Clinical and demographic predictors of four dimensions of sleep in patients with acute and chronic pain

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Sleep quality is known to be associated with a number of variables. These include chronic pain (Abernethy, 2008; Harman et al., 2002; Kelly, Blake, Power, O'Keeffe, & Fullen, 2011), depression (Lepine & Briley, 2004; Von Korff & Simon, 1996), anxiety (Marcks, Weisberg, Edelen, & Keller, 2010), hypertension (Hildingh & Baigi, 2010) and other variables. However, less is known about the specific clinical and demographic predictors of poor sleep quality for specific dimensions of sleep in patients with pain. This study attempted to identify clinical predictors of four types of sleep disorders: delayed sleep onset, difficulty staying asleep, insufficient sleep duration, and being exhausted but unable to sleep.

METHOD

Subjects: The subjects in this study were 414 consecutive patients who were referred for multidisciplinary treatment for pain or injury.

Instrumentation: The Battery for Health Improvement 2 (BHI 2) is a clinical questionnaire designed for biopsychosocial assessment of patients with chronic pain, injury or illness. The BHI 2 has two validity scales, four physical symptom scales, three affective scales, five character scales, and four social environment scales (Bruns & Disorbio, 2003).

Procedure: Subjects were asked to rate their sleep quality using four dimensions: delayed onset (minutes to fall asleep), difficulty staying asleep (number of times waking during the sleep cycle), insufficient sleep (number of hours of sleep), and being exhausted but unable to sleep (four point Likert scale). Following this, stepwise logistic regression was used to predict each of these sleep dimensions using eight BHI-2 scales hypothesized to be associated with insomnia (pain, somatization, muscular bracing, depression, anxiety, anger, borderline personality traits, and dependent personality traits) and the following demographic predictor variables: Gender, age, race, education, acute vs. chronic status, pain, somatization, muscular bracing, depression, anxiety, anger, borderline personality traits, dependent personality traits, caffeine use, alcohol use, tobacco use, opioid prescription, sleep medication prescription, height, weight and body mass index. To reduce the risk of Type I errors, predictor variables were entered using a forward stepwise method, using $p<.01$ to enter a variable into the regression equation, and $p<.05$ to retain.

RESULTS

These analyses determined that delayed sleep onset was predicted by (in order of entry) muscular bracing ($p=.004$) and pain level ($p=.01$), Nagelkerke $R2 = .102$. Difficulty staying asleep was predicted by pain level ($p=.005$) and dependent traits ($p=.01$), Nagelkerke $R2 = .102$, and insufficient sleep was predicted by pain level ($p=.000$) and height ($p=.001$), Nagelkerke $R2 = .154$. Finally, being exhausted but unable to sleep was predicted by muscular bracing ($p = .000$) and somatic complaints ($p = .000$), Nagelkerke $R2 = .330$.

DISCUSSION

The most recent review of the literature concluded that pain is related to several dimensions of sleep. This study adds further support to this literature by identifying the predictors of four types of insomnia, using the same subjects and measures.

While these regression equations were statistically significant, three accounted for only a relatively small percentage of the variance of their respective sleep disorders. The absence of race, gender, education and other demographic predictors was noted, suggesting that these differences in sleep may be more attributable to clinical variables.

For three of the types of sleep disorders assessed in this study, the patient's pain level was a significant predictor ($p<.01$). Beyond that, however, each type of sleep disorder exhibited unique predictors. This raises the possibility that in patients in treatment for chronic pain, each sleep disorder may have a unique etiology, and thus may respond differently to specific sleep treatments. Further research is needed to test this hypothesis.

TABLE 1.

Demographic Characteristics of Subjects/Patients

Variable	Category	Rehabilitation Chronic Pain Patients (n = 414)
Age (years)		M = 39.8
		SD = 10.1
		R = 19, 65
Age (years)	18-24	24 (7.3%)
	25-44	202 (61.8%)
	45-65	101 (30.9%)
Race	White	275 (81.8%)
	Black	25 (7.4%)
	Asian	1 (0.3%)
	Native American	13 (3.9%)
	Hispanic	21 (6.3%)
	Other	1 (0.3%)
Gender	Male	149 (43.7%)
	Female	192 (56.3%)
Education	Less than High School	55 (16.4%)
	High School Graduate	94 (28.0%)
	Some College	142 (42.3%)
	College Graduate or more	45 (13.4%)

TABLE 2

Variables Used to Predict Forms of Sleep Disturbance

Psychological Variables	Demographics	Medication and Substance Use
BHI 2 Pain Complaints BHI 2 Muscular Bracing BHI 2 Somatic Complaints BHI 2 Muscular Bracing BHI 2 Depression BHI 2 Anxiety BHI 2 Hostility BHI 2 Borderline BHI 2 Dependent	Gender Age Race Education Acute vs. chronic pain Height Weight Body mass index	Opioid use Sleep medication use Level of caffeine use Level of alcohol use Level of tobacco use

TABLE 3

Variables Predicting Sleep Onset Using Stepwise Logistic Regression

Step	Step χ^2 (df), p value	% of Cases Predicted Correctly by the Model	Step Nagelkerke R^2	Predictor Variable	B	Wald, p value	Odds Ratio
1	8.789 (1), .003	60.0	.059	BHI 2 Muscular Bracing	.042	8.245, .004	1.043
2	6.784 (1), .009	60.5	.102	BHI 2 Highest Pain Level	.182	6.313, .012	1.200

TABLE 4

Variables Predicting Number of Times Awakening Using Stepwise Logistic Regression

Step	Step χ^2 (df), p value	% of Cases Predicted Correctly by the Model	Step Nagelkerke R^2	Predictor Variable	B	Wald, p value	Odds Ratio
1	9.054 (1), .003	56.5	.059	BHI 2 Highest Pain Level	.218	7.937, .005	1.243
2	6.821 (1), .009	56.0	.102	BHI 2 Symptom Dependency	.035	6.518, .011	1.035

TABLE 5

Variables Predicting Number of Hours of Sleep Using Stepwise Logistic Regression

Step	Step χ^2 (df), p value	% of Cases Predicted Correctly by the Model	Step Nagelkerke R^2	Predictor Variable	B	Wald, p value	Odds Ratio
1	15.977 (1), .000	60.8	.093	BHI 2 Somatic Complaints	-.058	14.545, .000	1.060
2	11.206 (1), .001	66.2	.154	Height	-.012	10.333, .001	1.120

TABLE 6

Variables Predicting Being Exhausted But Can't Sleep Using Stepwise Logistic Regression

Step	Step χ^2 (df), p value	% of Cases Predicted Correctly by the Model	Step Nagelkerke R^2	Predictor Variable	B	Wald, p value	Odds Ratio
1	63.583 (1), .000	73.5	.330	BHI2 Muscular Bracing	.121	43.641, .000	1.129
2	16.628 (1), .000	78.2	.403	BHI 2 Somatic Complaints	.071	14.769, .000	1.074