

# The Subjective Meaning of Sleep Quality: A Comparison of Individuals with and without Insomnia

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**Study objectives:** “Sleep quality” is poorly defined yet ubiquitously used by researchers, clinicians and patients. While poor sleep quality is a key feature of insomnia, there are few empirical investigations of sleep quality in insomnia patients. Accordingly, our aim was to investigate the subjective meaning of sleep quality among individuals with insomnia and normal sleepers.

**Design:** Cross sectional between groups (insomnia vs. good sleeper). Analyses were conducted across three outcome variables: (1) a “Speak Freely” procedure in which participants’ descriptions of good and poor sleep quality nights were analysed, (2) a “Sleep Quality Interview” in which participants judged the relative importance of variables included in previous research on sleep quality and (3) a sleep quality diary completed over seven consecutive nights.

**Setting:** University Department of Psychiatry

**Participants:** Individuals with insomnia ( $n = 25$ ) and normal sleepers ( $n = 28$ ).

**Interventions:** N/A

**Results:** Both the insomnia and normal sleeper groups defined sleep quality by tiredness on waking and throughout the day, feeling rested and restored on waking, and the number of awakenings they experienced in the night. The insomnia group had more requirements for judging sleep to be of good quality.

**Conclusion:** The meaning of sleep quality among individuals with insomnia and normal sleepers was broadly similar. A comprehensive assessment of a patient’s appraisal of their sleep quality may require an assessment of waking and daytime variables.

**Keywords:** Sleep quality, insomnia, sleep, perception, daytime processes, CBT

**Citation:** Harvey AG; Stinson K; Whitaker KL; Moskowitz D; Virk H. The subjective meaning of sleep quality: a comparison of individuals with and without insomnia. *SLEEP* 2008;31(3):383-393.

GOOD SLEEP QUALITY IS ASSOCIATED WITH A WIDE RANGE OF POSITIVE OUTCOMES SUCH AS BETTER HEALTH, LESS DAYTIME SLEEPINESS, GREATER well-being and better psychological functioning.<sup>1</sup> Poor sleep quality is one of the defining features of chronic insomnia.<sup>2</sup> Although the construct of sleep quality is widely used, a review of the empirical literature suggests that it is not yet fully understood. Indeed, Akerstedt, Hume, Minors, and Waterhouse<sup>3</sup> noted that “there seems to be very little systematic knowledge as to what actually constitutes subjectively good sleep and how this should be measured” and Buysse et al.<sup>4</sup> referred to sleep quality as a “complex phenomenon that is difficult to define and measure objectively.” Indeed, the empirical results highlight the complexity of sleep quality, particularly as it relates to patients with insomnia. Research studies have reported that “a history of chronic insomnia does not predict poor EEG sleep.”<sup>5</sup> Similarly, sleep quality is not directly associated with sleep quantity. For example, a common finding in the literature is that self-reported sleep does not correlate well with PSG defined sleep.<sup>6</sup> Indeed, Edinger and colleagues<sup>7</sup> distinguished between two groups: a

subjective insomnia group who met criteria for insomnia but had normal/nondisturbed sleep on PSG and a subjective normal sleeper group who met criteria for a “normal sleeper” but had objectively disturbed sleep. Psychological variables were found to distinguish between these two groups: the subjective insomnia group exhibited more depressed mood, anxiety and they held more dysfunctional beliefs about sleep, relative to the subjective normal sleeper. These findings highlight the complexity of sleep quality and the importance of understanding the subjective meaning of sleep quality. Accordingly, the broad aim of the present study was to contribute new data to improving understanding of the subjective meaning of sleep quality.

The primary focus of previous research has been to identify correlates of sleep quality. A wide range of factors have been investigated that, for ease of description, can be grouped into three clusters. First, there have been a handful of investigations of the correlation between perceived sleep quality and PSG-measured sleep parameters. These studies have included older female normal sleepers,<sup>8</sup> older adults with insomnia,<sup>9</sup> young adult good and poor sleepers,<sup>10</sup> and individuals with unipolar depression.<sup>11</sup> The consensus to emerge is that poor sleep quality estimates are associated with reduced Stage 1 sleep and more Stages 3 and 4 sleep.

Second, other studies have investigated the association between sleep quality and the subjective perception of sleep parameters. The results suggest that sleep quality is associated with subjective estimates of the ease of sleep onset,<sup>12</sup> sleep maintenance,<sup>13-15</sup> total sleep time,<sup>14</sup> and early awakening.<sup>13,15</sup> In addition, restlessness during the night,<sup>3,13,16</sup> movement during sleep,<sup>15,17</sup> and anxiety, tension, or calmness when trying to sleep<sup>15</sup> have also been reported to be associated with sleep quality. Moreover, perceived depth of sleep is important with less

## Disclosure Statement

This was not an industry supported study. Dr. Harvey has participated in speaking engagements for SME Communications. The other authors have indicated no financial conflicts of interest.

Submitted for publication January, 2007

Accepted for publication November, 2007

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perceived light sleep and more perceived deep sleep being associated with higher sleep quality.<sup>18</sup>

Finally, several studies have examined correlations between sleep quality and how the individual feels immediately on waking and during the day. The results indicate that sleep quality is associated with ease of waking,<sup>19</sup> tiredness, sense of balance and coordination,<sup>19</sup> clear-headedness,<sup>18</sup> how rested, restored and refreshed one feels,<sup>13</sup> and mood and physical feelings<sup>15</sup> on waking. During the day, feelings of tiredness predicted poorer sleep quality and alertness predicted better sleep quality.<sup>19</sup>

Taken together, although some consensus has emerged from studies of PSG-measured sleep parameters, there have been few consistent results from the studies that have focused on subjectively estimated aspects of sleep. The variability in the results obtained to date may be attributable to differences across studies in (1) the list of potential correlates evaluated, (2) the vague use of terminology, with some studies using terms like “sleep satisfaction” or “depth of sleep” and others referring to “sleep quality” and (3) the samples employed; the majority of previous studies have recruited good or normal sleepers, with only a handful based on poor sleepers or individuals with insomnia. Gaining an improved understanding of the subjective meaning of sleep quality among individuals with insomnia is important. For example, although differences in Rechtschaffen and Kales scored EEG sleep may not always be evident in patients with insomnia, relative to normal sleepers,<sup>5</sup> it is possible that a more sophisticated understanding of the subjective meaning of sleep quality may produce a better measure of sleep quality, which may correlate better with EEG sleep. Alternatively, objective and subjective assessments of sleep quality may reflect different processes and not be directly related.<sup>19</sup> In addition, understanding the meaning of sleep quality for individuals with insomnia may turn out to be important for a full recovery from insomnia. This suggestion is made based on cognitive theories which highlight the importance of the perception of or meaning or interpretation attached an event as the critical cause of distress, as opposed to the event itself.<sup>20</sup>

To summarize, the broad aim of the present study was to conduct a detailed and systematic investigation of the subjective meaning of sleep quality among individuals who meet diagnostic criteria for insomnia compared with a group of normal sleepers. We sought (1) to determine which sleep quality variables are judged to be most important, (2) to use a qualitative approach to determine whether there are important variables influencing perception of sleep quality not covered in the existing research literature, and (3) to compare the insomnia and normal sleeper groups on the meaning of sleep quality. Three different but complementary empirical approaches were employed to index the meaning of sleep quality: (1) a “Speak Freely” procedure in which participants were asked to describe a night of good and a night of poor quality sleep, (2) a “Sleep Quality Interview” in which participants rated the importance of variables included in previous research on sleep quality, and (3) sleep diaries in which participants also answered questions about their sleep quality over seven consecutive nights. These methods were selected to give a varied view of the meaning of sleep quality from both retrospective and prospective viewpoints and to capitalize on the advantages of procedures that

require participants to endorse items versus procedures that require responses to be generated.

## METHOD

### Participants

The insomnia and normal sleeper groups were recruited from January to July, 2004 via flyers posted around the city and referrals from primary care physicians. Of the 208 individuals who responded to advertisements, 152 did not take part due to falling outside the inclusion criteria ( $n = 30$ ), currently taking sleep medication ( $n = 6$ ), difficulty with the English language ( $n = 4$ ), insufficient time ( $n = 48$ ), sleep disturbance being attributable to a medical or psychological problem ( $n = 7$ ), and not able to be contacted ( $n = 57$ ). Three others completed the first session but did not return to the second session.

To be admitted to the insomnia group, participants must have met criteria for primary insomnia on the Insomnia Diagnostic Interview (IDI), and the problem must have been present at least three nights per week for at least one month. Inclusion criteria for the normal sleeper group were not meeting criteria on the IDI and a score of  $\leq 7$  on the Insomnia Severity Index. The final sample included 25 individuals who met DSM-IV-TR criteria for primary insomnia and 28 normal sleepers.

In the insomnia group, 9 participants (17% of the total sample) met criteria for one or more current DSM-IV-TR Axis 1 diagnoses (specific phobia = 4, major depression = 2, generalized anxiety disorder = 1, anorexia = 1, and alcohol abuse = 1). In the normal sleeper group, 2 participants (4% of the total sample) met criteria for specific phobia. As insomnia is commonly comorbid with a range of psychological disorders, individuals with comorbid problems were not automatically excluded because (1) the occurrence of a comorbid psychological problem does not necessarily mean the insomnia is secondary and (2) selecting just “pure” cases would reduce the representativeness of the sample. Instead, participants were assessed for primary insomnia using Section C of the IDI which tests whether insomnia or the comorbid disorder is currently the most distressing and disabling problem.

### Procedure

After obtaining informed consent, the IDI and the Structured Clinical Interview for DSM-IV (SCID) were administered and participants completed the Beck Depression Inventory (BDI) and State Trait Anxiety Inventory (STAI), as well as the Sleep over the Past Week Questionnaire. The Speak Freely procedure and the Sleep Quality Interview were administered. Participants were then given instructions for the coming week. They were given 7 envelopes, with each envelope labelled for when it should be opened (e.g. “please open on Thursday morning”) and each containing a sleep diary. Participants were asked to open and complete one sleep diary each morning for the next 7 days. Finally, an appointment for the second session 8-10 days later was scheduled. In the second session, the sleep diaries were collected and the participant was debriefed and paid an honorarium for their participation.

## Materials

### Insomnia Diagnostic Interview (IDI)

A structured clinical interview, the Insomnia Diagnostic Interview (IDI), was administered by the experimenter to identify the presence of insomnia. The IDI assesses each of the DSM-IV-TR criteria including that: (a) the predominant complaint is a difficulty initiating or maintaining sleep or nonrestorative sleep for at least one month (Cluster A); (b) the complaint causes distress or impairment (Cluster B); (c) the insomnia does not occur exclusively as a result of another sleep disorder (Cluster C); (d) the insomnia does not occur exclusively as a result of another mental disorder (Cluster D); and (e) the insomnia is not due to the effects of a substance or illness (Cluster E). In addition to endorsing each of the criteria, the participant must have experienced the problems  $\geq 3$  nights per week for at least one month. The IDI was selected because at the time the study began there was no validated diagnostic interview for insomnia. We have preliminary unpublished psychometric data on a sample of 55 individuals with insomnia; the IDI showed high internal consistency ( $\alpha = 0.87$ ), sensitivity (92%) and specificity (89%). The test-retest reliability of the IDI has been evaluated on 62 individuals with a re-administration interval of one to two weeks. The results indicated strong test-retest reliability ( $r = 0.90$ ) and good diagnostic agreement for the presence (90%) and absence (92%) of insomnia.

### Structured Clinical Interview for DSM-IV (SCID)

The SCID-I was administered to assess for comorbid Axis I disorders; so as to avoid misdiagnosis of secondary insomnia as primary insomnia.<sup>21</sup> The SCID-I has been shown to yield strong inter-clinician agreement.

### Insomnia Severity Index

The Insomnia Severity Index (ISI)<sup>22,23</sup> was administered to assess insomnia severity. It is a seven item questionnaire. The items are summed to obtain a total score ranging from zero to 28, with higher scores indicating greater subjective sleep impairment. It is an internally reliable instrument and sensitive to change.<sup>22</sup> A score  $\leq 7$  was used to define the normal sleeper group.<sup>22</sup> However, we decided against using the cutoffs for insomnia defined by Bastien et al.,<sup>22</sup> given recent evidence that they may be too stringent.<sup>24</sup>

### Beck Depression Inventory

The Beck Depression Inventory (BDI)<sup>25</sup> was included as an index of severity of depression symptoms. It is composed of 21 items rated on a 0 to 3 scale, with higher scores indicative of greater severity of depression. It has well-established reliability and validity.

### Spielberger State-Trait Anxiety Inventory

The State Trait Anxiety Inventory (STAI)<sup>26</sup> was administered as an index of state and trait anxiety. It is composed of 20 items rated on a scale of 1 “not at all” to 4 “very much so” (higher

scores indicate higher anxiety). It has well-established reliability and validity.

### Sleep Over the Past Week Questionnaire

This brief interview obtained typical sleep onset latency (SOL), wake after sleep onset (WASO, defined as total amount of time awake excluding SOL), total sleep time (TST), and sleep satisfaction (from 1 “not at all satisfied” to 10 “very satisfied”) over the past week.

### Speak Freely Procedure

This method was adapted from Halford et al.<sup>27</sup> Participants were asked to talk freely for 3 min about the characteristics of a night when they experienced good sleep quality and for another 3 min about the characteristics of a night when they experienced poor sleep quality (the order in which the good versus poor quality sleep night instructions were administered was counterbalanced within each group and across participants). The instructions for good sleep quality were as follows [note that wording changes for the poor sleep instructions are italicized in square brackets]:

I want you to tell me about the characteristics of a night when you experienced good sleep quality [poor sleep quality]. I want you to talk for three minutes about this topic and I'm not going to interrupt you. Any questions? (pause to answer any questions) OK. Tell me about the characteristics of a night when you experienced good sleep quality [poor sleep quality]. Ready, begin now.”

If the participant finished speaking prior to the end of 3 min and did not recommence within 5 sec the interviewer administered the first of three standard prompts: “Is there anything else you can think of that would indicate to you that you had a good/poor quality night's sleep?” After the 3 elaborative prompts, if the participant ceased speech and did not recommence within 5 sec, the interview stopped. This part of the session was tape recorded and subsequently transcribed verbatim.

### Sleep Quality Interview

In the absence of a psychometrically validated alternative, this interview was developed specifically for this study to determine the relative importance of variables from the literature for judging sleep quality among individuals with insomnia and normal sleepers. The construction of the interview involved two steps. First, we thoroughly surveyed the existing literature on sleep quality, as already reviewed, and made a comprehensive list of all the possible constituents of sleep quality. Second, we gave this list to 4 normal sleepers and 4 insomnia patients. They were asked to examine the list of items and note down other items not included in the list but which they thought were important when making a judgment about the quality of sleep. This procedure generated a further 6 items: movement during sleep, how you feel on waking, how motivated you feel about the day ahead, time of going to bed, natural versus enforced awakening, and season (dark or light on awakening). These methods resulted in a 41-item interview. For each item, the experimenter asked the participant “When making a judgement

**Table 1**—Participant Characteristics, Sleep Over the Past Week and Sleep Diary Variables for the Insomnia Group and the Normal Sleeper Group

	<b>Insomnia N = 25</b>	<b>Normal sleeper N = 28</b>	
Participant Characteristics			$\chi^2$ (1)
Sex			
Female	18	25	2.58
Male	7	3	
Age (in years)	22.56 (3.14)	20.82 (1.79)	$t$ (51) 2.44
ISI	16.20 (2.12)	3.70 (2.14)	0.00 <sup>a</sup> **
BDI	8.74 (5.28)	4.43 (3.54)	3.53**
STAI-state	36.28 (10.18)	32.43 (8.81)	1.48
STAI-Trait	45.00 (12.36)	35.36 (7.91)	3.42**
Duration of Insomnia (months)	73.35 (78.91)	N/A	N/A
Retrospective Estimate of Sleep over the Past Week			$t$ (51)
SOL	49.30 (29.84)	18.57 (9.70)	86.50 <sup>a</sup> **
WASO	34.50 (31.85)	4.27 (7.36)	144.00 <sup>a</sup> **
TST	6:52 (0:57)	7:57 (0:50)	-4.39**
Sleep satisfaction‡	3.66 (1.21)	7.10 (1.50)	-9.13**
Prospective Estimate of Sleep from the Sleep Diary			$t$ (51)
SOL	26.48 (18.27)	17.29 (10.70)	231.00 <sup>a</sup> *
WASO	19.31 (12.57)	8.17 (7.66)	151.50 <sup>a</sup> **
TST	6:55 (0:51)	7:44 (0:55)	-3.35*
Sleep Quality Index Total	14.20 (2.24)	16.49 (1.57)	-4.37**
Question 1: How well you slept	3.31 (0.49)	3.81 (0.51)	-3.61*
Question 2: Difficulty falling asleep	3.61 (0.80)	4.12 (0.52)	-2.74*
Question 3: Restless sleep	3.57 (0.74)	4.09 (0.49)	-2.97
Question 4: Early waking and not being able to go back to sleep	3.71 (0.73)	4.47 (0.59)	-4.17**
Overall sleep quality rating	5.78 (1.30)	7.05 (3.07)	223.00 <sup>a</sup> *

Data are presented as mean values with standard deviations in parentheses, except for sex where frequency is reported. ISI = Insomnia Severity Index; BDI = Beck Depression Inventory; STAI = State-Trait Anxiety Inventory; SOL = sleep onset latency; WASO = wake after sleep onset; TST = total sleep time; Overall sleep quality rating: “very bad” to “very good.”

<sup>a</sup>Whenever variables were not normally distributed, the Mann Whitney U is reported.

‡ 1 = Not at all satisfied, 10 = Very satisfied. \* $P < 0.01$ , \*\* $P < 0.001$ .

about the quality of your sleep, how important is \_\_\_\_.” The participant was asked to make a rating on a 1 “not at all important” to 5 “very important” response scale, which was presented on a card placed in front of them. For ease of administration we grouped the items into three sections: sleep variables (19 items), on waking variables (17 items) and daytime variables (5 items). Section 1 began with the experimenter saying “The next set of questions are about your sleep” (Cronbach alpha = 0.78). Section 2 began with the experimenter saying “how you feel when you wake up” (Cronbach alpha = 0.87). Section 3 began with the experimenter saying “how you feel during the day” (Section 3; Cronbach alpha = 0.76). A full list of the items that comprised the Sleep Quality Interview is presented in Table 3.

### Sleep Diary

This diary was completed by participants immediately on waking over seven consecutive nights. Participants were asked to complete the four items that comprise the Sleep Quality Index,<sup>3</sup> which is a 4-item scale derived from the Karolinska Sleep Diary (see Table 1 for a list of the items). In addition, par-

ticipants recorded the time they went to bed, how long it took them to fall asleep (SOL; sleep onset latency), the amount of time they were awake during the night (WASO; wake time after sleep onset), the time they woke up, the time they got out of bed and the amount of sleep obtained in total (TST; total sleep time). Participants were asked overall how they would rate the quality of the sleep they obtained last night (Response scale: 0 “very bad” to 10 “very good”). Finally, they were asked to describe “in as much detail as possible how (i.e., on what basis) you made this judgment of your sleep quality.” The participants were given 4 blank lines on which to record their answer.

### Data Analysis

For the participant characteristics and basic sleep variables, two group comparisons were analyzed with independent sample  $t$ -tests or chi-square tests. The data from the speak freely procedure are reported as the percentage of participants who mentioned each category. Chi-squares were used to analyse differences between the 2 groups. For Chi-squares, Fisher’s exact test was conducted when the cell size was  $<5$ . For the Sleep

Quality Interview, a multivariate analysis for each domain was followed by independent sample *t*-tests to investigate significant main effects. Wherever variables were skewed even after transformation, nonparametric tests were conducted. Wherever the equal variance assumption was not upheld, the Levene correction was employed. Weighing the possibility that multiple comparisons increase the chance of a type I error with the view that adopting more conservative error rates increases the chance of type II errors,<sup>28</sup> we compromised by using  $P < 0.01$  as the cutoff for statistical significance.

Qualitative analysis was conducted on the results of the Speak Freely procedure and the question in the 7 consecutive morning sleep diaries asking participants to describe the basis on which they made their sleep quality judgment. All descriptions were carefully transcribed in full. They were then divided into utterance units which were defined as a clause containing only one thought, action, or idea.<sup>29</sup> The utterance units were coded using the N6 version of the Non-numerical Unstructured Data Indexing Searching and Theorizing System.<sup>30</sup> N6 is a code based qualitative analysis system that allows for rapid coding and continuous review. It is a flexible computer package for the analysis of qualitative data. The coding schemes, which are presented in Tables 2 and 4, were developed by carefully considering each utterance unit and creating a new coding variable for each new topic raised. The first rater (D.M.) was blind to group status. The data from the first rater served as the basis for analysis. A second rater (H.V.) coded the narratives of 4 participants with insomnia and 4 normal sleepers (15%) for both the Speak Freely procedure and the sleep diaries; there was 78% interrater agreement. N6 was employed to search the data for the frequency of each factor under investigation. The number of participants in each group who identified each factor as a basis of their sleep quality was transferred to a statistical analysis package.

## RESULTS

### Participant Characteristics

As evident in Table 1, there was no difference between the insomnia and normal sleeper groups for sex or age. The insomnia group scored higher on the ISI and exhibited higher levels of depression and trait anxiety than the normal sleeper group. There was no difference between the groups on state anxiety. Individuals in the insomnia group had suffered with insomnia for a mean of 73.35 ( $SD = 78.91$ ) months. The sample was 94% Caucasian; individuals from ethnic minorities were equally spread across the two diagnostic groups.

### Retrospective Estimate of Sleep over the Past Week

As can be seen in Table 1, over the past week the insomnia group reported longer SOL and WASO and less TST than the normal sleeper group. The insomnia group also reported lower sleep satisfaction.

### Prospective Estimate of Sleep from the Sleep Diary

As evident in Table 1, the insomnia group reported longer SOL and WASO and less TST than the normal sleeper group.

On the Sleep Quality Index, relative to the normal sleeper group, the insomnia group had a lower total score (a lower score indicating poorer sleep quality) and they also scored lower on question 1 (how well you slept), question 2 (difficulty falling asleep), and question 4 (early waking and not being able to go back to sleep). The insomnia group also scored lower on the overall sleep quality rating relative to the normal sleeper group. We note that although the key inclusion criteria for the insomnia group was meeting DSM-IV-TR criteria for insomnia, a comparison of the sleep diary estimates with the modal quantitative cutoffs for insomnia in published clinical trials<sup>31</sup> indicated that all but two individuals in the insomnia group reached the cutoffs (sleep onset latency or wakefulness after sleep onset  $>30$  min and frequency  $\geq 3$  times a week).

## The Meaning of Sleep Quality

### Speak Freely Procedure

Due to equipment failure, one participant (from the insomnia group) was excluded from this analysis. During the Speak Freely procedure, the number of prompts administered by the experimenter was summed and entered into a 2 (Group: Insomnia, Normal sleeper) by 2 (Night Type: Poor, Good) ANOVA, with repeated measures for Night Type. The experimenter administered significantly more prompts when participants were describing a good night (Insomnia group;  $M = 3.00$ ;  $SD = 0.88$ ; Normal Sleeper group;  $M = 2.96$ ;  $SD = 1.00$ ) than when they were describing a bad night (Insomnia group;  $M = 2.46$ ;  $SD = 0.93$ ; Normal Sleeper group;  $M = 2.71$ ;  $SD = 1.08$ ),  $F_{1,50} = 172.89$ ,  $P < 0.001$ . There was no effect of Group and no interaction.

The participants' descriptions were qualitatively analysed (using N6). The results for the sleep variables are presented in Table 2 and in Table 3 for the on waking and daytime variables. Note that unlike the qualitative analysis for the sleep diary data (presented below), the data obtained during the Speak Freely procedure were also categorized according to the direction of the response and whether the participant was describing a good or poor night (presented in the 4 columns on the right side of Tables 2 and 3). Across Tables 2 and 3, the 5 categories mentioned by the greatest number of people in the insomnia group were: "Motivation to get up or sleep in the morning," "Tiredness on waking and throughout the day," "Anxiety, worry, and mood on waking and throughout the day," "Sleep onset latency," and "Awakenings in the night." The 5 categories mentioned by the greatest number of people in the normal sleeper group were: "Tiredness on waking and throughout the day," "Motivation to get up or sleep in the morning," "Alertness, clear-headedness, concentration on waking and throughout the day," "Sleep onset latency," and "Awakenings in the night."

Chi-square tests were carried out to investigate differences in the proportion of each group who mentioned each category as a basis of their sleep quality judgement. Three significant differences emerged. The insomnia group were more likely to mention "monitoring" and "body sensations on waking and throughout the day," relative to the normal sleeper group, and the normal sleeper group were more likely to mention "memory of sleep" relative to the insomnia group.

**Table 2**—Percentage of the Insomnia Group (IG) and the Normal Sleeper Group (NSG) Mentioning Each Category from the “Speak Freely” Procedure: Results for the Sleep Variables

Category	% IG NSG $\chi^2$ (1)			Direction	Good night IG NSG		Poor night IG NSG	
	IG	NSG	$\chi^2$ (1)		IG	NSG	IG	NSG
Sleep onset latency	88	86	0.04	Short sleep onset latency	63	68	0	0
				Long sleep onset latency	0	0	83	79
Awakenings in the night	88	86	0.04	No awakenings	67	79	0	0
				Awakenings	0	0	79	68
Anxiety, worry, mood in the night	79	61	2.07	No anxiety/positive mood	50	29	0	0
				Anxiety/negative mood	0	0	67	61
Total sleep time	71	54	1.63	Sleep for a long time/“enough”	38	43	0	0
				Short time/“not enough”	0	0	46	25
Sleep inducing activity the previous day	63	36	3.71	Sleep inducing activity	42	21	0	0
				Activity not conducive to sleep	0	0	50	21
Tiredness	58	32	3.59	Tired	29	21	17	14
				Not tired	4	4	12	7
Bed time	54	61	0.23	Go to bed early	38	46	4	11
				Go to bed late	8	4	29	39
Sleeping “well”	46	46	0	Sleep “well” or similar	33	25	0	0
				Sleep “badly” or similar	0	0	29	25
Body sensations (e.g., hunger, warmth)	42	43	0.01	Positive body sensations	21	14	0	0
				Negative body sensations	0	0	38	32
Restlessness of sleep	42	32	0.51	Restful sleep	13	7	0	0
				Restless sleep	0	0	42	29
Dreams	38	46	0.42	No dreams	12	29	4	0
				Dreams	13	18	25	25
Setting/context (e.g., whose bed, bed partner)	29	25	0.11	Sleep inducing context	13	11	0	0
				Non sleep inducing context	0	0	21	21
Quality of sleep on recent nights	25	14	0.95	Slept badly on recent nights	13	11	8	4
				Slept well on recent nights	4	0	4	0
Monitoring (e.g., clock watching)	25	4	5.09*	No monitoring	4	0	0	0
				Monitoring	0	0	21	4
Use of substances (e.g., alcohol, drugs, caffeine)	13	11	0.04	Not taken substances/alcohol	8	0	0	0
				Taken substances/alcohol	4	0	4	11
Physiological arousal in the night	13	4	1.45	Not physiologically aroused	0	0	13	4
				Physiologically aroused	0	0	0	0
Pre-sleep expectation of how sleep would be	13	0	3.71	Expected good night’s sleep	4	0	0	0
				Expected poor night’s sleep	0	0	9	0

IG = Insomnia Group (n = 24); NSG = Normal Sleeper Group (n = 28).

\*P < .01, \*\* P < .001.

### Sleep Quality Interview

Table 4 presents the results for the Sleep Quality Interview. As evident in Table 4, the five items considered most important for judging sleep quality by the insomnia group were: “how well you slept” (Sleep Quality Index item), “how tired you feel” when you wake up and during the day, and “how rested you feel” and “how restored you feel” when you wake up. The five items considered most important for judging sleep quality by the normal sleeper group were: “whether you get enough sleep,” “how rested you feel,” and “how restored you feel” when you wake up, as well as “how tired you feel” and “how alert you feel” throughout the day.

A MANOVA was conducted for each of the 3 domains within the Sleep Quality Interview (sleep variables, on-waking variables, daytime variables). As evident in Table 4, the diagnosis main effect (i.e., the comparison between the insomnia and

normal sleeper groups) reached significance on one of these 3 analyses; the on-waking variables. For this domain, between group tests were conducted between the insomnia and normal sleeper groups. Two of the 17 variables in this domain reached significance (P < 0.01).

### Sleep Diary

As can be seen in Table 5, over 7 consecutive nights, the five categories mentioned by the greatest number of people in the insomnia group were “awakenings in the night,” level of “tiredness on waking and throughout the day,” “total sleep time,” “feeling rested, restored, refreshed, replenished on waking” and “time of waking in the morning.” The five categories mentioned by the greatest number of people in the normal sleeper group were “awakenings in the night,” “sleeping well or badly,” level of “tiredness on waking and throughout the day,” “total sleep

**Table 3**—Percentage of the Insomnia Group (IG) and the Normal Sleeper Group (NSG) Mentioning Each Category from the “Speak Freely” Procedure: Results for the On Waking and Daytime Variables

Category	%		$\chi^2$ (1)	Direction	Good night		Poor night	
	IG	NSG			IG	NSG	IG	NSG
Motivation to get up or sleep in the morning	100	89	2.73	Motivated to get up	79	79	21	4
				Desired to sleep more	21	22	83	71
Tiredness on waking and throughout the day	96	96	0.01	Not tired	67	79	0	0
				Tired	0	0	79	93
Anxiety, worry and mood on waking and in the day	92	82	1.01	Positive mood/no anxiety	79	54	0	0
				Negative mood/anxiety	0	0	83	68
Alertness, clear-headedness, concentration	79	89	1.02	Alert, clear headed	58	64	0	0
				Not alert, groggy	0	0	63	54
Coping behaviours (e.g., coffee, napping, alcohol)	71	68	0.05	No coffee, napping etc.	33	36	0	0
				Use of coffee, napping etc.	0	0	54	50
Time of waking in the morning	71	64	0.25	Waking late in the morning	33	32	13	11
				Waking early in the morning	17	7	63	50
Performance level and efficiency	71	50	2.33	Performance level high	38	25	0	0
				Performance level low	0	0	63	39
Feeling rested, restored, refreshed, replenished	67	64	0.03	Feeling rested etc.	67	61	0	0
				Not feeling rested etc	0	0	4	14
Body sensations on waking and during the day	63	25	7.45**	Positive body sensations	33	18	0	0
				Negative body sensations	0	0	50	18
Feelings of energy/lethargy	58	71	0.98	Feeling energetic	42	57	0	0
				Feeling lethargic	0	0	29	39
Alarm/natural awakening	46	68	2.57	Wake naturally	25	43	17	0
				Wake by alarm	13	18	0	14
Ability to go back to sleep on final awakening	38	18	2.53	Can easily go back to sleep	4	0	0	0
				Can't go back to sleep	4	0	38	18
Level of sociability	33	32	0.01	Feeling sociable	33	21	0	0
				Feeling asocial	0	0	8	18
Ease or difficulty of staying awake	29	32	0.05	Easy to stay awake	13	14	0	0
				Difficult to stay awake	0	0	25	25
Nonspecific feeling “good” or “bad”	25	39	1.20	Feel ‘good’	13	32	0	0
				Feel ‘bad’	0	0	17	21
Appearance on waking	8	29	3.41	Appearance ‘good’	8	4	0	0
				Appearance ‘bad’	0	0	4	25
Level of light on waking	8	7	0.03	Light outside when wake	0	0	8	4
				Dark outside when wake	0	4	0	0
Memory of sleep	4	25	4.31*	No memory of sleep	4	25	0	0
				Remember sleep	0	0	0	0
Physiological arousal in the day	4	21	3.31	Not physiologically aroused	0	0	0	0
				Physiologically aroused	0	4	4	18
Coordination and balance	4	0	1.19	Coordinated, balanced	4	0	0	0
				Not coordinated, balanced	0	0	4	0
Expectation of sleep’s impact on day	0	4	0.87	Expect positive impact	0	0	0	0
				Expect negative impact	0	0	0	4

\*P &lt; 0.01, \*\* P &lt; 0.001.

time,” and “feeling rested, restored, refreshed, replenished on waking.”

Chi Square tests were carried out to investigate differences in the proportion of people in each group who mentioned each category as a basis of their sleep quality judgements. A significantly greater percentage of the normal sleepers mentioned “sleeping well/badly” and a nonspecific feeling of “good” or “bad” (e.g., “I don’t feel too bad this morning”; and “I woke up feeling quite good”) than the insomnia group. A significantly greater percentage of the insomnia group mentioned “time of waking in the morning” and “body sensations on waking and during the day” relative to the normal sleeper group.

## DISCUSSION

The broad aim of this study was to conduct a detailed and systematic investigation of the subjective meaning of sleep quality among individuals who met DSM-IV-TR diagnostic criteria for insomnia, relative to a group of normal sleepers. This is an important gap in the literature as the majority of previous research that has attempted to systematically examine sleep quality has been conducted with individuals who are normal sleepers.<sup>3,18</sup>

The first aim of the present study was to use a quantitative Sleep Quality Interview to determine which of the variables considered important in the existing sleep quality literature (largely based on normal sleepers) are endorsed as most important to the sleep qual-

**Table 4**—Mean Values for the Sleep Quality Interview Across the Insomnia Group and the Normal Sleeper Group

<b>How Important is:</b>	<b>Insomnia (N = 24)</b>	<b>Normal Sleeper (N = 28)</b>	
Sleep Variables: Diagnosis Main Effect, $F = 3.18$ , <i>ns</i> .			
How well you slept	4.46 (0.64)	3.82 (0.86)	
How satisfied you are with your sleep	4.28 (0.68)	3.54 (0.96)	
Whether you get enough sleep	4.24 (0.97)	4.18 (0.82)	
How easy it is to fall asleep	4.18 (0.99)	3.79 (0.69)	
Whether you feel calm and relaxed as you're trying to get to sleep	4.16 (0.9)	3.64 (0.91)	
Whether you feel anxious, worried or tense as you're trying to get to sleep	4.16 (0.62)	3.71 (0.94)	
How restless you are during the night	4.12 (0.73)	3.39 (1.23)	
How deep your sleep feels	4.04 (0.89)	3.96 (0.84)	
Whether you feel tense or physiologically aroused when you're trying to get to sleep	4.00 (0.91)	3.50 (0.96)	
Early waking too early and not being able to get back to sleep	3.92 (1.14)	2.64 (1.03)	
The number of hours of sleep you get	3.72 (1.14)	3.96 (1.00)	
Whether you slept throughout the night	3.67 (0.82)	3.46 (0.88)	
The length of awakenings during the night	3.60 (1.29)	3.29 (1.24)	
The time you go to bed	3.24 (1.20)	2.96 (1.00)	
The number of times you wake up during the night	3.16 (1.25)	3.43 (1.00)	
Whether you have been woken by an external factor	3.08 (1.08)	2.61 (1.23)	
How disturbing your dreams are	3.08 (1.32)	3.00 (1.39)	
How much you moved during sleep	2.54 (1.29)	2.00 (1.05)	
The amount you dream	2.38 (1.29)	1.96 (1.07)	
On Waking Variables: Diagnosis main effect, $F = 2.76$ , $P < 0.05$ .			
How rested you feel	4.70 (0.68)	4.14 (0.89)	$t(51)$
How restored you feel	4.52 (0.65)	4.11 (0.92)	210.50 <sup>a*</sup>
How tired you feel	4.44 (0.77)	3.96 (1.00)	262.50 <sup>a</sup>
How refreshed you feel	4.32 (0.80)	4.04 (0.92)	251.50 <sup>a</sup>
How energetic you feel	4.04 (0.93)	3.75 (1.11)	1.19
How you feel about the day ahead	3.92 (1.04)	3.46 (1.07)	1.02
How you feel immediately	3.88 (0.90)	3.11 (1.13)	1.57
How easy you find it to wake up	3.88 (1.01)	3.96 (0.96)	2.67*
Body sensations (e.g., heavy eyes, tired shoulders)	3.72 (0.98)	3.71 (1.05)	-0.31
Whether you feel anxious, worried, tense	3.68 (1.11)	3.43 (1.07)	0.02
How alert you feel	3.68 (1.03)	3.64 (0.99)	0.84
How clear-headed you feel	3.64 (0.99)	3.79 (0.96)	0.13
Whether you feel calm and relaxed	3.60 (1.12)	3.36 (0.91)	-0.54
Whether you feel tense, on edge or physiologically aroused	3.38 (1.32)	3.57 (0.92)	0.87
Whether it is dark or light	3.17 (1.2)	2.71 (1.15)	-0.62
Whether you have woken up naturally	2.92 (1.29)	3.32 (1.09)	262.50 <sup>a</sup>
Your sense of balance and co-ordination	2.60 (1.19)	2.82 (1.22)	-1.23
Daytime Variables Diagnosis Main Effect, $F = 1.58$ , <i>ns</i> .			
How alert you feel	4.48 (0.59)	4.25 (0.84)	-0.67
How tired you feel	4.44 (0.87)	4.07 (0.94)	
How well you perform	4.20 (0.65)	3.57 (1.03)	
How energetic you feel	4.12 (0.60)	3.89 (0.83)	
Body sensations (e.g., shoulders tired)	3.68 (1.14)	3.61 (1.10)	

Data are presented as mean values with standard deviations appear in parentheses. Scale for all questions: 1 "Not at all important" to 5 "Very important." <sup>a</sup>Whenever variables were not normally distributed, the Mann Whitney U is reported.

\*  $P < 0.01$ ; \*\*  $P < 0.001$ .

ity judgments made by individuals with insomnia. Both groups considered feeling rested on waking, feeling restored on waking and feeling alert throughout the day as among the most important factors for judging sleep quality. However, the insomnia group also rated "how well you slept" (Sleep Quality Index item) and how tired they feel when they wake up among their five most important factors, whereas the normal sleeper group rated "whether you get enough sleep" and "how tired you feel throughout the day" among their five most important factors. These findings suggest that the meaning of sleep quality among individuals with in-

somnia are broadly similar to their meaning for normal sleepers; namely, that subjective feelings the day following sleep appear to be the most important basis for judging sleep quality. The findings are also consistent with previous studies that have reported a correlation between perceived sleep quality and feelings immediately on waking and during the day<sup>16,19</sup> and with accruing evidence from other qualitative and quantitative studies of the importance of daytime symptoms to the experience of insomnia.<sup>32</sup>

The second specific aim was to use a qualitative approach to determine whether there are important variables influencing



**Table 5**—Percentage of the Insomnia Group and the Normal Sleeper Group Mentioning Each Category as the Basis for Their Sleep Quality Judgment from the Seven Consecutive Nights of Sleep Diaries

Category	Insomnia (%)	Normal Sleeper (%)	$\chi^2$ (1)
<b>Evening/Night time variables</b>			
Awakenings in the night	88	89	0.02
Total sleep time	76	71	0.14
Sleep Onset Latency	60	61	0.00
Sleeping “well” or “badly”	52	79	4.16*
Anxiety and worry and mood in the night	48	32	1.39
Restless sleep	36	43	0.26
Dreams	28	39	0.75
Body Sensations, e.g. pain, hunger, thirst, comfort	28	29	0.00
Need for sleep on the basis of quality of sleep on recent nights	28	18	0.78
Tiredness	20	14	0.31
Time of getting into bed	16	25	0.65
Use of substances (e.g., alcohol, drugs, caffeine)	4	7	0.24
Expectation last night of how sleep would be	4	0	1.14
Activity the previous day	0	11	2.84
Setting/context (e.g. whose bed, bed partner)	0	7	1.86
Monitoring (e.g. clock-watching)	0	7	1.86
Physiological arousal in the night	0	0	N/A
<b>Daytime variables</b>			
Tiredness on waking and throughout the day	84	71	1.19
Feeling rested, restored, refreshed, replenished	68	68	0.00
Time of waking in the morning	64	36	4.23*
Body sensations on waking and during the day	44	14	5.75*
Motivation to get up or sleep in the morning	32	50	1.76
Alertness, clear-headedness, ability to concentrate	32	25	0.32
Mood/emotion/anxiety on waking	28	25	0.06
Feelings of energy/lethargy	12	14	0.06
Inability to go back to sleep on final awakening	12	7	0.37
Alarm/natural awakening	8	29	3.65
Expectation of sleep’s impact on day	8	0	2.32
Non-specific feeling ‘good’ or ‘bad’	4	25	4.55*
Performance level and efficiency	4	0	1.14
Coordination and balance	4	0	1.14
Memory of sleep	0	7	1.86
Level of light when wake up	0	4	0.91
Physiological arousal in the day	0	4	0.91
Level of sociability	0	0	N/A
Coping strategies (e.g., coffee, naps)	0	0	N/A
Ease or difficulty of staying awake	0	0	N/A
Appearance on waking	0	0	N/A

\*  $P < 0.01$ 

perceptions of sleep quality among individuals with insomnia that are not covered in the previous literature. Except for 6 questions which were added, the Sleep Quality Interview was comprised of a comprehensive list of the variables that have been studied in previous research on sleep quality. So our method for ascertaining the results relevant to this second aim was to compare the unique variables (i.e., those not covered in the Sleep Quality Interview) that emerged from the “Speak Freely” procedure and/or the seven sleep diaries. Examples of the unique variables that emerged from the “Speak Freely” procedure that have not been highlighted in previous research were “coping behaviours” (e.g., “I tend to take a nap,” “I’ll drink coffee to try and keep me awake”), “time of waking in the morning,” “tiredness” at bedtime, “body sensations” *at night* (e.g., “I’d probably be really uncomfortable,” “I wouldn’t get cold”), “sociability”

(“like wanting to interact with other people,” “not wanting to talk to people as much as usual”), “quality of sleep on recent nights,” “appearance on waking,” “monitoring,” and “memory of sleep.” From the sleep diaries, examples of the variables that were not discussed in previous research but were mentioned by participants as the basis of their sleep quality rating were “time of waking in the morning,” “body sensations” *at night* (e.g., “your ears might be ringing,” “because I’d be too hot or too cold,” and “quality of sleep on recent nights.”).

To address the third aim, it is striking that there appear to be more similarities than differences between the insomnia and normal sleeper groups in the meaning of sleep quality. There was also consistency in the results that emerged across the three methods. All three measures implicated tiredness on waking and throughout the day as most consistently associated with sleep

quality judgements and two out of the three methods implicated feeling rested, restored, refreshed, replenished on waking and awakenings in the night. An inspection of Tables 2, 3, and 4 reveals the handful of differences that did emerge across the two groups. In interpreting these differences the reader is reminded of the concern mentioned previously that multiple comparisons may have increased the chance of a type I error. Perhaps the most notable difference to emerge, although not all comparisons reached significance, was that the insomnia group considered the majority (36 of 41) of variables covered in the Sleep Quality Interview to be more important for judging their sleep quality relative to the normal sleepers. These findings raise the possibility that individuals with insomnia may have a long “laundry list” of requirements for them to feel they have experienced a night of good sleep quality. This is an issue to which we will return in our discussion of the clinical implications below.

Taken together, the results have a number of implications for the measurement of sleep quality. The Sleep Quality Index<sup>3</sup> was administered in this study and it proved to be sensitive to the sleep quality concerns of patients with insomnia. Specifically, in the Sleep Quality Interview the insomnia group judged 3 of the 4 Sleep Quality Index variables to be significantly more important for judging sleep quality, relative to the normal sleepers. In addition, over 7 consecutive days, the insomnia group scored higher (indicating poorer sleep quality) on the total Sleep Quality Index score, relative to the normal sleeper group. This is an important finding as to the best of the authors’ knowledge this is the first study to be done, using the Sleep Quality Index, among patients with insomnia. However, all 4 items on the Sleep Quality Index (a list of the questions appears in Table 1) pertain to nighttime variables. The present results suggest that a complete assessment of sleep quality for patients with insomnia would require additional questions to assess “on waking” and “daytime” sleep quality variables. The latter is consistent with increasing recognition of an important role for daytime variables in insomnia.<sup>32-34</sup>

In addition to the future research directions already discussed, a key issue arising from this study is the need for research to determine which of the variables found to be associated with sleep quality judgments are *real/veridical* indicators of sleep quality versus the result of *psychological processes operating to bias perception of sleep quality*. It is emphasized that it is possible that *both* may be present. The psychological processes might take the form of an interpretation bias; namely, many everyday events are ambiguous and can be interpreted in more than one way. Across a range of psychological disorders there is evidence that individuals display a disproportionate tendency to make disorder-congruent interpretations of ambiguous material,<sup>35</sup> including in patients with insomnia.<sup>36</sup> Perhaps in a similar way, detecting ambiguous information (e.g., sore eyes, heavy head on waking) might lead to a disorder-congruent interpretation (e.g., “the quality of my sleep was poor last night”) among individuals with insomnia.

An issue to which we would like to draw the readers’ attention is the discrepancy between the estimates of SOL, WASO and TST over the past week compared to the sleep diary (evident in Table 1). This difference between retrospectively estimated sleep and prospectively estimated sleep is not atypical in the insomnia literature and might be attributable to: (1) a diary

keeping effect, such that an “enhanced awareness” of sleep patterns may reduce anxiety over sleep loss and thus contribute to better sleep;<sup>23</sup> (2) difficulty understanding the concept of an average, which is required when making a retrospective estimate; and/or (3) the retrospective estimate is open to reasoning biases, such as answering on the basis of saliency (the worst night) or how recently the night occurred.<sup>37</sup>

These results need to be interpreted within the confines of at least 3 limitations. First, as this was an exploratory study, including a qualitative component, the data analysis required the completion of multiple comparisons. As such, there is a concern about type I error. We considered whether to reduce the number of multiple comparisons by collapsing variables into subscales. However, we decided against this option as our goal was to conduct an exploratory study designed to guide future research. We suggest the potential for deriving novel hypotheses is best achieved by providing maximal detail as to the results and is diminished by collapsing into subscales. Second, although the insomnia group met strict DSM-IV-TR criteria for insomnia, it is emphasized that the sample was a non-treatment seeking sample that was drawn from a university city and included university students. We suggest that the use of a non-treatment seeking sample is a reasonable initial step on the basis that (1) many insomnia patients do not seek treatment<sup>38</sup> and (2) every science needs an analogue to test and hone new hypotheses in a timely and resource-efficient manner.<sup>39</sup> Having said that, if results based on non-treatment seeking samples are promising, the investment of resources to recruit a treatment seeking sample to check the generalizability of the findings to treatment seeking ethnically diverse samples is a crucial next step. Third, although qualitative analysis can be a powerful tool for hypothesis generation, it can be criticized for researcher bias, lacking generalizability and generating a large amount of detailed information that can be difficult to replicate. In an attempt to overcome these potential limitations, we heeded Mays and Pope’s<sup>40</sup> methodological checklist for ensuring high quality qualitative research. Specifically, we verified the reliability of the analysis by assessing interrater agreement, sought evidence from three different sources to ensure the validity of findings and reduced the potential for observer bias by presenting quantitative summaries of the results and fully describing the context of the study and the sample. Finally, the insomnia and normal sleeper groups differed on several measures (ISI, BDI, STAI-Trait). The role these variables play in sleep quality judgements should be addressed in future research.

In conclusion, we aimed to complete a detailed and systematic investigation of the subjective meaning of sleep quality among individuals with insomnia, relative to a group of normal sleepers. The results highlight that there is considerable overlap between individuals with insomnia and normal sleepers in their perception of sleep quality; the exception is that the insomnia group appeared to have more requirements for judging sleep quality to be of good quality than the normal sleepers. Based on the data reported, a preliminary definition of sleep quality should include reference to tiredness on waking and throughout the day, feeling rested and restored on waking, and the number of awakenings in the night. Although the Sleep Quality Index<sup>3</sup> emerged as distinguishing between the sleep quality of patients with insomnia and normal sleepers, the findings from the quali-

tative analyses suggest that the Sleep Quality Index may need to be extended to include morning and daytime variables as these emerged as of key importance to the judgments of sleep quality among patients with insomnia.

## ACKNOWLEDGMENTS

This research was supported by a grant from the Wellcome Trust (Grant reference number – 065913).

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