Illness perception in individuals with subjective sleep complaints.
Abstract

The aims of the study were to: (1) Describe illness perception in individuals with subjective sleep complaints and high risk of sleep disordered breathing and compare the results with those of other studies. (2) Study the relationship between illness perception and sleep disordered breathing, insomnia, daytime sleepiness and fatigue. (3) Study the relationship between illness perception, anxiety and depression in individuals with subjective sleep complaints.

Methods: The study comprised 223 individuals classified as Berlin Questionnaire (BQ) high risk and who reported subjective sleep complaints. BQ assesses the patients’ risk of having sleep disordered breathing (SDB). These individuals were assessed with self report questionnaires, including the Illness Perception Questionnaire (IPQ-R), which assesses the individuals’ cognitive representations of their sleep complaints by asking about their own beliefs about their condition, and the Hospital Anxiety and Depression scale (HADS). All patients were also assessed with the structured clinical interview for DSM-IV (SCID) and monitored with polysomnography.

Results: Individuals with subjective sleep complaints scored higher on the beliefs about the number of symptoms attributed to their complaint, and the negative consequences of it. Individuals with fatigue had a more negative illness perception (IP) regarding number of symptoms than those without fatigue. Both daytime sleepiness and fatigue were associated with lower scores on illness coherence. We found no relationship between IP and SDB. Anxiety and depression were significantly associated with identity and consequences, and the presence of current major depression was negatively associated with illness coherence.

Conclusion:
Illness perceptions were associated with subjective aspects of sleep, but not with objective measures of SDB. Aspects of illness perceptions were associated with anxiety and depression. Focusing on changing these perceptions might play a role not only in relation to treatment of sleep symptoms, but also in relation to anxiety and depression.

Introduction

In recent years there has been a growing interest in exploring patients’ beliefs about their complaints and illnesses. One of the most influential theories has been the self-regulation model of illness cognition and behavior developed by Leventhal and colleagues [1,2]. The Leventhal Self Regulation Model (LSRM) proposes that patients develop complex cognitive and emotional representations of their illnesses/complaints, termed illness perceptions [1]. The Illness Perception Questionnaire was developed as a measure to identify these cognitive representations/beliefs that patients have about their illness [1,3]. These illness perceptions directly influence the individual’s emotional response to the illness and their coping behavior. [4].

Illness perceptions are increasingly found to be related to important outcomes in a numbers of illnesses and complaints. Boot and colleagues [5] found that IP scores, especially high scores on consequences, in patients with chronic illnesses were significantly associated with non-employment and that self reported health was more strongly associated with work disability than the assessment of health status by the physician. In AMI patients’ high scores on the control/cure, and consequences dimensions, were found to significantly predict high attendance at cardiac rehabilitation, and to be associated with more depressive symptoms [6-8]. Also, low scores on the timeline and consequences dimensions significantly predicted faster return to work after AMI [7]. Furthermore, studies of patients with diabetes showed that targeting the patients’ illness beliefs, especially changes in term of more control/cure and coherence, were effective in improving their self management behaviors [9-10]. In patients with head and neck cancer, it has been found that more negative pretreatment IPQ-R scores (high scores on ‘identity’ and ‘timeline-cyclical’, and lower scores in regards of ‘cure’) were associated with a lower quality of life (QOL) score before treatment, and that the patients could be at risk of poorer adjustment to cancer therapy [11]. A similar relationship between IP
and QOL was reported in end-staged renal disease patients treated by hemodialysis. In this study, lower scores on the ‘timeline’ and ‘personal control’ dimensions were significantly associated with better QOL scores [12]. In patients with obstructive sleep apnoea syndrome (OSAS) higher scores on ‘identity’ and ‘personal control’ was significantly related to Continues Positive Airway Pressure (CPAP) compliance, those with higher scores being more compliant [13]. In depressive individuals, aspects of IP, like high scores on control/cure, were significantly associated with a higher likelihood of seeking help and a higher treatment response. [14]. Thus illness perception has been reported to affect treatment seeking, treatment response and outcome in various medical conditions.

To the best of our knowledge, we are not aware of any previous studies which have explored illness perception in individuals with subjective sleep complaints. This would be interesting to explore because if we find an association between IP and subjective sleep complaints, this could have important implications for management and treatment of people complaining about their sleep.

Sleep problems are common complaints. Population studies show that 10-20% of people suffer from severe or long term sleep problems. [15-17]. Subjective sleep complaints in SDB individuals comprise different entities such as insomnia, excessive daytime sleepiness and fatigue. Sleep Disordered Breathing is defined as having an AHI≥5 (Apnoea-Hypopnea Index), while Obstructive Sleep Apnoea (OSA) is defined as having an AHI≥15 [18-21]. This means that you stop breathing for more than 10 seconds – at least 5 times per hour during sleep [21-22.] It has been reported that 2-4% of the general population, aged 30-60 years, have this condition [18, 21, 23].

The most studied psychosocial factors related to SDB are symptoms of depression and anxiety. [24] Some studies have found significantly elevated rates of depression and/or anxiety compared with the general population, but rates range from 7-63% for depression, and 11-70% for anxiety [23, 25-30]. In patient groups with illnesses such as chronic fatigue syndrome and tuberculosis, raised depression and anxiety scores have been associated with higher scores of symptoms (IPQ-identity), more seriously perceived consequences and the perception of less control over illness [31-32].
With this background the aims of this study were to: (1) Describe illness perception in individuals with subjective sleep complaints and high risk of sleep disordered breathing and compare the results with those of other studies. (2) Study the relationship between illness perception and sleep disordered breathing, insomnia, daytime sleepiness and fatigue. (3) Study the relationship between illness perception, anxiety and depression in individuals with subjective sleep complaints.

**Methods**

*Individuals*

This study is a sub-study of the ‘Akershus sleep apnoea project’ (ASAP). Thirty thousand randomly selected men and women aged 30-65 received the Berlin Questionnaire (BQ) and additional questions per mail.

Of the 16302 responses, 1429 were excluded due to missing variables, missing contact information for re-contact, or response after the inclusion time limit. Thus the sample comprised 14873 individuals, of which 3661 were classified as BQ high risk according to defined criteria [33-34]. Of these 760 were randomly selected in oversampling groups. Of these 314 did not want (refused) to participate, 84 were not available for contact, 29 were excluded due to use of CPAP (n=9), not understanding the Norwegian language (n=4), not showing up (n=8), physical impairment (n=2), were pregnant (n=4), failure to sleep at all in the sleep laboratory (n=1) or misclassification as a BQ high risk subject (n=1). Of these 289 individuals, 223 reported subjective sleep complaints and were included in the present study.

*Measures*

The Berlin Questionnaire (BQ) is a 10-item self-report scale consisting of 3 categories that assesses the patients’ risk of having sleep disordered breathing [22, 33-34]. The classification into High Risk or Low Risk is based on the responses given to the individual items and the overall score in the symptom categories [33-34]. A subject is considered to be in high risk of having SDB if criteria for two or three out of the three risk groups are fulfilled.

*Subjective sleep complaints*

All of the 289 patients were asked the following question: “At the present time, do you feel you have any kind of difficulties with your sleep?” Those who answered yes to this question were included in the present study.
Demographic data and clinical characteristics
Self reported demographic data included age, sex, marital status, and education status. BMI was computed based on height and weight (kg/m^2) as measured in the clinical examination.

The Illness Perception Questionnaire-Revised (IPQ-R) (35) is a 38-item questionnaire which assesses the individuals’ cognitive representations of their sleep complaints by asking about their own beliefs about their condition [20]. It comprises seven subscales [4, 11, 36-37]: (1) Identity: The number of defined symptoms that the patient sees as part of their illness. (Ex: fatigue, dizziness, muscle pain). (2) Timeline: How long the patient believes the illness may last (acute, chronic). (3) Timeline-cyclical: The patients’ belief about their illness having a cyclical nature (season variations). (4) Consequences: The expected outcome of the complaint (seriousness of the condition). (5) Personal control: Thought about the patients’ own ability to cure/control the complaint. (6) Treatment control: Thoughts about the treatments ability to cure/control the complaint. (7) Illness coherence: The degree of which patients believe they have a personal understanding of their illness. High scores on the identity, timeline, consequences, and cyclical dimensions represent strongly held beliefs about the number of symptoms attributed to the illness, the chronicity of the condition, the negative consequences of the illness, and the cyclical nature of the condition. High scores on the personal control, treatment control and coherence dimensions, represent positive beliefs about the controllability of the illness and a personal understanding of the condition. [38]. Mean subscale scores were computed with higher scores denoting greater endorsement of the given construct. The IPQ-R has been translated to Norwegian by the application of international guidelines for translation [35, 38-39].

Sleep
Polysomnography (PSG)
All individuals were monitored with standard, multi channel, Embla TM, polysomnography devices. Apnoeas were scored when airflow dropped below 20% of the reference amplitude for more than 10 seconds. Hypopnoea was scored when airflow dropped below 70% for more than 10 seconds with subsequent oxygen desaturation of 4%. The AHI was calculated as the average of total numbers of apnoeas and hypopnoeas identified per hour of sleep. The AHI index was sub-grouped into AHI <5, ≥5-14.9, ≥15-29.9 and ≥30.
Sleep disordered breathing was defined as having an AHI $\geq 5$ in subjects who scored high on the BQ.

All individuals were monitored overnight at Stensby Hospital. Aspects of their sleep were scored using a polysomnography device according to specific criteria, described in more detail elsewhere [40]. Clinical and study assessments were conducted prior to the procedures.

**Bergen Insomnia Scale (BIS)** is a six item instrument that assesses insomnia [41]. It has recently been developed and validated in a student sample, a community sample and a patient sample of subjects referred to a sleep clinic (Ståle Pallesen, submitted).

BIS can be scored either as a continuous global score or by dichotomizing the scale (Ståle Pallesen, personal communication). The cut-off score for insomnia was set at $>14$.

**The Epworth Sleepiness Scale (ESS)** [42-45] is an 8-item self administered questionnaire which gives a measure of daytime drowsiness. Scores range from 0-24, with higher scores indicating more sleepiness. ESS score 2-10 is considered ‘normal’ and $>10$ indicative of pathological sleepiness [23, 43]. Thus cut-off for daytime sleepiness was set at $>10$. It’s a useful test to help diagnose sleeping problems – and to see if a patient’s symptoms might be caused by sleep apnoea. [42-45]

**The Fatigue Questionnaire (FQ)** is an eleven item instrument used to assess the severity of fatigue [46-47]. It comprises 7 items related to physical symptoms, and 4 items related to mental symptoms of fatigue. It can be scored using a Linkert-type scale with score range of 0-3 on each item. Giving a total score range of 0-33, with high score indicating more fatigue [46]. The cut-off score for fatigue was set at $>14$.

**Depression and anxiety**

The Hospital Anxiety and Depression Scale (HADS) is a 14-item self report questionnaire for depression and anxiety [48-50]. Depressive symptoms and anxiety symptoms were each measured through seven items rated on a four-point Likert-type scale. Scores on both subscales range from 0-21, with higher scores indicating more symptoms of anxiety and depression. A score $\leq 7$ was interpreted as normal, 8-10 represents moderate symptomatology and a score $\geq 11$ represent clinical significant symptomatology [23].
The Structured Clinical Interview for DSM-IV, axis I-disorders (SCID) was used to obtain psychiatric diagnoses [51]. All interviews were conducted by one trained physician (HHS) and taped. Forty randomly selected interviews performed by HHS were drawn and independently scored by TD. Cohens Kappa for agreements was calculated for the following diagnoses: Current major depression (CMD) and previous major depression (PMD): 1.0, and at least one current anxiety disorder: 0.95. In order to have statistical power to examine differences between groups of psychiatric disorders, current anxiety disorders except specific phobia were merged to the category “any current anxiety disorder” (ACAD).

Further details on the Methods and Material are described elsewhere [40].

**Ethics**

The study protocol was approved by the regional ethics committee.

**Statistical analysis**

The independence Student’s t-test, the chi-square test or Fischer’s exact test were used to test for group differences for continuous and categorical variables respectively.

The Pearson r correlation coefficient (r) was used to test correlation between the variables IPQ-R, HADS, ‘Current major depression’, ‘previous major depression’, ‘any current anxiety disorder’, and scores on the subjective sleep entities (BIS, ESS, FQ).

One-way between-groups ANOVA with post-hoc test was used to test for differences in the mean scores between the four AHI-index groups (<5, ≥5-14.9, ≥15-29.9 and ≥30).

We chose a 95% confidence interval on the analyses. All reported p-values are two-tailed with a p-value of <0.05 considered as statistically significant.

Data were analyzed by SPSS 16.0 for Windows [52].
Results

Subject Characteristics
The characteristics of the 223 individuals with subjective sleep complaints are shown in table 1. Compared to those without sleep complaints, those with subjective sleep complaints reported significantly higher scores on BIS, ESS and FQ. They also reported more frequent use of sleep medication. The prevalence of current major depression, previous major depression and any current anxiety disorder were significantly higher in those with sleep complaints than those without (table 1). There were no significant differences between the groups in regards of age, BMI, sex, median AHI, prevalence of sleep disordered breathing and scores on the HADS-scale.

Illness perception in individuals with subjective sleep complaints and high risk of SDB and comparison with the results of those of other studies (aim1).
Scores are presented in table2 [5, 9, 11, 35, 53-54].
We found that people with SSC attribute more symptoms to their illness than people with head and neck cancer (cancer) and acute pain. They attribute about the same amount of symptoms as people with sleep disordered breathing (SDB).

They consider their complaint to be more chronic, and of a more cyclical nature than those who suffer from cancer and acute pain, and to be as chronic as those who suffer from SDB, Diabetes Mellitus (DM) and Chronic Fatigue Syndrome (CFS).

Furthermore they perceive their sleep problems to have more severe consequences than those who suffer from chronic illness and acute pain. They score around the same level on ‘consequences’ as those suffering from SDB, DM and atopic dermatitis (AD).

People with SSC experience a higher level of treatment control than those suffering from DM, chronic pain and chronic illness. They experience a level of treatment control
similar to patients with SDB, Rheumatoid arthritis (RA), CFS and AD, and they experience a level of personal control similar to those suffering from SDB, cancer and chronic pain.

They understand their complaints better than those with chronic and acute pain, cancer and CFS. They have around the same level of coherence as patients with SDB, DM and AD.

Thus, we found the IPQ-R scores of people with SSC to be about the same level as for those suffering from SDB, DM, AD and chronic illness. They reported more negative IPQ-R scores on most dimensions than patients suffering from acute pain and cancer, while compared with patients who suffer from chronic pain, RA and CFS, they have a more positive IPQ-R score.

The relationship between illness perception and sleep disordered breathing, insomnia, daytime sleepiness and fatigue (aim2).

We found significant positive correlations between scores of various aspects of subjective sleep complaint (insomnia, excessive daytime sleepiness and fatigue) and IPQ scores of ‘identity’ and ‘consequences’. Insomnia and fatigue correlated significantly with the ‘timeline’ variable, while both excessive daytime sleepiness and fatigue correlated negatively with the scores of ‘illness coherence’. These results are shown in Table 3A.

This means that the higher insomnia, daytime sleepiness, and fatigue scores patients have, the more symptoms they attribute to their complaint, and the more severe they consider their illness to be. Also high scores on insomnia and fatigue correlate with the belief of this being a chronic illness. As the daytime sleepiness and fatigue scores rise, the understanding of their illness tends to decline.

When BIS was dichotomized into high scores (insomnia) and low scores (no insomnia), no differences were found between the groups regarding mean scores on IPQ domains (table 3B). Those in the excessive daytime sleepiness (EDS) group scored significantly higher on ‘consequences’, and lower on ‘illness coherence’ compared with those not having EDS. People with fatigue reported more symptoms, more severe consequences of their illness, and a more chronic timeline, as shown in Table 3B. Thus people with EDS have beliefs about more negative consequences of their illness, while those with fatigue have more negative illness perceptions than those not complaining of fatigue.

No associations were found between IPQ scores and the presence of sleep disordered breathing (SDB) (table 3A). Furthermore, we did not find any significant difference between
the AHI groups regarding IPQ-R scores. The results are shown in table 3C. Thus we found no relation between SDB and illness perception.

The relationship between illness perception, anxiety and depression in individuals with subjective sleep complaints (aim3).

HADS anxiety score was positively correlated with ‘illness identity’ (r=.21, p<0.05) and ‘consequences’ (r=.19, p<0.01). HADS depression score was positively correlated with ‘illness identity’ (r=.22, p<0.01) and ‘consequences’ (r=.35, p<0.01), and negatively correlated with ‘illness coherence’ (r=-.20, p<0.01). As shown in Table 4.

Current major depression was positively correlated with ‘illness identity’ and ‘consequences’, and negatively correlated with ‘illness coherence’, while previous major depression and any current anxiety disorder correlated both positively to ‘Illness identity’, and ACAD also correlated positively with ‘Consequences’.

Thus we found an association between higher scores or the presence of anxiety and depression and increasing number of symptoms and more seriously perceived consequences of the illness. The presence of current major depression also correlated significantly with a lesser ability to understand the subjective sleep symptoms.
Discussion

The aims of the present study were to:

(1) Describe illness perception in individuals with subjective sleep complaints and high risk of sleep disordered breathing, and compare the results with those of other studies.

One main finding was that the IPQ-R scores of people with subjective sleep complaints were within the same range as for those who suffer from sleep disordered breathing, diabetes, atopic dermatitis and chronic illness. However, the SSC individuals reported more negative IPQ-R scores on most dimensions than patients suffering from acute pain and cancer, while compared with patients who suffer from chronic pain, RA and CFS they have a more positive IPQ-R score on almost all dimensions.

People with SSC perceive their complaint to be as severe and chronic as those with diabetes. They perceive that they have the similar levels of personal control over their complaint as those who suffer from cancer and chronic pain. The scores of treatment control are in the same range as those reported by RA and CFS patients. They feel they understand their complaint as good as diabetics and atopic dermatitis patients.

Thus, our results indicate that individuals with SSC perceive their complaints as a chronic, severe, condition, which they have a good understanding of – compared to individuals with other illnesses/complaints.

(2) Study the relationship between illness perception and sleep disordered breathing, insomnia, daytime sleepiness and fatigue.

Individuals who scored higher on the subjective sleep complaint entities reported higher number of symptoms attributed to the illness, more chronicity of the condition, and more negative consequences of the illness.

There were no significant differences in IPQ scores between those with or without insomnia. Individuals with daytime sleepiness reported perception of more negative
consequences of their illness, while individuals classified with fatigue had a more negative illness perception than those without fatigue. Individuals scoring high on daytime sleepiness and fatigue had a poorer comprehension of their illness than those scoring lower.

It is somewhat expected that people with fatigue score higher on the IPQ-R scores (higher number of symptoms and negative consequences) than those without fatigue. But, we did not find such a relationship for individuals with insomnia. Although we found some significant correlations between insomnia and aspects of IP – these were lower than those found for fatigue. Thus, insomnia does not affect peoples’ perception of their sleep complaints to the same degree, as is that found for fatigue. Our results indicate that different aspects of IP may be specifically related to various entities of sleep complaints. Further studies should elucidate the relationship between fatigue and negative perception about sleep complaints. Is a higher score of number of symptoms rather related to fatigue symptoms than sleep complaints. The analysis should be controlled for confounders such as anxiety and depression.

(3) Study the relationship between illness perception, anxiety and depression in individuals with subjective sleep complaints

Raised anxiety and depression scores correlated with higher held beliefs about the number of symptoms attributed to the illness and the negative consequences of it. The presence of a current mood disorder was associated with higher scores and negative consequences, thus it may make people perceive their sleep complaints as more severe. Individuals with a current depression had a poorer understanding of their illness than those scoring lower. This is what we may expect, because it is well known that mood influence on peoples' perception in a way that they tend to focus more on symptoms and have more negative beliefs [14]. The finding is, however, important new knowledge because it indicates that this aspect of illness perception should be addressed in persons with both sleep complaints and depressive disorder. Although the relationship between sleep disorders and psychiatric illnesses still is not fully understood [55], the findings suggest that future prospective studies should explore the relationship between depression and illness perception in more detail in order to explore if it is the mood/anxiety disorder that causes the individuals’ perceptions of sleep complaints, or vice versa.

Strengths and limitations

The strengths of this study are that we used validated and comprehensive psychometrically sound assessment instruments of various aspects of subjective sleep complaints, and that we
used both questionnaires and diagnostic assessments of anxiety and depression [46, 56-57]. All individuals underwent polysomnography.

However, one limitation was the use of the BQ in assessing people with risk of having SDB. This scale has yet to be validated in the general population, and although it has a sensitivity around 80%, the specificity has been shown to be as low as under 30% [58]. In a study by Ahmadi et al [58] the need of further studies to determine the reliability of the BQ in identifying people with undiagnosed sleep apnoea has been emphasized.

Another limitation is the fact that out of a sample of 16302 individuals who responded to the BQ, we ended up with a study sample of only 223. We do not know if these are representative of the population in general or of clinical samples of patients with sleep complaints.

We did not control for confounders when assessing the relationship between illness perceptions and subjective sleep complaints

Because the study is cross-sectional, we do not know the time sequence between e.g. depression and illness perceptions. Therefore no conclusions can be drawn regarding the cause of IP in eg. persons with depression.

We did not apply statistical analysis to test for significant differences between the different patient groups as related to the first aim of the study. However it was interesting to compare the mean IPQ-R scores in patients with subjective sleep complaints to those of other illnesses/complaints in regards of trying to understand the IP of our group with subjective sleep complaints.

**Interpretation and Conclusion**

Subjective sleep complaints were related to a stronger belief about chronicity and perceptions of more negative consequences of the complaints. The highest correlation was found between fatigue and negative illness perception (r=0.4, p=<0.001), but all correlations were considered low - to moderate. We found no significant relation between SDB and IP.

Persons with depression and anxiety had more negative perceptions of number of symptoms and consequences.

In our study we found IP scores of specific dimensions to be differently associated with various subjective sleep complaint entities. On the contrary, we found no association between SDB (BQ high risk) and illness perception scores on any dimension. This is an interesting finding because it emphasizes that it is the individuals own perceptions of health that influence their IP, and not the health objectively measured by the doctors.
Petrie et al. have shown that illness perception influence patients’ behaviors, and that changing these may improve recovery [59]. Another study has shown that negative IP is associated with increased use of healthcare and poorer recovery [60]. These may all be improved if the individuals’ IP is modified. It’s the subjective perception that matters in our sample of BQ high risk individuals – and we should there for as health care workers be more aware of the point that it is not what we objectively measure that matters the most to our patients in regards of their IP, and that assessing their perceptions and trying to work with them in changing these might improve, not only their QOL and illness per se, but also maybe their mood disorder.
References


37. The Illness Perception Questionnaire Website. (). Downloaded on 15th of August, 2008, from www.uib.no/ipq/


40. Referanse til metode artikkelen til HHS


Abbreviation list

- **BQ**: The Berlin Questionnaire
- **SDB**: Sleep Disordered Breathing
- **IPQ-R**: The Illness Perception Questionnaire – Revised.
- **HADS**: The Hospital Anxiety and Depression Scale
- **SCID**: The Structured Clinical Interview for DSM-IV, axis I disorders.
- **IP**: Illness Perception
- **LSRM**: The Leventhal Self Regulation Model
- **QOL**: Quality of life
- **OSAS**: Obstructive Sleep Apnoea Syndrome
- **CPAP**: Continues Positive Airways Pressure.
- **AHI**: Apnoea–Hypopnea Index
- **BMI**: Body mass index
- **PSG**: Polysomnography
- **BIS**: Bergen Insomnia Scale
- **ESS**: The Epworth Sleepiness Scale
- **FQ**: The Fatigue Questionnaire
- **CMD**: Current major depression
- **PMD**: Previous major depression
- **ACAD**: Any current anxiety disorder.
- **DM**: Diabetes Mellitus
- **RA**: Rheumatoid Arthritis
- **AD**: Atopic Dermatitis
- **CFS**: Chronic Fatigue Syndrome
Figure 1: Flow-chart of sample selection
Table 1: Subject characteristics

<table>
<thead>
<tr>
<th>Subjective sleep</th>
<th>Sample without subjective sleep</th>
<th>p-</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>complaints (n=223)</td>
<td>complaint (n=66)</td>
</tr>
<tr>
<td>------------------------------</td>
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</tr>
<tr>
<td><strong>Demographics</strong></td>
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</tr>
<tr>
<td>Female gender (%)</td>
<td>103 (46,2)</td>
<td>24 (36,4)</td>
</tr>
<tr>
<td>Mean age (sd)</td>
<td>47,7 (10,8)</td>
<td>49,6 (12,4)</td>
</tr>
<tr>
<td>Age ≥50 (%)</td>
<td>111 (49,8)</td>
<td>36 (54,5)</td>
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<tr>
<td><strong>Clinical characteristics</strong></td>
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<td></td>
</tr>
<tr>
<td>Mean BMI (sd)</td>
<td>30,0 (5,5)</td>
<td>29,9 (4,3)</td>
</tr>
<tr>
<td>Current smoker (%)</td>
<td>23 (15,3)</td>
<td>5 (9,8)</td>
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<tr>
<td>Use of sleep medication (%)</td>
<td>14 (6,3)</td>
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<tr>
<td>Use of antidepressants (%)</td>
<td>19 (8,5)</td>
<td>3 (4,5)</td>
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<td><strong>Objective sleep variables</strong></td>
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<tr>
<td>Mean AHI (sd)</td>
<td>15,9 (19,8)</td>
<td>18,4 (21,4)</td>
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<tr>
<td>Median AHI</td>
<td>7,0</td>
<td>8,5</td>
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<td>AHI ≥5 (%)</td>
<td>131 (58,7)</td>
<td>44 (66,7)</td>
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<tr>
<td>AHI ≥15 (%)</td>
<td>77 (34,5)</td>
<td>27 (40,9)</td>
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<tr>
<td><strong>Subjective sleep variables</strong></td>
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</tr>
<tr>
<td>Mean BIS (sd)</td>
<td>18,8 (8,6)</td>
<td>9,3 (6,9)</td>
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<tr>
<td>Mean ESS (sd)</td>
<td>10,2 (4,1)</td>
<td>6,9 (3,5)</td>
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<tr>
<td>ESS &gt;10 (%)</td>
<td>107 (48,2)</td>
<td>9 (13,6)</td>
</tr>
<tr>
<td>Mean FQ (sd)</td>
<td>15,8 (4,8)</td>
<td>12,4 (4,8)</td>
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<td><strong>Psychiatric measures</strong></td>
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<tr>
<td>HADS-A ≥11 (%)</td>
<td>22 (9,9)</td>
<td>2 (3,0)</td>
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<td>HADS-D ≥11 (%)</td>
<td>18 (8,1)</td>
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<td>CMD (%)</td>
<td>34 (15,2)</td>
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<td>PMD (%)</td>
<td>70 (31,4)</td>
<td>11 (16,7)</td>
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<tr>
<td>ACAD (%)</td>
<td>41 (18,4)</td>
<td>2 (3,0)</td>
</tr>
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</table>

1Body Mass Index. 2Apnoea-Hypopnea Index. 3Bergen Insomnia Scale. 4Epworth Sleepiness Scale. 5Fatigue Questionnaire. 6Hospital Anxiety and Depression Scale – Anxiety score. 7Hospital Anxiety and Depression Scale – Depression score. 8Current Major Depression. 9Previous Major Depression. 10Any Current Anxiety Depression.

**Table 2:** Illness Perception Questionnaire Revised (IPQ-R) score in subjective sleep complaints, sleep disordered breathing and various illnesses/complaints, presented with mean and SD.
<table>
<thead>
<tr>
<th>Identity</th>
<th>SSC</th>
<th>SDB</th>
<th>DM</th>
<th>RA</th>
<th>CFS</th>
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<tr>
<td>3.41 (2.38)</td>
<td>3.29 (2.54)</td>
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<td>7.26 (0.36)</td>
<td>9.3 (0.49)</td>
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<tr>
<td>20.46 (4.24)</td>
<td>20.85 (4.17)</td>
<td>21.0 (4.6)</td>
<td>23.38 (0.58)</td>
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<td>12.41 (3.04)</td>
<td>12.17 (3.19)</td>
<td>11.2 (3.4)</td>
<td>13.82 (0.39)</td>
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<td>17.16 (4.17)</td>
<td>17.27 (3.97)</td>
<td>17.7 (4.5)</td>
<td>21.38 (0.56)</td>
<td>24.48 (0.71)</td>
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</tr>
<tr>
<td>18.48 (3.87)</td>
<td>18.53 (3.74)</td>
<td>22.4 (3.8)</td>
<td>19.97 (0.51)</td>
<td>22.05 (0.66)</td>
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</tr>
<tr>
<td>16.68 (2.45)</td>
<td>16.58 (2.44)</td>
<td>15.7 (2.9)</td>
<td>16.69 (0.42)</td>
<td>16.78 (0.54)</td>
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</tr>
<tr>
<td>16.25 (3.78)</td>
<td>16.50 (3.54)</td>
<td>15.9 (4.6)</td>
<td>16.82 (0.61)</td>
<td>15.56 (0.77)</td>
<td></td>
</tr>
</tbody>
</table>

**SSC:** Subjective Sleep Complaints. **SDB:** Sleep Disordered Breathing. **DM:** Diabetes Mellitus. **RA:** Rheumatoid Arthritis. **CFS:** Chronic Fatigue Syndrome.

<table>
<thead>
<tr>
<th>Identity</th>
<th>Head &amp; neck cancer</th>
<th>Chronic illnesses</th>
<th>Atopic dermatitis</th>
<th>Chronic pain</th>
<th>Acute pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.32 (2.49)</td>
<td>-</td>
<td>4.1(2.47)</td>
<td>6.19(2.40)</td>
<td>2.81 (1.73)</td>
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</tr>
<tr>
<td>17.12 (4.35)</td>
<td>25.62 (4.56)</td>
<td>23.53 (4.87)</td>
<td>23.12 (4.41)</td>
<td>13.40 (5.38)</td>
<td></td>
</tr>
<tr>
<td>9.92 (3.06)</td>
<td>12.24 (3.80)</td>
<td>14.16 (3.08)</td>
<td>12.87 (3.89)</td>
<td>9.37 (2.58)</td>
<td></td>
</tr>
<tr>
<td>19.43 (4.28)</td>
<td>15.18 (4.80)</td>
<td>16.91 (6.33)</td>
<td>23.45 (3.89)</td>
<td>14.23 (4.44)</td>
<td></td>
</tr>
<tr>
<td>18.77 (3.78)</td>
<td>19.2 (4.68)</td>
<td>21.41 (4.53)</td>
<td>18.42 (4.01)</td>
<td>22.94 (3.52)</td>
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</tr>
<tr>
<td>17.46 (2.86)</td>
<td>15.9 (3.30)</td>
<td>16.64 (3.79)</td>
<td>14.22 (3.36)</td>
<td>19.43 (3.28)</td>
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</tr>
<tr>
<td>15.79 (3.78)</td>
<td>20.00 (3.75)</td>
<td>16.05 (5.30)</td>
<td>13.37 (4.78)</td>
<td>9.31 (3.00)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3A:** Pearson’s correlations coefficients (r), and p-values, showing the association between illness perception and the different entities of subjective sleep complaint.
Table 3B: Means (sd) and t-test between different entities of subjective sleep complaint, sleep disordered breathing and the Illness Perception Questionnaire Revised variables.

Table 3C: One-way between-groups ANOVA with post-hoc tests analysis between the Apnoea-Hypopnea-Index (AHI) groups and Illness Perception Questionnaire Revised variables.

Table 4: Pearson’s correlations coefficients (r), and p-values, showing the association between mood and illness perceptions in individuals with subjective sleep complaint
<table>
<thead>
<tr>
<th>Variable</th>
<th>Current major depression</th>
<th>Previous major depression</th>
<th>Any current anxiety disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity</td>
<td>(r)=0.36, p=&lt;0.001</td>
<td>(r)=0.16, p=0.045</td>
<td>(r)=0.32, p=&lt;0.001</td>
</tr>
<tr>
<td>Time-line</td>
<td>(r)=-0.04, p=0.580</td>
<td>(r)=-0.02, p=0.828</td>
<td>(r)=0.07, p=0.289</td>
</tr>
<tr>
<td>Time-line cyclical</td>
<td>(r)=0.05, p=0.474</td>
<td>(r)=0.07, p=0.359</td>
<td>(r)=0.01, p=0.893</td>
</tr>
<tr>
<td>Consequences</td>
<td>(r)=0.27, p=&lt;0.001</td>
<td>(r)=0.03, p=0.653</td>
<td>(r)=0.21, p=0.002</td>
</tr>
<tr>
<td>Personal control</td>
<td>(r)=-0.02, p=0.804</td>
<td>(r)=-0.04, p=0.524</td>
<td>(r)=0.10, p=0.135</td>
</tr>
<tr>
<td>Treatment control</td>
<td>(r)=0.07, p=0.305</td>
<td>(r)=-0.08, p=0.273</td>
<td>(r)=0.02, p=0.765</td>
</tr>
<tr>
<td>Illness coherence</td>
<td>(r)=-0.19, p=0.006</td>
<td>(r)=0.03, p=0.684</td>
<td>(r)=-0.07, p=0.298</td>
</tr>
</tbody>
</table>

HADS: Hospital Anxiety and Depression Scale