

# Bending Not Breaking

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## IMPACT PARAGRAPH

### Relevance

Everyone experiences acute pain at some point in their lifetime. Pain is a vital experience that warns us about potential physical harm or illness. However, acute pain develops into chronic pain when it persists beyond three months. Under those circumstances, pain loses its protective function and becomes detrimental. Chronic pain comprises a serious health burden with approximately 20% of U.S. and European adults suffering from it (Breivik et al., 2006; Dahlhamer et al., 2018). Chronic pain negatively influences physical, social and cognitive functioning. About 50% of chronic pain sufferers receive inadequate pain management, and as a result, work productivity is decreased and health care costs are enormous (Breivik et al., 2006; Medicine, 2011). Indeed, pain is the health condition with the highest annual health care spending, thereby exceeding the costs for diabetes, cancer, and heart disease (Dieleman et al., 2020; Gaskin & Richard, 2012).

Various psychosocial factors influence pain perception. Psychological flexibility (including its subcomponents emotional and cognitive flexibility) and mindfulness may be among those factors. However, the role of psychological flexibility in the transition of acute pain into chronic pain (i.e., non-recovery) remains largely unknown. The general aim of this thesis was to study the protective role of psychological flexibility and mindfulness against high pain levels and slow recovery. Specifically, we aimed to examine associations among psychological flexibility (i.e., emotional and cognitive flexibility), mindfulness, pain experience, and recovery (i.e., pain recovery and recovery of wounds).

Given the significant health burden and accompanying costs of chronic pain and its related disability, more insight into factors contributing to non-recovery of acute pain is of vital importance. The studies in this dissertation were fundamental in nature. Admitting that the implications of fundamental research are generally limited, the findings in this dissertation may have scientific and societal impact in several ways, both in the short term and in the long run.

### Scientific impact

Ultimately, the obtained knowledge in this thesis might contribute to the reduction of individual, economic, and societal costs of chronic pain. The scientific impact of this thesis lies in its contribution to the field of pain and recovery (from pain and of

wounds). The findings in **chapter 2** showed that two aspects of emotional flexibility (i.e., affective flexibility and flexible emotional responsiveness) were related to recovery from pain. Specifically, more flexibility in emotional responsiveness was associated with faster recovery with regard to self-reported pain unpleasantness. Additionally, more flexibility in switching toward the positive meaning of positive pictures was related to faster recovery in terms of pain intensity ratings. However, findings in **chapter 3** and **4** did not point to associations between affective and general cognitive flexibility, and pain experience and recovery. In **chapter 4**, we did not find an effect of mindfulness on pain experience and recovery, nor on affective and cognitive flexibility. However, tentative results in **chapter 5** suggested the potential beneficial effects of mindfulness meditation on the recovery speed of skin wounds. Taken together, current findings were not always univocal. It is therefore necessary that future studies unravel when and how these constructs exert their influence on pain experience and recovery from pain and of wounds.

The innovative value of this thesis lies in the focus on recovery with the rationale to prevent pain chronicity (as an instance of non-recovery) in the long run. In respect to earlier pain research, the focus on recovery can be described as distinctive and scientifically innovative. With this PhD project, we hope to stimulate future research to continue the study of recovery, and more specifically, to further elucidate psychosocial factors on which to intervene in the prevention of slow and non-recovery.

In addition to its contribution to the field of pain, this dissertation also contributed to the conceptualisation of psychological flexibility (i.e., emotional and cognitive flexibility). Current findings and methodology regarding the study of emotional flexibility have furthered our understanding of this relatively new construct and how it can be measured, as well as how it relates to general cognitive flexibility. The finding that emotional flexibility is related to recovery from pain will inspire more experimental studies on the topic in the short term. More research attention for emotional flexibility is highly warranted in order to maximize the usefulness of this concept in explaining pain and vulnerability. Hopefully, future research efforts will continue studying different aspects of emotional flexibility, given their unique predictive value for recovery from pain. We consider the study of emotional flexibility in relation to pain and mindfulness in relation to wound healing as pioneering work, and have thereby contributed to the development of a relatively new body of research.

For a long time, psychological research has been problem-oriented with a focus on “fixing what is wrong” (weaknesses / risk factors), instead of “building what is strong” (strengths / protective factors). This latter point of view is central to a relatively new movement called positive psychology (Seligman, 2002). This science discipline

concentrates on positive subjective experience (e.g., happiness, love, and joy) and positive states and traits (e.g., resilience and compassion). By focusing on psychological flexibility (i.e., emotional and cognitive flexibility) and mindfulness as protective factors against high pain levels and slow recovery, this dissertation contributes to our knowledge about resilience, and as such, fits well within the field of positive psychology. Only when protective factors are identified alongside vulnerability factors, the field of pain will be able to move forward towards a comprehensive understanding of pain perception and (non-)recovery. In the long run, the results of this dissertation may contribute to interventions aiming at strengthening psychosocial factors such as emotional flexibility and mindfulness that protect against high pain levels and slow recovery.

### ***Knowledge transfer***

The knowledge that was obtained in this dissertation is relevant for scientist and therapists working in the field of pain and wound healing. Present findings have been reported in scientific articles that are published by international open access peer-reviewed journals (Journal of Behavioral Medicine, impact factor = 2.960; Motivation and Emotion, impact factor = 2.340; Journal of Experimental Psychopathology, impact factor = 1.964). In addition, current findings have been presented at various national and international scientific conferences across the fields of emotion (e.g., Emotions Congress), pain (e.g., Pain Research Meeting, IASP World Congress on Pain, Congress of the European Pain Federation), and behavioral medicine (e.g., International Congress of Behavioral Medicine). We have shared our research findings on popular social media platforms such as ResearchGate, Web of Science, and Twitter. Findings have also been referred to in blog posts (e.g., "Everyday Health", "Information for Practice") and on a Facebook group page ("Meditation Research"). Moreover, our research endeavors have also been shared via teaching activities at Maastricht University, which included the supervision of master students who joined research projects that form a part of this dissertation, and/or have written their master theses on related topics. We plan to keep sharing our research among the scientific community (e.g., scientists and students) and the general public through various online and offline channels.

### **Potential clinical impact**

Given the fundamental approach of the studies in this dissertation, the direct clinical implications of its results are limited and must be carefully interpreted. However, current findings have generated first indications of links between emotional flexibility

and recovery from pain, and of potential beneficial effects of mindfulness meditation on the process of wound healing. As such, they do contribute to our understanding of psychosocial protective factors related to pain and recovery, and thereby to our knowledge about factors involved in the transition from acute to chronic pain and the recovery of wounds.

The study presented in **chapter 2** has contributed to the increasingly dominant view that emotional flexibility is generally adaptive and healthy, and that emotional inflexibility or rigidity is broadly maladaptive. Advancing current theoretical models of pain and recovery with the addition of emotional flexibility may increase our knowledge about why some people are more protected against developing chronic pain than others. In the long term, this knowledge may provide clinicians with new insights on how to tailor prevention and treatment programs for patients with acute and chronic pain. For example, training of emotional flexibility before surgery might be of value to the prevention of slow post-operative recovery. Future research is required aiming to explore this potential by testing the trainability of emotional flexibility and its different components. In this context, promising results have already shown that cognitive flexibility can be improved with practice (Grönholm-Nyman et al., 2017; Zhao et al., 2018). Acceptance and Commitment Therapy may offer a way to increase emotional flexibility, as it is directed at improving psychological flexibility, the overarching construct of emotional flexibility (Hayes et al., 2012).

Mindfulness-based interventions (MBIs) are frequently used as treatments for chronic pain (e.g., Garland et al., 2019). Given the link between pain and tissue damage, MBIs may also be promising treatments for recovery from pain and of wounds. In order to prevent further suffering, MBI's may be offered as preventative treatments prior to the onset of acute pain, for instance before surgery. Along this line of reasoning, MBIs such as Mindfulness-Based Stress Reduction (MBSR) might be of use to the process of wound healing. Findings presented in **chapter 5** provide preliminary evidence for the potential of MBSR (delivered prior to wounding) to positively influence early stages of wound healing. Although these results should be confirmed in future research, they may be relevant for clinicians (e.g., surgeons) and people who will undergo surgery in the future and/or are at risk of slow wound healing.

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