

University of Nevada, Reno

**A Stage One Feasibility Study of an Online, Asynchronous
Intervention for Pain Catastrophizing**

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy
in Psychology

by

Dominique Cheung, M.A.

William O'Donohue, Ph.D./Dissertation Advisor

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THE GRADUATE SCHOOL

We recommend that the dissertation
prepared under our supervision by

DOMINIQUE CHEUNG, M.A.

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be accepted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

William O'Donohue, Ph.D.
Advisor

Melanie Duckworth, Ph.D.
Committee Member

Lorraine Benuto, Ph.D.
Committee Member

Michelle Granner, Ph.D.
Committee Member

Fang Jiang, Ph.D.
Graduate School Representative

Markus Kimmelmeier, Ph.D., Dean
Graduate School

August, 2023

Abstract

The American Pain Society defines chronic pain as persistent pain lasting three months or more and affects at least 50 million adults in the United States (Rikard et al., 2023). It impacts individuals' mood, cognitive processes, sleep, and quality of life, and has been identified as a leading cause of disability (Fine, 2011, Gaskin & Richard, 2012; Vos et al., 2017). Additionally, chronic pain has also been found to be associated with high economic cost, approximately \$560-\$638 billion annually, comprised primarily of healthcare spending, disability programs, and lost productivity (Dahlhamer et al., 2018; Smith & Hillner, 2019).

Pain catastrophizing, or persistent negative affective and cognitive responses to pain, has been identified in research as a psychosocial risk factor associated with worse pain outcomes in chronic pain patients (Schütze et al., 2018). Although a number of CBT-based interventions have been found to successfully reduce pain catastrophizing, the majority of those interventions include several (e.g., 6-10) sessions, potentially reducing accessibility. From Catastrophizing to Recovery (FCR), later rebranded to Empowered Relief (ER), was designed by Darnall et al. (2014) as a single-session, CBT-based intervention and was found to significantly reduce pain catastrophizing. Both in-person and synchronous online formats were found to be at reducing pain catastrophizing in chronic pain patients (Darnall et al., 2021; Ziadni et al., 2021).

The current study focused on determining the feasibility of an online, asynchronous intervention, named Healthy Coping for Pain, for pain catastrophizing. Healthy Coping for Pain utilized components that were included in evidence-based CBT-based interventions and pain catastrophizing and pain management (e.g., ER, CBT for Chronic Pain), including psychoeducation on pain, pain coping skills/relaxation techniques, and recognizing and challenging unhelpful/negative pain-related thoughts. Additionally, participants were asked to

create a Coping with Pain Catastrophizing Plan using a template that was provided. ER was also used as a model for a shorter intervention, with Healthy Coping for Pain lasting approximately two hours in length. The stage model for behavioral therapies research approach, as described by Onken et al. (1997), was taken for this study. More specifically, this is a Stage I study which focused specifically on designing a brief intervention (Healthy Coping for Pain) and testing its feasibility.

Healthy Coping for Pain comprised of three pre-recorded videos that were hosted on Nevada Box. Participants were recruited both locally and nationally and were invited to complete Healthy Coping for Pain online and fill out pre-intervention (demographics, pain experience, depression) and post-intervention (satisfaction, practicality, relevance, and accessibility ratings, feedback) surveys. Additionally, attention check activities were utilized after the first and second videos, and participants were asked to submit a copy of their Coping with Pain Catastrophizing Plan after the third video. Participant feedback was summarized, and themes were identified. Overall, participants were satisfied with the content and online format of Healthy Coping for Pain, and found the intervention acceptable, relevant, easy to understand, and easy to follow. Limitations of the current study, as well as future research directions, are also discussed.

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Introduction

Chronic pain

The American Pain Society defines chronic pain as persistent pain lasting three months or more. Chronic pain affects at least 50 million adults in the United States, negatively impacts individuals' mood, cognitive processes, sleep, and quality of life, and has been identified as a leading cause of disability (Fine, 2011; Gaskin & Richard, 2012; Rikard et al., 2023; Vos et al., 2017). Chronic pain stems from numerous sources such as headaches and migraines, musculoskeletal pain including but not limited to neck pain, lumbar pain such as lower back pain, and arthritis. These conditions are widespread with Strine and Hootman (2007) and the Center for Disease Control and Prevention estimating that 22.1% of Americans suffer from arthritis, 20.3% from low back pain, 14% from neck pain, 30% from both neck and back pain, and 2% from fibromyalgia. Furthermore, chronic pain has also been found to be associated with high economic cost, approximately \$560-\$638 billion annually, comprised primarily of healthcare spending, disability programs, and lost productivity (Dahlhamer et al., 2018; Smith & Hillner, 2019).

Pain catastrophizing as a psychosocial risk factor for chronic pain

Pain catastrophizing, or persistent negative affective and cognitive responses to pain, has been identified in research as a psychosocial risk factor associated with worse pain outcomes in chronic pain patients, including greater pain intensity, disability, healthcare use, and missed work, and has also been identified as a contributing factor for the transition of acute to chronic pain (Schütze et al., 2018). There have been numerous studies examining the impact of pain catastrophizing in chronic pain patients, including the older, but often cited, studies by Severeijns et al. (2001), Picavet et al. (2002), and Somers et al. (2009) which found that higher levels of

pain catastrophizing in low back pain (LBP) patients (Severeijns et al., 2001 and Picavet et al., 2002) and osteoarthritis (OA) patients (Somers et al., 2009) was predictive of higher levels of pain intensity and physical disability. A systematic review completed by Burns and colleagues in 2015 found that pain catastrophizing was a predictor for chronic pain after a total knee arthroplasty, a surgery intended to treat OA that generally has a high success rate. A study conducted by Jöud et al. (2017) utilized data from the SWEPAIN study and found that those who reported higher levels of pain catastrophizing and longer duration of chronic pain experienced were significantly more likely to seek healthcare services. Similarly, de Boer et al. (2012) found that higher levels of pain catastrophizing were predictive of increased consultation with healthcare providers and medication use in the pain patients assessed. Pain catastrophizing is also associated with work absenteeism: Urquhart et al.'s 2013 study assessed LBP patients and found that increased pain catastrophizing was associated with increased absence from work. Likewise, Macias-Toronjo et al. (2020) found pain catastrophizing to be associated with increased duration of absence from work in LBP patients surveyed.

Current psychosocial interventions for pain management, including pain catastrophizing

Currently, psychosocial interventions for pain management include evidence-based interventions such as Cognitive Behavioral Therapy and Cognitive Behavioral Therapy for Chronic Pain, Acceptance and Commitment Therapy, and Mindfulness Based Stress Reduction. Studies and meta-analyses including Khoo et al. (2019), Beehler et al. (2019), and Wetherell et al. (2011) have found such therapies can help improve various pain outcomes, including pain intensity, pain catastrophizing, and pain-related depression and/or anxiety. Numerous interventions have also been developed to address pain catastrophizing. Such interventions have utilized principles, techniques, and theories from Acceptance and Commitment Therapy,

Cognitive Behavioral Therapy (CBT), mindfulness, physical treatments (e.g., exercise, acupuncture), with some interventions utilizing a combination of these (Schütze et al., 2018). A systematic review and meta-analysis completed by Schütze and colleagues in 2018 of interventions targeting pain catastrophizing found that interventions included were most likely to be psychological (60.8%), specifically CBT-based (35.4%). They also noted that 27.8% of the studies included utilized a multimodal approach, utilizing both physical and psychotherapy techniques. Results indicated that CBT-based interventions were most effective in reducing pain catastrophizing when examining studies that named pain catastrophizing as a primary outcome and that multimodal interventions were most effective overall (Schütze et al., 2018).

The CBT-based interventions examined in studies included in Schütze et al.'s 2018 review and meta-analysis varied in format and content. The studies included regular CBT (e.g., Alda et al., 2011), a program including psychoeducation, medication guidelines, identifying and addressing behavioral factors affecting medication use, and skills training to manage fear of migraines (Fritsche et al., 2010), a group program that consisted of psychoeducation, problem solving skills training and practice, and homework assignments (Helminen et al., 2015). Several interventions utilized a web-based approach, including Bromberg et al. (2012)'s program which included psychoeducation, self-management skills, coping skills, communication skills, and medication safety, de Boer et al. (2014)'s "Learning to live with pain" program consisting of psychoeducation, graded activity, relaxation exercises, and addressing pain cogitations, and Carpenter et al. (2012)'s program which was a self-help intervention comprising of psychoeducation, mindfulness, stress reduction and management, cognitive restructuring, and behavioral activation.

From Catastrophizing to Recovery/Empowered Relief as a possible intervention to reduce pain catastrophizing

While there is empirical support for CBT-based interventions in reducing pain catastrophizing, many of those interventions include multiple sessions (e.g., 6-10) (Darnall et al., 2014; Schütze et al., 2018). Darnall et al. (2014) contended that the duration of these programs may pose a burden on participants and may also be a barrier for others to participate. Therefore, Darnall and colleagues created From Catastrophizing to Recovery (FCR), a CBT-based, single-session intervention that omitted the topics beyond pain catastrophizing and focused on didactic information on pain catastrophizing and mind-body science, pain coping skills (i.e., diaphragmatic breathing and progressive muscle relaxation), thought restricting and reframing practice, and creating a personalized plan (i.e., a list of techniques) to combat pain catastrophizing. A pilot study conducted by Darnall et al. (2014) included 57 chronic pain patients recruited from Stanford Pain Management center who attended FCR and completed surveys containing the Pain Catastrophizing Scale (PCS) at baseline and at two- and four-weeks post-intervention. Results found that participants experienced a significant reduction in pain catastrophizing at both post-intervention time points and provided support that FCR could serve as a more economical and briefer, yet effective and efficient, alternative to longer CBT-based interventions for pain catastrophizing.

FCR was then renamed Empowered Relief (ER) and examined more closely in a three-arm RCT with an eight-session course of CBT and two-hour health education class serving as the comparison interventions (Darnall et al., 2021). 263 chronic low back pain patients (CLBP) were recruited from the community and randomly assigned to one of the three intervention groups. Pain catastrophizing was named as the primary outcome and was assessed with the PCS.

Pain intensity, pain interference, sleep disturbance, pain behavior, depression, anxiety, physical function, fatigue, pain bothersomeness, pain self-efficacy, and treatment expectations were identified as secondary outcomes and assessed with the a question on pain intensity in the past seven days, the National Institutes of Health Patient-Reported Outcomes Measurement Information System short-form (PROMIS), a question on pain bothersomeness in the past seven days, the Pain Self-Efficacy Questionnaire, and the Stanford Expectations of Treatment Scale. Researchers found that ER significantly reduced pain catastrophizing and was noninferior to CBT for reducing pain catastrophizing in CLBP patients at three months follow-up. Both ER and CBT were found to be more effective in reducing pain catastrophizing than the two-hour health education intervention. Furthermore, ER was found to be noninferior to CBT for depression, anxiety, sleep disturbance, pain behavior, and pain bothersomeness but not for fatigue and self-efficacy. CBT was found to be superior to ER for physical function.

An online, Zoom-delivered version of ER was then examined by Ziadni and colleagues in their 2021 pilot study. 101 participants were recruited from the Stanford Pain Management Center and Stanford's Collaborative Health Outcomes Information Registry and randomized into either the ER intervention group or waitlist control (WLC). All participants were assessed for pain catastrophizing, pain bothersomeness, pain interference, sleep disturbance, pain intensity, depression, anxiety, physical function, social isolation, and anger with the PCS, a question on pain bothersomeness for the past seven days, and the National Institutes of Health PROMIS short-form at baseline, two weeks, one, two, and three months post-intervention. Additionally, a satisfaction survey was completed by participants in the ER intervention group at one-week post-intervention. Results found the online version of ER superior to the WLC for all outcomes assessed and that ER significantly reduced pain catastrophizing, pain intensity, sleep disturbance,

and pain bothersomeness at the three-month follow-up. Additionally, participants reported high satisfaction and engagement with the online presentation of ER.

Given that both ER and longer CBT-based interventions for pain catastrophizing and pain management (e.g., CBT-CP) include psychoeducation on pain, pain coping skills/relaxation techniques, and how to recognize and challenge unhelpful/negative pain-related thoughts, the intervention examined in this study, titled Healthy Coping for Pain, also included these components. ER was also used as a model for a shorter intervention and Healthy Coping for Pain had a similar duration.

Utility of Online Formats

Interventions delivered online have been found to effectively treat a variety of mental health conditions, including depression and social anxiety (Hedman et al., 2012). Additionally, a systematic review conducted by Garg and colleagues in 2016 found Web-based CBT interventions to be effective in reducing pain catastrophizing and improving patient attitudes in chronic low back pain patients. The COVID-19 pandemic also necessitated the transition of many aspects of life (e.g., school, work, psychological services) from an in-person to an online format for a period of time. Studies have found that mental health clinicians report favorable attitudes towards online delivery of psychological services, or telemental health (TMH), and that many will continue to offer telehealth options even after the pandemic ends (e.g., Gentry et al., 2021; Zhu et al., 2021). Such studies have identified increased accessibility and reduced exposure to COVID-19 and other illnesses as benefits of TMH (Gentry et al., 2021; Zhu et al., 2021). An additional benefit of TMH would be to expand reach and improve accessibility. According to the Health Resources and Services Administration (HRSA), all counties in Nevada are designated as Health Professional Shortage Areas in all three disciplines the HRSA

considers: primary care, dental health, and mental health. The online format of the Healthy Coping for Pain may also help increase the accessibility of the intervention and address some of the barriers to treatment for pain catastrophizing identified by Darnall et al. (2014) which led to the creation of FCR/ER.

Feasibility studies and a stage model for behavioral therapies research

Onken and colleagues argue in their 1997 paper that a stage model for behavioral therapies research should be taken to ensure that sufficient focus is given to treatment development. They proposed that Stage I should focus on treatment development, feasibility testing, initial evaluation, and development of adherence and/or competence measures for new treatments. Stage II focuses on randomized clinical trials and understanding mechanisms of action and effective aspects of treatment, while Stage III focuses on generalizability of treatments. Rounsaville and Carroll (2001) expanded on Onken et al.'s 1997 paper, describing components to be included in Stage I in order to adequately prepare for Stage II research. Components included in their outline are to develop the treatment based on theoretical rationale, demonstrate feasibility of treatment, move to pilot testing, and then develop a treatment manual for therapists. Additionally, Rounsaville and Carroll noted aspects related to therapists (e.g., determining how many therapists are needed, availability of therapists, procedures for training therapists, etc.), participants (e.g., who to target, inclusion/exclusion criteria, retention rate, etc.), and design and analysis (e.g., measures, analysis plan, etc.). This study focused on Stage I of this model, specifically with designing a brief intervention and testing the feasibility of the intervention.

Aims of the study and hypothesis

The aim of the current study is to determine the feasibility of implementing an online, asynchronous intervention for pain catastrophizing. Feasibility was determined with the use of a feedback survey completed by participants and assessment by study staff. The participant feedback survey included questions on acceptability, more specifically on the accessibility of the intervention, perceived appropriateness, and satisfaction, and on practicality, with questions asking participants the likelihood of future use of their Coping with Pain Catastrophizing Plan and how useful they find the concept of pain catastrophizing. Study staff also examined the remainder of the relevant areas of feasibility, including implementation by assessing the amount and type of resources needed to implement the intervention and factors that affect the ease of implementation. We hypothesized that participants would find the intervention, including the online format, acceptable.

Method

Participants

In order to be included in the study, participants had to meet the following inclusion criteria: (1) were above 18 years of age, (2) had been suffering from chronic pain that was ongoing for at least the last three months, and (3) could read and write in English. Individuals were excluded if they were currently in therapy given potential overlap of this study's intervention and the individual's therapy. Additionally, individuals who reported psychosis were excluded as individuals who are experiencing psychosis may have difficulty with processing information from the intervention and with providing an accurate report of their experience. Lastly, individuals who were currently experiencing suicidality were excluded as study staff could not ensure patient access to sufficient services to manage their symptoms.

Demographics and reported pain experience are presented in Table 1. Participants were predominantly female (76.9%) and white (84.6%). The average BMI (27.12) was in the overweight range. Average pain and current pain were both an average of 5.85 out of 10, while the average of worst pain in the past 24 hours was 7.31 out of 10, and least pain in the last 24 hours was 5.08. Participants reported an average duration of 126.92 months for their current episode of chronic pain, an average score of a 30.25 out of 70 on the Pain Disability Index, and an average score of a 7.75 on the Patient Health Questionnaire-8 (mild depression). Lastly, the average Pain Catastrophizing Scale score was 20.42, which is below the cutoff of 30 for clinically significant pain catastrophizing.

Table 1

Descriptives for Demographics and Clinical and Psychosocial Variables

Variable	N	M	SD	Range
Age (years)	13	46.08	19.44	19-71
BMI	13	27.12	7.61	14.6-41
Duration of Chronic Pain (months)	13	126.92	131.37	3-463
PCS	13	20.42	14.21	1-43
PDI	13	30.25	16.68	6-59
PHQ-8	13	7.75	3.96	2-15
Pain intensity (past 24 hours)				
Worst	13	7.31	1.55	5-10
Least	13	5.08	3.01	1-10
Average	13	5.85	1.99	3-9
At time of survey	13	5.85	2.73	2-9

Recruitment

Participants for the study were recruited from local (Reno, NV) and national sources. The local recruitment sources comprised of Healthy Psychology Associates (HPA), Sweetwater

Pain and Spine, and Tahoe Fracture/Swift Institute. Health Psychology Associates, a private practice clinic that serves the greater Reno area provides mental health services for a wide variety of presenting problems, including chronic pain. Additionally, they work alongside local pain clinics and practices such as Sweetwater Pain and Spine and Tahoe Fracture/Swift Institute to provide care for chronic pain patients. Study flyers containing an overview of the study and contact information were provided to Sweetwater Pain and Spin and Tahoe Fracture/Swift Institute through HPA. At HPA, those presenting with chronic pain concerns were identified as potential participants by front desk staff. A list of 20 potential participants was provided to the graduate student researcher by HPA staff and were subsequently contacted regarding interest in participating in the study and eligibility. Of the 20, six individuals agreed to participate in the study and all six met inclusion criteria.

The national source for participant recruitment used was ResearchMatch. ResearchMatch is a web-based recruitment tool that is maintained at Vanderbilt University. It is a data repository comprising of volunteers who provide basic demographic information (e.g., age, weight, height, gender) as well as health conditions and medications. Researchers who meet criteria to use ResearchMatch, having an IRB-approved protocol and being part of an institution registered with ResearchMatch, are permitted to search the database of volunteers for participants who meet criteria for their study. In this case, a search was conducted which included participants who met the inclusion criteria and did not meet exclusion criteria. After the list of volunteers meeting these criteria was generated, a random number of volunteers were selected and contacted about their interest in the study with an IRB-approved message. Initially, 30 random volunteers were selected and contacted as study staff were unsure how responsive volunteers on this recruitment tool would be. When no responses were received in the following

two to three business days, additional lists of randomly selected volunteers were generated and contacted. These lists were comprised of approximately 100-250 volunteers each. Volunteers who met criteria and were contacted were given the option by ResearchMatch to indicate interest and consent or decline for their contact information to be passed to study staff. A total of 1750 volunteers were contacted through ResearchMatch and 112 indicated they were interested and were screened. Of the 112, 70 were eligible for the study.

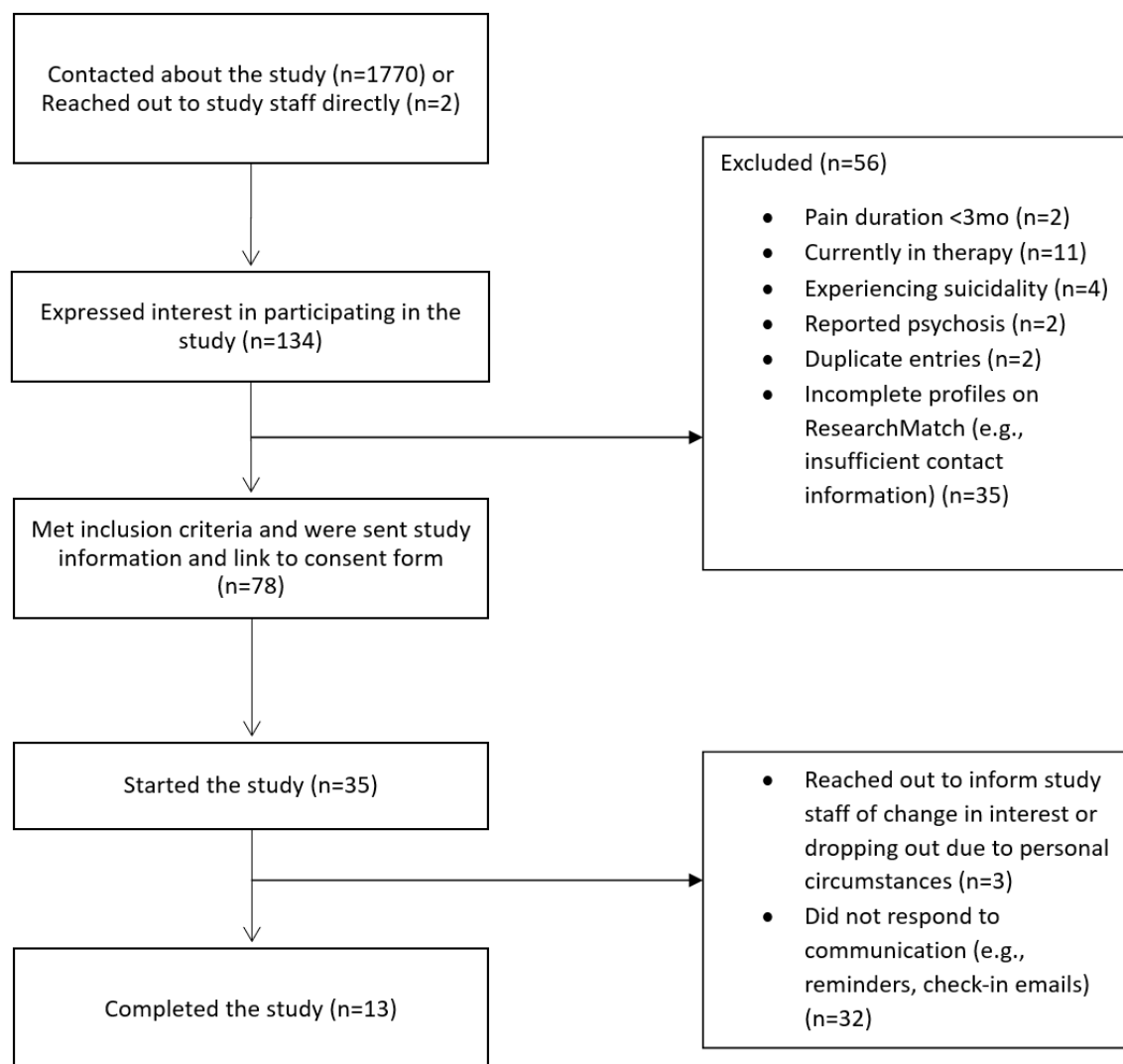
Through all recruitment sites, a total of 1770 individuals were contacted. Additionally, two individuals who saw the study flyer reached out individually to study staff expressing interest in participating. Both of those individuals were screened and met criteria for the study.

All individuals who expressed interest in the study and met criteria were sent an email containing an overview of the study format, instructions on how to complete the study, information regarding compensation, and the link to the consent form. While the compensation originally offered was entry into a drawing for e-gift cards, because of the difficulties experienced of recruiting participants into the study it was later increased to \$30 Amazon e-gift cards to all participants who finished the study. Participants were notified of this change and those who had consented already were given the option to re-consent and indicate their interest in the e-gift card or withdraw from the study. All participants who completed the study prior to the change in compensation re-consented. Individuals who expressed interest but did not begin the study were sent a reminder email several days to a week after they were originally contacted. Similarly, individuals who began the study but had not finished were sent a reminder email as well. Participants who began the study and reached out to study staff with questions about the study (e.g., lost link, format questions, etc.), but did not finish the study were sent two check-in or reminder emails regarding the study.

Of the 1772 individuals who were contacted about the study or reached out to study staff directly, 134 expressed interest in participating in the study, 78 were eligible, 35 started the study, and 13 completed the study. The majority of the participants who began the study but did not complete it dropped out after partially completing the pre-intervention survey. Three participants reached out to study staff to inform them that they would be dropping out of the study and/or no longer interested in participating, citing personal circumstances.

Figure 1

Participant flow



Measures

Demographic questions (i.e., age, gender, ethnicity, height, weight), along with questions regarding duration of chronic pain and measures assessing depression, pain catastrophizing, pain related disability, and experiences with pain, were included in the pre-intervention survey completed by participants through Qualtrics. Additionally, the post-intervention survey included questions that targeted areas of focus for feasibility studies, as outlined by Bowen et al. (2009), including satisfaction, perceived appropriateness and relevance, practicality, usefulness, along with open-ended questions soliciting feedback on what participants liked and disliked about the intervention, their understanding of pain catastrophizing, what they learned from the intervention, and other comments, suggestions, or feedback.

Pain Catastrophizing

The Pain Catastrophizing Scale (PCS, Sullivan et al., 1995), a 13-item scale, was used to measure pain catastrophizing. The PCS asks participants to indicate if they experienced certain feelings or thoughts while they were experiencing pain (Sullivan et al., 1995). There are three subscales of feelings and thoughts covered by the PCS: helplessness, rumination, and magnification. The clinical cutoff score is 30 and higher scores are indicative of a greater degree of pain catastrophizing. Test-retest correlations were found to be 0.75 across a 6-week period, which indicate a good level of stability (Sullivan et al., 1995). Additionally, Osman et al.'s 2000 study provided evidence of the scale's construct validity. The PCS has been used in studies which focused on a variety of pain populations including, but not limited to osteoarthritis patients (e.g., Lazaridou et al., 2019), fibromyalgia patients (e.g., Dorado et al., 2018; Lazaridou et al., 2020), chronic low back pain (e.g., Wolff et al., 2008), and acute low back pain (e.g., Ramirez-Maestre et al., 2017; Swinkels-Meewisse et al., 2006). The PCS has also been

translated, adapted, and used in several countries, including Germany, Norway, and Brazil (Fernandes et al., 2012; Lopes et al., 2015; Meyer et al., 2008).

Pain Intensity

The Brief Pain Inventory-Short Form (BPI-sf, Cleeland & Ryan, 1994) was used to assess pain severity and the impact of pain on different areas of daily functioning. It is a 9-item self-report measure that has been validated with several pain populations and in several languages. These studies include Mendoza et al.'s 2006 study which found the BPI-sf's test-retest reliability to be between 0.83 to 0.93 for pain interference and between 0.83 and 0.88 for pain severity after administering the measure daily for a week to osteoarthritis population.

Pain Disability Index

The Pain Disability Index (PDI, Tait et al., 1990) was used to measure pain-related disability and how severely various aspects of an individual's life have been disrupted by chronic pain. It is a 7-item self-report measure that is widely used across different pain populations, including musculoskeletal pain, and has been translated into several languages, including French (Gauthier et al., 2008; Soer et al., 2013). The highest total score possible is 70 and higher scores indicate a greater level of pain-related disability. The PDI has been shown to have good test-retest reliability with Soer et al. (2013) finding the intraclass correlation coefficient to be 0.76 in their study assessing 968 patients with musculoskeletal pain.

Depression

The Patient Health Questionnaire eight-item scale (PHQ-8, Kroenke et al., 2009) was used to assess depression. It is a validated, self-report measure that uses diagnostic criteria for depression from the Diagnostic and Statistical Manual of Mental Disorder, fourth edition. High scores on the PHQ-8 indicate greater severity of depression. It has been shown to have good

internal consistency (Cronbach's $\alpha = 0.88$) and has been used in studies across a number of populations, including coronary artery disease patients, pregnant women, community populations, and psychiatric outpatients (Kroenke et al., 2009; Razykov et al., 2012; Shin et al., 2019; Smith et al., 2010). Additionally, a meta-analysis conducted by Kroenke et al. in 2010 found the measure to have good specificity and sensitivity for detecting depressive disorders.

Feedback survey

The post-intervention feedback survey comprised of 14 questions which asked participants to provide ratings, utilizing a four-point Likert scale, for their satisfaction with the intervention content and intervention format, usefulness of skills covered, usefulness of the concept of pain catastrophizing, relevance of course material to their pain experience, likelihood they would use their Coping with Pain Catastrophizing Plan, how easy it was to understand the material, and how they found the pacing of the material. Additionally, there were five open-ended questions which solicited feedback on what participants liked and disliked about the intervention, their understanding of pain catastrophizing, what they learned from the intervention, and other comments, suggestions, or feedback.

Intervention

The intervention presented in this study was given the name Healthy Coping for Pain. It was presented in an asynchronous format comprising of three pre-recorded videos. The content covered in each video are as follows:

The video for Part One was approximately 20 minutes long and included an overview of Healthy Coping for Pain (e.g., topics to be covered, goals for the intervention), a brief overview of study format and components, didactic content regarding pain catastrophizing, the chronic pain cycle, factors that may impact pain, and the cognitive model.

The video for Part Two was approximately 50 minutes long and focused on relaxation skills to help reduce physiological hyperarousal. The skills covered were diaphragmatic breathing, progressive muscle relaxation, and guided imagery and participants were led through demonstrations of each of these skills. Suggestions were provided on when to utilize these skills and participants were encouraged to practice them regularly.

The video for Part Three was approximately 35 minutes long and focused on recognizing and addressing thoughts of pain catastrophizing, as well as other negative automatic thoughts about pain. Examples of potential negative automatic thoughts about pain were provided, as well as techniques to address these thoughts (e.g., reframing, asking oneself if the thought is 100% true, giving evidence for/against, speaking as if to a friend). Lastly, participants were asked to put together a personalized Coping with Pain Catastrophizing Plan which included listing signs or symptoms that would prompt the use of the plan, relaxation skills to be used, techniques that would be used to challenge thoughts of pain catastrophizing and/or other automatic negative thoughts about pain, and other activities or hobbies that could help improve mood or distract from the pain.

All videos were hosted on Nevada Box, as were the pages for Parts One, Two, and Three. The video for each part was included at the top of their respective pages, with a link to a brief, three-question attention check quiz beneath each video for Parts One and Two, and a link to a submission portal for their Coping with Pain Catastrophizing Plan and the post-intervention survey beneath the video for Part Three. Participants were given the option to upload an image or pdf or Word document copy of their Coping with Pain Catastrophizing Plan or copy and paste the text of their plan into a word box in the submission portal. Additionally, a link to a document containing links to relaxation skills (e.g., breathing exercises, guided imagery) was included on

the page for the Part Two and a link to a blank template for Coping with Pain Catastrophizing Plan was included on the page for Part Three. To access the next part of the intervention, participants were required to complete the brief attention check quiz after Parts One and Two where the link to the next part was included in the confirmation page after the quiz was submitted.

Analyses

Analyses focused on ratings of satisfaction (e.g., with intervention content, format), practicality (e.g., use of skills covered, Coping with Pain Catastrophizing Plan), relevance of course content to their pain experience (e.g., concept of pain catastrophizing, relevance of material and skills covered), and accessibility (e.g., how easy it was to understand the material, pacing of the material). Additionally, written feedback from participants was summarized and themes in responses were identified. Within these themes of content, format, accessibility, and patient experience, subthemes were identified and frequencies for these subthemes were determined. Rates of correct responses for the two attention checks were also examined. Lastly, observations by study staff regarding feasibility, specifically implementation and accessibility, were noted.

Results

Overall, the majority of participants provided favorable ratings in all domains assessed: satisfaction, practicality, relevance, and accessibility. All 13 participants provided ratings for all questions. Please see figures 2-5 for response breakdowns. For satisfaction, 61.5% (8/13) of participants reported being “Very Satisfied” with Healthy Coping for Pain, 30.8% (4/13) were “Mostly Satisfied,” and 7.7% (1/13) were “Somewhat Satisfied.” Additionally, 76.9% (10/13) of participants reported being “Very Satisfied” with the online format of Healthy Coping for Pain,

15.4% (2/13) were “Mostly Satisfied,” and 7.7% (1/13) was “Somewhat Satisfied.” While 92.3% of participants indicated being either “Very” or “Mostly” satisfied with the online format, only one participant expressed lower satisfaction with the online format and provided feedback that it was not phone friendly. For practicality, participants reported both high confidence (76.9% (10/13) were “Very Confident” and 23.1% (3/13) were “Mostly Confident”) in their ability to utilize skills covered by Healthy Coping for Pain; and 76.9% (10/13) were “Very Likely” and 23.1% (3/13) were “Likely” to use skills covered. In the relevance domain, participants were asked to indicate how useful they found the concept of pain catastrophizing, with 53.8% (7/13) indicating it was “Very Useful,” 23.1% (3/13) indicating it was “Mostly Useful,” and 23.1% (3/13) indicating it was “Somewhat Useful.” Additionally, the majority of participants rated the material and skills covered in Healthy Coping for Pain as “Very Relevant” (61.5% (8/13)) to their pain experience, with 23.1% (3/13) indicating it was “Mostly Relevant,” and the remaining 15.4% (2/13) indicating it was “Somewhat Relevant.” Lastly, for accessibility, participants were asked to indicate their level of agreement with two statements: (1) the material was easy to understand and (2) the pacing of the material was easy to follow. Participants provided the same ratings for both questions, with 92.3% (12/13) indicating they “Strongly Agree” with the statements and 7.7% (1/13) indicating they “Somewhat Agree.”

Figure 2

Participant ratings of satisfaction with Healthy Coping for Pain

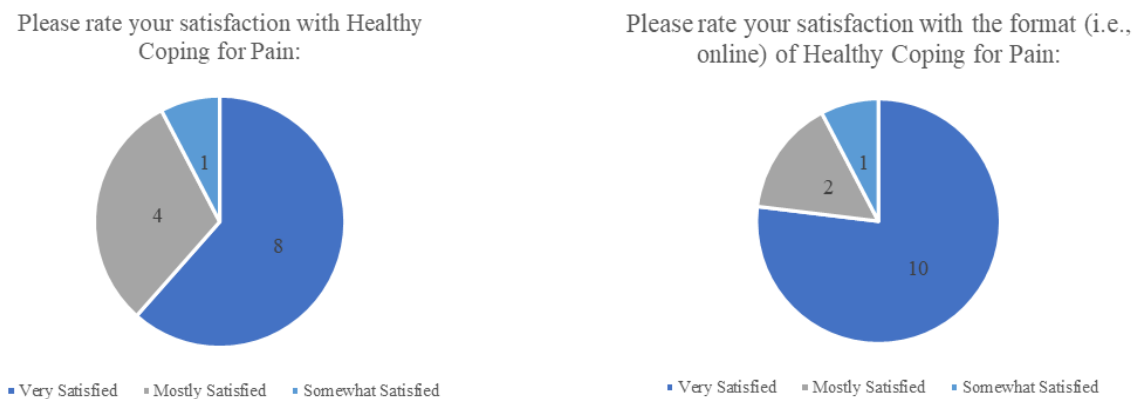


Figure 3

Participant ratings of practicality-related aspects of Healthy Coping for Pain

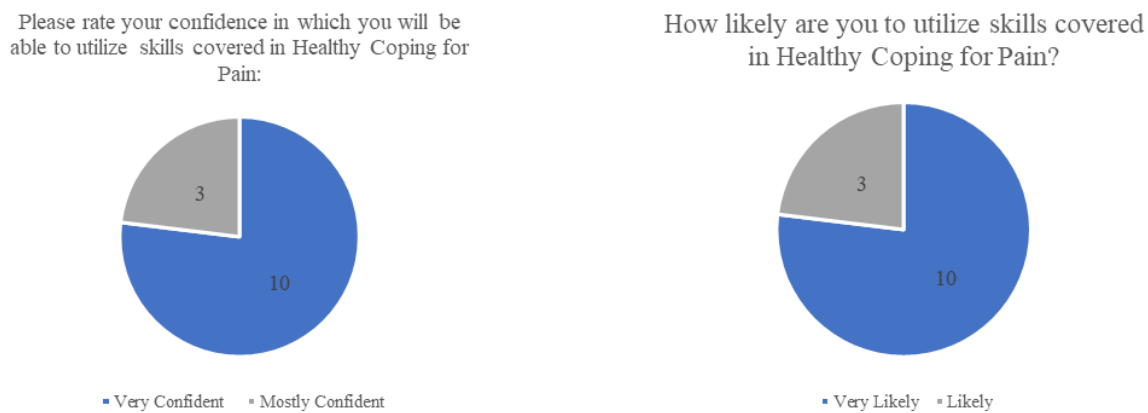
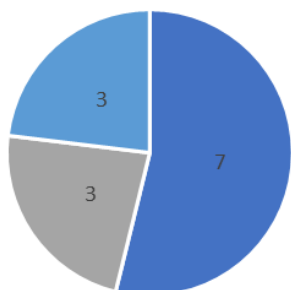


Figure 4

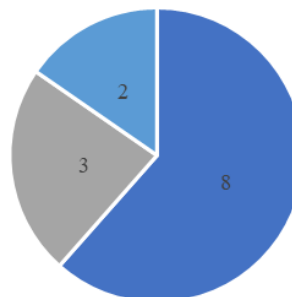
Participant ratings of relevance of Healthy Coping for Pain

Please indicate how useful you found the concept of pain catastrophizing:



■ Very Useful ■ Mostly Useful ■ Somewhat Useful

How relevant are the material and skills covered in Healthy Coping for Pain to your pain experience?

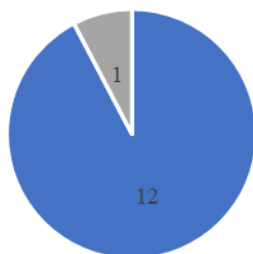


■ Very Relevant ■ Mostly Relevant ■ Somewhat Relevant

Figure 5

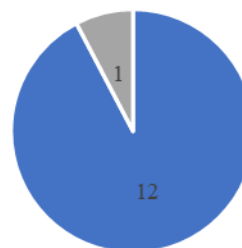
Participant ratings of accessibility of Healthy Coping for Pain

Please indicate your level of agreement with the following statement: The material was easy to understand.



■ Strongly Agree ■ Somewhat Agree

Please indicate your level of agreement with the following statement: The pacing of the material was easy to follow.



■ Strongly Agree ■ Somewhat Agree

Participants were also invited to provide written feedback. While all 13 participants provided written feedback, the amount of feedback provided varied by participants. The majority elected to write 1-3 sentences for each question while two provided 4+ sentences and two participants provided either one-word or short phrases for their responses. Additionally, three participants reached out via email to study staff to provide additional feedback after they submitted their feedback surveys. After coding the data, several themes were found in responses

and can be viewed in Tables 2 and 3. Aspects of Healthy Coping for Pain that participants reported liking could be organized into four areas: content, format, accessibility, and participant experience. The aspect of Healthy Coping for Pain that was mostly widely identified as a useful skill/skill that participants liked were the relaxation techniques, with 61.5% (8/13) of participants including this in their feedback. While 61.5% (8/13) of participants provided favorable feedback regarding the relaxation techniques (e.g., it was their favorite exercise covered, the techniques were new to them, or were “pretty good”), only 15.4% (2/13) noted that they found instructions for PMR to be unclear, specifically for breathing rhythm. Additionally, 23.1% (3/13) of participants mentioned that it was helpful to have the exercises demonstrated during the intervention. The Cognitive Behavioral Conceptualization of Chronic Pain was also identified by 46.2% (6/13) of participants as a helpful topic. While it was mentioned by fewer participants in their feedback, 38.5% (5/13) wrote that it was helpful to put together their own Coping with Pain Catastrophizing Plan and 15.4% (2/13) found the resource list provided helpful. In regard to format, 23.1% (3/13) participants mentioned in their feedback that they appreciated being able to go through the intervention at their own pace, including watching and/or rewinding the videos. 15.4% (2/13) also specifically identified the online format as an aspect they liked. Additionally, 15.4% (2/13) wrote that they appreciated having time built into the intervention to write a Coping with Pain Catastrophizing Plan. Accessibility was another theme observed in participant responses. Thirty-point eight percent (4/13) of participants mentioned that the intervention was easy to understand and 30.8% (4/13) made mention of appropriate pacing. Lastly, themes of participant experience were noted in responses. More specifically, 38.5% (5/13) of participants included feedback stating that they felt Healthy Coping for Pain validated their pain experience and/or coping skills they were already using. Thirty-point eight percent (4/13) of participants

also mentioned that they liked the narration in the videos, with some describing it as “soothing” or “calming.”

Aspects of Healthy Coping for Pain participants reported disliking could be organized into two areas: accessibility and study components. Accessibility-related concerns reported included unclear instructions on timing of breathing for PMR (15.4%), with both participants that mentioned this in feedback writing that they had difficulty timing their breathing and/or were confused on when to inhale or exhale during the exercise. Additionally, 23.1% (3/13) of participants wrote that they found the pacing to be too slow and 7.7% (1/13) wrote that the intervention and study was not phone friendly. Lastly, an aspect of the study was specifically identified as an item that was disliked by one participant: difficulty with uploading a copy of their Coping with Pain Catastrophizing Plan.

Participants were also asked to describe their understanding of pain catastrophizing, what they learned from the intervention, and any other comments, suggestions for feedback they wished to provide. 12 out of the 13 participants completed the question asking about their understanding of pain catastrophizing on the feedback survey. Of these twelve, eight were able to define pain catastrophizing correctly, two defined only catastrophizing, and two provided answers that were not relevant to the question. Similarly, 12 out of the 13 participants answered the question regarding what they had learned from Healthy Coping for Pain. All respondents stated they learned at least one technique to help them cope with their pain and the breakdown of which skill(s) learned are as follows: eleven mentioned coping skills, five mentioned the connection between chronic pain, emotions, behaviors, and thoughts, two mentioned recognizing and challenging thoughts of pain catastrophizing, and four mentioned recognizing and challenging other automatic negative thoughts regarding their pain. Lastly, space was provided

for participants to provide any additional comments, suggestions or feedback. Ten participants elected to write something in this space, with two comments saying they liked the intervention and two saying they would have liked to have a copy of the slides used. Other feedback included suggestions for a facilitated message board for future participants, larger font, easier navigation, and better phone compatibility. Lastly, there were comments from participants expressing interest in participating in future research, finding the intervention effective, that the intervention is “needed” for individuals with chronic pain, and appreciation for the research being done for chronic pain management.

The vast majority of participants provided accurate responses on both of the attention checks. On the first attention check, all 13 participants answered all three questions, and all responded to the first question asking about the components of the Cognitive Behavioral Conceptualization of Chronic Pain correctly, one participant answered the second question regarding an example of pain catastrophizing incorrectly, and one participant answered the third question regarding the impact of under or over-activity on pain incorrectly. On the second attention check, all participants again answered all three questions, and all participants answered the first question (use of relaxation skills) and third question (relaxation skills covered) correctly, and one participant answered the second question (PMR) incorrectly.

Lastly, study staff examined the remainder of the relevant areas of feasibility, namely implementation (e.g., type and amount of resources needed). The pages for Parts One, Two, and Three of the intervention, videos, documents (e.g., resource list, template for the Coping with Pain Catastrophizing Plan, copy of consent form) were hosted on Nevada Box while all surveys and attention check quizzes were hosted on Qualtrics. These resources were available to study staff through the Psychology Department at the University of Nevada, Reno and therefore came

at no additional out-of-pocket costs. However, as Nevada Box is not a web hosting service (e.g., GoDaddy), a more traditional website with additional and more streamlined features (e.g., embedded videos, surveys, etc., hit count, smoother backwards and forwards navigation) was not possible through this platform. One participant included in their feedback in the post-intervention survey that this format was not easy to navigate on his phone. Additionally, four participants emailed study staff requesting that links to one of the three parts of the intervention be sent to them again as they had closed the page they were on accidentally and/or had forgotten to bookmark the page before taking a break.

Table 2

Aspects of Healthy Coping for Pain Participants Liked

Categories, subthemes, incidence	Sample Quotations
Content Relaxation techniques (8/13, 61.5%) Cognitive Behavioral Conceptualization of Chronic Pain (6/13, 46.2%) Putting together a Coping with Pain Catastrophizing Plan (5/13, 38.5%) Demonstration of relaxation techniques (3/13, 23.1%)	“(The intervention) gave some pretty good suggestions for techniques to try out to help relax and distract from the pain.” “I learned some new relaxation techniques (PMR and guided imagery), which I hadn’t tried before.” “The PMR exercise was my favorite and I could feel it shake off tension I was holding.” “The course clearly articulated the connection between thoughts, stress, and pain.” “I hadn’t really considered how my attitude could contribute to my experience of pain.” “I liked putting it all together and creating my own plan.” “I find (the plan) very helpful to cope with my pain.” “It feels helpful to have skills/tools at a time when I otherwise can feel defeated by pain.”

<p>Resource List (2/13, 15.4%)</p>	<p>“It was helpful to be guided through the exercises in such detail, and I found a lot of value in learning about the exercises.” “Examples of (the relaxation) exercises were given.” “I appreciated that (the presenter) didn’t rush through the exercises because it was much more beneficial to follow along than it would have been to quickly receive instruction and then to go through the exercises on my own.”</p> <p>“I appreciated the resource list at the end of the course.” “I really appreciated the Resources page at the end of the modules as a way to continue practicing these (skills).”</p>
<p>Format</p> <p>Being able to go at own pace, including watching and rewinding the videos (3/13, 23.1%)</p> <p>Online format (2/13, 15.4%)</p> <p>Time built in for putting together a Coping with Pain Catastrophizing Plan (2/13, 15.4%)</p>	<p>“It was great to have a format where I could pause the videos when needed.” “I could go at my own pace.”</p> <p>“I really liked the online format.” “It was great to have a format where I could pause the videos when needed.”</p> <p>“It was great to have dedicated time to fill out the Coping with Pain Catastrophizing Plan live during the sessions. If it was assigned as homework to do after, I would have written it down on a to-do list and probably never make time to complete it. But instead the time was built in, so I now have a customized tool ready to apply”</p>
<p>Accessibility</p> <p>Easily understandable (4/13, 30.8%)</p> <p>Appropriate pacing (4/13, 30.8%)</p>	<p>“(The intervention) was detailed and easy to understand.” “Things were easy to understand.”</p> <p>“The presenter's pace was consistent, which set a soothing vibe for the session.”</p>
<p>Participant Experience</p> <p>Participants reported feeling Healthy Coping for Pain validated their pain</p>	<p>“This course clearly articulated the connection between thoughts, stress, and</p>

<p>experience and/or current coping skills (5/13, 38.5%)</p>	<p>pain. This rang true to my experience but was validating to hear it put into words.” “(The intervention) gave me a different approach to dealing with pain. Some of the topics covered I do already but it did validate some of what I’ve been doing.” “Showed me all the things I have already been doing that are healthy coping techniques and helped me identify areas I can help myself even more.”</p>
<p>Video narration (4/13, 30.8%)</p>	<p>“I liked the one-on-one therapy-like format and the soothing and reassuring voice of the moderator.” “The instructor’s voice was very calming during the guided exercises in the second video.” “The narrator had a calming voice.”</p>

Table 3

Aspects of Healthy Coping for Pain Participants Disliked

Categories, subthemes, incidence	Sample Quotations
<p>Accessibility Instructions for PMR found to be unclear (2/13, 15.4%)</p> <p>Pacing was too slow (3/13, 23.1%)</p> <p>Intervention was not phone friendly (1/13, 7.7%)</p>	<p>“In part 2 I was slightly confused as to whether I was should have been inhaling then exhaling after the (PMR) exercises.” “I personally had trouble timing my breathing during the PMR exercise but that may have just been me.”</p> <p>“The pacing of the videos just felt a little slow” “The pacing of the course felt a little slow”</p> <p>“The setup for this program was very difficult for me to follow on my phone.”</p>
<p>Study components Difficulty with uploading copy of Coping with Pain Catastrophizing Plan (1/13, 7.7%)</p>	<p>“Can't seem to get my completed Plan to plug in here or by uploading.”</p>

Discussion

The current study aimed to determine the feasibility of CBT-based, asynchronous, online intervention. The intervention, named Healthy Coping for Pain, was aimed at helping participants better manage their pain, including pain catastrophizing. Given some of the barriers and challenges for more traditional courses of CBT (e.g., multiple sessions, high financial cost, limited number of clinicians), and the effectiveness of briefer CBT-based interventions for pain catastrophizing, such as Empowered Relief, Healthy Coping for Pain utilized an online, more time-limited format. Qualitative analyses were conducted; participants were asked to provide ratings on aspects of satisfaction, practicality, relevance, and accessibility, as well as being asked for written feedback. The ratings found high participant satisfaction with both the intervention and the online format, high confidence levels by participants in their ability to utilize skills covered in the intervention, as well as high likelihood in use of the skills learned. The written feedback was summarized, and results revealed content, including the relaxation techniques, Coping with Pain Catastrophizing Plan, and feeling that Healthy Coping for Pain validated participants' pain experience and/or current coping skills were among the most frequently named aspects of the intervention that participants liked. While pacing was nearly split down the middle between individuals who provided written feedback on whether it was appropriate or too slow, more clarity regarding PMR was an area two participants commented on. Accuracy of responses for the two attention checks were also examined and found to be nearly entirely accurate with only three total incorrect responses between all participants.

Overall, participants found the material easy to understand and follow, with 12 of the 13 participants indicating that they strongly agreed with the statements "The material was easy to understand" and "The pacing of the material was easy to follow," and one participant indicating

they “Somewhat Agree” with these statements. Additionally, the vast majority of participants answered the attention check questions correctly, with only three total incorrect responses among all questions and respondents. This suggests that the material was presented clearly, and the participants were able to gain an understanding of the material presented.

The relaxation activities were identified by over half of the participants as an aspect of the intervention they liked and/or their favorite part of the intervention. Additionally, the online format was generally well-received by participants. However, there were mentions of the format having poor compatibility for phones and navigation between intervention and study components not being smooth. Given all this, it would appear that keeping the relaxation techniques with a few suggestions made by participants (i.e., clarifying rhythm of breathing during PMR) and the online format would be appropriate for future iterations of Healthy Coping for Pain. However, improvements to the navigation in the intervention and device compatibility would be needed before additional research is done. Hosting the intervention on a traditional web hosting service may provide additional tools to accomplish these goals and may also help improve compatibility for phones, tablets, or other similar devices. It may also be beneficial to secure grant funding so professional web developers can be brought on to help re-design the intervention to improve not just navigability, but also accessibility with the website and intervention handouts, videos, and materials.

The difficulty with participant recruitment, more specifically with the large number of potential participants contacted but the low response rate and only half of the participants who qualified beginning, and then only half of those beginning the study completing it, is an area that warrants further investigation. While the data collection suggests that the study components and/or the fact that the intervention was embedded in a study may be an area that participants,

and possibly potential participants, did not like, there was also data showing that participants who did complete the study liked the content of the intervention. Therefore, understanding if the recruitment difficulties were a result of recruitment tactics, materials, or pathways or if it was related to some aspect of the intervention or study, would be an important area to examine before additional research is done on Healthy Coping for Pain. One potential area to examine is whether the intervention focus, and any advertisement materials, should be described in a more general way as focused on pain management, rather than in reducing pain catastrophizing, as only 53.8% of participants indicated that the concept of pain catastrophizing was “Very Useful,” but the majority still found the intervention as a whole helpful and relevant.

The study has provided preliminary support for Healthy Coping for Pain being a feasible brief intervention for pain management. While further research is needed to determine the effectiveness of Healthy Coping for Pain in reducing pain catastrophizing and on other pain outcomes, the feedback provided by participants can help inform adjustments to the intervention content and presentation before Stage I research is completed and progressing onto a RCT/Stage II research.

Limitations

There are several limitations to the current study, first, given that the focus of this study was on determining the feasibility of Healthy Coping for Pain, changes in pain outcomes (e.g., pain catastrophizing, pain intensity) post-intervention were not assessed. Second, the small sample size provides preliminary support for the feasibility of the intervention and highlights aspects that appealed to participants, but findings should not be overstated. Third, there was limited diversity in participants in this study, with most participants being white and female.

Future research on the intervention should ensure a more diverse population is recruited to help improve the generalizability of results.

Future research directions

Given that this Stage I research has focused on the feasibility of Healthy Coping for Pain and some initial support has been found for its feasibility, content, and format, the next step would be incorporate feedback received from participants and finish Stage I research in preparation for a RCT/Stage II research. First, an improved platform (e.g., website) for Healthy Coping for Pain should be developed. Next, the effectiveness of the improved version of the intervention should be tested with outcome measures to be given post-intervention. A more diverse and representative population should be recruited to help ensure better generalizability of study results. Additionally, given the overall goal of expanding access to individuals who may not be able to access or participate in more traditional courses of CBT for pain management, it would be beneficial to identify which types of individuals would most benefit from this intervention so outreach efforts can be more focused. After these areas are addressed, research should progress to Stage II with a RCT with a control group. Lastly, given that the relaxation techniques were most commonly mentioned in feedback as an aspect of Healthy Coping for Pain that participants found helpful, focusing on or prioritizing this particular skill may be an option that warrants further exploration, potentially as an even more time-limited, “bite-sized” intervention to improve accessibility.

References

- Alda, M., Luciano, J. V., Andrés, E., Serrano-Blanco, A., Rodero, B., del Hoyo, Y. L., ... & García-Campayo, J. (2011). Effectiveness of cognitive behaviour therapy for the treatment of catastrophisation in patients with fibromyalgia: a randomised controlled trial. *Arthritis research & therapy*, 13(5), 1-13.
- Beehler, G. P., Murphy, J. L., King, P. R., Dollar, K. M., Kearney, L. K., Haslam, A., ... & Goldstein, W. R. (2019). Brief cognitive behavioral therapy for chronic pain. *The Clinical journal of pain*, 35(10), 809-817.
- Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., ... & Fernandez, M. (2009). How we design feasibility studies. *American journal of preventive medicine*, 36(5), 452-457.
- Bromberg, J., Wood, M. E., Black, R. A., Surette, D. A., Zacharoff, K. L., & Chiauuzzi, E. J. (2012). A randomized trial of a web-based intervention to improve migraine self-management and coping. *Headache: The Journal of Head and Face Pain*, 52(2), 244-261.
- Burns, L. C., Ritvo, S. E., Ferguson, M. K., Clarke, H., Seltzer, Z. E., & Katz, J. (2015). Pain catastrophizing as a risk factor for chronic pain after total knee arthroplasty: a systematic review. *Journal of pain research*, 8, 21.
- Carpenter, K. M., Stoner, S. A., Mundt, J. M., & Stoelb, B. (2012). An online self-help CBT intervention for chronic lower back pain. *The Clinical journal of pain*, 28(1), 14.

- Cleeland, C. S., & Ryan, K. M. (1994). Pain assessment: global use of the Brief Pain Inventory. *Annals, Academy of Medicine, Singapore*.
- Dahlhamer, J., Lucas, J., Zelaya, C., Nahin, R., Mackey, S., DeBar, L., ... & Helmick, C. (2018). Prevalence of chronic pain and high-impact chronic pain among adults—United States, 2016. *Morbidity and Mortality Weekly Report*, 67(36), 1001.
- Darnall, B. D., Roy, A., Chen, A. L., Ziadni, M. S., Keane, R. T., You, D. S., ... & Mackey, S. C. (2021). Comparison of a single-session pain management skills intervention with a single-session health education intervention and 8 sessions of cognitive behavioral therapy in adults with chronic low back pain: a randomized clinical trial. *JAMA network open*, 4(8), e2113401-e2113401.
- Darnall, B. D., Sturgeon, J. A., Kao, M. C., Hah, J. M., & Mackey, S. C. (2014). From catastrophizing to recovery: a pilot study of a single-session treatment for pain catastrophizing. *Journal of pain research*, 7, 219.
- de Boer, M. J., Struys, M. M. R. F., & Versteegen, G. J. (2012). Pain-related catastrophizing in pain patients and people with pain in the general population. *European journal of pain*, 16(7), 1044-1052.
- De Boer, M. J., Versteegen, G. J., Vermeulen, K. M., Sanderman, R., & Struys, M. M. R. F. (2014). A randomized controlled trial of an Internet-based cognitive-behavioural intervention for non-specific chronic pain: An effectiveness and cost-effectiveness study. *European journal of pain*, 18(10), 1440-1451.

- Dorado, K., Schreiber, K. L., Koulouris, A., Edwards, R. R., Napadow, V., & Lazaridou, A. (2018). Interactive effects of pain catastrophizing and mindfulness on pain intensity in women with fibromyalgia. *Health psychology open, 5*(2), 2055102918807406.
- Fernandes, L., Storheim, K., Lochting, I., & Grotle, M. (2012). Cross-cultural adaptation and validation of the Norwegian pain catastrophizing scale in patients with low back pain. *BMC musculoskeletal disorders, 13*(1), 1-9.
- Fine, P. G. (2011). Long-term consequences of chronic pain: mounting evidence for pain as a neurological disease and parallels with other chronic disease states. *Pain Medicine, 12*(7), 996-1004.
- Fritsche, G., Frettlöh, J., Hüppe, M., Dlugaj, M., Matatko, N., Gaul, C., & Diener, H. C. (2010). Prevention of medication overuse in patients with migraine. *PAIN®, 151*(2), 404-413.
- Garg, S., Garg, D., Turin, T. C., & Chowdhury, M. F. U. (2016). Web-based interventions for chronic back pain: a systematic review. *Journal of medical Internet research, 18*(7), e4932.
- Gaskin, D. J., & Richard, P. (2012). The economic costs of pain in the United States. *The Journal of Pain, 13*(8), 715-724.
- Gauthier, N., Thibault, P., Adams, H., & Sullivan, M. J. (2008). Validation of a French-Canadian version of the pain disability index. *Pain Research and Management, 13*(4), 327-333.
- Gentry, M. T., Puspitasari, A. J., McKean, A. J., Williams, M. D., Breiting, S., Geske, J. R., ... & Hilty, D. M. (2021). Clinician satisfaction with rapid adoption and implementation of telehealth services during the COVID-19 pandemic. *Telemedicine and e-Health, 27*(12), 1385-1392.

Health Resources & Services Administration. (n.d.). *HPSA Find*. HPSA find.

<https://data.hrsa.gov/tools/shortage-area/hpsa-find>

Hedman, E., Ljótsson, B., & Lindefors, N. (2012). Cognitive behavior therapy via the Internet: a systematic review of applications, clinical efficacy and cost-effectiveness. *Expert review of pharmacoeconomics & outcomes research*, 12(6), 745-764.

Helminen, E. E., Sinikallio, S. H., Valjakka, A. L., Väisänen-Rouvali, R. H., & Arokoski, J. P. (2015). Effectiveness of a cognitive-behavioural group intervention for knee osteoarthritis pain: a randomized controlled trial. *Clinical rehabilitation*, 29(9), 868-881.

Jöud, A., Björk, J., Gerdle, B., Grimby-Ekman, A., & Larsson, B. (2017). The association between pain characteristics, pain catastrophizing and health care use—Baseline results from the SWEPAIN cohort. *Scandinavian journal of pain*, 16(1), 122-128.

Khoo, E. L., Small, R., Cheng, W., Hatchard, T., Glynn, B., Rice, D. B., ... & Poulin, P. A. (2019). Comparative evaluation of group-based mindfulness-based stress reduction and cognitive behavioural therapy for the treatment and management of chronic pain: A systematic review and network meta-analysis. *BMJ Ment Health*, 22(1), 26-35.

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2010). The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. *General hospital psychiatry*, 32(4), 345-359.

Kroenke, K., Strine, T. W., Spitzer, R. L., Williams, J. B., Berry, J. T., & Mokdad, A. H. (2009). The PHQ-8 as a measure of current depression in the general population. *Journal of affective disorders*, 114(1-3), 163-173.

- Lazaridou, A., Martel, M. O., Cornelius, M., Franceschelli, O., Campbell, C., Smith, M., ... & Edwards, R. R. (2019). The association between daily physical activity and pain among patients with knee osteoarthritis: the moderating role of pain catastrophizing. *Pain Medicine, 20*(5), 916-924.
- Lazaridou, A., Paschali, M., Schreiber, K., Galenkamp, L., Berry, M., Paschalis, T., ... & Edwards, R. R. (2020). The association between daily physical exercise and pain among women with fibromyalgia: the moderating role of pain catastrophizing. *Pain Reports, 5*(4).
- Lopes, R. A., Dias, R. C., Queiroz, B. Z. D., Rosa, N. M. D. B., Pereira, L. D. S. M., Dias, J. M. D., & Magalhães, L. D. C. (2015). Psychometric properties of the Brazilian version of the Pain Catastrophizing Scale for acute low back pain. *Arquivos de Neuro-psiquiatria, 73*, 436-445.
- Macías-Toronjo, I., Rojas-Ocaña, M. J., Sánchez-Ramos, J. L., & García-Navarro, E. B. (2020). Pain catastrophizing, kinesiophobia and fear-avoidance in non-specific work-related low-back pain as predictors of sickness absence. *Plos one, 15*(12), e0242994.
- Mendoza, T., Mayne, T., Rublee, D., & Cleeland, C. (2006). Reliability and validity of a modified Brief Pain Inventory short form in patients with osteoarthritis. *European journal of pain, 10*(4), 353-361.
- Meyer, K., Sprott, H., & Mannion, A. F. (2008). Cross-cultural adaptation, reliability, and validity of the German version of the Pain Catastrophizing Scale. *Journal of psychosomatic research, 64*(5), 469-478.

- Onken, L. S., Blaine, J. D., & Battjes, R. J. (1997). Behavioral therapy research: A conceptualization of a process.
- Osman, A., Barrios, F. X., Gutierrez, P. M., Kopper, B. A., Merrifield, T., & Grittmann, L. (2000). The Pain Catastrophizing Scale: further psychometric evaluation with adult samples. *Journal of behavioral medicine*, 23(4), 351-365.
- Picavet, H. S. J., Vlaeyen, J. W., & Schouten, J. S. (2002). Pain catastrophizing and kinesiophobia: predictors of chronic low back pain. *American journal of epidemiology*, 156(11), 1028-1034.
- Ramírez-Maestre, C., Esteve, R., Ruiz-Párraga, G., Gómez-Pérez, L., & López-Martínez, A. E. (2017). The key role of pain catastrophizing in the disability of patients with acute back pain. *International journal of behavioral medicine*, 24(2), 239-248.
- Razykov, I., Ziegelstein, R. C., Whooley, M. A., & Thombs, B. D. (2012). The PHQ-9 versus the PHQ-8—is item 9 useful for assessing suicide risk in coronary artery disease patients? Data from the Heart and Soul Study. *Journal of psychosomatic research*, 73(3), 163-168.
- Rikard S.M., Strahan A.E., Schmit K.M., Guy G.P. Jr. (2023). *Chronic Pain Among Adults — United States, 2019–2021* (Report No. 72: 15). Centers for Disease Control and Prevention. <http://dx.doi.org/10.15585/mmwr.mm7215a1>
- Rounsaville, B. J., Carroll, K. M., & Onken, L. S. (2001). A stage model of behavioral therapies research: Getting started and moving on from stage I. *Clinical psychology: Science and practice*, 8(2), 133.

- Schütze, R., Rees, C., Smith, A., Slater, H., Campbell, J. M., & O'Sullivan, P. (2018). How can we best reduce pain catastrophizing in adults with chronic noncancer pain? A systematic review and meta-analysis. *The Journal of Pain, 19*(3), 233-256.
- Severeijns, R., Vlaeyen, J. W., van den Hout, M. A., & Weber, W. E. (2001). Pain catastrophizing predicts pain intensity, disability, and psychological distress independent of the level of physical impairment. *The Clinical journal of pain, 17*(2), 165-172.
- Shin, C., Lee, S. H., Han, K. M., Yoon, H. K., & Han, C. (2019). Comparison of the usefulness of the PHQ-8 and PHQ-9 for screening for major depressive disorder: analysis of psychiatric outpatient data. *Psychiatry investigation, 16*(4), 300.
- Smith, M. V., Gotman, N., Lin, H., & Yonkers, K. A. (2010). Do the PHQ-8 and the PHQ-2 accurately screen for depressive disorders in a sample of pregnant women?. *General hospital psychiatry, 32*(5), 544-548.
- Smith, T. J., & Hillner, B. E. (2019). The cost of pain. *JAMA Network Open, 2*(4), e191532-e191532.
- Soer, R., Köke, A. J., Vroomen, P. C., Stegeman, P., Smeets, R. J., Coppes, M. H., & Reneman, M. F. (2013). Extensive validation of the pain disability index in 3 groups of patients with musculoskeletal pain. *Spine, 38*(9), E562-E568.
- Somers, T. J., Keefe, F. J., Pells, J. J., Dixon, K. E., Waters, S. J., Riordan, P. A., ... & Schmitt, D. (2009). Pain catastrophizing and pain-related fear in osteoarthritis patients: relationships to pain and disability. *Journal of pain and symptom management, 37*(5), 863-872.

- Strine, T. W., & Hootman, J. M. (2007). US national prevalence and correlates of low back and neck pain among adults. *Arthritis Care & Research*, 57(4), 656-665.
- Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: development and validation. *Psychological assessment*, 7(4), 524.
- Swinkels-Meewisse, I. E., Roelofs, J., Oostendorp, R. A., Verbeek, A. L., & Vlaeyen, J. W. (2006). Acute low back pain: pain-related fear and pain catastrophizing influence physical performance and perceived disability. *Pain*, 120(1-2), 36-43.
- Tait, R. C., Chibnall, J. T., & Krause, S. (1990). The pain disability index: psychometric properties. *Pain*, 40(2), 171-182.
- Urquhart, D. M., Kelsall, H. L., Hoe, V. C., Cicuttini, F. M., Forbes, A. B., & Sim, M. R. (2013). Are psychosocial factors associated with low back pain and work absence for low back pain in an occupational cohort?. *The Clinical journal of pain*, 29(12), 1015-1020.
- Vos, T., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., Abd-Allah, F., ... & Criqui, M. H. (2017). Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, 390(10100), 1211-1259.
- Wetherell, J. L., Afari, N., Rutledge, T., Sorrell, J. T., Stoddard, J. A., Petkus, A. J., ... & Atkinson, J. H. (2011). A randomized, controlled trial of acceptance and commitment therapy and cognitive-behavioral therapy for chronic pain. *Pain*, 152(9), 2098-2107.

- Wolff, B., Burns, J. W., Quartana, P. J., Lofland, K., Bruehl, S., & Chung, O. Y. (2008). Pain catastrophizing, physiological indexes, and chronic pain severity: tests of mediation and moderation models. *Journal of Behavioral Medicine, 31*, 105-114.
- Ziadni, M. S., Gonzalez-Castro, L., Anderson, S., Krishnamurthy, P., & Darnall, B. D. (2021). Efficacy of a Single-Session “Empowered Relief” Zoom-Delivered Group Intervention for Chronic Pain: Randomized Controlled Trial Conducted During the COVID-19 Pandemic. *Journal of Medical Internet Research, 23*(9), e29672.
- Zhu, D., Paige, S. R., Slone, H., Gutierrez, A., Lutzky, C., Hedriana, H., ... & Bunnell, B. E. (2021). Exploring telemental health practice before, during, and after the COVID-19 pandemic. *Journal of telemedicine and telecare, 1357633X211025943*.