See commentary by Crawford and Ong

Exploring the Construct of Subjective Sleep Quality in Patients With Insomnia

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ABSTRACT

Objective: The construct of subjective sleep quality is poorly understood. One widely used measure of subjective sleep quality is the Pittsburgh Sleep Quality Index (PSQI). The role of psychiatric illness in the association between the PSQI and a prospective, sleep diary–derived sleep quality measure (SDSQ) was investigated plus the degree to which the PSQI may reflect mood states.

Method: A sample of 211 insomnia patients (*International Classification of Sleep Disorders, Second Edition*) divided by the presence or absence of a comorbid psychiatric disorder (*DSM-IV-TR*) and recruited between January 2004 and February 2009, completed the PSQI (primary outcome) and 2 weeks of sleep diary monitoring. First, correlations between PSQI and SDSQ were compared; second, regression analyses were used to investigate whether the association between PSQI and SDSQ depends on diagnostic status; third, the differences in sleep quality between the groups, plus the contribution of anxiety and depression in explaining these differences, were explored.

Results: The correlation between PSQI and SDSQ was significant only in the nonpsychiatric group ($P < .001$). The association between PSQI and SDSQ was moderated by diagnostic status: it was weaker in psychiatric patients ($P = .047$). Patients with psychiatric comorbidity scored significantly higher on the PSQI than those without ($P < .001$); this difference disappeared after controlling for anxiety. There were no group differences for the SDSQ.

Conclusions: The present findings suggest that (1) psychiatric patients may be more biased in their retrospective sleep quality ratings, and (2) the PSQI total score may reflect sleep-related distress. The use of a prospective sleep diary measure in patients with a psychiatric disorder is recommended.

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The construct of subjective sleep quality and the assessment thereof has been a complex matter.[1–3] Although the construct is universally used in research and elsewhere, there is no clear consensus of the exact definition of subjective sleep quality and how to measure it; furthermore, subjective sleep quality may differ from individual to individual.[3] The Pittsburgh Sleep Quality Index (PSQI), the most widely used questionnaire to assess subjective sleep quality, has been the result of a salient effort to develop a measure tapping the complex construct of sleep quality.[3] The PSQI is a retrospective self-administered questionnaire assessing subjective sleep quality over the previous month; since its publication in 1989, its excellent psychometric qualities have been demonstrated in numerous studies.[3–7]

Pittsburgh Sleep Quality Index scores have been shown to be strongly correlated with measures of depression[6,8–10] and anxiety.[6,11–14] A number of studies suggest that retrospective PSQI ratings are especially sensitive to negative mood and may partly reflect negative cognitive viewpoints,[4,15,16] a reporting bias that may be more pronounced for subjects with a psychiatric history.[17,18] As such, it may be argued that, due to its retrospective nature, the PSQI may tap not only the construct of subjective sleep quality purely but other (negative) states as well, possibly, in particular, in patients with a psychiatric condition.[19]

To confirm this speculation, the present study investigated the retrospective PSQI in relation to a prospective measure of subjective sleep quality in the context of different diagnostic insomnia subtypes, ie, in patients diagnosed with insomnia either with or without comorbid psychiatric conditions. It was hypothesized that (1) the correlation between PSQI-derived sleep quality and sleep quality derived by a prospective sleep diary would be higher among insomnia patients without psychiatric comorbidity, (2) the association between PSQI-derived sleep quality and sleep diary–derived sleep quality would be moderated by psychiatric status, and (3) the 2 groups would show differences in their appraisals of their sleep quality, but PSQI-derived sleep quality measures would show greater group differences than diary-based sleep quality ratings. In addition, we conducted analyses to determine the contribution of depressive and anxiety symptoms to the group differences observed.

METHOD

Participants

Participants were recruited within the framework of a large 2-center (Duke University Medical Center, Durham, North Carolina, and Rush Medical Center, Chicago, Illinois) diagnostic insomnia study, described elsewhere.[20] The study was approved by the institutional review boards of both centers and all participants gave their written consent before participation. Participants were either those seeking insomnia treatment or research volunteers recruited via local advertisements; recruitment took place between January 2004 and February 2009. Interested persons were eligible for participation if they were 18 years or older, fluent in English, and able to provide informed consent. Participants were not eligible if they reported any severe psychiatric or medical condition that required

Clinical Points

- A Consensus Committee for the Standardization of Insomnia Assessment practices recommended the Pittsburgh Sleep Quality Index (PSQI) as a tool to assess for global sleep disturbance.
- If an index of sleep quality is desired, the PSQI score may reflect sleep-related distress rather than sleep quality per se, particularly in the presence of psychopathology. Thus, the use of prospective sleep diaries may be preferred for this reason.

imminent treatment attention (ie, requiring referral to a psychiatric hospital) or showed signs of significant cognitive impairment as demonstrated by a Mini-Mental Status Examination[21] score below 24. For the purpose of this study, only participants diagnosed with an insomnia disorder as the primary diagnosis according to the *International Classification of Sleep Disorders, Second Edition* (*ICSD-2*),[22] were included. Those participants who enrolled in the parent study but were found to have polysomnographic evidence of sleep-disordered breathing or periodic limb movement disorder (eg, apnea-hypopnea index ≥ 15) were excluded from the analyses.

Measures

PSQI. The PSQI[3] is a retrospective, self-rated, 19-item questionnaire of perceived sleep quality during the last month. It consists of 7 domains of sleep difficulties (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction) that are summed into a single global score varying from 0 to 21, with higher scores suggesting worse sleep quality. The PSQI has been investigated in various languages and clinical populations, showing good internal consistency, test-retest reliability, and construct validity,[3–7] whereas the concordance with objective measures of sleep quality has been low.[3,15]

Sleep diaries. Over a period of 2 weeks, participants rated their subjective sleep quality on a 10-point Likert scale (higher scores indicating better sleep quality) using a hand-held personal digital assistant programmed using Satellite Forms software (Thacker Network Technologies, Inc; Lacombe, Alberta, Canada). Participants were instructed to record their sleep quality ratings along with other information about their previous night's sleep daily upon arising from bed. In the analyses conducted herein, each participant's mean sleep quality rating for the 2-week period was used.

Beck Anxiety Inventory. The Beck Anxiety Inventory (BAI)[23] is a self-report questionnaire assessing prevailing symptoms of anxiety; it is specifically designed to differentiate anxiety symptoms from depression. The BAI has been shown to have high internal reliability, as well as good factorial and discriminant validity,[24] and generally has acceptable psychometric properties in persons with insomnia.[25]

Beck Depression Inventory. The Beck Depression Inventory, second edition (BDI) [26] is a self-report questionnaire, assessing the severity of common depressive symptoms in 21 four-point Likert items. The BDI is widely used and has acceptable psychometric properties[27,28] (but see also Carney et al[29]). Since the BDI includes 2 items measuring changed sleep patterns and fatigue, these items were removed.

Structured Clinical Interview for* DSM-IV-TR *Axis I Disorders. The Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders (SCID-I)[30] is a widely used diagnostic instrument to assess the presence of 1 or more mental disorders according to the *DSM-IV-TR*. The SCID-I was used to obtain current as well as lifetime *DSM-IV-TR* diagnosis.

Procedure

After an initial brief insomnia screening via the telephone, participants were invited to the laboratory interview, during which the SCID-I was administered. Participants subsequently completed 2 weeks of sleep monitoring by using the personal digital assistant sleep diary, after which they returned to the research site for 2 consecutive nights of laboratory polysomnography and to complete the self-report questionnaires (ie, BAI, BDI, PSQI). Thus, the period of sleep monitoring by the sleep diary fell within the 4-week period assessed retrospectively by the PSQI. Upon completion of the measures, participants were assigned a sleep disorder diagnosis by sleep specialists (for a detailed description of the procedures and purposes of the parent study, see Edinger et al[20]). For the purpose of the current study, only those participants assigned a diagnosis of insomnia according to the ICSD-2 (American Academy of Sleep Medicine) and having no polysomnographic evidence (mean of 2 nights) of clinically significant sleep-disordered breathing (eg, apnea-hypopnea index ≥ 15) or PLMD (eg, periodic limb movement arousal index ≥ 15) were selected.[31]

Analyses

By using the ICSD-2 insomnia diagnoses and SCID-based *DSM-IV-TR* psychiatric diagnoses, 2 groups of participants were formed: 1 group of participants diagnosed with insomnia without a psychiatric comorbidity (insomnia group) and 1 group of participants who were, in addition to insomnia, diagnosed with a current or recently remitted (within last 2 months) psychiatric condition (comorbid insomnia group). All analyses were repeated with the recently remitted patients included in the insomnia instead of the comorbid insomnia group.

Association between PSQI and sleep diary–derived sleep quality. In our first analysis, we examined the correlation between sleep quality as assessed by the PSQI and sleep diary–derived sleep quality (SDSQ) in the 2 insomnia groups. Subsequently, we examined whether the association between PSQI sleep quality and SDSQ would depend on diagnostic group (insomnia vs comorbid insomnia). A regression analysis was performed (STATA 12[32] routine REG) with the PSQI global score as the outcome variable and mean score of the SDSQ as predictor; subsequently, an interaction term between diagnostic group and SDSQ was added to the model. Post-estimation analyses were performed using the MARGINS and MARGINSPLOT routine in STATA 12.

Table 1. Demographic and Clinical Sample Characteristics

Variable	Insomnia Without a Comorbid Diagnosis (n = 96)	Insomnia With a Comorbid Diagnosis (n = 115)	Total (N = 211)
Demographic			
Age, mean (SD), y	49.5 (15.5)	45.7 (13.8)	47.4 (14.7)[a]
Female, %	73.7	61.4	67.0[a]
Years of education, mean (SD)	15.1 (3.1)	15.0 (2.9)	15.0 (3.0)[a]
Full-time/part-time work, %	41.1	37.5	39.1[b]
Living alone, %	22.1	34.5	28.9[c,d]
Race, n			
White	54	68	122
African American	34	39	73
Asian American	5	2	7
American Indian	1	0	1
Other	1	5	6
Clinical characteristic			
BAI score, mean (SD)	7.8 (6.4)	14.1 (9.2)	11.2 (8.7)[a,e]
BDI score, mean (SD)	10.8 (7.4)	19.2 (10.9)	15.4 (10.4)[a,e]
PSQI score, mean (SD)	11.8 (3.3)	13.6 (2.9)	12.8 (3.2)[e,f]
SDSQ score, mean (SD)	5.1 (1.5)	5.1 (1.4)	5.1 (1.4)[a]

[a]Missing for 2 participants (insomnia [n = 1], comorbid insomnia [n = 1]).
[b]Missing for 4 participants (insomnia [n = 3], comorbid insomnia [n = 1]).
[c]Groups differ significantly ($\chi^2_1 = 3.87$, $P = .049$).
[d]Missing for 3 participants (insomnia [n = 2], comorbid insomnia [n = 1]).
[e]Groups differ significantly (see Results section).
[f]Missing for 14 participants (insomnia [n = 7], comorbid insomnia [n = 7]).
Abbreviations: BAI = Beck Anxiety Inventory, BDI = Beck Depression Inventory, PSQI = Pittsburgh Sleep Quality Index, SDSQ = sleep diary–derived sleep quality.

The contribution of anxiety and depression. In our second analysis, we investigated whether the 2 insomnia groups differed significantly on the PSQI and assessed the contribution of anxiety and depression. A multiple regression analysis was performed (STATA 12 routine REG), with the PSQI global score as the outcome variable and diagnostic group (insomnia vs comorbid insomnia) and BAI and BDI mean scores as predictors. In a sensitivity analysis, all patients diagnosed with an anxiety disorder were excluded. The same analysis was repeated with SDSQ as dependent variable instead of the PSQI.

RESULTS

Mean and standard deviation values for the PSQI, SDSQ, and mood measures are displayed in Table 1.

Participants

A total of 372 participants were recruited for the parent study, of which 211 met the selection criteria for the current investigation. Of those 211 participants, 96 participants did not suffer any psychiatric condition (insomnia group) while 115 participants currently suffered a comorbid psychiatric condition (comorbid insomnia group). Table 2 provides an overview of the *DSM-IV* primary psychiatric diagnoses of the participants in the comorbid insomnia group.

Table 1 provides an overview of the demographic and clinical sample characteristics of the insomnia and comorbid insomnia groups. With the exception of their current living arrangements (more participants in the comorbid insomnia group lived alone as compared to the insomnia group [$\chi^2_1 = 3.87$, $P = .049$]), the 2 groups did not differ statistically in demographic variables.

Table 2. Participants' Primary Comorbid Diagnosis

DSM-IV Mental Disorder	Patients With Comorbid Insomnia, n
Psychotic disorders	1
Mood disorders	87
Anxiety disorders	14
Alcohol-related disorders	5
Substance-related disorders	3
Adjustment disorder	5
Total	115

Association between PSQI and SDSQ. The correlation between the PSQI and SDSQ was significant for the insomnia group ($r = -0.38$, $P < .001$) but not for the comorbid insomnia group ($r = -0.13$, $P = .177$).

In the linear regression model, SDSQ significantly predicted PSQI score ($\beta = -0.24$, $P = .001$). Adding diagnostic group (insomnia vs comorbid insomnia) as a moderator to the model yielded a significant interaction between diagnostic group and SDSQ in predicting PSQI score ($\beta = -0.51$, $P = .047$). Figure 1A shows the separate slopes for the insomnia and comorbid insomnia groups. Subsequent conditional marginal effects at different levels of SDSQ showed that the difference between the insomnia and comorbid insomnia groups was significant at $P \leq .05$ for values of SDSQ > 3 and was significant at $P \leq .01$ for values of SDSQ > 4; Figure 1B shows the conditional marginal effects and 95% confidence intervals.

When the recently remitted patients were included in the insomnia rather than the comorbid insomnia group (n = 34), SDSQ predicted PSQI score ($\beta = -0.24$, $P = .001$), but there was no significant interaction between diagnostic group and SDSQ ($\beta = 0.25$, $P = .33$).

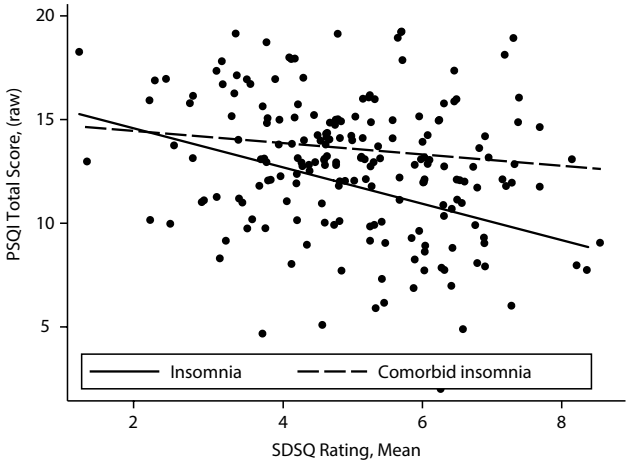
The Contribution of Anxiety and Depression

PSQI. Diagnostic group (insomnia vs comorbid insomnia) significantly predicted PSQI score ($\beta = 0.28$, $P < .001$), explaining 7.6% of the variance (base model). That is, the comorbid insomnia group scored significantly higher on the PSQI than the insomnia group. After adding BAI scores as a predictor to the model ($\beta = 0.38$, $P < .001$), the explained variance increased by 12.3%–20.0% ($F_{1,192} = 29.54$, $P < .001$); β for diagnostic group dropped to 0.14 and $P = .05$. Also, adding BDI mean scores as a predictor to the model ($\beta = 0.03$, $P = .69$ for BDI; $\beta = 0.36$, $P < .001$ for BAI) did not significantly add to the explained variance ($F_{1,191} = 0.16$, $P = .69$); β for diagnostic group dropped to 0.13 and was not significant anymore ($P = .08$). The results remained similar when those patients diagnosed with an anxiety disorder were excluded (n = 40, see supplementary material, part A, at Psychiatrist.com).

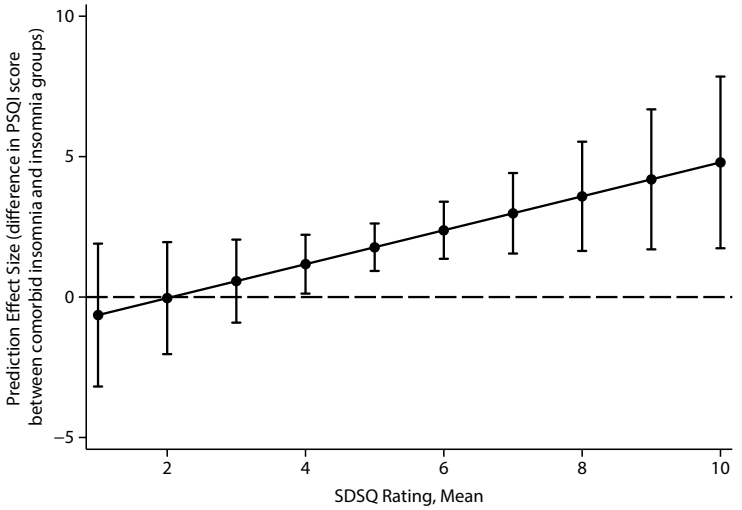
When the recently remitted patients were included in the insomnia rather than the comorbid insomnia group (n = 34), diagnostic group (insomnia vs comorbid insomnia)

Figure 1. Association Between Pittsburgh Sleep Quality Index (PSQI) Global Score and Sleep Diary–Derived Sleep Quality (SDSQ)

A. Scatterplot by Insomnia Subgroup[a]



B. Conditional Marginal Effects Plus 95% CIs[b]



[a]The interaction between SDSQ rating is statistically significant (β = –0.51, *P* = .047).
[b]The difference between insomnia and comorbid insomnia groups is significant for values of SDSQ > 3.

predicted PSQI score (β = 0.22, *P* = .002), explaining 4.6% of the variance. After adding BAI mean scores to the model (β = 0.41, *P* < .001), the explained variance increased by 14%–18.4% ($F_{1,192}$ = 32.32, *P* < .001), and the association between PSQI and diagnostic group disappeared (β = 0.03, *P* = .67). Also, adding BDI mean scores as a predictor to the model (β = 0.07, *P* = .37 for BDI; β = 0.39, *P* < .001 for BAI) did not significantly add to the explained variance ($F_{1,191}$ = 0.85, *P* = .37); β for diagnostic group dropped to 0.01, and the association between PSQI and diagnostic group disappeared (*P* = .89). The results remained similar when those patients diagnosed with an anxiety disorder were excluded (n = 40; see supplementary material, part B).

SDSQ. When the same analyses with SDSQ instead of PSQI score were repeated, a different picture emerged. Diagnostic group (insomnia vs comorbid insomnia) did not predict SDSQ (β < 0.01, *P* = .95). That is, there was no difference in sleep quality between insomnia and comorbid insomnia groups. After BAI mean scores were added to the base model (β = –0.15, *P* = .05), explained variance increased by 1.9% ($F_{1,206}$ = 3.9, *P* = .02) and diagnostic group still showed no association with SDSQ (β = 0.06, *P* = .44). Also, adding BDI mean scores as a predictor to the model (β = –0.13, *P* = .13 for BDI; β = –0.10, *P* = .24 for BAI) did not significantly add to the explained variance ($F_{1,205}$ = 2.34, *P* = .13).

When the recently remitted patients were included in the insomnia group rather than the comorbid insomnia group (n = 34), diagnostic group did not predict SDSQ (β = –0.07, *P* = .29). Furthermore, neither BAI mean score (β = –0.12, *P* = .13) nor BDI mean score (β = –0.10, *P* = .24) were significant predictors of SDSQ.

DISCUSSION

The present study investigated a retrospective measure of subjective sleep quality (the PSQI) in relation to a prospective measure (the SDSQ) in insomnia patients with differential psychiatric background.

As hypothesized, there was a stronger correlation between the PSQI score and the SDSQ in insomnia patients without a psychiatric comorbidity. Likewise, the association between the PSQI score and sleep quality, as measured by the sleep diary, was moderated by diagnostic status. That is, the association between the retrospective (PSQI-derived) sleep quality ratings and the prospective (sleep diary–derived) sleep quality ratings was weaker in insomnia patients with a comorbid psychiatric condition. These findings confirm the notion that psychiatric patients may be more biased in their retrospective ratings than individuals without psychiatric symptoms.[19] Additionally, psychiatric diagnostic status predicted the PSQI score, indicating that insomnia patients with a psychiatric comorbidity reported significantly worse sleep quality on the PSQI. However, this difference was weakened when anxiety was added to the model, and it disappeared when the recently remitted patients were excluded. In a sensitivity analysis excluding all patients with an anxiety disorder, the results remained similar, indicating that the observed difference between the insomnia groups on the retrospective PSQI sleep quality ratings may be partly accounted for by anxiety (and to a lesser extent also by depression).

In contrast to the PSQI, there was no difference in sleep quality between the 2 insomnia groups on the prospective sleep diary–derived sleep quality ratings. Depression and anxiety did not add to the predictive value of psychiatric

diagnostic status in explaining sleep diary–derived sleep quality ratings. Thus, a prospective sleep quality rating may tap into a construct seemingly independent of psychiatric status. In contrast, the PSQI may be detecting anxiety and distress in addition to sleep quality; as Backhaus and colleagues[4] suggest, there may be some bias introduced by the PSQI relative to the sleep diary, possibly due to the long retrospective recall. Why this bias appears to be stronger for patients with psychiatric comorbidity remains to be elucidated. Speculatively, a general memory deficit associated with psychopathology[33] or mood-congruent memory processes[34] may play a role.

In general, the reliability and validity data of the PSQI would not suggest that the PSQI is a poor measure; instead, this study and others suggest that the PSQI could benefit from a clarification of what it actually measures. Given that the PSQI is likely to be used in patients with current or past comorbid Axis I disorders, it is important to consider that the PSQI may reflect a form of sleep-related distress which has to be further defined. Future studies including, eg, the Dysfunctional Beliefs and Attitudes Scale[35] should shed more light on this. The finding that anxiety in particular explained much of the variation in the models above may provide some support for the hyperarousal theory of insomnia.[36]

If the PSQI reflects sleep-related distress more than sleep quality per se, then we might refine the recommendation of the Standardization of Assessment Workgroup[37] to use the PSQI as an insomnia symptom outcome measure. Indeed, the PSQI assesses symptoms other than insomnia (eg, nightmares)—thus a measure that focuses on only insomnia symptoms may be a better alternative. One such alternative from Buysse et al[37] is the Insomnia Severity Index[38]; further study would determine if this measure, or others like it, captures insomnia symptom severity or if it is confounded as well.

The present findings do not limit the utility of the PSQI as an outcome measure; however, they suggest some caution in interpretation when it is used as an index of sleep disturbance, unless there is no history of past mental illness.

Although this study was conducted in a large, well-screened sample of people with insomnia from both research respondents and clinician-referred recruitment sources, some limitations exist. The sample reflected the presumed clinical characteristics and gender distribution of an insomnia population; however, most participants were higher-educated white or African Americans, thus potentially limiting the generalizability to the larger insomnia population. In relation to this limitation, it would be interesting to further subdivide the insomnia groups, calling for future research with even larger samples. Furthermore, while subjective sleep quality assessed by the PSQI represents a composite score, sleep quality assessed by the sleep diary was based on a single item. As such, it may be argued that both measures reflect different aspects of subjective sleep quality, which are not yet defined. More research into the construct of subjective sleep quality is evidently required.

In conclusion, the present study demonstrated in a large, well-characterized clinical sample of patients with insomnia that (1) patients with psychiatric comorbidity may be more biased in their retrospective sleep quality ratings than those without and (2) the PSQI, possibly because of its retrospective nature, may reflect sleep-related distress to some degree, whereas the sleep diary–based prospective sleep quality ratings may tap into a less confounded construct of sleep quality. Clinicians who use the PSQI should consider this confound when using the measure in patients with a history of Axis I disorders—the most common group of people with insomnia.[39,40] This information is particularly germane in light of the omission of distinction between primary and comorbid insomnias in the new *DSM-5*.[41]

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Supplementary material follows this article.

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Supplementary Material

Article Title: Exploring the Construct of Subjective Sleep Quality in Patients With Insomnia

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List of Supplementary Material for the article

1. Supplementary Material — Supplementary material

Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary material

A Diagnostic group (I vs. CI) significantly predicted PSQI score (β=0.28, P<.001), explaining 7.6% of the variance (base model). After adding BAI scores as predictor to the base model (β=0.40, P<.001), the explained variance increased by 14.3 % to 22.0% ($F_{1,158}$=29.00, P<.001); β for diagnostic group dropped to 0.15 and P=.04. Also adding BDI mean scores as predictor to the model (β=0.15, P=.09 for BDI; β=0.33, P<.001 for BAI) did significantly add to the explained variance ($F_{1,157}$=2.98, P=.09); β for diagnostic group dropped to 0.11 and was not significant anymore (P=.14).

B Diagnostic group (I vs. CI) significantly predicted PSQI score (β=0.21, P=.007), explaining 4.4% of the variance (base model). After adding BAI scores as predictor to the base model (β=.43, P<.001), the explained variance increased by 15.6 % to 20.4% ($F_{1,158}$=30.83, P<.001 and the association between PSQI and diagnostic group disappeared (β=.04, p=.574). Also adding BDI mean scores as predictor to the model (β=0.19, P=.03 for BDI; β=0.34, p<.001 for BAI) did significantly add to the explained variance ($F_{1,157}$=4.72, P=.03); β for diagnostic group dropped to <0.01 and was not significant anymore (P=.969).