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Cognitive Behavioral Factors associated with Sleep Quality in Chronic Pain Patients.

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ABSTRACT

People with chronic pain commonly complain of sleep disturbance. This study reports the characteristics of the pain and sleep of a large sample of patients with chronic pain (n=160). We compared subgroups of good sleepers with pain (n=48) and poor sleepers with pain (n=108). Poor sleepers with pain were younger, and reported more pain, pain-related disability, depression, pain-related anxiety and dysfunctional beliefs about sleep. Using simultaneous regression analysis we examined the roles of pain, dysfunctional beliefs about sleep, pain-related disability, depression, and pain-related anxiety in predicting concurrent sleep quality. The findings are relevant to the development of models of sleep disturbance co-morbid with chronic pain.

INTRODUCTION

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (Lindblom, Merskey, Mumford et al., 1986). Chronic pain has been defined as pain that either persists beyond the point at which healing would be expected to be complete or occurs in disease processes in which healing does not take place (Clinical Standards Advisory Group, 1999). Ongoing pain can arise from a wide range of disease states (for example osteoarthritis), often continuing despite optimal medical management. The cause of chronic pain can be difficult to classify using biomedical diagnostic systems as in many cases no underlying cause is found on objective tests. Syndrome diagnoses are sometimes used (such as chronic pain syndrome, low back pain, or fibromyalgia) (Turk, 2005). Many research studies define pain as chronic once it has persisted for 6 months (eg Currie, Wilson & Curran, 2002).

Chronic pain is common and often associated with complaints of poor sleep. Ohayon (2005) found that 17% of a large sample drawn from the general population (n=18,980) reported chronic pain, and 23% of these also reported sleep problems. In a recent study Tang, Wright and Salkovskis (2007) found that 53% of people suffering from chronic pain (n=70) recruited from a hospital outpatient setting met criteria for insomnia, in contrast to 3% of pain free controls. Using a variety of different methods for defining sleep problems, several other studies have reported an even higher prevalence of poor sleep of between 64% and 88% amongst pain patients (e.g. Wilson, Eriksson, D'Eon, Mikail & Emery 2002; Smith, Perlis, Carmody, Smith & Giles 2001).

Interest in the literature has focused on specific sleep disorders, particularly insomnia. Until recently, explanatory models of insomnia co-existing with other psychiatric or medical

conditions were dominated by the idea that the sleep disturbance was often caused by the other disorder, and therefore secondary to it (Lichstein, 2006). Treatment has focused on the condition assumed to cause the insomnia rather than on the sleep disturbance itself. The idea of secondary insomnia is now disputed (National Institute of Health, 2005; Stepanski & Rybarczyk, 2006) and interest is turning to alternative models.

Little attention has been paid to the development of psychological models of sleep disturbance in the context of chronic pain. Despite this, cognitive behavioral therapy for insomnia (CBT-I) (Morin 1993; Morin & Espie 2003) has already been applied successfully to groups of people who have both chronic pain and insomnia. Currie, Wilson, Pontefract, and deLaplante (2000) compared CBT-I with a self monitoring waiting list control for participants with chronic pain and insomnia, with a follow up period of three months. Edinger, Wohlgemuth, Krystal and Rice (2005) compared CBT-I for people with fibromyalgia and insomnia with a sleep hygiene intervention and a self-monitoring waiting list control. The follow up was completed at six months. In both studies the CBT-I group reported better sleep at follow up, but there was no significant difference in pain symptoms.

There are several contemporary cognitive behavioral theories upon which CBT-I is based (Espie 1991; Morin 1993; Harvey 2002). Cognitive behavioral therapy focuses on negative thinking, emotional responses and unhelpful patterns of behavior maintaining sleep disturbance. Dysfunctional beliefs about sleep are considered to play an important role in underpinning these responses. Several studies have found that primary insomnia groups endorse more dysfunctional beliefs about sleep than normal controls (Edinger & Wohlgemuth, 2001; Fins, Edinger, Sullivan et al., 1996; Morin, Stone, Trinkle, Mercer & Remsberg, 1993; Means, Lichstein, Epperson, &

Johnson, 2000). The extent to which sleep disturbance in chronic pain is associated with dysfunctional beliefs about sleep has not previously been examined.

This study seeks to describe the pain characteristics, sleep quality, dysfunctional beliefs about sleep, pain-related disability, depression and pain-related anxiety of a sample of patients with chronic pain consulting a specialist pain service in the UK. The study compares subgroups of participants with pain that meet criteria for good sleepers and poor sleepers. Relationships between sleep quality and pain characteristics, pain-related disability, depression, pain-related anxiety, and dysfunctional beliefs about sleep will be explored.

METHOD

Participants

Participants were recruited from patients attending the Pain Management Service in Gloucestershire UK. Pain Management Services take a rehabilitation approach for people who have ongoing pain arising from benign conditions (i.e. not cancer or progressive disease such as rheumatoid arthritis), which has proved intractable despite medical intervention. The primary aim is not to improve pain, but to reduce associated distress and disability. 290 people were informed about the study, 272 (94%) indicated interest in participating in the study. 272 questionnaires were sent and 160 were returned (return rate 59%). The data included in the returned questionnaires was 98% complete. The majority of the group were women (69%) and a minority (36%) were working either full or part time. Participants ranged in age from 20 to 84. The mean age of the sample was 53.0 years (sd 12.6 years). Participants had experienced pain for a mean duration of 10.7 years (sd 11.2). The most common pain sites were back (87%), legs (69%), neck/shoulders (64%).

All participants had a diagnosis of chronic benign pain (of at least 6 months duration) made by the Consultant Physician referring them to the service as an inclusion criterion for entry into the study. Where available, further information about the disease state causing the chronic pain was obtained from their health records. Information was available for 94% of participants which was categorized independently by two physiotherapists experienced in pain management (whole sample: agreement 73%, kappa=0.63; good sleeper group: agreement 76%, kappa= 0.72; poor sleeper group: agreement 70%, kappa= 0.64). The low rate of agreement reflects the difficulty in classifying pain presentations using biomedical diagnostic systems (Turk, 2005). Beyond the diagnosis of chronic pain, fulfilled by all participants, the study did not seek to select a homogeneous biomedical diagnostic group. There was therefore no attempt to resolve lack of agreement between the physiotherapists. These descriptive data were not analyzed further in any way. The most common specific pain diagnoses were of mechanical back or neck pain (59%), and fibromyalgia (10%).

Procedure

Ethical approval for the study was granted by the Gloucestershire Local Research Ethics Committee, UK. Potential participants were given an information sheet and informed about the study by a health professional involved in their care. Those expressing interest in the study were sent a consent form and questionnaire with a reply paid envelope for its return by post.

Design

The study used a cross sectional design. The sample of chronic pain patients was split into two subgroups; good sleepers and poor sleepers. The criteria for splitting the sample into these two subgroups are as follows: Participants were assigned to the poor sleeper subgroup if they reported both significant sleep disturbance and concern about their sleep. The level of sleep

disturbance considered significant was guided by the quantitative criteria for insomnia proposed by Lichstein, Durrence, Taylor, Bush and Reidel (2003); sleep onset latency of more than 30 minutes and/or wake time after sleep onset of more than 30 minutes and/or early wakening of more than 30 minutes, three times a week or more, over the past six months. Significant concern was defined as a rating of worry/distress about their sleep pattern at 2 or above on a scale of 0 (not at all worried) to 4 (very worried) and/or interference with daily functioning at 2 or more on a scale of 0 (does not interfere at all) to 4 (interferes very much).

Measures

Sleep Questionnaire. This measure was devised for this study. This assesses the participant's estimate of the frequency of delayed sleep onset latency (more than 30 minutes), wake time after sleep onset (more than 30 minutes), and early wakening (more than 30 minutes) over the past six months; on a four point scale (0 = rarely, 3 = three or more times a week). The questionnaire also included some items from the Global Sleep Assessment Questionnaire (Roth, Zammit, Kushida, Doghramji, Mathias, Wong, & Buysse, 2002) to identify experience of daytime sleepiness, interruption to breathing/snoring, restless feelings in legs, jerking legs, and nightmares/ sleep walking, rated on the same four point scale. Supplementary questions about sleep included distress about poor sleep, interference with daily activities (rated on a five point likert scale 0=not at all, 4=very much), and attributions for sleep disturbance.

Pittsburgh Sleep Quality Index. The Pittsburgh Sleep Quality Index (PSQI: Buysse, Reynolds, Monk, Berman & Kupfer, 1989) is a 19 item questionnaire of sleep quality with scores ranging from 0-31. A high score indicates poorer sleep. Buysse et al (1989) reported good internal consistency ($\alpha=.83$) and reliability ($r=.85$). This measure was used as a continuous variable, however there are cutoffs which can be used to aid the interpretation of the scores. A

score above 8 has been used to indicate a clinically significant level of sleep disturbance in populations with physical illnesses (Carpenter & Andrykowski 1998). Sleep efficiency (percentage of time spent in bed that is spent asleep) can be estimated from two PSQI items. A sleep efficiency of < 85% is considered an indicator of sleep disturbance (Morin 1993).

Dysfunctional Beliefs and Attitudes about Sleep Scale-16 item version. The Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16: Morin, 1994; Morin, Vallieres, & Ivers, 2007) is a validated measure of beliefs about sleep. The recommendations of Morin et al (2007) were followed for the scoring of the questionnaire. Responses are made using an eleven point likert scale (0=strongly disagree, 10=strongly agree), and the total score calculated as an average score on all items. The total score ranges from 0-10. A higher score indicates more dysfunctional beliefs. The internal consistency of the abbreviated scale was reported as $\alpha=.77$ for clinical samples and test-retest reliability of $r=0.83$ (Morin et al., 2007). Morin et al (2007) report confirmatory factor analysis of the items of the DBAS-16, and describe four subscales: (1) Perceived consequences of insomnia, (2) Worry/helplessness about sleep, (3) Sleep expectations, and (4) Medication. Each subscale score is calculated as an average of the scores on the subscale items and so each subscale also has a range of 0-10. A higher score indicates a more dysfunctional score on the subscale. No consistency or validity data is reported for these subscales.

Roland Morris Disability Scale – Revised for pain in any site. The Roland Morris Disability Scale (RMDQ: Roland & Morris, 1983) is a well validated measure of back pain-related disability (Bombardier, 2000), which has been adapted for pain in any site (Stroud, McKnight & Jensen 2004). Scores range between 0 and 24, a higher score indicating greater

pain-related disability. The internal consistency of the scale has been reported as $\alpha=.90$ (Stroud et al., 2004) and test-retest reliability of $r=0.91$ (Roland & Morris 1983).

Beck Depression Inventory - Version II. The Beck Depression Inventory (BDI-II: Beck, Steer & Brown, 1996) measures symptoms of depression. The scores range from 0-63; a higher score indicates more severe depression. The second version (BDI-II) has only minor changes from the first for which validity is well established (Beck, Ward, Mendelson, Mock & Erlbaugh, 1961). High internal consistency ($\alpha=.92$) has been reported for a chronic pain sample (Harris & D'Eon, 2008).

Short Form Pain Anxiety Symptom Scale. The Short Form Pain Anxiety Symptom Scale (PASS-20: McCracken & Dhingra, 2002) is a validated measure of pain-related anxiety responses. A higher score is associated with more fearful thinking and physiological anxiety in response to pain, and a more avoidant style of coping with pain. The scale has a score ranging from 0-100. The scale has been validated against the original 40 item version, and construct and criterion validity have been established. Test-retest reliability data is lacking but internal consistency is high ($\alpha=.91$) (McCracken & Dhingra, 2002).

Pain site and severity. Questions were included to elicit information about the site(s) of pain within the body. These questions asked participants to tick all body areas in which they experienced pain from a list. This method for identifying pain locations has not been validated previously. Participants rated their pain using validated numerical rating scales of pain now, usual, worst and least during the day in past week with scale anchors ranging from 0 (no pain) to 10 (worst possible pain) (Jensen, Karoly & Braver, 1986; Jensen & Karoly, 1992). Although such rating scales are widely used, test-retest reliability data is lacking. Positive and significant correlations between these single item rating scales and other multi-dimensional pain measures

have been reported (Jensen & Karoly 1992). In this study, a composite score called daytime pain was computed by taking an average of worst, least and usual daytime ratings (Jensen, Turner, Romano & Fisher, 1999). A separate numerical rating scale was used to rate usual pain at night in the last week. The scale anchors ranged from 0 (no pain) to 10 (worst possible pain). The usual pain at night item has unknown validity and no test-retest data is available.

Medication Use. Respondents were asked to list all medications taken in the past week. These were categorized into the following categories: (1) Analgesics, (2) Anti-inflammatories, (3) Sedating antidepressants, (4) Non-sedating antidepressants, (5) Anti-convulsants, (4) Sleeping tablets (6) Benzodiazepines.

General Practitioner visits. Respondents were asked to report the number of visits they had made to their general practitioner in the past two months (for any reason).

Analysis

The power calculation was based on data reported by Edinger and Wohlgemuth (2001). They compared normal sleepers and insomnia groups without chronic pain using the Dysfunctional Beliefs and Attitudes about Sleep Scale (28 item version). They found a difference in mean item score of 9.1 (on a 0-100 scale version of the scoring). The sample size for this study was determined using a power calculation (80% power) to detect an equivalent difference at 0.05 level in the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16) when good and poor sleeper subgroups were compared. The data was analyzed using SPSS 11.0.

RESULTS

Description of Sleep of Whole Sample of Chronic Pain Patients.

Scores on the Pittsburgh Sleep Quality Index (PSQI) indicate a significant level of sleep disturbance (see Table 1), with 76% of the whole sample scoring above 8 on the PSQI. Mean sleep efficiency (estimated from PSQI items) was 68% (sd 17%) which is well below the 85% considered to indicate sleep disturbance (Morin 1993). All these indicators identify a very high proportion of the sample may have sleep disorder. Responses to the Sleep Disorders Screening Questionnaire indicated that daytime sleepiness was endorsed as experienced 3 times a week or more by 35%, interruption to breathing/snoring by 6%, restless feelings in legs by 21%, jerking legs by 18%, and nightmares or sleep walking by 9%. Only 5% were not taking any medication at all, 72% were taking analgesics, 38% were taking anti-inflammatories, 26% were taking sedating antidepressants and 7% non-sedating antidepressants, 12% anti-convulsants, 12% sleeping tablets, and 7% benzodiazepines.

Table 1 about here.

Comparison of Good and Poor Sleeper Subgroups of Chronic Pain Patients.

The sample of chronic pain patients was split into two subgroups; good sleepers (n=48) and poor sleepers (n=108). 4 participants could not be allocated to one of the subgroups due to missing data. 30 (63%) of the good sleepers and 76 (70%) of the poor sleepers were female. Participants were assigned to the poor sleeper subgroup if they reported both significant sleep disturbance (sleep onset latency of more than 30 minutes and/or wake time after sleep onset of more than 30 minutes and/or early wakening of more than 30 minutes, three times a week or more, over the past six months) and significant concern about their sleep (based on ratings of worry/distress about their sleep pattern and interference with daily functioning).

The good and poor sleeper subgroups were compared on 11 variables using t-tests, see Table 1. In order to control for possible inflated type I error rate arising from multiple

comparisons the Bonferoni method was used ensure that the overall type I error rate (α) across all comparisons remained at 0.05. The criterion for significance was therefore set at 0.0045. The good sleeper subgroup was significantly older (good sleepers $M=58.3$, sd 12.4, poor sleepers $M=50.3$, sd 11.9), but there was no difference in the duration of their pain. There was no significant difference in pain during the day, but good sleepers reported lower pain at night (good sleepers $M=4.4$, sd 2.4, poor sleepers $M=5.8$, sd 2.2), less pain-related disability (RMDQ-A) (good sleepers $M=9.8$, sd 4.8, poor sleepers $M=13.8$, sd 4.7), depression (BDI-II) (good sleepers $M=13.3$, sd 7.8, poor sleepers $M=23.0$, sd 9.4), and pain-related anxiety (PASS-20) (good sleepers $M=31.2$, sd 17.1, poor sleepers $M=45.6$, sd 17.9). Reported GP visits were also lower amongst good sleepers but this difference was not statistically significant at the 0.0045 level. Poor sleepers endorsed more dysfunctional beliefs about sleep (DBAS-16) (good sleepers $M=3.1$, sd 1.5, poor sleepers $M=5.2$, sd 1.9).

The pattern of scores across the DBAS-16 subscales is shown for the good and poor sleeper subgroups is shown in Figure 1. Tests of normality indicated that data for only one of the DBAS-16 subscales was normally distributed, therefore non-parametric tests (Mann-Whitney U) were used to compare the subgroups. Poor sleepers had higher scores on the Perceived consequences of insomnia subscale (good sleepers median 6.1, interquartile range (IQR) 4.2-7.4; poor sleepers median 2.9, IQR 1.4-5.0; $U=1162.5$, $p<0.001$), Worry/helplessness about insomnia subscale (good sleepers median 5.1, IQR 3.7-6.5; poor sleepers median 2.5, IQR 1.4-3.5; $U=921.5$, $p<0.001$), and Medication subscale (good sleepers median 3.0, IQR 1.0-5.3; poor sleepers median 1.8, IQR 1.3-2.9; $U=1959.0$, $p<0.05$). This indicates that the poor sleeper subgroup had more dysfunctional beliefs about sleep in these three domains. There was no

difference between the groups on the Sleep expectations subscale (good sleepers median 5.5, IQR 3.5-7.5; poor sleepers median 5.5, IQR 3.5-7.5; $U=2519.5$, $p=.92$).

Figure 1 about here.

There were no differences between the groups with respect to the numbers of each group taking analgesics, anti-inflammatories, non-sedating antidepressants, anti-convulsants, or benzodiazepines. Sedating antidepressants were taken by 13% of the good sleeper subgroup and 33% of the poor sleepers ($\chi^2=6.7$, $p<0.01$). Sleeping tablets were taken by 4% of the good sleepers and 16% of the poor sleepers ($\chi^2=4.1$, $p<0.05$).

Relationships between Sleep Quality, Pain and Psychological factors in Chronic Pain Patients

Correlational analyses (all Pearson's r) indicated that poorer sleep quality was significantly correlated with increasingly dysfunctional beliefs about sleep (DBAS-16) ($r=.50$, $p<0.001$), increasing daytime pain ($r=.40$, $p<0.001$), increasing pain at night ($r=.58$, $p<0.001$), increasing pain-related disability (RMDQ-A) ($r=.36$, $p<0.001$), increasing depression (BDI-II) ($r=.47$, $p<0.001$), and increasing pain-related anxiety (PASS-20) ($r=.41$, $p<0.001$). Poorer sleep quality (PSQI) was weakly correlated with age ($r=-.17$, $p<0.05$), but there was no significant relationship between sleep quality and pain duration. Pain ratings in the daytime and night time were strongly correlated ($r=.62$, $p<0.001$).

Simultaneous multiple regression analysis was used to examine predictors of sleep quality (PSQI). Those variables which had been found to correlate significantly with sleep quality (age, dysfunctional beliefs and attitudes about sleep (DBAS-16), daytime pain, pain at night, pain-related disability (RMDQ-A), depression (BDI-II), pain-related anxiety (PASS-20) were selected as potential predictors within the regression analysis. The results of the regression analysis are shown in Table 2. The normality, linearity and homeodasticity of residuals were

confirmed. Collinearity statistics, including tolerance, variance inflation factor, and condition index were examined and within the limits recommended by Tabachnick and Fidell (2001). Using mahalanobis distance, no multivariate outliers were identified.

The model accounted for 51% of the variance in sleep quality ($R^2 = .51$, $\text{adj } R^2 = .49$, $F(7,141)=20.89$, $p<0.001$). Only three of the predictor variables, pain at night, dysfunctional beliefs and attitudes about sleep (DBAS-16), and depression (BDI-II), made a significant contribution to the prediction of sleep quality (PSQI).

Table 2 about here.

DISCUSSION

When compared to good sleepers with chronic pain, we found that poor sleepers with chronic pain reported poorer functioning on measures of pain, pain-related disability, depression, and pain-related anxiety. Poor sleepers with chronic pain also had higher levels of dysfunctional beliefs about sleep, comparable to insomnia groups without chronic pain (Morin et al., 1993; Edinger & Wohlge-muth 2001; Ellis, Hampson & Cropley 2007). A majority of our sample (68%) were classed as poor sleepers, similar to the rates of reported by other studies of pain patients (Wilson et al., 2002; Smith et al., 2001). Significant correlations were found amongst the variables, but only pain at night, dysfunctional beliefs about sleep, and depression emerged as significant predictors of sleep quality in the regression equation. The regression model explained a respectable 51% of the variance in sleep quality.

Despite the significant correlations amongst daytime pain, pain at night and sleep quality, daytime pain did not contribute significantly to the regression model. This is interesting because most studies of pain and sleep do not measure daytime pain and pain at night separately (eg Tang et al., 2007), and a limitation of the current study is that the single item measure of night time

pain has unknown validity. Those people who experience more pain when lying down at night are more vulnerable to sleep disturbance. Alternatively the experience of poor sleep might prompt people to retrospectively rate their pain at night as more severe. Pain at night is worthy of further study, perhaps using diary records which are less biased than retrospective measures (Harvey 2002).

Our findings in this sample of chronic pain patients are consistent with cognitive behavioral approaches to insomnia (Espie, 1991; Morin, 1993; Espie, 2002; Harvey, 2002). Although there are some differences between these models, all of them consider dysfunctional beliefs about sleep have a role in maintaining insomnia. Many previous studies have reported that people with primary insomnia endorse more dysfunctional beliefs about sleep than those that sleep well (Edinger & Wohlgemuth, 2001; Fins et al., 1996; Morin et al., 1993; Means et al., 2000). We also showed that poor sleep in chronic pain patients is associated with the same pattern of dysfunctional beliefs about sleep seen in primary insomnia.

Our poor sleepers with chronic pain endorsed dysfunctional beliefs on three of the four subscales of the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16). The good and poor sleepers shared similar sleep expectations, for example “I need 8 hours sleep to feel refreshed and function well the next day”. This pattern is consistent with previous studies comparing older adults with and without insomnia (Morin et al., 1993; Ellis et al., 2007). The Dysfunctional Beliefs and Attitudes about Sleep Scale does not include any beliefs about sleep specific to pain, which might also have differentiated the groups. For example, it is common for chronic pain patients to attribute their sleep problems to their pain, and believe that their sleep will not improve unless their pain is relieved. They also seek solutions to their sleep problems by making efforts to reduce or cure their pain, and could fail to use effective sleep management

strategies. There are already two trials which have demonstrated the efficacy of cognitive behavioral therapy for insomnia (CBT-I) for people with chronic pain (Currie et al., 2000; Edinger et al., 2005). Our findings lend support to the use of cognitive behavioral approaches to this patient population who are often treated with sedating antidepressants or anticonvulsant medication, or offered no treatment at all.

We found no relationship between duration of pain and sleep quality. Spielman's model of insomnia (Spielman 1986), suggests that acute insomnia may be triggered by a precipitating event, but sleep recovers unless the problem is maintained by perpetuating processes. The onset of pain might serve as a precipitant. This model would predict that pain patients with more recent onset would be more likely to experience sleep disturbance. Our sample had chronic pain (of at least six months) with mean 10.7 years (sd 11.2). A relationship between pain duration and sleep quality might emerge if more patients with more recent pain onset were studied.

Our findings are preliminary, based on a cross sectional design and correlational analyses. At recruitment, subjects were informed that the study was focused on sleep, and those people with concerns about their sleep may have been more interested in taking part and more likely to return their questionnaire. The return rate was only 59%. These possible biases could mean that poor sleepers were over-represented in our sample. Our reliance on questionnaire based assessments meant that we were unable to identify whether the patients in our study met diagnostic criteria for specific sleep disorders such as insomnia, sleep apnoea or restless legs syndrome, but did allow us to access a reasonable sample of patients accessing specialist pain services. Similarly our method for splitting the sample into good sleepers and poor sleepers was not based on the gold standard of diagnostic interview and sleep diaries. This study shares the limitations of many previous studies in not defining our poor sleeper group using the diagnostic

criteria for insomnia (Buysse, Ancoli-Israel, Edinger, Lichstein & Morin 2006). Although the group we labeled as good sleepers did sleep better than the poor sleepers, even the good sleeper subgroup had a mean score of 8 on the Pittsburgh Sleep Quality Index, which indicates that many of them did not sleep well. It would be useful for future research to undertake more rigorous diagnostic examination of a sample of people consulting specialist pain services.

Improving our understanding of sleep disturbance in chronic pain is vital to the development of more effective treatments. This study provides new evidence that the cognitive behavioral models can improve our understanding of sleeping problems which are so common and disabling amongst people with chronic pain.

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Table 1: Age, Duration of Pain, Sleep Quality, Dysfunctional Beliefs and Attitudes about Sleep, Daytime Pain, Pain at Night, Pain-Related Disability, Depression, Pain-Related Anxiety and Health Care Use for the Whole Sample of Chronic Pain Patients (n=160), and Good Sleeper (n=48), and Poor Sleeper Subgroups (n=108)*.

<i>Variable</i>	All (n=160)		Good Sleepers (n=48)		Poor Sleepers (n=108)		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age (years)	53.0	12.6	58.3	12.4	50.3	11.9	$t(154) = 3.9, p < 0.001$
Duration of pain (years)	10.7	11.2	12.0	13.3	10.1	10.2	$t(150) = 0.9, p = 0.4$
Sleep quality (PSQI)	11.9	4.2	8.0	3.3	13.7	3.2	$t(153) = 10.1, p < 0.001$
Sleep Efficiency (%)	68.1	17.1	80.7	13.3	62.6	15.9	$t(146) = 6.7, p < 0.001$
Dysfunctional beliefs and attitudes about sleep (DBAS-16)	4.4	2.0	3.1	1.5	5.2	1.9	$t(152) = 6.1, p < 0.001$
Daytime pain	6.0	1.6	5.7	1.9	6.2	1.4	$t(70) = 1.5, p = 0.1$
Pain at night	5.4	2.3	4.4	2.4	5.8	2.2	$t(153) = 3.8, p < 0.001$
Pain-related disability (RMDQ-A)	12.5	5.1	9.8	4.8	13.8	4.7	$t(154) = 4.9, p < 0.001$
Depression (BDI-II)	20.2	10.1	13.3	7.8	23.0	9.4	$t(154) = 6.3, p < 0.001$
Pain-related anxiety (PASS-20)	41.3	18.7	31.2	17.1	45.6	17.9	$t(150) = 4.6, p < 0.001$
GP visits in last two months	1.8	1.5	1.4	1.4	2.0	1.5	$t(150) = 2.1, p = 0.04$

Note PSQI = Pittsburgh Sleep Quality Index, DBAS-16 = Dysfunctional Beliefs and Attitudes about Sleep Questionnaire 16 item version, RMDQ-A = Roland Morris Disability Scale-Revised, BDI-II = Beck Depression Inventory Version II, PASS-20 = Short Form Pain Anxiety Symptom Scale.

* = $p < 0.05$
 ** = $p < 0.01$

*4 participants could not be allocated to the subgroups due to missing data.

Table 2: Simultaneous Multiple Regression examining Age, Dysfunctional Beliefs and Attitudes about Sleep, Daytime Pain, Pain at Night, Pain-Related Disability, Depression, and Pain-Related Anxiety as Potential Predictors of Sleep Quality (PSQI) in Chronic Pain Patients (n=160).

	B	SE	β	t	R ² total	Adjusted R ²	F
Age	7.51 x10 ⁻³	.02	.02	0.35	.51	.49	20.89***
Dysfunctional beliefs and attitudes about sleep (DBAS-16)	0.57	.15	.27	3.73***			
Daytime pain	8.10 x10 ⁻²	.21	.03	0.38			
Pain at night	0.75	.14	.42	5.22***			
Pain-related disability (RMDQ-A)	-3.31 x10 ⁻²	.06	.04	0.56			
Depression (BDI-II)	9.15 x10 ⁻²	.03	.23	2.69**			
Pain-related Anxiety (PASS-20)	-3.04 x10 ⁻³	.02	-.01	-0.16			

*p<0.05, **p<0.01, ***p<0.001

Note PSQI = Pittsburgh Sleep Quality Index, DBAS-16 = Dysfunctional Beliefs and Attitudes about Sleep Questionnaire 16 item version, RMDQ-A = Roland Morris Disability Scale-Revised, BDI-II = Beck Depression Inventory Version II, PASS-20 = Short Form Pain Anxiety Symptom Scale.

Figure Captions

Figure 1: Patterns of Dysfunctional Beliefs about Sleep amongst Good Sleeper (n=48) and Poor Sleeper subgroups (n=108) of Patients with Chronic Pain.

