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Association between positive and negative affect and musculoskeletal pain among US home health aides

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ABSTRACT

As the US population ages, there is an expected increase in demand for home health aides (HHAs); therefore, it is important to ensure their occupational well-being. Previous studies have demonstrated associations between negative emotions and musculoskeletal pain. Using survey data collected from 285 HHAs, we characterize the association between affect and musculoskeletal pain. Affect was measured using the Positive and Negative Affect Schedule, while musculoskeletal pain was measured using the Brief Pain Inventory. We found that as positive affect composite score increased, musculoskeletal pain decreased [$\beta = -0.57$, $t(124) = -7.01$, $p < .001$]. There was no significant association between the negative affect composite score and musculoskeletal pain. However, several individual moods were associated with decreased or increased pain. These data suggest that some moods may buffer against musculoskeletal pain, while others may predispose HHAs to musculoskeletal pain.

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Affect; home health aides; mood; musculoskeletal pain

As the population of the United States ages, the demand for home health workers is expected to grow at an unprecedented rate. Since the working environment of home health aides (HHAs) is in the private home, they are exposed to a wide range of hazards, including musculoskeletal injury and strain, violence, percutaneous injuries with used sharp medical devices, and exposure to infectious agents and cleaning and disinfection chemicals.[1] Due to their exposure to both physical and psychological hazards, it is important to ensure the physical and emotional safety in the workplace of the growing HHA population.

Previous studies have shown associations between pain and psychosocial factors, such as affect and mood. More specifically, positive and negative moods (ie, Positive and Negative Affect Schedule; PANAS[2]) were found to be mediators in the relationship between exposure to bullying and musculoskeletal complaints among workers in a Norwegian public transport company.[3] Similarly, perceived job strain, anxiety, and depression have been found to be associated with musculoskeletal pain among social workers.[3] In addition, a cross-sectional survey in Japan found that among patients with chronic pain, low health-related quality of life was more frequent among those with poor social support and job dissatisfaction.[4] Overall, studies have shown that negative affect can be a risk factor for musculoskeletal pain, and conversely, positive affect may act as a buffer.[3, 4]

This cross-sectional study investigated the association between positive and negative affect and musculoskeletal pain among HHAs using data from The Home Health Occupations Musculoskeletal Examinations (HHOME) study. The relationship between positive and negative affect and musculoskeletal pain was examined, and then to further understand the association between mood and pain, we examined the individual mood–pain relationship.

Methods

Procedure

Survey design

To design the HHOME survey instrument, we conducted three focus groups with a total of 32 HHAs during a 10-month period in 2014. A 55-item, English-language questionnaire organized into 10 sections based on focus-group data was created and then translated into Spanish. We used an exploratory sequential mixed-methods design in the HHOME study to initially develop

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a language-sensitive and content-appropriate survey instrument for the HHA workforce. Many of the measures included in the HHA survey instrument were adopted from existing validated national health surveys. For example, one source of the survey measures was adopted from the 2007 US National Home Health Aide Survey. Once measures were adapted, we then evaluated the reliability and validity of both the English and Spanish-translated versions of the survey instrument with HHAs prior to fielding the final survey instrument with a large HHA sample.

Participant recruitment

Survey data collection took place from March 2014 to February 2016. Participants were recruited from home healthcare agencies in Massachusetts, Florida, and Oregon with established research partnerships with the investigators. Flyers recruiting HHAs to complete the survey were distributed in person by research members during scheduled HHA education sessions or by email. We recruited a total of 285 HHAs (response rate = 98.6% or 285/289).

Measures

Pain measurement

Musculoskeletal pain was measured using the Brief Pain Inventory.[5] Participants were asked to rate, on a scale from 1 to 10, any pain affecting their muscles, joints, neck, or back during the previous 7 days. Participants rated their pain at its worst, least, on average, and right now, from 1 (*no pain*) to 10 (*pain as bad as you can imagine*). These four values were averaged to provide a quantifiable measure of musculoskeletal pain. The internal consistency coefficient was 0.85.

Mood measurements

Positive and negative affect were determined using the PANAS scale.[2] Participants were asked to rate to what extent they had experienced 21 positive and negative moods during the past 7 days on a 5-point scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The positive affect moods include interested, excited, strong, enthusiastic, proud, alert, inspired, determined, active, and grateful. The negative affect moods include distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, lonely, afraid, and angry. The relationship between affect and musculoskeletal pain was determined for each of the 21 moods individually. In addition, a single quantifiable composite positive affect score and negative affect score was determined by adding the scores for all the positive and negative moods, respectively, for each survey participant. Using these aggregate positive and negative affect scores, we determined the relationship between aggregate positive and negative affect and musculoskeletal pain. Internal consistency coefficients were $\alpha = .91$ for positive moods and $\alpha = .84$ for negative moods.

Data analysis

Hierarchical regressions were conducted to examine the relationship between affect and musculoskeletal pain using SPSS Software (Version 21, IBM Co). This model determined whether there is a significant change in musculoskeletal pain, measured using the Brief Pain Inventory, as the PANAS score for moods increases. Our analysis controlled for age as a confounder because it was the only demographic variable shown to have an effect on the association between the variables in preliminary analyses.

Preliminary analyses demonstrated that variables such as age and ethnicity did not have a significant effect on the relationship between affect and musculoskeletal pain. Therefore, our final analysis did not control for these factors as confounders. The university's institutional review board (IRB) approved the research protocol for this pilot study (IRB#13-2798).

Results

Survey data from the HHOME pilot study were used to examine the association between affect and musculoskeletal pain. The survey was administered in Massachusetts (48.4% of participants), Florida (37.5%), and Oregon (14.0%). The surveyed population was composed of 94.4% women. The mean age of participants was 40.76 years (standard deviation [SD] = 13.8). The racial composition was 61.8% White (non-Hispanic) and 31% Hispanic or Latino. The remaining subjects were Black, American Indian/Alaskan, or other (Table 1). Participants were most commonly never married (32%), married (31.9%), or divorced (17.2%). In addition, most participants reported education through 12th grade or GED (41.1%), some college or technical school (36.1%), or college graduate (20%).

A hierarchical linear regression was conducted with age first, and then positive and negative moods inserted in the second step. The resulting models indicated that the relationship between positive moods and pain accounted for 34% of the explained variance (adjusted $R^2 = .34$). An increase in positive mood significantly decreased the level of pain [$\beta = -0.57$, $t(124) = -7.01$, $p < .001$], and interestingly, negative moods were not significantly related to pain levels [$\beta = -0.006$, $t(124) =$ z-0.070, $p =$ ns].

Table 1. Sociodemographic characteristics among home health aides participating in the HHOME study, March 2014 to February 2016.

Sociodemographic characteristics	($n = 285$)[†]
Gender (%)	
Female	94.4
Male	5.6
Mean age	
Years	40.8
Standard deviation	13.8
Race (%)	
White, non-Hispanic	61.8
American Indian or Alaskan Native	1.5
Black or African American	4.4
Hispanic or Latino/a	31
Other	1.5
Relationship Status (%)	
Married	31.9
Divorced	17.2
Widowed	1.4
Separated	1.8
Never married	32
Member of an unmarried couple	9.1
Missing	6.7
Education (%)	
9th—11th grade	2.1
12th grade/GED	41.1
Some college or technical school	36.1
College graduate	20
Master's degree or higher	1.1
Language (%)	
English	62.8
Spanish	37.2
State (%)	
Florida	37.5
Massachusetts	48.4
Oregon	14.0

Note. Differences in subtotal population sample due to item nonresponse or missing. HHOME = Home Health Occupations Musculoskeletal Examinations study.

Next, we examined average pain levels on individual positive moods. Another multiple regression was conducted controlling for age. The resulting models indicated that the relationship between individual positive moods and pain accounted for 52% of the explained variance (adjusted $R^2 = .52$). Interestingly, only 3 of the positive moods had a significant association with mean pain. Specifically, an increase in enthusiasm significantly decreased the level of pain [$\beta = -0.37$, $t(90) = -2.05$, $p < .04$]; when participants reported feeling more active, their pain levels also decreased [$\beta = -0.34$, $t(90) = -2.54$, $p = .01$]. Conversely, we found that when participants felt inspired, their pain levels increased [$\beta = 0.41$, $t(90) = 2.43$, $p = .02$].

Finally, participants' average pain levels were regressed onto individual negative moods. Another multiple linear regression was conducted controlling for age. The resulting models revealed that the association between individual negative moods and pain accounted for 47% of the explained variance (adjusted $R^2 = .47$). Results revealed significant associations between 7 specific negative moods and pain, yet they were not all in the same direction. Specifically, as guilty [$\beta = -0.75$, $t(95) = -3.86$, $p = .01$], hostile [$\beta = -0.55$, $t(95) = -3.95$, $p < .001$], and nervous [$\beta = -0.64$, $t(95) = -4.42$, $p < .001$] moods increased, average pain levels decreased. However, when scared [$\beta = 0.50$, $t(95) = 3.49$, $p = .001$], ashamed [$\beta = 0.72$, $t(95) = 4.51$, $p < .001$], lonely [$\beta = 0.39$, $t(95) = 3.27$, $p = .002$], and angry [$\beta = 0.44$, $t(95) = 2.15$, $p = .34$] moods increased, pain increased as well.

Comment

Increases in composite positive affect were found to be associated with decreased musculoskeletal pain. Therefore, these data suggest that positive affect may act as a buffer against musculoskeletal pain. This is consistent with a recent study that describes an "upward spiral" model of positive affect, resilience, and pain self-management, where positive affect buffers against maladaptive cognitive and affective responses to pain and promotes self-management of pain.[6] Due to a β value of –0.57, the gradient of the association between positive affect and musculoskeletal pain is likely clinically significant. This β value indicates that for every one-unit increase in positive affect score (which rages up to 100), the pain score (which ranges between 1 and 10) decreases by about half a unit.

Two individual positive moods were associated with significantly decreased musculoskeletal pain: active and enthusiastic. The association between feeling active and experiencing decreased pain is consistent with previous research that has shown pain and illness are important contributors to activity restriction, which in turn contributes to symptoms of depression.[7] Only one individual positive mood, feeling inspired, was associated with increased musculoskeletal pain.

Interestingly, we found that composite negative moods were not associated with increased musculoskeletal pain (Table 2). However, when we examined specific negative moods, we found strong associations; specifically, feeling lonely, scared, angry, and ashamed were associated with increased musculoskeletal pain. This suggests that individuals with these moods experience more musculoskeletal pain. This is consistent with previous research by Cacioppo and colleagues whereby they found loneliness linked to many deleterious health outcomes such as worse cardiovascular functioning and sleep issues.[8] Similarly, previous research by Fernandez and Turk showed that anger has a compounding effect on pain, which is in line with our findings.[9]

In addition, we found that specific negative moods, such as feeling hostile, guilty, and nervous, were

Table 2. Hierarchical linear regression analysis controlling for age: Effects of increasing reported PANAS moods on musculoskeletal pain among home health aides participating in the HHOME study, March 2014 to February 2016.

PANAS mood	B	*t*	*p*	*N*
Positive affect*	−0.571	−7.101	< .001	124
Negative affect*	−0.006	−0.07	.944	124
Hostile#	−0.55	−3.946	< .001	95
Nervous#	−0.636	−4.417	< .001	95
Guilty#	−0.749	−3.864	< .001	95
Ashamed#	0.716	4.512	< .001	95
Scared#	0.496	3.493	.001	95
Lonely#	0.39	3.27	.002	95
Angry#	0.437	2.152	.034	95
Afraid#	0.248	1.687	.095	95
Distressed#	−0.165	−1.636	.106	95
Upset#	0.142	−0.883	.38	95
Irritable#	−0.064	−0.226	.822	95
Active#	−0.335	−2.544	.013	90
Enthusiastic#	−0.373	−2.051	.044	90
Inspired#	0.413	2.432	.017	90
Grateful#	−0.155	−1.31	.194	90
Proud#	−0.274	−1.285	.202	90
Interested#	0.163	1.275	.206	90
Excited#	−0.137	−0.756	.452	90
Determined#	−0.051	−0.42	.675	90
Alert#	0.043	0.233	.816	90
Strong#	−0.001	−0.009	.993	95

Note. Musculoskeletal pain was measured using the Brief Pain Inventory.[5] Participants were asked to rate, on a scale from 1 to 10, any pain affecting muscles, joints, neck, or back during the previous 7 days, at its worst, least, on average, and right now. These four values were averaged to provide a quantifiable measure of musculoskeletal pain. PANAS = Positive and Negative Affect Schedule; HHOME = Home Health Occupations Musculoskeletal Examinations study.

*Composite positive and negative affect scores were determined by adding the scores for all positive or negative PANAS moods.

#Participants were asked to rate to what extent they had experienced the 21 PANAS moods during the past 7 days on a 5-point scale, ranging from *strongly disagree* to *strongly agree*.

associated with decreased musculoskeletal pain. Hostility, guilt, and nervousness may be associated with being less focused on self and more focused on problem solving and external issues.[10] As a result, individuals may not be devoting cognitive resources to thinking or ruminating about physical pain, and therefore report less pain.

Furthermore, it is possible that there are gender difference in the consequence of negative moods, more specifically, hostility.[11] Because the majority of HHAs in the United States are female, 94.4% of the participants in this study are female, which is representative of the HHA workforce population (Table 1).[12] Therefore, the results of this study reflect the relationship between hostility and musculoskeletal pain predominantly in women. In a previous study, comparing pain in men and women, men with high hostility and low anger expression experienced more pain than any group of women.[12] Therefore, perhaps men who experience hostility are prone to pain, but this association does not apply to women.

The HHOME study is composed of cross-sectional data with no temporality; hence, one cannot use this data set to distinguish whether changes in affect lead to changes in musculoskeletal pain, or vice versa. For example, this study found that feeling increasingly "active" is associated with decreased musculoskeletal pain. One could conclude that feeling active serves as a buffer against musculoskeletal pain, or that musculoskeletal pain prevents people from feeling active, or that both factors affect each other in a bidirectional relationship. Therefore, causality cannot be determined from this study due to the cross-sectional nature of the data; one can only conclude that there is an association between certain moods and musculoskeletal pain.

This investigation exhibits several additional limitations. Participants in the HHOME study were recruited from home health care agencies in Massachusetts, Florida, and Oregon. This may have introduced some sampling bias since only HHAs who were healthy enough to work were recruited. Perhaps HHAs who may have left the workforce due to exposure to worse working conditions were not included in the study. Furthermore, musculoskeletal pain was measured using the Brief Pain Inventory to quantify musculoskeletal pain during the past 7 days, with no distinction between new and ongoing pain episodes.[5] Therefore, this study assesses the association between mood and pain, without distinguishing between new and longstanding pain. Moreover, previous studies have demonstrated an association between pain and psychosocial factors.[3] However, this investigation focused solely on psychological factors. Psychosocial factors were not measured, and therefore were not taken into account as confounders.

As the population of the United States continues to age and there is an increasing demand and supply of HHAs, it is vital to continue to ensure their occupational physical and emotional well-being. This study demonstrates that HHAs' affect may have an effect on their physical health, or that their physical health has effects on their affect. This finding can inform future health interventions that ensure safe working conditions and adequate availability of wellness resources for HHAs to create a work environment that is conducive to physical and emotional health. Previous studies have demonstrated the positive effects of wellness interventions in the workplace. For example, a recent Randomized Waitlisted Controlled Trial demonstrated that mindfulness training may potentially decrease occupational injuries of hospital health care workers.[13] Similarly, a recent systematic review and meta-analysis showed that occupational digital mental health interventions can improve workers' psychological well-being

and increase work effectiveness.[14] Comparable wellness interventions should be implemented to increase wellness in the HHA workforce and potentially decrease musculoskeletal pain.

In addition, this study highlights the importance of addressing individuals' emotional well-being when managing pain. Previous studies have demonstrated the effectiveness of psychological interventions on pain management. For example, a recent cluster randomized controlled trial demonstrated the effectiveness of emotional awareness and expression therapy in treating the painful symptoms of fibromyalgia.[15] Moving on, a recent randomized controlled trial showed that brief mindfulness training and hypnotic suggestion delivered by hospital social workers led to clinically significant improvements in pain and related outcomes among hospitalized patients with acute pain.[16] Therefore, interventions aiming to promote psychological well-being among the HHA workforce may in turn reduce musculoskeletal pain.

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Institution and ethics approval and informed consent

The Harvard School of Public Health Institutional Review Board reviewed and approved the research protocol for this study (13-2798).

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