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Faculty of Behavioural, Management and Social Sciences (BMS)

The longitudinal relation between pain and positive and negative affect in people with polyarthritis

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Abstract

Objective. Due to their disease, patients with polyarthritis experience pain in their joints, which is interfering with their daily lives and which can cause problems in mental health. Previous research suggests that positive emotions may be a factor which has influence on the relationship between pain and its consequences on mental health such as anxiety and depression. The objective of this study was to explore the relationship between pain, positive and negative affect.

Method. A longitudinal questionnaire study with two measurements of pain, positive affect, anxiety and depression have been conducted among 331 patients with polyarthritis (61 % female, mean age: 62 years). The relationship between the variables were analyzed with mediation analyses.

Results. The relationship of pain with anxiety and depression was partially mediated by positive affect. Also, the relationships of changes in pain with changes in depression and anxiety were mediated by changes in positive affect.

Conclusion. The results support models and theories about the relationship between positive and negative affect. Therefore, further research is implicated to be able to make cause-effect statement about the relationship between pain, positive and negative affect.

Introduction

The current research focuses on how people with polyarthritis adapt to their disease and how or if positive emotions play a role in this process. Pain is reported to be the most challenging and common symptom for patients with rheumatoid arthritis (RA), which is one form of polyarthritis (Strand, Zautra, Thoresen, Ødegård, Uhlig, & Finset, 2006; Eustice, 2016). Polyarthritis is also known as polyarthralgia. Arthritis means inflamed joints and arthralgia means painful joints (Eustice, 2016). Polyarthritis is an inflammatory disease, which affects at least five joints (Arends, Bode, Taal, & Van de Laar, 2013). Joint inflammation is characterized by fatigue, low-grade fevers, anemia, weight loss, morning stiffness which increases with activity and pain when resting. RA primary attacks the synovial tissue around the joints which leads to joint tenderness, joint swelling, and destruction of synovial joints. In turn, these symptoms lead to serious disabilities and premature mortality (Vandever, 2014; Aletaha et al., 2010). Furthermore, polyarthritis contains a variety of disorders, such as RA, ankylosing spondylitis and psoriatic arthritis (Arends et al., 2013). The difference between RA and ankylosing spondylitis (AS) is that AS primarily attacks the joints in the spine. In contrast, RA attacks smaller joints first, such as the joints in the hand, feet and/or the knee. In addition to

this, both diseases are characterized by morning pain and stiffness (Nwachuku, 2016). The difference between RA and Psoriatic arthritis (PA) is that PA primarily affects the distal joints, which are furthest away from the body, such as the third knuckle of a finger. Nevertheless, both diseases affect the joints in the hands, feet and/or the knees and PA also causes painful, swollen and stiff joints. Due to the intensity and duration of pain as well as the difficulty to predict and control it, makes it a potential stressor for patients with RA (Strand et al., 2006).

Patients who struggle with high levels of stress are likely to experience poor physical health outcomes (Farrell, Simpson, Carlson, Englund, & Sung, 2017). Negative affective responses to pain can be influential to the course of illness because the frequency of painful flares increases and pain behaviors intensify (Strand et al., 2006). Moreover, research suggests that pain interferes with daily living, such as, pursuing goals which undermines self-regulatory processes (Mun, Karoly, & Okun, 2015). This interference with daily activities is also associated with poorer mental health including depression, suicide risk and anxiety (Hirsch, Sirois, Molnar, & Chang, 2016). Individuals who suffer from pain may have less opportunities for maintaining meaningful relationships or engaging in pain related activities. This reduced freedom can contribute to feelings of depression (Hirsch et al., 2016).

This assumption can be explained by the Fear Avoidance Model of Musculoskeletal Pain (figure 1), which states that the experienced pain contributes to the fear of pain, which can lead to pain anxiety. In turn, the pain anxiety may motivate the individual to avoid and escape from situations associated with pain. As the pain increases, so does the avoidance and the desire to escape pain related situations, which may contribute to depression and frustration (Hirsch et al., 2016). In addition to this, anxiety, depression and positive affect were found to predict weekly changes in pain in patients with RA and osteoarthritis in a study with weekly measurement over a period of 11 weeks. This study also found that anxiety had a stronger influence on pain than the effects of depression. Moreover, the influence of depression was mediated by positive affect and the influence of anxiety was mediated by negative affect (Smith & Zautra, 2008). Therefore, distinguishing positive and negative affect is necessary because positive affect may be able to weaken the effect of pain on negative affect (Hirsch et al., 2016).

Positive affect (PA) versus negative affect (NA) is also suggested to be a new distinction between emotional states (Spindler, Denollet, Kruse & Pedersen, 2009). Negative emotions have potential to become a recourse of dysfunctions. For example, a by-product of negative emotions are dysfunctional social interactions, which can keep psychophysiological reactivity alive and provoke harmful behavior toward self and others (Garland et al., 2010).

Figure 2. The Fear-Avoidance Model of Musculoskeletal Pain

Negative affect is characterized by symptoms such as depression or anxiety whereas positive affect is characterized by cheerfulness and joy (Spindler, Denollet, Kruse & Pedersen, 2009). Positive and negative affect represent the affective aspect of wellbeing which is an important part of human flourishing and overall life satisfaction (Pavani et al., 2016). In addition to this, positive emotions can decrease the negative influence of pain on well-being and it may decrease the probability of the onset of a clinical depression (Arends, Bode, Taal & Laar, 2016). In addition to this, positive emotions can also function as a shelter against life stressors, stressful encounters and decrease the effect of future distress (Garland et al., 2010). Previous research also suggests that it is not the presence of negative affect but the absence of positive affect which carries greater weight on physical and mental health (Hirsch et al., 2016).

This theory is in line with Mun et al. (2015), who found that positive affect can be a resource of resilience for patients with chronic pain. Resilience is a "dynamic process of maintaining positive adaption and effective coping strategies in the face of adversity" (Allen, Haley, Harris, Fowler, & Pruthi, 2011). Emotions arise due to the need of humans to adapt their behavior to the demands of day-to-day living. Different kinds of perceived opportunity create specific positive emotions such as joy or interest whereas different kinds of perceived threat create specific negative emotions such as sadness or anger (Garland et al., 2010).

This hypothesis could be explained by the broaden-and-build theory which suggests that positive emotions may have a revoking effect on the remnant of negative emotions. For example, the heart rate of a patient increases after having a negative emotion and recovers to a steady pace when having a positive emotion, instead of a negative or neutral one. Therefore, positive emotions may have a revoking effect on negative emotions and may be beneficial for physical and mental wellbeing (Garland et al., 2010). The broaden-and-build theory (figure 2)

states that positive emotions expand the thought-action repertoire of individuals (Garland, Fredrickson, Kring, Johnson, Meyer, & Penn, 2010).

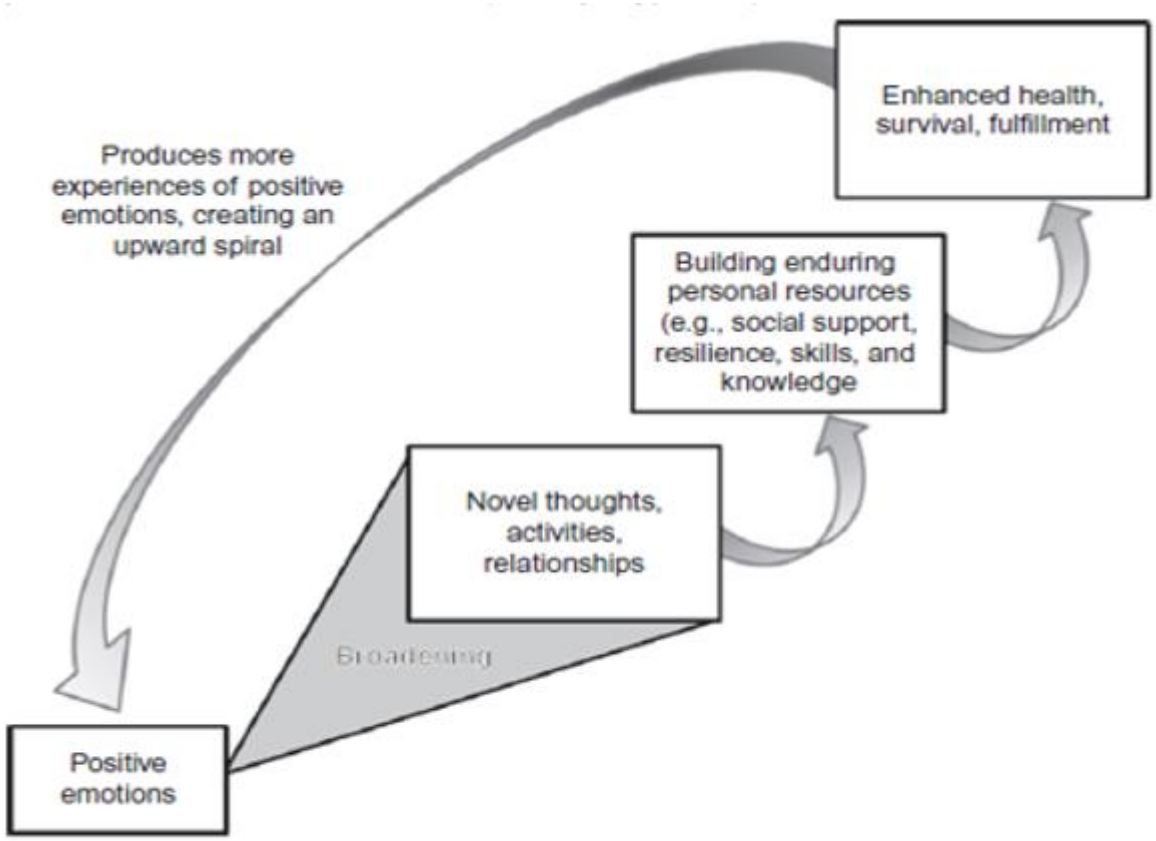

Figure 2. The broaden-and-build theory of positive emotions. *Adapted from Fredrickson and Conn (2008, Fig 48.1)*

In turn, the broadened thought-action repertoire stimulates behavioral flexibility which enables the individual to build personal resources, such as, physical health, social closeness, mindfulness and resilience (Garland et al., 2010). Individuals with these resources enjoy a higher probability to meet the challenges of life effectively and becoming and staying healthy and happy. Moreover, the frequent exposure to positive emotions is thought to be very important for later increases in wellbeing (Fredrickson et al., 2008). Furthermore, research reveals that positive emotions are beneficial for life outcomes such as the development of friendships, higher incomes, better physical health and a higher life expectancy (Fredrickson et al., 2008).

Garland et al. (2010) also argue that interventions, which encourage the enhancement of positive emotions, establish resilience and therefore may eradicate clinical disorders. Strand et al. (2006) investigated the relationship between pain and positive affect and negative affect among arthritis patients and found that positive affect has the most influence in reducing negative affect during weeks of higher pain and that positive affect may be a factor of resilience

because it helps patients to experience pain as less distressful than patients with low levels of positive affect.

A variety of studies exist which provide evidence regarding the hypotheses that positive emotions create durable personal resources (Garland et al., 2010). Fredrickson, Cohn, Coffey, Pek & Finkel (2008) conducted a randomized controlled trial of an intervention which induces positive emotions, namely loving-kindness meditation. Meditation and mindfulness are old Buddhist elements of spiritual practice which can help people regulate stress, anxiety, chronic pain and diverse illnesses (Fredrickson et al., 2008). This longitudinal field experiment displayed that those who participated in the loving-kindness meditation experienced an enhancement in nine distinct emotions (amusement, awe, contentment, gratitude, hope, interest, joy, love, and pride), which had an enduring effect over days. Most importantly, the enhancement of positive emotions established an increase in the creation of widespread personal resources including reduced illness symptoms, mindfulness and positive relations with others. In turn, the increase of personal resources produced an enhancement in life satisfaction and in the dismantling of depressive symptoms. These benefits of the loving-kindness meditation were also still present in a one-year follow up (Fredrickson et al., 2008).

The current research focuses on the relationship between pain and positive and negative affect among arthritis patients. Due to the indications of the literature, the assumption is that pain is causing negative affect and that positive affect can decrease the incurred negative affect which makes the pain less distressful. The research question is to what extent does positive affect mediate the relationship between pain and negative affect in patients with polyarthritis? Moreover, the literature suggests that anxiety, depression and positive affect predicted weekly changes in pain. It is therefore expected that changes in positive affect mediate the relationship between changes in pain, anxiety and depression over time.

Method

This research is a longitudinal questionnaire study with two measurements of pain, positive and negative affect among patients with polyarthritis. The two measurements were taken with an interval of six months. The internal review board of the Faculty of Behavioral Sciences at the University of Twente in the Netherlands gave the ethical approval for the study (Arends et al., 2016).

Table 1. Demographic and clinical characteristics of the participants on T1 and T2

	T1		T2	
Demographic characteristics				
Number of participants (%)	331	(100)	290	(87.6)
Sex, n (%)				
Male	129	(39)	114	(39.3)
Female	202	(61)	176	(60.7)
Age (years)				
Mean (SD)	62.5	(12.7)	61.7	(12.1)
Range	24-91		28-89	
Marital status, n (%)				
Not living with partner	83	(25.1)	64	(22.1)
Living with partner	241	(72.8)	219	(75.5)
Missing	7	(2.1)	7	(2.4)
Educational level, n (%)*				
No/lower	128	(38.7)	105	(36.2)
Secondary	123	(37.2)	108	(37.2)
Higher	72	(21.8)	69	(23.8)
Missing	8	(2.4)	8	(2.8)
Work status, n (%)				
No paid job	229	(69.2)	198	(68.3)
Full-time and part-time employment	96	(29)	86	(29.7)
Missing	6	(1.8)	6	(2.1)
Disease characteristics				
Diagnosis, n (%)				
Rheumatoid arthritis	192	(58)	170	(58.6)
Gout and other crystal diseases	34	(10.3)	27	(9.3)
Polymyalgia & Temporal Arteritis	33	(10)	27	(9.3)
Spondyloarthropathy	25	(7.6)	24	(8.3)
SLE and other systemic diseases	20	(6)	17	(5.9)
Other/non-classifiable	27	(8.2)	25	(8.6)
Disease duration (years)				
Mean (SD)	14.7	(12.3)	14.7	(12.3)
Range	1-71		1-71	

Notes: T1 = first measurement; T2 = second measurement.
*No/Lower: No education, primary school, or lower vocational education; Secondary: High school and middle vocational education; Higher: High vocational education and university.

Sample

The participants of this study were randomly picked from the electronic diagnosis registration system from a rheumatology outpatient clinic. There have been four criteria which the participants had to meet: (1) diagnosis of polyarthritis, (2) receiving treatment for polyarthritis, (3) 18 years or older and (4) sufficient language skills in Dutch to fill in the questionnaire, either by oneself or with the help of a relative. 639 out of 803 patients from the rheumatology clinic met the criteria and obtained an invitation letter, the first questionnaire and the informed consent

form which was retrieved from 331 patients (52%) (Arends, et al., 2016). The demographic and clinical characteristics are displayed in table 1.

Instruments

Questions were asked about sex, age, marital status, education, employment and disease duration. A detailed overview of the questionnaires used in this study are displayed in table 2.

Positive affect was assessed by the positive subscale of the Positive and Negative Affect Schedule (PANAS). The scores range from 10 to 50 and higher scores suggest more positive affect in the past week (Arends, et al., 2016). The items 1 to 10 were used to estimate the sum-score for positive affect.

Negative affect was assessed by the Dutch validated version of the Hospitality Anxiety and Depression Scale (HADS) which measures the levels of depression and anxiety. The scores range on both scales from 0 to 21. Higher scores suggest more depressive/anxiety symptoms (Arends, Bode, Taal, & Laar, 2016). All 14 items were recoded. In order to estimate the sum-score for anxiety the recoded items 1, 3, 5, 7, 9, 11 and 13 were used. In order to estimate the sum-score for depression the recoded items 2, 4, 6, 8, 10, 12 and 14 were used.

In order to measure pain, the respondents were asked to report the amount of pain on the numeric rating scale (NRS) which is a 1-item numerical scale: No pain at all [0]–unbearable pain [10].

Table 2. Characteristics of the questionnaires used in this study

Variable	Questionnaire	Author	Example	Response options	Alpha
Pain	NRS		Amount of pain in the past 7 days, caused by polyarthritis	No pain at all (0)–unbearable pain (10)	-
Positive affect	PANAS	Watson, Clark & Tellegen, 1988	Rate how you felt during the past week: e.g. attentive, interested	Very slightly or not at all (1) – very much(5)	.91
Anxiety	HADS	Zigmond & Snaith, 1983	I feel tense or wound up	Various response format (0–3)	.83
Depression	HADS	Zigmond & Snaith, 1983	I have no interest in my appearance	Various response format (0–3)	.80

Data analysis

SPSS 21 was used to perform the statistical analyses. A paired-samples t-test was conducted to compare the scores of the two measurements. A difference score was computed for the variables pain, positive affect, anxiety and depression in order to display the amount of change in the variables over 6 months. To investigate how positive affect mediates the relationship between pain and negative affect, the version 2.16 of the PROCESS macro for SPSS was used. The data from the first assessment point (begin of the study) and the difference scores were analyzed. Within the macro, model 4 and 1000 bias corrected bootstrap samples were selected. A 95% confidence level was chosen to apply a p-value of 0.05. Using these settings, four analyses were performed. In all four mediation analyses, pain was selected as independent variable and positive affect was selected as mediation variable. To address the expectations of this research, anxiety and depression were selected as dependent variables in two separate mediation analyses in order to assess negative affect. Figure 3 displays the path diagram of the mediation analyses. For each of the four mediation analyses, three regressions have been conducted. The first regression has pain predicting depression and anxiety. The second has pain predicting positive affect and the third has pain and positive affect predicting depression or anxiety. As a whole, four different mediation analyses have been conducted. The first two analyses have used the data set which was collected at the beginning of the study and the third and fourth mediation analyses has used the difference scores of the variables in order to explore if changes in positive affect between the two measurements mediates the relation between changes in pain and changes in anxiety and/or depression over time.

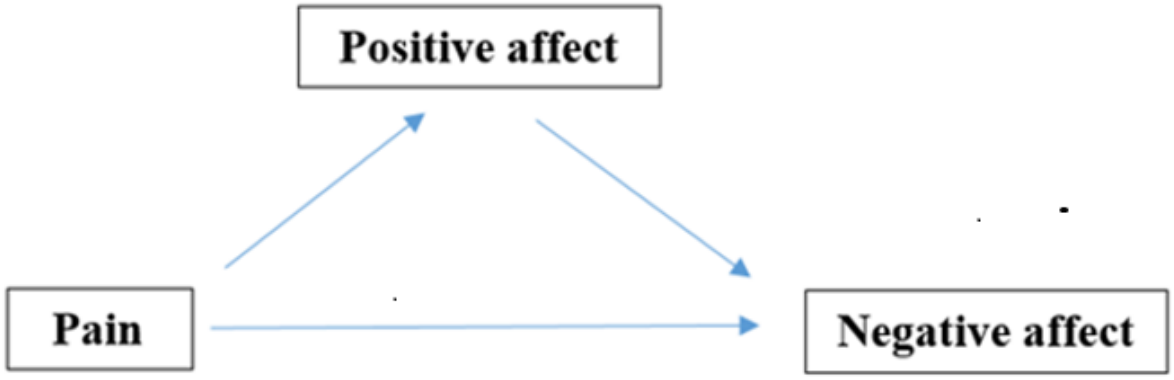

Figure 3. The path diagram of the mediation analyses

In order to verify the mediation, four conditions must be met. First, pain must be related to anxiety/depression (regression 1). Second, pain must be related to positive affect (regression 2). Third, in the final regression, positive affect should remain a significant predictor of anxiety/depression. Fourth, in the final regression, pain should no longer significantly predict anxiety/pain. If all four conditions are met, full mediation is supported. If only the first three conditions are met, then partial mediation is supported if the coefficient for pain decreases. If less than three conditions are met, then the expectation will not be fulfilled.

Results

A paired-samples t-test was conducted to compare the difference of scores of the first and second measurement. As displayed in Table 3, there are no statistically significant differences between the first and second measurement for all the tested variables.

Table 3. The t-test results for anxiety, depression, positive affect and pain. N=275

	T1		T2				
	M	SD	M	SD	t, df: 274	p	Correl.
Anxiety	5.19	3.65	5.35	3.56	-1.01	.31	.73*
Depression	4.66	3.49	4.74	3.57	-.58	.56	.79*
Positive Affect	34.35	7.00	34.58	6.77	-.72	.48	.70*
Pain	4.19	2.14	4.00	2.37	1.40	.16	.58*

Note. T1 = first measurement; T2 = second measurement; *p< .001.

The results of the mediation analyses demonstrated that pain was a significant predictor of positive affect (b= -.647, SE= .157, CI= -.9577; -.3373). Table 4 shows the results of the regression and mediation analyses with anxiety as dependent variable. Pain was a significant predictor of anxiety in model 1 and both, pain and positive affect, were significant predictors of anxiety in model 2. Pain remained to be a significant, but smaller predictor of anxiety after controlling for the mediator, consistent with partial mediation. Approximately 32% of the variance in anxiety was accounted for by the predictors. The indirect effect was tested using a bootstrap estimation approach with 1000 samples. These results indicated that the indirect coefficient was significant (Table 4).

Table 4. Results of the mediation model of Hayes with anxiety as dependent variable

	coeff.	SE	LLCI	ULCI
Model 1				
Pain	.64	.08	.48	.79
Model 2				
Pain	.50	.07	.36	.64
Positive affect	-.21	.03	-.26	-.26
Indirect effect of pain on anxiety	.14	.04	.06	.23

Model 1: R^2 = .17, p<. 001; Model 2: R^2 = .32, p< .001

The results of the second set of analyses, which are displayed in table 5, indicated that pain was a significant predictor of depression in model 1 and both, pain and positive affect, were significant predictors of depression in model 2. Pain remained to be a significant, but smaller predictor of depression after controlling for the mediator, consistent with partial mediation. Approximately 48% of the variance in depression was accounted for by the predictors. The indirect effect was tested using a bootstrap estimation approach with 1000 samples. These results indicated that the indirect coefficient was significant (Table 5).

Table 5. Results of the mediation model of Hayes with depression as dependent variable

	Coeff.	SE	LLCI	ULCI
Model 1				
Pain	.52	.08	.37	.67
Model 2				
Pain	.32	.06	. 20	.44
Positive Affect	-.30	.02	-.34	-.26
Indirect effect of pain on depression	.20	.05	.10	.32

Model 1: R^2 = .13, p < .0001; Model 2: R^2 = .48, p < .0001

Table 6 illustrates the results of mediation analyses with the difference scores, which indicated that change in pain was a significant predictor of change in positive affect (b= -.457, SE= .156, CI= -.7655; -.1493). Change in pain was a significant predictor of change in anxiety in model 1 and both, change in pain and change in positive affect, were significant predictors of change in anxiety in model 2. Change in pain remained to be a significant, but smaller predictor of change in anxiety after controlling for the mediator, consistent with partial mediation. Approximately 29% of the variance in change in anxiety was accounted for by the predictors. The indirect effect was tested using a bootstrap estimation approach with 1000 samples. These results indicated that the indirect coefficient was significant (Table 6). Moreover, the baseline values of pain, positive affect and anxiety were significant predictors of changes in anxiety.

Table 6. Results of the mediation model of Hayes with the difference scores (Δ), the baseline values as covariates and anxiety (Δ) as dependent variable

	Coeff.	SE	LLCI	ULCI
Model 1				
Δ Pain	.32	.08	.17	.47
Pain	.24	.08	.09	.39
Positive Affect	-.07	.02	-.12	-.03
Anxiety	-.43	.05	-.52	-.33
Model 2				
Δ Pain	.26	.08	.16	.41
Δ Positive Affect	-.12	.03	-.18	-.07
Pain	.19	.07	.04	.34
Positive Affect	-.11	.02	-.16	-.06
Anxiety	-.41	.05	-.51	-.32
Indirect effect of Δ pain on Δ anxiety	.06	.03	.00	.05

Model 1: $R^2 = .24$, $p < .05$; Model 2: $R^2 = .29$, $p < .05$

The last analyses showed that change in pain was a significant predictor of change in positive affect (b= -.38, SE= .15, CI= -.6788; -.0822). Change in pain was a significant predictor of change in anxiety in model 1 and both, change in pain and change in positive affect, were significant predictors of change in anxiety in model 2. Change in pain remained to be a significant, but smaller predictor of change in anxiety after controlling for the mediator, consistent with partial mediation. Approximately 29% of the variance in change in anxiety was accounted for by the predictors. The indirect effect was tested using a bootstrap estimation approach with 1000 samples. These results indicated that the indirect coefficient was significant (Table 7). Moreover, the baseline values of pain, positive affect and depression were significant predictors of changes in depression.

Table 7. Results of the mediation model of Hayes with the difference scores (Δ), the baseline values as covariates and depression (Δ) as dependent variable

	Coeff.	SE	LLCI	ULCI
Model 1				
Δ Pain	.26	.07	.13	.39
Pain	.15	.06	.13	.39
Positive Affect	-.08	.02	-.13	-.03
Depression	-.32	.05	-.42	-.22
Model 2				
Δ Pain	.19	.06	.07	.32
Δ Positive Affect	-.12	.03	-.18	-.07
Pain	.10*	.05	-.01	.22
Positive Affect	-.15	.02	-.20	-.10
Depression	-.36	.05	-.46	-.27
Indirect effect of Δ pain on Δ depression	.06	.03	.01	.14

Model 1: $R^2 = .17$, $p < .05$; Model 2: $R^2 = .29$, $p < .05$; *$p > .05$

Discussion

It was expected that positive affect mediated the relationship between pain and negative affect and that changes in positive affect mediated changes in pain, anxiety and depression. The results indicated that positive affect indeed mediated the relationship between pain and anxiety and between pain and depression. Moreover, the results suggested that changes in positive affect mediated the relationship between changes in pain, anxiety and depression over time. The indirect effect of pain on anxiety and depression was associated with approximately .14 points lower anxiety scores and approximately .20 points lower depression scores as mediated by positive affect. Therefore, the relationship of pain with negative affect decreased when the person disposed positive affect. The results of the first two mediation analyses also suggested that the relationship of positive affect was greater on depression than on anxiety. However, the change scores indicated that the indirect effect of changes in pain were nearly the same on changes in depression and on changes in anxiety. Furthermore, the results indicated that the baseline values of pain and positive affect predicted changes in anxiety and changes in pain. In addition to this, the results suggested that the baseline value of pain was a greater predictor of changes in anxiety than of changes in depression.

These findings are in line with the study of Hirsch et al. (2016) who suggested that pain contributed to anxiety and depression. The Fear Avoidance Model of Musculoskeletal Pain stated that pain could lead to pain anxiety which might contribute to depression and frustration (Hirsch et al., 2016). This model was supported by the findings of the current research because pain predicted anxiety and depression. The current results also supported the indication of Hirsch et al. (2016) that positive affect might act as a resource of resilience and could be able

to weaken the effect of pain on negative affect. In addition to this, the broaden-and-built theory was supported as well because higher levels of positive affect in participants were associated with lower levels of anxiety and depression. Smith et al. (2008) suggested that anxiety, depression and positive affect predicted weekly changes in pain among patients with RA and osteoarthritis. The results of the current research demonstrated that pain and positive affect predicted changes in anxiety and in depression. Moreover, changes in positive affect mediated the relationship between changes in pain, anxiety and depression over time Therefore, it is suggested that there is a mutual influence of pain, anxiety, depression and positive affect. The results of the current research might also support the suggestions from Smith et al. (2008) who concluded that anxiety had a stronger influence on pain than on depression. The first two analyses of the current research indicated that positive affect had a stronger relationship with depression than with anxiety. This might be because pain could have had a stronger influence on anxiety than on depression. Therefore, anxiety was more difficult to dismantle than depression. This could be explained by the results, which suggested that the baseline value of pain was a greater predictor of changes in anxiety than of changes in depression. Another explanation might be that anxiety may be the first reaction to pain which then causes depression, such as the fear avoidance model suggested. Nevertheless, in order to be able to make a clear statement about how the variables in this research influence each other, another design has to be applied.

The current research is therefore limited by its design. Without a randomized experimental design, a cause-effect statement cannot be made. However, the longitudinal design of the current study made it possible to make a statement over changes over time. Another limitation is that the pain NRS only measures one component of pain namely the pain intensity. Therefore, the pain NRS does not measure the entire extent of the pain experience due to variations in symptoms (Hawker, Mian, Kendzerska & French, 2011). Furthermore, the pain scores of the participants could not be compared to a healthy control group in order to estimate if the mean score of pain indicated more severe pain or average pain. This is important to know because if the population had a low or average pain score, it would not be necessary to do an intervention or to conduct a research for an arthritis population. Despite these limitations, the pain NRS is a reliable and valid instrument to assess pain intensity (Hawker et al., 2011).

Another positive aspect of the current study is that the questionnaires for positive affect, anxiety and depression have a good internal consistency. Despite the lack of clarity regarding the pain scores, the results could be considered as generalizable, because of the reliable instruments used, the 1000 bootstrap adjustment in the analyses and the representative sample

of participants. Moreover, this research supports several other studies and theories which might be helpful for future research. Because of the significant results, the current study might contributed to the development of an innovative and accessible treatment approach. Certainly, further research with another design is needed to explore the relationship of pain, positive and negative affect in detail.

It is hence recommended to apply a randomized experimental design with an intervention, such as the loving-kindness meditation, and a control group in order to demonstrate more reliable and valid results. Thus, it would be possible to make a trustworthy statement regarding the cause-effect relationship between positive affect, pain and negative affect. Another recommendation is to use more than one questionnaire to assess pain so that different aspects of pain can be measured and used in the analyses. It would also be interesting to know if certain character traits facilitate the production of positive emotions. Therefore, for future research a questionnaire which assesses character traits should be included in the methodology.

Implications

The impact of positive affect was indicated to be beneficial for the treatment of clinical symptoms. Due to its beneficial effect and its abundant character positive emotions should be investigated in more detail in order to establish this approach as a treatment in the health facilities. One way to induce positive emotions is the loving-kindness meditation which produces an enhancement in positive emotions and could be used as an intervention for further research. It may not be difficult to invest some time to meditate twice a day for five or ten minutes. It could be done at work, during the lunchbreak or at home.

Conclusion

People with higher levels of positive affect maintained better mental health (lower anxiety and lower depression) when experiencing pain as people with lower levels of positive affect. Moreover, changes in pain and changes in positive emotions are related to changes in negative affect. Positive affect may play a crucial role in the future when treating anxiety, depression or other clinical illnesses among people with chronic pain. It is concluded that positive affect is important in the relationship between pain and anxiety and depression, by which is meant that it decreases the negative affect of pain and therefore may act as a preventing variable for clinical illnesses.

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