

**Healthcare providers' judgements in chronic pain: the
influence of depression, trustworthiness and gender**

Gráinne Schäfer

D.Clin.Psy. Thesis (Volume 1), 2014

University College London

UCL Doctorate in Clinical Psychology

Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature:

Name:

Date:

Overview

Part one of this volume is a review of the literature on the association between chronic pain and depression. It presents the results of 15 prospective studies, divided into three categories: studies investigating outcomes of chronic pain in patients with depression, studies investigating outcomes of depression in patients with chronic pain, and studies investigating variables associated with chronic pain and depression. The review highlights problems with the measures of depression used in the majority of the studies. The clinical implications are discussed, and suggestions for how future research can overcome methodological limitations are made.

Part two presents an empirical study which investigates the influence of history of depression, perceived trustworthiness and gender of the patient; and training level of the clinician on judgements and treatment decisions in patients with chronic pain. The results showed that participants were affected by patient gender and trustworthiness in their pain judgements and management decisions. Implications for reducing bias in training clinicians are discussed.

Part three is a critical appraisal of the research process as a whole. It contains some personal reflections on the different stages of research: designing the study, recruiting participants and analysing data. It also reflects further on the research findings.

Table of Contents

Acknowledgements	7
Part 1: Literature Review	8
Abstract	9
Introduction.....	10
<i>Chronic pain</i>	10
<i>Factors affecting onset and outcome of chronic pain</i>	10
<i>Depression and its occurrence with chronic pain</i>	11
<i>Theories of the association between chronic pain and depression</i>	12
<i>Reviews on chronic pain and depression</i>	17
<i>Aims of the current review</i>	18
Method.....	19
<i>Search strategy</i>	19
<i>Eligibility criteria</i>	20
<i>Data extraction</i>	20
Results.....	22
<i>Overview of papers</i>	22
<i>Methodological quality assessment</i>	26
<i>Summary of findings</i>	27
1. <i>Does depression affect pain and disability outcomes in patients with chronic pain undergoing nonspecific treatments?</i>	27
2. <i>How does the presence of pain affect outcomes in patients with treated or untreated depression?</i>	35
3. <i>What variables mediate outcomes in chronic pain and depression at follow-up?</i>	42
Discussion.....	51
<i>Does depression affect outcomes in chronic pain?</i>	51
<i>Does pain affect outcomes in treated or untreated depression?</i>	52
<i>What variables mediate outcomes in chronic pain and depression at follow-up?</i>	52
<i>What are the psychological implications of the findings?</i>	53
<i>Implications for future research</i>	57
<i>Limitations of the current review</i>	59
<i>Conclusion</i>	60
References	62
Part 2: Empirical Paper.....	73
Healthcare providers' judgements in chronic pain: the influence of depression, trustworthiness and gender	73
Abstract	74
Introduction.....	75
<i>Pain</i>	75
<i>Factors affecting pain judgements</i>	76
<i>Chronic pain and depression</i>	79
<i>Trustworthiness</i>	81
<i>The vignette model for studying healthcare professional decision making in chronic pain</i>	83
<i>Aims of the current study</i>	83
Method.....	89
<i>Ethics</i>	89
<i>Participants and setting</i>	89
<i>Design</i>	90
<i>Power analysis</i>	91
<i>Materials</i>	91
<i>Measures</i>	92

<i>Procedure</i>	94
<i>Analysis</i>	95
Results.....	96
<i>Demographics</i>	96
<i>Trustworthiness ratings</i>	97
<i>Awareness of the study purpose</i>	98
<i>Research question 1</i>	98
<i>Research question 2</i>	101
<i>Research question 3</i>	103
<i>Research question 4</i>	105
<i>Research question 5</i>	114
<i>Research question 6</i>	115
<i>Research question 7</i>	120
Discussion.....	122
<i>The impact of patient gender</i>	123
<i>The impact of perceived trustworthiness</i>	125
<i>The impact of depression</i>	127
<i>The impact of training level</i>	130
<i>The impact of empathy</i>	132
<i>Limitations</i>	132
<i>Clinical and research implications</i>	133
<i>Conclusion</i>	136
References.....	138
Part 3: Critical appraisal	149
Introduction.....	150
Designing the study.....	150
Recruiting participants.....	152
Statistical analyses.....	155
Reflections on the research findings.....	157
<i>Generalisability of the results</i>	157
<i>The concept of trustworthiness</i>	158
Reflections on the research process.....	159
References.....	161
Appendices	163
Appendix 1: Search terms.....	163
Appendix 2: Quality Assessment Scale.....	164
Appendix 3: Ethical approval letters.....	166
Appendix 4: Recruitment emails.....	170
Appendix 5: Volunteer Information Sheet and Consent form.....	171
Appendix 6: Donation to Médecins Sans Frontières UK.....	174
Appendix 7: Method for obtaining ratings of trustworthiness/selecting stimuli.....	175
Appendix 8: Table with characteristics of patients in each video.....	177
Appendix 9: Study instructions.....	178
Appendix 11: Vignettes.....	181
Appendix 13: Further results.....	185

Tables and Figures

Part 1: Literature review

Table 1: <i>Methodologies of included studies</i>	23
Table 2: <i>Studies with chronic pain at baseline</i>	29
Table 3: <i>Assessment of the methodological quality of studies with chronic pain at baseline: results</i>	31
Table 4: <i>Studies with depression at baseline</i>	38
Table 5: <i>Assessment of the methodological quality of studies with depression at baseline: results</i>	39
Table 6: <i>Studies including other variables</i>	44
Table 7: <i>Assessment of the methodological quality of studies including other variables: results</i>	46
Figure 1: <i>Flowchart illustrating the selection process of papers</i>	21

Part 2: Empirical paper

Table 1: <i>Demographic information: pain clinicians</i>	97
Table 2: <i>Demographic information: medical students</i>	97
Table 3: <i>Means for the effect of history of depression on pain estimates and judgements</i>	99
Table 4: <i>Means for the effect of history of depression on likelihood of indicating pain management</i>	100
Table 5: <i>Means for the effect of perceived trustworthiness on pain judgements</i>	102
Table 6: <i>Means for the effect of perceived trustworthiness on likelihood of indicating pain management</i>	103
Table 7: <i>Means for the effect of gender on pain estimates and judgements</i>	104
Table 8: <i>Means for the effect of gender on likelihood of indicating pain management</i>	104
Table 9: <i>Interactions between history of depression, trustworthiness and gender for pain judgements</i>	106
Table 10: <i>Means and post hoc test results for the trustworthiness x gender interaction</i>	107
Table 11: <i>Means and post hoc test results for the history of depression x gender interaction</i>	109
Table 12: <i>Means for the history of depression x trustworthiness x gender interaction</i>	110
Table 13: <i>Means and post hoc test results for the trustworthiness x gender interaction</i>	112
Table 14: <i>Means and post hoc test results for the history of depression x gender interaction</i>	113
Table 15: <i>Means for the effect of training level on pain judgements</i>	114
Table 16: <i>Means for the effect of training level on likelihood of indicating pain management</i>	115
Table 17: <i>Interactions between training level, history of depression, trustworthiness and gender for pain estimates, judgements and management decisions</i>	117
Table 18: <i>Means and post hoc test results for the trustworthiness x gender interaction</i>	118
Table 19: <i>Means and post hoc test results of the history of depression x training level interaction for likelihood of prescribing antidepressants</i>	119
Table 20: <i>Mean empathy scores of clinicians and medical students</i>	121

Acknowledgements

I would like to thank Dr. Amanda C de C Williams for her supervision, support and invaluable feedback throughout the research process. She was incredibly generous in sharing her vast knowledge about pain research and her great enthusiasm for the subject with me. I am very grateful for all of her help. I would also like to thank my course tutor, Professor Nancy Pistrang, for her support throughout the course.

I am very grateful to Dr Ken Prkachin and Kimberley Kaseweter for providing me with the stimuli used in the empirical study. I would also like to show my appreciation to all of the pain clinicians and medical students who volunteered to take part in the research.

Personally, I am so grateful to my parents, Mary and Werner, and my sister, Aoibheann for their constant support. I would like to thank Tom, my best friend, for believing in me and for helping me to get through it all. Lastly, I would like to thank my cat Bellz for her constant companionship and conditional love.

Part 1: Literature Review

A Review of the Association between Chronic Pain and Depression

Abstract

Background Patients with chronic pain are reported to be at an increased risk for developing depression.

Aim To review the current evidence for associations between chronic pain and depression.

Method PsychInfo and Ovid Medline searches for prospective studies measuring chronic pain and depression identified 15 articles meeting criteria.

Results Studies provided some evidence that depression in patients with chronic pain leads to increased pain at follow-up, and that chronic pain in patients with depression leads to worse outcomes in treated or untreated depression at follow-up. Studies investigating other variables involved in the relationship between chronic pain and depression found that catastrophising, self-efficacy, acceptance-related coping strategies and physician's prognosis may influence outcomes in depression and chronic pain. The majority of studies used depression measures that include somatic symptoms, possibly inflating depression scores and undermining confidence in the results.

Conclusions Future studies should use measures suitable for chronic pain populations. Interventions targeting both depression and chronic pain might improve outcomes, but their efficacy in patients with both chronic pain and depression awaits investigation.

Introduction

This review provides a brief overview of the relationship between chronic pain and depression, a detailed review of recent findings examining this relationship and a discussion of the psychological implications. Additionally, this review will discuss how the findings fit with current theories concerning the association between chronic pain and depression.

Chronic pain

The International Association for the Study of Pain defines pain in humans as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey, 1979). Pain may be described as either acute or chronic, with pain that continues for more than three months commonly defined as chronic pain. Chronic pain affects approximately 20% of adult Europeans (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006), and approximately 10% of adults are diagnosed with chronic pain each year worldwide (Goldberg & McGee, 2011). It has a significant impact on those who experience it; people with chronic pain are more likely to have an anxiety or depressive disorder and to experience significant activity limitations (Gureje, Von Korff, Simon, & Gater, 1998).

Factors affecting onset and outcome of chronic pain

Pain processing is influenced by biological, psychological and social factors such as genetics, neurological structures, neurotransmitters, cognition, mood and the context in which the pain occurs and is therefore highly variable (Tracey & Mantyh, 2007). Similarly, the development of chronic pain has been associated with a range

of interacting biopsychosocial risk factors including female sex (Filligim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley, 2009), older age (Verhaak, Kerssens, Dekker, Sorbi, & Bensing, 1998), health behaviours such as smoking (Shiri, Karppinen, Leino-Arjas, Solovieva, & Viikari-Juntura, 2010), and social factors such as lower levels of formal education (Dionne et al., 2001). The psychological factor of mood also plays a role, with depression, anxiety and anger all found to be associated with the development of chronic pain (Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Kroenke et al., 2011; van der Windt, Dunn, Pincus, & McCracken, 2013). Of these, depression has received the most attention and will be the focus of this review.

Depression and its occurrence with chronic pain

The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; American Psychiatric Association, 2013) describes the primary symptoms of major depression as either depressed mood or loss of interest or pleasure. The symptoms need to be present for at least two weeks, and in addition, at least five additional symptoms need to be present. These symptoms are: loss of energy, disturbed appetite and sleep, feelings of worthlessness and guilt, suicidal ideation and diminished ability to think or concentrate. Diagnosis of depression when chronic pain is present is a complex issue, as chronic pain and depression have several symptoms in common, including sleep disturbance, loss of energy and diminished ability to concentrate, leading to a risk of overdiagnosis of depression (Williams, 1998) and an inflation of prevalence estimates for depression in patients with chronic pain (e.g. Breivik et al., 2006; Miller & Cano, 2009). Despite this, depression rating scales that include somatic symptoms, such as the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), are commonly used in pain populations despite only being

validated in psychiatric populations from which those with physical illness and disability had been excluded (Morley, Williams, & Black, 2002).

Additionally, there is evidence that depression experienced by patients with chronic pain is different to depression experienced by patients without chronic pain. For example, patients with chronic pain were not found to take a particularly negative view of themselves (Morley et al., 2002) and cognitions relating to depression in patients with chronic pain differ from cognitions experienced by patients with depression alone, with depressed patients with chronic pain more likely to have negative cognitions related to health (Pincus, Pearce, McClelland, & Isenberg, 1995; Rusu, Pincus, & Morley, 2012). These findings imply that possible differences between depression in chronic pain and depression in the absence of chronic pain should be considered.

Theories of the association between chronic pain and depression

Several theories have attempted to explain why chronic pain and depression frequently occur together. Many of these theories are problematic as they view depression and chronic pain as two distinct disorders that are independent of one another, and ignore their overlapping symptoms.

One outdated theory suggests that in the absence of tissue damage, depression precedes pain and the pain is the result of an underlying emotional conflict that the patient is unable to confront (Blumer & Heilbronn, 1982). This unhelpful view placed 'blame' on the patient for their pain, and there is ample evidence against this theory (Turk & Salovey, 1984). Another simplistic theory is that pain is a direct cause of depression (Fishbain, Cutler, Rosomoff, & Rosomoff, 1997), but evidence for this is mixed.

More recently, theories have recognised that the relationship between chronic pain and depression is not straightforward; these have moved away from simple explanations of causation and include cognitive processes as well as behaviours and symptoms (Pincus & Williams, 1999). A starting point for theories relating to chronic pain and depression is Beck's cognitive theory, which suggests that attitudes and biases about the self are formed during early childhood experiences and are integrated cognitively in the form of schemata and core beliefs (Beck, 1967). Events later in life can activate the schemata, leading to automatic thoughts that affect emotions, biological reactions and behaviours, and distorting perceptions of the event (Beck, 1976). Emotional distress, including depression, occurs when individuals become stuck in unhelpful patterns of thinking and behaviour.

The diathesis-stress model (Banks & Kerns, 1996) integrates Beck's (1967) cognitive model, and suggests that individuals with increased sensitivity to particular stressors, either through genetic vulnerability or early adverse experiences, may have an increased risk of developing depression. Banks and Kerns (1996) suggest that chronic pain is one such stressor because of its persistence and the wide-ranging effects it can have on a person's life, such as restriction of pleasurable activities and loss of roles. Vulnerable individuals who have chronic pain may experience negative thoughts relating to their situation and develop feelings of helplessness and hopelessness, which may then increase their perception of pain. A vicious cycle develops where increased perception of pain further activates depressive cognition and feelings of a loss of control, resulting in the development of depression. While the diathesis-stress model was helpful in moving away from more simplistic models of the development of chronic pain (e.g. Blumer & Heilbronn, 1982) and provides an explanation for why not all people with chronic pain experience depression, there is a

lack of studies investigating this theory (Williams, 2007). The model also does not take systemic and cultural differences into account.

More recently, Linton and Bergbom (2011) presented a model that includes a role for catastrophising and emotional regulation in the relationship between chronic pain and depression. It suggests that a flare-up of pain triggers catastrophic worry in the patient, which in turn puts a strain on emotional regulation and leads to an increase in negative affect, pain and mood-related disability. Like the diathesis stress model above, there is a lack of inclusion of the role of the wider system and culture. Both models also view chronic pain and depression as two independent conditions and fail to take into account the overlap of symptoms between the two. Williams (1998) suggests that a phenomenological approach needs to be taken with regards to the co-occurrence of chronic pain and depression. This approach includes patients' experiences and social and cultural contexts as well as interactions with health professionals.

Contemporary psychodynamic perspectives have also moved away from the Blumer and Heilbronn's (1982) simplistic model by developing a complex biopsychosocial model. They suggest that biological and environmental factors interact to predispose a patient to chronic pain and depression. In response to stress and anxiety, patients rely on attachment-deactivating and attachment-hyperactivating strategies that lead to impairments in their ability to mentalise (Luyten, Van Houdenhove, Lemma, Target, & Fonagy, 2013). Impairment in mentalising might lead the patient to adopt a *psychic equivalence mode*, where patients equate psychological and physical pain, and emotional and physical exhaustion. Luyten et al. (2013) suggest this mode might explain the high co-occurrence of pain, fatigue and depression.

From a biological perspective, neurochemical and neuroanatomical similarities between chronic pain and depression might play a role in their common co-occurrence (Delgado, 2004). An individual's perception of pain is influenced by the interplay of ascending and descending neural pathways. Ascending pain pathways transmit peripheral nociceptive signals to the brain via the spinal cord. Descending pathways are active in the other direction, and involve projections from cortical, subcortical and midbrain regions to the brain stem and on to the spinal cord, where the release of neurotransmitters can inhibit or amplify ascending pain signals (Bushnell, Ceko, & Low, 2013). Outputs from 'higher' regions of the brain, including the prefrontal cortex (Bushnell et al., 2013) and limbic areas also reach the midbrain, which might explain how cognitions and low mood can influence the experience of pain (Tracey & Mantyh, 2007). The neurotransmitters serotonin (also known as 5-hydroxytryptamine or 5-HT) and norepinephrine have both been linked to the development of depression, with lower levels of both associated with depression, and both also found to play a role in pain modulation by inhibiting ascending peripheral pain messages (Bair et al., 2003). Therefore, when there is a decrease in one or both of these neurotransmitters, the peripheral pain signals may be increased, leading to an elevation in the experience of pain. One possibility is that a decrease in these neurotransmitters is a common cause of both conditions. While low serotonergic and noradrenergic activity in the midbrain and brain stem can enhance ascending pain signals, depletion of these neurotransmitters in limbic areas could have the dual effect of inducing depressive symptoms and enhancing nociceptive signals further, leading to both depression and the *exacerbation* of pre-existing chronic pain conditions (Bair et al., 2003). Alternatively, a decrease in serotonin and norepinephrine may lead to depression and *induce* chronic pain, as reduced levels of

descending inhibition would lead to amplified pre-existing sub-perceptual nociceptive signals, to the extent that they become strong enough to be registered as painful by the person (Bair et al., 2003).

A second possible scenario is that consistently high levels of glucocorticoid stress hormones, triggered by chronic pain, could damage serotonergic neurons in limbic areas, particularly the hippocampus, reducing their ability to produce serotonin (Blackburn-Munro & Blackburn-Munro, 2001). The resulting reduction in serotonin levels may lead to symptoms of depression (Duman, Heninger, & Nestler, 1997). It is important to note that the situation is more complex than described here as these two neurotransmitters can also facilitate ascending pain signals depending on which receptor is activated. For instance, although the activation of 5-HT₇ receptors by serotonin can inhibit pain signals in rats, the activation of the 5-HT₃ receptor facilitates them (Dogrul, Ossipov, & Porreca, 2009). Several other neurotransmitters have also been associated with the development of pain and depression (Campbell, Clauw, & Keefe, 2003).

Attempts at explaining a biological basis for the development of chronic pain and depression also neglect to mention a role for social factors in their development. Some pain related behaviours, such as facial expressions or verbal communication, are social in nature and serve to communicate pain to others (Cano & Williams, 2010). These behaviours can be reinforced depending on different social responses such as validation or reassurance from others, and they might also affect a patients' emotional state or experience of pain. For example, one study found that chronic pain patients who perceived their spouse to be critical and hostile towards their experience of pain were more likely to have increased pain intensity 3 hours later (Burns et al., 2013). Another study found that frequent hostile spousal reactions to

pain were associated with increased pain intensity and decreased marital satisfaction, which then led to increased symptoms of depression (Cano, Weisberg & Gallagher, 2000). This evidence suggests that it is important to include social factors in models of the development of chronic pain and depression.

Reviews on chronic pain and depression

There have been several reviews on the association between chronic pain and depression. However, many reviews have tended to view chronic pain and depression as independent conditions and have therefore focused on questions of causality. By doing this, they fail to capture the complexity of the relationship between the two conditions and do not address the issue of common symptoms occurring in both. They also include epidemiological and cross-sectional studies, which provide limited information about the association between chronic pain and depression and cannot demonstrate causal relationships. They do not include measures of the methodological quality of the studies included in the reviews, so the following summary of findings from the reviews should be interpreted with caution. One review focused on the question of whether depression is an antecedent or consequence of chronic pain (Fishbain, Cutler, Rosomoff, & Rosomoff, 1997). Fishbain et al. (1997) found more studies providing evidence that depression is caused by chronic pain than studies suggesting that it is an antecedent of chronic pain. Bair and colleagues (2003) reviewed studies investigating the prevalence of comorbidity of chronic pain and depression and the consequences of comorbidity on diagnosis and treatment outcomes. Though there were a limited number of longitudinal studies, there was evidence for a reciprocal relationship between pain and depression, with an increase in pain severity and interference with daily

activities leading to an increase in symptoms of depression. To improve outcomes, they suggest that treatment needs to include assessment and treatment of both depression and pain.

A more recent review asked whether depression triggers pain, whether treating one results in improvements in the other, and discussed the possible mechanisms by which pain and depression are linked (Linton & Bergbom, 2011). The review found evidence for the co-occurrence of depression and pain but limited evidence that depression is preceded by pain. They found evidence suggesting that in order to maximise improved outcomes, both depression and chronic pain need to be treated as opposed to targeting just one and recommended early intervention for depression.

Aims of the current review

This paper will review the literature examining the association between chronic pain and depression. It will address the following questions:

1. Does depression affect pain and disability outcomes in patients with chronic pain undergoing nonspecific treatments?
2. Does pain affect outcomes in treated or untreated depression?
3. What variables mediate outcomes in chronic pain and depression at follow-up?
4. What are the psychological implications of the findings?

Previous reviews include cross-sectional studies, which provide limited information about the association between chronic pain and depression and cannot demonstrate causal relationships. Further, they have included general population

studies rather than patient samples, the most clinically relevant group. This review will include studies with longitudinal designs in clinical populations only.

Method

Search strategy

An initial search for past reviews uncovered several review papers examining the link between chronic pain and depression, described above. Because of the wide-ranging questions of Linton and Bergbom's (2011) review, a large amount of literature is discussed and no individual study is reviewed in any depth. The search was conducted to include studies published after the review by Bair et al. (2003) to limit results to a manageable quantity.

Selected databases (PsycINFO, Medline) and the reference lists of relevant papers were searched. An initial search included the search terms (*depress**) or (*low mood*) combined with (*chronic pain*) or (*subacute pain*) or (*sub-acute pain*) or (*acute to chronic pain*) or (*enduring pain*) or (*continual pain*) or (*sustained pain*) (Appendix 1). Two extra papers were identified when relevant reference lists were examined. One of the papers did not initially come up in the search because pain was described as 'back pain' in the study. Therefore, the search was re-run to include the additional search terms of (*back pain*), (*musculoskeletal pain*), (*neck pain*) and (*shoulder pain*). In total 2370 papers were identified after removal of duplicates. The titles and abstracts of the resulting papers were then examined by the reviewer (see Figure 1 for a flowchart of the selection). Longitudinal epidemiological studies including participants from the general population at the beginning of the study were not included in the review due to the lack of good examples in the literature.

Eligibility criteria

The search was limited to studies from 2003 – 2013, written in English and with human participants. Studies were included if they met the following criteria: 1) reported in a peer-reviewed journal; 2) had a longitudinal design; 3) based on a clinical population where the majority of participants (>50%) had sub-acute pain (defined as pain lasting 4 weeks or longer) or chronic pain (defined as pain lasting 3 months or longer) and/or depression; 4) not focused on treatment outcomes; 5) pain and depression were both measured at baseline and follow-up; 6) the primary sample was adults; 7) chronic pain was not related to a specific disease process (e.g. cancer or rheumatoid arthritis). When there was more than one study describing the same sample population, the most recent paper was selected. There were no exclusion criteria.

Data extraction

Data pertaining to the following elements from all studies were abstracted by the author: 1) country of study, 2) recruitment method, 3) sample population, 4) sample size, 5) time from baseline to follow-up(s), 6) pain measures, and how they were entered into analyses, 7) depression measures, and how they were entered into analyses, 8) additional variables, 9) aims, 10) main findings. These data were used to assess the methodological quality of the studies and their findings.

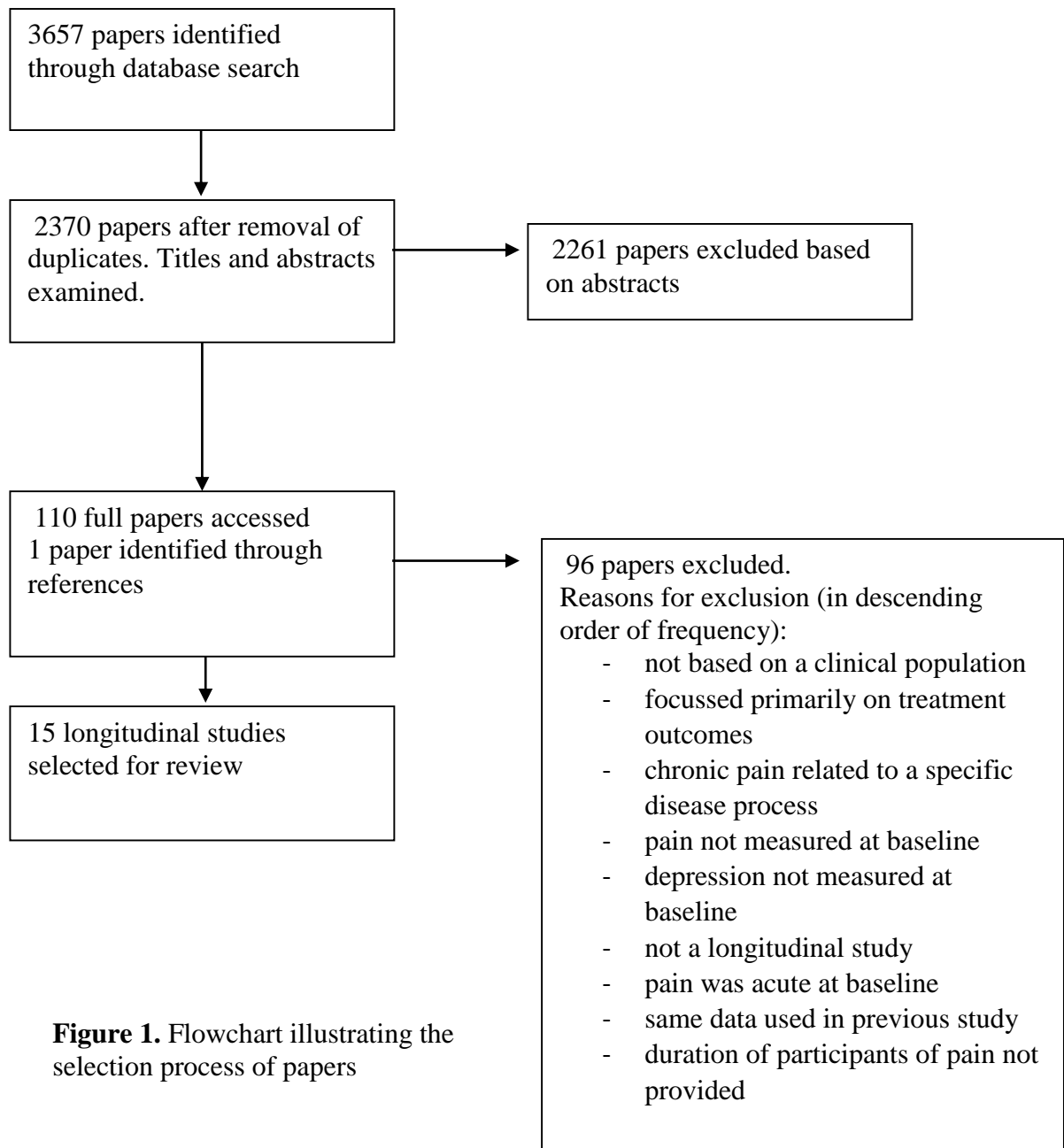


Figure 1. Flowchart illustrating the selection process of papers

Results

Overview of papers

Of the 3657 initial search results, 15 studies were chosen for the review. There was some variation in study methodologies ranging from postal questionnaires to face-to-face clinical interviews. There was also a wide range in time between baseline and follow-up points, ranging from 2 months to 5 years. Sample recruitment and data collection methods are shown in Table 1, below. Studies were grouped according to whether they 1) included patients with chronic pain at baseline, 2) included patients with depression at baseline, and 3) focused on identifying variables that mediated outcomes in chronic pain and depression.

Table 1. Methodologies of included studies

Author (Year) Country	Recruitment method	Data collection method	Sample population	Mean age (years; <i>SD</i>); range	Sample size (n male)	Time from baseline to follow up(s)
<i>Studies with chronic pain at baseline</i>						
Dunn et al. (2007) UK	Recruited via a postal survey	Self report questionnaire	Patients with low back pain	46.6 (8.2), 30 - 59	426 (188)	12 months
Hurwitz et al. (2003) USA	Recruited via postal survey	Self report questionnaire	Patients with back pain	51 (16.7), NP	681 (327)	2 weeks, 6 weeks, 6, 12 and 18 months
Kroenke et al. (2012) USA	Recruited during a clinic visit	Clinical interviews	Patients with chronic low back, hip or knee pain – 127 with depression, 250 without	55.8 (11.0), NP	377 (187)	3 months, 6 months and 12 months
Muller et al. (2013) UK	Recruited during general practice consultations	Self report questionnaire	Patients with chronic pain	65.2 (9.5), >50	329 (126)	12 months
Ryall et al. (2007) UK	Recruited during primary care appointments, physiotherapy appointments and a triage clinic	Self-report questionnaire Clinical assessment Telephone interview	Patients with chronic arm pain	NP, 15 - 64	313 (127)	1 month, 3 months, 6 months and 12 months

Von Korff et al. (2005) USA	Recruited during a primary care clinic visit	Telephone interviews	Patients with chronic back pain	NP, 18 - 75	1213 (600)	1, 2 and 5 years
<i>Studies with depression at baseline</i>						
Chung et al. (2012) Hong Kong	Recruited during a clinic visit	Clinical interview	Patients with a diagnosis of major depressive disorder	48.3 (9.5) 18 – 65	82 (18)	3 months
Gerrits et al. (2012) Netherlands	Screening questionnaire posted to participants	Clinical interview, self-report questionnaires	Patients with depressive and/or anxiety disorder at baseline	42.1 (12.3), NP	1209 (531)	24 months
Kroenke et al. (2008) USA	Recruited during a clinic visit	Clinical interviews, telephone interviews at follow-up	Patients with a diagnosis of depression	42.0 (NP), NP	405 (81)	3 months and 6 months
<i>Studies with other variables</i>						
Lerman et al. (2012) Israel	Recruited during clinic visit	Self-report questionnaires Telephone interview	Patients with chronic pain	56.7 (14.1), 19 - 90	163 (61)	An average of 4.34 months (range 2-8 months)
McCracken et al. (2005) UK	Recruited during clinic visit	Clinical assessment	Patients with chronic pain	44.2 (10.7), NP	118 (NP)	An average of 3.9 months

McCracken et al. (2007) UK	Recruited during clinic visit	Clinical assessment	Patients with chronic pain	44.6 (10.7), NP	115 (53)	An average of 3.7 months
Rudich et al. (2010) Israel	Patients approached while waiting for their first visit to a pain specialist	Questionnaires and medical assessment	Patients with chronic pain	58.0 (13.0), 24 - 81	45 (19)	An average of 5 months (range 2-8 months)
Van Liew et al. (2013) USA	Advertisements in newspapers and physician offices, referrals by physicians	Questionnaires	Patients with fibromyalgia syndrome (majority female)	54 (11.1), NP	462 (20)	6 months, 12 months
Velly et al. (2011) USA	Advertisements in local dentists	Clinical examination Questionnaires	Patients with chronic temporomandibular joint pain	36.8 (12.2), NP	480 (276)	18 months

NP Not provided

Methodological quality assessment

Assessment of methodological quality was informed by recommendations to assess the quality of non-randomised studies from Chapter 13 of the Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0; Reeves, Deeks, Higgins, & Wells, 2011). The Newcastle-Ottawa Scale (NOS; Wells, Shea, O'Connell, & Peterson, 2000) was chosen to assess the quality of studies and was adapted to meet the requirements of this review (Appendix 2). The reviewer assessed the methodological quality.

Items on the NOS are: representativeness of the sample population, appropriate selection of the control cohort, reliable and valid measurement of chronic pain and depression at baseline and/or follow-up, control for gender and age, length of time between baseline and follow-up, and adequacy of follow-up of the cohort. Studies met the aforementioned criteria if they 1) included a sample population representative of typical patients with chronic pain or depression, 2) included a control cohort from a similar population 3) included reliable and valid measures of depression and chronic pain at baseline, including measures of depression that were valid for a pain population, 4) had a sample size of more than 50 participants, 5) controlled for gender and age, 6) included reliable and valid measures of depression and chronic pain at follow-up, 7) time from baseline to follow-up was greater than 6 months, 8) had less than 25% participants lost to follow-up and/or controlled for differences in participants lost to follow-up in the analyses. A maximum of eight stars could be awarded for any study. Quality ratings are summarised in Tables 3, 5 and 7.

Summary of findings

1. Does depression affect pain and disability outcomes in patients with chronic pain undergoing nonspecific treatments?

Six studies were identified that included patients with chronic pain at baseline and focused on how depression affects outcomes in chronic pain. These are described in Table 2, below.

Methodological quality of the studies

Overall, quality ratings for the studies in this group ranged from 6 – 7 out of a possible 8. All studies included patients who were representative of the chronic pain population, controlled for gender and age in their analyses, had a sample size of greater than 50 participants, had a follow-up time period of greater than 6 months, and where more than 25% of baseline participants were lost to follow-up, reported any differences between participants lost to follow-up and participants who stayed in the study. Some studies present problems concerning the measurement of depression and pain, and these will be discussed in the next two sections.

Measurement of pain and inclusion of participants with chronic pain

Participants' reports of the length of time they had been experiencing pain varied between studies. One study included patients with pain for at least 3 months, with at least moderate pain, defined as a score of 5 out of 10 or greater on the Brief Pain Inventory (Keller et al., 2004; Kroenke et al., 2012). Another study included patients who reported pain ranging from less than 3 weeks to more than 1 year (Hurwitz, Morgenstern, & Yu, 2003). Four studies included patients with a range of

time since the first onset of pain, ranging from less than 3 months to over 3 years, and some patients being included in the study at their first presentation to the service and others after several visits (Dunn, Croft, Main, & Von Korff, 2008; Muller, Thomas, Dunn, & Mallen, 2013; Ryall, Coggon, Peveler, Poole, & Palmer, 2007; Von Korff & Miglioretti, 2005). Measurement techniques used included established self report instruments such as the Chronic Pain Grade Scale (Von Korff, Ormel, Keefe, & Dworkin, 1992) and numerical rating scales (Jensen & Karoly, 1992). Follow-up measurement of pain varied, with Ryall et al. (2007) using patient reports of whether their pain was continuing. Kroenke et al. (2012) used the Chronic Pain Grade Scale but did not dichotomise patients into pain vs. no pain, instead analysing data according to four pain grades. The Chronic Pain Grade Scale uses two scales to measure pain severity and pain disability. Scores on the scale can be used to classify patients into the following grades 1) low intensity, low disability, 2) high intensity, low disability, 3) high disability, moderately limiting, and 4) high disability, severely limiting (Von Korff et al., 1992). Dunn et al. (2008), Muller et al. (2013) and Von Korff et al. (2005) also used the Chronic Pain Grade Scale, and considered a grade of two or higher as clinically significant back pain. Hurwitz et al. (2003) classified participants as having clinically meaningful low back pain if they reported scores of 2 or more out of 10 in the numerical rating scale.

Table 2. Studies with chronic pain at baseline

Author (year)	Pain measures, classification of pain in analyses	Depression measures, classification of depression in analyses	Other variables at baseline	Aims	Main findings
Dunn et al. (2007)	Chronic Pain Grade Scale Dichotomous	Hospital Anxiety and Depression Scale* Integrated into an overall 'risk score'	Age Sex Employment	To investigate whether a prognostic approach to defining chronic pain developed in the US by Von Korff (2005) can be applied to a UK population	The cut-off points for chronic pain developed in the US population were replicated in the UK population, apart from the low-risk cut-off points
Hurwitz et al. (2003)	Numerical rating scales for pain intensity, 0 – 10. Frequency of pain in past week Dichotomous	Five-item Mental Health Index from the Short Form Health Survey* Dichotomous	Age Sex Employment Education Sickness Impact Profile	To provide a longitudinal estimation of associations of low-back pain and disability with psychological distress	Pain and disability at baseline significantly predicted subsequent depression at follow-up and depression at baseline predicted pain and disability at follow-up
Kroenke et al. (2012)	Brief Pain Inventory Chronic Pain Grade Scale Continuous	PHQ-9 Dichotomous Hopkins Symptom Checklist	Age Sex Pain location Self-efficacy Short Form Health Survey (Quality of Life) Race	To investigate whether comorbid depression at baseline is associated with worse pain outcomes at follow-up	Patients with comorbid depression at baseline had increased pain severity and worse pain-related disability at follow-up. Only 10% of patients in the non-depressed group went on to develop depression at follow-up

Muller et al. (2013)	Chronic Pain Grade Scale Dichotomous	Hospital Anxiety and Depression Scale* Integrated into an overall 'risk score'	Age Sex	To test whether Von Korff's (2005) prognostic approach to chronic pain was successful in predicting pain in older adults	The cut-off points for chronic pain in Von Korff's (2005) study were replicated, though newer cutoffs were needed to adjust for higher risk profiles for older adults
Ryall et al. (2007)	The Southampton Examination Schedule for Upper Limb Disorders Frequency of pain Patient reports of continuing pain Dichotomous	Hospital Anxiety and Depression Scale* Dichotomous	Age Sex Somatizing tendency Health anxiety Fear-avoidance beliefs	To investigate potential risk factors for the persistence of arm pain	Depression was not found to be a significant predictor of continuing arm pain. Male sex, higher frequency of pain in the past month at baseline, chronic pain at other sites and current smoking predicted continuing pain
Von Korff et al. (2005)	Characteristic Pain Intensity (0-10 rating) Pain Interference Score (0-10 rating) Pain Impact Score Chronic Pain Grade Dichotomous	SCL-90 depression scale Integrated into an overall 'risk score'	Age Sex Number of days with back pain in the prior 6 months Number of other pain sites	To investigate whether symptoms of depression, number of pain sites and number of days of pain in the previous 6 months can be used to predict the course of chronic pain	High levels of baseline depression significantly raised the risk of severe back pain at year 1. Lower levels of depressive symptoms at baseline had a decreased risk of having severe back pain at year 1, even when participants had severe back pain at baseline

* measure of depression is suitable for the pain population

Table 3. Assessment of the methodological quality of studies with chronic pain at baseline: results

Author (year)	Selection		3. Reliable and valid measurement of pain and depression at baseline	4. Sample size (>50 participants)	Control	Outcome		8. Participants lost to follow-up < 25%	Total
	1. Selection: representative- ness of the cohort	2. Selection of the control cohort			5. Control for gender and age	6. Reliable measurement of pain and/or depression at follow-up	7. Time from baseline to follow-up > 6 months		
Dunn et al. (2007)	*	n/a	*	*	*	*	*	*	7
Hurwitz et al. (2003)	*	n/a	*	*	*	-	*	*	6
Kroenke et al. (2012)	*	*	+	*	*	*	*	*	7
Muller et al. (2013)	*	n/a	*	*	*	*	*	*	7
Ryall et al. (2007)	*	n/a	*	*	*	-	*	*	6
Von Korff et al. (2005)	*	n/a	+	*	*	*	*	*	6

* criterion met - criterion not met + measurement of depression included somatic symptoms n/a no control cohort, not applicable

Measurement and classification of depression

Studies varied not only for their chosen measures of depression, but also for how they integrated the scores for the measures into analyses. Three studies used the Hospital Anxiety and Depression Scale (Dunn et al., 2007; Muller et al., 2013; Ryall et al., 2007; HADS; Zigmond & Snaith, 1983) to measure depression and one study used the 5-item mental health index (MHI-5; Hurwitz et al., 2003; McHorney, Ware, & Raczek, 1993). Both the HADS and the MHI-5 exclude somatic symptoms in their measurement of depression, therefore avoiding score inflation by symptoms of chronic pain. Hurwitz et al. (2003) considered patients as depressed if their score was below the median of 76, and patients were divided into two groups according to whether their scores were above or below 76 in the analyses. Dunn et al. (2007), Muller et al. (2013) and Von Korff et al. (2005) integrated the depression scores into an overall 'risk score' designed to predict pain at follow-up. Ryall et al. (2007) classified patients as depressed if they had a HADS depression score greater than eight out of a total of 21, classifying patients with mild, moderate and severe depression in the same group (Zigmond & Snaith, 1983). This was entered into analysis as a risk factor for continuing pain. Kroenke et al. (2012) used the PHQ-9 to determine whether patients were depressed at the beginning of the study, with patients with a score higher than ten classified as depressed, and lower than seven as non-depressed. They used the 20-item Hopkins Symptom Checklist for Depression (HSCD) due to its sensitivity to change at follow-up (Löwe, Unützer, Callahan, Perkins, & Kroenke, 2004). Von Korff et al. (2005) used the Symptom Check-List to measure depression (SCL-90-R; Derogatis, 1986). The PHQ-9, the HSCD and the SCL-90-R all have significant contribution from somatic symptoms which are also characteristic of chronic pain and one study on a population with chronic pain did not

find evidence for the validity of the SCL-90-R in this population (Hardt, Gerbershagen, & Franke, 2000).

Discussion of findings

The studies in the review used a range of different measures, methods and time periods between baseline and follow-up, which makes it difficult to compare their results. However, five of the six studies found evidence that depression at baseline had adverse effects on chronic pain at follow-up. Some of these studies are discussed below since they used problematic tools to assess depression and chronic pain, which call their results into question. The findings of the studies are summarised in Table 2.

One study (Ryall et al. 2007) found that depression did not predict continuing chronic pain, while three other studies (Hurwitz et al., 2003; Muller et al., 2013; Dunn et al., 2008) reported that depression at baseline predicted pain at follow-up. All used suitable depression scales, but Ryall used a low cut-off score and classified patients as depressed versus not, thus the 'depressed sample' very likely included some very mild depression.

Von Korff et al. (2005) developed a score to predict patients' prognosis in chronic pain using baseline scores of depression, pain sites and duration of pain. Dunn et al. (2008) and Muller et al. (2013) replicated the study but with an appropriate depression scale and showed that their method of prediction is also valid in adults and older adults in the United Kingdom, respectively. While these studies showed that depression can be used to predict chronic pain at follow-up, they included depression in total 'prognosis' score, calculated alongside pain sites and duration of pain at baseline, so the specific role of depression could not be estimated

from these studies. Dunn et al. (2008) and Muller et al. (2013) also used postal questionnaires, which may introduce bias against people with literacy or language difficulties.

Von Korff et al. (2005) and Kroenke et al. (2012) both used measures of depression that included somatic symptoms, possibly inflating depression scores, and possibly accounting for their findings that depression at baseline leads to worse pain outcomes at follow-up.

Another aspect that makes findings difficult to interpret is dichotomous classification of depression in several studies (Hurwitz et al., 2003; Kroenke et al., 2012; Ryall et al. 2007). Information about symptom severity is thus lost, and similar participants whose scores fall close to the cut-offs and within the limits of the standard error of measurement, are classified in different groups. Where measures that include somatic symptoms have been used, such as by Kroenke et al. (2012), there is also a risk of the somatic symptoms of pain elevating patients' scores over the cut-off points, erroneously classifying participants as depressed.

While Hurwitz et al. (2003) used an appropriate measure of depression for patients with chronic pain, their use of 2/10 as the cut-off for clinically significant pain in patients compromises the validity of their results, as there is no adequate evidence for this (Krebs, Carey, & Weinberger, 2007). Hurwitz et al., (2003) claim that their study provides evidence that the relationship between chronic pain and depression works in both directions, with depression at baseline predicting increased pain and disability at follow-up, and increased pain and disability at baseline also predicting increased depression at follow-up, but their method of dichotomising pain obscures most changes in pain over that time.

Overall, five out of the six studies provided evidence that depression at baseline has a negative impact on chronic pain at follow-up, with higher levels of depression predicting higher levels of pain, but only two of these studies (Dunn et al., 2008; Muller et al., 2013) used a valid measure of depression in a pain population, and therefore were of high enough methodological quality to be counted as evidence. One study, which also used an appropriate measure of depression, did not find depression to predict arm pain at follow-up (Ryall et al., 2007). The findings suggest a very tentative conclusion that depression at baseline has a negative impact on chronic pain at follow-up.

2. How does the presence of pain affect outcomes in patients with treated or untreated depression?

Three studies were identified that included patients with depression at baseline. These are described in Table 4, below.

Methodological quality of the studies

Overall, quality ratings for the studies in this group ranged from 5 – 6 out of a possible 8 (Table 5). All studies included patients who were representative of the chronic pain population, controlled for gender and age in their analyses and had a sample size greater than 50 participants. Two studies had a follow-up time period greater than 6 months. All studies reported any differences between participants lost to follow-up and participants who stayed in the study. Again, studies presented problems concerning the measurement of depression and pain, and these will be discussed in the next two sections.

Measurement of pain

Chung, Tso, Yeung, and Li (2012) used a verbal rating scale and visual analogue scale to assess the severity of pain across different pain sites in each patient including muscle soreness, abdominal pain, heart or chest pain, lower back pain, joint pain and neck pain for the past week. An average score across different sites was then obtained. Gerrits et al. (2012) assessed pain by using the Chronic Pain Grade Scale (Von Korff et al., 1992), classing participants as grades 1- 4 (see above). They also obtained estimates of the duration of pain and number of pain locations. The third study (Kroenke, Shen, Oxman, Williams, & Dietrich, 2008) used the pain interference item from the Short Form Health Survey (Ware & Sherbourne, 1992) and entered both a categorical classification of pain (2 and above on the SF-36 pain interference classified as high interference), and the continuous score on the SF-36 in analyses. They did not obtain a measure of actual pain experienced.

Measurement of depression

Chung et al. (2012) included patients in their study if they had a diagnosis of major depressive disorder according to DSM-IV criteria. They then used the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960) to assess severity of depression. The authors acknowledged that the HRSD contains a large number of somatic symptoms and the depression and anxiety components of the HRSD were analysed separately. The HRSD also has poor content validity and poor retest and inter-rater reliability (Bagby, Ryder, Schuller, & Marshall, 2004). Chung et al. (2012) also used the HADS (Zigmond & Snaith, 1983) to evaluate symptoms from the patients' perspective. Gerrits et al. (2012) screened participants using the Composite International Diagnostic Interview (CIDI; Wittchen, 1994) and the Life

Chart Interview (Lyketsos, Nestadt, Cwi, & Heithoff, 1994). Participants were included if they had symptoms of a depressive and/or anxiety disorder in the previous month, using the CIDI at baseline and at follow-up. The CIDI is based on the DSM-IV symptoms of depression and also contains somatic symptoms in its measurement of depression. Kroenke et al. (2008) included participants in the study if they were diagnosed with depression using the PRIME-MD interview, which is also based on DSM-IV criteria for depression (Spitzer et al., 1995). They then used the 20-item Hopkins Symptom Checklist (HSCD; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974) to assess severity of depression throughout the study. As mentioned above, the HSCD has a significant contribution from somatic symptoms characteristic of chronic pain. They used both categorical classifications of depression (HSCD < 0.5 classified as remission from depression at follow-up) and continuous scores for the HSCD in their analyses.

Table 4. Studies with depression at baseline

Author (year)	Pain measures, classification of pain in analyses	Depression measures, classification of depression in analyses	Other variables	Aims	Main findings
Chung et al. (2012)	Verbal Rating Scale and Visual Analogue Scale for severity of pain in the past week Continuous	Hamilton Rating Scale for Depression Hospital Anxiety and Depression Scale* Continuous	Age Sex Short Form Health Survey (Quality of Life) Pain Catastrophising Scale	To investigate whether pain and pain catastrophising were independent predictors of quality of life in major depressive disorder after accounting for anxiety and depression	Pain severity, and not anxiety and depression were predictive of quality of life at 3 months, with a greater reduction in pain severity associated with greater improvement in quality of life. Pain catastrophising was also associated with quality of life after controlling for depression, severity of pain and anxiety.
Gerrits et al. (2012)	Chronic Pain Grade Scale (location, duration, use of pain medication and severity of pain) Continuous	Composite International Diagnostic Interview Life Chart Interview Dichotomous	Age Sex Education Fear questionnaire (anxiety)	To examine the influence of pain on the course of depressive and/or anxiety disorders while controlling for other variables such as severity, duration and age of onset of depression	More pain locations, joint pain, daily use of pain medication and a higher Chronic Pain Grade score at baseline led to worse outcomes of depressive and anxiety disorders at follow-up. These associations disappeared when controlling for baseline severity of the mental disorder.
Kroenke et al. (2008)	Short Form Health Survey – pain interference item Dichotomous and continuous	PRIME-MD Hopkins Symptom Checklist Dichotomous and continuous	Age Sex Chronic Disease Score	To investigate whether pain affects treatment outcomes in depression	The presence of pain had a significant negative impact on treatment outcomes in depression.

* measure of depression is suitable for the pain population

Table 5. Assessment of the methodological quality of studies with depression at baseline: results

Author (year)	Selection				Control	Outcome			Total
	1. Selection: representativeness of the cohort	2. Selection of the control cohort	3. Reliable and valid measurement of pain and depression at baseline	4. Sample size (>50 participants)	5. Control for gender and age	6. Reliable measurement of pain and/or depression at follow-up	7. Time from baseline to follow-up > 6 months	8. Participants lost to follow-up < 25%	
Chung et al. (2012)	*	n/a	*	*	*	*	-	*	6
Gerrits et al. (2012)	*	n/a	+	*	*	+	*	*	5
Kroenke et al. (2008)	*	n/a	+	*	*	+	*	*	5
* criterion met	- criterion not met	+ measurement of depression included somatic symptoms			n/a no control cohort, not applicable				

Other variables

Chung et al. (2012) included additional variables in their study: the Short Form Health Survey (McHorney et al., 1993) to measure quality of life (QOL) and the Pain Catastrophising Scale to measure pain-related catastrophising (Sullivan, Bishop, & Pivik, 1995). Both studies also assessed anxiety.

Discussion of findings

The findings of the studies are summarised in Table 4. The three studies included in the review that address this question had different outcome variables, with Chung et al. (2012) using QOL and Gerrits et al. (2012) and Kroenke et al. (2008) using depression as an outcome variable. Chung et al. (2012) found evidence suggesting that the severity of pain and pain catastrophising play more important roles than depression and anxiety in predicting QOL. However, the study used a small sample of patients, smaller than is usually required for regression analysis. The patients were moderately depressed and reported an average experience of pain that fell in the mild range; findings might have been different if more severely depressed patients with moderate to severe chronic pain were included in study. Their use of QOL as a variable is also problematic. They used the SF-36 to measure QOL, a questionnaire that contains multiple physical and psychosocial domains, some of which are relevant to pain and depression.

Gerrits et al. (2012) found that more severe pain at baseline was predictive of an increased risk for depression at two-year follow-up. However, this association was no longer present when controlling for baseline severity of depression and anxiety in all pain types except joint pain, which remained associated with worse outcomes independent of baseline severity. The study did not include treatment as a

variable since a previous study found no difference according to treatment (Penninx et al., 2011). Kroenke et al. (2008) found that in treated depression, the presence of pain at baseline has a significant negative impact on treatment outcomes at follow-up. The study covaried the presence and severity of medical co-morbidity, demonstrating that the adverse effects of pain on outcomes in depression are not due to greater medical co-morbidity but to the severity of pain. However, Kroenke et al. (2008) measured pain in the study by pain interference with activities, as opposed to measuring actual pain experienced by patients. Using a measure of pain interference as a measure of pain in a population of depressed patients might have led to inflated scores as baseline levels of depression might have influenced patients' ratings of the interference of pain. Both Kroenke et al. (2008) and Gerrits et al. (2012) used measures of depression that included somatic symptoms, and Gerrits et al. (2012) classified patients dichotomously as 'depressed' and 'not depressed' in their analyses according to the median score for depression. The use of these measures might have led to an inflated estimation of depression and also may have increased the likelihood that chronic pain would lead to worse outcomes in depression, since patients with chronic pain would have been more likely to report somatic symptoms of depression than patients without chronic pain. Analysing the data using a measure of depression that does not include somatic symptoms would have prevented this and given a clearer picture of the relationship between outcomes in depression and chronic pain.

Overall, the studies provide evidence that the pain patients with depression have worse outcomes for depression at follow-up, whether depression is treated or untreated. Pain and pain catastrophising might also independently predict lower QOL at follow-up. The use of measures of depression that include somatic symptoms in

two studies renders their findings impossible to interpret. Therefore, only tentative conclusions can be drawn regarding outcomes for depression when chronic pain is present.

3. What variables mediate outcomes in chronic pain and depression at follow-up?

Six studies were identified that included other variables as well as chronic pain and depression in their analyses. These are described in Table 6, below.

Methodological quality of the studies

Overall, quality ratings for the studies in this group were low: 3 - 7 out of a possible 8 (Table 7). Nearly all studies included patients who were representative of the chronic pain population and controlled for gender in their analyses, apart from Van Liew et al. (2013), which included a large majority of female patients. All studies had a sample size greater than 50 participants, apart from Rudich et al. (2010). Only two studies had a follow-up time period greater than 6 months. All studies reported any differences between participants lost to follow-up and participants who stayed in the study. Again, problems with methodological quality arose in the chosen measures of pain and depression, and these will be discussed in the next two sections.

Measurement of pain

Inclusion criteria for studies varied, with two studies including patients who were receiving treatment at an interdisciplinary pain management unit (McCracken & Eccleston, 2005; McCracken, Vowles, & Gauntlett-Gilbert, 2007), two studies

including patients who were being treated at an outpatient pain clinic and who had pain for at least 3 months (Lerman, Shahar, & Rudich, 2012; Rudich et al., 2010) and other studies using as inclusion criteria a diagnosis of fibromyalgia and temporomandibular joint disorder (TMJD) respectively (Van Liew, Brown, Cronan, Bigatti, & Kothari, 2013; Velly et al., 2011). Participants' reports of the length of time they had been experiencing pain also varied between studies. Patients with pain for at least 3 months were included in five studies (Lerman et al., 2012; McCracken et al., 2007; McCracken & Eccleston, 2005; Rudich et al., 2010; Velly et al., 2011). Van Liew et al. (2013) did not collect data on duration of pain. Again, measurement techniques used included established self-report instruments such as the Chronic Pain Grade Scale (Von Korff et al., 1992), the short-form McGill Pain Questionnaire (Melzack, 1987) and numerical rating scales.

Table 6. Studies including other variables

Author (year)	Pain measures, classification of pain in analyses	Depression measures, classification of depression	Other variables	Aims	Main findings
Lerman et al. (2012)	The Short-Form McGill Pain Questionnaire Continuous	Centre for Epidemiological Studies for Depression Scale Continuous	Age Sex Self-criticism	To examine the role of self-criticism in the relationship between chronic pain and depression	There was a significant 3-way interaction between self-criticism, affective pain and gender – females with high affective pain and self-criticism at Time 1 were more likely to have higher levels of depression at Time 2.
McCracken et al. (2007)	0-10 ratings of present, usual, and highest pain in the past week Continuous	Beck Depression Inventory Continuous	Age Sex Chronic Pain Acceptance Questionnaire Brief Pain Coping Inventory Sickness Impact Profile Pain Anxiety Symptoms Scale	To evaluate the role of control-oriented and acceptance-oriented coping responses in patient functioning	Four factors within the coping data were identified: Pain Management, Pain Control, Help Seeking and Activity Persistence. Higher levels of Pain Management at Time 1 were associated with less depression and pain at Time 2. Pain Control was associated with more pain and depression. Increased Pain Control between Time 1 and 2 was associated with increased depression at Time 2.
McCracken et al. (2005)	0-10 ratings of usual pain in the past week Continuous	Beck Depression Inventory Continuous	Age Sex Chronic Pain Acceptance Questionnaire Pain Anxiety Symptoms Scale Sickness Impact Profile	To prospectively examine the relationship between acceptance of chronic pain and patient functioning	Pain acceptance (composed of activity engagement and pain willingness) at Time 1 significantly predicted depression at Time 2 with increased levels of pain acceptance predicting lower levels of depression

Rudich et al. (2010)	The Short-Form McGill Pain Questionnaire Continuous	Center for Epidemiological Studies Depression Scale Continuous	Age Sex Physician's prognosis Self-criticism (using items from the Depressive Experiences Questionnaire) Pain duration	To investigate whether physician's prognosis ratings predict patient's pain and depression levels at follow-up	Physician's pessimistic ratings of patient prognosis at Time 1 uniquely predicted subsequent depressive symptoms and affective pain but not sensory pain at Time 2 when controlling for Time 1 levels of these variables. Depression at Time 2 was not predicted by self-criticism, depression or pain ratings at Time 1.
Van Liew et al. (2013)	The Short-Form McGill Pain Questionnaire Continuous	Center for Epidemiologic Studies for Depression Scale Continuous	Age Sex Arthritis self-efficacy scale Physical functioning (measured using the Fibromyalgia Impact Questionnaire)	To examine the longitudinal roles of self-efficacy, depression, pain and functioning in the maintenance of pain in patients with fibromyalgia syndrome	Self-efficacy significantly predicted depression, physical functioning and pain intensity ratings over time, with higher self-efficacy predicting lower levels of depression, pain and higher functioning.
Velly et al. (2011)	Chronic Pain Grade Scale Continuous	Beck Depression Inventory Continuous	Age Sex Catastrophising (measured using items from the Coping Strategies Questionnaire)	To investigate the role of depression and catastrophising in progression of pain and disability in patients with temporomandibular joint disorder	There was a positive association between catastrophising at Time 1 and pain intensity and disability at Time 2. Depression at Time 1 was a predictor of disability, but not pain intensity, at Time 2.

Table 7. Assessment of the methodological quality of studies including other variables: results.

	Selection				Control	Outcome				
Author (year)	1. Selection: representativeness of the cohort	2. Selection of the control cohort	3. Reliable measurement of pain and depression at baseline	4. Sample size (> 50 participants)	5. Control for gender and age	6. Reliable measurement of pain and/or depression at follow-up	7. Time from baseline to follow-up > 6 months	8. Participants lost to follow-up < 25%		Total
Lerman et al. (2012)	*	n/a	+	*	*	+	-	*		4
McCracken et al. (2005)	*	n/a	+	*	*	+	-	*		4
McCracken et al. (2007)	*	n/a	+	*	*	+	-	*		4
Rudich et al. (2010)	*	n/a	+	-	*	+	-	*		3
Van Liew et al. (2013)	-	n/a	+	*	-	*	*	*		5
Velly et al. (2011)	*	n/a	+	*	*	*	*	*		6

* criterion met - criterion not met + measurement of depression included somatic symptoms n/a no control cohort, not applicable

Measurement of depression

Three studies measured depression using the Centre for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), which contains items assessing somatic symptoms. A previous evaluation of the CES-D found the somatic items on the scale not to bias depression scores in patients (Foelker & Shewchuk, 1992), though another study recommends raising the cut-off for a diagnosis of depression in a chronic pain population from 16 to 19 (Turk & Okifuji, 1994). This cut-off was mentioned by Van Liew et al. (2013), but depression scores were entered as a continuous variable in analyses. Three studies used the Beck Depression Inventory (BDI; Beck et al., 1961). As mentioned earlier, the BDI includes somatic symptoms in its measurement of depression and previous studies have recommended a higher cut-off score for the chronic pain population (Poole, White, Blake, Murphy, & Bramwell, 2009).

Measurement of other variables

Two studies included acceptance of pain as a measure by using the Chronic Pain Acceptance Questionnaire (McCracken et al., 2007; McCracken & Eccleston, 2005) and pain anxiety. The Chronic Pain Acceptance Questionnaire used in the study has two subscales – activity engagement, encompassing persistence of activity despite pain, and pain willingness, encompassing willingness to accept pain. McCracken and Eccleston (2005) also investigated control-oriented and acceptance-oriented coping using the Brief Pain Coping Inventory. One other study included measures of coping and catastrophising by using the Coping Strategies Questionnaire (CSQ; Velly et al. 2011). One study included self-efficacy as a variable (Van Liew et al., 2013). Self-criticism was included as a variable in two other studies (Rudich et

al., 2010; Lerman et al., 2012) and Rudich et al. (2010) also included physician's prognosis.

Discussion of findings

The studies included addressing this question used a wide range of variables statistical methods and outcomes, further complicating conclusions. The findings of the studies are summarised in Table 6. All studies used measures of depression that included somatic symptoms, and therefore may have overestimated depression scores in patients. However, unlike the studies in the previous questions, continuous scores rather than categories for depression were used in analyses.

One study investigated the role of catastrophising in patients with depression and chronic pain. Velly et al. (2011) found evidence that catastrophising at baseline predicted an increase in pain intensity and disability at 18 months follow-up when controlling for depression. They also found that depression was not a significant predictor of pain at follow-up when controlling for catastrophising, suggesting that the role of depression in the development of chronic pain is mediated by catastrophising.

Two studies examined the role of acceptance in patients with chronic pain. McCracken et al. (2005) found that increased measures of pain acceptance at baseline predicted lower levels of depression at follow-up, suggesting that patients who show signs of willingness to accept pain and persist in activities despite pain are less likely to be depressed at follow-up, regardless of how much pain they were experiencing. McCracken et al. (2007) found that acceptance-oriented coping responses, including pain management responses such as changing activities, physical exercise, paced activity and self-encouragement at baseline were associated

with less depression and pain at follow-up. Coping responses that were more control-oriented such as using painkillers, resting, or using ice or heat were associated with more pain and depression at follow-up. Both studies suggest that acceptance may play a role in decreasing chronic pain and depression at follow-up, but neither study could demonstrate causality due to the stability of acceptance measures and coping strategies at baseline and follow-up. The studies also had a short follow-up period of less than 4 months.

One study (Van Liew et al., 2013) found that high self-efficacy at baseline was associated with lower levels of depression, lower levels of pain and higher levels of physical functioning at follow-up, suggesting that patients who believed they were less able to manage their fibromyalgia symptoms were more likely to become depressed. The authors suggest that targeting self-efficacy could lead to decreases in depression and pain in patients with fibromyalgia. Certain features of the study limit the interpretation of these findings; for example the authors used a measure of depression that includes somatic symptoms. The observed decrease of depression scores in patients with higher self-efficacy at baseline could be due to a decrease in somatic symptoms, related to decreases in pain that were also reported. Additionally, they included only 21 males of 462 fibromyalgia patients in the study. While fibromyalgia occurs more commonly in females, this study has disproportionately few men (Wolfe, Ross, Anderson, Russell, & Hebert, 1995) and findings can only be generalised to women with fibromyalgia.

Lerman et al. (2011) investigated the effects of self-criticism on depression. The study distinguished between sensory and affective pain, with sensory pain referring to the intensity and location of pain, and affective pain referring to the unpleasantness, attributed meaning and long-term implications of pain (Lerman et

al., 2011). They found evidence that women with high affective pain scores and high self-criticism scores at baseline are more likely than females with low affective pain scores and low self-criticism to have higher levels of depression at follow-up. Rudich et al. (2010) also included self-criticism in their study but found no evidence for self-criticism as a predictor of depression in chronic pain. It is likely that this study was underpowered.

Rudich et al. (2010) was the only study to investigate a variable relating to factors external to the patient. They found that when physicians had a more pessimistic prognosis of chronic pain in a patient, the patient was more likely to have increased depression scores and affective pain at follow-up. They did not find a link between pessimistic prognosis and sensory aspects of pain at follow-up. The study did not find a link between physicians' treatment decisions and outcomes in depression and pain, suggesting that the link between pessimistic prognosis and depression at follow-up is not mediated by the physician's treatment of the patient. However, the study did not investigate the interactions between the physician and the patient that might have been affected by the physician's pessimistic outlook, which could in turn have affected the patients' wellbeing. Another possibility might be that the physician based their prognosis on a heuristic developed from their years of experience working with patients with chronic pain. The study did not investigate physicians' reasoning behind their decisions, which might have provided evidence for this.

The above studies, when taken together, show that a wide range of variables may mediate outcomes in chronic pain and depression, including catastrophising, acceptance, coping responses, self-efficacy, self-criticism and physician's prognosis.

As with previous questions, the choice of measures of depression in patients with chronic pain could have significantly affected the results of these studies.

Discussion

Does depression affect outcomes in chronic pain?

Six studies were identified in the literature search addressing this question. There are several differences between the studies included in the literature review that complicated comparisons of studies and conclusions. For example, studies differed according to time between follow-up, treatment received and assessment of depression and chronic pain. Though five of the studies found that in patients with chronic pain, those who are depressed at baseline are more likely to have higher ratings of pain at follow-up, two of the five studies used measures of depression that risk overdiagnosing depression in chronic pain, and one study had an unduly low threshold for 'clinically significant' chronic pain. In these cases, individuals without depression or clinically significant pain might have been erroneously included and affected the findings. Additionally, nearly all studies entered pain and depression as dichotomies in their studies, limiting information relating to the effects of the severity of pain and depression. Therefore, there were only two studies of appropriate methodology that found that the presence of depression in patients with chronic pain at baseline leads to worse outcomes of pain and disability at follow-up, preventing firm conclusions from being made.

This is in contrast to the conclusions of several past reviews on the association between chronic pain and depression (e.g. Bair et al., 2003), which did not acknowledge problems with including somatic symptoms in the assessment of depression in their review, and were more definitive in their conclusions that the

presence of depression in patients with chronic pain leads to worse outcomes in chronic pain.

Does pain affect outcomes in treated or untreated depression?

Three studies were identified in the literature search addressing this question. Two studies found that the presence of pain in depressed patients at baseline had a significant negative impact on treated or untreated depression (Kroenke et al., 2008; Gerrits et al., 2012). However, both studies used depression measures that included somatic symptoms, limiting the validity of their results. Chung et al. (2012) found that pain severity was a more important predictor of quality of life in depressed patients than depression or anxiety. Overall, the studies provided some evidence that the presence of pain in patients with depression at baseline leads to worse outcomes in quality of life and depression at follow-up, but there is a lack of high quality evidence, preventing firm conclusions from being made.

What variables mediate outcomes in chronic pain and depression at follow-up?

The six studies addressing this question reported that cognitive variables such as catastrophising, acceptance, self-efficacy and self-criticism, behavioural variables such as coping responses, and systemic variables such as physician's prognosis, can all mediate outcomes in chronic pain and depression. Although all of these studies successfully avoided using dichotomous measures of pain and depression, they used measures of depression that included somatic symptoms, which means the results should still be interpreted with caution. Future studies should seek to replicate findings using a measure of depression validated in a pain population. Despite this

methodological issue, the results indicate that there are multiple possible mediators, and that several pathways lead to the development of depression in chronic pain.

What are the psychological implications of the findings?

The psychological implications of the findings of the studies in the review will be discussed in relation to current models, clinical implications, and issues to be addressed in future research.

How do the findings fit with current models?

None of the studies included in the current review explicitly set out to test current models of the development of chronic pain and depression, but they did include variables that are relevant to those models. With regards to the diathesis-stress model, no studies investigated whether participants in their studies had genetic vulnerabilities or were exposed to adverse experiences in childhood, therefore this part of the model will not be discussed. Similarly, there were no studies identified for inclusion in the review that addressed biological mechanisms in the development of chronic pain and depression.

One study included catastrophising, one of the variables included in the Linton and Bergbom (2011) model. One study found evidence that increased catastrophising at baseline leads to an increase in pain intensity and disability at follow-up when controlling for depression, providing some evidence for the model. However, the presence of studies that found relationships with other variables in pain and depression suggest that the Linton and Bergbom (2011) model is very limited in explaining the development of depression in pain patients. It is more likely that

depression in chronic pain is linked with a variety of factors, not just catastrophising, and that several pathways explain the development of depression in chronic pain.

Findings that high levels of catastrophising and low levels of self-efficacy lead to worse outcomes for pain and depression provide support for the diathesis-stress model. Low self-efficacy could be a pre-existing vulnerability that interacts with chronic pain to lead to depression, and catastrophic thoughts could contribute to low mood (Nezu, Nezu, & Perri, 1989). Lerman et al. (2011) suggest that their findings on high levels of self-criticism and of affective dimensions of pain in females can be used to expand the Banks and Kerns (1996) model. They suggest that self-criticism could be a pre-existing vulnerability, and that pain could act as a stressor to activate the affective dimensions of pain, leading to the development of depression in females with chronic pain. One mechanism they suggest for this is that individuals high in self-criticism might view their pain as a punishment, or that they are to blame for their pain. They noted that the females in the study had higher scores than males for depression in the study, and that males high in depression might also be found to have a similar pattern for self-criticism, affective pain and depression.

Rudich et al. (2010) found that the prognosis of their physician can affect depression and affective pain outcomes at follow-up. The study could not identify the mechanism, but it is possible that the physician's pessimistic outlook for the patient are conveyed to the patient, which could in turn affect the patients' mood and view of their pain. Further research on how interactions with health professionals affect outcomes in pain patients might allow for the diathesis-stress model to be expanded to include the patient's wider system.

Two of the studies in the current review provided evidence for the role of acceptance in outcomes in chronic pain and depression (McCracken et al., 2005;

McCracken et al., 2007). Acceptance is one of the components of the psychological flexibility model that has been applied to both depression and chronic pain in recent years (McCracken & Morley, 2014). Similar to Beck's (1976) model, psychological flexibility proposes that thoughts can have an influence on individual's behaviour. However, the psychological flexibility model proposes that behaviour can be changed by bringing awareness to thoughts and emotions and bringing actions in line with the individual's goals and values (McCracken & Morley, 2014). According to the model, suffering occurs when the individual responds in an inflexible way to stressors, by avoiding emotions or thoughts, and not acting in line with his/her goals. The model differs from Heilbronn and Blumer's (1982) model as it does not suggest that an individual's negative emotional state leads to a physical manifestation of pain. It is possible that this model could also apply to people with chronic pain who develop depression.

Implications for interventions

Many of the studies addressing the first two questions suggested very similar implications for interventions, calling for both depression and chronic pain to be kept in mind during the assessment phase and, if deemed necessary, to intervene psychologically or pharmacologically in both to improve outcomes and QOL. One caveat that the studies do not mention is that clinicians should ensure that the diagnosis for clinical depression is not based on patients' reports of somatic symptoms associated with chronic pain (Pincus & Williams, 1999). There is evidence that tricyclic antidepressants can reduce pain (Dharmshaktu, Tayal, & Kalra, 2012), but the dose to achieve an analgesic effect is lower than the dose required for the antidepressant effect. There is less evidence for the effects of

antidepressants specifically in patients with chronic pain and depression. One study found that patients with chronic pain and depression treated with closely monitored antidepressant therapy and attending a self-management pain programme had improved outcomes in depression and chronic pain at follow-up compared with patients who underwent usual care (Kroenke et al., 2009) of clinic visits, some of whom were prescribed antidepressants.

There is a lack of studies investigating psychological interventions specifically for depression in patients with chronic pain. However, studies investigating outcomes for CBT for chronic pain commonly measure depression as an outcome, and a review of CBT for chronic pain found some evidence that CBT improves mood and catastrophising outcomes, and appears to have weak effects on improving pain (Williams, Eccleston, & Morley, 2012). CBT for patients with chronic pain aims to change unhelpful patterns of thinking and behaviour related to chronic pain (Williams, 2007). It contains components in common with CBT for depression, such as behavioural reactivation and targeting unhelpful cognitions, which could explain why CBT for chronic pain can improve depression. However, outcomes might be different for a population with both depression and chronic pain and this should be investigated. Studies that identified a significant role for other variables in outcomes in chronic pain and depression tended to suggest that these variables, such as catastrophising, self-efficacy and self-criticism could be targeted in treatments to improve outcomes. Catastrophising and self-efficacy are variables that commonly are associated with chronic pain, and CBT, coming from the flexible cognitive model, is routinely used to address these in patients with chronic pain (Ehde, Dillworth, & Turner, 2014). One current problem with CBT interventions for chronic pain is that they can vary widely in their content, and it is not known what

components are most effective for which patients. However, using an individualised psychological formulation that takes the many effects of pain on the patient's emotional life, interference with activities and interpersonal relationships into account, could identify clear targets for treatment (Williams, 2007).

Another target for intervention identified in the literature is control-oriented coping and avoidance of pain, which were linked with poorer outcomes in chronic pain and depression (McCracken et al., 2005). Acceptance-based strategies could be used to provide alternative ways of coping, and have already been integrated into treatment for both chronic pain and depression separately, showing small to medium effects on physical and mental health and have been identified as an alternative to CBT (Hunot et al., 2013; Veehof, Oskam, Schreurs, & Bohlmeijer, 2011). Again, studies have not been carried out exclusively on patients with chronic pain and depression, and this warrants further investigation.

Implications for future research

There are numerous methodological issues with the studies included in the current review. One of the most salient problems is that 10 out of the 15 studies selected for the review used measures of depression that risk overestimating depression scores in a population with chronic pain. Future studies investigating chronic pain and depression should ensure that their choice of measures of depression is suitable for patients with chronic pain and that there is no risk of inflation of scores.

No studies assessed whether patients had experienced previous episodes of depression prior to the development of chronic pain. Distinguishing between patients who had previous episodes of depression, and patients who experienced a first

episode of depression upon the development of chronic pain could aid in the understanding of differences between the two sets of patients and identify processes in the development of depression in chronic pain, and targets for treating both groups. Additionally, depression and chronic pain can both fluctuate over time (Judd, 1997; Patel, Greasley, & Watson, 2007), which could be missed when assessed only at fixed time points. Gerrits et al. (2012) used a life chart assessment, which decreased the risk of missing out on episodes of depression between baseline and follow-up; this or other measures that take into account such fluctuations over time could be used in future investigations.

There was a lack of studies testing the theories of the development of chronic pain and depression, and future prospective studies could be designed to test these theories. In particular, the diathesis-stress model remains the most promising psychological model of the development of depression in patients with chronic pain (Banks & Kerns, 1996). Prospective studies aimed at identifying changes in cognition in patients who develop chronic pain and depression could also provide more insight into the development of depression in pain patients, and could allow for the development of new models, or the expansion of the diathesis-stress model.

One problem with studies in the review, and with psychology research in general, is that the vast majority of studies are not pre-registered (Bishop, 2013). This means that it is impossible to know whether the hypotheses and corresponding data analyses of the studies in the current review were decided on before data analyses, or whether they were altered after data analyses and the significant result found. Most studies that used cut-off points for depression and chronic pain did not state whether the cut-off points were decided on before analyses were carried out. Additionally, research with negative findings might not have shown up in the

literature review due to publication bias. Pre-registering future studies would reduce both of these problems (Bishop, 2013).

Limitations of the current review

This review only used one reviewer to narrow down search results and assess the methodological quality of the studies. The lack of a second reviewer to verify search results and methodological quality means that relevant studies might have accidentally been excluded from the review, and errors made in the judgement of methodological quality.

One inclusion criterion for the review was that studies included patients with sub-acute or chronic pain and/or depression at baseline. Some studies in the review included a small percentage of patients who had pain for less than 3 weeks, but studies were included as long as the majority of patients reported pain for at least 3 months. Since studies controlled for duration of pain in their analyses, it is not possible to say whether inclusion created problems.

The current review only included studies that included clinical populations who already had depression and/or chronic pain at baseline. Longitudinal epidemiological studies could enhance understanding of potential causal factors in the development of chronic pain and depression due to their inclusion of participants who do not have chronic pain and/or depression at baseline; these should be included in future literature reviews. Another issue with the review is that it included studies with patient populations that were receiving a range of treatments for chronic pain. Though most studies controlled for treatment received, their inclusion could have had an effect on outcomes in chronic pain and depression at follow-up.

The Newcastle Ottawa Scale (NOS) was used to assess some of the methodological problems of the studies. However, quality assessment tools are not without problems (Sanderson, Tatt, & Higgins, 2007). For example, Stang (2010) criticises the NOS (Wells et al., 2000), for the lack of evidence for its reliability and validity (Stang, 2010) and for providing arbitrary criteria for whether items in the checklist meet criteria or not. One of the criteria included in the NOS was number of participants included in the study, which the current review set at 50 participants. Ideally, this would have been assessed using statistical power, however this was not provided by the studies and therefore not possible to do this. Additionally, assessment of the methodological quality did not include an assessment of the statistical analyses used in studies. This would have allowed confirmation that studies used the appropriate analyses and employed corrections for multiple comparisons.

Conclusion

Overall, the studies included in this review provide some evidence that the presence of depression in patients with chronic pain leads to increased pain at follow-up, and that the presence of chronic pain in patients with depression leads to worse outcomes in treated or untreated depression at follow-up. However, the conclusions from this review are not as strong as those of previous reviews due shortcomings in quality of the studies. The main issue with quality is that many studies included measures of depression that were not validated in a population with chronic pain. Future studies should seek to resolve this issue by using measures suitable for chronic pain populations, such as the HADS. Studies investigating other variables involved in the relationship between chronic pain and depression found that

catastrophising, self-efficacy, acceptance-related coping strategies and physician's prognosis may influence outcomes in depression and chronic pain. However, the limited number of studies available and the wide range of variables included prevents firm conclusions from being drawn. Psychological interventions targeting both depression and chronic pain might improve patient outcomes, but research needs to investigate their efficacy in patients with both chronic pain and depression.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Bagby, R. M., Ryder, A. G., Schuller, D. R., & Marshall, M. B. (2004). The Hamilton Depression Rating Scale: has the gold standard become a lead weight? *The American Journal of Psychiatry*, *161*, 2163–77.
- Bair, M. J., Robinson, R. L., Katon, W., & Kroenke, K. (2003). Depression and pain comorbidity: a literature review. *Archives of Internal Medicine*, *163*, 2433–45.
- Banks, S., & Kerns, R. (1996). Explaining high rates of depression in chronic pain: a diathesis-stress framework. *Psychological Bulletin*, *119*, 95–110.
- Beck, A. T. (1967). *Depression: Clinical, Experimental, and Theoretical Aspects*. New York: Harper & Row.
- Beck, A. T. (1976). *Cognitive therapy and emotional disorders*. London: Penguin.
- Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561–71.
- Bishop, D. (2013). *Why we need pre-registration*. Retrieved October 13, 2014, from <http://deevybee.blogspot.co.uk/2013/07/why-we-need-pre-registration.html>
- Blackburn-Munro, G., & Blackburn-Munro, R. E. (2001). Chronic pain, chronic stress and depression: coincidence or consequence? *Journal of Neuroendocrinology*, *13*, 1009–1023.
- Blumer, D., & Heilbronn, M. (1982). Chronic pain as a variant of depressive disease: the pain-prone disorder. *The Journal of Nervous and Mental Disease*, *170*, 381–406.

- Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *European Journal of Pain, 10*, 377–391.
- Bushnell, M. C., Ceko, M., & Low, L. A. (2013). Cognitive and emotional control of pain and its disruption in chronic pain. *Nature Reviews. Neuroscience, 14*, 502–11.
- Campbell, L. C., Clauw, D. J., & Keefe, F. J. (2003). Persistent pain and depression: a biopsychosocial perspective. *Biological Psychiatry, 54*, 399–409.
- Chung, K.-F., Tso, K.-C., Yeung, W.-F., & Li, W.-H. (2012). Quality of life in major depressive disorder: The role of pain and pain catastrophizing cognition. *Comprehensive Psychiatry, 53*, 387–395.
- Delgado, P. L. (2004). Common pathways of depression and pain. *The Journal of Clinical Psychiatry, 65*, 16–9.
- Derogatis, L., Lipman, R., Rickels, K., Uhlenhuth, E., & Covi, L. (1974). The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. *Behavioral Science, 19*, 1–15.
- Derogatis, L. R. (1986). *SCL 90 R Administration, Scoring and Procedures Manual II for the Revised Version and Other Instruments of the Psychopathology Rating Scale Series*. Clinical Psychometric Research. Retrieved from http://books.google.co.uk/books/about/SCL_90_R_Administration_Scoring_and_Proc.html?id=PRUBPAAACAAJ&pgis=1
- Dharmshaktu, P., Tayal, V., & Kalra, B. S. (2012). Efficacy of antidepressants as analgesics: a review. *Journal of Clinical Pharmacology, 52*, 6–17.

- Dionne, C. E., Von Korff, M., Koepsell, T. D., Deyo, R. A., Barlow, W. E., & Checkoway, H. (2001). Formal education and back pain: a review. *Journal of Epidemiology & Community Health, 55*, 455–468.
- Dogrul, A., Ossipov, M. H., & Porreca, F. (2009). Differential mediation of descending pain facilitation and inhibition by spinal 5HT-3 and 5HT-7 receptors. *Brain Research, 1280*, 52–9.
- Duman, R. S., Heninger, G. R., & Nestler, E. J. (1997). A molecular and cellular theory of depression. *Archives of General Psychiatry, 54*, 597–606.
- Dunn, K. M., Croft, P. R., Main, C. J., & Von Korff, M. (2008). A prognostic approach to defining chronic pain: replication in a UK primary care low back pain population. *Pain, 135*, 48–54.
- Ehde, D. M., Dillworth, T. M., & Turner, J. A. (2014). Cognitive-behavioral therapy for individuals with chronic pain: efficacy, innovations, and directions for research. *The American Psychologist, 69*, 153–66.
- Fillingim, R. B., King, C. D., Ribeiro-Dasilva, M. C., Rahim-Williams, B., & Riley, J. L. (2009). Sex, gender, and pain: a review of recent clinical and experimental findings. *The Journal of Pain, 10*, 447–485.
- Fishbain, D. A., Cutler, R., Rosomoff, H. L., & Rosomoff, R. S. (1997). Chronic pain-associated depression: antecedent or consequence of chronic pain? A review. *The Clinical Journal of Pain, 13*, 116–37.
- Foelker, G. A., & Shewchuk, R. M. (1992). Somatic complaints and the CES-D. *Journal of the American Geriatrics Society, 40*, 259–62.
- Gatchel, R. J., Peng, Y. B., Peters, M. L., Fuchs, P. N., & Turk, D. C. (2007). The biopsychosocial approach to chronic pain: scientific advances and future directions. *Psychological Bulletin, 133*, 581–624.

- Gerrits, M. M. J. G., Vogelzangs, N., van Oppen, P., van Marwijk, H. W. J., van der Horst, H., & Penninx, B. W. J. H. (2012). Impact of pain on the course of depressive and anxiety disorders. *Pain, 153*, 429–436.
- Goldberg, D. S., & McGee, S. J. (2011). Pain as a global public health priority. *BMC Public Health, 11*, 770.
- Gureje, O., Von Korff, M., Simon, G. E., & Gater, R. (1998). Persistent pain and well-being: a World Health Organization Study in Primary Care. *JAMA : The Journal of the American Medical Association, 280*, 147–51.
- Hamilton, M. (1960). A rating scale for depression. *Journal of Neurology, Neurosurgery, and Psychiatry, 23*, 56–62.
- Hardt, J., Gerbershagen, H. U., & Franke, P. (2000). The symptom check-list, SCL-90-R: its use and characteristics in chronic pain patients. *European Journal of Pain (London, England), 4*, 137–48.
- Holloway, K. L., & Zerbe, K. J. (2000). Simplified approach to somatization disorder. When less may prove to be more. *Postgraduate Medicine, 108*, 89–92, 95.
- Hunot, V., Moore, T. H. M., Caldwell, D. M., Furukawa, T. A., Davies, P., Jones, H., ... Churchill, R. (2013). “Third wave” cognitive and behavioural therapies versus other psychological therapies for depression. *The Cochrane Database of Systematic Reviews, 10*, CD008704.
- Hurwitz, E. L., Morgenstern, H., & Yu, F. (2003). Cross-sectional and longitudinal associations of low-back pain and related disability with psychological distress among patients enrolled in the UCLA Low-Back Pain Study. *Journal of Clinical Epidemiology, 56*, 463–471.

- Jensen, M. P., & Karoly, P. (1992). Self-report scales and procedures for assessing pain in adults. In D. C. Turk & R. Melzack (Eds.), *Handbook of Pain Assessment* (xv., pp. 135–151). New York, NY: Guildford Press.
- Judd, L. L. (1997). The clinical course of unipolar major depressive disorders. *Archives of General Psychiatry*, *54*, 989–91.
- Keller, S., Bann, C. M., Dodd, S. L., Schein, J., Mendoza, T. R., & Cleeland, C. S. (2004). Validity of the brief pain inventory for use in documenting the outcomes of patients with noncancer pain. *The Clinical Journal of Pain*, *20*, 309–18.
- Krebs, E. E., Carey, T. S., & Weinberger, M. (2007). Accuracy of the pain numeric rating scale as a screening test in primary care. *Journal of General Internal Medicine*, *22*, 1453–8.
- Kroenke, K., Bair, M. J., Damush, T. M., Wu, J., Hoke, S., Sutherland, J., & Tu, W. (2009). Optimized antidepressant therapy and pain self-management in primary care patients with depression and musculoskeletal pain: a randomized controlled trial. *JAMA : The Journal of the American Medical Association*, *301*, 2099–2110.
- Kroenke, K., Shen, J., Oxman, T. E., Williams, J. W., & Dietrich, A. J. (2008). Impact of pain on the outcomes of depression treatment: results from the RESPECT trial. *Pain*, *134*, 209–15.
- Kroenke, K., Wu, J., Bair, M. J., Damush, T. M., Krebs, E. E., & Tu, W. (2012). Impact of depression on 12-month outcomes in primary-care patients with chronic musculoskeletal pain. *Journal of Musculoskeletal Pain*, *20*, 8–17.
- Kroenke, K., Wu, J., Bair, M. J., Krebs, E. E., Damush, T. M., & Tu, W. (2011). Reciprocal relationship between pain and depression: a 12-month longitudinal

- analysis in primary care. *The Journal of Pain : Official Journal of the American Pain Society*, *12*, 964–973.
- Lerman, S. F., Shahar, G., & Rudich, Z. (2012). Self-criticism interacts with the affective component of pain to predict depressive symptoms in female patients. *European Journal of Pain*, *16*, 115–122.
- Linton, S., & Bergbom, S. (2011). Understanding the link between depression and pain. *Scandinavian Journal of Pain*, *2*, 47–54.
- Löwe, B., Unützer, J., Callahan, C. M., Perkins, A. J., & Kroenke, K. (2004). Monitoring depression treatment outcomes with the patient health questionnaire-9. *Medical Care*, *42*, 1194–201.
- Luyten, P., Van Houdenhove, B., Lemma, A., Target, M., & Fonagy, P. (2013). Vulnerability for functional somatic disorders: A contemporary psychodynamic approach. *Journal of Psychotherapy Integration*, *23*, 250 – 262.
- Lyketsos, C. G., Nestadt, G., Cwi, J., & Heithoff, K. (1994). The Life Chart Interview: A standardized method to describe the course of psychopathology. *International Journal of Methods in Psychiatric Research*, *4*, 143 – 155.
- McCracken, L. M., & Eccleston, C. (2005). A prospective study of acceptance of pain and patient functioning with chronic pain. *Pain*, 164–169.
- McCracken, L. M., & Morley, S. (2014). The psychological flexibility model: a basis for integration and progress in psychological approaches to chronic pain management. *The Journal of Pain : Official Journal of the American Pain Society*, *15*, 221–34.
- McCracken, L. M., Vowles, K. E., & Gauntlett-Gilbert, J. (2007). A prospective investigation of acceptance and control-oriented coping with chronic pain. *Journal of Behavioral Medicine*, *30*, 339–349.

- McHorney, C. A., Ware, J. E., & Raczek, A. E. (1993). The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Medical Care*, *31*, 247–63.
- Melzack, R. (1987). The short-form McGill Pain Questionnaire. *Pain*, *30*, 191–7.
- Merskey, H. (1979). Pain Terms: a list of definitions and notes on usage. *Pain*, *6*, 249–252.
- Miller, L. R., & Cano, A. (2009). Comorbid chronic pain and depression: Who is at risk? *The Journal of Pain*, *10*, 619–627.
- Morley, S., Williams, A. C. de C., & Black, S. (2002). A confirmatory factor analysis of the Beck Depression Inventory in chronic pain. *Pain*, *99*, 289–98.
- Muller, S., Thomas, E., Dunn, K. M., & Mallen, C. D. (2013). A prognostic approach to defining chronic pain across a range of musculoskeletal pain sites. *The Clinical Journal of Pain*, *29*, 411–416.
- Nezu, A. M., Nezu, C. M., & Perri, M. G. (1989). *Problem-solving therapy for depression: Theory, research, and clinical guidelines*. Wiley series on personality processes. Oxford, England: John Wiley & Sons.
- Ohara, P. T., Vit, J.-P., & Jasmin, L. (2005). Cortical modulation of pain. *Cellular and Molecular Life Sciences : CMLS*, *62*, 44–52.
- Patel, S., Greasley, K., & Watson, P. J. (2007). Barriers to rehabilitation and return to work for unemployed chronic pain patients: a qualitative study. *European Journal of Pain (London, England)*, *11*, 831–40.
- Penninx, B. W. J. H., Nolen, W. A., Lamers, F., Zitman, F. G., Smit, J. H., Spinhoven, P., ... Beekman, A. T. F. (2011). Two-year course of depressive and anxiety disorders: results from the Netherlands Study of Depression and Anxiety (NESDA). *Journal of Affective Disorders*, *133*, 76–85.

- Pincus, T., Pearce, S., McClelland, A., & Isenberg, D. (1995). Endorsement and memory bias of self-referential pain stimuli in depressed pain patients. *The British Journal of Clinical Psychology / The British Psychological Society*, 34 (Pt 2), 267–77.
- Pincus, T., & Williams, A. (1999). Models and measurements of depression in chronic pain. *Journal of Psychosomatic Research*, 47, 211–219.
- Poole, H., White, S., Blake, C., Murphy, P., & Bramwell, R. (2009). Depression in chronic pain patients: prevalence and measurement. *Pain Practice : The Official Journal of World Institute of Pain*, 9, 173–80.
- Radloff, L. S. (1977). The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement*, 1, 385–401.
- Reeves, B., Deeks, J., Higgins, J., & Wells, G. (2011). Chapter 13: Including non-randomised studies. In J. Higgins & S. Green (Eds.), *Cochrane Handbook of Systematic Reviews of Interventions. Version 5.1.0*. The Cochrane Collaboration. Retrieved from www.cochrane-handbook.org
- Rudich, Z., Lerman, S. F., Gurevich, B., & Shahar, G. (2010). Pain specialists' evaluation of patient's prognosis during the first visit predicts subsequent depression and the affective dimension of pain. *Pain Medicine*, 11, 446–452.
- Rusu, A. C., Pincus, T., & Morley, S. (2012). Depressed pain patients differ from other depressed groups: Examination of cognitive content in a sentence completion task. *Pain*, 153, 1898–1904.
- Ryall, C., Coggon, D., Peveler, R., Poole, J., & Palmer, K. T. (2007). A prospective cohort study of arm pain in primary care and physiotherapy - prognostic determinants. *Rheumatology (Oxford, England)*, 46, 508–515.

- Sanderson, S., Tatt, I. D., & Higgins, J. P. T. (2007). Tools for assessing quality and susceptibility to bias in observational studies in epidemiology: a systematic review and annotated bibliography. *International Journal of Epidemiology*, *36*, 666–76.
- Shiri, R., Karppinen, J., Leino-Arjas, P., Solovieva, S., & Viikari-Juntura, E. (2010). The association between smoking and low back pain: a meta-analysis. *The American Journal of Medicine*, *123*, 87.e7–87.e35.
- Spitzer, R. L., Kroenke, K., Linzer, M., Hahn, S. R., Williams, J. B., deGruy, F. V., ... Davies, M. (1995). Health-related quality of life in primary care patients with mental disorders. Results from the PRIME-MD 1000 Study. *JAMA : The Journal of the American Medical Association*, *274*, 1511–7.
- Stang, A. (2010). Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *European Journal of Epidemiology*, *25*, 603–5.
- Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and Validation. *Psychological Assessment*, *7*, 524–532.
- Tracey, I., & Mantyh, P. (2007). The cerebral signature for pain perception and its modulation. *Neuron*, *55*, 377–391.
- Turk, D. C., & Okifuji, A. (1994). Detecting depression in chronic pain patients: adequacy of self-reports. *Behaviour Research and Therapy*, *32*, 9–16.
- Turk, D. C., & Salovey, P. (1984). Chronic pain as a variant of depressive disease: a critical reappraisal. *Journal of Nervous and Mental Disease*, 398–404.
- Van der Windt, D. A. W. M., Dunn, K. M., Pincus, T., & McCracken, L. M. (2013). Psychological factors and treatment opportunities in low back pain. *Best Practice & Research Clinical Rheumatology*, *27*, 625–635.

- Van Liew, C., Brown, K. C., Cronan, T. A., Bigatti, S. M., & Kothari, D. J. (2013). Predictors of pain and functioning over time in fibromyalgia syndrome: an autoregressive path analysis. *Arthritis Care & Research*, *65*, 251–256.
- Veehof, M. M., Oskam, M.-J., Schreurs, K. M. G., & Bohlmeijer, E. T. (2011). Acceptance-based interventions for the treatment of chronic pain: a systematic review and meta-analysis. *Pain*, *152*, 533–542.
- Velly, A. M., Look, J. O., Carlson, C., Lenton, P. A., Kang, W., Holcroft, C. A., & Fricton, J. R. (2011). The effect of catastrophizing and depression on chronic pain - a prospective cohort study of temporomandibular muscle and joint pain disorders. *Pain*, *152*, 2377–2383.
- Verhaak, P. F. ., Kerssens, J. J., Dekker, J., Sorbi, M. J., & Bensing, J. M. (1998). Prevalence of chronic benign pain disorder among adults: a review of the literature. *Pain*, *77*, 231–239.
- Von Korff, M., & Miglioretti, D. L. (2005). A prognostic approach to defining chronic pain. *Pain*, *117*, 304–313.
- Von Korff, M., Ormel, J., Keefe, F. J., & Dworkin, S. F. (1992). Grading the severity of chronic pain. *Pain*. Netherlands: Elsevier Science.
- Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care*, *30*, 473–83.
- Wells, G., Shea, B., O'Connell, D., & Peterson, J. (2000). The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Retrieved from [http://www.medicine.mcgill.ca/rtamblyn/Readings/The Newcastle - Scale for assessing the quality of nonrandomised studies in meta-analyses.pdf](http://www.medicine.mcgill.ca/rtamblyn/Readings/The%20Newcastle%20Scale%20for%20assessing%20the%20quality%20of%20nonrandomised%20studies%20in%20meta-analyses.pdf)

- Williams, A. C. de C. (1998). Depression in chronic pain: mistaken models, missed opportunities. *Behaviour Therapy*, 27, 61–80.
- Williams, A. C. de C. (2007). Chronic pain: treatment. In S. Lindsay & G. Powell (Eds.), *The handbook of clinical adult psychology* (3rd ed., pp. 708 – 725). Hove: Routledge.
- Williams, A. C. de C., Eccleston, C., & Morley, S. (2012). Psychological therapies for the management of chronic pain (excluding headache) in adults. *The Cochrane Database of Systematic Reviews*, CD007407.
- Wittchen, H. U. (1994). Reliability and validity studies of the WHO--Composite International Diagnostic Interview (CIDI): a critical review. *Journal of Psychiatric Research*, 28, 57–84.
- Wolfe, F., Ross, K., Anderson, J., Russell, I. J., & Hebert, L. (1995). The prevalence and characteristics of fibromyalgia in the general population. *Arthritis & Rheumatism*, 38, 19–28.
- Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67, 361–70.

Part 2: Empirical Paper

**Healthcare providers' judgements in chronic pain: the influence of
depression, trustworthiness and gender**

Abstract

Background: Clinicians are influenced by information immediately available about patients, such as gender or mental health history, and this affects their assessment and treatment decisions relating to the patient. Due to the subjective nature of pain, clinicians rely on patient reports of pain in their assessments. Therefore, perceived trustworthiness of the patient might also affect assessments and treatments.

Aims: To investigate the influence of history of depression, perceived trustworthiness and gender of the patient; and the training level of the provider on judgements and treatment decisions in patients with chronic pain.

Method: Pain clinicians and medical students (n = 63) viewed 12 videos of patients with chronic shoulder pain and corresponding vignettes, and made pain estimates, judgements and treatment decisions for each patient. Patient's history of depression, perceived trustworthiness and gender were manipulated across each paired vignette and video.

Results: The presence and timing of depression in chronic pain patients was not found have a consistent effect. Gender and trustworthiness affected pain judgements and management decisions, with low trustworthy females receiving the lowest estimates of overall pain, the highest estimates of exaggerating pain, and less likely to be prescribed opioids or other analgesics. Males, even those of low trustworthiness, received more favourable judgements. Medical students were particularly subject to this gender bias.

Conclusions: These findings contribute to our understanding of what generates lower estimations of pain, adverse judgements about honest expression of pain, and the consequences of those on treatment decisions. Training programs for healthcare staff should include interventions in minimising implicit bias.

Introduction

Pain

The International Association for the Study of Pain describes pain in humans as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey, 1979). At an individual level, pain processing is influenced by biological, psychological and social factors such as genetics, neurological structure or neurotransmitters, cognition, mood and the context in which the pain occurs and is therefore a highly variable and subjective experience (Tracey & Mantyh, 2007). Severity of pain is not correlated with the level of tissue damage and pain can persist after the damage resolves (Turk & Okifuji, 2009). Pain is normally described as either acute or chronic, with chronic pain defined as persisting for more than three months and not associated with on-going injury or disease.

Chronic pain is experienced by 7.8 million people in the UK (Donaldson, 2008), and almost 20% of individuals in Europe have some form of chronic pain (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006). It is one of the most common reasons why people seek medical care and is associated with more frequent use of health services (Elliott, Smith, Penny, Smith, & Chambers, 1999). Though the mechanisms behind the development of chronic pain are unclear, the development of chronic pain has been associated with a range of interacting biopsychosocial risk factors including female sex (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley, 2009), depression and anxiety (e.g. Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Kroenke et al., 2011; van der Windt, Dunn, Pincus, & McCracken, 2013), health behaviours such as smoking (Shiri, Karppinen, Leino-Arjas, Solovieva, & Viikari-Juntura, 2010), and social factors such as lower levels of formal education

(Dionne et al., 2001). Neuroimaging studies have identified various functional, structural and chemical changes in the brains of patients with chronic pain (Tracey & Bushnell, 2009). These changes lead to the amplification of pain, and suppress the inhibition of pain (Tracey & Bushnell, 2009). Chronic pain is treated using a wide range of interventions including prescription of opioids, non-steroidal anti-inflammatory drugs, antidepressants and injection with anaesthetics, which aim to alleviate or eradicate pain (Turk, Wilson, & Cahana, 2011). Other interventions, such as pain management programmes and cognitive behavioural therapy, aim to help patients develop strategies to manage their pain. Evidence suggests that no one treatment is sufficient to eliminate pain and improve physical and emotional functioning in most patients (Turk et al., 2011) and both practitioners and patients often report dissatisfaction with treatment (Parsons et al., 2007). Treatment of chronic pain can therefore be a controversial area, particularly due to the prescription of opioid medication. Long term opioid use can produce hyperalgesia, where patients experience increased sensitivity to pain (Ballantyne & Mao, 2003), and other health problems. There are also concerns that opioid use might lead to dependence and offset the benefits of pain relief in some patients (Ballantyne & LaForge, 2007), though problematic opioid use is less prevalent in the UK than in the USA (Stannard, 2013).

Factors affecting pain judgements

Because of pain's subjective nature, and the fact that it can occur in the absence of tissue damage, healthcare professionals are faced with the challenge of making medical judgements and treatment choices using patient's reports and behaviour, without the certainty of elicited signs commonly present in other

conditions (Tait, Chibnall, & Kalauokalani, 2009). healthcare professionals must use the patients' reports and behaviour, and their medical knowledge, to estimate the amount of pain experienced by the patient, and this frequently results in underestimation of pain (Kappesser, Williams, & Prkachin, 2006). Additionally, healthcare professionals' beliefs about individual patients or patients in general tending to simulate, exaggerate, minimise or hide their pain contribute to their assessment of the authenticity of pain and whether it warrants treatment (Kappesser et al., 2006). In the absence of clear symptoms and in the limited time with the patient, healthcare professionals may be influenced, consciously or unconsciously, by information immediately available about the patient in order to seek symptom certainty, which can then affect their assessment, estimation of pain and treatment decisions relating to the patient (Tait et al., 2009).

Studies investigating factors that bias healthcare professionals' judgements of pain have found that social characteristics of the patient can affect treatment decisions relating to pain. Factors that have been found to affect treatment include ethnicity, where African American and Hispanic patients consistently receive lower doses of pain medication than white patients across a variety of treatment settings (Green et al., 2003) and age, where pain in children (Alexander & Manno, 2003) and older adults (e.g. Fox, Raina, & Jadad, 1999) is consistently undertreated. The presence or absence of medical evidence has an especially important effect on healthcare professionals' decisions and estimations of pain (e.g. Chibnall, Tait, & Ross, 1997), and this can interact with other features of the patient. For example, Birdwell, Herbers, and Kroenke (1993) found that doctors presented with videos of "histrionic" patients complaining of chest pain were less likely to attribute symptoms to cardiac factors than they did for "business-like" patients, unless objective medical

evidence supporting the patient's symptoms was present. Another study found that when there is an absence of medical evidence for patients' pain, they are more negatively evaluated by observers, which leads to observers providing lower ratings of pain and sympathy (De Ruddere, Goubert, Stevens, Williams, & Crombez, 2013).

Gender

Another factor that has been found to affect treatment decisions is gender, with clinical studies finding that females are more likely to have their pain underestimated than males (Anderson et al., 2000; Cleeland et al., 1994; Tait et al., 2009). However, another study found that undergraduate students viewing videos of a participant undergoing a cold pressor task gave higher estimates of pain to females than males (Robinson & Wise, 2003). Biases have also been found regarding treatment decisions, with one study finding that women were less likely to receive analgesia for injuries (Michael, Sporer, & Youngblood, 2007). Another study found that women were less likely to receive a diagnosis of coronary heart disease when they presented with chest pain (Chang et al., 2007). Women are also more likely to have their pain attributed to emotional or psychological factors and are more likely to be prescribed antidepressants and non-opioid analgesics, while men are more likely to be prescribed opioids (Hoffmann & Tarzian, 2001). However, other studies found no differences in treatment between males and females by healthcare professionals (Safdar et al., 2009; Turk & Okifuji, 1997) and one study found that females were more likely than males to be prescribed opioids (Hirsh, George, & Robinson, 2009).

Factors relating to healthcare professionals

Factors relating to healthcare professionals themselves can also influence pain judgement. For example, in a review of pain judgement accuracy, studies consistently found that increasing experience of healthcare professionals leads to an underestimation of pain in patients, compared to caregivers, who overestimate pain (Kappesser & Williams, 2010). Another review found that nurses, physicians and physical and occupational therapists provide significantly lower estimates of pain compared to lay observers (Tait et al., 2009).

Empathy has also been found to influence pain judgement, with higher levels of trait empathy in observers correlating with higher estimates of others' pain (Green, Tripp, Sullivan, & Davidson, 2009; Saarela et al., 2007). Another study investigated the effects of empathy on physicians' judgements by asking surgeons to attribute surgical outcomes in patients with back pain to physician attributes (reflecting skill) and patient attributes (reflecting psychological factors). Surgeons were more likely to link successful surgery outcomes with physician attributes, and less successful surgery outcomes with patient attributes. However, surgeons with more empathy were less likely to blame patient attributes for unsuccessful surgery outcomes than surgeons with less empathy (Tait, Chibnall, Luebbert, & Sutter, 2005).

Chronic pain and depression

Depression is common in people with chronic pain, with estimates from epidemiological studies ranging from 20 – 50% (Bair, Robinson, Katon, & Kroenke, 2003; Breivik et al., 2006; Miller & Cano, 2009). The presence of depression in patients with chronic pain can have a negative impact on treatment outcomes (Bair et al., 2003) and further decrease quality of life (Arnouk et al., 2006). However, there is

a risk of overdiagnosis of depression when pain is present due to symptom overlap between the somatic symptoms of depression and the effects of chronic pain (Williams, 1998, 2007). Depression rating scales that include somatic symptoms, such as the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), are persistently used in pain populations despite only being validated in psychiatric populations from which those with physical illness and disability had been excluded (Morley, Williams, & Black, 2002).

Several theories have been proposed to explain why chronic pain and depression frequently occur together, with some models suggesting that depression leads to chronic pain, and others suggesting that chronic pain leads to depression. One out-dated, though widespread theory suggested that pain without the presence of objective tissue damage was the result of an underlying emotional conflict that the patient was unable to confront (Holloway & Zerbe, 2000). The diathesis-stress model suggested that individuals who are exposed to particular stressors such as chronic pain may be more vulnerable to depression due to the loss of roles and restriction of pleasurable activities associated with chronic pain (Banks & Kerns, 1996). Other evidence suggests that pain and depression share common neurological pathways, meaning that patients with one may be vulnerable to the other (Delgado, 2004). Despite the common occurrence of depression in patients with chronic pain, few studies have examined the effects of a history of depression on treatment decisions and judgements in patients with chronic pain. healthcare professionals presented with a patient who developed chronic pain before depression might view the chronic pain as a cause of depression, while a patient who developed chronic pain after depression might be viewed as their depression causing pain. These differing views could have

an effect on healthcare professionals' assessment and treatment of the patients' chronic pain.

Studies investigating the effects of psychiatric history on quality of healthcare received suggest that patients with psychological problems are at risk of not receiving preventative healthcare treatment (Druss, Rosenheck, Desai, & Perlin, 2002; Viron & Stern, 2010). One review suggested that healthcare professionals might hold discriminatory beliefs against patients with psychological problems, viewing them as "difficult" (Viron & Stern, 2010). Another study found that clinicians were less likely to believe that patients had a serious illness when presenting with a severe headache or abdominal pain if they had a prior history of depression (Graber et al., 2000).

Other evidence suggests that patients with chronic pain and depression are more likely to be prescribed opioids than patients without depression (Sullivan, Edlund, Steffick, & Unützer, 2005; Sullivan, Edlund, Zhang, Unützer, & Wells, 2006). Hirsh et al. (2013) investigated the influence of depression, patient gender and race on healthcare professionals' treatment decisions in chronic pain. They found that depression had the strongest influence on clinical decision-making: patients with depression were more likely to be prescribed opioids, antidepressants or referred to a mental health specialist.

Trustworthiness

People make rapid automatic judgements of others' facial traits (Willis & Todorov, 2006) and these judgements have been found to influence their subsequent decisions. For example, Olivola and Todorov (2010) found that in a hypothetical political election, participants were more likely to vote for faces high in traits of

‘competence’. Other studies have investigated facial features associated with implicit judgements in trustworthiness. These studies have found high inter-rater reliability for trustworthiness, and there is a consistent positive correlation between the activation of the amygdala and increasing untrustworthiness of faces (Todorov, Baron, & Oosterhof, 2008). Todorov et al. (2008) suggest that face evaluation of neutral faces is closely linked to the detection of emotional states in others, and that judgements of trustworthiness reflect the detection of subtle facial features that resemble positive or negative emotional states in others. Features associated with trustworthiness include high inner eyebrows, pronounced cheekbones and wide chins, while features associated with untrustworthiness included low inner eyebrows, shallow cheekbones and thin chins (Todorov et al., 2008). Another study found that facial features associated with the appearance of untrustworthiness can affect people’s decisions in trust games and lead people to invest less money in the partner with the ‘untrustworthy’ facial features than the partner with the ‘trustworthy’ facial features (Rezlescu, Duchaine, Olivola, & Chater, 2012). This effect is reduced, but remains significant, even after ‘good’ reputational information is made available about the trustworthy or untrustworthy person. It appears that facial features associated with trustworthiness potentially have a strong effect on decision-making. Trustworthiness might be an important factor in the context of assessments and decision-making in chronic pain. As mentioned earlier, pain is a subjective experience that can be experienced without objective tissue damage (Turk & Okifuji, 2009). Assessments involve the patient reporting their pain to their health care professional, requiring the health care professional to trust that the patient is being truthful about their experience of pain. This is particularly an issue in relation to the prescription of opioids, where providers are often suspicious about whether patients

might present a dishonest representation of their pain in order to receive opioids (Sullivan & Ferrell, 2005). To our knowledge, there are no studies that have investigated the influence of perceived trustworthiness of the patient in pain judgements and decision-making.

The vignette model for studying healthcare professional decision making in chronic pain

Many of the studies investigating the effects of patient characteristics on pain judgements in healthcare professionals employed vignettes to provide information about the patient. More recently studies have paired images of patients displaying expressions of pain with vignettes (e.g. Hirsh et al., 2013). Other studies have used actors to depict facial pain, though differences in facial expression have been found between actors and expressions of people experiencing genuine pain (Craig & Patrick, 1985). Ecological validity of these studies has been further increased by the use of dynamic videos depicting real patients experiencing pain (e.g. De Ruddere, Goubert, Vervoort, Prkachin, & Crombez, 2012), which have been shown to evoke distinct activation in the facial perception network in the brain (Foley, Rippon, Thai, Longe, & Senior, 2012).

Aims of the current study

As mentioned above, several studies have found that healthcare professionals make judgements of pain based on aspects of the patient. Past studies have not investigated the effects of a patient's perceived trustworthiness on healthcare professionals' pain judgements and treatment decisions. Only a limited number of studies, mentioned above, have explored the effects of a history of depression on

healthcare professionals' judgements and treatment decisions in chronic pain (e.g. Hirsh et al., 2013), and of those, no studies have investigated whether judgements differ between patients who had a diagnosis of depression before or after chronic pain.

The current study therefore chose to investigate the effects of the following variables: history of depression, patient trustworthiness and gender on clinicians' judgements in pain using videos of real patients with chronic shoulder pain and supporting vignettes. In order to compare the effect of years of experience on estimates of pain and treatment decisions, participants of varying levels of training were included in the study. Therefore, doctors specialising in chronic pain and medical students in their 4th, 5th and 6th years were recruited for the study. The effects of empathy on pain judgements were also explored by obtaining measures of participants' empathy. Participants were asked to estimate the amount of pain they thought each patient was experiencing, and their estimates that the patient was exaggerating, minimising or hiding their pain. They were also asked to rate the likelihood of recommending the prescription of opioids, analgesics, antidepressants or referral to a pain management programme or a mental health specialist, all orthodox methods for managing chronic pain in primary and secondary care settings (Turk et al., 2011). The following questions were addressed:

1. Are pain clinicians' and medical students' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions influenced by a patient's depression, and by the timing of its onset in relation to chronic pain?

Hypotheses

Impact of depression on pain judgements:

1a) Participants will give lower pain estimates for patients with a history of depression than for control patients. Further,

1b) Participants will view depression developed after chronic pain as a consequence of the pain and therefore estimates of pain will not be affected. In contrast, for patients whose depression preceded chronic pain, they may view pain as a ‘symptom’ of depression, leading to higher estimations of exaggerating pain, and lower estimations of pain, and of minimising and hiding pain compared to scores for controls and patients whose depression developed after chronic pain.

Impact of depression on pain management decisions:

1c) Participants will be less likely to recommend prescribing opioids and other analgesics, and less likely to recommend referral to a pain management programme, for patients who developed depression prior to chronic pain than for patients without a history of depression and for patients who developed depression after chronic pain.

1d) Participants will be more likely to recommend prescribing antidepressants to patients who developed depression prior to chronic pain and more likely to recommend referral to a mental health specialist than they would for patients in the other two groups: depression onset after chronic pain, and no depression.

2. Are pain clinicians’ and medical students’ estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions influenced by how trustworthy the patient looks?

Hypotheses

Impact of trustworthiness on pain judgements:

2a) Participants will estimate lower pain and rate higher the probability that patients were exaggerating their pain in low trustworthy (LT) patients compared to high trustworthy (HT) patients.

Impact of trustworthiness on pain management decisions:

2b) Participants will be less likely to recommend prescribing opioids, analgesics or antidepressants for LT patients than for HT patients. There were no specific hypotheses regarding likelihood of recommending referral to a pain management programme and to a mental health specialist.

3. Are pain clinicians' and medical students' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions influenced by the gender of the patient?

Hypotheses

Impact of gender on pain judgements:

3a) Participants will estimate lower pain and rate higher probability of exaggeration of pain in female patients compared to males.

3b) Participants will rate a higher probability that patients are minimising or hiding their pain for male patients than female patients.

Impact of gender on pain management decisions:

3c) Participants will be less likely to prescribe opioids and analgesics, and more likely to prescribe antidepressants, for female patients than males. There were no specific hypotheses regarding likelihood of referring to a pain management programme and mental health specialist.

4. Do the above variables (depression history, patient trustworthiness and gender) interact to affect participants' ratings of pain and treatment decisions?

Hypotheses

Impact of interactions between depression history, patient trustworthiness and gender on pain judgements:

4a) Perceived trustworthiness would moderate the effects of depression on participants' pain ratings. Therefore, LT patients with a history of depression predating their pain would be given lower pain estimations and lower estimates of minimising or hiding their pain than HT patients with a history of depression predating their pain. LT patients with a history of depression predating their pain would also receive higher probabilities of exaggerating their pain compared to HT patients with a history of depression predating their pain. It was also hypothesised that the main effect for gender would remain across this interaction, with males given higher pain estimations and estimates of minimising or hiding their pain, and lower estimates of exaggerating their pain than females.

Impact of interactions between depression history, patient trustworthiness and gender on pain management decisions:

4b) Perceived trustworthiness will moderate the effects of depression on participants' treatment decisions. Therefore, LT patients that have a history of depression predating their pain will be less likely to be recommended a prescription of opioids and analgesics than HT patients with a history of depression predating their pain. It was also hypothesised that the main effect for gender would remain across the interaction, with males more likely to be prescribed opioids and analgesics than females.

4c) There were no other hypotheses for interactions between depression history, patient trustworthiness and gender, but it was decided that significant interactions would be explored with post hoc tests and results interpreted with caution.

5. Do pain clinicians' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions differ from those of medical students'?

Hypotheses

Impact of training level on pain judgements:

5a) Pain clinicians will provide lower estimates of pain than medical students. There were no specific hypotheses regarding the impact of training level on judgements of exaggerating, minimising or hiding pain.

Impact of training level on pain management decisions:

5b) There were no specific hypotheses regarding the effects of training on likelihood of prescribing opioids, analgesics or antidepressants, or referring to a pain management programme to a mental health specialist.

6. Are pain clinicians' and medical students' estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions affected differently by history of depression, trustworthiness and gender of the patient?

Hypotheses

There were no particular hypotheses for this research question, but it was decided that significant interactions would be explored with post hoc tests and results interpreted with caution.

7. Do empathy scores of pain clinicians and medical students correspond with estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions?

Hypotheses

Impact of empathy on pain judgements:

6a) Empathy will positively correlate with pain estimates and estimates of the probability that the patient was minimising or hiding his or her pain, and negatively correlate with estimates that the patient was exaggerating pain.

Impact of empathy on pain management decisions:

6b) There were no specific hypotheses regarding the impact of empathy on pain management decisions.

Method

Ethics

Ethical approval was obtained from University College London Ethics Committee (Project ID Number 4714/001; Appendix 3). Informed consent was obtained from all participants.

Participants and setting

Participants eligible to take part in the study were doctors working in the UK, specialising in pain and members of the International Association for the Study of Pain, or a UCL medical student in their 4th, 5th or 6th year of study. Medical students

from their fourth year were selected due to their experience of clinical contact with patients. Participants were included in the study if they had good spoken English and good or corrected vision. The study was set up on the survey platform Qualtrics, and participants accessed the study online.

Clinicians were invited to participate in the study via email (Appendix 4) using the IASP members' directory. Medical students were invited to participate in the study via an advertisement in the weekly medical society newsletter and by a verbal advertisement of the study before three lectures. Both the emails and the advertisements contained brief information about the study and the link to the study website.

Design

Participants were exposed to twelve different vignettes and corresponding videos. There were four vignettes for each condition: no history of depression, depression before chronic pain (CP) and depression after CP. There were six videos depicting male patients, three rated as high in trustworthiness and three rated as low in trustworthiness. Similarly, there were six videos depicting female patients, three rated as high in trustworthiness and three rated as low in trustworthiness. All analyses included training level (clinician, medical student) as an independent variable.

A 3 (history of depression: no history of depression, depression before CP, depression after CP) x 2 (trustworthiness: high, low) x 2 (gender: male, female) x 2 (training level: clinician, medical student) mixed design was used, with history of depression, trustworthiness and gender as within-subjects factors and training level as a between-subjects factor. The dependent variables were participants' estimations

of pain, estimations of the probability that patients were exaggerating, minimising or hiding their pain, and treatment choices.

Power analysis

Power analysis for this study was informed by prior work by De Ruddere, Goubert, Vervoort, Prkachin, and Crombez, (2012). In this study the authors recruited participants from the community to estimate pain using video clips similar to those used in the current study and found an effect size f of 0.25 (medium). Power calculation on participants' estimates of pain was carried out using the "G*Power 3.1.5" computer program (Erdfelder, Faul, & Buchner, 1996), specifying $\alpha = 5\%$ and desired power = 80% and estimating correlation among repeated measures to be 0.5. The required sample size was estimated at 30 per participant group.

Materials

Videos

Twelve videos (six male) were selected from the UNBC-McMaster Shoulder Pain Expression Archive Database (Lucey et al., 2011) based on ratings of high and low trustworthiness. Trustworthiness ratings were obtained using a method similar to Oosterhof and Todorov (2008). For a description of the method for obtaining trustworthiness ratings, see Appendix 7. The mean age of patients in the video was 51 years and the range was 34 – 67 years (Appendix 8). Videos were already rated for facial pain expression intensity, using the FACS system (Ekman & Friesen, 1986) adapted for pain (Prkachin & Solomon, 2008). The scores can range from 0-16 and for the present study, patients expressing pain rated in the moderate range (5 – 9) were selected and FACS ratings were balanced across conditions. Videos were edited

so that only either neutral expressions (before the physiotherapy manoeuvre) or expressions of pain (during or immediately after the manoeuvre) were depicted in the video. Videos ranged from five to ten seconds in length.

Vignettes

Twelve corresponding vignettes were developed, taking the form of a brief letter from a GP asking for an opinion regarding the treatment of the patient (Appendix 11). Vignettes described how long the patients had suffered from pain (1 year), how the pain was affecting their life (e.g. “She finds it difficult to drive due to pain”), whether they had 1) asthma, 2) depression before they developed pain, or 3) depression after they developed pain. For the patients with depression, the letters stated that they were not currently on medication or receiving psychological therapy for depression.

Measures

Pain estimation

Participants’ estimates of pain were measured using a numerical scale with a slider bar, ranging from values 0 to 10 (Appendix 9). Participants were only able to select one of the 11 values. The scales were anchored at either end with the words “No pain” and “Extreme pain”. Participants were asked: “Please rate the amount of pain you think the patient in the video experienced.”

Estimates of pain exaggeration, minimising or hiding

To estimate participants’ suspicions that the person in the video was exaggerating, minimising or hiding his or her pain, the participant was asked: “On a

scale of 0 to 10, how likely do you think it is that the person in the video is exaggerating their pain?” The scales were anchored at either end with the words “Very unlikely” and “Very likely”. The question was repeated to elicit probabilities of ‘minimising (i.e. downplaying)’ and ‘hiding (i.e. concealing)’ their pain.

Treatment options

To investigate the treatment outcome chosen by participants, they were asked: “On a scale of 0 to 10, please rate the likelihood that you would consider/recommend management strategies listed below in the care of this patient.” The scales were anchored at either end with the words “Very unlikely” and “Very likely”. The management strategies listed were “Prescription of opioid medication”, “Prescription of analgesic medication”, “Prescription of antidepressant medication as analgesic”, “Referral to a pain management programme” and “Referral to a mental health specialist”.

Trustworthiness ratings

To investigate whether participants were in agreement with earlier trustworthiness ratings provided by trainee clinical psychologists, a rating of the trustworthiness of patients was also obtained. Participants were shown a picture of each patient with a neutral expression and asked to rate the trustworthiness of each patient. They were asked to rely on their ‘gut feeling’ and not to take past information from the vignettes and videos into account. Participants’ estimations of trustworthiness were measured on a scale of 1 to 9. The scales were anchored at each end with the words “Not trustworthy at all” and “Extremely trustworthy”.

Empathy

Trait empathy of participants was measured using the Interpersonal Reactivity Index (IRI; Davis, 1980; 1983; Appendix 12). The IRI is a 28-item self-report questionnaire with statements relating to different aspects of empathy. For each statement, the possible responses range from “does not describe me well” (0) to “describes me very well” (4). The IRI has four factors: *perspective taking*, *identifying* with the person observed (called *fantasy* in the original scale but referred to here as *identification* since this is a more accurate description of its content), *empathic concern* (ability to feel compassion for the other) and *personal distress* (experience of distress at the distress of another). Cronbach’s alpha coefficients for internal reliability of the IRI for this sample was 0.79.

Guess at study purpose

On the final page of the study, participants were asked to guess the study’s purpose. This was asked in order to investigate whether awareness of the study’s purpose affected participant responses. Responses were provided in an open field text box.

Procedure

Upon entering the study website, participants were presented with an information sheet about the study and were asked to give their consent to take part in the study (Appendix 5). Participants were then asked to report their level of training, their gender, and number of years practicing as a pain clinician or year of study. Subsequently, participants were shown a screen with instructions for the study and asked to maximise their screens and switch their phones to silent in order to

minimise distractions while participating in the study. Participants viewed the vignette before watching the corresponding video. They were asked to tick a box to confirm that they had both read the vignette and watched the video. They were then asked to estimate pain, the probability that the patient was exaggerating, minimising or hiding their pain and the likelihood of recommending each of the treatment options provided. Participants were able to re-view the pain video and re-read the vignette until they had submitted their responses corresponding to the particular video and vignette pair. Once they clicked on the 'next' button, they were not able to return to the previous page and change their answers. This procedure was repeated for each of the 12 vignettes and videos.

Vignettes and their corresponding videos were shown in a random order to counterbalance any order effects. Participants were then asked to fill out the IRI, provide ratings of trustworthiness of patients and guess the study aim. The study took approximately 20 minutes to complete. As an incentive to complete the study, £2 was donated to *Médecins Sans Frontières/Doctors Without Borders* for each complete study response (Appendix 6).

Analysis

Data were transferred to an SPSS 21 database. Prior to analysis, the data were checked for outliers using histograms, resulting in the adjustment of nine data points to less extreme values (Field, 2013a). All variables were checked for normality using measures of skewness and kurtosis and Q-Q plots of the residuals. The variables 'likelihood of prescribing opioids' and 'likelihood of referring to a mental health specialist' were found to have extreme positive skews ($z > 2.58$). Due to a high number of zeros in the data, transformation did not lead to a normal distribution.

There is no non-parametric test available for mixed ANOVAs on SPSS 21. However, ANOVA has been found to be robust to deviations from normality (Field, 2013b) and it was decided that a mixed ANOVA could still be used to analyse the data. Levene's test was used to test for homogeneity of variance and was not found to be violated ($p > .01$).

Pain estimations and treatment choices were tested using 3 x 2 x 2 x 2 mixed ANOVAs, with history of depression (no history of depression, depression before CP, depression after CP), trustworthiness (high vs. low), and gender of patient (male vs. female) as within-subjects factors and with training level (clinician vs. student) as a between-subjects factor. Sphericity was assessed using Mauchly's Test of Sphericity. Greenhouse-Geisser corrected F -values were reported where the assumption of sphericity was found to be violated ($p < .05$). Due to the increased chance of significant findings in a 4-way ANOVA, interactions that were not previously hypothesised were given a stricter level of significance, at $p < .01$ (Bishop, 2014). Therefore, interactions not previously hypothesised that did not meet this significance level are not reported in the main text and can be found in Appendix 13. Interactions and main effects were further analysed with Bonferroni corrected post-hoc tests using the SPSS syntax Adj (Bonf) command. Effect sizes were calculated using partial eta squared (η_p^2); which is defined as the proportion of the variability accounted for by a variable that is not explained by other variables in the model (Field, 2013).

Results

Demographics

Thirty-four doctors specialising in pain who were members of the International Association for the Study of Pain, and 29 medical students in their 4th,

5th and 6th years, took part in the study. Tables 1 and 2 present details of the two participant groups. The majority of pain clinicians were male (29/35: 85%) and had been practicing for over 20 years (65%). The majority of medical students were female (61%) and in their fourth year (19/29: 61%). The difference in numbers of males and females between groups was significant ($\chi^2(1, 63) = 15.15, p < 0.001$).

Table 1. Demographic information: pain clinicians.

	n (N=34)	%
Gender		
Female	5	15
Male	29	85
Years practicing as a clinician		
0-5 years	0	0
6-10 years	1	3
11-15 years	6	18
16-20 years	5	14
20+ years	22	65
Years practicing as a pain clinician		
0-5 years	5	15
6-10 years	7	20
11-15 years	5	15
16-20 years	5	15
20+ years	12	35

Table 2. Demographic information: medical students.

	n (N=29)	%
Gender		
Female	18	62
Male	11	38
Year of study		
4 th	18	62
5 th	8	28
6 th	3	10

Trustworthiness ratings

Clinicians' and medical students' mean ratings of trustworthiness were less extreme than ratings made by the trainee clinical psychologists (High

trustworthiness, male stimuli: $M = 5.93$, $SD = 1.02$, $Range = 4-9$; High trustworthiness, female stimuli: $M = 5.01$, $SD: 1.07$, $Range = 3-8$; Low trustworthiness, male stimuli: $M = 4.75$, $SD = 0.96$, $Range = 2-8$; Low trustworthiness, female stimuli: $M = 4.43$, $SD = 1.19$, $Range = 1-8$). This may have been due to 11 participants giving all patient stimuli a rating of '5'. Despite this, there was a significant difference in trustworthiness ratings between patients rated high vs. low in trustworthiness, $F(1, 62) = 81.72$, $p < .001$.

Awareness of the study purpose

Only three participants guessed or inferred that the aim of the study concerned mental health issues in patients with chronic pain. Two other participants mentioned perceived trustworthiness in their response. Twenty-one participants referred to 'bias', 'first impressions' or 'judging by appearance'; 11 participants said that the study was about perception of pain; eight referred to empathy, four to malingering and three to decision making. Nine participants said that they were 'not sure of' or did not know the study's purpose. Participants were therefore divided into groups that guessed the study concerned bias (26) and those who did not (37) and data analysed using these groups. There were no significant main effects or interactions in any of the analyses ($p > 0.05$), indicating that participants' responses were not affected by their belief about the purpose of the study.

Research question 1

Are pain clinicians' and medical students' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their

treatment decisions influenced by a patient's depression, and by the timing of its onset in relation to the onset of chronic pain?

Effects of history of depression on pain estimations and judgements

There was a main effect of history of depression on estimates of overall pain (Table 3). Post hoc tests indicated that patients who had depression prior to developing CP were estimated to have more pain than patients who developed depression after CP ($t(62) = 2.67, p = .030$). There were no differences between patients with no history of depression compared to patients with a history of depression. There was no significant main effect of history of depression on estimates of exaggerating, minimising, or hiding pain.

Table 3. Means (*standard errors*) for the effect of history of depression on pain estimates and judgements, where 0 = “No pain” or “Very unlikely”, and 10 = “Extreme pain” or “Very likely”

	No history of depression	Depression before CP	Depression after CP	<i>F</i> (2, 60)	<i>p</i>	η_p^2
Pain estimates	5.09 (0.16)	5.22 (0.14)	4.96 (0.15)	3.46	.035	.05
Exaggerating pain	3.59 (0.15)	3.57 (0.17)	3.52 (0.17)	0.13	.878	.002
Minimising pain	4.17 (0.20)	4.19 (0.17)	3.87 (0.19)	7.94	.057	.05
Hiding pain	3.96 (0.19)	4.00 (0.18)	3.95 (0.19)	0.07	.936	<.01

Note: Values in bold denote significance ($p < .05$)

Effects of history of depression on pain management decisions

In general, participants were unlikely to endorse prescription of opioids to patients, with scores falling at the lower end of the scale. There was no main effect for history of depression on likelihood of prescribing opioids (Table 4).

Table 4. Means (*standard errors*) for the effect of history of depression on likelihood of indicating pain management, where 0 = “Very unlikely”, and 10 = “Very likely”

	No history of depression	Depression before CP	Depression after CP	<i>F</i> (2, 60)	<i>p</i>	η_p^2
Opioids	2.42 (0.21)	2.52 (0.21)	2.32 (0.20)	3.04	.110	.04
Analgesics	6.59 (0.19)	6.33 (0.21)	6.41 (0.30)	4.23	.017	.07
Antidepressants	2.96 (0.25)	5.18 (0.26)	4.59 (0.27)	87.30	<.001	.59
Pain management programme	4.04 (0.30)	4.29 (0.28)	3.96 (0.29)	3.63	.029	.06
Mental health specialist	1.87 (0.19)	4.32 (0.28)	3.63 (0.26)	95.91	<.001	.61

Note: Values in bold denote significance ($p < .05$)

There was a main effect of history of depression on likelihood of prescribing analgesics, indicating that patients without a history of depression were more likely to be prescribed analgesics than patients who had depression prior to developing CP ($t(62) = 2.80, p = .021$). There was no difference in likelihood of prescribing analgesics between patients without a history of depression and patients who developed depression after CP.

There was a main effect of history of depression on likelihood of prescribing antidepressants. Post-hoc tests indicated that patients who developed depression before CP were more likely to be prescribed antidepressants than patients who developed depression after CP and than patients without a history of depression ($t(62) = 4.76, p < .001$; $t(62) = 10.70; p < .001$). Patients who developed depression after CP were also more likely to be prescribed antidepressants than patients without a history of depression, $t(62) = 9.01; p < .001$.

There was a main effect of history of depression on likelihood of referring to a pain management programme. Post hoc tests indicated borderline significance of participants rating patients who developed depression before CP as more likely to be referred to a pain management programme than patients with no history of depression ($t(62) = 0.54, p = .05$). There was no significant difference in likelihood of referral between patients who developed depression after CP and patients with no history of depression.

There was a significant main effect of history of depression on likelihood of referring to a mental health specialist. Post-hoc tests indicated that patients who developed depression before CP were more likely to be referred to a mental health specialist than patients who developed depression after CP and patients without a history of depression ($t(62) = 11.29, p < .001$; $t(62) = 4.30; p < .001$). Patients who developed depression after CP were also more likely to be referred to a mental health specialist than patients without a history of depression, $t(62) = 10.70; p < .001$.

Research question 2

Are pain clinicians' and medical students' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions influenced by how trustworthy the patient looks?

Effects of trustworthiness on pain estimations

There was no main effect of trustworthiness on estimates of pain (Table 5). There was a significant main effect of trustworthiness on estimations of exaggerating pain, indicating that participants rated LT patients as more likely to exaggerate their pain than HT patients. There was a main effect of trustworthiness on estimates of

hiding and minimising pain, indicating that participants rated HT patients as more likely to minimise and hide their pain than LT patients.

Table 5. Means (*standard errors*) for the effect of perceived trustworthiness on pain judgements

	High trustworthiness	Low trustworthiness	<i>F</i> (1, 61)	<i>p</i>	η_p^2
Pain estimates	5.13 (0.14)	5.04 (0.14)	1.18	.282	.02
Exaggerating pain	3.09 (0.16)	4.03 (0.16)	58.15	< .001	.49
Minimising pain	4.46 (0.18)	3.69 (0.16)	35.54	< .001	.37
Hiding pain	4.37 (0.19)	3.56 (0.18)	36.15	< .001	.37

Note: Values in bold denote significance ($p < .05$)

Effects of trustworthiness on pain management decisions

There was no main effect of trustworthiness on likelihood of prescribing opioids (Table 6). There was a significant main effect of trustworthiness on likelihood of prescribing analgesics, indicating that participants were more likely to prescribe analgesics for HT patients than LT patients. There was no main effect of trustworthiness on likelihood of prescribing antidepressants, on the likelihood of referring to a pain management programme and to a mental health specialist.

Table 6. Means (*standard errors*) for the effect of perceived trustworthiness on likelihood of indicating pain management

	High trustworthiness	Low trustworthiness	<i>F</i> (1, 61)	<i>p</i>	η_p^2
Opioids	2.49 (0.21)	2.34 (0.21)	2.81	.099	.04
Analgesics	6.57 (0.19)	6.32 (0.21)	7.53	.008	.11
Antidepressants	4.22 (0.24)	4.27 (0.25)	0.18	.671	< .01
Pain management programme	4.09 (0.28)	4.11 (0.29)	0.04	.844	< .01
Mental health specialist	3.25 (0.23)	3.30 (0.24)	0.24	.625	< .01

Note: Values in bold denote significance ($p < .05$)

Research question 3

Are pain clinicians' and medical students' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions influenced by the gender of the patient?

Effects of gender on pain estimations and judgements

There was a main effect of gender on estimates of pain, indicating that participants estimated males as having more pain than females (Table 7).

There was a significant main effect of gender on estimations of exaggerating pain, indicating that participants estimated female patients as more likely to exaggerate their pain than males. There was a significant main effect of gender on estimations of minimising and hiding pain, indicating that participants estimated males are more likely to minimise or hide their pain than females.

Table 7. Means (*standard errors*) for the effect of gender on pain estimates and judgements

	Female	Male	<i>F</i> (1, 61)	<i>p</i>	η_p^2
Pain estimates	4.65 (0.15)	5.53 (0.14)	69.61	<.001	.53
Exaggerating pain	3.92 (0.16)	3.21 (0.16)	26.92	<.001	.31
Minimising pain	3.74 (0.17)	4.41 (0.18)	19.37	<.001	.24
Hiding pain	3.59 (0.18)	4.34 (0.18)	23.87	<.001	.28

Note: Values in bold denote significance ($p < .05$)

Effects of patient gender on pain management decisions

There was a main effect of gender on likelihood of prescribing opioids and analgesics, indicating that male patients were more likely to be prescribed opioids and analgesics than females (Table 8). There was no main effect of gender on likelihood of prescribing antidepressants. There was a main effect of gender on likelihood of referring to a pain management programme, indicating that male patients were more likely to be referred to a pain management programme than females. There was no main effect of gender on likelihood of referring to a mental health specialist.

Table 8. Means (*standard errors*) for the effect of gender on likelihood of indicating pain management

	Female	Male	<i>F</i> (1, 61)	<i>p</i>	η_p^2
Opioids	2.16 (0.19)	2.68 (0.22)	31.84	< .001	.34
Analgesics	6.12 (0.22)	6.77 (0.20)	31.01	< .001	.34
Antidepressants	4.26 (0.23)	4.23 (0.25)	0.01	.758	< .01
Pain management programme	3.88 (0.28)	4.31 (0.29)	10.53	.002	.15
Mental health specialist	3.31 (0.24)	3.24 (0.22)	0.44	.508	< .01

Note: Values in bold denote significance ($p < .05$)

Research question 4

Do depression history, patient trustworthiness and gender interact?

Pain estimates and judgements: interactions

Patient trustworthiness x gender

There was a significant interaction between patient trustworthiness and gender for pain estimates and all judgements of pain (Table 9). Post hoc tests indicated that trustworthiness had an effect on pain estimations for female, but not for male patients (Table 10). This indicates that participants estimated HT females as in more pain than LT females, but participants gave similar and higher pain estimates to males, regardless of their level of trustworthiness. The main effect for patient gender remained, with participants estimating males as in higher pain than females for both levels of trustworthiness ($t(62) = 3.28, p = .001$; $t(62) = 7.69, p < .001$).

Table 9. Interactions between history of depression, trustworthiness and gender for pain judgements

	Trustworthiness x gender			History of depression x trustworthiness			History of depression x gender			Trustworthiness x gender x history of depression		
	<i>F</i> (1,61)	<i>p</i>	η_p^2	<i>F</i> (2,60)	<i>p</i>	η_p^2	<i>F</i> (2,60)	<i>p</i>	η_p^2	<i>F</i> (2,60)	<i>p</i>	η_p^2
Pain estimates	9.78	.003	.14	6.16	.003	.09	4.40	.014	.07	16.87	< .001	.22
Exaggerating pain	45.71	< .001	.43	2.63	.076	.04	2.75	.068	.04	14.01	< .001	.19
Minimising pain	11.99	< .001	.16	0.64	.528	.01	7.30	.001	.11	17.13	< .001	.22
Hiding pain	19.44	< .001	.24	1.20	.305	.02	7.58	.001	.11	22.44	< .001	.27
Opioids	13.61	<.001	.18	2.23	.112	.04	0.78	.461	.01	1.91	.153	.03
Analgesics	6.50	.013	.10	0.58	.560	.01	2.19	.116	.04	4.20	.017	.06
Antidepressants	3.72	.058	.06	6.42	.002	.10	7.58	.001	.11	2.70	.071	.04
Pain management programme	0.06	.808	<.01	3.38	.037	.05	6.12	.003	.09	4.62	.015	.07
Mental health specialist	7.67	.007	.11	0.66	.517	.01	4.10	.019	.06	2.33	.102	.04

Note: Grey shades indicate: $\eta_p^2 \leq .10$ $\eta_p^2 \leq .20$ $\eta_p^2 > .20$

Values in bold denote significance ($p < .01$)

Table 10. Means (*standard errors*) and post hoc test results for the trustworthiness x gender interaction

	Females				Males			
	HT	LT	<i>t</i> (62)	<i>p</i>	HT	LT	<i>t</i> (62)	<i>p</i>
Pain estimates	4.87 (0.16)	4.43 (0.16)	3.27	.002	5.39 (0.15)	5.66 (0.16)	1.89	.063
Exaggerating pain	2.95 (0.19)	4.89 (0.20)	8.85	<.001	3.23 (0.18)	3.18 (0.17)	0.35	.724
Minimising pain	4.39 (0.22)	3.09 (0.18)	6.72	<.001	4.52 (0.21)	4.30 (0.19)	1.48	.299
Hiding pain	4.32 (0.21)	2.86 (0.19)	7.19	<.001	4.42 (0.21)	4.27 (0.21)	0.78	.440

Note: Values in bold denote significance ($p < .05$)

For exaggerating, minimising and hiding pain, post hoc tests indicated that the previously mentioned main effects for trustworthiness only occurred in female, but not male patients. The main effects for patient gender also only occurred in patients low, and not high, in trustworthiness. Participants rated LT females as more likely to exaggerate, and less likely to minimise or hide their pain than HT females, but gave similar ratings of exaggerating, minimising and hiding to males regardless of their level of trustworthiness. There was no difference between participants' estimates of exaggerating, minimising and hiding in HT females and HT males ($t(62) = 1.45, p = .152$; $t(62) = 0.58, p = .562$; $t(62) = 0.44, p = .660$), but participants rated LT females as more likely to exaggerate, and less likely to minimise or hide pain than LT males ($t(62) = 8.30, p < .001$, $t(62) = 5.91, p < .001$; $t(62) = 6.93, p < .001$).

Patient trustworthiness x history of depression

There was a significant interaction between patient trustworthiness and history of depression for pain estimations, but not for pain judgements. Post hoc tests

indicated that the previously mentioned main effect for history of depression did not occur in HT patients, indicating that participants gave similar pain estimates to HT patients, regardless of their history of depression ($p > .05$). Participants estimated LT patients who had no history of depression as in more pain than LT patients who developed depression after CP (LT, no history of depression: $M = 5.18$, $SE = 0.15$; LT, depression after CP: $M = 4.71$, $SE = 0.17$; $t(62) = 3.62$, $p = .002$). Participants were also more likely to estimate LT patients who developed CP before depression as in more pain than patients who developed depression after CP (LT, depression before CP: $M = 5.24$, $SE = 0.16$; $t(62) = 3.45$, $p = .003$). HT patients who developed depression after CP received higher estimates than LT patients in the same group ($t(62) = 3.45$, $p = .001$), and there were no differences between HT and LT patients in the other two groups ($p > .05$).

History of depression x gender

There was also an interaction between patient gender and history of depression for minimising and hiding pain. Post hoc tests indicated that the previously mentioned main effect for gender only occurred in patients without a history of depression and patients who developed depression after CP, but not for patients who developed depression before CP (Table 11; minimising: $t(62) = 2.72$, $p = .008$; $t(62) = 5.83$, $p < .001$; $t(62) = 0.78$, $p = .440$; hiding: $t(62) = 3.06$, $p = .003$; $t(62) = 5.82$, $p < .001$; $t(62) = 0.98$, $p = .329$). There was no difference in estimates of minimising or hiding between male patients, regardless of their history of depression ($p > .05$). Participants rated females who developed depression after CP as less likely to minimise their pain than females who developed depression before CP and females without a history of depression ($t(62) = 5.08$, $p = .002$; $t(62) = 3.66$,

$p < .001$). Females who developed depression after CP were less likely to be rated as hiding their pain than females who developed depression before CP ($t(62) = 3.51, p = .003$).

Table 11. Means (*standard errors*) and post hoc test results for the history of depression x gender interaction

	No history of depression		Depression before CP		Depression after CP	
	Female	Male	Female	Male	Female	Male
Minimising pain	3.89 (0.19)	4.44 (0.20)	4.09 (0.21)	4.29 (0.21)	3.23 (0.20)	4.51 (0.24)
Hiding pain	3.63 (0.21)	4.43 (0.21)	3.88 (0.21)	4.11 (0.23)	3.26 (0.21)	4.63 (0.24)

Note: Values in bold denote significance between male and female patients ($p < .05$)

Trustworthiness x gender x history of depression

There was also a significant interaction between trustworthiness, gender and history of depression for pain estimates and all pain judgements, indicating that the trustworthiness x gender interactions differed according to the patient's history of depression (Table 12). Post hoc tests for pain estimates indicated that the difference between HT and LT females was not consistent across depression groups, with only the HT female with depression before CP estimated as in higher pain than the LT female ($t(62) = 3.99, p < .001$). There was a trend for a similar pattern between the females with no history of depression ($t(62) = 1.88, p = .065$). Post hoc tests indicated that males were affected by trustworthiness ratings. For patients with no history of depression or who developed depression before CP, LT males were estimated as in more pain than HT males ($t(62) = 3.07, p = .003$; $t(62) = 3.87, p < .001$). The opposite effect was found for males who developed depression after CP ($t(62) = 3.71, p < .001$).

Table 12. Means (*standard errors*) for the history of depression x trustworthiness x gender interaction

	Females						Males					
	No history of depression		Depression before CP		Depression after CP		No history of depression		Depression before CP		Depression after CP	
	HT	LT	HT	LT	HT	LT	HT	LT	HT	LT	HT	LT
Pain estimates	4.92 (0.19)	4.56 (0.20)	5.05 (0.20)	4.20 (0.20)	4.65 (0.20)	4.51 (0.19)	5.06 (0.20)	5.81 (0.17)	5.36 (0.19)	6.27 (0.20)	5.75 (0.20)	4.91 (0.22)
Exaggerating pain	2.51 (0.23)	5.22 (0.24)	2.91 (0.21)	4.74 (0.27)	3.42 (0.26)	4.71 (0.26)	3.49 (0.26)	3.15 (0.21)	3.66 (0.26)	2.96 (0.23)	2.55 (0.22)	3.42 (0.28)
Minimising pain	4.82 (0.26)	2.97 (0.22)	4.93 (0.30)	3.25 (0.24)	3.41 (0.24)	3.05 (0.22)	4.40 (0.26)	4.49 (0.26)	4.01 (0.27)	4.57 (0.27)	5.16 (0.31)	3.86 (0.28)
Hiding pain	4.65 (0.28)	2.62 (0.22)	4.68 (0.28)	3.08 (0.25)	3.63 (0.24)	2.89 (0.25)	4.10 (0.25)	4.45 (0.30)	3.85 (0.26)	4.39 (0.30)	5.31 (0.31)	3.96 (0.28)

Note: Values in bold denote significance between high trustworthy and low trustworthy patients ($p < .05$)

Post-hoc comparisons for exaggerating and hiding pain indicated that participants rated all LT females as more likely to exaggerate and less likely to hide pain than HT females (exaggerating: $t(62) = 8.39, p < .001$; $t(62) = 6.38; p < .001$; $t(62) = -3.70; p < .001$; hiding: $t(62) = 7.45; p < .001$; $t(62) = 4.74; p < .001$; $t(62) = 2.94; p = .005$). Only HT females with no history of depression ($t(62) = 6.49, p < .001$) and who developed depression before CP ($t(62) = 4.89; p < .001$) were rated as more likely to minimise their pain, while there was no difference between HT and LT females who developed depression after CP ($p > .05$). For males who developed depression before CP, participants rated the HT male as more likely to exaggerate his pain than the LT male ($t(62) = 2.61, p = .010$). For males who developed depression after CP, the LT male was rated as more likely to exaggerate pain than the HT male ($t(62) = -3.23, p = .002$), and less likely to minimise ($t(62) = -8.39, p < .001$) or hide his pain ($t(62) = 3.94, p < .001$). There was no difference between HT and LT males with no history of depression for exaggerating, minimising or hiding pain ($p > .05$).

Pain management decisions: interactions

There was a significant interaction between patient trustworthiness and gender for likelihood of prescribing opioids and analgesics. Post hoc tests indicated there was an effect of trustworthiness in female, but not male patients (Table 13). This interaction indicates that participants were more likely to prescribe opioids and analgesics to HT females than LT females, but participants gave similar ratings of prescription of opioids and analgesics to males, regardless of their level of trustworthiness. For prescription of opioids, the main effect for patient gender only occurred in LT patients, with LT males more likely to be prescribed opioids than LT females ($t(62) = 6.15, p < .001$). There was no difference for HT females compared

to HT males ($p > .05$). For prescription of analgesics, the main effect for patient gender remained, with males more likely to be prescribed analgesics than females for both levels of trustworthiness ($t(62) = 2.79, p = .007$; $t(62) = 5.56, p < .001$).

Table 13. Means (*standard errors*) and post hoc test results for the trustworthiness x gender interaction

	Females				Males			
	HT	LT	$t(62)$	p	HT	LT	$t(62)$	p
Opioids	2.41 (0.21)	1.90 (0.20)	4.08	<.001	2.58 (0.22)	2.79 (0.24)	1.49	.139
Analgesics	6.39 (0.22)	5.87 (0.20)	3.37	.001	6.77 (0.20)	6.77 (0.22)	< .01	.998

Note: Values in bold denote significance between high and low trustworthy patients ($p < .05$)

There was also an interaction between patient trustworthiness and gender for likelihood of referring to a mental health specialist. Post hoc tests showed that in LT patients, females were more likely than males to be referred to a mental health specialist ($M = 3.50, SE = 0.27$; $M = 3.10, SE = 0.23$; $t(62) = 2.44, p = .018$). There was no difference between HT males and females ($M = 3.39, SE = 0.23$; $M = 3.11, SE = 0.25$).

Patient trustworthiness x history of depression

There was a significant interaction between patient trustworthiness and history of depression for likelihood of prescribing antidepressants. The main effect for history of depression remained across patient trustworthiness. Post hoc tests indicated that for patients with no history of depression, LT patients were more likely to be prescribed antidepressants than HT patients ($M = 3.17, SE = 0.27$; $M = 2.75, SE = 0.25$; $t(62) = 2.45, p = .017$). There was no difference between HT and LT patients for patients who developed depression before CP, while for patients who

developed depression after CP, HT patients were more likely to be prescribed antidepressants than LT patients ($M = 4.81$; $SE = 0.30$; $M = 4.38$, $SE = 0.28$; $t(62) = 2.30$, $p = .025$).

History of depression x gender

There was a significant interaction between patient gender and history of depression for likelihood of prescribing antidepressants and likelihood of referring to a pain management programme. Post hoc tests indicated that for patients without a history of depression, females were more likely than males to be prescribed antidepressants (Table 14, $t(62) = 3.00$, $p = .004$). There were no differences between males and females in patients who developed depression before or after CP. There was no difference in likelihood of referring to a pain management programme between males and females who had no history of depression ($p > .05$), but males who developed depression before or after CP were more likely to be referred to a pain management programme than females in the same conditions ($t(62) = 3.05$, $p = .003$; $M = 4.40$, $t(62) = 3.78$, $p < .001$).

Table 14. Means (*standard errors*) and post hoc test results for the history of depression x gender interaction

	No history of depression		Depression before CP		Depression after CP	
	Female	Male	Female	Male	Female	Male
Antidepressants	3.23 (0.27)	2.69 (0.25)	5.03 (0.32)	5.33 (0.29)	4.44 (0.32)	4.77 (0.31)
Pain management programme	4.01 (0.33)	3.92 (0.33)	3.95 (0.34)	4.63 (0.33)	3.37 (0.33)	4.40 (0.34)

Note: Values in bold denote significance between male and female patients ($p < .05$)

Research question 5

Do pain clinicians' estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions differ from those of medical students'?

Effects of training level on pain estimations

There was a main effect of training level on estimates of pain, indicating that pain clinicians were more likely to give patients higher pain estimates than medical students (Table 15). Pain clinicians provided similar estimates of pain, regardless of the number of years of practice ($F(4, 33) = 0.28, p = .890$).

There was a significant main effect of training level on estimations of exaggerating, indicating that medical students were more likely rate the patient as exaggerating their pain than pain clinicians, and there was no main effect of training level on estimations of minimising or hiding pain.

Table 15. Means (*standard errors*) for the effect of training level on pain judgements

	Pain clinicians	Medical students	$F(1, 61)$	p	η_p^2
Pain estimates	5.50 (0.18)	4.68 (0.19)	9.85	.003	.14
Exaggerating pain	3.19 (0.19)	3.93 (0.21)	6.54	.013	.10
Minimising pain	3.89 (0.21)	4.19 (0.17)	1.41	.24	.02
Hiding pain	3.71 (0.22)	4.23 (0.24)	2.54	.116	.04

Note: Values in bold denote significance ($p < .05$)

Effects of training level on pain management decisions

There was a main effect of training level on likelihood of prescribing opioids and analgesics, indicating that medical students were more likely to prescribe opioids and analgesics than pain clinicians (Table 16). There was no main effect of training level on likelihood of prescribing antidepressants. There was a main effect of training level on likelihood of referring to a pain management programme and a mental health specialist, indicating that medical students were more likely to refer patients to a pain management programme and a mental health specialist than pain clinicians.

Table 16. Means (*standard errors*) for the effect of training level on likelihood of indicating pain management

	Pain clinicians	Medical students	<i>F</i> (1, 61)	<i>p</i>	η_p^2
Opioids	1.81 (0.27)	3.03 (0.27)	9.19	.004	.13
Analgesics	6.04 (0.27)	6.85 (0.29)	4.13	.046	.06
Antidepressants	4.31 (0.32)	4.18 (0.35)	0.90	.772	<.01
Pain management programme	3.39 (0.38)	4.81 (0.41)	6.40	.014	.09
Mental health specialist	2.24 (0.31)	4.31 (0.33)	29.11	<.001	.26

Note: Values in bold denote significance ($p < .05$)

Research question 6

Are pain clinicians' and medical students' estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions affected differently by history of depression, trustworthiness and gender of the patient?

Interactions between training level and history of depression, trustworthiness and gender

Patient gender x training level

There was an interaction between gender of patient and training level for pain estimations and all pain judgements (Table 17). Both clinicians and students were more likely to estimate male patients having higher pain than female patients, but this effect was more pronounced in students (Table 18). For exaggerating pain, post hoc comparisons indicated that medical students rated females as more likely to exaggerate their pain than males while there was no difference between males and females in clinicians' ratings of exaggerating pain. For estimates of minimising and hiding pain, post hoc tests indicated that medical students rated females as less likely to minimise and hide their pain than males, while there was no difference between males and females in clinicians' ratings of minimising pain.

Table 17. Interactions between training level, history of depression, trustworthiness and gender for pain estimates, judgements and management decisions

	Gender x training level			History of depression x training level		
	<i>F</i> (1,61)	<i>p</i>	η_p^2	<i>F</i> (2,60)	<i>p</i>	η_p^2
Pain estimates	30.85	<.001	.34	0.33	.035	.05
Exaggerating pain	21.65	<.001	.26	0.34	.716	.01
Minimising pain	8.99	.004	.13	0.78	.380	.01
Hiding pain	8.48	.005	.12	0.99	.373	.02
Opioids	27.29	<.001	.31	0.86	.425	.01
Analgesics	4.69	.034	.07	4.53	.017	.07
Antidepressants	0.23	.631	<.01	5.87	.004	.09
Pain management programme	3.20	.079	.05	5.10	.007	.08
Mental health specialist	0.66	.420	.01	19.18	<.001	.24

Note: Grey shades indicate:

$\eta_p^2 \leq .10$

$\eta_p^2 \leq .20$

$\eta_p^2 > .20$

Values in bold denote significance ($p < .05$)

Table 18. Means (*standard errors*) and post hoc test results for the gender x training level interaction

	Clinicians				Medical students			
	Females	Males	<i>t</i> (62)	<i>p</i>	Females	Males	<i>t</i> (62)	<i>p</i>
Pain estimates	5.35 (0.20)	5.65 (0.19)	2.06	.044	5.41 (0.20)	3.94 (0.22)	9.48	<.001
Exaggerating pain	3.23 (0.22)	3.16 (0.21)	0.40	.694	4.60 (0.24)	3.25 (0.23)	6.69	<.001
Minimising pain	4.00 (0.23)	3.78 (0.24)	0.27	.787	3.69 (0.26)	4.83 (0.25)	2.44	.018
Hiding pain	3.55 (0.24)	3.86 (0.25)	1.45	.151	3.63 (0.26)	4.83 (0.27)	5.31	<.001

Note: Values in bold denote significance ($p < .05$)

Interactions between training level and history of depression, trustworthiness and gender: pain management decisions

Patient gender x training level

There was a significant interaction between patient gender and training level for likelihood of prescribing opioids. Post hoc tests indicated that students were more likely to prescribe opioids for males than females ($M = 3.54$, $SE = 0.32$; $M = 2.52$, $SE = 0.29$; $t(62) = 7.37$, $p < .001$), while there was no difference in clinicians' ratings between males and females ($M = 1.83$, $SE = 0.29$ $M = 1.79$, $SE = 0.26$; $t(62) = 0.31$, $p = .759$).

History of depression x training level

There was a significant interaction between history of depression and training level of participants for likelihood of prescribing analgesics, antidepressants and for referring to a pain management programme and to a mental health specialist. Post hoc tests indicated that clinicians' likelihood of prescribing analgesics were not affected by the history of depression of patients (Table 19), but that medical students

were more likely to prescribe analgesics for patients who had no history of depression than patients who developed depression before CP, and patients who developed depression after CP.

For antidepressants, post hoc tests indicated that for both clinicians and students, patients who developed depression before CP were more likely to be prescribed antidepressants than both patients with no history of depression and patients who developed depression after CP (Table 19). Patients who developed depression after CP were also more likely to be prescribed antidepressants than patients with no history of depression.

Table 19. Means (*standard errors*) and post hoc test results of the history of depression x training level interaction for likelihood of prescribing antidepressants

				<i>t</i>	<i>p</i>
	No history of depression	Depression before CP	Depression after CP		
Analgesics					
Clinician	6.06 (0.27)	5.90 (0.29)	-	1.23	.668
	6.06 (0.27)	-	6.15 (0.29)	0.72	.999
	-	5.90 (0.29)	6.15 (0.29)	1.94	.169
Student	7.12 (0.29)	6.76 (0.31)	-	2.66	.029
	7.12 (0.29)	-	6.66 (0.31)	3.46	.003
	-	6.76 (0.31)	6.66 (0.31)	0.70	.999
Antidepressants					
Clinician	3.37 (0.33)	5.02 (0.35)	-	5.89	<.001
	3.37 (0.33)	-	4.55 (0.37)	4.77	<.001
	-	5.02 (0.35)	4.55 (0.37)	2.85	.017
Student	2.55 (0.36)	5.33 (0.38)	-	9.13	<.001
	2.55 (0.36)	-	4.65 (0.40)	7.82	<.001
	-	5.33 (0.38)	4.65 (0.40)	3.83	.001
Mental health specialist					
Clinician	1.49 (0.27)	2.88 (0.38)	-	4.75	<.001
	1.49 (0.27)	-	2.36 (0.36)	3.94	.001
	-	2.88 (0.38)	2.36 (0.36)	2.39	.059
Student	2.26 (0.29)	5.76 (0.41)	-	10.97	<.001
	2.26 (0.29)	-	4.90 (0.39)	10.95	<.001
	-	5.76 (0.41)	4.90 (0.39)	3.65	.002

Values in bold denote significance ($p < .05$)

There was an interaction between history of depression and training level. Students were more likely to refer the patient to pain management than clinicians in patients with no history of depression and patients who developed depression before CP ($M = 4.91, SE = 0.42; M = 3.02, SE = 0.39; t(62) = 3.27, p = .002; M = 4.87, SE = 0.41; M = 3.71, SE = 0.38; t(62) = 2.10, p = .04$). There was a trend in a similar direction for patients who developed depression after CP ($M = 4.64, SE = 0.44; M = 3.43, SE = 0.41; t(62) = 1.99, p = .051$).

Medical students were more likely to refer patients who developed depression before or after chronic pain to a mental health specialist than clinicians, ($t(62) = 5.14, p < .001; t(62) = 4.82; p < .001$) with a similar trend for patients with no history of depression $t(62) = 1.96; p = .055$. Both clinicians and students were more likely to refer patients with depression to a mental health specialist than the patients with no history of depression (Table 19), but only students were more likely to refer patients who developed depression before CP than patients who developed depression after CP.

Research question 7

Do empathy levels of pain clinicians and medical students correspond with estimations of pain, estimations of the probability that patients are exaggerating, minimising or hiding their pain, and their treatment decisions?

Empathy

Independent t-tests were used to compare total empathy scores from the IRI and the sub-scales between clinicians and medical students (Table 20). Clinicians and medical students differed for total empathy and the *identification* and *personal*

distress subscales, with clinicians scoring lower in empathy than medical students ($t(61)=-4.65, p < .001$; $t(61)=-4.32, p < .001$; $t(61)=-5.06, p < .001$). There was a significant gender difference between the two participant groups, and t-tests showed that there was a significant difference between males and females for total empathy ($t(61)=-3.65, p = .001$) and the subscales *empathic concern* ($t(61)=-2.91, p = .005$) and *personal distress* ($t(61)=-3.14, p = .003$), with females scoring higher than males.

Table 20. Mean empathy scores of clinicians and medical students.

	Clinicians <i>M (SD)</i>	Medical students <i>M (SD)</i>	<i>t</i>	<i>df</i>	<i>p</i>
Total empathy score	56.18 (10.50)	67.86 (9.25)	-4.65	61	< .001
Perspective	18.56 (4.91)	18.14 (4.53)	.352	61	.726
Identification	12.23 (4.36)	17.38 (5.15)	-4.32	61	< .001
Empathic concern	18.79 (3.52)	20.34 (3.22)	-1.81	61	.075
Personal distress	6.62 (3.76)	12.00 (4.68)	-5.06	61	< .001

Values in bold denote significance ($p < .05$)

The relationship between empathy scores, pain estimations and likelihood of recommending treatment was investigated using correlations (Pearson's Product Coefficient or Spearman's Rho depending on whether or not the data were normally distributed). For brevity, only the significant correlations are reported. Bonferroni corrections were applied, with p values multiplied by five to correct for the number of comparisons for each variable.

Impact of empathy on pain judgements

Estimated pain was not correlated with empathy scores. Separately, estimated pain in females and males were also not correlated with empathy scores. There was no relationship between estimation that the patient was exaggerating, minimising or hiding their pain and empathy scores.

Impact of empathy on pain management decisions

There were no correlations between likelihood of prescribing opioids, analgesics, antidepressants or referral to a mental health specialist with any of the empathy scores. The subscale *identification* was positively correlated with referral to a pain management ($r = .327; p = .045$).

Discussion

This study aimed to investigate the effects of four variables on judgements and treatment decisions in patients with chronic pain. Three variables concerned the patient: history of depression, trustworthiness, and gender; and one concerned the (participant) caregiver/provider: training level. Although the main hypotheses concerned trustworthiness and history of depression, gender was the most influential factor, and consistently affected estimates, judgements and treatment decisions, while trustworthiness and history of depression affected them more selectively. Therefore, gender findings will be discussed first, followed by trustworthiness, history of depression and then training level and empathy. Complicating the interpretation of results, several interactions also occurred between trustworthiness, gender and depression for pain estimates and judgements, and these will be discussed

in further detail. For clarity and brevity, only the interactions that were hypothesised or that emerged consistently across different analyses, and/or that had larger effect sizes, will be discussed.

The impact of patient gender

The hypotheses relating to the impact of patient gender on pain estimates and judgements were strongly supported, and hypotheses relating to pain management decisions were partially supported. Males were consistently estimated to be in more pain than females, by nearly 0.9/10 units, by both clinicians and medical students. Females were judged as more likely to exaggerate pain and less likely to minimise or hide it than males by medical students, but not by clinicians. Trustworthiness interacted with gender to suggest that for judgements of exaggeration, minimising, and hiding, it was the LT females who were adversely judged, while HT females were rated similarly to HT males. The effect sizes for these were large, suggesting that this is a clinically significant difference.

Consistent with understanding men's pain as more genuine and/or serious, men were more likely than women to be prescribed opioids by medical students, and more likely to be prescribed analgesics by both pain clinicians and medical students. Trustworthiness interacted with gender to suggest that for opioid prescription, it was LT females who were less likely to be prescribed opioids than LT males, while HT females were just as likely to be prescribed opioids as HT males. Males with a history of depression were also more likely to be referred to a pain management programme than females in the same groups, though the effect size for this difference was smaller than the differences in drug prescription. There were no overall gender differences in likelihood of antidepressant prescription or referral to a mental health

specialist, but among patients with no history of depression, women were more likely than men to be prescribed antidepressants by both students and clinicians.

These findings are in line with previous studies that have found that pain in females is taken less seriously than pain in males, and that males are more likely to be treated than females (Tait et al., 2009). There is evidence of real sex differences in the prevalence of many chronic pain problems, probably due to a combination of biological, psychological, and social factors (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley, 2009). Stereotypes of gender roles in pain experience mean that both males and females perceive the 'typical' man as less willing to report pain, and more tolerant of pain, than the 'typical' woman (Bernardes, Keogh, & Lima, 2008; Robinson et al., 2001). Clinicians and medical students in the current study provided results consistent with these stereotypes, so that females who express pain at a similar level to males are actually estimated to experience less pain than males because of their decreased tolerance and increased willingness to express their pain. Thus men are estimated to have more pain than women, to be less likely to exaggerate pain and more likely to minimise or hide it, and as a consequence, are more eligible for opioids and analgesics. The stereotype that females are less tolerant of and more likely to report pain might also lead to providers providing a higher burden of proof on their reports, and therefore less likely to prescribe analgesics and opioids (Hoffmann & Tarzian, 2001). They could possibly view males as more able to handle the effects of a 'stronger' drug such as an opioid, and females as less tolerant of the side effects. The results are also consistent with reported experiences of female patients that their health problems are not taken seriously (Werner & Malterud, 2003). In one study, females with medically unexplained symptoms reported spending time before their appointments thinking about how their

appearance and description of their symptoms during the appointment might affect their credibility as patients (Werner & Malterud, 2003). However, the lack of gender differences in the current study for antidepressant prescription and referral to a mental health specialist contrast with another study which found that females were more likely to be prescribed antidepressants or referred to a mental health specialist (Hirsh, Hollingshead, Matthias, Bair, & Kroenke, 2014).

The impact of perceived trustworthiness

It was hypothesised that participants would estimate lower pain in LT patients compared to HT patients, but this effect emerged only for female patients, with LT females estimated to experience about 1/10 units less pain than HT females. This is consistent with the notion that women are prone to report more pain.

Findings on exaggerating pain were complex, with partial support for the hypothesis that participants would rate LT patients as more likely to exaggerate their pain. Low trustworthiness overall, but only in women, was associated with a higher likelihood of exaggeration; for men, low trustworthiness was associated with higher expectation of exaggeration for those with depression onset after CP. For HT men, those with depression onset before CP were judged more likely to exaggerate pain. This is hard to interpret.

Findings on minimising and hiding pain also interacted with trustworthiness, gender and depression history. Overall, HT patients were judged more likely to minimise or hide their pain, but for HT females compared to LT females minimising was only judged more likely for those with no depression or depression onset after CP, with no difference for those with depression onset before CP, while hiding pain was more likely for HT females in either depression group. The effects for males

were also complex but consistent, with HT males with depression onset after CP judged as particularly likely to minimise or hide their pain compared to the LT male in the same category.

Hypotheses relating to the effects of trustworthiness on recommending treatment were partially supported. Trustworthiness interacted with gender for opioids and analgesics, with HT females more likely to be prescribed opioids and analgesics than LT females. Patients at both trustworthiness levels were just as likely to be prescribed antidepressants, or referred to a pain management programme or mental health specialist.

Perceived trustworthiness affects investment decisions in trust games (Rezlescu et al., 2012; Wout & Sanfey, 2008); our results suggest that it also affects clinical decisions which purport to be free of such biases. Previous studies in trustworthiness do not appear to have tested for differences in judgements of males and females according to trustworthiness (Olivola, Funk, & Todorov, 2014; van 't Wout & Sanfey, 2008). This appears to be the first finding that gender interacts with perceived trustworthiness to influence judgements in the context of assessment of chronic pain. In the context of pain assessment, it is possible that clinicians and medical students view LT females as more likely to 'manipulate' clinicians by exaggerating their pain, leading to compensatory discounting of pain in their estimates; their treatment decisions are consistent with this in being less inclined to prescribe analgesics or opioids. In contrast, LT males might be seen as 'tough', and in line with gender role expectations, less likely to exaggerate their pain, and more likely to minimise or hide their pain, leading to higher pain estimations.

Due to the differences within the three-way interactions, there is no clear explanation for why males of different levels of trustworthiness with different

histories of depression might receive different estimations of pain and judgements of how they expressed pain. One possibility is that information in the vignettes about the patient's social situation influenced participants' estimates of pain. For example, the LT male who developed depression before CP was described as a 'carer' in the vignette, as was the HT male who developed depression after CP. Both received higher estimates of pain, and were judged as less likely to exaggerate than the respective HT and LT males in the same groups. Participants could have a stereotypical view of a carer as being trustworthy, which could have over-ridden the effects of facial cues of perceived trustworthiness. One study found that perceived trustworthiness can be altered by priming participants with the word 'partner' instead of 'opponent' (Burnham, McCabe, & Smith, 2000). Therefore, it is possible that the social description could have influenced the effects of perceived trustworthiness on participants.

The impact of depression

It was hypothesised that participants would conceptualise pain developed after depression as a 'symptom' or 'presentation' of depression or at least amplified by it (Holloway & Zerbe, 2000), and therefore estimate less pain in patients with a history of depression before CP than in patients with no history of depression and patients who developed depression after CP. The hypothesis also stated that participants would rate patients with a history of depression as more likely to exaggerate and less likely to minimise or hide their pain. Results did not support these hypotheses: participants rated *more* pain in patients who developed depression prior to CP than in patients who developed depression after CP. The effect size was small, so it would be unlikely to have clinical impact, and this effect only occurred in

LT patients. There was no overall difference in pain estimates between patients with and without a history of depression, suggesting that the presence of depression whenever it developed in relation to CP did not affect pain estimates in a consistent way. An unexpected interaction with trustworthiness and gender suggested that LT males with no depression or depression before CP were given higher pain estimates than HT males in those groups, while for males who developed depression after CP, HT males were given higher pain estimates than LT males. For females, only LT females with depression before CP were given lower estimates of pain than HT females. History of depression did not affect participants' judgements on the likelihood that the patient was exaggerating, minimising or hiding their pain, but interacted with gender such that while judgements of male patients were unaffected by depression history, female patients who developed depression after CP were rated as less likely to minimise or hide their pain than the other two groups.

It was also hypothesised that participants would be less likely to prescribe opioids and analgesics, less likely to recommend a pain management programme, and more likely to prescribe antidepressants and to refer to a mental health specialist for patients with a history of depression (consistent with Hirsh et al. 2013).

Depression history did not have the expected effect on the likelihood of being prescribed opioids; participants were reluctant in general to endorse prescription of opioids, and that may have obscured small effects of variable manipulations. The hypothesis was partially supported for prescription of analgesics and referral to a pain management programme, with patients with no history of depression more likely to be prescribed analgesics or referred to a pain management programme than patients who developed depression before CP. However, the effect sizes were small and unlikely to be of clinical significance.

History of depression was, as hypothesised, associated with the likelihood of prescribing antidepressants even though they were specified as analgesics, so not at an antidepressant dose, most strongly for patients who developed depression before CP, followed by those who developed depression after CP. History of depression also had a large effect on likelihood of referring to a mental health specialist, with no differentiation according to time of onset. These findings are consistent with those of Hirsh et al. (2013), and for mental health treatment (Teh, Zaslavsky, Reynolds, & Cleary, 2010) and to an extent for tricyclic antidepressants. The issue of different dose of antidepressants for pain and for depression (Mico, Ardid, Berrocoso, & Eschalier, 2006) seems to have been overlooked by both experienced (clinician) and inexperienced (medical student) participants, as were the analgesic benefits of antidepressants available to patients without depression (Mico et al., 2006). It was hypothesised that perceived trustworthiness would moderate the effects of depression on participants' pain estimates, but we found no such interaction.

The current study is the first to investigate differences in participants' judgements according to the timing of depression in patients with chronic pain. The lack of any consistent effects does not necessarily imply that pain clinicians and medical students are unaffected by history of depression, but that they are not simple. One study found that treatment decisions of medical students and physicians for patients with depression and chronic pain varied according to their attitudes about patients with depression (Botega & Silveira, 1996; Hirsh, Hollingshead, Bair, Matthias, & Kroenke, 2014). We did not measure this variable, although participants with more negative attitudes about patients with depression would be expected to estimate the pain of depressed patients as lower than of non-depressed patients, while participants with more positive attitudes about patients with depression might have

provided higher estimations of pain. Such an effect, if strong, could easily obscure any effects of history of depression on pain estimation. Another reason for the unexpected effects of history of depression could be that participants interpreted the information about the patient's history of depression in the referral letter incorrectly, interpreting depression onset before pain to mean not currently depressed, which would produce the same effects for that group as for the non-depressed group, but it is not possible to ascertain if this is the case.

The impact of training level

It was hypothesised that pain clinicians would give lower estimates of pain than medical students, consistent with many findings on the effects of years of experience (Tait et al., 2009), but results indicated the opposite, with pain clinicians giving patients higher pain estimates than medical students. In both groups, the gender effect of estimating men's pain higher than females held, though the effect was more pronounced in medical students. It could be that the specialist nature of pain clinicians' experience, unlike a range of clinician experience in published studies, moderates the tendency towards lower estimates with years of experience; differences between specialisms were found in a study by Kappesser et al. (2006). Medical students were more likely than clinicians to rate patients as exaggerating their pain, particularly female patients, and while there were no differences between clinicians and students on overall estimates of minimising and hiding pain, medical students rated females as less likely to minimise or hide their pain than males.

Medical students were more likely to endorse prescription of opioids especially for males, consistent with their greater confidence in male presentation of pain. A similar pattern for the prescription of opioids was found in a study of medical

records at a general medical practice, with newly qualified clinicians more likely to prescribe opioids to patients than more senior clinicians (Colburn, Jasinski, & Rastegar). Medical students were also more likely than clinicians to prescribe analgesics, particularly for females with no history of depression compared to those with a history of depression, though this effect was small. Both training levels were equally likely to endorse prescription of antidepressants, especially to those with a history of depression before pain. Medical students were more likely to endorse referral to a pain management programme and to a mental health specialist. It is possible that medical students' greater readiness to refer to pain management and to a mental health specialist is due to a self-selection bias. Medical students with an interest in psychology could have been more likely to take part in the study than medical students without an interest. As a result, they might be more likely to endorse referrals to pain management, which includes psychological elements, and a mental health specialist. Both clinicians and students were more likely to refer patients with depression to a mental health specialist than patients with no history of depression but only students were more likely to refer patients who developed depression before CP than patients who developed depression after CP. This suggests that medical students, though generally giving lower pain estimates, were more inclined to offer a range of treatments than were pain clinicians; this differs from the study by Hirsh et al. (2014), which found no difference between medical students and qualified clinicians. These differences could be due to differences in the training of medical students in the US, where the study was conducted, and the UK, and the inclusion of qualified clinicians of differing specialities as opposed to exclusively including pain clinicians. Perhaps in our study the pain clinicians' desire to treat was modified by greater scepticism about the strength of evidence of efficacy, or because

they would have preferred other treatment options not included in the study, or because without it being preceded by a full assessment they found it hard to recommend particular treatments.

The impact of empathy

Clinicians had lower empathy scores than medical students, particularly for the subscale ‘personal distress’, and male participants also scored lower than female participants. Based on previous literature, it was hypothesised that empathy would predict pain estimates and judgements of likelihood of exaggerating, minimising or hiding pain, but no significant correlations emerged. Similarly, there were no correlations of note with pain management decisions. This is in contrast to other studies that have found empathy linked with estimations of pain (Green, Tripp, Sullivan, & Davidson, 2009; Saarela et al., 2007; Williams et al., 2013).

Limitations

This study has several limitations that may have influenced the accuracy of the results. First, the study did not control for whether participants had paid attention to all information in each vignette, specifically whether they had taken in the information about each patient’s history of depression, and its timing. As mentioned above, medical students and clinicians could have mistaken the information in the vignette about onset of depression before pain, producing inconsistent findings for history of depression. It can be difficult to include such checks without making the study hypotheses transparent. It may also be that the reference to depression in the vignette may have been too weak to trigger biases in judgement, and that an enriched

description, or behaviour indicative of depression in the video, would have had more impact.

Using videos of patients, expressing real pain, was superior to using still images or actors, but a genuine pain presentation entails many other variables that may influence clinician judgements and treatment decisions, including the patient's own report of pain, and his or her behaviours during the assessment. Some of these variables would interact with those we investigated here. Additionally, each video was paired with the same vignette, so that unidentified peculiarities of particular patient videos could have created systematic biases in participant responses. Although we did balance pain intensity as quantified by FACs ratings across conditions, differences in dynamics of pain expression could not be controlled and could have influenced findings.

Including additional measures in the study, such as measures of gender role expectations (Bernardes et al., 2008), or stigma in depression (Hirsh et al., 2014), might have helped with the understanding of the pain judgements and treatment decisions of medical students and pain clinicians, as might an exploration with clinicians and medical students about how patients' trustworthiness affects their evaluation and treatment decisions.

Clinical and research implications

Although history of depression and timing of depression onset did not have the expected impact on pain judgements and management decisions in this study, it is sufficiently important an issue not to abandon on this basis, particularly given the findings of Hirsh et al. (2014) who found an effect on pain management decisions of clinicians and medical students presented with patients with depression and chronic

pain. Future studies could investigate whether timing of onset of depression in relation to pain is thought by clinicians to be relevant information in understanding pain and deciding on treatment options; our assumptions might have been incorrect.

Perceived trustworthiness was found to have an effect on pain judgements, particularly in females. Trustworthiness is an automatic and very rapid judgement made on first meeting someone (Willis & Todorov, 2006) and the clinician may not be sufficiently aware of this to try to exclude it from his or her clinical decisions (Chapman, Kaatz, & Carnes, 2013). In particular, females who are judged to be low in trustworthiness may have their pain discounted and not be offered treatment to which they are entitled; it is clear that such decisions are made on the basis of gender and ethnicity (Anderson et al., 2000; Green et al., 2003; Michael et al., 2007).

If the results of the current study are taken to show implicit bias and stereotyping among medical students and clinicians about people with chronic pain, there are several implications. Professional training alone may not bring about a change in bias, as found by Drwecki, Moore, Ward, and Prkachin (2011) in relation to ethnicity; nurses were found to be as biased in their treatment decision making as undergraduate psychology students. In their review of implicit bias in clinicians, Chapman et al. (2013) discuss studies where implicit bias was successfully reduced. They suggest that reminding clinicians of their potential susceptibility to bias is one way of targeting implicit bias, citing a study on racial bias in clinicians which found that clinicians who were aware of the study's purpose were more likely to treat white and black patients similarly than unaware clinicians (Green et al., 2007). However, this effect may have been due in part to participants giving a socially desirable response, and may not be as effective if clinicians are not being observed by others (Furnham, 1986). At a minimum, regular feedback regarding potential biases in their

treatment decisions might enable clinicians to correct implicit biases in their practice (Green et al., 2007). While gender and race are more obvious biases, clinicians may not be aware of other cues, such as perceived trustworthiness, that can affect their responses. Interventions to reduce bias by increasing awareness of the bias would not be able to target sources of bias that are currently unknown. There is evidence that bias can be reduced without requiring awareness of the particular bias. For example, when people are asked to focus on the unique qualities of individuals and look past the social categories to which they belong, automatically activated stereotypes can be inhibited (Chapman et al., 2013). Even just increasing the amount of information available about a patient can reduce bias, with initial gender bias in physicians' diagnosis of COPD in patients with chest pain successfully reduced after physicians were provided with spirometry data consistent with COPD (Chapman, 2001). Although empathy was not found to be a predictor of pain judgements in the current study, there is evidence that encouraging nurses to take on the perspective of the patient reduced racial bias in prescribing pain medication (Drwecki et al., 2011). Future studies should investigate whether 'individuating' or perspective taking will reduce bias in pain judgements of patients of different genders and perceived trustworthiness, and if so, what is most effective.

Additionally, timing of interventions in bias might be important. First of all, medical students were more biased in their pain judgements and decisions, making it important to take steps to reduce their bias. Teaching medical students techniques in reducing implicit bias while they are still learning about patient assessments might make them less susceptible to implicit bias later on in their careers. Medical schools have already implemented diversity training with the aim of reducing bias into the curriculum (Dogra, Reitmanova, & Carter-Pokras, 2010), but there is a lack of

published research on what techniques are employed to reduce bias, and whether these interventions are effective and translate to decreasing bias in patient care. Additionally, there is evidence that medical students are influenced by the behaviour of senior clinicians, which can counteract the effects of training (Neumann et al., 2011). Therefore, courses should incorporate methods to specifically decrease non-conscious bias in their diversity training (e.g. Stone & Moskowitz, 2011) and consistently evaluate the effectiveness of these interventions. Successful early interventions in implicit bias could also decrease the cognitive load that is required to reduce implicit bias over the longer term (Burgess, van Ryn, Dovidio, & Saha, 2007).

At a higher level, healthcare policies could potentially play a role in reducing bias in treatment. There is limited evidence that policies already introduced to promote gender equality in healthcare are effective (Payne, 2014). Policies fail to address healthcare professionals' susceptibility to implicit bias in medical treatment, and place more of an emphasis on differences between males and females, while ignoring their similarities. Future policies should include evidence based ways of addressing implicit bias.

Conclusion

This study provides evidence of effects of history of depression, gender, and perceived trustworthiness on pain clinicians' and medical students' judgements and pain management decisions in patients with chronic pain. These findings contribute to our understanding of what generates lower estimations of pain, adverse judgements about honest expression of pain, and the consequences of those on treatment decisions. The presence and timing of depression in chronic patients was

not found have a consistent effect. However, gender and trustworthiness was found to consistently bias pain judgements and management decisions, with LT females particularly subject to adverse judgements, receiving the lowest estimates of overall pain, the highest estimates of exaggerating pain, and less likely to be prescribed opioids or other analgesics. Males, even those of low trustworthiness, received more favourable judgements. Medical students, male and female, were particularly subject to this gender bias. Implications both for treatment of patients and for training of healthcare staff to minimise bias, are obvious.

References

- Alexander, J., & Manno, M. (2003). Underuse of analgesia in very young pediatric patients with isolated painful injuries. *Ann Emerg Med*, *41*, 617–22.
- Anderson, K. O., Mendoza, T. R., Valero, V., Richman, S. P., Russell, C., Hurley, J., ... Cleeland, C. S. (2000). Minority cancer patients and their providers: pain management attitudes and practice. *Cancer*, *88*, 1929–38.
- Arnow, B. A., Hunkeler, E. M., Blasey, C. M., Lee, J., Constantino, M. J., Fireman, B., ... Hayward, C. (2006). Comorbid depression, chronic pain, and disability in primary care. *Psychosomatic Medicine*, *68*, 262–8.
- Bair, M. J., Robinson, R. L., Katon, W., & Kroenke, K. (2003). Depression and pain comorbidity: a literature review. *Archives of Internal Medicine*, *163*, 2433–45.
- Ballantyne, J. C., & LaForge, K. S. (2007). Opioid dependence and addiction during opioid treatment of chronic pain. *Pain*, *129*, 235–55.
- Ballantyne, J. C., & Mao, J. (2003). Opioid therapy for chronic pain. *The New England Journal of Medicine*, *349*, 1943–53.
- Banks, S., & Kerns, R. (1996). Explaining high rates of depression in chronic pain: a diathesis-stress framework. *Psychological Bulletin*, *119*, 95–110.
- Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561–71.
- Bernardes, S. F., Keogh, E., & Lima, M. L. (2008). Bridging the gap between pain and gender research: a selective literature review. *European Journal of Pain*, *12*, 427–40.
- Birdwell, B. G., Herbers, J. E., & Kroenke, K. (1993). Evaluating chest pain. The patient's presentation style alters the physician's diagnostic approach. *Archives of Internal Medicine*, *153*, 1991–5.

- Bishop, D. V. M. (2014, May 18). *Interpreting unexpected significant findings*.
doi:doi:10.6084/m9.figshare.1030406.
- Botega, N. J., & Silveira, G. M. (1996). General practitioners' attitudes towards depression: a study in a primary care setting in Brazil. *International Journal of Social Psychiatry, 42*, 230–237.
- Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *European Journal of Pain, 10*, 377–391.
- Burgess, D., van Ryn, M., Dovidio, J., & Saha, S. (2007). Reducing racial bias among health care providers: lessons from social-cognitive psychology. *Journal of General Internal Medicine, 22*, 882–7.
- Burns, J. W., Peterson, K. M., Smith, D. A., Keefe, F. J., Porter, L. S., Schuster, E., & Kinner, E. (2013). Temporal associations between spouse criticism/hostility and pain among patients with chronic pain: a within-couple daily diary study. *Pain, 154*, 2715–21.
- Burnham, T., McCabe, K., & Smith, V. L. (2000). Friend-or-foe intentionality priming in an extensive form trust game. *Journal of Economic Behavior & Organization, 43*, 57–73.
- Cano, A., Weisberg, J. N., & Gallagher, R. M. (2000). Marital satisfaction and pain severity mediate the association between negative spouse responses to pain and depressive symptoms in a chronic pain patient sample. *Pain Medicine (Malden, Mass.), 1*, 35–43.
- Cano, A., & Williams, A. C. de C. (2010). Social interaction in pain: reinforcing pain behaviors or building intimacy? *Pain, 149*, 9–11.

- Chang, A. M., Mumma, B., Sease, K. L., Robey, J. L., Shofer, F. S., & Hollander, J. E. (2007). Gender bias in cardiovascular testing persists after adjustment for presenting characteristics and cardiac risk. *Academic Emergency Medicine : Official Journal of the Society for Academic Emergency Medicine*, *14*, 599–605.
- Chapman, K. R. (2001). Gender Bias in the Diagnosis of COPD. *CHEST Journal*, *119*, 1691.
- Chapman, K. R., Kaatz, A., & Carnes, M. (2013). Physicians and implicit bias: how doctors may unwittingly perpetuate health care disparities. *Journal of General Internal Medicine*, *28*, 1504–10.
- Chibnall, J. T., Tait, R. C., & Ross, L. R. (1997). The effects of medical evidence and pain intensity on medical student judgments of chronic pain patients. *Journal of Behavioral Medicine*, *20*, 257–71.
- Cleeland, C. S., Gonin, R., Hatfield, A. K., Edmonson, J. H., Blum, R. H., Stewart, J. A., & Pandya, K. J. (1994). Pain and its treatment in outpatients with metastatic cancer. *The New England Journal of Medicine*, *330*, 592–6.
- Colburn, J. L., Jasinski, D. R., & Rastegar, D. A. (n.d.). Long-term opioid therapy, aberrant behaviors, and substance misuse: comparison of patients treated by resident and attending physicians in a general medical clinic. *Journal of Opioid Management*, *8*, 153–60.
- Craig, K. D., & Patrick, C. J. (1985). Facial expression during induced pain. *Journal of Personality and Social Psychology*, *48*, 1080–1091.
- Davis, M. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, *44*, 113–126.

- Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 10*, 85.
- De Ruddere, L., Goubert, L., Stevens, M., Williams, A. C. de C., & Crombez, G. (2013). Discounting pain in the absence of medical evidence is explained by negative evaluation of the patient. *Pain, 154*, 669–76.
- De Ruddere, L., Goubert, L., Vervoort, T., Prkachin, K. M., & Crombez, G. (2012). We discount the pain of others when pain has no medical explanation. *The Journal of Pain : Official Journal of the American Pain Society, 13*, 1198–205.
- Delgado, P. L. (2004). Common pathways of depression and pain. *The Journal of Clinical Psychiatry, 65*, 16–9.
- Dogra, N., Reitmanova, S., & Carter-Pokras, O. (2010). Teaching cultural diversity: current status in U.K., U.S., and Canadian medical schools. *Journal of General Internal Medicine, 25 Suppl 2*, S164–8.
- Donaldson, L. (2008). *Chief Medical Officer's Annual Report 2008*.
- Druss, B. G., Rosenheck, R. A., Desai, M. M., & Perlin, J. B. (2002). Quality of preventive medical care for patients with mental disorders. *Medical Care, 40*, 129–36.
- Drwecki, B. B., Moore, C. F., Ward, S. E., & Prkachin, K. M. (2011). Reducing racial disparities in pain treatment: the role of empathy and perspective-taking. *Pain, 152*, 1001–6.
- Ekman, P., & Friesen, W. V. (1986). A New Pan-Cultural Facial Expression of Emotion. *Motivation and Emotion, 10*, 159–168.
- Elliott, A. M., Smith, B. H., Penny, K. I., Smith, W. C., & Chambers, W. A. (1999). The epidemiology of chronic pain in the community. *Lancet, 354*, 1248–52.

- Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers*, 28, 1–11.
- Field, A. (2013a). *Discovering Statistics using IBM SPSS Statistics* (p. 198). London: Sage Publications.
- Field, A. (2013b). *Discovering Statistics using IBM SPSS Statistics* (pp. 443–444). London: Sage Publications.
- Fillingim, R. B., King, C. D., Ribeiro-Dasilva, M. C., Rahim-Williams, B., & Riley, J. L. (2009). Sex, gender, and pain: a review of recent clinical and experimental findings. *The Journal of Pain*, 10, 447–485.
- Foley, E., Rippon, G., Thai, N. J., Longe, O., & Senior, C. (2012). Dynamic facial expressions evoke distinct activation in the face perception network: a connectivity analysis study. *Journal of Cognitive Neuroscience*, 24, 507–20.
- Fox, P. L., Raina, P., & Jadad, A. R. (1999). Prevalence and treatment of pain in older adults in nursing homes and other long-term care institutions: a systematic review. *CMAJ: Canadian Medical Association Journal = Journal de l'Association Medicale Canadienne*, 160, 329–33.
- Furnham, A. (1986). Response bias, social desirability and dissimulation. *Personality and Individual Differences*, 7, 385–400.
- Graber, M. A., Bergus, G., Dawson, J. D., Wood, G. B., Levy, B. T., & Levin, I. (2000). Effect of a patient's psychiatric history on physicians' estimation of probability of disease. *Journal of General Internal Medicine*, 15, 204–6.
- Green, A. D., Tripp, D. A., Sullivan, M. J. L., & Davidson, M. (2009). The relationship between empathy and estimates of observed pain. *Pain Medicine (Malden, Mass.)*, 10, 381–92.

- Green, A. R., Carney, D. R., Pallin, D. J., Ngo, L. H., Raymond, K. L., Iezzoni, L. I., & Banaji, M. R. (2007). Implicit bias among physicians and its prediction of thrombolysis decisions for black and white patients. *Journal of General Internal Medicine, 22*, 1231–8.
- Green, C. R., Anderson, K. O., Baker, T. A., Campbell, L. C., Decker, S., Fillingim, R. B., ... Vallerand, A. H. (2003). The unequal burden of pain: confronting racial and ethnic disparities in pain. *Pain Medicine (Malden, Mass.), 4*, 277–94.
- Hirsh, A. T., George, S., & Robinson, M. E. (2009). Pain assessment and treatment disparities: a virtual human technology investigation. *Pain, 143*, 106–13.
- Hirsh, A. T., Hollingshead, N. A., Bair, M. J., Matthias, M. S., & Kroenke, K. (2014). Preferences, experience, and attitudes in the management of chronic pain and depression: a comparison of physicians and medical students. *The Clinical Journal of Pain, 30*, 766–74.
- Hirsh, A. T., Hollingshead, N. A., Bair, M. J., Matthias, M. S., Wu, J., & Kroenke, K. (2013). The influence of patient's sex, race and depression on clinician pain treatment decisions. *European Journal of Pain (London, England)*. England: Department of Psychology, Indiana University - Purdue University Indianapolis, USA.
- Hirsh, A. T., Hollingshead, N. A., Matthias, M. S., Bair, M. J., & Kroenke, K. (2014). The influence of patient sex, provider sex, and sexist attitudes on pain treatment decisions. *The Journal of Pain : Official Journal of the American Pain Society, 15*, 551–9.
- Hoffmann, D. E., & Tarzian, A. J. (2001). The girl who cried pain: a bias against women in the treatment of pain. *The Journal of Law, Medicine & Ethics : A Journal of the American Society of Law, Medicine & Ethics, 29*, 13–27.

- Holloway, K. L., & Zerbe, K. J. (2000). Simplified approach to somatization disorder. When less may prove to be more. *Postgraduate Medicine, 108*, 89–92, 95.
- Kappesser, J., & Williams, A. C. de C. (2010). Pain estimation: asking the right questions. *Pain, 148*, 184–7.
- Kappesser, J., Williams, A. C. de C., & Prkachin, K. M. (2006). Testing two accounts of pain underestimation. *Pain, 124*, 109–16.
- Lucey, P., Cohn, J. F., Prkachin, K. M., Solomon, P. E., & Matthews, I. (2011). Painful data: The UNBC-McMaster Shoulder Pain Expression Archive Database. In *Ninth IEEE International Conference on Automatic Face and Gesture Recognition (FG 2011)* (pp. 21–25). Santa Barbara, USA.
- Merskey, H. (1979). Pain Terms: a list of definitions and notes on usage. *Pain, 6*, 249–252.
- Michael, G. E., Sporer, K. A., & Youngblood, G. M. (2007). Women are less likely than men to receive prehospital analgesia for isolated extremity injuries. *The American Journal of Emergency Medicine, 25*, 901–6.
- Mico, J. A., Ardid, D., Berrocoso, E., & Eschalier, A. (2006). Antidepressants and pain. *Trends in Pharmacological Sciences, 27*, 348–354.
- Miller, L. R., & Cano, A. (2009). Comorbid chronic pain and depression: Who is at risk? *The Journal of Pain, 10*, 619–627.
- Morley, S., Williams, A. C. de C., & Black, S. (2002). A confirmatory factor analysis of the Beck Depression Inventory in chronic pain. *Pain, 99*, 289–98.
- Neumann, M., Edelhäuser, F., Tauschel, D., Fischer, M. R., Wirtz, M., Woopen, C., ... Scheffer, C. (2011). Empathy decline and its reasons: a systematic review of

- studies with medical students and residents. *Academic Medicine : Journal of the Association of American Medical Colleges*, 86, 996–1009.
- Olivola, C. Y., Funk, F., & Todorov, A. (2014). Social attributions from faces bias human choices. *Trends in Cognitive Sciences*, 18, 566–570.
- Olivola, C. Y., & Todorov, A. (2010). Elected in 100 milliseconds: Appearance-Based Trait Inferences and Voting. *Journal of Nonverbal Behavior*, 34, 83–110.
- Oosterhof, N. N., & Todorov, A. (2008). The functional basis of face evaluation. *Proceedings of the National Academy of Sciences of the United States of America*, 105, 11087–92.
- Parsons, S., Harding, G., Breen, A., Foster, N., Pincus, T., Vogel, S., & Underwood, M. (2007). The influence of patients' and primary care practitioners' beliefs and expectations about chronic musculoskeletal pain on the process of care: a systematic review of qualitative studies. *The Clinical Journal of Pain*, 23, 91–8.
- Payne, S. (2014). Constructing the gendered body? A critical discourse analysis of gender equality schemes in the health sector in England. *Current Sociology*, 62, 956–974.
- Prkachin, K. M., & Solomon, P. E. (2008). The structure, reliability and validity of pain expression: evidence from patients with shoulder pain. *Pain*, 139, 267–74.
- Rezlescu, C., Duchaine, B., Olivola, C. Y., & Chater, N. (2012). Unfakeable facial configurations affect strategic choices in trust games with or without information about past behavior. *PloS One*, 7, e34293.
- Robinson, M. E., Riley, J. L., Myers, C. D., Papas, R. K., Wise, E. A., Waxenberg, L. B., & Fillingim, R. B. (2001). Gender role expectations of pain: relationship to sex differences in pain. *The Journal of Pain : Official Journal of the American Pain Society*, 2, 251–7.

- Robinson, M. E., & Wise, E. A. (2003). Gender bias in the observation of experimental pain. *Pain, 104*, 259–64.
- Saarela, M. V., Hlushchuk, Y., Williams, A. C. de C., Schürmann, M., Kalso, E., & Hari, R. (2007). The compassionate brain: humans detect intensity of pain from another's face. *Cerebral Cortex (New York, N.Y. : 1991), 17*, 230–7.
- Safdar, B., Heins, A., Homel, P., Miner, J., Neighbor, M., DeSandre, P., & Todd, K. H. (2009). Impact of physician and patient gender on pain management in the emergency department--a multicenter study. *Pain Medicine (Malden, Mass.), 10*, 364–72.
- Stannard, C. (2013). Opioids in the UK: what's the problem? *British Medical Journal, 347*:f5108.
- Stone, J., & Moskowitz, G. B. (2011). Non-conscious bias in medical decision making: what can be done to reduce it? *Medical Education, 45*, 768–76.
- Sullivan, M. D., Edlund, M. J., Steffick, D., & Unützer, J. (2005). Regular use of prescribed opioids: association with common psychiatric disorders. *Pain, 119*, 95–103.
- Sullivan, M. D., Edlund, M. J., Zhang, L., Unützer, J., & Wells, K. B. (2006). Association between mental health disorders, problem drug use, and regular prescription opioid use. *Archives of Internal Medicine, 166*, 2087–93.
- Sullivan, M., & Ferrell, B. (2005). Ethical challenges in the management of chronic nonmalignant pain: negotiating through the cloud of doubt. *The Journal of Pain : Official Journal of the American Pain Society, 6*, 2–9.
- Tait, R. C., Chibnall, J. T., & Kalauokalani, D. (2009). Provider judgments of patients in pain: seeking symptom certainty. *Pain Medicine (Malden, Mass.), 10*, 11–34.

- Tait, R. C., Chibnall, J. T., Luebbert, A., & Sutter, C. (2005). Effect of treatment success and empathy on surgeon attributions for back surgery outcomes. *Journal of Behavioral Medicine*, 28, 301–12.
- Teh, C. F., Zaslavsky, A. M., Reynolds, C. F., & Cleary, P. D. (2010). Effect of depression treatment on chronic pain outcomes. *Psychosomatic Medicine*, 72, 61–7.
- Todorov, A., Baron, S. G., & Oosterhof, N. N. (2008). Evaluating face trustworthiness: a model based approach. *Social Cognitive and Affective Neuroscience*, 3, 119–27.
- Tracey, I., & Bushnell, M. C. (2009). How neuroimaging studies have challenged us to rethink: is chronic pain a disease? *The Journal of Pain : Official Journal of the American Pain Society*, 10, 1113–20.
- Tracey, I., & Mantyh, P. (2007). The cerebral signature for pain perception and its modulation. *Neuron*, 55, 377–391.
- Turk, D. C., & Okifuji, A. (1997). What factors affect physicians' decisions to prescribe opioids for chronic noncancer pain patients? *The Clinical Journal of Pain*, 13, 330–6.
- Turk, D. C., Wilson, H. D., & Cahana, A. (2011). Treatment of chronic non-cancer pain. *Lancet*, 377, 2226–35.
- Turk, D., & Okifuji, A. (2009). Pain terms and taxonomies of pain. In S. Fishman, J. Ballantyne, & J. Rathmell (Eds.), *Bonica's Management of Pain* (4th ed., pp. 13–23). New York, NY: Lippincott Williams & Wilkins.
- Van 't Wout, M., & Sanfey, A. G. (2008). Friend or foe: the effect of implicit trustworthiness judgments in social decision-making. *Cognition*, 108, 796–803.

- Viron, M. J., & Stern, T. A. (2010). The Impact of Serious Mental Illness on Health and Healthcare. *Psychosomatics*, *51*, 458–465.
- Werner, A., & Malterud, K. (2003). It is hard work behaving as a credible patient: encounters between women with chronic pain and their doctors. *Social Science & Medicine*, *57*, 1409–19.
- Williams, A. C. de C. (1998). Depression in chronic pain: mistaken models, missed opportunities. *Behaviour Therapy*, *27*, 61–80.
- Williams, A. C. de C. (2007). Chronic pain: treatment. In S. Lindsay & G. Powell (Eds.), *The handbook of clinical adult psychology* (3rd ed., pp. 708 – 725). Hove: Routledge.
- Williams, A. C. de C., Morris, J., Stevens, K., Gessler, S., Cella, M., & Baxter, J. (2013). What influences midwives in estimating labour pain? *European Journal of Pain (London, England)*, *17*, 86–93.
- Willis, J., & Todorov, A. (2006). First impressions: making up your mind after a 100-ms exposure to a face. *Psychological Science*, *17*, 592–8.

Part 3: Critical appraisal

Introduction

This appraisal considers some of the conceptual and practical issues encountered during the steps in designing the empirical study and collecting, analysing and interpreting the data. It aims to shed light on the different decision making processes involved at each step, and lessons learned, to aid researchers carrying out similar studies. The appraisal ends with reflections on the study findings and the research process as a whole.

Designing the study

The study aimed to investigate whether the perceived trustworthiness and history of depression of the patient affected pain judgements and clinical decision making in pain clinicians and medical students. When designing the study and putting together the study stimuli, I noticed the constant interplay between internal and external validity in the study design, and how difficult it can be to increase external validity while making sure that the study remains as internally valid as possible. Studies eliciting judgements and decision making can be difficult to design, and methodologies incorporating questionnaires and interviews have been criticised in the past due to vague questions and misleading results (Poulou, 2001). Researchers address this problem by using vignettes, which provide brief accounts of hypothetical persons or situations, containing concrete details necessary for participants to base their judgements upon. They provide a method to easily manipulate information in the vignette according to the variables being studied, and are commonly used in research eliciting judgements and decision making. For those reasons, I decided that information relating to history of depression would be conveyed using vignettes. However, vignettes on their own provide only limited

information (Hughes & Huby, 2002), so to test perceived trustworthiness, my supervisor and I decided to supplement vignettes with videos of real patients with chronic shoulder pain. The inclusion of videos had the advantage of increasing external validity of the study, but it meant that variables relating to the patients, such as facial expressions, could possibly affect study responses. In order to decrease this risk, I edited the videos so that patients were not shown with facial expressions other than a neutral or pain expression.

Past studies investigating judgements and decision-making in health care professionals use either independent groups designs, where participants are exposed to one condition, or repeated measures designs, where participants are exposed to all conditions. I decided to use a repeated measures design due to its advantage of increased statistical power, and therefore a need for fewer participants. One disadvantage of the repeated measures design is that participants, when viewing all conditions, might be able to notice differences between the conditions and therefore guess the aim of the study. As a consequence, they might change their responses to what they would see as socially desirable. I mitigated this possibility by first piloting the study on colleagues who had completed medical school, and eliciting their feedback. I also decided to ask participants to guess the aim of the study as an extra precaution. Another disadvantage of using a repeated measures design is that participants' responses might have been affected by being exposed to twelve different vignettes of patients. This might have decreased participants' concentration as the task went on, and they might have paid less attention to the content of the vignettes. The study was counterbalanced to avoid this potential effect on results (Field, 2013), but the repetition in the study might have led to participants choosing to drop out before completion. The use of a repeated measures design also meant that

12 different videos were used in the study, as opposed to just four videos that would have been needed if using an independent groups design. This could have led to more variation between the different conditions in the repeated measures design, and made the results more difficult to interpret. The advantages and disadvantages of the two research designs is something that should be carefully considered by future researchers.

Recruiting participants

Before the study started, my supervisor and I decided that medical students in their 5th and 6th years and qualified pain clinicians would be most suitable to recruit for the study. Medical students at UCL have contact with patients from their 4th year. Therefore both groups have regular contact with patients and are responsible for clinical decision-making, which made them a sample of participants, representative of those likely to be involved in decision making in chronic pain. However, this population of participants is particularly in demand, making them more difficult to recruit than a less representative sample. Medical students in their 5th and 6th years have a heavy workload, regular assessments and are frequently asked to provide feedback on various aspects of their course. These circumstances are likely to make them less willing to volunteer their time to others' studies. Survey responses from health professionals has also decreased through the years, likely due to their work demands (Cho et al., 2013). Therefore, the study was designed to be online so that participants could take part in the study in their own time, and without needing to arrange a face-to-face meeting, which would have been difficult given the different locations of the pain clinicians and medical students.

Although an online study was more convenient, it also has its disadvantages that might affect both internal and external validity. If the study were to take place in a laboratory, the experimenter is able to control the environment, limiting the amount of intrusive visual, auditory or social stimuli (Kraut et al., 2003). The online study included instructions designed to decrease this risk by asking participants to switch their computer and mobile phones to silent. Online studies have the additional advantage of eliminating incomplete responses in data, and a study comparing an online study with questionnaires in clinicians found minimal differences between the two methods and that the online study produced higher quality data (Matteson et al., 2011).

Given the budget for the study and the differing financial positions that medical students and pain clinicians are likely to be in, we decided that a £2 donation to Médecins Sans Frontières for each study response would be an appropriate incentive to encourage both groups of participants to take part in the study. Pain clinicians in the UK were invited to participate in the study using the mailing list of the International Association for the Study of Pain (IASP), and recruitment, while slow, was steady and attracted the required number of participants to meet the power recommendations for the study.

There was a similar plan for recruiting medical students, but I soon found out that it would not be possible to email all medical students at once. This is because the medical school is the holder of the mailing list and has a policy of not emailing students for two reasons: 1) medical students already receive a lot of emails and 2) they were concerned that students would feel pressured to take part in the study due to the email coming from the medical school. Therefore, the study could only be advertised through a weekly mailing list sent to medical students, which featured

several other advertisements, meaning that students were less likely to see the study. Despite advertising the study on the mailing list for several months, there was a very low response rate to the study. For this reason, we decided to expand recruitment to 4th year medical students, who also have clinical experience, to increase the available subject pool, and also to invite students to participate in the study by talking to them about the study at the beginning of a lecture, at the discretion of the lecturer. This led to a better response rate and meant that enough students were recruited to meet the power recommendations for the study.

Given the number of medical students that attend UCL, and the efforts in recruitment, the study had a low response rate. Recruiting health care professionals for studies is particularly challenging, and there have been several studies investigated the best techniques to improve recruitment (e.g. Cho, Johnson, & Vangeest, 2013). Posting surveys is more successful than sending emails, but this would not have been possible given the stimuli used in the study. One of the reasons for low recruitment in the current study is likely to be due to the barrier of not being able to contact medical students directly. It is also possible that the incentive was not enough to interest medical students in the study, and using a different incentive, such as a chance to win a prize or a small financial incentive, might have recruited more participants. In fact, previous studies have found that charity donations are not successful in increasing recruitment rates (Gendall & Healey, 2008). However, since the type of incentive can affect participants' performance in studies (Brase, 2008), then pain clinicians would also require the same incentive, and they might not have been motivated by a chance at winning a modest prize or small financial incentive (Cho et al., 2013). Medical students also differ from pain clinicians in their experience of psychology. Pain clinicians frequently work alongside psychologists in

multidisciplinary teams, and might be more willing to take part in psychology studies. Interest in the study area is also known to improve recruitment rates, and given pain clinicians' choice of field, they might also be more interested in studies relating to chronic pain and therefore be more likely to take part in the study (Groves, Presser, & Dipko, 2004).

The low response rates in the study for medical students could also have led to a sample bias, potentially affecting results. As mentioned in the discussion, medical students with a specific interest in psychology might have decided to take part in the study, and their results might not be typical of other medical students who chose not to take part. Before taking part, students were told that the study involved decision making in chronic pain. Therefore, students who were more confident in their assessment and decision-making skills might have been more likely to take part, and their responses could be less representative of the general population of medical students.

Statistical analyses

Although the field of statistics purports to be an objective way of testing data, I was aware that statistical techniques can be manipulated by researchers to provide misleading results (Bishop, 2013), and wanted to make sure that my statistical analyses would be of high quality. However, I was often stalled in my progress when finding conflicting advice from statistics texts, and I was surprised to see that choices were not always straightforward. I noticed that the choice of statistical technique described in books is often due to the personal preference of the author, or due to practical limitations. For example, when it came to reporting the effect size of my results, I had several choices for my estimate of effect size, including partial eta

squared and omega squared. Of these effect size estimates, SPSS only calculates partial eta squared. The use of partial eta squared is problematic, as it can overestimate and provide a misleading effect size (Bakeman, 2005). However, due to time constraints, and Andy Field's description of calculating omega squared as 'the road to madness' (Field, 2013), I chose to go with partial eta squared for my effect size measure. I also became aware of issues that are not often talked about in statistical texts, for example, how the use of 4-way ANOVAs can increase the risk of false positive results (Bishop, 2014), so my supervisor and I decided that it would be better to use a stricter p value when reporting results. The use of mixed ANOVAs is seen as out-dated by some statisticians, and techniques such as multilevel modelling are advised instead (Institute of Psychiatry, 2014). One of the main issues with mixed ANOVAs appears to be their exclusion of whole cases due to missing data points, which was not an issue in my study. However, it is an example of how the statistics field is constantly evolving, and that it is important to keep up to date with changes.

I would advise future researchers to be cautious when deciding on the number of variables to include in studies. My curiosity about the effects of multiple variables when designing the study turned into confusion during my statistical analyses, when my data produced several 3-way interactions. This meant that my results, though interesting, were difficult to interpret. I sought guidance from statistical books, my supervisor, and statistics advisor, only to find that there are several options for carrying out post-hoc tests and ways of interpreting the interactions, and the only consensus seemed to be about the difficulty of their interpretation. It also meant that the use of videos and vignettes to make the study more externally valid might have

introduced unknown variables relating to the patients in the videos that affected the results, and therefore played a role in the 3-way interaction.

Reflections on the research findings

Generalisability of the results

Due to the need for internal validity, only a limited amount of information about the patient's history was available to participants. As a result, participants might have had difficulty with providing responses to the study, and could have provided different responses if more information was available about the patient's history. Additionally, a face-to-face consultation provides a much richer experience with patients, and patient communication styles can also influence decision making (Birdwell, Herbers, & Kroenke, 1993). Future studies could enhance the design of the current study by including videos of chronic pain patients responding to questions typically asked in a pain consultation. This format has been successfully implemented in previous studies using actors (e.g. Birdwell, Herbers, & Kroenke, 1993), though admittedly would be more difficult to implement using chronic pain patients.

Similarly, only a limited amount of demographic information about the patient was available to participants. In reality several categories might activate bias in a consultation, such as race, social class and sexual orientation of the patient; and these categories occur in patients simultaneously, an issue known as intersectionality (Cole, 2009). Testing the effects of all of these categories would have been beyond the scope of the study. It would also be very difficult to design a study with all variables, since the introduction of more variables would lengthen the study and make statistical results difficult to interpret. Nevertheless, when designing future

studies, researchers should keep issues of intersectionality in mind. Additionally, programmes aiming to reduce bias are often targeted at single biases (e.g. Stone & Moskowitz, 2011), which might not reduce biases in other categories, so intersectionality should also be kept in mind when designing these programmes.

Due to differences in training programmes, the results from the study might not be applicable to clinicians in other specialities. Conducting the study with clinicians of other specialities is important, given that other specialities are regularly involved in the treatment of pain. In particular, general practitioners might be an important group to target, given their role in referring patients to other specialists and that they would often be the first clinical contact when patients develop chronic pain.

The concept of trustworthiness

There are some issues with the inclusion of perceived trustworthiness as a variable in the study that has not yet been discussed. Facial features of trustworthiness are highly positively correlated with attractiveness and intelligence and negatively correlated with aggressiveness (0.75, 0.63, and -0.76 respectively; Todorov, Baron, & Oosterhof, 2008). Therefore, it is not possible for experimental stimuli to have a face high in trustworthiness, without also having other facial traits implied. Because of this, factors such as attractiveness and aggressiveness might have also played a role in differences in participants' judgements. Additionally, chronic pain patients in the videos were from a region in Northern Canada, and might have had different facial features to patients in the UK. Todorov (2008) proposes that the evaluation of traits from facial features is similar to how emotional expressions can be used to evaluate the behavioural intentions of a person. For example, expressions of anger might communicate that the person should not be

approached. Todorov (2008) suggests that people infer traits about others based on the similarity of their neutral faces to active facial expressions. Similar to how people make decisions to approach or avoid others based on their emotional expressions, they also can make similar decisions based on a person's resting facial features. To my knowledge, there have been no studies investigating whether there is an interaction with facial trait trustworthiness and emotional expressions. The additional use of pain expressions in the study could also have had an effect on participants' perceived trustworthiness of the patient.

Reflections on the research process

One major aspect of conducting research that I noticed is that there is a difference between how a study is designed and executed, and how the resulting findings are communicated. A typical scientific paper will present a hypothesis, describe how the hypothesis was tested and the subsequent findings, and come to a conclusion that is in line with the findings (Howitt & Wilson, 2014). The presentation of research in this way makes sense, as it communicates the findings as clearly as possible. However, it also conveys the impression that there were no roadblocks during the research process and that the researcher was confident at all stages that they were making the correct decisions. The scientific method is also frequently conveyed as a series of clearly defined steps that will lead to answers as long as they are followed (Howitt & Wilson, 2014). In reality, I encountered several crossroads, such as in my statistical analyses, where I had to make informed, but sometimes subjective, decisions. From discussions with my colleagues, I began to realise that getting stuck and encountering obstacles is part of the process, and that one of the most important lessons of research is how I dealt with the obstacles and

learnt from them, and to seek guidance from my supervisor if I couldn't solve the problem myself. Researchers embarking on their first projects might find it helpful to keep in mind that obstacles are normal and part of the process.

References

- Bakeman, R. (2005). Recommended effect size statistics for repeated measures designs. *Behavior Research Methods*, 37, 379–84.
- Birdwell, B. G., Herbers, J. E., & Kroenke, K. (1993). Evaluating chest pain. The patient's presentation style alters the physician's diagnostic approach. *Archives of Internal Medicine*, 153, 1991–5.
- Bishop, D. (2013). *Why we need pre-registration*. Retrieved October 13, 2014, from <http://deevybee.blogspot.co.uk/2013/07/why-we-need-pre-registration.html>
- Bishop, D. (2014, May 18). *Interpreting unexpected significant findings*. doi:doi:10.6084/m9.figshare.1030406
- Brase, G. (2008). How different types of participant payments alter task performance. *Judgment and Decision Making*, 4, 419 – 428.
- Cho, Y. I., Johnson, T. P., & Vangeest, J. B. (2013). Enhancing surveys of health care professionals: a meta-analysis of techniques to improve response. *Evaluation & the Health Professions*, 36, 382–407.
- Cole, E. R. (2009). Intersectionality and research in psychology. *The American Psychologist*, 64, 170–80.
- Field, A. (2013). *Discovering Statistics using IBM SPSS Statistics* (pp. 443–444). London: Sage Publications.
- Gendall, P., & Healey, B. (2008). Alternatives to Prepaid Monetary Incentives in Mail Surveys. *International Journal of Public Opinion Research*, 20, 517–527.
- Groves, R. M., Presser, S., & Dipko, S. (2004). The Role of Topic Interest in Survey Participation Decisions. *Public Opinion Quarterly*, 68, 2–31.
- Howitt, S. M., & Wilson, A. N. (2014). Revisiting “Is the scientific paper a fraud?”: The way textbooks and scientific research articles are being used to teach

- undergraduate students could convey a misleading image of scientific research. *EMBO Reports*, *15*, 481–4.
- Hughes, R., & Huby, M. (2002). The application of vignettes in social and nursing research. *Journal of Advanced Nursing*, *37*, 382–6.
- Institute of Psychiatry. (2014). *Statistics Advisory Service Frequently Asked Questions: General Analysis Strategies*. Retrieved May 20, 2014, from www.kcl.ac.uk/ioppn/depts/biostatistics/SAS/faqs6.aspx
- Kraut, R., Olson, J., Banaji, M., Bruckman, A., Cohen, J., & Couper, M. (2003). *Psychological Research Online: Opportunities and Challenges*. American Psychological Association.
- Matteson, K. A., Anderson, B. L., Pinto, S. B., Lopes, V., Schulkin, J., & Clark, M. A. (2011). Surveying ourselves: examining the use of a web-based approach for a physician survey. *Evaluation & the Health Professions*, *34*, 448–63.
- Poulou, M. (2001). The role of vignettes in the research of emotional and behavioural difficulties. *Emotional and Behavioural Difficulties*, *6*, 50–62.
- Stone, J., & Moskowitz, G. B. (2011). Non-conscious bias in medical decision making: what can be done to reduce it? *Medical Education*, *45*, 768–76.
- Todorov, A. (2008). Evaluating faces on trustworthiness: an extension of systems for recognition of emotions signaling approach/avoidance behaviors. *Annals of the New York Academy of Sciences*, *1124*, 208–24.
- Todorov, A., Baron, S. G., & Oosterhof, N. N. (2008). Evaluating face trustworthiness: a model based approach. *Social Cognitive and Affective Neuroscience*, *3*, 119–27.

Appendices

Appendix 1: Search terms

Database: Ovid MEDLINE(R) <1946 to October Week 3 2013>, PsycINFO <1806 to October Week 3 2013>

Search Strategy:

-
- 1 depress*.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (615054)
 - 2 low mood.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (694)
 - 3 chronic pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (33223)
 - 4 neck pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (7909)
 - 5 musculoskeletal pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (4203)
 - 6 shoulder pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (5353)
 - 7 back pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (43343)
 - 8 subacute pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (47)
 - 9 sub-acute pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (7)
 - 10 acute to chronic pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (1653)
 - 11 enduring pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (44)
 - 12 continual pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (13)
 - 13 sustained pain.mp. [mp=ti, ab, ot, nm, hw, kf, ps, rs, ui, tc, id, tm] (444)
 - 14 1 or 2 (615277)
 - 15 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (86562)
 - 16 14 and 15 (8525)
 - 17 ((depress* or low mood) and (chronic pain or neck pain or musculoskeletal pain or shoulder pain or back pain or subacute pain or sub-acute pain or acute to chronic pain or enduring pain or continual pain or sustained pain)).ab,ti.
(6926)
 - 18 limit 17 to "300 adulthood <age 18 yrs and older>" [Limit not valid in Ovid MEDLINE(R); records were retained]
(6044)
 - 19 limit 18 to humans [Limit not valid in PsycINFO; records were retained]
(5931)
 - 20 limit 19 to human (5929)
 - 21 limit 20 to humans [Limit not valid in PsycINFO; records were retained]
(5929)
 - 22 limit 21 to human (5929)
 - 23 limit 22 to yr="2003 -Current" (3954)
 - 24 limit 23 to humans [Limit not valid in PsycINFO; records were retained]
(3954)
 - 25 limit 24 to english language (3727)
 - 26 limit 25 to peer reviewed journal [Limit not valid in Ovid MEDLINE(R); records were retained] (3657)
 - 27 remove duplicates from 26 (2370)

Appendix 2: Quality Assessment Scale

ADAPTED FROM NEWCASTLE-OTTAWA QUALITY ASSESSMENT SCALE (COHORT STUDIES)

Italics represent changes from original assessment scale

Note: A study can be awarded a maximum of one star for each numbered item within the Selection and Outcome categories. A maximum of two stars can be given for Comparability.

Selection (Max 5*)

- 1) Representativeness of the exposed cohort (*initial sample*)
 - a. Truly representative of the *average patient with chronic pain or depression**
 - b. Somewhat representative of the *average patient with chronic pain or depression **
 - c. Selected group of users
 - d. No description of the derivation of the cohort

- 2) Selection of the non-exposed cohort
 - a. drawn from the same community as the exposed cohort*
 - b. drawn from a different source
 - c. no description of the derivation of the non exposed cohort

- 3) Ascertainment of *chronic pain or depression diagnosis*
 - a. *Diagnosis confirmed with validated measures, measures of depression suitable for the pain population**
 - b. *Evidence of assessment by a health professional**
 - c. Written self report
 - d. No description

- 4) *Criterion 4 (Demonstration that the outcome of interest was not present at start of study) removed as not applicable to current review*

- 5) *Sample size*
 - a. *Fifty or more adults included**
 - b. *Less than fifty adults included*

Control (Max 1*)

- 1) Appropriate control for other variables
 - a. study controls for *sex and age**

Outcome (Max 3*)

- 1) Assessment of outcome
 - a. *Diagnosis confirmed with validated measures, measures of depression suitable for the pain population**

- b. No description or inappropriate measures
- 2) Was follow-up long enough for outcomes to occur
- a. *6 months or more between baseline and follow-up**
 - b. No
- 3) Adequacy of follow-up of cohorts
- a. Complete follow-up – all subjects accounted for *
 - b. Subjects lost to follow up unlikely to introduce bias – small number lost <25% or description provided of those lost*
 - c. Follow-up rate <75% and no description of those lost
 - d. No statement

Appendix 3: Ethical approval letters

UCL RESEARCH ETHICS COMMITTEE
GRADUATE SCHOOL OFFICE



Dr Amanda C de C Williams
Research Department of Clinical, Educational and
Health Psychology
UCL

17 April 2013

Dear Dr Williams

Notification of Ethical Approval

Project ID: 4714/001: Investigating the effects of psychiatric history and perceived trustworthiness on doctors' estimations of pain

I am pleased to confirm that in my capacity as Chair of the UCL Research Ethics Committee I have approved your study for the duration of the project i.e. until June 2014.

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: <http://www.grad.ucl.ac.uk/ethics/> and clicking on the button marked 'Key Responsibilities of the Researcher Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

Reporting Non-Serious Adverse Events

For non-serious adverse events you will need to inform Helen Dougal, Ethics Committee Administrator (ethics@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

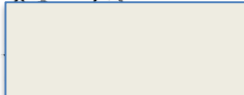
Reporting Serious Adverse Events

The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

With best wishes for the research.

Yours sincerely



Professor John Foreman
Chair of the UCL Research Ethics Committee

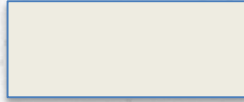
Cc:
Grainne Schafer, Applicant
Professor Peter Fonagy, Head of Department



Amendment Approval Request Form

1	Project ID Number: 4714/001	Name and Address of Principal Investigator: Dr Amanda C de C Williams Research Department of Clinical, Educational and Health Psychology UCL Gower Street London WC1E 6BT
2	Project Title: Investigating the effects of psychiatric history and perceived trustworthiness on doctors' estimations of pain	
3	Type of Amendment/s (tick as appropriate)	
	<input type="checkbox"/> Research procedure/protocol (including research instruments) <input checked="" type="checkbox"/> Participant group <input type="checkbox"/> Sponsorship/collaborators <input type="checkbox"/> Extension to approval needed (extensions are given for one year) <input checked="" type="checkbox"/> Information Sheet/s <input type="checkbox"/> Consent form/s <input type="checkbox"/> Other recruitment documents <input type="checkbox"/> Principal researcher/medical supervisor* <input type="checkbox"/> Other *	
	*Additions to the research team other than the principal researcher, student supervisor and medical supervisor do not need to be submitted as amendments but a complete list should be available upon request.	
4	Justification (give the reasons why the amendment/s are needed) We are having difficulty recruiting the required number of participants using 5 th and 6 th year UCL medical students as a subject pool alone, therefore we would like to extend the subject pool to include 4 th year medical students.	
	Details of Amendments (provide full details of each amendment requested, state where the changes have been made and attach all amended and new documentation) 1 We are now seeking to recruit 4 th year medical students as well as 5 th and 6 th year medical students.	
5	Changes to indicate this are changed in our advertisement for the study and information sheet form to reflect this (attached). 2 We are also asking for recruits at the beginning of lectures of potential recruits, by arrangement with and permission of the lecturer.	
6	Ethical Considerations (insert details of any ethical issues raised by the proposed amendment/s) There are no known ethical issues raised by the proposed amendments.	
7	Other Information (provide any other information which you believe should be taken into account during ethical review of the proposed changes) none	
	Declaration (to be signed by the Principal Researcher)	
	<ul style="list-style-type: none"> • I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it. • I consider that it would be reasonable for the proposed amendments to be implemented. • For student projects I confirm that my supervisor has approved my proposed modifications. 	

Signature:

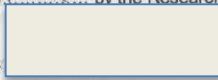


Date: 18th December 2013

FOR OFFICE USE ONLY:

Amendments to the proposed protocol have been Approved by the Research Ethics Committee.

Signature of the REC Chair, Professor John Foreman: ...



Date: 8/1/2014

Appendix 4: Recruitment emails

4th, 5th and 6th year medical students needed for short online study.

We are inviting 4th, 5th and 6th year UCL medical students to participate in a short online study which aims to improve our understanding of medical students' decisions about chronic pain.

A £2 donation will be made to Medecins san Frontieres (Doctors Without Borders) on your behalf for your participation.

The study is an online experiment which takes no more than 20 minutes to complete. If you are interested in taking part in the study or would like further information, please click on the following link:

https://uclpsych.eu.qualtrics.com/SE/?SID=SV_8dnHU8SoCQtgDpr

This study is being completed as part of my Doctorate in Clinical Psychology at University College London and has been approved by the UCL Ethics Committee (project ID: 4714/001). Your responses will be confidential and data will be handled in accordance with the Data Protection Act 1998.

If you have any further questions, please email Grainne Schafer at [email] or Dr Amanda C de C Williams at [email]

Dear Dr

You are invited by Dr Amanda Williams and Grainne Schafer to participate in a short online study which aims to increase our understanding of doctors' decisions about chronic pain. We are also sampling medical students using the same materials.

A £2 donation will be made to Médecins san Frontières (Doctors Without Borders) on your behalf if you decide to take part in the study. If you are interested in taking part in the study or would like further information, please click on the following link: https://uclpsych.eu.qualtrics.com/SE/?SID=SV_8dnHU8SoCQtgDpr The study requires you to take part in an online experiment which should take no more than 20 minutes. Your responses will be confidential and data will be handled in accordance with the Data Protection Act 1998. This study is being completed as part of Grainne's Doctorate in Clinical Psychology at University College London and has been approved by the UCL Ethics Committee (project ID: 4714/001). Your participation in this study is entirely on a voluntary basis and you are free to withdraw from the study at any time. The findings from the study may be published in peer-reviewed journals. Please note: sometimes organisations block the survey site. If this happens to you, we would be very grateful if you still completed the survey from your home computer. If you have any further questions, please email Grainne Schafer at [email] or Dr Amanda Williams at [email].

Many thanks

Appendix 5: Volunteer Information Sheet and Consent form

Treatment decisions in Chronic Pain

Volunteer Information Sheet

This study has been approved by the Ethics Chair of the UCL Research Ethics Committee as Project ID Number 4714/001

Investigators:

Dr. Amanda C de C Williams
Research Department of Clinical,
Educational and Health Psychology
UCL Gower Street
London WC1E 6BT
[email]

Gráinne Schafer
Research Department of Clinical,
Educational and Health Psychology
UCL Gower Street
London WC1E 6BT
[email]

You are invited to participate in a research study. This study aims to increase our understanding of factors affecting the decisions of doctors and medical students relating to CP.

This study is being conducted by researchers from the Research Department of Clinical, Educational and Health Psychology at University College London. Before we describe the study and its purpose to you we would like to make it clear that it is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

Who can participate in this study?

We are inviting medical doctors who are specialists in CP and 4th and 6th year UCL medical students to take part in the study. All volunteers must have good spoken English and good or corrected vision.

What is involved?

Before taking part in the study, you will be asked to give your consent by signing a computerised consent form. Testing will take place in a single session, lasting approximately 20 minutes. You will be shown 12 vignettes paired with short (<10 seconds) video clips featuring patients with pain. After each vignette and its accompanying video, you will be asked questions relating to the patient's experience of CP and possible treatment decisions. You will also be asked to provide demographic information about yourself and fill out an additional questionnaire.

What are the risks of taking part in this study?

No risks are envisaged from taking part in this study and the videos and vignettes are not anticipated to be distressing.

What are the benefits to me?

You will leave with the knowledge that you have contributed to our understanding of treatment decisions in CP and have helped in pain research.

Will I receive compensation for giving my time?

A donation of £2 to *Médecins Sans Frontières/Doctors Without Borders* will be made on your behalf.

How will my data be kept?

Your data from this study will be stored electronically using a numbered code. Your email address will be taken in order for us to be able to send you a full debrief of the study and the results when the data collection process is complete. Your email address will be stored in a separate password protected file and will not be linked with your data. Only researchers directly involved in the study have access to the data. All data will be collected and stored in accordance with the Data Protection Act (1998).

Whom can I contact for further information?

If you have any further questions please contact:

Gráinne Schäfer [email]

Dr. Amanda C de C Williams [email]

You do not have to take part in this study if you do not want to. If you decide to take part, you may withdraw at any time without having to give a reason.

Factors affecting decisions of doctors and medical students in the treatment of Chronic Pain

All research projects are reviewed by an ethics committee. This study has been approved by the Ethics Chair of the UCL Research Committee as Project ID Number 4714/001

Volunteer consent form

Confidential

Investigators: Gráinne Schäfer, Dr. Amanda C de C Williams

Participant's Statement

I agree that I have (please tick each statement to which you agree):

- Read the information sheet
- Had the opportunity to ask questions and discuss the study via email and
- Received satisfactory answers to all of my questions or have been advised of an individual to contact for answers to pertinent questions about the research and of my rights as a participant and of whom to contact in the event of a research-related injury.

- I understand that I am free to withdraw from the study without penalty if I so wish, and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose.
- I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

By clicking the 'next' button, you agree to take part in the study.

Appendix 6: Donation to Médecins Sans Frontières UK

Dear Grainne

Thank you for your donation of £126.00 to Médecins Sans Frontières UK.

The reference for this donation is W0049018



Thank you

Donations such as yours make our work possible. They allow us to remain independent from political, religious and economic interests, and ensure we can act fast and save lives based on needs alone.

See donations at work

Our [website](#) is a great place to see how much of an impact donations have. On there you'll find the latest news, photo stories, videos and our staff and patient blogs.

Come and join our social communities

Where there is always something interesting being discussed. It's also another great source for the latest news from MSF UK. You can find us on [Facebook](#), [Instagram](#), [Pinterest](#) and [Twitter](#).

Do you have any questions?

If you do have any questions about your donation or the work it's helping to fund, then please feel free to contact us on uk.fundraising@london.msf.org or by calling 020 7404 6600 (office hours).

Thank you once again for your donation to MSF UK

giftaid it

As a UK taxpayer, you have agreed to Gift Aid your donations. MSF may reclaim the tax on donations you have made in the previous four years, this donation and all future donations. You have confirmed that you pay an amount of Income and/or Capital Gains tax at least equal to the tax that MSF, and any other charities or CASCs you donate to, will claim on your donation(s). If in the future you no longer pay an amount of Income tax or Capital Gains tax equal to the tax we are reclaiming, or if you wish to cancel the declaration, please notify us and we will take your donations out of the scheme. Please let us know if your name or address details change so we can update our details.

Appendix 7: Method for obtaining ratings of trustworthiness/selecting stimuli

Participants and setting

A convenience sample of fifty-five (14 male) trainee clinical psychologists took part in the trustworthiness rating task prior to the main study.

Materials

Stimuli from the UNBC-McMaster Shoulder Pain Expression Archive Database (Lucey, Cohn, Prkacin, Solomon, & Matthews, 2011) were used in both parts of the current study. The database contains 130 videos showing faces of patients with shoulder pain while they were undergoing a series of painful physiotherapeutic manoeuvres (for a full description of patient characteristics, tests and videotape characteristics see Lucey et al., 2011). For the first part of the study, still images of the patients carrying a neutral expression were used as stimuli, following the methods of Oosterhof and Todorov (2008). Stimuli were chosen for trustworthiness ratings if the patient expressed a moderate intensity of pain expression in their respective video and if their ethnicity was Caucasian. As a result, 51 (28 male, age range 20 – 67 years) patient stimuli were selected for trustworthiness ratings.

Measures

Estimations of trustworthiness were made on a scale of 1 to 9 (Appendix), the same method as that of Oosterhof and Todorov (2008). The scales were anchored at either end with the words “Not trustworthy at all” and “Extremely trustworthy”.

Procedure

The study was set up on the survey platform Limesurvey, and participants accessed it online. Participants were emailed invitations to take part in the study and upon entering the website, they were asked to provide informed consent. They reported their gender and year of training. They were then presented with each of the 51 patient stimuli in a random order and were asked to rate the trustworthiness of each patient, relying on their 'gut feeling'. Each presentation lasted as long as it took participants to select a rating of trustworthiness and click through to the next presentation. It was not possible for participants to go back and change previous ratings.

Results

The mean rating of trustworthiness was 5.14 ($SD = .85$, $range = 1-9$). There was a difference in mean ratings of female and male chronic pain patients, with female chronic pain patients ($M = 5.49$, $SD = .61$) rated higher in trustworthiness than males ($M = 4.85$, $SD = .80$, $t(49) = -3.14$, $p = 0.003$). The videos of male and female patients with the three lowest and highest ratings in trustworthiness were selected for the second part of the study (Table 1) in order to maximise effects due to trustworthiness.

Appendix 8: Table with characteristics of patients in each video

Table. Characteristics, FACs ratings and mean trustworthiness ratings of patients in each video.

	Mean (SD) trustworthiness rating	Trustworthiness classification	Gender
Video 1	6.42 (1.60)	High	Female
Video 2	6.36 (1.46)	High	Female
Video 3	6.51 (1.61)	High	Female
Video 4	6.24 (1.45)	High	Male
Video 5	6.25 (1.31)	High	Male
Video 6	6.06 (1.80)	High	Male
Video 7	4.76 (1.47)	Low	Female
Video 8	3.96 (1.35)	Low	Female
Video 9	4.91 (1.48)	Low	Female
Video 10	3.95 (1.79)	Low	Male
Video 11	3.60 (1.67)	Low	Male
Video 12	3.60 (1.47)	Low	Male

Appendix 9: Study instructions

You will be shown a series of vignettes that are followed by videos of patients with CP. You will then be asked questions relating to the corresponding vignettes and videos.

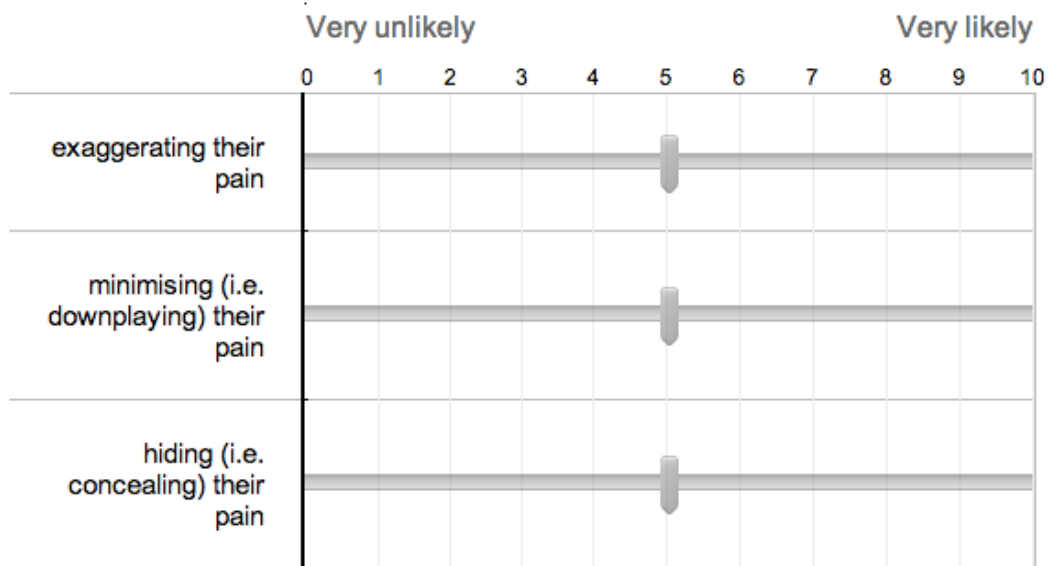
Please ensure that your mobile phone and sound on the computer are switched to silent to minimise distractions while you are doing the study (the videos you will be watching have no sound so you don't need speakers for this study).

Please press the F11 button on your keyboard. This will change your browser to fullscreen view. You can change it back to normal view by pressing F11 again after completing the study.

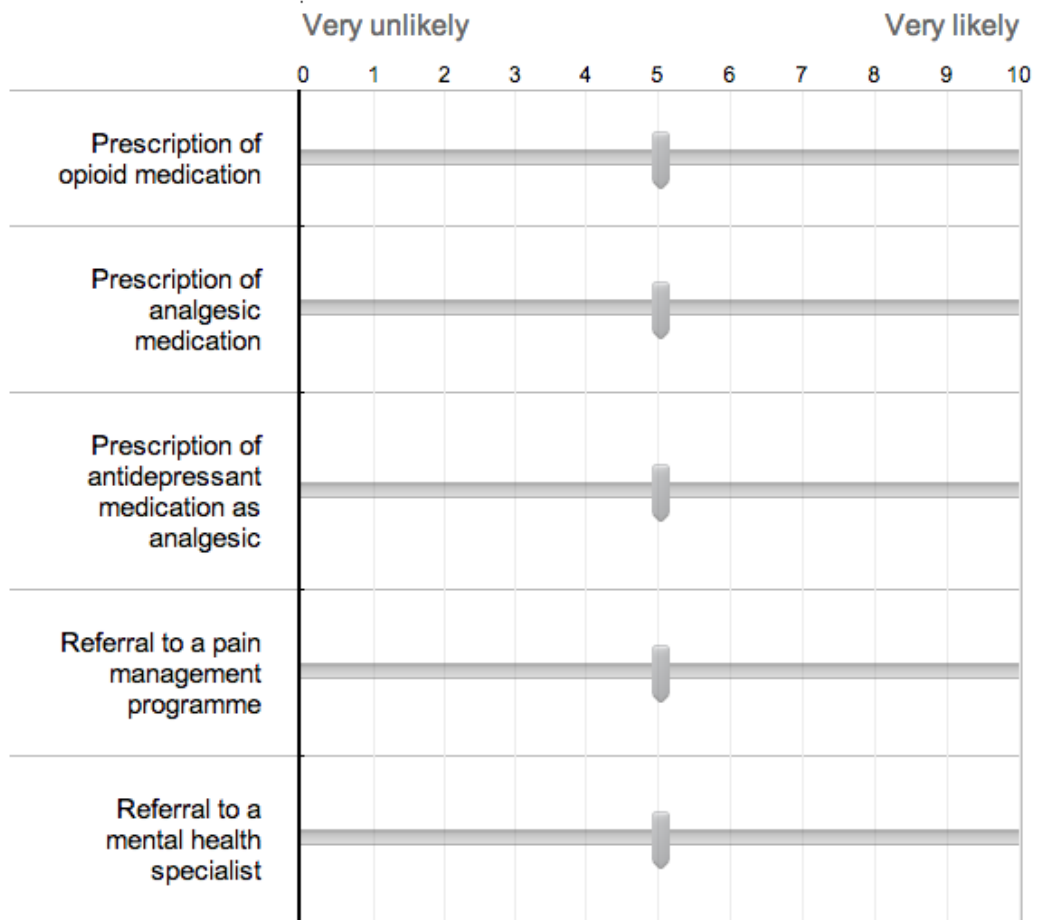
If you have to leave the survey and come back again, your progress will be saved as long as you access the survey from the same browser.
By clicking the 'next' button, you agree to take part in the study.

Appendix 10: Response bars

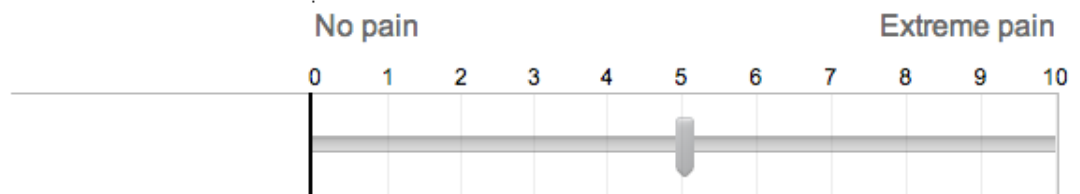
On a scale of 0 to 10, how likely do you think it is that the person in the video is:



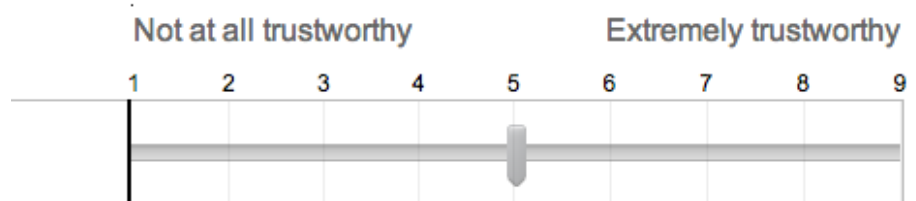
On a scale of 0 to 10, please rate the likelihood that you would consider/recommend the pain management practices listed below in the care of this patient:



Please rate the amount of pain you think the patient in the video experienced



How trustworthy is this patient?



Appendix 11: Vignettes

Vignette 1

Dear Doctor,

Re: Ms Wilson, Hospital number: 4816752

I would be grateful if you could see this patient, who says that she has experienced pain in her right shoulder for about 1 year. She reports that she is finding it difficult to drive due to the pain and she lives in a rural area with limited public transport so finds it difficult to leave her house for daily errands. She said that she has no other health conditions, apart from asthma.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 2

Dear Doctor,

Re: Ms Walker, Hospital number: 7494018

I would be grateful if you could see this patient, who says that she has experienced pain in her right shoulder for about 1 year. She reports that she is finding it difficult to look after her two young grandchildren because of the pain. She reports that she has been depressed for about 3 years, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 3

Dear Doctor,

Re: Ms Harris, Hospital number: 4185247

I would be grateful if you could see this patient, who says that she has experienced pain in her right shoulder for about 1 year. She reports that she is finding it difficult to continue full time work because of the pain. She reports that she began to feel depressed about 6 months ago, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 4

Dear Doctor,

Re: Mr Anderson, Hospital number: 9187282

I would be grateful if you could see this patient, who presents with shoulder pain and says that the pain started about 1 year ago. He reports that he is finding it difficult to drive due to the pain and he lives in a rural area with limited public transport so finds it difficult to leave his house for daily errands. He said that he has no other health conditions, apart from asthma.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 5

Dear Doctor,

Re: Mr Brown, Hospital number: 0234052

I would be grateful if you could see this patient, who presents with shoulder pain and says that the pain started about 1 year ago. He reports that he is finding it difficult to continue full time work because of the pain. He has been depressed for about 3 years, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 6

Dear Doctor,

Re: Mr Davis, Hospital number: 1475482

I would be grateful if you could see this patient, who reports pain in his right shoulder for about 1 year. He said that he is a carer for his elderly father and that he has been finding it more difficult to care for him due to the pain. He reports that he began to feel depressed about 9 months ago, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 7

Dear Doctor,

Re: Ms Moore, Hospital number: 4815751

I would be grateful if you could see this patient, who presents with shoulder pain and says that the pain started about 1 year ago. She reports that she is finding it difficult to continue full time work because of the pain. She is asthmatic but said that she does not have any other problems with her health.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 8

Dear Doctor,

Re: Ms Thomas, Hospital number: 4815729

The patient presents with shoulder pain and reports that the pain started about 1 year ago. She reports that the pain is interfering with her ability to carry out her studies. She has been depressed for about 2 years, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 9

Dear Doctor,

Re: Ms White, Hospital number: 4816752

I would be grateful if you could see this patient, who presents with shoulder pain and says that the pain started about 1 year ago. She reports that she is finding it difficult to look after her young child because of the pain. She reports that she began to feel depressed about 9 months ago, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 10

Dear Doctor,

Re: Mr Taylor, Hospital number: 4815495

I would be grateful if you could see this patient, who reports pain in his right shoulder for about 1 year. He reports that the pain is interfering with his ability to carry out his studies. He is asthmatic but said that he does not have any other problems with his health.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 11

Dear Doctor,

Re: Mr Smith, Hospital number: 0434023

I would be grateful if you could see this patient, who reports pain in his right shoulder and says that the pain started about 1 year ago. He said that he is a carer for his elderly uncle and that he has been finding it more difficult to care for his uncle due to the pain. He reports that he has been depressed for 2 years, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Vignette 12

Dear Doctor,

Re: Mr Jones, Hospital number: 5861679

I would be grateful if you could see this patient, who presents with shoulder pain and says that the pain started about 1 year ago. He reports that he is self-employed and is finding it difficult to keep up with his work duties because of the pain. He says that he began to feel depressed about 6 months ago, but does not currently take medication or have psychological treatment for it.

I am requesting your opinion regarding the appropriate treatment of this patient. Thank you for your help.

Yours sincerely,

Dr. Watson

Appendix 13: Further results

Interactions with $p > .01$ and post-hoc test results for interactions that were $p < .05$.

Table 21. Interactions between training level, history of depression, trustworthiness and gender for pain management decisions with $p > .01$

	Trustworthiness x training level			Trustworthiness x gender x training level			Gender x history of depression x training level		
	<i>F</i> (1,61)	<i>p</i>	η_p^2	<i>F</i> (1,61)	<i>p</i>	η_p^2	<i>F</i> (2,60)	<i>p</i>	η_p^2
Pain estimates	2.49	.120	.04	2.87	.061	.05	2.36	.099	.04
Exaggerating pain	0.19	.666	<.01	0.03	.857	<.01	1.74	.180	.03
Minimising pain	0.94	.336	.02	0.02	.89	<.01	4.21	.017	.07
Hiding pain	5.91	.018	.09	0.19	.662	<.01	0.86	.427	.01
Opioids	4.03	.049	.06	4.28	.043	.07	1.91	.153	.03
Analgesics	1.18	.283	.02	0.15	.699	<.01	3.88	.02	.04
Antidepressants	0.72	.400	.01	1.41	.240	.02	2.00	.14	.03
Pain management programme	2.61	.111	.04	5.77	.019	.09	0.51	.602	.01
Mental health specialist	2.84	.097	.04	0.20	.659	<.01	2.21	.114	.04

Patient gender x history of depression

There was a significant interaction between patient gender and history of depression (Table 10). Post hoc tests indicated that the previously mentioned main effect for gender remained, with participants estimating males as in more pain than

females, regardless of history of depression (Female, no history of depression: $M = 4.74$, $SE = 0.17$; Male, no history of depression: $M = 5.43$, $SE = 0.14$; $t(62) = 5.35$, $p < .001$; Female, depression before CP: $M = 4.63$, $SE = 0.17$; Male, depression before CP: $M = 5.82$, $SE = 0.16$; $t(62) = 7.63$, $p < .001$; Female, depression after CP: $M = 4.56$, $SE = 0.16$; Male, depression after CP: $M = 5.33$, $SE = 0.18$; $t(62) = 4.74$, $p < .001$). Pain estimates for male patients were similar across all histories of depression ($p > .050$), while female patients with no history of depression and who developed depression after CP were more likely to be given higher estimates of pain than female patients who developed depression before CP ($t(62) = 3.00$, $p = .01$; $t(62) = 3.43$, $p = .003$).

There was also an interaction between patient gender and history of depression for likelihood of referring to a mental health specialist. Post hoc tests revealed that for patients with no history of depression, females were more likely than males to be referred to a mental health specialist ($M = 2.10$, $SE = 0.23$; $M = 1.64$, $SE = 0.19$; $t(62) = 3.11$, $p = .003$). There were no differences between males and females in the other two conditions.

Patient trustworthiness x gender

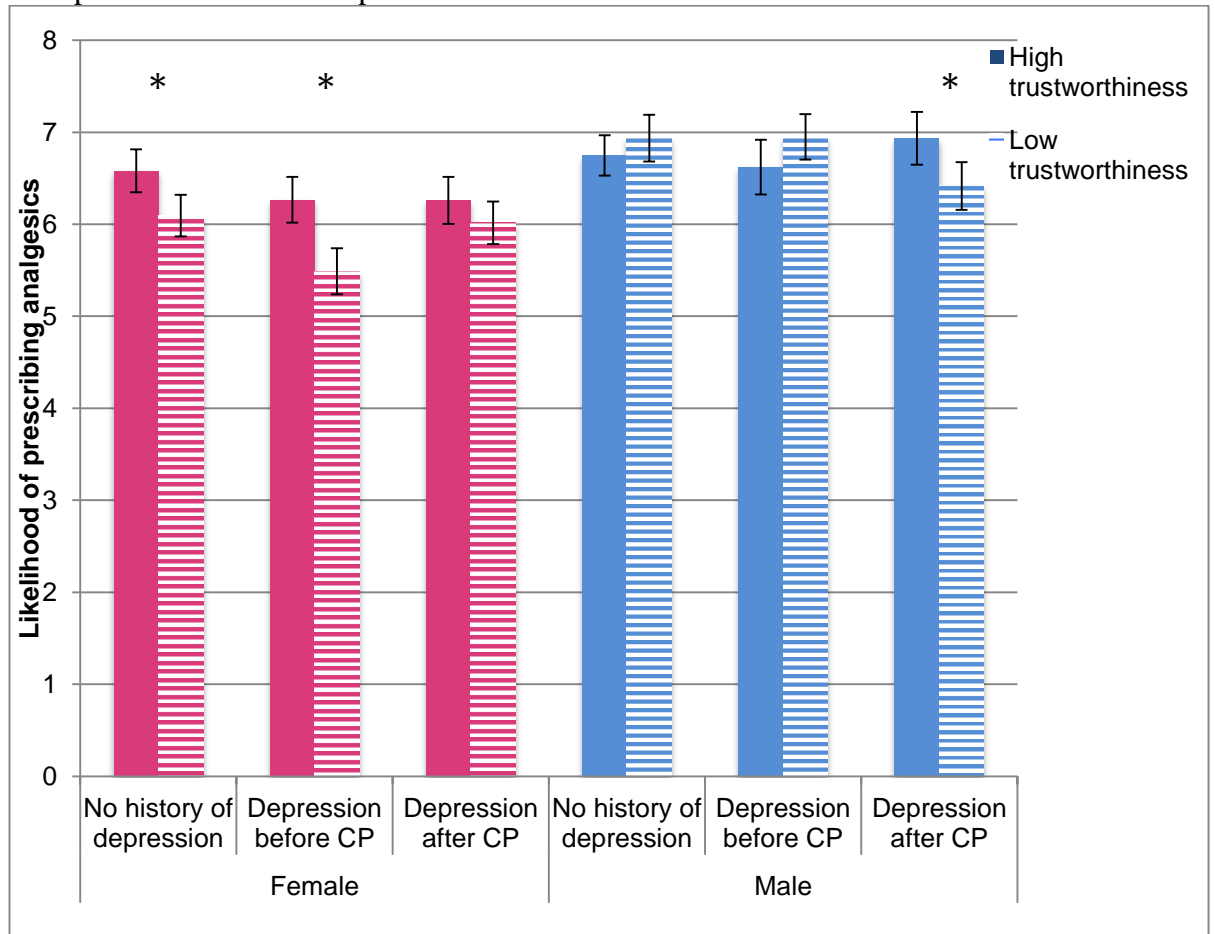
There was an interaction between patient trustworthiness and gender for likelihood of prescribing analgesics. Post hoc tests indicated that the previously mentioned main effect for trustworthiness only occurred in female, but not male patients (HT female: $M = 6.39$, $SE = 0.22$; LT female: $M = 5.87$, $SE = 0.20$; $t(62) = 3.37$, $p = .001$; HT male: $M = 6.77$, $SE = 0.20$; LT male: $M = 6.77$, $SE = 0.22$; $t(62) = 0$, $p = .998$). This interaction indicates that participants were more likely to

prescribe analgesics to HT females than LT females, but participants gave similar ratings of prescription of analgesics to males, regardless of their level of trustworthiness. The main effect for patient gender also only occurred in LT patients, with LT males more likely to be prescribed opioids than LT females ($t(62) = 6.15, p < .001$). There was no difference for HT females compared to HT males ($p > .05$). The main effect for patient gender remained, with males more likely to be prescribed analgesics than females for both levels of trustworthiness ($t(62) = 2.79, p = .007$; $t(62) = 5.56, p < .001$).

Patient trustworthiness x gender x history of depression

There was also a significant interaction between trustworthiness, patient gender and history of depression for likelihood of prescribing analgesics (Figure 1). Post hoc tests showed that the HT male who developed depression after CP was more likely to be prescribed analgesics than the LT male in the same condition ($t(62) = 2.51, p = .015$). For females who had no history of depression and who developed depression before CP, HT females were more likely than LT females to be prescribed analgesics ($t(62) = 2.24, p = .029$; $t(62) = 2.63, p = .011$).

Figure 1. Mean likelihood of prescribing analgesics across trust, gender and history of depression. Error bars represent standard errors.



Note: * $p < .05$, ** $p < .01$, *** $p < .001$

There was an interaction between trustworthiness, patient gender and history of depression for likelihood of referring to pain management. Post hoc tests indicated that the HT male who developed depression after CP was more likely to be referred to pain management than the HT female in the same condition ($M = 4.60$, $SE = 0.32$; $M = 3.56$, $SE = 0.33$; $t(62) = 3.62$, $p = .001$). There were no differences between HT males and females for patients who developed depression before CP and patients with no history of depression. The LT male who developed depression

before CP was more likely than the LT female to be referred to pain management ($M = 5.06, SE = 0.34; M = 3.90, SE = 0.36; t(62) = 3.37, p = .001$). There was a similar trend for patients who developed depression after CP ($M = 4.21, SE = 0.36; M = 3.78, SE = 0.33; t(62) = 1.88, p = .065$) and there was no difference between males and females who had no history of depression.

Patient trustworthiness x training level

There was an interaction between patient trustworthiness and training level for likelihood of prescribing opioids (21). Post hoc tests indicated that students were more likely to prescribe opioids to HT patients than LT patients ($M = 3.15, SE = 0.30; M = 2.87, SE = 0.30; t(62) = 2.50, p = .015$), while clinicians were not affected by patient trustworthiness ($M = 1.79, SE = 0.28; M = 1.82, SE = 0.28; t(62) = 0.24, p = .808$).

Patient gender x training level

There was a significant interaction between patient gender and training level for likelihood of prescribing analgesics. Post hoc tests indicated that medical students gave a higher likelihood of prescribing analgesics to male patients than pain clinicians, but that there was no difference between groups in female patients (male patients: $M = 7.30, SE = 0.30; M = 6.24, SE = 0.27; t(62) = 2.65, p = .010$; female patients: $M = 6.40, SE = 0.32; M = 5.84, SE = 0.27; t(62) = 1.30, p = .199$). The main effect for patient gender remained, with both groups more likely to prescribe analgesics for males than females ($t(62) = 5.28, p < .001; t(62) = 2.51, p = .015$).

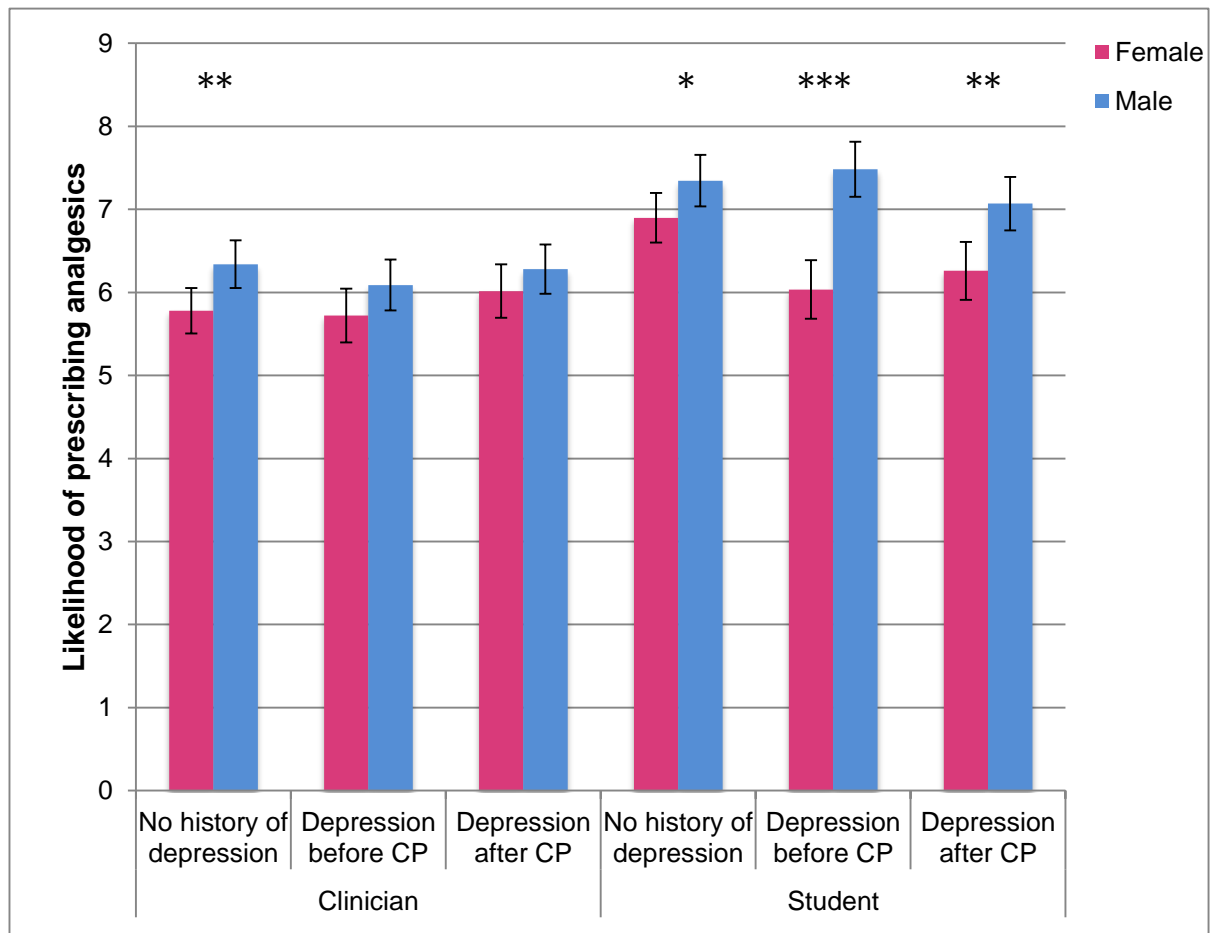
History of depression x training level

There was a significant interaction between history of depression and training level for likelihood of prescribing analgesics. Post hoc tests indicated that clinicians' likelihood of prescribing analgesics were not affected by the history of depression of patients ($p > .05$), but that medical students were more likely to prescribe analgesics for patients who had no history of depression than patients who developed depression before CP, and patients who developed depression after CP (no history of depression: $M = 7.12$, $SE = 0.29$; depression before CP: $M = 6.76$, $SE = 0.31$; depression after CP: $M = 6.66$, $SE = 0.31$; $t(62) = 2.66$, $p = .029$; $t(62) = 3.46$, $p = .003$).

Patient gender x history of depression x training level

There was a significant interaction between patient gender, history of depression and training level for likelihood of prescribing analgesics (Figure 2). Post hoc tests found that students were more likely to prescribe analgesics for males than females, regardless of their history of depression (control: $t(62) = 2.22$, $p = .03$; depression before CP: $t(62) = 5.10$, $p < .001$; depression after CP: $t(62) = 3.15$, $p = .003$). There was no significant difference for clinicians between males and females, except for patients with no history of depression, where clinicians were more likely to prescribe analgesics for males than females, $t(62) = 3.01$, $p = .004$. The history of depression x training level interaction was found to only occur for female patients, with students more likely to prescribe analgesics for female patients who had no history of depression than female patients who developed depression before CP, and female patients who developed depression after CP ($t(62) = 4.66$, $p < .001$; $t(62) = 3.61$, $p = .002$).

Figure 2. Mean likelihood of prescribing analgesics across gender, history of depression and training level. Error bars represent standard errors.

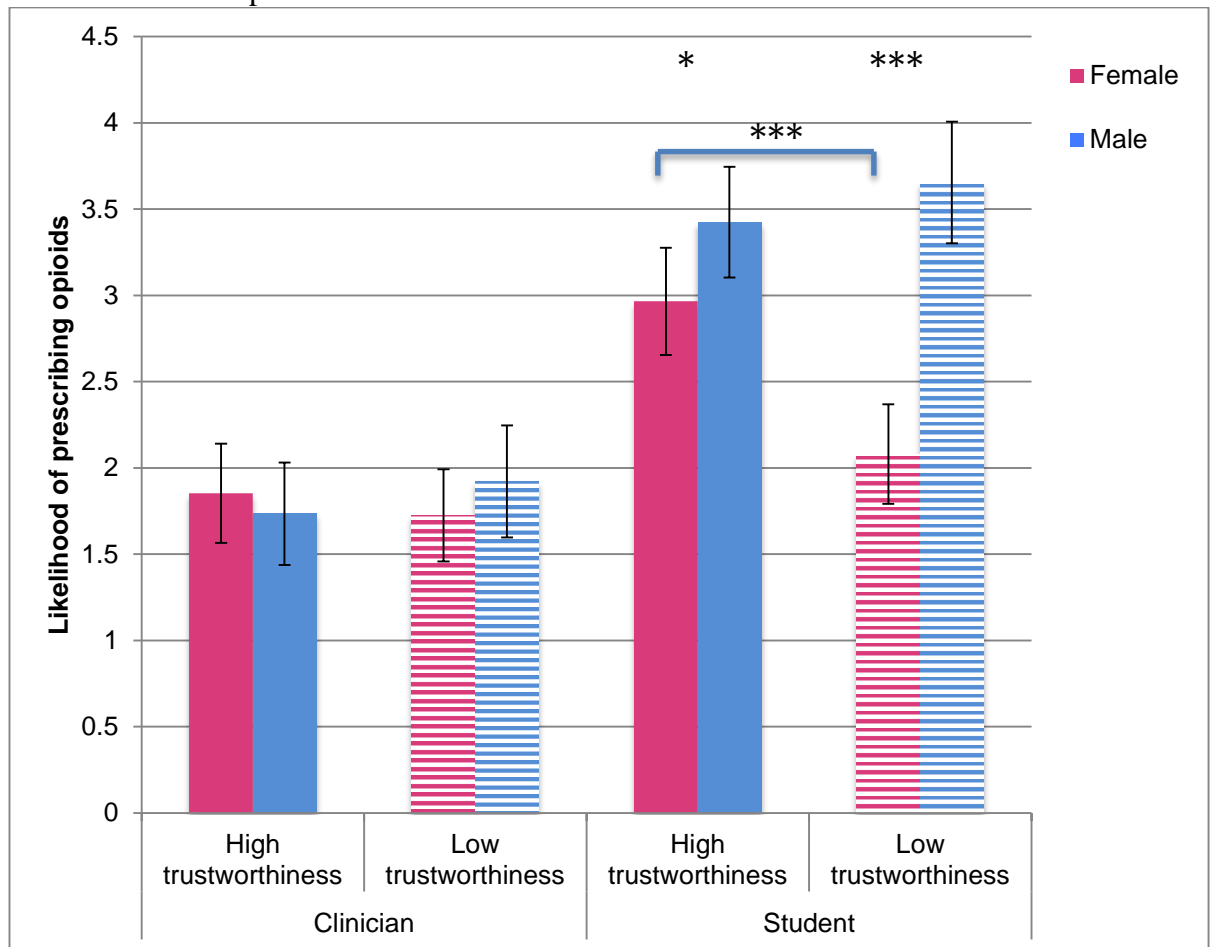


Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Patient trust x gender x training level

There was an interaction between trust, gender and training level for likelihood of prescribing opioids (Figure 3). Post-hoc tests indicated that the patient gender x training level interaction remained, but that the trustworthiness x training level interaction only occurred for female patients. This interaction indicates that students were more likely to prescribe opioids for HT females than LT females ($t(62) = 4.86, p < .001$), but there were no differences in students' ratings between HT males and LT males ($p > .05$).

Figure 3. Mean likelihood of prescribing opioids across trust, gender and training level. Error bars represent standard errors.



Note: * $p < .05$, ** $p < .01$, *** $p < .001$

There was an interaction between trust, patient gender and training level, for likelihood of referring to pain management. Post hoc tests revealed that students were more likely to refer LT males than LT females to pain management ($M = 5.20$, $SE = 0.45$; $M = 4.25$, $SE = 0.43$; $t(62) = 4.43$, $p < .001$). There were no differences between HT males and females. Clinicians were just as likely to refer males to pain management as females regardless as to whether they were high or low in trustworthiness.