduction in the relationship between pain and depressive symptoms when including both functional impairment and sense of mastery in the model. We next confirmed that sense of mastery partially mediated the relationship between pain and depressive symptoms with the Sobel test (z=2.08, p<0.05).

DISCUSSION

The current study examined whether sense of mastery and functional impairment mediated the relationship between pain and depressive symptoms in African-American and white women with arthritis. We established that, while there is a direct relationship between pain and depressive symptoms, both functional impairment and sense of mastery were partial mediators in the relationship between pain and depressive symptoms. However, we found a different pattern of results for African Americans and whites. For white women, both functional impairment and sense of mastery partially mediated the relationship between pain and depressive symptoms. For African-American women, sense of mastery but not functional impairment partially mediated the relationship between pain and depressive symptoms. It is important to note that if we only examined mediators in the pain-depression relationship for the entire sample (and not by race), then we would have missed the different patterns that emerged when comparing the two race groups. This finding underscores the importance of examining relationships separately by race in research on health and aging, which may allow different patterns to emerge.

The finding that functional impairment partially mediated the pain-depression relationship is consistent with the activity restriction model[13,14] and research showing that pain is related to activity limitations, which is then associated with psychological well-being.[9,10] However, this finding only held true for the white sample. Thus, the question remains as to why functional impairment did not mediate the relationship between pain and depression for African-American women. This finding is consistent with results from a recent longitudinal study which found that, among elders with low SES, increases in functional limitations were related to increases in depressive symptoms for whites but not for African Americans.[30] The authors speculated that African Americans are more likely to experience illness and physical disabilities over their lifetime and are better able to cope with their limitations. For white women, functional impairment that comes with older age may be unexpected and more distressing compared to African-American women, who are more likely to have had the disease longer and at a younger age. Therefore, African-American women may have developed better coping mechanisms in comparison to white women. Past research also suggests that African Americans may be more resilient to life stressors such as disablement.[37]

Sense of mastery, however, was found to partially mediate the relationship between pain and depressive symptoms for both white and African-American women. This finding corroborates with research showing that sense of mastery or control plays a role in the context of poor health, disability[25] or a painful chronic condition.[24] Specifically, sense of mastery may serve as an important psychological resource that enables individuals to better adapt and cope with illness and disability. This finding is also consistent with past research demonstrating the importance of sense of mastery for older African-American women[26] and suggests that it may be important to consider psychological resources, such as sense of mastery or personal control over one's health, in future research on the pain-depression relationship.

The current study offers preliminary evidence on the nature of the pain-depression relationship in African-American and white women with arthritis; however, several limitations should be noted. The results of this study are preliminary, and the use of a convenience sample of women suggests that results cannot be generalized to males or to all African Americans and whites. Another limitation is that some participants were recruited from a clinic setting, which suggests a select group of people who are already seeking or receiving treatment and support for their arthritis. Future research should examine race differences in potential physical and psychosocial mediators in the pain-depression relationship using a large, representative sample. Participants self-reported having arthritis, and self-reports can be prone to bias. However, we were able to access participants' rheumatologist or physician for further confirmation of their diagnosis for the majority of the sample (63%).

The cross-sectional design limits the conclusions that can be drawn about the direction of the pain-depression relationship. Our assumption that pain influences functional impairment or sense of mastery, which then influences depressive symptoms, was guided both by past research and the activity restriction model. However, longitudinal data are necessary to truly test for mediation and to truly understand "mechanisms" through which pain influences depression (or vice versa). It is also prob-

able that the pain-mediator-depression process is more complex and that relationships among the variables may be bidirectional.[14] However, it should be noted that cross-sectional findings suggesting that functional impairment mediates the relationship between pain and depressive symptoms were confirmed longitudinally in a study on pain in cancer patients.[38] Given the lack of investigation into the mechanisms that may drive the pain-depression relationship in different race groups, the current study does provide preliminary evidence for 2 possible mechanisms and may inform future studies. Future studies using a longitudinal design would help to clarify the direction and nature of these relationships in arthritis.

Recall bias is another limitation to consider in that we asked participants to think back about pain, functional impairment, sense of mastery and depressive symptoms and in some cases the time frame varied among the instruments (e.g., past week versus past month). Future research might benefit from considering these constructs in real time using methods such as the daily diary approach. An additional concern is in regards to the potential influence of self-administering the questionnaire to 7 participants. We do not believe that including these 7 participants changes the results of the study. The participants were evenly distributed across the 2 race groups, with 3 African-American and 4 white participants self-administering the questionnaire. Mediation analyses were examined with and without these 7 participants, and the results were unchanged.

In the current study, we included both middle-aged and older women with arthritis. We controlled for age in the mediation analyses due to the established relationship in the literature between age and pain, disability and psychological well-being.[11,39] This is particularly relevant as African Americans, in general, are more likely to be diagnosed with a medical condition at a younger age, are disproportionately diagnosed with debilitating illnesses and are more incapacitated from such illnesses compared to whites.[40,41] Similarly, African-American women are more likely to report pain-related chronic conditions (e.g., OA, fibromyalgia, migraines) at a younger age, are more likely to rate their health as poor and demonstrate diminished functional capacities than majority populations.[5,42-44]

While results are preliminary, our findings do have implications for designing interventions to help women with arthritis maintain their quality of life. Interventions might focus on increasing normal daily activities through various means such as increasing social ties[14] and educating family members about arthritis and the needs of an older relative with arthritis.[45] Improving the likelihood that women with arthritis can continue their daily activities may then help to alleviate depression. While some arthritis interventions focus on improvements in psychosocial variables such as arthritis-related self-efficacy,[46] many arthritis intervention programs focus mainly on improving arthritis-related symptoms such as pain and disability. However, the results from the current study emphasize the importance of focusing on psychosocial variables such as enhancing sense of mastery, which may be beneficial for both groups. Moreover, given the finding that functional impairment was not a mediator between pain and depressive symptoms for African-American women, service providers should be aware of the different lifetime experiences and perceptions of illness in order to better attend to the needs of women from different race groups.

The results of this study provide a better understanding of the relationship between pain and depression for African-American and white women with arthritis. Our findings highlight the importance of examining the pain-depression relationship separately for the 2 race groups, which revealed that, while sense of mastery mediated the pain-depression relationship for both African-American and white women, functional impairment mediated this relationship for white women only. Future research on arthritis should consider potential race differences that may contribute to adaptation to illness and quality of life. Understanding the factors that underscore the relationship between pain and depression and how to meet the needs of different race groups will be essential as our population ages in the coming decades.

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