

Chronic pain and positive emotions: A systematic review

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Abstract

Background: Chronic pain is a longlasting disorder that requires attention: with 19% of the adult European population suffering from chronic pain, it is not something that should be ignored. Only since recent times has the area of chronic pain and positive emotions been studied, but so far the results have been promising. The severity of the issue and novelty of the topic mean that there is need for comprehensive work in this field.

Objective: This systematic review aims to investigate a possible relationship between chronic pain and positive emotions by summarising current research done in this area.

Method: This review is based on a select few articles that discuss a relationship between chronic pain and positive emotions. These articles were gathered through a systematic literature search that focused on two search constructs consisting of key terms relating to both chronic pain as well as positive emotions. The initial 1531 search results were brought down to eight by systematic filtering based on the title, abstract, and content of the articles. The remaining eight articles were categorised into four sections.

Results: The results showed that there are multiple relationships between chronic pain and positive emotions. A direct negative relationship was confirmed in several studies with more positive emotions leading to less chronic pain. Further results show an indirect effect of negative affect or pain catastrophising on the relationship between the two main concepts.

Conclusion: Based on mainly longitudinal studies a significant relationship between chronic pain and positive emotions was found, with pain catastrophising and negative emotions both playing a role in the indirect relationship. Relationships have also been found between positive and negative affect, and between pain catastrophising and emotions in general. It is plausible that positive affect helps chronic pain patients in reaching an upward spiral towards emotional well-being. These conclusions are largely based on cross-sectional and longitudinal studies.

Samenvatting

Achtergrond: Chronische pijn is een langdurende aandoening die aandacht behoeft: wanneer 19% van de volwassen Europese populatie lijdt aan chronische pijn. Huidig onderzoek over chronische pijn en positieve emoties is veelbelovend, ondanks het feit dat er pas sinds kort aandacht aan het onderwerp wordt besteed. De ernst van het probleem en de nieuwigheid van het onderwerp betekenen dat er behoefte is aan uitgebreid werk op dit gebied.

Doel: Deze systematische review is erop gericht om een mogelijk verband tussen chronische pijn en positieve emoties te onderzoeken door middel van het samenvatten van huidig onderzoek op dit gebied.

Methode: De review is gebaseerd op een aantal artikelen die een verband tussen chronische pijn en positieve emoties bespreken. De artikelen zijn vergaard door middel van een systematische literatuur zoektocht die gebruik maakte van twee zoekconstructen bestaande uit termen gerelateerd aan zowel chronische pijn als positieve emoties. De aanvankelijke 1531 zoekresultaten zijn teruggebracht tot acht dankzij het systematisch filteren op basis van de titel, abstract, en inhoud van de artikelen. Deze acht artikelen zijn opgedeeld in categorieën.

Resultaten: De resultaten laten zien dat er meerdere verbanden zijn tussen chronische pijn en positieve emoties. Een directe negatieve relatie was bevestigd in verschillende studies, waar meer positieve emoties leidden tot minder pijn. Verdere resultaten laten een indirect verband zien tussen negatieve emoties of catastroferen bij pijn en de twee hoofdconcepten.

Conclusie: Op basis van voornamelijk longitudinale studies is er een significante relatie tussen chronische pijn en positieve emoties gevonden, waarbij catastroferen bij pijn en negatieve emoties een rol spelen in het indirecte verband. Er zijn ook verbanden gevonden tussen positief en negatief affect, en tussen catastroferen bij pijn en emoties in het algemeen. Het is aannemelijk dat positief affect chronische pijn patiënten helpt om een opwaartse spiraal te bereiken richting emotioneel welzijn.

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Introduction

Pain is a subjective and generally unpleasant sensory and emotional experience in a part or parts of the body as a consequence of a physical event or physiological process (Merskey, 1991). There are two kinds of pain: acute pain and chronic pain. Acute pain appears sudden and is not expected to last very long; it is often linked to an injury such as a strained muscle or toothache and can easily be treated. As such it holds no relevance to this review as opposed to the other form of pain: chronic pain. The word chronic is derived from the Latin word 'chronicus', referring to time. As such, chronic pain is pain that lasts between three and six months or longer (Institute of Medicine, 2011) and generally starts with a period of acute pain that does not go away as time passes. Chronic pain can be divided into two groups: benign and progressive. Chronic benign pain is a pain where a longlasting pain of consistent intensity can be felt, such as pain in the lower back. Chronic progressive pain is pain that gets progressively worse over time, with a prime example being rheumatoid arthritis (Hamilton, Zautra, & Reich, 2005).

It is difficult to determine a prevalence rate of chronic pain due to the classifications being highly variable; where some studies classify any pain that lasts more than three months as chronic (Andersson et al., 1993; Blyth et al., 2001), others assume a period of six months or longer (e.g. Breivik et al., 2006). For clarity's sake will, in this review, chronic pain be defined as a pain that lasts longer than three months. In a European-wide study performed by Breivik et al. (2006), results showed that 19% of adult Europeans suffer from chronic pain of moderate to severe intensity. Other, nation-wide, studies provided similar results: Eriksen et al. (2003), for example, also reported 19% of their Danish sample suffering from chronic pain.

Chronic pain has some very serious consequences that cannot and should not be underestimated. A notable example is that the pain can prevent people from participating in

social activities (Sturgeon, Zautra, & Arewasikporn, 2014). This has a negative influence on social relationships and marriages, leading to marital issues which then exacerbate the pain (Schwartz, Slater, & Birchler, 1996). Another example, that concerns not only the individual but also the society as a whole, is an economic one: the pain can be due to physical injury so severe that the person in question is no longer able to work, causing more stress and depression to the individual as well as costing the society money (e.g. Barham, 2012). Not only are there potential social, marital, and economical issues for those unfortunate enough to suffer from chronic pain, but due to all this it should be no surprise that in many cases of chronic pain depression is a common denominator. In a literature review by Bair et al. (2003), a mean of 52% of patients in pain clinics or in-patient pain programmes suffered from depression, and 38% of patients in psychiatric clinics or consultation. A comprehensive review by Gatchel, Peng, Peters, Fuchs, and Turk (2007) discusses the importance of emotional states such as depression as responses to pain more in-depth.

The role of negative emotions in particular should be highlighted due to the large role they play in the experiencing of pain. Negative emotions increase the level of pain experienced when they are at a usual or above-usual level (Connelly et al., 2007). This conclusion is supported in a study by Zempsky et al. (2013) which showed a significant association between negative affect and pain scores. Rhudy and Meagher (2000) confirm this as well in their study, concluding two things: their first conclusion is that when one is exposed to repeated experiences of fear, anticipatory anxiety is a possibility; this is important because their second conclusion is that anxiety contributes to persistent pain. Lastly, the inhibition of a negative emotion such as anger can also exacerbate pain, with suppression leading to a lower pain tolerance and higher pain ratings (Burns, Quartana, & Bruehl, 2007; Quartana, Yoon, & Burns, 2007).

One of the relationships between the two concepts of chronic pain and emotions lies in pain catastrophising, defined as an exaggerated negative cognitive response to actual or anticipated pain (Ong, Zautra, & Reid, 2010). Pain catastrophising is one of the most important psychological predictors of pain experience (Sullivan et al., 2001) and numerous studies have consistently associated pain catastrophising with intensified pain (Peters et al., 2005; Turner et al., 2002, 2004). An important role of pain catastrophising is played in the fear-avoidance model, displayed in Figure 1 (Leeuw et al., 2007). The tenet of this model is that the way pain is interpreted determines the path it takes. When pain is perceived as non-threatening, recovery is a likely outcome. When pain is catastrophised, however, the fear of pain can lead to a plethora of negative emotions, or affect, such as fear and anxiety. These negative emotions in turn play a significant role in the model as they eventually lead to outcomes such as disability and depression. This then causes a vicious circle where the patient gets stuck in a downward spiral.

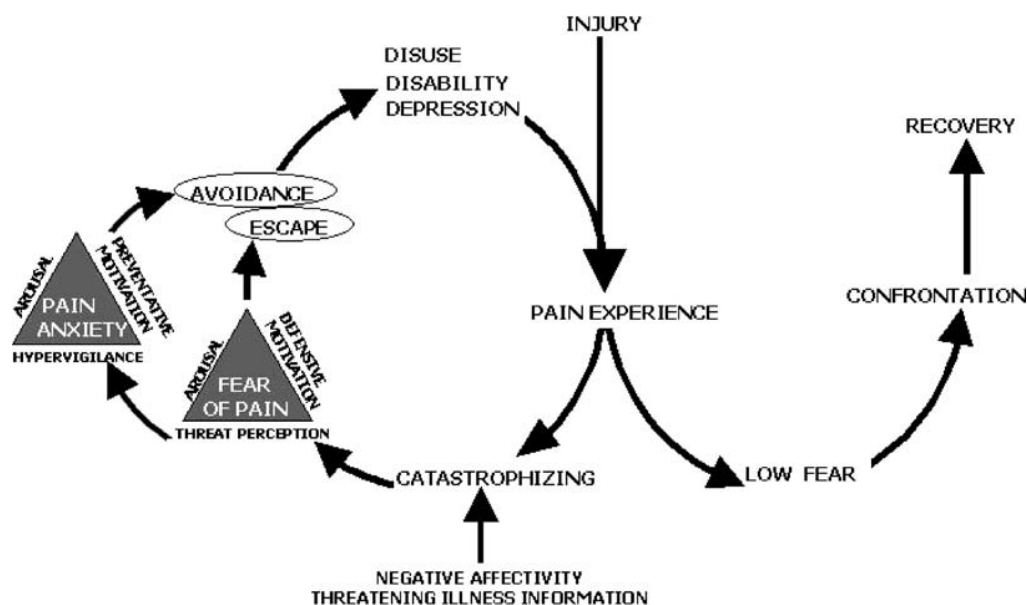


Figure 1. The fear-avoidance model of chronic pain. Taken from “The fear-avoidance model of musculoskeletal pain: Current state of scientific evidence”, by M. Leeuw et al., (2007).

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With higher scores of pain catastrophising leading to increased levels of pain perception (Benedetti, Lanotte, Lopiano, & Colloca, 2007; Kristiansen et al., 2014), it can be concluded that there is a relationship between emotion and pain with pain catastrophising as a mediating variable. Furthermore, the brain has a subcortical circuit that, when dysregulated, interacts with the cerebral cortex which leads to negative emotions such as fear and anxiety, as well as rumination about the consequences and fear of pain (Johnson, Nolen-Hoeksma, Mitchell, & Levin, 2009). When this dysregulation is sustained, as is the case with for example depression (Ericsson et al., 2002), emotional reactions associated with pain can then contribute to increased pain perception or suffering (Ericsson et al., 2002). This is displayed in the fear-avoidance model. On the back of these examples, it is clear that there is a notable relationship between pain and emotion with emotion playing a significant role in how pain is experienced.

The scope of this review is positive emotions and chronic pain. With these emotions playing such a pivotal role, a short clarification on what this concept exactly means is warranted. Positive emotions characterise positive affect through emotions such as excitement, confidence, and eagerness (Folkman & Moskowitz, 2000). Keyes (2005) later adds to this description of positive affect with keywords such as happy, full of life, calm and peaceful, satisfied, and cheerfulness. The measuring of positive affect can be done through the PANAS scales: two 10-item mood scales comprised of the positive and negative affect schedule (Watson, Clark, & Tellegen, 1988) with each item being rated from 1 (“very slightly or not at all”) to 5 (“extremely”). The PANAS is one of the most widely used affect scales (Schmukle, Egloff, & Burns, 2002) and provides reliable, precise, and largely independent measures of positive and negative affect, regardless of the subject population (Watson, Clark, & Tellegen, 1988).

The reason that the focus of this review lies with positive emotions is because while research in this area so far has been promising, positive emotions and other resources have long been neglected – specifically chronic pain. A second reason is based on a study by Smith and Zautra (2008) where they discuss the two-factor model of positive and negative affect. The main implication of this study is that not only should the influence of negative affect be reduced, but also that the influence of positive affect should be increased. Positive and negative emotions do not appear to correlate very strong in their study ($r = -.12$), so helping someone overcome negative emotions does not necessarily cause positive emotions to suddenly emerge. This implies that separate efforts are required, and it is important to study these efforts so that the suffering of chronic pain patients can be reduced to a minimum. Furthermore, Fredrickson and Joiner (2002) state that positive emotions lead to more positive emotions, causing an upwards spiral towards emotional well-being – in sharp contrast to pain catastrophising causing a downwards spiral. This is a statement in line with the broaden-and-build theory (Fredrickson, 1998), a theory which states that positive emotions broaden the scopes of attention and cognition and consequently increase emotional well-being. This contributes to better adaptation to chronic pain, because according to Lamers (2012) emotional well-being is, among other things, beneficial for the recovery and survival of the physically ill. Additionally, emotional well-being is assumed to involve the presence of positive affect (Diener, Suh, Lucas, & Smith, 1999; Keyes, 2005). While the studies by Fredrickson discuss positive emotions in general, it is possible that the conclusions can be applied to a chronic pain context. To illustrate this point: studies have shown that an increase in positive emotions predicts a decrease in pain catastrophising because they counter the feeling of helplessness or the constant ruminating, which are both key characteristics of pain catastrophising (Ong, Zautra, & Reid, 2010).

Based on the studies mentioned earlier, it seems safe to assume that there is a distinctive relationship between chronic pain and emotions in general and that the studying of positive emotions in combination with chronic pain is of great importance. The main goal of this review is to provide a more definitive conclusion on whether there is a relationship between chronic pain and positive emotions and, if so, what this relationship entails. This goal will be reached with the help of subgoals: by summarising all the studies used for review based on several categories, a clear overview of factors is provided. It is important to make these distinctions between categories to allow for the drawing of a more refined conclusion. In the long term this review aims to inform future research on chronic pain and positive emotions as well as assisting in the treatment of pain.

Methods

Search strategy

This systematic review is based on an extensive literature search with its main goal being to gain more insight into how positive emotions influence the experience of chronic pain. Following a systematic search strategy, a library of research articles about positive emotions or chronic pain, or both, was created. On the back of this library articles were selected based on title, after which the results were further filtered by selection based on the abstract. The initial search was conducted on October 19, 2014, covering all available years and categories in three different databases: Web of Science, SciVerse Scopus, and PsycINFO. These three have been selected due to their extensive libraries and ease of use. However, any combination of search terms used in PsycINFO netted a consistent zero results. For this reason, the articles reviewed in this paper have been gathered solely through Web of Science and SciVerse Scopus.

The search strategy used was based on two different constructs, with each construct aimed at a different category. The first construct consisted of terms related to chronic pain, including some of the more common chronic disorders that come with pain. Rheumatoid arthritis, for example, was chosen as a search term due to the large amount of research done on the disorder. The construct was further complimented by more generic pain terms as well as a number of common pain locations. The second construct consisted of positive affect and two terms that are often used synonymous or interchangeable with positive affect: positive mood and positive emotions. The two search constructs with their respective key terms are illustrated in *Figure 2*.

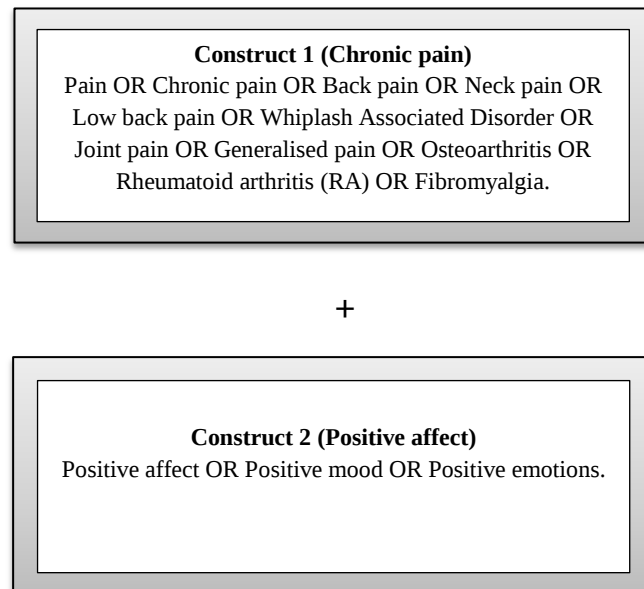


Figure 2. Used search constructs with their key terms on which the search is based.

With the constructs determined, the search was done in such a way that every possible combination was used as a search term (e.g. Chronic pain AND positive affect, chronic pain AND positive mood, chronic pain AND positive emotions). This led to a total of 1531 articles identified, with a second screening done a week later leading to 15 more articles, possibly due to the continuous process of updating the SciVerse Scopus and Web of Science databases. The next step was to remove all duplicates as well as articles where access to the full version was lacking; this left a total of 479 articles. For an overview of the number of search results per construct combination in both databases see Table 1. The results show that positive affect is used significantly more than positive mood and emotions for every search term from the first construct, bar a few, and that those few (back pain, low back pain, and joint pain) hardly have any results at all. Whiplash associated disorder and generalised pain gave only two search results in as many databases, so in future research it is advised to use different terms instead.

Table 1. *Number Of Search Results By Construct Combinations In Both Databases.*

Number of search results	SciVerse Scopus			Web of Science		
	Positive affect	Positive mood	Positive emotions	Positive affect	Positive mood	Positive emotions
Pain	209	98	84	250	105	87
Chronic pain	48	24	11	81	24	23
Back pain	6	12	1	26	17	3
Neck pain	2	0	0	2	0	1
Low back pain	5	10	1	24	11	1
WAD	0	0	0	1	0	1
Joint pain	0	5	0	0	5	0
GP	0	0	0	0	0	0
Osteoarthritis	24	8	1	29	7	2
RA	39	13	6	91	21	16
Fibromyalgia	35	5	4	44	6	11

Note. WAD = whiplash associated disorder. GP = generalised pain. RA = rheumatoid arthritis.

Study selection

The remaining 479 articles were then judged based on title on three separate occasions. The initial selection was based on keywords from either or both search constructs, references to a systematic review in the title, and any other form of thematic emphasis. This screening was performed a second time two days later to minimise false positives and negatives. After these two screenings there were 69 articles left that appeared relevant to this research based solely on title. These findings were then compared to those of a co-assessor for a third screening. Together with the co-assessor, several inclusion and exclusion criteria were determined. Articles were included if the title:

- contained the words ‘chronic pain’;
- contained any of the words from the first search construct;
- contained any of the words from the second construct in a context of chronic pain; or
- was about pain-related depression.

Articles were excluded if the title:

- included or focused on animals;
- focused on cancer, because while cancer can come with chronic pain (e.g. Wang, Liu, Zhao, He, & Li, 2014), both assessors agreed this to be an entirely different category;
- contained the words ‘quality of life’ or ‘health’, as these terms were considered too broad;
- contained the words ‘religion’, ‘spirituality’, or were otherwise not related to the theme; or
- contained the words ‘chronic illness’, due to illness not necessarily including pain.

After deliberation between both assessors and the setting of inclusion and exclusion criteria, 12 of the initial 69 articles were removed from the database and 21 new articles were added, leaving a total of 78 articles with a disparity of two where both assessors could not come to an agreement on the potential use of the articles. The next step was to filter out articles from the remaining 78 on the basis of their abstracts. With the goal of writing a review on the empirical data on chronic pain and positive emotions in mind, abstracts were selected on being both of empirical nature as well as being as thematic as possible, meaning the same criteria as in the first screening phase were applied. After the screening there were 37 articles of the 78 left. These 37 were then screened for relevance to this review based on the full text of the articles, with the selection process being handled similarly to those of the abstract phase but not the title phase (e.g. the words “chronic illness” did not mean the article was up for immediate disqualification). After this screening process, a total of 25 articles were deemed irrelevant to the review: nine of these articles did not discuss a relationship between emotions and chronic pain; six articles ended up, despite a promising abstract, focusing too much on other concepts (e.g. resilience, coping) and putting emotions on a sidetrack; five articles made no mention of

positive emotions at all; two articles were not empirical; two articles did not specifically mention chronic pain but rather acute pain; and lastly one article was not available in English. With 25 of 37 articles being excluded, there were 12 articles left that were considered relevant to this review, of which four were judged unsuitable. Of those, two articles focused on sickle-cell disease without specifying the disorder's chronicity. Another article put too much focus on the relation between two chronic disorders and not enough on the role of positive emotions, and the last article did the exact opposite. This left a total of eight articles to be reviewed. The full selection process is displayed in the form of a flow diagram in Figure 3 and the articles included in this review are displayed in Table 2, as well as their authors and journal of publication. Furthermore, in the table can be seen that each of the eight studies has been given a reference code ranging from S1 to S8.

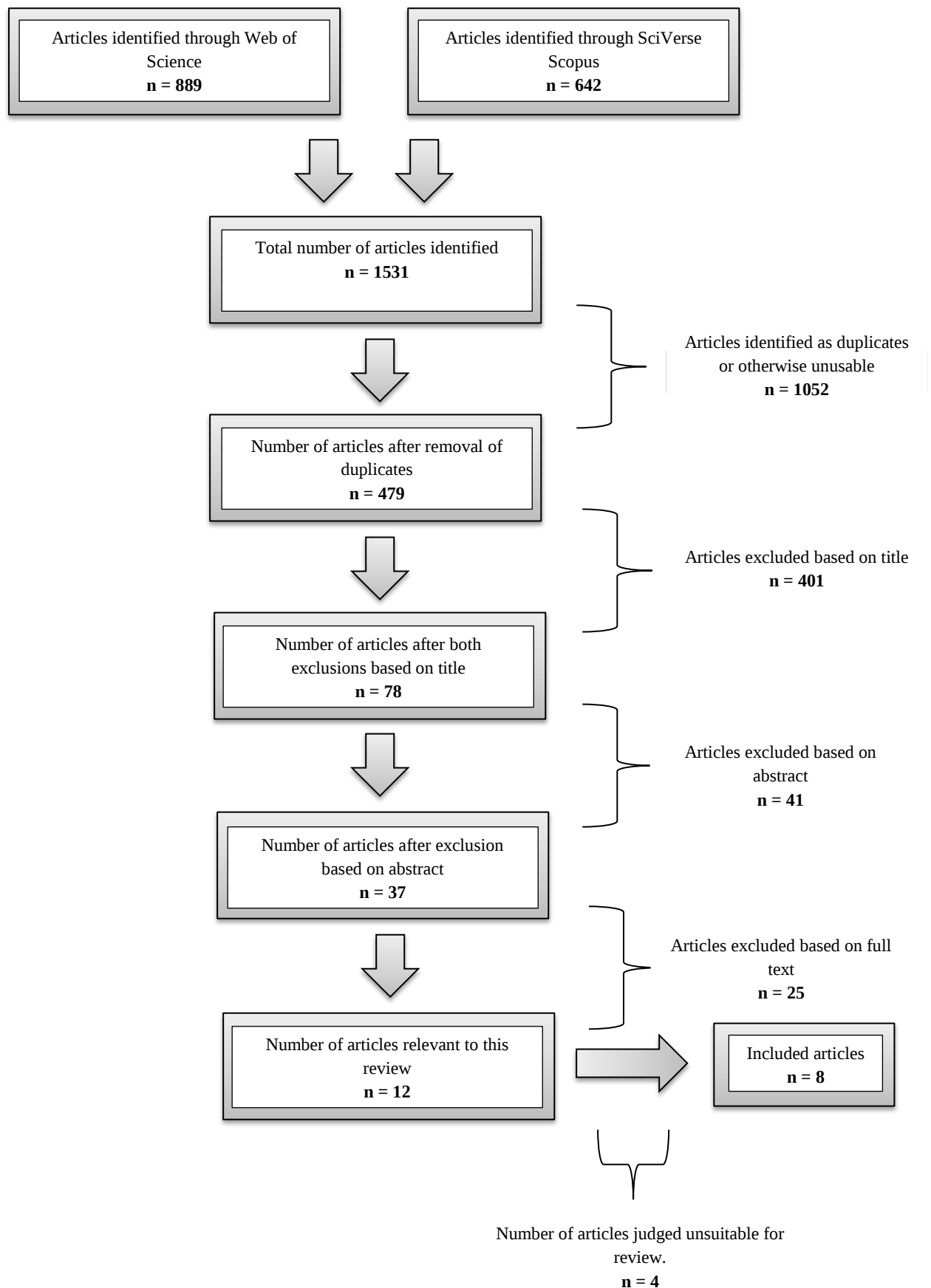


Figure 3. Flow diagram of study selection.

Table 2. *Articles Used For Systematic Review*

Authors	Title of publication	Journal and year of publication	Reference code
Connelly, M., Keefe, F.J., Affleck, G., Lumley, M.A., Anderson, T., & Waters, S.	Effects of day-to-day affect regulation on the pain experience of patients with rheumatoid arthritis	<i>Pain</i> , 131(1-2), 2007, 162-170	S1
Ong, A.D., Zautra, A.J., & Reid, M.C.	Psychological resilience predicts decreases in pain catastrophizing through positive emotions	<i>Psychology and Aging</i> , 25(3), 2010, 516-523	S2
Sturgeon, J.A, Zautra, A.J., & Arewasikporn, A.	A multilevel structural equation modeling analysis of vulnerabilities and resilience resources influencing affective adaptation to chronic pain	<i>Pain</i> , 155(2), 2014, 292-298	S3
Zautra, A.J., Johnson, L.M. & Davis, M.C.	Positive Affect as a Source of Resilience for Women in Chronic Pain	<i>Journal of Consulting and Clinical Psychology</i> , 73(2), 2005, 212-220	S4
Tooyserkani, M.A., Besharat, M.A., & Koochi, S.	The Moderating Role of Positive and Negative Affects on the Relationship Between Alexithymia and Experience of Pain in Chronic Pain Patients	<i>Procedia – Social and Behavioral Sciences</i> , 30, 2011, 154-158	S5
Van Middendorp, H., Lumley, M.A., Jacobs, J.W.G., Van Doornen, L.J.P., Bijlsma, J.W.J., & Geenen, R.	Emotions and emotional approach and avoidance strategies in fibromyalgia	<i>Journal of Psychosomatic Research</i> , 64(2), 2008, 159-167	S6
Tang, N.K.Y., Salkovskis, P.M., Hodges, A., Wright, K.J., Hanna, M., & Hester, J.	Effects of mood on pain responses and pain tolerance: an experimental study in chronic back pain patients	<i>Pain</i> , 138(2), 2008, 392-401	S7
Zautra, A.J., Burleson, M.H., Smith, C.A., Blalock, S.J., Wallston, K.A., DeVellis, R.F., DeVellis, B.M., & Smith, T.W.	Arthritis and perceptions of quality of life: An examination of positive and negative affect in rheumatoid arthritis patients	<i>Health Psychology</i> , 14(5), 1995, 399-408	S8

Data analysis and categorisation

In order for a clear systematic review, four categories were created. All articles were compared to each other by study characteristics, participant characteristics, results, and limitations. This allowed for an easy and systematic way of reviewing by having all necessary information compiled into a detailed yet concise summary. If a certain characteristic (e.g. ethnicity) was not mentioned for one article in the table while it was for others, it means the characteristic in question was not provided by the authors in that particular article. The four categories mentioned above are described as follows.

Study characteristics

This category included characteristics about the studies themselves. The purpose of the studies was mentioned here as well as the study design. This includes any information about the task the participants had to perform and which measurement instruments were used to measure the relevant constructs.

Participant characteristics

The demographic used in the studies was discussed in this section as well as what disorder(s) the participants suffered from.

Results

The results category addressed the main conclusions and results concerning a relationship, direct or indirect, between chronic pain and positive emotions mentioned in the articles. Findings that were not related to this relationship were not discussed in this review. Beta coefficients or, when not provided, the correlational values were given in this section as well.

Limitations

This section discusses the limitations of the design of the studies as discussed by the authors themselves.

Results

With the systematic literature search finished, eight articles out of the initial 1531 remain; in all of them is a relationship between chronic pain and emotions discussed after performing an empirical study involving chronic pain patients. Table 2 shows that all studies have been performed in the last decade with the exception of the last one which was performed in 1995. Notable is that Zautra has contributed to four out of the eight included articles. The highest contributor after Zautra is Lumley with contributions to two out of eight articles. Other than Zautra and Lumley, there was no overlap between the 38 authors.

The results of this review have been presented in Tables 3, 4, 5, and 6. Each table discusses one of the four categories (study characteristics, participant characteristics, results, and limitations) for every included study. This gives a clear overview and allows for an easy comparison within each category.

Table 3. Articles And Their Study Characteristics

Article	Study characteristics
S1: Connelly et al., 2007	Purpose: Understanding how affect regulation impacts the pain experience by inferring affect regulation from day-to-day changes in affect intensities. Design: Longitudinal daily sampling (diaries). Task: Each participant was given a set of 30 booklets that included measures of daily pain and positive and negative affect. They had to complete one booklet per day just before retiring for the next 30 days. Each day's diary had to be mailed the following morning. Measuring instruments: Daily levels of positive and negative affect were assessed using the PANAS.
S2: Ong, A.D., Zautra, A.J., & Reid, M.C., 2010	Purpose: Addressing the question of how psychological resilience and positive emotions influence the way in which individuals respond to pain over time. Design: Longitudinal daily sampling (diaries). Task: Each participant was given a set of 14 diary questionnaires containing emotion and pain measures. The diaries had to be filled out half an hour before bed time each day and then stamped with a time stamper that indicated the current date and time. Measuring instruments: Pain intensity was rated by having the participants select a number between 0 ("no pain") and 10 ("pain as intense as you can imagine") that best described their average level of pain that day; positive and negative emotions were measured by asking participants to rate how they felt during the day by rating different positive terms (e.g. happy, joyful) and negative terms (e.g. angry, upset) on a 5-point Likert-type scale; and lastly pain catastrophising was measured by taking items with the highest total correlations in past research (Sullivan, Bishop, & Pivik, 1995) and having participants rate these.

Article	Study characteristics
S3: Sturgeon, J.A, Zautra, A.J., & Arewasikporn, A., 2014	Purpose: Examining the contributions of pain catastrophising, negative interpersonal events, and positive interpersonal events to daily negative and positive affect. Design: Longitudinal daily sampling (diaries). Task: Each participant was trained in the use of a laptop and was then asked to complete daily diaries each night for 30 days. Measuring instruments: Daily average pain was measured with a numerical rating scale ranging from 0 (“no pain”) to 100 (“pain as bad as it can be”). Pain catastrophising was assessed with two questions from the Coping Strategies Questionnaire in which participants rated their level of agreement with each statement for that day: “I worried about whether my pain would ever end” and “I felt my pain was so bad I couldn’t stand it anymore.” Ratings ranged from 1 (“strongly disagree”) to 5 (“strongly agree”). Interpersonal events were assessed by the Inventory of Small Life Events, and lastly, positive and negative affect were measured through the use of the PANAS-X.
S4: Zautra, A.J., Johnson, L.M., & Davis, M.C., 2005	Purpose: Examining the role of positive affect in blunting the impact of exacerbation of pain and interpersonal stress on negative affective states among women with osteoarthritis and fibromyalgia. Design: A longitudinal self-report including interviewer-administered questionnaires as well as weekly telephonic interviews. Task: After returning an informed consent form by mail, participants were mailed a questionnaire to fill in. The questionnaires were picked up during an in-home visit during which the participants were taking part in an interviewer-administered questionnaire. After the home visit, participants entered the weekly interview phase of the study. In this phase they had to answer a 45 minute telephone interview once a week for 10-12 weeks. Measuring instruments: Pain was assessed during each interview with a standard numerical rating scale ranging from 0 (“no pain”) to 100 (“pain as bad as it can be”). Positive and negative affect was measured using the PANAS-X.

Article	Study characteristics
S5: Tooyserkani, M.A., Besharat, M.A., & Koochi, S., 2011	Purpose: Investigating the role of positive and negative affects on the relationship between alexithymia and emotional pain. Design: A cross-sectional self-report questionnaire Task: Participants were asked to fill in three different questionnaires. One questionnaire to measure alexithymia, one to measure positive and negative affect, and one to measure pain severity. Measuring instruments: Alexithymia was measured using the Farsi version of The Toronto Alexithymia Scale-20 (FTAS). Positive and negative affect was measured through the PANAS, and pain severity was measured through the visual analogue scale for pain severity (VAS).
S6: Van Middendorp et al., 2008	Purpose: Examining emotions and emotion-regulation strategies in women with fibromyalgia and in controls, and how those variables relate to symptoms of fibromyalgia. Design: A cross-sectional self-report questionnaire. Task: Participants were sent a questionnaire booklet that they were asked to send back after filling it in. Measuring instruments: The PANAS-X was used to assess the experience of various emotions. The emotional processing was assessed with a four-item scale of the Emotional Approach Coping Scales.

Article	Study characteristics
S7: Tang et al., 2008	Purpose: Understanding the impact of experimentally inducing either depressed or happy moods on pain patients' experience of pain. Design: A 3x2 repeated-measures laboratory design was used with induction type as the between-subjects variable and manipulation as the within-subjects variable. Task: Participants first read a neutral themed magazine for seven minutes, after which they had to provide a rating between 0 and 100 of their cheerfulness, depression, and pain. To evaluate pain tolerance, the participants had to stand up and use only their dominant hand to hold a moderately heavy shopping bag still for 'as long as they feel safe and comfortable'. After this task, they immediately had to provide a second pain rating. In the next step, the participants were asked to get into a desired mood state with the help of mood-suggestive music, after which they had to provide second cheerfulness and depression ratings as well as two more pain ratings (before and after the second bag-holding task that followed the second mood ratings). Measuring instruments: The Short-Form McGill Pain Questionnaire was used to measure pain severity and the depression and cheerfulness ratings were determined by 0-100 rating scales, marked by numerical anchors in steps of ten and word anchors at the end of each scale.
S8: Zautra et al., 1995	Purpose: Focusing on assessments of affective states as indicators of the subjective side of the quality of life for rheumatoid arthritis patients. Design: A cross-sectional self-report questionnaire among three different samples (A, B, and C) as well as an in-person interview for sample B. Task: In sample B, the participants filled out self-report questionnaires in conjunction with in-person interviews. In samples A and C, the questionnaires were self-administered and mailed to the participants' homes. Measuring instruments: The pain subscale of the Arthritis Impact Measurement Scale was used to measure pain in all three samples through a 6-point scale ranging from 'none or never' to 'very severe or always'; positive and negative affect were measured using the PANAS; and coping was assessed with the Coping Strategies Questionnaire.

Findings in the study characteristics

Five of the studies selected for review have a similar purpose and study the direct effect of positive emotions on the experience of chronic pain (S1, S2, S6, S7, and S8). The remaining three (S3, S4, and S5), however, have a slightly different purpose and study a more indirect effect. S3 does so through examining the contributions of pain catastrophising to positive affect, while S4 does so by examining the role of positive emotions on negative affective states. The authors can then conclude whether positive emotions indirectly affect the experience of chronic pain due to the effect negative emotions have on this experience (see for example S1).

The eight studies used in this systematic review have as common denominator that all of them use a self-report study design. There are, however, some differences in the types of self-report used. In three studies participants were asked to fill in a diary every night (S1, S2, and S3), while in the five remaining the studies the participants had to fill in questionnaires (S4, S5, S6, S7, and S8) with S4 and S8 also including interviews, both face-to-face as well as telephonic.

With S1, S2, and S3 being longitudinal diary studies, the participants had to fill in a questionnaire every night before going to bed. S2 is slightly different from the other two because the participants only had to fill in a total of 14 questionnaires, as opposed to the 30 questionnaires in S1 and S3. While S4 was also both longitudinal and a questionnaire study, it was not a diary study and required a bit more from the participants than to fill in a form; in the last phase of the study they were asked to answer a 45 minute telephone interview once a week for 10-12 weeks (depending on how many weeks were missed). Both S5 and S6 were regular cross-sectional questionnaires and required participants to fill in the questionnaire booklets and mail them back before a certain deadline. There are two studies that stick out in this review. The first one is S7 due to the 3x2 repeated-measures design and the fact that

participants were required to perform a certain task, other than filling in questionnaires, multiple times during the on-site experiment. It was also the only laboratory study. The second study is S8 due to the use of three different samples where different tasks were performed by the participants. Samples A and C only had to fill out a questionnaire similar to the participants in S5 and S6, while sample B had to fill out self-report questionnaires in conjunction with in-person interviews in their homes. Similar to S5 and S6, S8 had a cross-sectional design.

Lastly, it is notable that six out of eight (S1, S3, S4, S5, S6, and S8) studies used the PANAS or its expanded version, the PANAS-X, to measure positive and negative affect. The two studies (S2 and S7) where the PANAS was not used also happened to use a different wording compared to the other five studies ('positive emotions' and 'positive mood', respectively, whereas the other studies used 'positive affect'). Furthermore, S3 and S4 both measured pain severity through a numerical rating scale ranging from 0 ('no pain') to 100 ('pain as bad as it can be'). S2 was very similar in this regard, but instead the scale measured for pain intensity ranging from 0 ('no pain') to 10 ('pain as intense as you can imagine'). The other measuring instruments used in the studies all vary greatly.

Articles And Their Participant Characteristics

Article	Participant characteristics
S1: Connelly et al., 2007	Participants: 94 adults (68 female, 26 male) with a mean age of 56. All participants were recruited from clinics affiliated with the Ohio University College of Osteopathic Medicine or Duke University Medical School. The majority of the participants were White (91%). Disorder: Rheumatoid arthritis based on criteria established by the American College of Rheumatology.
S2: Ong, A.D., Zautra, A.J., & Reid, M.C., 2010	Participants: 95 adults (72 female, 23 male) with a mean age of 76. The income of the participants was approximately normally distributed, with the majority (35.5%) earning between \$25,000 and \$75,000. The majority of the participants were White (95%) and approximately a quarter (27%) was married at the time of the study. Disorder: Low back pain and osteoarthritis of the hip and/or knee were the most common disorders; others were included but not mentioned in the article.
S3: Sturgeon, J.A, Zautra, A.J., & Arewasikporn, A., 2014	Participants: 260 women with a mean age of 57. The majority of the participants were White (91,7%) and a bit more than half (54,5%) indicated to be married at the time of the study. Disorder: Fibromyalgia (n=53), osteoarthritis (n=106), or both (n=101).
S4: Zautra, A.J., Johnson, L.M., & Davis, M.C., 2005	Participants: 124 women with a mean age of 54. The average household income fell within the range of \$50,000 to \$59,999 and 62% were unemployed at the beginning of the study. The majority of the participants were White (96%). Disorder: Osteoarthritis (n=38), fibromyalgia (n=86), or both. If both, participants had to classify fibromyalgia as the most disabling of the two disorders to be classified in that group.

Article	Participant characteristics
S5: Tooyserkani, M.A., Besharat, M.A., & Koochi, S., 2011	Participants: 100 adults (67 female, 33 male) with a mean age of 39 for the males and 49 for the females. Participants did not have surgery in the three months prior to the study. Disorder: Chronic musculoskeletal pain (except headache and neck pain).
S6: Van Middendorp et al., 2008	Participants: 403 women with a mean age of 46 suffering from fibromyalgia based on criteria established by the American College of Rheumatology. All women were recruited from three hospitals in Utrecht and Almere, The Netherlands. The study also included 196 control women. Disorder: Fibromyalgia.
S7: Tang et al., 2008	Participants: 55 adults (61,8% female) with a mean age of 47. The majority of the participants were White (72,6%). All participants were seeking medical treatment for persistent back pain in London. Disorder: Chronic back pain.
S8: Zautra et al., 1995	Participants: Sample A consisted of 227 participants (68,9% female) with a mean age of 52; sample B consisted of 201 participants (88,1% female) with a mean age of 53; and sample C had the least participants with 172 (78% female) and a mean age of 57. All participants across all samples had their disorder confirmed by either a physician (sample B) or by their rheumatologist (samples A and C). Disorder: Rheumatoid arthritis.

Findings in the participant characteristics

Notable is that the vast majority of participants across all eight studies were female. While five studies did use male participants (S1, S2, S5, S7, and S8), these were also the studies that used the least participants in total (S8 being an exception) as well as using more females than males in their studies. Furthermore, in each of the studies where the ethnicity of the participants was provided (S1, S2, S3, S4, and S7) more than 90% was White, with S7 being an exception (72,6%). As for age, in only three studies (S5, S6, and S7) was the mean age of the female participants lower than 50 and even then barely so.

A total of five different chronic disorders have been studied across all eight articles. S1 and S8 are the only studies to examine rheumatoid arthritis patients, while S2 and S7 are the only ones to specifically focus on back pain. However, S5 used participants suffering from musculoskeletal pain (headache and neck pain excluded) in their study, and musculoskeletal pain includes back pain (Picavet & Schouten, 2003). As such, S2, S5, and S7 all studied participants with chronic back pain. Furthermore, two articles (S3 and S4) used both fibromyalgia and osteoarthritis patients in their study, while S6 focused solely on fibromyalgia.

Table 5. Articles And Their Study Results

Article	Study results
S1: Connelly et al., 2007	Individuals who maintained positive affect levels at or above their typical level between any two days ($\beta = -3.23$, $P = .009$) or recovered more quickly from a prior day's decrease in positive affect ($\beta = -2.08$, $P = .024$) were found to experience significantly lower levels of pain intensity on the current day.
S2: Ong, A.D., Zautra, A.J., & Reid, M.C., 2010	Positive emotions were found to decrease pain catastrophising the following day ($\beta = -.19$, $P < .01$) with gender moderating this effect significantly ($\beta = -.25$, $P < .001$). Additionally, it was found that experiences of positive emotions have the potential to counter the habitual thinking (e.g. rumination) that is so characteristic of pain catastrophising.
S3: Sturgeon, J.A, Zautra, A.J., & Arewasikporn, A., 2014	The within-person models show that day-to-day changes in pain catastrophising play a key role in decreases in positive affect ($\beta = -.145$, $P < .01$), and increases in negative affect ($\beta = .144$, $P < .01$) that accompany increases in pain experience. Additionally, a greater number of daily positive interpersonal events were significantly related to greater daily positive affect ($\beta = .06$, $P < .01$) on the same day.
S4: Zautra, A.J., Johnson, L.M., & Davis, M.C., 2005	Both higher weekly positive affect ($\beta = -.234$, $P < .001$) as well as greater positive affect on average ($\beta = -.072$, $P = .227$) resulted in lower negative affect both directly and in interaction with pain. Furthermore, higher levels of overall positive affect predicted lower levels of pain in following weeks ($\beta = -.005$, $P = .001$). Lastly, deficits in positive affect were related to increased negative affect during times of high pain. This increase in negative affect in turn increased the experience of pain during subsequent weeks, meaning deficits in positive affect lead to an increased pain experience.

Article	Study results
S5: Tooyserkani, M.A., Besharat, M.A., & Koochi, S., 2011	The results show a positive relationship between alexithymia and pain intensity ($\beta = .28$, $P = .001$) and a negative relationship between positive affect and pain intensity ($\beta = -.56$, $P = .001$). Positive affect was also found to have a moderating effect on the relationship between alexithymia and pain intensity ($\beta = -.31$, $P = .001$).
S6: Van Middendorp et al., 2008	The fibromyalgia group reported lower positive affect ($M = 3.17$, $SD = .64$) than the control group ($M = 3.47$, $SD = .51$) and there was a significant correlation between positive affect and pain ($r = -.10$, $P < .001$). This provides support for a general positive affect deficit in fibromyalgia patients.
S7: Tang et al., 2008	A happy mood resulted in significantly lower pain ratings both before ($r = -.45$, $P < .01$) and after ($r = -.37$, $P < .01$) the bag holding challenge, as well as greater pain tolerance ($r = .38$, $P < .01$). None of the groups differed from each other in pain characteristics (duration, intensity, and interference).
S8: Zautra et al., 1995	High pain predicted more maladaptive coping ($r = .20$, $P < .05$), which in turn predicted more negative affect ($r = .58$, $P < .01$) and less positive affect ($r = -.17$, $P < .05$). It is important to note the authors define maladaptive coping as 'pain catastrophising'.

Findings in the study results

Five studies (S1, S4, S5, S6, and S7) found a direct relationship between positive emotions and the experience of chronic pain. In S1, having positive affect at or above one's usual level lead to lower pain ratings the following day. Results are similar in S4 and S5; higher levels of positive affect predicted lower pain ratings and pain intensity respectively in the following weeks. S6 showed that fibromyalgia patients generally experience less positive affect, but due to the study design no causal inferences could be made between fibromyalgia and positive affect. S7 also showed that a happy mood resulted in a lower experience of pain as well as increasing the tolerance for pain. Other than a direct relationship, an indirect one can be found in S2, S3, S4, and S8. The pain catastrophising discussed in S2 is decreased by positive emotions, and with pain catastrophising leading to increased pain ratings it can be concluded that positive emotions indirectly reduce pain ratings by decreasing pain catastrophising. The results of S3 show that daily changes in pain catastrophising play an important role in decreasing positive affect and increasing negative affect that accompany increases in pain experience. While S4 did conclude a direct effect between positive emotions and chronic pain, an indirect effect was found as well. Deficits in positive affect were related to increased negative affect. This increase in negative affect then increased the experience of pain, meaning deficits in positive affect lead to an increased pain experience. The findings in S8 are similar to those of S3; they show that high levels of pain predict more pain catastrophising, which in turn predicts less positive affect.

Table 6. Articles And Their Study Limitations.

Article	Study limitations
S1: Connelly et al., 2007	The sample is relatively well educated and primarily Caucasian, which may lead to issues with generalisability. Additionally, it was also chosen to define affect regulation based on these day-to-day changes, rather than within-day changes. It is possible that findings would have been different had they sampled pain and affect reports using a real-time assessment design.
S2: Ong, A.D., Zautra, A.J., & Reid, M.C., 2010	The biggest limitation is their use of a primary care sample, which raises concern regarding the generalisability of the study findings to patients with specific chronic disorders, including rheumatoid arthritis. Furthermore, some variables that are known to have an impact on pain catastrophising were not examined; in particular the authors did not attempt to measure variation in depression as a possible predictor of day-to-day pain catastrophising. Lastly, the study is limited by its design, as the authors cannot draw any conclusive causal inferences due to the nature of their data being observational.
S3: Sturgeon, J.A, Zautra, A.J., & Arewasikporn, A., 2014	The entire sample is female which may affect the generalisability of the findings. As a result, the findings should be interpreted with the understanding that the cognitive and social consequences of pain mentioned in the study may have been different if the study had included male participants.
S4: Zautra, A.J., Johnson, L.M., & Davis, M.C., 2005	The sample used in this study is biased towards European and American women with a slightly higher than average income and education. Furthermore, the sample consisted solely of women of 35 years of age and older. As such, the limited representativeness of the sample means there may be a limited generalisability of the findings when it comes to income and ethnic minority groups.

Article	Study limitations
S5: Tooyserkani, M.A., Besharat, M.A., & Koochi, S., 2011	The authors used an improbable sampling method meaning it is hard to generalise the results to the entire population of chronic pain patients.
S6: Van Middendorp et al., 2008	Although fibromyalgia participants were compared with nonparticipants on a number of demographic and health variables, that information was only available for a small part of the nonparticipants due to the recruitment procedure used in the study. Additionally, the control group was not selected entirely random and the groups were also different in a number of respects that come with suffering from fibromyalgia (e.g. medication use). Furthermore, the findings cannot be generalised to other ethnicities, males, or patients with fibromyalgia not diagnosed according to the American College of Rheumatology criteria. Lastly, the study is limited by the use of self-report questionnaires and its cross-sectional nature.
S7: Tang et al., 2008	Firstly, the bag-holding task was used both as an outcome measure and as a pain-provoking stimulus in the experiment. Secondly, the authors used single-item numerical rating scales to measure changes in mood and pain at various points of the experiment; additional measures to establish validity and reliability would have been optimal.
S8: Zautra et al., 1995	Based on the models used in the article, no definitive claims of causation can be made. A longitudinal study design, rather than cross-sectional, could have provided more evidence of causality between the variables.

Findings in the study limitations

Six (S1, S2, S3, S4, S5, and S6) of the eight studies have as main limitation that their results are hard to generalise. Either the samples used in the studies consisted entirely of females (S3, S4, and S6), or the samples were otherwise not mixed enough due to ethnicity (S1 and S4) or specified disorders (S2 and S5). Furthermore, three studies (S2, S6, and S8) were limited by their cross-sectional design meaning no causal inferences could be made. Another limitation found in S2 is the lack of inclusion of other factors that could predict day-to-day pain catastrophising, such as depression. The main limitation found in S7 was a lack of thorough measurements during the bag-holding task.

Discussion

This systematic review attempted to summarise the work done in the field of chronic pain and positive emotions. The main goals were 1) to investigate a possible relationship between those two concepts and 2) to provide a concise summary of current research done on the subject. Eight publications, derived from a systematic literature search that initially provided more than 1500 results, are included in this review.

All articles used in this review conclude that there is indeed a significant relationship, either direct or indirect, between chronic pain and positive emotions. It is difficult to compare the results of the studies directly due to the use of different tests and coefficients. However, all studies with a direct relationship between positive emotions and chronic pain unanimously show this to be a negative one with more positive emotions leading to less pain, albeit with varying levels of significance. The strength of the relationship varies from very small to moderate, depending on the study. However, it can be concluded without doubt that there is a connection. Some of the studies show that there is an indirect relationship as well, with pain catastrophising or negative affect as mediating variables; these studies show negative relationships between positive emotions and pain catastrophising or negative affect. Because pain catastrophising predicts the pain experience (Sullivan et al., 2001) and both pain catastrophising and negative affect often exacerbate the pain based on the fear-avoidance model (Leeuw et al., 2007), it can be concluded that there is indeed an indirect relationship between positive emotions and chronic pain.

There are several reflections based on the results of this review. Firstly, it is notable that in one study (Ong, Zautra, & Reid, 2008) positive emotions lead to a decrease in pain catastrophising. Two other studies (Sturgeon, Zautra, & Arewasikporn, 2014; Zautra et al., 1995), however, showed the opposite: pain catastrophising lead to a decrease in positive emotions. These three studies, while having varying conclusions, are all reciprocal because all

three are in line with the fear-avoidance model discussed earlier by showing that emotions are preceded by cognition. Secondly, according to the fear-avoidance model, both positive and negative emotions directly affect pain catastrophising; positive emotions lead to less catastrophising while negative emotions lead to more. The model corresponds with several studies included in this review that concluded this relationship: Ong, Zautra, and Reid (2010) found in their study that positive emotions had a reducing effect on pain catastrophising, and Sturgeon, Zautra, and Arewasikporn (2014) found that negative emotions had an increasing effect. While the relationship cannot be called causal based on those two studies due to the observational nature of their data, other studies do not share this issue and have a solid causal study design (e.g. Leeuw, Goossens, Van Breukelen, Boersma, & Vlaeyen, 2007). Third, there appears to be a relationship between positive and negative affect. In a study by Zautra, Johnson, and Davis (2005), reduced positive affect lead to increased negative affect and vice versa. The study by Smith and Zautra (2008) on the two-factor model mentioned in the introduction confirms this correlation.

With regard to the articles included in this review, there are two things that stand out; these are not so much limitations as they are remarkable. Firstly, there are more articles that discuss fibromyalgia and chronic back pain than there are articles that discuss rheumatoid arthritis (three for fibromyalgia and back pain, and two for rheumatoid arthritis). While osteoarthritis is discussed in two articles as well, it is still surprising considering the initial search results displayed significantly more articles that discussed rheumatoid arthritis compared to the other three disorders (see Table 1). Secondly, as opposed to the disorders from the first search construct, the search terms from the second construct do match the number of search results. Out of the eight articles included in this review, six study positive affect, with the other two studying positive mood or positive emotions; this is in line with positive affect giving significantly more results than the other two search terms despite having

similar meanings. It is evident there is some degree of overlap in terminology, however it is likely that positive affect is so much more used due to the popularity of the PANAS.

While the findings of this systematic review do provide a concise overview of modern research on the topic of chronic pain and positive emotions, there are some methodological issues that should be taken into account. Firstly, while the second search construct consisted of the right key terms, the same could not be said of the first construct. Looking at the number of search results by construct combinations in both databases (Table 1), it is evident that some of the search terms (more specifically neck pain, joint pain, generalised pain, and whiplash associated disorder) gave none or very few results. Therefore it would have been better to use different terms instead in order to gain more evenly spread out search results. A second methodological issue involves the large population imbalances when it comes to the participants. With nearly all participants across all studies included in this review being female and White, it is hard to generalise the results across different populations. Furthermore, it is difficult to compare different chronic disorders to each other; in hindsight it might have been better to focus on the relationship between one particular disorder and positive emotions, rather than on chronic pain in general. While there is not much reason to assume that positive emotions have different effects based on chronic disorder, there seems to be no evidence to the contrary either. By focusing on one specific disorder this factor is taken out of the equation entirely, thus causing the results to be more conclusive. However, the amount of specific chronic disorders to study would be limited due to the availability of research, or lack thereof; some disorders have been studied significantly more than others. Lastly, a questionable decision in this review may have been whether it was a good idea to only include the results that discuss a relationship between chronic pain and positive emotions. It became evident in the introduction that negative affect also plays an important role in the experience of pain, and in hindsight it is possible that some potential indirect

relationships between chronic pain and positive emotions have been missed due to largely omitting negative affect, among others, as a variable.

While the study limitations according to the studies' authors have been discussed, there are some issues that were not mentioned in the articles but do deserve attention. Firstly, three studies (Connelly et al., 2007; Ong, Zautra, & Reid, 2012; Sturgeon, Zautra, & Arewasikporn, 2014) all have the exact same study design – longitudinal diary sampling – but only Ong, Zautra, & Reid (2012) mention this design as a limitation when it comes to drawing causal inferences. This same limitation should have been mentioned in the other two articles. Secondly and similarly, three other studies (Tooyserkani, Besharat, & Koochi, 2011; Van Middendorp et al., 2008; Zautra et al., 1995) also share their study design with each other. However, while Van Middendorp et al. (2008) and Zautra et al. (1995) mention the cross-sectional design as a limitation, Tooyserkani, Besharat, and Koochi (2011) do not. Another common omission regarding study design is that six articles do not mention self-reporting as a limitation while the remaining two (Ong, Zautra, & Reid, 2010; Van Middendorp et al., 2008) do. Lastly, a large limitation lies in the lack of beta-coefficients in the studies by Connelly et al. (2007), Tang et al. (2008), and Zautra et al. (1995). This makes it very hard to compare the results of these studies to the other studies that do provide the beta values due to the variance between the tests.

There are several implications for future research. Firstly, it is notable that whenever positive affect was a factor that needed measuring, the PANAS (Watson, Clark, & Tellegen, 1988) was used as a measuring instrument. While the PANAS has proven to be reliable, the main issue is that the items are all high arousal feelings, and that many items (e.g. “active”, “strong”) are not considered emotions or feelings (Diener et al., 2009). Missing from the PANAS are emotions such as love, compassion, and happiness. In future research it might be recommended to use a different and more recent scale to assess positive and negative affect.

The Scale of Positive and Negative Experience, or SPANE (Diener et al., 2009), reflects all levels of arousal for both positive and negative feelings and could be a viable replacement for the PANAS as a measuring instrument for affects. Furthermore, in future research it may be advisable to focus on one type of chronic pain as opposed to multiple because it will allow for a better comparison and more specific conclusions. When it comes to the use of search terms, following studies should either omit the terms from this study that netted few results or choose to use more or different search databases. This review showed that searching by pain location proves to be an unsuccessful way of gathering results. Further studies should also aim to include more male participants or participants of ethnicities other than White in their research. By doing so the results will be applicable to a wider population than they are now due to evening out the heavy focus on White females in existing studies. Granted, this is easier said than done due to the fact women are more likely to suffer from chronic pain than men (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley, 2009), but this means that in following studies more effort should be put into finding male participants.

As for recommendations for future research: research on this topic should aim to use interventions or a longitudinal design as the study results will be more reliable. Furthermore, with a significant relationship between chronic pain and positive emotions established, future studies should aim to investigate how to increase the effectiveness of positive emotions on reducing the pain experience. One way to do this might be through the use of CBT, a technique aimed at the management of pain and its consequences (Vowles, McCracken, & Eccleston, 2007). Also, the development of interventions that inform chronic pain patients on the importance and effectiveness of positive emotions may prevent them from getting stuck in a downward spiral as per the fear-avoidance model; this is also something that would require further study. Lastly, based on the results of this review it is advisable to add positive affect as another component to the fear-avoidance model. With the addition of this concept to the

model it can be made more clear how to avoid a downwards spiral, based on what the broaden-and-build theory (Fredrickson, 1998) suggests; it states that positive emotions may restore the effect of negative emotions and consequently benefit (physical) health (Fredrickson, 1998).

To conclude, it is evident that there is a substantial relationship between chronic pain and positive emotions, and that pain catastrophising and negative emotions play a significant role in mediating this relationship. Relationships have also been found between positive and negative affect as well as between pain catastrophising and emotions in general. Based on current research it is likely that positive affect helps chronic pain patients in reaching an upwards spiral, thus countering the downwards one caused by pain catastrophising and negative affect.

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