Chronic sleep reduction in adolescents

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Publication date
2012

Citation for published version (APA):

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“Think in the morning. Act in the noon. Eat in the evening. Sleep in the night.

-William Blake-
Chapter 4

Measuring sleep deficit through self-report: Development and validation of the Chronic Sleep Reduction Questionnaire-Short Form (CSRQ-SF)

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Under review
Abstract

Chronic sleep reduction, resulting from insufficient and/or poor sleep over a long time period, is a common phenomenon in adolescents. Due to its severe negative psychological and behavioural daytime consequences, it is important to have a short reliable and valid measure of chronic sleep reduction. Therefore, this study aims to develop and validate a short version of the Chronic Sleep Reduction Questionnaire. Different samples from the general population and clinical cases were included in the study. Principal Components Analysis and item-total correlations were used to develop the Chronic Sleep Reduction Questionnaire-Short Form (CSRQ-SF). The questionnaire was validated by calculating correlations with self-reported and objective sleep and daytime functioning and by determining its discriminant validity. Internal consistencies of the CSRQ-SF were good. Correlations with self-reported sleep, daytime functioning and objective sleep variables were similar to the correlations with the original questionnaire. Furthermore, the CSRQ-SF can discriminate well between clinical and non-clinical cases. The CSRQ-SF appears to be a reliable and valid questionnaire. Due to the limited number of items and the availability of cut-off scores, it is a practical tool for clinical and research purposes.
4.1. Introduction

Chronic sleep reduction, resulting from insufficient and/or poor sleep over a long time period, is a common phenomenon in adolescents (Loessl et al., 2008; Meijer, 2008) which can have severe negative psychological and behavioural daytime consequences (e.g. behavioural problems, poor emotional wellbeing, impaired cognitive and school performance) (Curcio et al., 2006; Dewald et al., 2010; Fallone et al., 2002; Mitru et al., 2002; Moore et al., 2009; Wolfson & Carskadon, 2003). To date, most studies have used shortened or restricted sleep during a few nights to effectuate and operationalise sleep reduction (Roberts et al., 2010; van Dongen et al., 2003a). Although this is an interesting and worthy approach, it may miss the aspect of chronicity, which can develop only over a longer time period during which insufficient and/or poor sleep occurs.

Therefore, Meijer (2008) developed the Chronic Sleep Reduction Questionnaire (CSRQ) which measures symptoms of insufficient and/or poor sleep rather than assessing (shortened) sleep duration directly. In this questionnaire, symptoms are clustered into four subscales: Shortness of Sleep, Sleepiness, Loss of Energy and Irritation. Assuming that symptoms will only develop after chronic sleep reduction has occurred for a longer time period (e.g. a few weeks), the CSRQ enables to study the aspect of chronicity. An additional advantage of this assessment approach refers to the idea that it interprets insufficient sleep, leading to sleep debt, in reference to one’s individual sleep need. This is important as several studies demonstrated large individual differences in sleep need (Anderson et al., 2009; Mercer et al., 1998, van Dongen et al., 2003b).

The CSRQ appears to be a reliable questionnaire (Meijer, 2008) and Dutch and English versions have recently been validated against actigraphy data (Dewald et al., 2012). In this previous study differential relationships of the four subscales with sleep variables have been reported. This difference applies especially to the subscale Irritation, suggesting that irritation is not a universal symptom of chronic sleep reduction that can be observed in all adolescents (Dewald et al., 2012).

The aim of the present study is twofold. First, we aim to develop a short version of the CSRQ which only measures universal symptoms of chronic sleep reduction (CSRQ-SF). Second, we will validate the CSRQ-SF by calculating correlations with self-reported and objective sleep data (actigraphy) as well as with daytime functioning. We will examine whether the CSRQ-SF can discriminate between clinical and non-clinical cases and determine cut-off scores. Developing a brief and valid tool with excellent discriminability will be clinically significant for therapists in clinical practice (Morin, 2003).
4.2. Method

4.2.1. Sample

4.2.1.1. Samples from the general population

951 adolescents (41.3 % boys, mean age 14.7 years) from the general population completed online questionnaires on chronic sleep reduction, sleep quality, daytime sleepiness, sleep disorders (insomnia, circadian rhythm sleep disorders), depression, attention problems and school performance. Adolescents were recruited from four different schools around Amsterdam. These data were used for the development of the CSRQ-SF, as well as for its validation (correlations with daytime functioning and subjective sleep variables, discrimination between clinical and non-clinical groups, and cut-off scores).

For calculating the correlations with the actigraphy data, we used data from 166 Dutch (28 % boys, mean age 15.2 years) and 236 Australian (65 % boys, mean age: 15.5 years) adolescents that have been described elsewhere (Dewald et al., 2012).

4.2.1.2. Clinical samples

To investigate criterion validity, we included the following two clinical samples:

4.2.1.2.1. Delayed Sleep Phase Syndrome (DSPS).

116 adolescents (55.2 % boys, mean age 15.4 years) who were referred to the Centre for Sleep–Wake Disorders and Chronobiology of Hospital Gelderse Vallei in Ede, the Netherlands, were diagnosed with Delayed Sleep Phase Syndrome (DSPS; mean Dim Light Melatonin Onset = 22:23 h). All adolescents completed the CSRQ before they started melatonin treatment.

4.2.1.2.2. Insomnia

66 adolescents (19.7 % boys, mean age 15.1 years) who received cognitive behavioural therapy for their sleep onset and maintenance problems, completed the CSRQ prior to treatment. Adolescents were included in the study after a clinical interview indicated insomnia (sleep onset and/or maintenance problems).

4.2.2. Measurements

4.2.2.1. Chronic sleep reduction

The CSRQ (Meijer, 2008) was administered in all samples to measure chronic sleep reduction. This 20-item questionnaire consists of the following four subscales: ‘Shortness of Sleep’ (6 items; e.g. ‘I am a person who does not get enough sleep’), ‘Sleepiness’ (4 items; e.g. ‘Do you feel sleepy during the day?’), ‘Loss of Energy’ (5 items; e.g. ‘I am active during
the day’) and ‘Irritation’ (5 items; e.g. ‘Others think that I am easily irritated’), and refers to the previous two weeks (see Table 1 for a full list of items). Each question has three ordinal response categories with higher scores indicating more chronic sleep reduction. The total CSRQ scale consists of the sum of the four subscales, with a Cronbach’s alpha of .84 (Meijer, 2008) (see Results section for Cronbach’s alphas in the present study).

4.2.2.2. Sleep quality

Sleep quality was assessed by a sleep quality questionnaire (Meijer & van den Wittenboer, 2004). This questionnaire consists of seven items with five-point response scales measuring problems with falling asleep, maintaining sleep, reinitiating sleep and waking up (e.g. ‘I felt well rested when I woke up this morning’). Meijer and van den Wittenboer (2004) reported a Cronbach’s alpha of .67. Cronbach’s alpha in the present study was .74.

4.2.2.3. Daytime sleepiness

Daytime sleepiness was measured using a paediatric modification of the Epworth Sleepiness Scale (ESS) (Johns, 1991). In this eight-item questionnaire, adolescents rate on a four-point Likert scale how likely they are to doze in different situations (e.g. ‘Sitting and reading’; ‘Watching TV’). Various modifications have been used in paediatric populations (Gibson et al., 2006; Anderson et al., 2009). For this study, the last item ‘In a car while stopped for a few minutes in traffic’ was replaced with ‘Doing homework or taking a test’. This change was adapted from previous research which reported a Cronbach’s alpha of .74 (Anderson et al., 2009). Cronbach’s alpha in the present study was also .74.

4.2.2.4. Insomnia

Insomnia was assessed with the insomnia subscale of the Holland Sleep Disorder Questionnaire (HSDQ) (Kerkhof et al., 2012) measuring different sleep disorders. It consists of seven items (e.g. ‘The quality of my sleep is poor and I do not feel rested when waking up’) which have to be rated on a five-point Likert Scale. One item that also measures narcolepsy (‘During daytime I may perform ‘on the automatic pilot’, without any recollection of the event’) was excluded in the present study. Cronbach’s alpha reported by Kerkhof et al. (2012) was .91. In the present study Cronbach’s alpha was .86.

4.2.2.5. Circadian rhythm sleep disorder (CRSD).

CRSD was measured with the CRSD subscale of the HSDQ (Kerkhof et al., 2012). This subscale consists of six items (e.g. ‘I usually fall asleep in the morning hours. In the morning
I have trouble to wake up on time. I sleep in during the weekend which have to be rated on a five-point Likert Scale. Cronbach’s alpha was .81 in the study of Kerkhof et al. (2012). Cronbach’s alpha in the present study was .78.

4.2.2.6. Depression

Depression was assessed with the Dutch version of the Children’s Depression Inventory (CDI) (Kovacs, 2002), which is based on the Beck Depression Inventory (BDI) (Beck et al., 1961) for adults. Most CDI items cover similar content and symptom areas, however, some additional items have been added to the CDI in order to cover areas of school, aggression and other social-peer relations. The CDI includes 27 items, each consisting of three statements that are graded in severity (e.g. ‘I am sad once in a while’; ‘I am sad many times’; ‘I am sad all the time’). The higher the assigned value (ranging from 0 to 2), the more severe the symptom. The total score can range from 0 to 54. Cronbach’s alpha of the Dutch CDI version was .80 (Kovacs, 2002). Cronbach’s alpha in the present study was .85.

4.2.2.7. Attention problems

Attention problems were measured with the attention problems subscale of the Youth Self-Report (YSR) (Verhulst et al., 1997). This scale consists of nine items (e.g. ‘I find it difficult to concentrate and to keep paying attention’) which have to be rated on three-point Likert Scales. Cronbach’s alphas ranging from .57 to .68 have been found for different age groups in healthy children. Cronbach’s alpha in the present study was .74.

4.2.2.8. School performance

Participants were asked about the grades that they mostly received at school ('Which grade do you usually receive at school?'). Answers consist of five categories ranging from ‘4 or lower’ (reflecting a clear ‘fail’ in the Netherlands) to ‘9/10’ (the highest grades that can be achieved in the Netherlands).

4.2.2.9. Actigraphy

Actigraphy involves use of a wristwatch-like portable device that can record movements over an extended period of time (e.g. a few weeks). Actigraphy is known to be a reliable and valid measure to study sleep in a natural environment (Kushida et al., 2001; Morgenthaler et al., 2007). In the present study we used the following sleep parameters from five consecutive school nights (Sunday to Thursday night): (a) sleep onset latency: time between bedtime and sleep onset, (b) sleep duration: time between sleep onset and sleep offset, (c) total
sleep time: number of minutes that adolescents actually slept (i.e. the time between sleep onset and sleep offset minus wake after sleep onset) and (d) sleep efficiency (i.e. 100 x (total sleep time/time in bed)): percentage of uninterrupted night sleep (see Dewald et al., 2012 for more information on the data collection and analysis).

4.2.3. Statistical analyses

4.2.3.1. Development of the CSRQ-SF

To develop the CSRQ-SF, we used the data from the general population (N=951). Items were excluded from the original CSRQ in a stepwise procedure, taking both content and statistics into account. Statistical decisions were based on Principal Components Analysis (PCA) and corrected item-total correlations. To warrant the content validity of the CSRQ-SF, we aimed to include an equal number of items for each included subscale.

4.2.3.2. Validation of the CSRQ-SF

To test whether the CSRQ-SF has similar psychometric properties as the original questionnaire, we first calculated internal consistencies (Cronbach’s alphas). Correlations with different aspects of self-reported sleep (e.g. sleep quality) and daytime functioning (e.g. depression) are reported to give an indication of the validity. Furthermore, we calculated correlations with actigraphy data of five consecutive school nights (Sunday to Thursday night).

In order to further validate the CSRQ-SF we examined whether the CSRQ-SF could discriminate between clinical and non-clinical cases. To determine cut-off scores, Receiver Operating Characteristic (ROC) curves were used. ROC curves graphically depict the proportions of true positives (the ‘sensitivity’ of the questionnaire, i.e. the probability of a positive test result if the clinical diagnosis is positive) against the proportions of false positives (i.e. the probability of a positive test result if the clinical diagnosis is negative, expressed as ‘1-specificity’). The area under the curve (AUC) indicates the probability that a person is correctly classified by the questionnaire (i.e. as belonging to the clinical or general population group). Depending on the purpose of the cut-off score, one may be interested in a cut-off score with optimal sensitivity, optimal specificity or one that maximises the sum of sensitivity and specificity (Youden’s criterion; Youden, 1950). These three cut-off scores are reported for the CSRQ-SF.
4.3. Results

4.3.1. Development of the CSRQ-SF

In a PCA of the 20 CSRQ items administered to the general population (N=951), the five Irritation items (9, 10, 14, 19, 20; see Table 1) showed high loadings on a single, separate component. Corrected item-total correlations of these five items were also among the lowest seven, so these items were removed first, together with items 6 and 7 that did not correlate satisfactorily with the sum of the remaining items either. Four of the remaining thirteen items belonged to the subscale Shortness of Sleep (items 1, 5, 17 and 18), four to Sleepiness (3, 4, 8 and 13) and five to Loss of Energy (2, 11, 12, 15 and 16). As one of the response categories of item 18 was rarely chosen (only 1.3% of the respondents chose the second response option), this item was removed, which left three items in the Shortness of Sleep scale.

In order to warrant the content validity of the short form, we aimed at covering three universal aspects of chronic sleep reduction with an equal number of items. We therefore removed item 4 from the Sleepiness subscale as it had the lowest corrected item-total correlation. Items 2 and 16 from the subscale Loss of Energy were removed because their contents overlap with aspects of Sleepiness. As a result, the final short form contained 9 items covering three aspects of chronic sleep reduction with three items each (see Table 1).

4.3.2. Validation of the CSRQ-SF

Cronbach’s alpha for the CSRQ-SF was .79 in the general population (N=951), .78 in the DSPS group and .77 in the insomnia group. Furthermore, Cronbach’s alpha was .76 in the Dutch (N=166) and .84 in the Australian sample. These reliabilities are considered satisfactorily high in comparison to the much longer 20-item CSRQ. That is, correcting the .86 Cronbach’s alpha of the 20-item CRQ for test length would yield a reliability of .73, which is lower than the .79 Cronbach’s alpha of the 9-item CSRQ-SF.

Correlations for the CSRQ-SF with self-reported sleep and daytime functioning were calculated for the general population (N=951) (see Table 2). The results show that the CSRQ-SF was correlated with self-reported sleep and daytime functioning variables in the expected directions, and that the correlations were as high as the correlations of the 20-item CSRQ version.

We found similar, even slightly stronger relationships between the CSRQ-SF and objectively measured sleep variables than the ones that have been reported by Dewald et al. (2012) for the CSRQ (see Table 3). All relationships were in the expected directions, meaning that adolescents who scored high on the CSRQ-SF also had longer sleep onset
latencies and slept shorter than adolescents that scored low on the CSRQ-SF. Sleep efficiency was not significantly related to CSRQ-SF scores.

**Table 1. CSRQ and CSRQ-SF items**

<table>
<thead>
<tr>
<th>Item</th>
<th>CSRQ</th>
<th>Item</th>
<th>Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>Do you have trouble getting up in the morning?</td>
<td></td>
<td>Shortness of Sleep</td>
</tr>
<tr>
<td>2</td>
<td>Do you feel well rested at school?</td>
<td></td>
<td>Loss of Energy</td>
</tr>
<tr>
<td>3*</td>
<td>Do you feel sleepy during the day?</td>
<td></td>
<td>Sleepiness</td>
</tr>
<tr>
<td>4</td>
<td>Do you often yawn throughout the day?</td>
<td></td>
<td>Sleepiness</td>
</tr>
<tr>
<td>5*</td>
<td>Are you immediately wide awake when you wake up?</td>
<td></td>
<td>Shortness of Sleep</td>
</tr>
<tr>
<td>6</td>
<td>I oversleep in the morning (e.g. continuing to sleep even though I need to get up)</td>
<td></td>
<td>Shortness of Sleep</td>
</tr>
<tr>
<td>7</td>
<td>At noon I feel as energetic as in the morning</td>
<td></td>
<td>Shortness of Sleep</td>
</tr>
<tr>
<td>8*</td>
<td>When I am at school for a while I have trouble keeping my eyes open</td>
<td></td>
<td>Sleepiness</td>
</tr>
<tr>
<td>9</td>
<td>Do other people think that you react angrily when they ask you for something or say something to you?</td>
<td></td>
<td>Irritation</td>
</tr>
<tr>
<td>10</td>
<td>When I do not get enough sleep it is more likely that I start an argument</td>
<td></td>
<td>Irritation</td>
</tr>
<tr>
<td>11*</td>
<td>Do you have enough energy during the day to do everything?</td>
<td></td>
<td>Loss of Energy</td>
</tr>
<tr>
<td>12*</td>
<td>I am active during the day</td>
<td></td>
<td>Loss of Energy</td>
</tr>
<tr>
<td>13*</td>
<td>I have to struggle to stay awake in class</td>
<td></td>
<td>Sleepiness</td>
</tr>
<tr>
<td>14</td>
<td>Do other people say that you seem annoyed?</td>
<td></td>
<td>Irritation</td>
</tr>
<tr>
<td>15*</td>
<td>I don’t feel like going to school because I feel too tired</td>
<td></td>
<td>Loss of Energy</td>
</tr>
<tr>
<td>16</td>
<td>I feel very alert at school</td>
<td></td>
<td>Loss of Energy</td>
</tr>
<tr>
<td>17*</td>
<td>I am a person who does not get enough sleep</td>
<td></td>
<td>Shortness of Sleep</td>
</tr>
<tr>
<td>18</td>
<td>I would like to sleep longer</td>
<td></td>
<td>Shortness of Sleep</td>
</tr>
<tr>
<td>19</td>
<td>Others think that I am easily irritated</td>
<td></td>
<td>Irritation</td>
</tr>
<tr>
<td>20</td>
<td>Do you think that you behave unkindly towards your friends or parents without a reason?</td>
<td></td>
<td>Irritation</td>
</tr>
</tbody>
</table>

Note. *Items included in the CSRQ-SF

1 Item 7 was excluded from the analyses, as none of the response categories was applicable to the DSPS-group

2 As responses to item 18 were not equally spread over the three response categories (the second response category was barely chosen), the second and third response categories were combined

Cut-off scores for the identification of clinical cases were determined using the sample from the general population (N=951) and the two clinical groups. To make the groups comparable, we matched cases from the general population with clinical cases according to sex and age. As the two clinical groups did not differ on the pre-treatment CSRQ scores, we combined them into a single clinical group in the analyses. After case-control matching, the sample from the general population consisted of 543 adolescents (42.5% boys, mean age = 15.1 years, mean CSRQ-SF = 14.29) and the clinical group consisted of 181 adolescents (42.5% boys, mean age = 15.3 years, mean CSRQ-SF = 20.25).
Table 2. Correlations between chronic sleep reduction (CSRQ-SF and CSRQ), self-reported sleep and daytime functioning

<table>
<thead>
<tr>
<th></th>
<th>CSRQ-SF</th>
<th>20-item CSRQ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-reported sleep</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep quality</td>
<td>-.55</td>
<td>-.58</td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td>.43</td>
<td>.42</td>
</tr>
<tr>
<td>Insomnia</td>
<td>.71</td>
<td>.74</td>
</tr>
<tr>
<td>Circadian rhythm sleep disorder</td>
<td>.55</td>
<td>.56</td>
</tr>
<tr>
<td><strong>Daytime functioning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.52</td>
<td>.57</td>
</tr>
<tr>
<td>Attention problems</td>
<td>.48</td>
<td>.51</td>
</tr>
<tr>
<td>School performance</td>
<td>-.17</td>
<td>-.17</td>
</tr>
</tbody>
</table>

Note: All p-values ≤ .001

Table 3. Correlations between chronic sleep reduction (CSRQ-SF and CSRQ) and actigraphy data in Dutch and Australian samples

<table>
<thead>
<tr>
<th></th>
<th>CSRQ-SF (p value)</th>
<th>CSRQ* (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dutch sample (N =166)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sleep time</td>
<td>-.16 (.05)</td>
<td>-.12 (.14)</td>
</tr>
<tr>
<td>Sleep onset latency</td>
<td>.24 (≤ .01)</td>
<td>.22 (≤ .01)</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>-.23 (≤ .01)</td>
<td>-.19 (≤ .01)</td>
</tr>
<tr>
<td>Sleep efficiency</td>
<td>-.03 (.68)</td>
<td>-.01 (.93)</td>
</tr>
<tr>
<td><strong>Australian sample (N = 236)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sleep time</td>
<td>-.08 (.20)</td>
<td>-.09 (.17)</td>
</tr>
<tr>
<td>Sleep onset latency</td>
<td>.35 (≤ .001)</td>
<td>.34 (≤ .001)</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>-.20 (≤ .01)</td>
<td>-.18 (≤ .01)</td>
</tr>
<tr>
<td>Sleep efficiency</td>
<td>.05 (.46)</td>
<td>.01 (.92)</td>
</tr>
</tbody>
</table>

Note: Total sleep time: minutes of actually obtained sleep. Sleep duration: time between sleep onset and sleep offset. Sleep efficiency: total sleep time/time in bed*100

* Correlations for the CSRQ have been previously reported (Dewald et al., 2012)

ROC analyses were conducted to investigate whether the questionnaires can discriminate between cases from clinical and general populations. For the CSRQ-SF, we found a ROC curve with an AUC of .86 (95% confidence interval: .83 - .89) (see Figure 1). This AUC is comparable to the AUC for the original CSRQ (AUC = .85, 95% confidence interval: .82 - .88). For the CSRQ-SF the optimal cut-off according to Youden’s criterion, which gives equal weight to sensitivity and specificity, was 15.50. With this cut-off, 88.4% of the clinical cases and 68.0% of the general population were correctly identified. The overall percentage of correct classifications was 83.3%. For optimal sensitivity a cut-off of 14.50 was found (correctly identifying 92.8% of the clinical cases and 60.4% of the general population,
yielding an overall percentage of 84.7% correct classifications), and for optimal specificity a cut-off of 20.50 was found (correctly identifying only 50.8% of the clinical cases but 92.6% of the general population, yielding an overall percentage of 61.3% correct classifications).

Note: Sensitivity = true positive rate, 1- specificity = false positive rate.

Figure 1. Receiver Operating Characteristic (ROC) curve for the CSRQ-SF including cut-off scores

4.4. Discussion
The aim of the present study was to develop and validate a short version of the CSRQ, the CSRQ-SF. Our results demonstrate that the CSRQ-SF is a reliable and valid questionnaire. Internal consistencies of the CSRQ-SF were good and, taking the number of items into account, comparable to the internal consistencies of the CSRQ. Correlations with self-reported sleep, daytime functioning and objective sleep variables were similar to the correlations with the original questionnaire. Furthermore, we showed that the CSRQ-SF can discriminate well between clinical and non-clinical cases.

The original CSRQ consists of four subscales (Shortness of Sleep, Sleepiness, Loss of Energy and Irritation) measuring different symptoms of chronic sleep reduction, which
were differentially related to objective sleep variables (Dewald et al., 2012). Correlational patterns and PCA showed that the Irritation items were only indirectly related to the universal symptoms of chronic sleep reduction.

Similar correlations with daytime functioning and sleep variables were found for the CSRQ-SF and the 20-item CSRQ, indicating that the short form is as valid as the original questionnaire. Interestingly, relationships with self-reported sleep variables (sleep quality and daytime sleepiness) were stronger than the relationships with the objective sleep variables. A possible explanation is that, contrary to objectively measured sleep duration, sleep quality and daytime sleepiness also take individual sleep need into account, which is an important influential factor in chronic sleep reduction.

The CSRQ-SF discriminates well between clinical and non-clinical cases, once more supporting the validity of the questionnaire. However, as chronic sleep reduction does not refer to a sleep disorder as being defined by the DSM-IV (American Psychiatric Association, 2000) or ICSD-2 (American Academy of Sleep Medicine, 2005), the CSRQ-SF is not primarily intended for diagnosing sleep disorders. Still, scores above the cut-off do indicate the presence of sleep-related problems and in these cases further assessment of possible sleep disorders is strongly recommended.

The validation results of the CSRQ-SF are partly based on Dutch samples. However, a multi-group factor analysis has shown the English and Dutch versions of the CSRQ to be equivalent (Dewald et al., 2012), which is also supported by the similar correlations with actigraphy data in the Dutch and Australian samples. We can therefore assume that all validity results apply to both the Dutch and English language versions of the CSRQ-SF. Still, precise cut-off scores for the English language version remain to be determined in future research.

To summarise, the CSRQ-SF appears to be a valid and reliable measure to assess chronic sleep reduction in adolescents. It is related to relevant measures of sleep and daytime functioning and can discriminate well between clinical and non-clinical cases. Due to the limited number of items, the availability of cut-off scores and because it takes individual sleep need into account, it is a practical tool for clinical and research purposes.
4.5. References


