

Catastrophizing and Pain: Mechanisms of Action



Michael Sullivan, PhD

Professor
Departments of Psychology, Medicine and Neurology
McGill University, Montreal, Canada

Honorary Professor
Recover Injury Research Centre
University of Queensland



Recover is a joint initiative of the Motor Accident Insurance Commission
The University of Queensland and Griffith University.



Disclosures

Consultant:

Several work-injury and disability insurers, motor vehicle insurers, veterans' administrations, governmental organisations.

Funding:

CIHR, FRSQ, IRSST, Canada Research Chairs Program, Alan Edwards Pain Foundation, Pfizer, Epicept.

Royalties and revenues:

Books, clinical workshops.

Pain Catastrophizing

...has emerged as one of the most robust and powerful predictors of adverse recovery outcomes following whiplash injury.

Pain Catastrophizing

as an exaggerated negative "mental set" brought to bear during actual or anticipated pain experience,,,,,comprising elements of rumination, magnification and helplessness.



 University of Utah
PCS
 PAIN CATASTROPHIZING SCALE

Client No: _____ Age: _____ Sex: M ___ F ___ Date: _____

Experience experimental painful situations at some point in their lives. Such experiences may include
 headaches, tooth pain, joint or muscle pain. *Pain is often exposure to situations that they cannot
 get away from, surgery, dental procedures or injury.

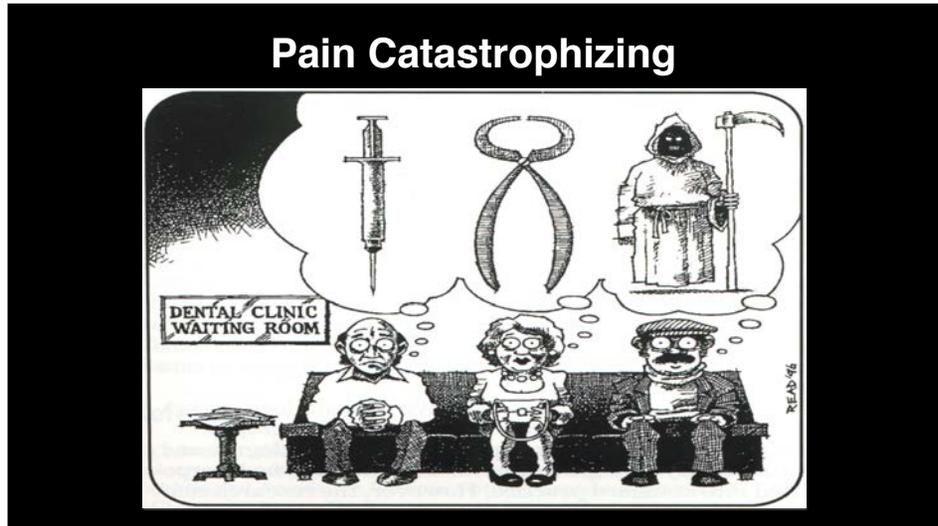
We are interested in the types of thoughts and feelings that you have when you are in pain. Listed
 below are fourteen statements describing different thoughts and feelings that may be associated with
 pain. Using the following scale, please indicate the degree to which you have these thoughts and
 feelings when you are experiencing pain.

0 = not at all 1 = to a slight degree 2 = to a moderate degree 3 = to a great degree 4 = all of the time

When I'm in pain ...

- I worry all the time about whether the pain will end.
- I feel I can't go on.
- It's terrible and I think it's never going to get any better.
- It's awful and I feel that it overwhirls me.
- I feel I can't stand it anymore.
- I become afraid that the pain will get worse.
- I keep thinking of other painful events.
- I occasionally want the pain to go away.
- I can't seem to keep it out of my mind.
- I keep thinking about how much it hurts.
- I keep thinking about how badly I want the pain to stop.
- There's nothing I can do to reduce the intensity of the pain.
- I wonder whether something serious may happen.

...Total



Research Paper
PAIN

Heritability of pain catastrophizing and associations with experimental pain outcomes: a twin study

Zina Trost^{1*}, Eric Strachan^{2†}, Michael Sullivan³, The Vervoort⁴, Aly R. Avery⁵, Nicolae Atarfi^{6*}

Abstract

This study used a twin paradigm to examine genetic and environmental contributions to pain catastrophizing and the observed association between pain catastrophizing and cold-pressor task (CPT) outcomes. Male and female monozygotic (n = 206) and dizygotic twins (n = 194) from the University of Washington Twin Registry completed a measure of pain catastrophizing and performed a CPT challenge. As expected, pain catastrophizing emerged as a significant predictor of several CPT outcomes, including cold-pressor immersion Tolerance, Pain Tolerance, and Delayed Pain Rating. The heritability estimate for pain catastrophizing was found to be 37% with the remaining 63% of variance attributable to unique environmental influence. Additionally, the observed associations between pain catastrophizing and CPT outcomes were not found attributable to shared genetics or environmental exposure, which suggests a direct relationship between catastrophizing and experimental pain outcomes. This study is the first to examine the heritability of pain catastrophizing and potential processes by which pain catastrophizing is related to experimental pain response.

Keywords: Catastrophizing, Twins, Genetics, Pain sensitivity

"The heritability estimate for pain catastrophizing was 37% with the remaining 63% of variance attributable to environmental influence"

The Biology of Pain Catastrophizing

Association of catastrophizing with interleukin-6 responses to acute pain

Robert R. Edwards^{a,b,*}, Tarek Kronfli^b, Jennifer A. Haythornthwaite^b,
Michael T. Smith^b, Lynanne McGuire^c, Gayle G. Page^d

^a Department of Anesthesiology, Perioperative and Pain Medicine, Harvard Medical School, Pain Management Center, Brigham & Women's Hospital, 850 Boylston Street, Chestnut Hill, MA 02467, USA

^b Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, 600 North Wolfe St, Baltimore, MD 21287, USA

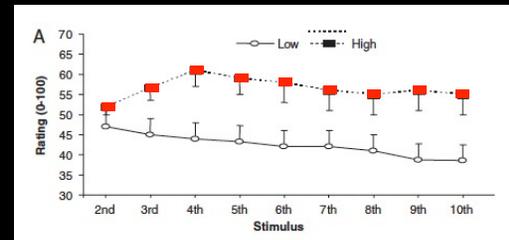
^c Department of Psychology, University of Maryland at Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, USA
^d Johns Hopkins University School of Nursing, 525 North Wolfe St, Baltimore, MD 21205, USA

“The amplification of inflammatory responses to acute stress may partly underlie catastrophizing’s enduring effects on pain outcomes.”

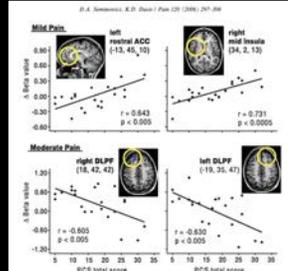
ORIGINAL ARTICLE

Pain-related Catastrophizing in Healthy Women Is Associated With Greater Temporal Summation and Reduced Habituation to Thermal Pain

Robert R. Edwards, PhD^a, Michael T. Smith, PhD^a, Gregory Stoneruck, BA,^a
and Jennifer A. Haythornthwaite, PhD^a



“...alterations in central pain processing may play a role in the effects of catastrophizing”.



Catastrophizing associated with increased activation of brain centres responsible for modulation of affective, and motor aspects of pain.

Catastrophizing associated with decreased activation of brain centres involved in descending inhibition of pain.

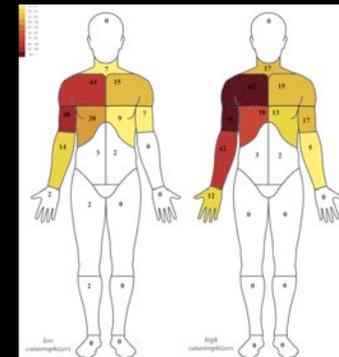
Catastrophizing and Widespread Pain

Delayed onset muscle soreness
DOMS



Day 1

Low PCS High PCS



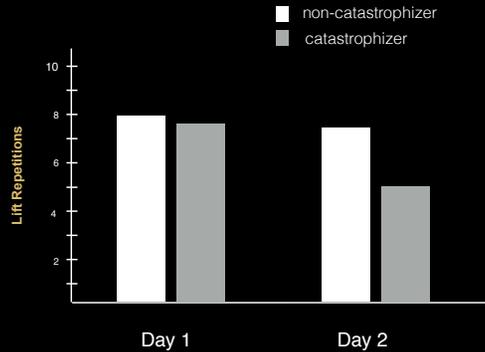
Day 2

Catastrophizing and Physical Performance Decrements

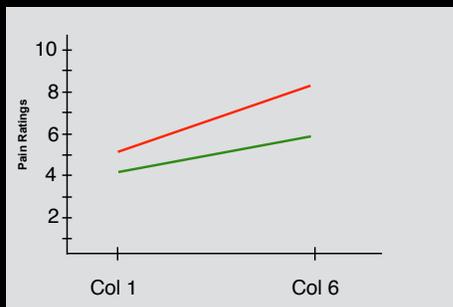
Delayed onset muscle soreness
DOMS



Day 1



	C	F	I	L	O	R
→ Extreme + positive	2.9 kg 18.6 Nm 42%	3.9 kg 23.4 Nm 35%	5.4 kg 21.7 Nm 30%	5.9 kg 23.8 Nm 35%	5.4 kg 21.7 Nm 30%	2.9 kg 18.6 Nm 42%
→ Moderate + positive	3.4 kg 20.7 Nm 47%	2.9 kg 18.7 Nm 42%	3.9 kg 22.7 Nm 35%	4.4 kg 20.7 Nm 30%	3.9 kg 18.7 Nm 42%	3.9 kg 22.7 Nm 35%
→ Normal + positive	3.9 kg 19.7 Nm 29%	3.4 kg 18.4 Nm 28%	2.9 kg 18.4 Nm 23%	2.9 kg 18.4 Nm 23%	3.9 kg 19.7 Nm 29%	3.4 kg 18.4 Nm 28%
Mean moment (Nm)	17.3	17.7	17.8	17.8	17.4	17.6
Mean moment (% MVE)	48.3	41.8	41.4	41.5	48.6	48.8

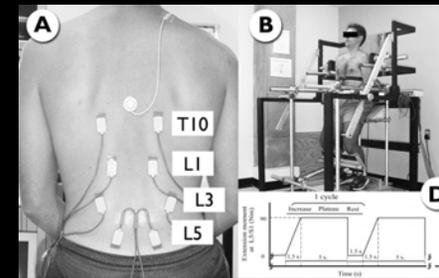


“Catastrophizing was associated with a 60% increase in pain across repeated lifts.”

SPINE Volume 35, Number 22, pp E1178-E1184
©2010, Lippincott Williams & Wilkins

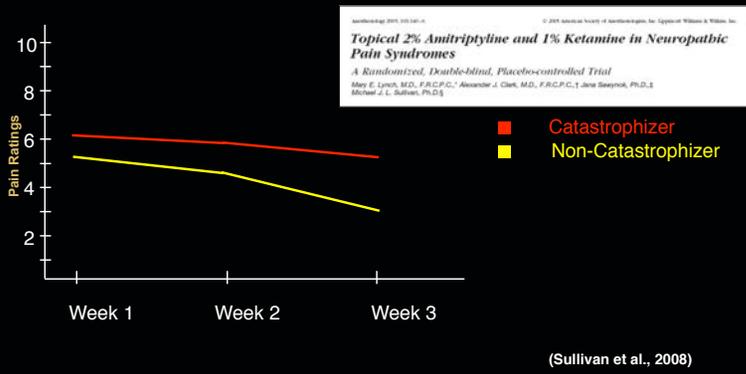
Poor Back Muscle Endurance Is Related to Pain Catastrophizing in Patients With Chronic Low Back Pain

Christian Larivière, PhD,*† Martin Bilodeau, PT, PhD,‡ Robert Forget, PT, PhD,†§
Roger Vadeboncoeur, MD,† and Hakim Mecheri, Eng, MSc†



Catastrophizing and Treatment Response

Catastrophizing and Response to Topical Analgesics for Neuropathic Pain



PAIN® 143 (2009) 123–129

IASP **PAIN**
www.elsevier.com/locate/pain

Psychological determinants of problematic outcomes following Total Knee Arthroplasty

Michael Sullivan^{a,*}, Michael Tanzer^b, William Stanish^c, Michel Fallaha^d, Francis J. Keeffe^e, Maureen Simmonds^f, Michael Dunbar^g

^aDepartment of Psychology, McGill University, 1205 Doctor Penfield, Montreal, Que., Canada H3A 1B1
^bDepartment of Surgery, McGill University, Montreal, Q., Canada
^cDepartment of Surgery, Dalhousie University, Halifax, NS B3H 3A2, Canada
^dDepartment of Surgery, Université de Montréal, Montreal, Q., H3T 2M4, Canada
^eOrder Pain Prevention and Treatment Research Program, Duke University, Durham, NC 27710, USA
^fSchool of Physical and Occupational Therapy, McGill University, Montreal, Q., H3C 1V5, Canada

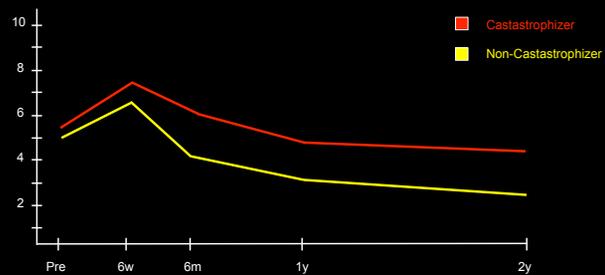
ARTICLE INFO **ABSTRACT**

Article history:
 Received 20 July 2008
 Received in revised form 8 January 2009
 Accepted 17 February 2009

Keywords:
 Arthritis
 TKA
 Pain catastrophizing
 Fear of movement
 Depression
 Surgical outcomes
 Pain

ABSTRACT
 The primary objective of the present study was to examine the role of pain-related psychological factors in predicting pain and disability following Total Knee Arthroplasty (TKA). The study sample consisted of 75 (46 women, 29 men) individuals with osteoarthritis of the knee who were scheduled for TKA. Measures of pain severity, pain catastrophizing, depression, and pain-related fears of movement were completed prior to surgery. Participants completed measures of pain severity and self-reported disability 6 weeks following surgery. Consistent with previous research, cross-sectional analyses revealed significant correlations among measures of pre-surgical pain severity, pain catastrophizing, depression and pain-related fears of movement. Prospective analyses revealed that pre-surgical pain severity and pain catastrophizing were unique predictors of post-surgical pain severity (6-week follow-up). Pain-related fears of movement were predictors of post-surgical functional difficulties in univariate analyses, but not when controlling for pre-surgical co-morbidities (e.g. back pain). The results of this study add to a growing literature highlighting the prognostic value of psychological variables in the prediction of post-surgical health outcomes. The results support the view that the psychological determinants of post-surgical pain severity differ from the psychological determinants of post-surgical disability. The results suggest that interventions designed to specifically target pain-related psychological risk factors might improve post-surgical outcomes.
 © 2009 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

High catastrophizing as a risk factor for poor response to surgery



PCS Scores above 20 predict poor response to a wide range of treatments including analgesics, rehabilitation and surgery.

ORIGINAL ARTICLE

Clinically Meaningful Scores on Pain Catastrophizing Before and After Multidisciplinary Rehabilitation

A Prospective Study of Individuals With Subacute Pain After Whiplash Injury

Whitney Scott, BA, Timothy H. Wideman, PT, PhD, and Michael J. L. Sullivan, Ph.D.

Objective: Pain catastrophizing has been identified as a significant risk factor for problematic outcomes after orthopedic surgery. The present study examined the role of pain catastrophizing in predicting post-surgical pain severity and disability following Total Knee Arthroplasty (TKA). The study sample consisted of 75 (46 women, 29 men) individuals with osteoarthritis of the knee who were scheduled for TKA. Measures of pain severity, pain catastrophizing, depression, and pain-related fears of movement were completed prior to surgery. Participants completed measures of pain severity and self-reported disability 6 weeks following surgery. Consistent with previous research, cross-sectional analyses revealed significant correlations among measures of pre-surgical pain severity, pain catastrophizing, depression and pain-related fears of movement. Prospective analyses revealed that pre-surgical pain severity and pain catastrophizing were unique predictors of post-surgical pain severity (6-week follow-up). Pain-related fears of movement were predictors of post-surgical functional difficulties in univariate analyses, but not when controlling for pre-surgical co-morbidities (e.g. back pain). The results of this study add to a growing literature highlighting the prognostic value of psychological variables in the prediction of post-surgical health outcomes. The results support the view that the psychological determinants of post-surgical pain severity differ from the psychological determinants of post-surgical disability. The results suggest that interventions designed to specifically target pain-related psychological risk factors might improve post-surgical outcomes.
 © 2009 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

Keywords:
 Arthritis
 TKA
 Pain catastrophizing
 Fear of movement
 Depression
 Surgical outcomes
 Pain

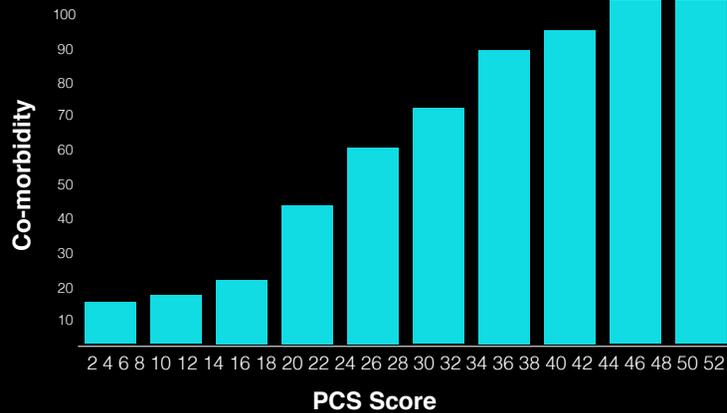
ABSTRACT
 The primary objective of the present study was to examine the role of pain-related psychological factors in predicting pain and disability following Total Knee Arthroplasty (TKA). The study sample consisted of 75 (46 women, 29 men) individuals with osteoarthritis of the knee who were scheduled for TKA. Measures of pain severity, pain catastrophizing, depression, and pain-related fears of movement were completed prior to surgery. Participants completed measures of pain severity and self-reported disability 6 weeks following surgery. Consistent with previous research, cross-sectional analyses revealed significant correlations among measures of pre-surgical pain severity, pain catastrophizing, depression and pain-related fears of movement. Prospective analyses revealed that pre-surgical pain severity and pain catastrophizing were unique predictors of post-surgical pain severity (6-week follow-up). Pain-related fears of movement were predictors of post-surgical functional difficulties in univariate analyses, but not when controlling for pre-surgical co-morbidities (e.g. back pain). The results of this study add to a growing literature highlighting the prognostic value of psychological variables in the prediction of post-surgical health outcomes. The results support the view that the psychological determinants of post-surgical pain severity differ from the psychological determinants of post-surgical disability. The results suggest that interventions designed to specifically target pain-related psychological risk factors might improve post-surgical outcomes.
 © 2009 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

Article history:
 Received 20 July 2008
 Received in revised form 8 January 2009
 Accepted 17 February 2009

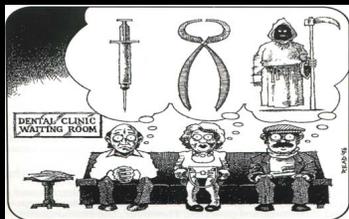
Keywords:
 Arthritis
 TKA
 Pain catastrophizing
 Fear of movement
 Depression
 Surgical outcomes
 Pain

ABSTRACT
 The primary objective of the present study was to examine the role of pain-related psychological factors in predicting pain and disability following Total Knee Arthroplasty (TKA). The study sample consisted of 75 (46 women, 29 men) individuals with osteoarthritis of the knee who were scheduled for TKA. Measures of pain severity, pain catastrophizing, depression, and pain-related fears of movement were completed prior to surgery. Participants completed measures of pain severity and self-reported disability 6 weeks following surgery. Consistent with previous research, cross-sectional analyses revealed significant correlations among measures of pre-surgical pain severity, pain catastrophizing, depression and pain-related fears of movement. Prospective analyses revealed that pre-surgical pain severity and pain catastrophizing were unique predictors of post-surgical pain severity (6-week follow-up). Pain-related fears of movement were predictors of post-surgical functional difficulties in univariate analyses, but not when controlling for pre-surgical co-morbidities (e.g. back pain). The results of this study add to a growing literature highlighting the prognostic value of psychological variables in the prediction of post-surgical health outcomes. The results support the view that the psychological determinants of post-surgical pain severity differ from the psychological determinants of post-surgical disability. The results suggest that interventions designed to specifically target pain-related psychological risk factors might improve post-surgical outcomes.
 © 2009 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

Co-Morbidity of Depression or PTSD



End-of-treatment PCS Scores above 20 predict failure to maintain treatment gains made in rehabilitation.

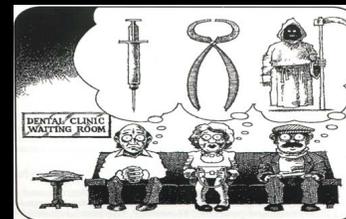


Pain Severity

Exaggerated inflammatory response leading to sensitisation of the nerve system?

Increased pain sensitivity may reflect dysfunction of central pain modulation?

Spreading of pain might reflect a deficit in endogenous pain inhibition?

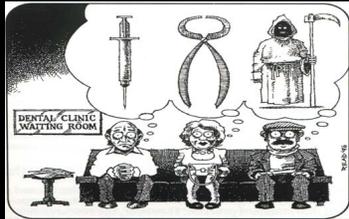


Disability

Fatigue could lead to lower tolerance for physical activity.

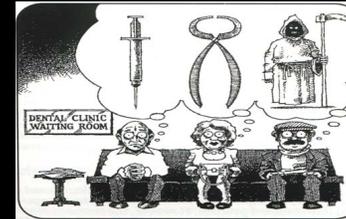
Physical performance decrements in response to pain could compromise ability to successfully complete physical tasks.

Sensitivity to movement-evoked pain might lead to negative expectancies for recovery.



Opioid Misuse

- Poor response to analgesics.
- Poor response to rehabilitation interventions.
- Poor response to surgical interventions.



Depression

- Excessive focus on symptoms.
- Cognitive disengagements deficits.
- Inability to effectively use distraction strategies.
- Deficient mental control over pain-related stimuli.

Can catastrophizing be reduced for therapeutic benefit?



- Physical therapy.
- Rehabilitation interventions.
- Pain management interventions.
- Psychological interventions.
- Analgesic medication.
- Surgical interventions.

Was the intervention provided only to individuals with PCS scores in the risk range?

Was the magnitude of reduction in PCS scores sufficient to have meaningful impact on clinical outcomes?



A Tool Kit for Targeting
Psychosocial Risk Factors for
Prolonged Disability

www.PGAPworks.com

Techniques to Target Catastrophizing

Education.

Disclosure techniques.

Thought monitoring and emotional problem-solving.

Activity participation as a means of assisting the client in disengaging from catastrophic rumination.



Conclusions

Catastrophizing has emerged as the most robust psychological predictor of adverse pain outcomes.

Measures of catastrophizing should be included as standard approach to assessment of pain-related conditions.

Rehabilitation outcomes can be enhanced by the inclusion of techniques designed to target catastrophic thinking.

Knowledge Gaps

What is the best collection of techniques required to yield meaningful and sustainable reductions in catastrophizing.

What are the mechanisms linking catastrophizing to pathological pain processing?

Can reductions in catastrophizing alter pathological pain processes?

PGAP Training Workshops

July 14-15, 2017. Sydney, AU.

November 17-18, 2017. Melbourne, AU.

www.PGAPworks.com



Merci!



Recover is a joint initiative of the Motor Accident Insurance Commission, The University of Queensland and Griffith University.



michael.sullivan@mcgill.ca