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ORIGINAL ARTICLE

Emotional distress drives health services overuse in patients with acute low back pain: a longitudinal observational study

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Abstract
Purpose To determine whether emotional distress reported at the initial consultation affects subsequent healthcare use either directly or indirectly via moderating the influence of symptoms.
Methods Longitudinal observational study of 2891 participants consulting primary care for low back pain. Negative binomial regression models were constructed to estimate independent effects of emotional distress on healthcare use. Potential confounders were identified using directed acyclic graphs.
Results After the initial consultation, participants had a mean (SD) of one (1.2) visit for back pain over 3 months, and nine (14) visits for back pain over 12 months. Higher reports of anxiety during the initial consultation led to increased short-term healthcare use (IRR 1.06, 95 % CI 1.01–1.11) and higher reports of depression led to increased long-term healthcare use (IRR 1.04, 95 % CI 1.02–1.07). The effect sizes suggest that a patient with a high anxiety score (8/10) would consult 50 % more frequently over 3 months, and a person with a high depression score (8/10) would consult 30 % more frequently over 12 months, compared to a patient with equivalent pain and disability and no reported anxiety or depression.
Conclusions Emotional distress in the acute stage of low back pain increased subsequent consultation rates. Interventions that target emotional distress during the initial consultation are likely to reduce costly and potentially inappropriate future healthcare use for patients with non-specific low back pain.

Keywords Low back pain · Depressive symptoms · Primary healthcare · Medical overuse

Introduction

Direct costs of low back pain in the UK are estimated to be £2.8 billion annually [1]. In the USA, this figure approaches $50 billion [2]. Between 1997 and 2005, the expenditure on back pain-related healthcare increased by 65 % and visits to physicians explained the largest proportion of cost [3]. Although guidelines recommend a minimum intervention approach for a new episode of low back pain, some patients consult a practitioner multiple times and seek costly medical or alternative interventions [4]. Considerable savings are likely if unnecessary healthcare visits are avoided.

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What compels patients to visit frequently for their low back pain? Symptoms alone do not explain healthcare use—around 50 % of patients with substantial pain and disability do not consult [5]. Other factors such as predisposing (socio-demographic variables that make healthcare use more likely), enabling (access to health insurance and services), and illness (perceived need for healthcare) factors may be important [6].

Emotional distress (feelings of anxiety or depression) has also been found to predict poor prognosis [7] and high healthcare use [8]. However, predictors of poor outcomes are not likely to be useful targets for treatment unless a causal relationship is established. Unfortunately, those studies that have tested the independent relationship between emotional distress and healthcare use do not describe how confounders were selected, which introduces a significant bias [9] that might explain their contrasting findings [8, 10–12]. If emotional distress reported at the initial consultation does indeed drive future healthcare use, interventions that target emotional distress may prevent subsequent health services overuse.

We aimed to determine, in patients with acute low back pain, the role of emotional distress in subsequent treatment seeking.

Methods

We hypothesized that emotional distress (anxiety and depression) at the initial primary care consultation for back pain (1) increases short- and long-term healthcare use and (2) moderates the effect of initial pain and disability on subsequent healthcare use.

Data sources

This study used data from two previous studies enrolling a total of 2891 patients who consulted primary care for their acute low back pain. The aim of Study 1 (a randomized controlled trial) was to test the effect of paracetamol on acute low back pain [13]. Healthcare visits for low back pain were recorded throughout the 3 months following the initial consultation. The aim of Study 2 (a cohort study) was to describe the course of acute low back pain [14]. Healthcare visits for low back pain in Study 2 were recorded 12 months after the initial consultation.

Study settings

Both studies were conducted in the metropolitan region of Sydney, Australia. Study 1 recruited patients from November 2009 to March 2013, and Study 2 recruited patients from November 2003 to July 2005.

Health system characteristics

In Australia, general practitioners, physiotherapists, and chiropractors provide the majority of healthcare for back pain. They are accessed via public and private insurance schemes. Australia's public scheme, Medicare, offsets the costs of private medical services and selected pharmaceuticals, but not private non-medical healthcare providers, for example private physiotherapists or chiropractors. State governments provide free medical and physiotherapy treatment in public hospitals. Patients attending ancillary services, or receiving care in a private hospital, may use private health insurance schemes to partially cover costs. Approximately, 51 % of Australians have private health insurance [15].

Study samples

Study 1 included participants who were seeking primary care for non-specific acute low back pain defined as at least moderate intensity pain between T12 and the buttock creases, with or without leg pain, which had lasted for fewer than 6 weeks duration and was preceded by a pain-free period of at least 1 month. 235 primary care clinicians (181 general practitioners, 50 pharmacists and four physiotherapists) screened patients for eligibility. Participants were excluded if they had suspected serious spinal pathology, were using regular analgesic medication, had spinal surgery in the previous 6 months, had contraindications to paracetamol, had used psychotropic drugs that would preclude reliable study follow-up, or were pregnant.

Study 2 included participants who were seeking primary care for non-specific acute low back pain. Acute low back pain was defined as for Study 1, but also included patients of fewer than 4 weeks duration, with no minimum pain intensity. 170 primary care clinicians (73 general practitioners, 77 physiotherapists, and 20 chiropractors) screened patients for eligibility. Participants 14 years or older and able to read and write English were eligible. Participants were excluded if they had been diagnosed with serious spinal pathology before or during the course of the study. Participants with leg pain were eligible; participants with diagnosed radiculopathy were excluded.

Measures

Baseline data

Baseline data were collected at, or immediately after, the initial consultation. Data were collected on proposed predictors of subsequent healthcare use, categorized as predisposing factors (age, gender, postal code, past history of

low back pain, cultural background), access factors (health insurance, income, worker's compensation status), or illness factors (pain intensity, disability, emotional distress, general health).

Emotional distress

The independent variable of interest, emotional distress, was measured using two 11-point scales. These two scales, "How tense or anxious have you felt in the past week?" and "How bothered by feelings of depression have you been in the past week?" were taken from a valid [16] and reliable [17] acute low back pain screening questionnaire, and have been shown to be valid instruments for detecting depressive symptoms in low back pain patients presenting to primary care [18]. Because the scales assess anxious or depressive symptoms, any reference to 'anxiety' or 'depression' hereinafter refers only to symptoms of emotional distress, rather than to clinically diagnosed anxiety or depression.

Healthcare use

The dependent variable was the self-reported number of primary healthcare visits for low back pain measured during a 3-month period or a 12-month period after the initial primary care consultation. Researchers in Study 1 asked patients to estimate how many times they had "utilized health services" for their low back pain both at 4 weeks and 3 months following the initial consultation. Count data from 4 weeks and 3 months were combined into 'short-term healthcare use'. Researchers in Study 2 asked patients to estimate how many times they had visited a general practitioner, physiotherapist, or chiropractor for their low back pain, at the 12-month follow-up. Data on the number of visits for each practitioner were combined into 'long-term healthcare use'. All data were collected over the phone.

Statistical analysis

A full statistical analysis protocol was locked and published online [19] prior to commencing the analysis. All analyses were performed in SPSS Statistics for Windows, Version 22.0, Armonk, NY: IBM Corp.

A negative binomial regression analysis was used to model the association between emotional distress and healthcare use. This method was chosen because the dependent variable (healthcare use—count data) did not approximate a normal distribution, and the data were overdispersed (i.e., the variance was greater than the mean). Because Study 1 measured short-term healthcare use and Study 2 measured long-term healthcare use, we built a separate model for each data set. To maintain statistical power, we did not dichotomize the outcome and retained the healthcare visits as count data. Because the number of cases with missing baseline variables was low (<1 %), we excluded these cases from the analysis.

To identify the most important covariates to include in our model, we constructed a directed acyclic graph (DAG) according to Shrier et al. [20]. The DAG was constructed using free software available at www.dagitty.net. In accordance with our DAG (see Online Resource 1, Figs. 1–5), we adjusted for selected predisposing factors (age, gender, socioeconomic status, past history, cultural background), compensation status, and illness factors (pain, disability, co-morbid illness), to minimize bias in our estimate.

Although anxiety and depression scores were significantly correlated in both samples [Study 1: 0.38 ($p < 0.01$), Study 2: 0.61 ($p < 0.01$)], we did not detect multicollinearity among the distress variables using collinearity diagnostics (tolerance and variation inflation factor) in SPSS. Therefore, anxiety and depression were assessed in the same model.

The emotional distress variables were entered in the first block of the model. In the second block of the model, we adjusted for the following covariates (see Online Resource 1, Fig. 3): pain intensity (1–6 scale) [21], disability (Roland–Morris Score or 0–10 scale) [22] [21], co-morbid illness (self-rated general health on a 1–5 scale) [21], age, gender, socioeconomic status (Socio-Economic Indexes for Areas (SEIFA) score, based on postal code) [23], past history of low back pain (y/n), compensation status (y/n), cultural background (born in Australia, y/n—measured in Study 2 only).

The unstandardized exponentiated regression coefficient [Exp (B)] was used to calculate the incidence rate ratio (IRR). The IRR can be interpreted similarly to the odds ratio. For example, an IRR of 1.10, for a continuous independent variable measured on a 0–10 scale, would mean that a 1-point increase in the predictor variable increases the incidence rate by 10 %.

To test our second hypothesis, we modeled the association between symptoms and healthcare use in both the short- and long-term. To estimate the crude IRRs, we built two separate models: one for pain and another for disability. To select important confounders of the relationship between pain and disability (exposure) and healthcare use (outcome), we used the same DAG used in for the primary models (see Online Resource 1, Fig. 2).

Covariates adjusted for in the moderation model (see Online Resource 1, Fig. 5) were age, gender, socioeconomic status [Socio-Economic Indexes for Areas (SEIFA) decile score, based on postal code] [23], past history of low back pain (y/n), cultural background (born in Australia y/n—measured in Study 2 only), and pain intensity (1–6 scale) [21].

After determining the main effects of pain and disability, we performed a moderation analysis. Moderating effects of anxiety and depression were investigated in separate models. Moderation analysis was performed by adding interaction terms to the symptom-healthcare use regression models, and by constructing plots using the PROCESS macro in SPSS, written by Andrew F. Hayes [24]. We included the following interaction terms: pain–anxiety, pain–depression, disability–anxiety, disability–depression. Separate models tested each interaction term, for both short- and long-term healthcare use (eight models in total). Interaction terms were added to a model that included the independent variable (pain or disability), confounders, and moderator (anxiety or depression). A significant interaction term ($p < 0.05$) in the final model would confirm our moderation hypothesis.

Institutional review board approval

This is a secondary analysis of two studies that were approved by the University of Sydney Human Research Ethics Committee: Ref. 11-2002/3/3144 [14] and Ref. 11638 [13].

Results

Table 1 shows baseline demographic and clinical characteristics in the two study samples. Healthcare use data were available for 100 % of patients in Study 1 (3-month follow-up) and 97.2 % of patients in Study 2 (12-month follow-up). Compensation cases were more common in Study 2 (18.2 %) than in Study 1 (7.1 %). The proportion of patients developing chronic LBP, defined as ≥3/10 pain at 3 months and no periods of recovery, was also higher in Study 2 (29.7 %) than in Study 1 (17.6 %).

Participants had a mean (SD) of one (1.2) visit [median (IQR) of 0 (1) visits] over 3 months in Study 1, and a mean (SD) of nine (14) visits [median (IQR) of 5 (7) visits] over 12 months in Study 2 (see Online Resource 2, Figs. 6, 7).

Associations between emotional distress and healthcare use are shown in Table 2. Higher reports of anxiety led to a higher rate of short-term healthcare use (IRR 1.06, 95 % CI 1.01–1.11) and higher reports of depression led to a higher rate of long-term healthcare use (IRR 1.04, 95 % CI 1.02–1.07). Reports of depression did not lead to a significantly higher rate of short-term healthcare use (IRR 1.03, 95 % CI 0.99–1.06), and reports of anxiety did not lead to a significantly higher rate of long-term healthcare use (IRR 1.02, 0.99–1.05).

In the moderation analysis, there were significant main effects of baseline pain and disability on short-term and long-term healthcare use (Table 3). Although the interactions plots show a tendency for distressed patients to consult more in the short-term for a given level of symptoms (see Online Resource 3, Figs. 8, 9), IRR confidence intervals for each interaction term included 1 and there were no statistically significant interactions (Table 3).

Discussion

We found that higher levels of emotional distress at the initial consultation led to more frequent subsequent healthcare use in patients with acute low back pain. Higher levels of pain and disability at initial consultation also led to more frequent healthcare use, but this effect was not moderated by emotional distress. The effect sizes suggest

Table 1 Baseline characteristics in each study sample

	Study 1 ($N = 1643$)	Study 2 ($N = 1248$)
Age	44.8 (15.9)	43.9 (14.8)
Gender female (*N*, %)	688 (46.8 %)	558 (46.7 %)
Pain intensity (0–10)	6.3 (1.9)	7.2 (1.6)
Disability (0–10)	5.4 (2.5)	4.9 (2.3)
Anxiety (0–10)	5.2 (2.0)	5.5 (2.6)
Depression (0–10)	3.1 (2.9)	3.3 (3.1)
History of a previous episode (*N*, %)	1172 (71.3 %)	888 (74.3 %)
Compensable cases (*N*, %)	118 (7.1 %)	218 (18.2 %)
Socioeconomic status (0–10)[a]	6.4 (2.9)	7.2 (3.1)
General health (1–5)	2.5 (0.9)	2.3 (0.9)

Figures are mean (SD) unless stated otherwise

IQR Interquartile range, *LBP* low back pain

[a] Socio-Economic Indexes for Areas (SEIFA) decile score. 0 = lowest socioeconomic decile, 10 = highest socioeconomic decile

Table 2 Effects of baseline anxiety and depression on short- and long-term low back pain-related healthcare use

	Crude IRR (95 % CI)	Adjusted IRR (95 % CI)[a]
Short-term healthcare use (Study 1)		
Anxiety	1.05 (1.00–1.09)	1.06 (1.01–1.11)
Depression	1.04 (1.01–1.07)	1.03 (0.99–1.06)
Long-term healthcare use (Study 2)		
Anxiety	1.04 (1.01–1.07)	1.02 (0.99–1.05)
Depression	1.07 (1.04–1.09)	1.04 (1.02–1.07)

IRR Incidence rate ratio

[a] Adjusted for baseline levels of pain, disability, and general health, as well as age, gender, socioeconomic status, past history of low back pain, compensation status, and cultural background (Study 2 only)

that a patient with a high anxiety score (8/10) would consult 50 % more frequently over 3 months, and person with a high depression score (8/10) would consult 30 % more frequently over 12 months, compared to a patient with equivalent pain and disability and no reported anxiety or depression. Treatments targeted at these individuals with high distress might lead to important reductions in unnecessary healthcare use for low back pain.

Our findings provide empirical support for the proposition that emotional factors influence one's perception of their need for care and motivate their consultation behavior [6]. Importantly, this effect is independent of symptoms (pain/disability). These findings suggest that targeting emotional distress in the early management of acute low back pain is likely to reduce future consultation rates. Our findings also support the intuitively sensible and established view that pain and disability at the initial consultation are powerful influencers of subsequent treatment seeking, underpinning the importance of targeting acute pain and disability in treatment. Leg pain in particular has recently been shown to predict high healthcare use, though it is unclear whether this effect is independent of emotional distress [25]. Although we ruled out any strong interaction between emotional distress and symptoms (pain/disability), those patients with a combination of these factors are likely to form an important subgroup for targeted intervention [26].

Despite the criticism of using statistical modeling to select confounders [9], to our knowledge, there have been no investigations of the relationship between emotional distress and subsequent treatment seeking using a theory-driven structural approach instead. Our findings suggest that the differences in effects seen in previous studies [8, 10–12, 27] might reflect differences in confounder selection and incorrect assumptions in the modeling process.

Both samples included in this study were large and broadly representative of patients consulting primary care for low back pain. Despite the differences in the two samples (e.g., number receiving compensation, Table 1),

Table 3 Main effects and moderated effects of baseline pain and disability on short- and long-term healthcare use

	Crude IRR (95 % CI)	Adjusted IRR (95 % CI)[a]
Short-term healthcare use (Study 1)		
Main effects		
Pain	1.08 (1.00–1.16)	1.07 (1.00–1.15)
Disability	1.06 (1.02–1.10)	1.04 (1.00–1.09)[b]
Moderated effects		
Pain–anxiety		1.02 (0.99–1.05)
Pain–depression		1.01 (0.98–1.03)
Disability–anxiety		1.01 (1.00–1.03)
Disability–depression		1.01 (1.00–1.03)
Long-term healthcare use (Study 2)		
Main effects		
Pain	1.23 (1.15–1.32)	1.22 (1.14–1.31)
Disability	1.22 (1.16–1.28)	1.16 (1.10–1.24)[b]
Moderated effects		
Pain–anxiety		1.00 (0.98–1.04)
Pain–depression		1.00 (0.98–1.03)
Disability–anxiety		1.02 (1.00–1.04)
Disability–depression		1.02 (0.99 to 1.04)

IRR Incidence rate ratio, *95 % CI* 95 % confidence interval

[a] Adjusted for age, gender, socioeconomic status, past history of low back pain, cultural background (Study 2 only)

[b] Also adjusted for pain intensity

we found that distress affected consultation rate in both studies. We could control for a wide age range (14–75) which included adolescents, a subgroup recently shown to exhibit differences in their patterns of healthcare use [28]. However, both studies were conducted in a similar region in Australia, which could reduce the generalizability of our findings.

This study has some limitations. First, we defined a causal structure using available theoretical [6, 7] and empirical [5, 29] data, but it remains possible that there are important confounders that we did not identify. Second, because we were limited to variables already measured in the two studies, not all potential confounders identified in our causal diagram were accounted for. For example, neither study measured marital status, and only Study 2 assessed cultural background using a proxy measure (born in Australia—y/n). Third, although the perceived general health item from the SF-36 correlates with the presence of comorbid illness [30], it may not be as accurate as medical record abstraction [31] nor does it capture the number, type, and severity of co-morbidities. If these factors are important confounders, it is possible that our estimate of effect contains a spurious component [5, 7, 29]. Another limitation is that our chosen summary measures of emotional distress may not be as sensitive or specific as full questionnaires. However, we aimed to evaluate the effect of self-reported feelings of anxiety or depression, rather than clinical anxiety or depression per se. Finally, healthcare use data obtained via self-report is known to have limitations and contains an element of recall bias. It is also conceivable that distressed patients might have a tendency to report more or less frequent healthcare use than non-distressed patients, though as far as we are aware, this assumption is untested.

Future research into the effects of cognitive factors, such as beliefs, knowledge of pain-related biology, and physician behaviors such as diagnostic imaging referrals, is essential to fully understand the etiology of health services overuse. Validated tools are available to identify patients with high distress and high symptoms who would benefit from targeted intervention [32]. Simple interventions aimed at reducing distress, such as reassurance and brief education [33], are promising measures for future trials to investigate. It would also be worthwhile for trials to test whether, regardless of pain outcomes, reducing distress mediates reductions in healthcare use.

Conclusion

Emotional distress can explain in part why patients use additional healthcare for their low back pain after an initial consultation. There is some uncertainty around the individual effects of anxiety and depression, but it would seem reasonable to suggest that reassurance might be an important aspect of early management to reduce the effects of emotional distress on future healthcare use.

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Compliance with ethical standards

Conflict of interest None.

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