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Shifting the perspective

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Topical Review

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Shifting the perspective: how positive thinking can help diminish the negative effects of pain

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Abstract

Objectives: The field of pain psychology has taken significant steps forward during the last decades and the way we think about how to treat chronic pain has radically shifted from a biomedical perspective to a biopsychosocial model. This change in perspective has led to a surge of accumulating research showing the importance of psychological factors as determinants for debilitating pain. Vulnerability factors, such as pain-related fear, pain catastrophizing and escape/avoidant behaviours may increase the risk of disability. As a result, psychological treatment that has emerged from this line of thinking has mainly focused on preventing and decreasing the adverse impact of chronic pain by reducing these negative vulnerability factors. Recently, another shift in thinking has emerged due to the field of positive psychology, which aims to have a more complete and balanced scientific understanding of the human experience, by abandoning the exclusive focus on vulnerability factors towards including protective factors.
Methods: The authors have summarised and reflected on the current state-of-the-art of pain psychology from a positive psychology perspective.
Results: Optimism is an important factor that may in fact buffer and protect against pain chronicity and disability. Resulting treatment approaches from a positive psychology perspective are aimed at increasing protective factors, such as optimism, to increase resilience towards the negative effects of pain.
Conclusions: We propose that the way forward in pain research and treatment is the inclusion of both *vulnerability* and *protective factors*. Both have unique roles in modulating the experience of pain, a finding that had been neglected for too long. Positive thinking and pursuing valued goals can make one's life gratifying and fulfilling, despite experiencing chronic pain.

Keywords: (chronic) pain; biopsychosocial model; optimism; positive affect; positive psychology; protective factor.

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From a biomedical to a biopsychosocial perspective

Our thinking about how to treat chronic pain has radically shifted. For a long time, the experience of chronic pain was thought of solely as a medical problem. Pain was considered a direct sign of an underlying injury, tissue damage, or organic pathology and, as such, should be treated medically. However, numerous studies illustrate that the report of pain, either acute or chronic, is not strongly correlated with the presence of tissue damage. For instance, in a meta-analysis, findings showed that many degenerative spine findings (e.g. disc bulges) are also found in uninjured individuals who do not report lower back pain, with the prevalence rising with age [1]. This suggests that medical findings are not always related to the pain experience. Furthermore, most individuals who experience chronic pain and seek help from a primary care provider rarely have a previously undiagnosed serious pathology or experienced an injury [2]. Moreover, similar pain phenotypes occur in individuals in the absence of an identifiable aetiological trigger (i.e. injury or medical disease), such as fibromyalgia, irritable bowel syndrome, and tension headaches, which may reflect changes in pain sensitivity due to central sensitization (i.e. an amplification of neural signalling within the central nervous system that elicits pain hypersensitivity) [3, 4]. After the discovery of central sensitization, it became clear that experiencing a noxious stimulus is not necessary to produce a pain experience [3].

These medically unexplained experiences of pain fuelled a shift in thinking from a solely biomedical perspective to a biopsychosocial perspective, resulting in influential

biopsychosocial models such as the cognitive-behavioural fear-avoidance model [5]. Central in the fear-avoidance model is the dysfunctional interpretation of an acute pain experience. People who tend to have catastrophic thoughts concerning their pain are more likely to get caught in a downward vicious circle of pain-related fear, defensive behaviours, disuse and disability, and, in turn, increased pain [5]. This shift from a biomedical to a biopsychosocial conceptualization of pain led to a surge of research that however, predominantly focused on negative factors, such as negative cognitions (e.g. pain catastrophizing, negative attention bias, fear-avoidance beliefs) and behaviours (e.g. avoidance).

This focus on negative factors has guided numerous studies and increased our knowledge about vulnerability factors that contribute to or maintain chronic pain. As a result, psychological treatment has concentrated on decreasing the adverse impact of chronic pain by reducing these negative vulnerability factors, such as by means of cognitive behavioural therapy (CBT) or exposure techniques [6, 7]. CBT is mainly directed at changing maladaptive cognitions into more benign or helping cognitions [7, 8]. A systematic review [9] indicated that CBT is an effective treatment for adult chronic pain, leading to decreased disability, distress, and pain. However, the effect sizes across all outcomes are modest, ranging from very small to small. In exposure therapy, patients are asked to perform an activity to challenge the validity of their catastrophic expectancies, and to encourage explorative behaviour, enabling recovery [10]. Exposure treatments can effectively reduce pain-related fear and catastrophic expectancies about physical activities and have been found cost-effective [11–14]. Nevertheless, effect sizes for treatment outcomes are small [15] and exposure treatments are associated with high drop-out rates of 30–50% [6]. In sum, there are effective psychological treatments developed for chronic pain, but effect sizes suggest that there is room for improvement.

From a negative towards a positive focus

At the turn of the century, a new way of thinking emerged that contributed to a new field within psychology: positive psychology [16].The aim of positive psychology is to have a more complete and balanced scientific understanding of the human experience by abandoning the exclusive focus on vulnerability factors and 'fixing what is wrong' and including protective factors and 'building what is strong' [17, 18]. This new approach also found its way into the field of pain [19, 20]. Protective factors, for instance, dampen pain intensity, diminish the negative side effects of a pain experience, protect against developing chronic pain, or promote adaptation to chronic pain. Positive affect, self-efficacy (i.e. perceived ability to learn or perform behaviour to attain designated goals) [21], hope (i.e. belief that one can find pathways to desired goals and become motivated to use those pathways) [22], and optimism (i.e. generalised and global positive outcome expectancies) [23] are examples of protective factors that are shown to promote pain resilience [19, 24–30]. A review of the empirical literature shows that self-efficacy, hope and optimism are structurally distinct and differentially related to important life outcomes, including psychological adjustment [31]. Better chronic pain adjustment by increasing positive factors is in line with the influential broaden-and-build theory of Fredrickson [32]. This theory states that experiencing and strengthening positive behaviours, emotions, and cognitions cause an upward, mutually reinforcing spiral to ensue, in which broadened thinking patterns and building of durable resources result in further positive emotions, in turn enhancing emotional well-being [32]. Examining both vulnerability and protective factors will help to disentangle what leads to outcomes of recovery, sustainability (perseverance in valued activities despite chronic pain), and growth (benefit finding due to adversity, such as experiencing chronic pain) [33].

It should be noted that the fear-avoidance model of chronic pain [5] specifies not only a negative downward spiral, but also a positive upward spiral. When a non-threatening appraisal of pain is made that does not elicit fear, this is assumed to result in confrontation and engagement behaviour, resulting in functional recovery. Originally, the model did not specify any factor, besides the absence of fear that could elicit this upward spiral to recovery. However, since its conception, suggestions to expand the fear-avoidance model have been proposed. In fact, the authors themselves never presumed the model was finished, but saw it as a theory-based heuristic to guide further research in an attempt to gain a better understanding of pain disability and improving existing treatment protocols [10]. It has been argued that in order to understand chronic pain, examining the motivation of an individual and taking the (social) context into account are essential [34–37]. Chronic pain is not experienced in isolation. Chronic pain always occurs within a context of daily life, with various constraints and demands of its own, often resulting in competing goals. Fear and avoidance behaviour operate in this context of multiple competing goals, influencing an individual's motivation to pursue certain valued activities at one point or abandon them at other times to cope with a chronic pain experience [34]. Protective factors may promote the pursuit

of valued life goals, in contrast to a persistent attempt to control or to avoid pain [34, 38, 39]. For an extensive review of the attenuating effect of positive affect on pain, see Hanssen et al. [40]. In this topical review, we will focus on optimism, given the theoretical underpinnings of the protective effect of optimism in the context of pain. We will first review the evidence that optimism can help alleviate the negative impact of pain and whether it is possible to increase optimism. Then, we will discuss the clinical implications of increasing optimism in chronic pain patients and possible interventions.

How optimism helps diminish the negative effects of pain

Dispositional optimism is characterised by generalised and global positive outcome expectancies [23]. In other words, individuals with high levels of optimism have the tendency to expect that good things will happen in the future. This definition is based on the expectancy-value model of motivation [41]. It assumes that behaviour reflects the pursuit of goals, which is defined as internal representations of a desired state [42]. The model proposes two aspects that influence goal-directed behaviour. First, if a goal is perceived as more important, the *value* that is given is greater, resulting in more effort displayed to attain the goal. Second, motivation is determined by the *expectancy* of goal attainment. Doubt may increase withdrawal from effort towards goal attainment, while confidence in reaching a goal will foster perseverance and continued effort, even when it is difficult to carry on. Optimism is in this case distinct from self-efficacy in that self-efficacy is only one potential source for the expectancy of goal attainment. Other possible sources that may contribute to these expectancies of goal attainment are for instance help from others, fate or a benevolent god.

There are several possible explanations why optimism can diminish the negative and debilitating impact of chronic pain. The most intuitive explanation is that optimism reduces the experienced intensity of pain [43]. Recently, a meta-analysis [44] was conducted to examine the relationship between optimism and pain-related outcomes. Results showed that optimism was related to lower pain severity, better physical functioning, and less psychological dysfunction (i.e. depressive or anxiety symptoms). A systematic review [25] was conducted on experimental and clinical studies investigating the relation between optimism and the experience of pain. Almost 70% of the studies found a significant beneficial association between optimism and at least one pain characteristic (i.e. pain intensity, frequency or unpleasantness, pain tolerance thresholds, habituation, temporal summation, conditioned pain modulation, or placebo/nocebo effects). Furthermore, optimism has been shown to increase the responsiveness to placebo-induced pain relief [45].

Optimism may also prevent individuals from being caught in a downward spiral of fear-avoidance that fuels negative pain-related outcomes. Optimism is associated with less pain catastrophizing [19, 33], which may prevent the downward spiral through a non-threatening interpretation of pain-related stimuli [46, 47]. Vancleef and Peters [48] reported that optimistic individuals make less negative or catastrophic interpretations of ambiguous information in various domains, such as pain-related sensations, other bodily sensations, and social and general situations. Alternatively, optimism may broaden attention by reducing pain-induced distressing thoughts and rumination that consume attention [49–52]. As optimism is associated with less worry, rumination, and pain catastrophizing [46, 53–55], all available attentional resources can be dedicated towards continuing pursuing valued activities and/or actively coping with the pain experience. Research findings have indeed indicated that the association between optimism and the experience of less pain is mediated by coping strategies. Optimism is associated with more active coping, which, in turn, is associated with low levels of pain, anxiety, depression, and impairment. Pessimism is related to the use of passive coping, which is associated with high levels of pain, anxiety, depression, and impairment [56].

Another potential mechanism of the beneficial effects of optimism is increased goal attainment. Optimism may diminish the negative impact of chronic pain on an individual's life by increasing motivation towards continuing effort and engagement towards (valued) goal attainment [57]. Self-regulation resources are considered to be limited. Self-regulation is the ability to control or alter emotions and thoughts, enabling behaviour to vary adaptively from moment to moment [41, 58]. When an individual is confronted with a pain experience, resources are directed towards the pain in order to cope with this aversive experience. However, directing these resources towards the pain demand will render them unavailable for additional demands, causing resources to be fatigued [59–61]. Optimism may increase motivation to continue allocating resources towards valued activities, despite fewer resources being available [59, 62]. Optimists indeed seem to invest more effort to reach personal and health goals despite pain or limitations [63, 64]. But this increased motivation by optimism may only occur when the activity is perceived as important and personally relevant [37]. Interestingly, when the decision to avoid potential injury is outweighed by

the motivation to pursue a conflicting goal that is perceived as important and personally relevant, top-down processes in the brain may inhibit nociception (i.e. the neurophysiological process of encoding noxious stimuli that produce actual or potential tissue injury) [65] via the release of opioid peptides. In contrast, if the individual decides to ignore the conflicting goal and instead respond to the noxious stimulus, top-down facilitation of nociception can occur [66].

The ability to adjust goals when goals have become unattainable due to the chronic pain experience is also important [67, 68]. One might argue that this higher tendency to pursue goal achievement may in fact be potentially harmful for chronic pain patients. Pain itself is often not alleviated; thus, pursuing the goal to abolish the pain experience may lead to disappointment and increased likelihood of experiencing goal conflict [69]. Goal conflict arises when pursuing one goal is at the cost of other goals [69] and results in decrements in overall well-being [70, 71]. However, optimism is associated with more flexible goal adjustment [72–75]. Chronic pain patients who report higher levels of optimism seem to be more flexible when confronted with competing goals, re-engage more easily with new attainable goals, and behave tenaciously with valued goals [76]. This tendency of optimistic individuals to show goal adjustment strategies such as re-engagement, flexibility, and tenacity is associated with higher levels of purpose in life, which, in turn, are strongly associated with adaptation in patients with chronic pain [76]. Additionally, optimistic individuals are more flexible in applying different coping strategies [57, 62, 77, 78]. It is proposed that optimists in general are more inclined to focus their attention on positive aspects of the situation, but focus on the pain whenever it is relevant for their well-being and action is required, resulting in active and problem-focused tendencies [27, 57, 78–80]. In an eye-tracker study, results showed that optimists indeed tended to turn away from negative information (i.e. angry faces) and gazed more at positive information (i.e. joyful faces) [81]. However, when faced with a serious threat to their well-being (e.g. an operation or cancer), optimists tend to focus on the context and pain instead of withdrawing from them [82]. Furthermore, studies have indicated that optimists are less vulnerable to experiencing disappointment, even after receiving a cancer diagnosis [83], undergoing cancer treatment [84, 85], or experiencing a failed *in vitro* fertilisation attempt [86].

Increasing optimism

In the previous section, we made a case for the importance of optimism as a protective factor in the context of pain. However, one can wonder about the practical and clinical implications of the knowledge that optimism can act as a protective factor. Do chronic pain sufferers with a more pessimistic inclination just have bad luck, or can we help them to think in a more optimistic way? We know that both heritable [87, 88] and environmental factors (e.g. secure attachment to caregivers, self-esteem, and financial security) [89–91] contribute to one's level of optimism. Although optimism has been defined as an enduring personality trait, optimism levels can change over time [92, 93]. More importantly, optimism is modifiable by psychological interventions [94]. One of the most powerful and best researched interventions to increase optimism is the Best Possible Self (BPS) exercise [95]. The BPS is a positive future-thinking technique in which participants are asked to write about and imagine a life in the future where everything turned out for the best. Numerous studies and a recent meta-analysis demonstrated that the BPS manipulation is effective in increasing optimism and positive affect [47, 96, 97] and decreasing goal ambivalence, which hampers positive emotions [98]. The BPS has been applied in different contexts (i.e. online or face-to-face), with different delivery modes (i.e. individually or in a group) and with different components, such as writing and imagery components or combining both [96, 99]. So far, the BPS manipulation has been predominately used in experimental studies to investigate the causal effects of optimism in the context of (experimentally) induced acute pain. For instance, in the study by Hanssen et al. [47], participants who received the BPS manipulation reported less pain intensity during a cold-water task compared to participants who received a neutral manipulation.

Optimism has also been demonstrated to protect against pain-induced executive task performance deterioration [100, 101]. Executive functioning is an umbrella term that describes multiple high-level cognitive processes and behavioural abilities [102]. It encompasses the ability to actively monitor behaviour, inhibit or facilitate certain responses, and optimise one's approach to unfamiliar circumstances [102]. Numerous studies have demonstrated that experimentally induced pain impairs executive task performance [e.g. 103–106]. Pain seems to be especially disruptive to task performance when the pain is novel and the threat-value and pain intensity are high [107, 108]. The first study to examine the effects of optimism in this context explored whether increasing optimism can counteract this sustained deteriorating effect of pain on executive task performance. Participants received either the BPS manipulation or a control task before the pain induction. Results showed that although pain significantly impaired executive task performance in the control condition, this sustained

deteriorating effect of pain on task performance was abolished in the optimism condition [100]. In another study, results showed that experimentally induced heat pain deteriorated concurrent task-shifting performance, but that inducing a temporary optimistic state also protected against this negative pain-induced concurrent task performance [101].

Increasing optimism in chronic pain patients

Is the BPS exercise a suitable technique to use in patients with chronic pain? One could argue that writing and thinking about an ideal future may be daunting for a person suffering from chronic pain because it might trigger worries that the pain will get worse and becomes more disabling. This may in turn increase pain awareness [109]. Thus, one could imagine that the BPS exercise may potentially even be harmful for chronic pain patients when it increases the perceived discrepancy between the actual self (i.e. who you are now) and the ideal self (i.e. who you want to be) and decreases the perceived discrepancy between the actual self and the feared self (i.e. who you fear to be) [110, 111]. Self-discrepancies are associated with higher levels of pain, depression, anxiety, and distress, and lower levels of acceptance of pain in chronic pain patients [112–114]. This is especially true when the ideal self is conditional on the absence of pain (i.e. high self-pain enmeshment) [115–117]. Therefore, the BPS exercise may potentially increase the risk of maladjustment towards pain when self-discrepancies cause effortful attempts to pursue the (often) unachievable goal to abolish pain. Several studies have examined whether the BPS can be used in patients with chronic pain. Molinari and García-Palacios [118] used a multimedia system to deliver the BPS or a control intervention to 71 patients with fibromyalgia. No negative effects of BPS on patients' well-being were observed. Instead, at 3 months follow-up, patients reported higher levels of optimism and lower negative affect compared to patients in the control condition.

An intervention for chronic pain that has embedded the BPS exercise in a larger package of positive psychology exercises is called 'happy despite pain' [119]. In this intervention, the BPS followed after three other positive exercises that aimed at creating more openness in patients to engage with the BPS by increasing self-compassion and positive affect. The 'happy despite pain' intervention consists of four modules, namely self-compassion, positive focus, savouring, and optimism, which are offered during an 8 weeks period. Module 1 targets self-compassion, which refers to fully accepting oneself, the ability to treat oneself with kindness rather than self-criticism, and recognising that everyone experiences failures [120, 121]. Module 2 requires patients to practice the 'three good things' exercise on a daily basis. Patients write down three good things that happened that day and why they happened. This exercise aims to shift the focus from a negative orientation towards a more positive one, by raising awareness of the good things in life [122, 123]. Module 3 contains savouring techniques that promote the frequency and intensity of positive experiences in daily life. Patients actively plan pleasant activities, so-called 'mini vacations' of 20 min. In these mini vacations, patients do something for themselves that they enjoy. In addition, patients are asked to actively recall pleasant memories and to write down everyday things that they enjoy in a savouring diary. First, patients formulate and write down their concrete and achievable goals, wishes and expectations for the future. Next, patients visualise this ideal future every day for 5 min, alternating between the three domains of their choice. Some precautions were taken to ward off potential negative consequences of the BPS. First, to prevent a heightened focus on pain and disability, patients were asked to focus on three out of eight pre-determined life domains (i.e. family life, romantic life, social life, professional life, leisure and hobby, educational life, societal commitment, and personal growth). Importantly, patients were asked to write down a detailed narrative of what their best possible future in these domains would look like, *despite pain*. Formulating a BPS narrative despite pain may increase the acceptance of the pain experience, decrease perceived self-discrepancies, and increase engagement in meaningful and valued activities [67].

Two successive studies in samples that predominantly consisted of fibromyalgia patients showed that the 'happy despite pain' intervention was effective in increasing optimism [119, 124]. In addition, happiness, positive affect, self-compassion, and ability to live a desired life despite pain increased, and pain catastrophizing, depression, and anxiety decreased. These effects lasted at least until the 6 months follow-up assessment period [119]. The intervention did not decrease pain intensity and disability, which is not an uncommon outcome when examining psychological treatments for chronic pain [125, 126]. Indeed, as implied by the name, the therapeutic goal of 'happy despite pain' is not pain relief, but disengaging from the pursuit to abolish the pain experience and fostering an individual's ability to live a desired life despite the presence of pain.

Resilience building interventions

In addition to the interventions that (mainly) focus on optimism, other positive psychology interventions (PPIs) have been developed that focus on building resilience in chronic pain patients. In a systematic review [127], eight studies were identified that tested the effect of PPIs in chronic pain patients. They concluded that PPIs led to improvements in happiness, well-being, hope, life-satisfaction, and self-efficacy in dealing with pain. Müller and Gertz [128] examined the effects of an individually tailored PPI in which they matched the exercises that participants received with their interests by having them complete the Person-Activity Fit Diagnostic (PAFD). In total, there were 10 possible exercises, including the best possible future self-exercise. Each participant was assigned four exercises based on their personal activity fit. A first feasibility study in patients with chronic pain showed that this individually tailored PPI led to increased life satisfaction, positive affect, and pain control and decreased pain intensity, depression, pain interference, and pain catastrophizing, with small to moderate effect sizes. Most benefits remained until 2.5 months follow-up. However, for many of the outcomes the control group showed similar benefits, and at follow-up there were no longer significant differences between the groups [128]. A larger follow-up study with participants experiencing chronic pain secondary to spinal cord injury largely replicated these results [129]. Compared to an active control group, pain intensity was significantly lower after the tailored PPI. Pain catastrophizing and pain interference also decreased and pain control increased, but this was not significantly different from the control intervention. Nevertheless this study is remarkable in that it shows a reduction in pain intensity after a PPI.

Integrating positive psychology interventions in traditional treatment approaches

The above-mentioned PPIs indicate that not addressing pain cognitions or pain behaviours specifically can still have beneficial effects for patients with chronic pain. In fact, in a direct comparison, 'happy despite pain' was as effective as CBT in decreasing catastrophic cognitions about pain. CBT directly targets maladaptive cognitions such as pain catastrophizing by teaching patients to identify these cognitions, challenge them, and replace them with more helpful cognitions. PPIs take a more transdiagnostic focus: they teach people to lead a good and fulfilling life despite any adversity they encounter. As such, their beneficial effects may extend beyond reducing pain-related suffering and can foster personal growth in general. There is also evidence that patients prefer PPIs over traditional CBT and report to be more stimulated and motivated to change [130]. PPIs might be preferred over traditional pain-focused approaches because they are easily accessible and engaging and come with possibly less stigma than traditional behavioural treatment approaches [131, 132]. Moreover, many of these interventions have a self-help format and do not require the involvement of a mental health professional [133]. As the studies above have shown, PPIs can be effective treatments for chronic pain, even as stand-alone interventions. Nevertheless, it should be admitted that, so far, evidence is still sparse. This is not surprising as it is an emerging field. Yet, as scholars in the field have argued, even greater benefits might be gained by combining PPIs with more traditional approaches [133, 134].

One such approach was employed, for instance, by Herrero et al. [135]. They used virtual reality (VR) to induce positive affect in conjunction with an activity management programme in patients with fibromyalgia. The VR was given with the aim to increase motivation related to the performance of the chosen activities. During the VR component, a positive nature scenario was projected in the VR surrounding, including music with positive valence and high arousal. This VR component was successful in improving self-efficacy and motivation related to meaningful activities, increasing positive emotions, and reducing negative emotions and dysfunctional coping strategies. As this was a pilot study, no control condition was added. In a follow-up study [136], the activity management intervention with VR component was compared to a treatment-as-usual condition. Results showed that participants in the VR condition achieved significantly greater improvements in perceived disability, quality of life, and functional coping strategies. There were no differences regarding pain intensity, pain interference, and depression symptoms.

The recognition that including or increasing protective factors is important has also been incorporated in CBT, of which acceptance-based CBTs (e.g. acceptance and commitment therapy (ACT) and mindfulness-based cognitive therapy) are examples. All these therapies have in common that they do not focus on controlling or fighting the pain experience, but on the acceptance of pain. They commonly use certain acceptance techniques (e.g. mindfulness, meditation) to facilitate a separation between the 'self' and one's thoughts, feelings and the actual pain experience. Moreover, patients are encouraged to base their actions on their values as opposed to their immediate feelings, thoughts and pain

[137]. In a meta-analysis on the effects of acceptance-based therapies on the mental and physical health in patients with chronic pain, it was found that acceptance-based therapies have small to medium effects on decreasing pain intensity, depression, and anxiety and increasing physical well-being and quality of life. The authors conclude that based on these findings, acceptance-based interventions and CBT produce small but equivalent effects [137]. In a recent systematic review, there was no evidence of a difference between ACT and an active control for pain, disability, or distress at treatment end [9]. Another approach is mindfulness-based stress reduction (MBSR), which also focusses on the acceptance of moment-to-moment experiences, but additionally includes increasing bodily and emotional awareness, and learning self-regulation strategies and more adaptive responses to stress [138, 139]. A systematic review comparing MBSR to CBT showed that both caused beneficial changes in physical functioning, pain intensity, and depression relative to control conditions, but there was no evidence that MBSR and CBT differed in their impact on these outcomes [140]. Thus, these acceptance-based CBT interventions are helpful, but not more effective than traditional CBT.

Another new development that aims to integrate positive psychology within CBT is what has been termed positive CBT. Whereas acceptance-based CBT interventions do not focus on increasing positive emotions per se, positive CBT was developed using a solution-focused framework, amplified with positive psychology exercises [130]. Increasing positive emotions and positive mental health is a specific aim of this intervention. In a crossover within-subjects design study on patients with depressive disorders, positive CBT was compared to traditional, problem-focused CBT. Results showed that the positive CBT led to significantly higher rates of clinically significant or reliable change for depression, negative affect, and happiness [141]. Although not examined, this treatment may be a promising approach for chronic pain.

A treatment approach incorporating positive psychology techniques that is specifically developed for pain patients is Mindfulness-Oriented Recovery Enhancement (MORE) [142]. This approach has been driven by the notion that because positive emotions and rewarding experiences can produce analgesia, they should be intentionally cultivated for their therapeutic value. See Garland [142] for more details, but in essence, it is argued that given the observation that chronic pain and the overuse and misuse of opioid analgesics can impair reward learning and reward responsiveness and exacerbate pain-related hedonic dysregulation, psychological treatment should focus on modulating the positive affective/reward-related mechanisms as means of addressing chronic pain and opioid misuse. Garland [142] proposes three core positive affective/reward mechanisms that should be activated in treatment: savouring (i.e. focusing on pleasant features and associated emotions and bodily responses of naturally rewarding stimuli), noticing and generating pleasant internal states (i.e. cultivating introceptive awareness of pleasurable sensations, and using imagination to superimpose pleasure on painful body sites), and cultivating meaning and self-transcendence (i.e. shifting patients' thinking from a narrowed focus on pain to a much broader awareness of how pleasant and painful life experiences interact to produce meaning in life). MORE encompasses these three core therapeutic mechanisms and has been shown to significantly decrease chronic pain, opioid misuse, and craving [143–145].

A final note on the way forward

This review summarised the current state-of-the-art of pain psychology from a positive psychology perspective and has shown that interventions targeting positive and protective factors are feasible and acceptable for chronic pain patients. Interestingly, most of these positive focussed interventions have demonstrated to increase positive factors, such as positive affect, optimism, quality of life and well-being despite pain, as well as decrease negative risk factors for pain disability, such as pain catastrophizing and anxiety. The finding that pain mostly persists after treatment validates the importance of having self-help techniques to reduce the burden of living with chronic pain. Moreover, the improvements of PPIs specifically were achieved via minimal therapeutic guidance and relatively low attrition rates (all <25%) [119, 124, 128], making them an attractive treatment option for chronic pain patients, either as stand-alone treatment or in conjunction with other treatment protocols. Especially when considering that positive and negative affect may have unique roles in modulating the experience of pain [19, 146], a treatment combining insights from both research areas may have additional benefits. As discussed earlier, optimism may increase the confidence regarding the attainability of a desired goal (e.g. treatment goal), which fosters action and continued effort towards this goal, resulting in more motivation and treatment adherence.

We propose that the way forward in pain research and treatment is the inclusion of both *vulnerability* and *protective factors*, since they have unique roles in modulating the experience of pain, a finding that had been neglected for too long. The effort to identify both vulnerability and protective factors in the context of chronic pain has obvious theoretical and scientific benefits. But maybe the most important contribution of these types of studies is that they raise

awareness among clinicians of the important role of protective factors in the context of pain. This does not mean that existing approaches and theories have to be abandoned. For instance, clinicians may use the fear-avoidance model to explain patient's' pain condition and how their vulnerability factors can instigate a vicious downward spiral that results in maladjustment to pain. But clinicians should not stop there. Together with their clients, they may explore their resilience factors and explain how these may incite a positive upward spiral, fuelling positive adaptation to pain.

There are still important steps to take. Many of the findings related to protective factors such as optimism come from studies in which experimental pain was induced. It is well known that experimentally induced pain in most cases is predictable, temporary, and evaluated as less threatening than chronic pain [147]. Chronic pain has far greater emotional and motivational significance [147]. Therefore, most researchers see findings regarding experimental pain as a proof of concept, which should be replicated in pain populations. However, such studies are rarely performed, likely due to the difficulties inherent in research with chronic pain patients, such as recruitment difficulties, time constraints, and ethical objections. There is a clear need to validate research findings in clinical samples. This is, of course, true not only for research findings related to protective factors, but because this is a relatively new field, much work remains to be done.

Although these are early days for application of PPIs in chronic pain treatment, exciting new developments are ongoing. The transdiagnostic focus on what makes life worthwhile is a recognition of the fact that a good and meaningful life is not dependent on the absence of physical ailments such as pain. Positive thinking, feeling, acting and pursuing valued goals can make one's life gratifying and fulfilling, despite experiencing chronic pain.

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