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The Dutch version of the self-report Child Activity and Limitations Interview in adolescents with chronic pain

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ABSTRACT
Purpose: To assess the factor structure, related constructs and internal consistency of the Child Activity Limitation Interview 21-Child version for use in Dutch-language countries.

Methods: Cross-sectional validation study: After forward and back translation of the Dutch version of the Child Activity Limitation Interview 21-Child adolescents (11–21 years old) with chronic musculoskeletal pain completed an assessment. The assessment contained the Dutch Child Activity Limitation Interview, and questionnaires about demographics, pain intensity, functional disability, anxiety and depression. Internal consistency and construct validity were evaluated through exploratory factor analysis (principal axis factoring with oblique rotation) and hypotheses testing using pain intensity, activity limitations, anxiety and depression as comparative constructs.

Results: Seventy-four adolescents completed the assessment. Exploratory factor analysis resulted in a two-factor structure, explaining 50% of the variance. Internal consistency was good (Cronbach’s $\alpha = 0.91$ total scale, $\alpha = 0.90$ Factor 1, $\alpha = 0.80$ Factor 2). All nine hypotheses were confirmed.

Conclusion: The Dutch version can be used to assess pain-related disability in Dutch-speaking adolescents comparable to the study sample. Scores on both subscales provide insight into the severity of the pain-related disability in both daily routine and more physically vigorous activities.

IMPLICATIONS FOR REHABILITATION
- Chronic pain is a disabling disorder which not only impacts physically but restricts quality of life.
- This study provides clinicians a questionnaire to measure pain-related disability and quantify the impact of pain on the daily living of adolescents.
- The advantage of the Dutch version of the Child Activity and Limitations Interview over other measurements is that it can distinguish limitations in daily activities from more physically vigorous activities.

Introduction

Chronic musculoskeletal pain without an underlying disease is considered a common problem, affecting 4–40% [1] of children and adolescents. Girls are more likely to develop chronic pain complaints than boys [2,3]. Adolescents with chronic musculoskeletal pain experience limitations participating in normal age-appropriate activities such as attending school, social- and leisure activities, sports and social interactions with peers and family [4]. Due to rapid psychosocial development and maturation in childhood, the normal age-appropriate activities are changing constantly, which makes it very difficult to recognize limitations in activity and participation due to pain. Currently, instruments to measure pain-related disability in adolescents are not available for a Dutch-speaking population. If pain-related disability could be assessed in adolescents with chronic musculoskeletal pain, it would give more insight in the types of activity limitations in adolescents.

So far only one questionnaire has been specifically developed for screening pain-related disability in adolescents; the Child Activity Limitations Interview (CALI21C) [5,6]. The CALI 21-C is an English self-report questionnaire and was derived from the original Child Activity Limitations Interview. Where the score of the original CALI only include the eight most difficult items, the CALI 21-C measures the pain-related limitations and distinguishes daily routine- and more physically vigorous activities. The modification to a self-report questionnaire increased flexibility when an interview was not possible. The English self-report CALI21-C has been examined on its factor structure as being an aspect of construct
validity but it has not yet been translated and validated in a Dutch-language population. A total number of 21 items in the CALI21-C captures concepts of sleep and rest, eating, school, ambulation, mobility, work-related tasks and physical, social and recreational interactions. The original English CALI21-C has demonstrated good internal consistency and construct validity in youth with a variety of chronic pain conditions, like back-, abdominal- and musculoskeletal pain, recurrent headaches, juvenile idiopathic arthritis and sickle cell disease [5,6]. The advantage of the CALI21-C to other frequently used instruments is that it not only recognizes limitations in activity and participation but it can also distinguish pain-related disabilities affecting activities of daily living from more physically vigorous activities, such as running and sports.

The focus in the current assessment of pain-related disability in youth consist of a set of rather generic instead of disease-specific questionnaires. Although questionnaires like the Functional Disability Inventory [7,8] (FDI) are frequently used, they were originally not designed for daily report of pain-related disability in youth. Often limitations in activities are related to ‘overall health’ or do not contain subscales concerning different domains in activity, which makes it difficult to gain a more detailed insight in the impact of chronic musculoskeletal pain on the daily life.

The aims of the present study were to establish: (i) the factorial structure, (ii) the construct validity, and (iii) the internal consistency of the CALI21-C after translation in the Dutch language (DCALI).

Methods

Participants and procedures

Data was collected at the Department of Rehabilitation Medicine at Maastricht University Medical Center between January 2013 and July 2014. In total 94 adolescents with chronic musculoskeletal pain visiting the Department of Rehabilitation Medicine were invited to participate. After initial intake by a consultant in rehabilitation medicine, the adolescents were invited to complete a digital screening set of self-report questionnaires. For the purpose of the validation study, the translated DCALI was added to the screening questionnaires. The aim of the intake is to gain insight in the level of functioning and the impact of pain on the adolescent’s life and to identify facilitating and disabling factors for changing the current situation with pain. The adolescents received a link enclosed in an email with a personal login code, allowing the participants to complete the questionnaire at home.

For eligibility, chronic musculoskeletal pain was defined as having musculoskeletal pain complaints with a duration over 3 months. Furthermore, no specific somatic (rheumatic, neurological and orthopaedic) conditions could be diagnosed as the cause or severity of the current pain complaints. The Medical Ethical Committee University Maastricht approved of the study (NL41712.068.12/METC12–3-052) and the consent procedure. Participants consented for the use of the data for scientific research.

Measures

Pain-related disability The CALI21-C is a measure to assess functional disability due to chronic pain in school-age adolescents. The original measure demonstrates sound psychometric properties [5,6]. The original English version of the CALI21-C consists of 21 items capturing seven concepts, which should encounter the broad range of age-appropriate activities of school-aged children. Each item is scored over the previous 4 weeks, rating the difficulty in participating in each activity on a five-point Likert scale, ranging from 0 ‘not difficult’ to 4 ‘extremely difficult’. Total score ranges from 0 to 84 where higher scores indicate greater activity limitation or more impairment due to pain.

In the original version two subscales were found, ‘Routine’ (five items, $\alpha = 0.73$) and ‘Active’ (eight items, $\alpha = 0.93$). The routine subscale indicates difficulties with basic activities of daily living and learning tasks like ‘Going to school’ or ‘Reading’. The active subscale includes more vigorous physical activities, which require higher levels of functional ability like ‘Sports’ and ‘Riding a bike or scooter’. The CALI21-C showed a high level of internal consistency ($\alpha = 0.95$) and revealed relationships with measures of pain intensity and depressive symptoms (moderate correlation, $r$ ranged between 0.42–0.58). Confirming the hypothesis that the CALI21-C would be moderately related to measures of pain symptoms, anxiety and depression [5,6].

Translation procedure

The CALI21-C was originally an English questionnaire. A Dutch version was systematically produced by a translation process. A first translator translated the questionnaire in Dutch. Then a native English speaker translated this Dutch version back into the English language. After comparison of the English translation and original English questionnaire the final Dutch translation was accepted by the authors. Translation of the CALI21-C into a Dutch version was not part of this study.

Comparator measures

Activity limitations The Functional Disability Inventory (FDI) is a self-report inventory for adolescents and measures activity limitations by 15 items over four domains, school, home, recreation and social interactions [9]. The items are rated on a five-point Likert scale ranging from 0 ‘no trouble’ to 4 ‘impossible’ where higher total scores indicate greater amount of activity limitations. The FDI was designed to be applicable to a broad range of diseases and varying levels of severity of activity limitations. The original FDI was validated in children with abdominal pain at an American University Medical Centre and showed a high internal consistency ($\alpha$ ranging from 0.86 to 0.91) with moderate-to-high test–retest reliability (0.74) [9]. Furthermore, the FDI is also found to be a significant predictor of pain, school-related disability somatic and depressive symptoms [9]. Although the Dutch version of the FDI is a frequent used questionnaire, any cross-cultural validation has not yet been performed [7–9].

Depressive symptoms Depressive symptoms were measured by the Dutch version of the Child Depression Inventory (CDI) [10–12]. The CDI is a self-report inventory that assesses symptoms of depression in children and adolescents aged 7–18 years. It contains 27 items on five subscales respectively negative mood, interpersonal problems, ineffectiveness, anhedonia and negative self-esteem, representing depressive symptoms. Respondents are asked to choose one description out of three that best fits how they have been feeling over the past 2 weeks. Descriptions to choose from are ‘I do most things well’, ‘I do most things wrong’ and ‘I do everything wrong’ scored on a scale from 0 to 2 with total CDI scores ranging from 0 to 54. Higher scores indicate higher levels of depressive symptoms. Timbremont et al. (2002) [11] found the CDI to have a high internal consistency $\alpha = 0.85$ in a nonclinical and $\alpha = 0.86$ in a clinical sample. The original English CDI subscales have shown good-to-fair internal consistency,
negative mood $\alpha = 0.62$, interpersonal problems $\alpha = 0.59$, ineffectiveness $\alpha = 0.63$, anhedonia $\alpha = 0.66$ and negative self-esteem $\alpha = 0.68$ [10]. Reliable and valid norms for its utility as a screening instrument for depression in both clinical and nonclinical youths are available in the Dutch version [10,13].

**Pain intensity**

Pain intensity was measured by a 10 cm Visual Analogue Scale ranging from ‘no pain’ to ‘the worst pain I can imagine’. The average score of three VAS scales measuring the current level of pain, the worst pain in the past week and the least pain in the past week. Pain severity measured by VAS has good reliability and validity among individuals as young as 9 years [14,15].

**Data analysis**

Data analysis was performed using SPSS version 23.0 (IBM Corp, Armonk, NY). The digital set of questionnaires alerted adolescents in case of unanswered questions. Missing items were not replaced.

**Analysis of factor structure and internal consistency** After translation the CALI21-C was approached as a ‘new’ instrument. Exploratory factors analysis was conducted to investigate latent constructs within the broader domain of activity [16]. All 21 items of the DCALI were investigated for normality of the scoring distribution. Inter-item correlations were calculated to investigate for a lack of correlation and multicollinearity (inter-item correlation $0.2 < r < 0.9$) in the correlation matrix [17]. In case of high inter-item correlations on the correlation matrix ($r > 0.75$) the underlying constructs were discussed between the authors. If it was concluded that underlying constructs were similar one of the items was excluded. Corrected item-total correlations for all DCALI items were calculated. Principal axis factoring is used as extraction method. Assessment of the number of factors was examined by the Kaiser’s criterion [18] (the eigenvalue represents the amount of variation explained by a factor) and interpretation of the Scree plot. The original CALI21-C consisted of two factors, which the authors expected to be similar in the translated version. A 1-, 2- and 3-factor structure on meaningfulness of the factors was investigated. Items with one factor loading $> 0.4$ and a loading $< 0.4$ on other factors were directly included [19]. Items loading $< 0.4$ were individually assessed on clinical relevance. If an item loaded on multiple factors the classification of the item to a certain factor was based on the relation of the underlying construct of the item with the construct of the factor. Factor structure was established by the use of oblique promax rotation as the subscales were known to correlate in the original CALI21-C [6]. Sampling adequacy and internal consistency were evaluated by Kaiser–Meyer–Olkin and Cronbach’s $\alpha$. Values of Cronbach’s $\alpha$ between 0.70 and 0.95 are considered good [20].

**Conceptual framework and hypotheses for evaluation of construct validity**

To assess construct validity, the scores of the DCALI were correlated with scores of theoretically more or less related measures, being the FDI [7,8], pain intensity measured by a VAS [15] and the CDI [13]. Escorpizo et al. [21] has described pain, in adults, as a musculoskeletal condition and classified musculoskeletal-related disability as complex and multifaceted. Musculoskeletal-related disability is spread over the different horizontal domains of the ICF and can be influenced by contextual factors. Within the ICF model, the authors have situated pain-related disability primarily in the activity and participation domain and have linked it to both the “body structures and functioning” (BSF) domain, for pain intensity, and the contextual domain, to encompass the feeling of being disabled due to pain. Functional disability (FDI) is a construct closely to pain-related disability and situated in the same domain; however, it differs from the broader construct of pain-related disability which also includes the feeling of pain, situated in the BSF domain, and encompasses the perception of disability, situated in the contextual domain. In validation studies, the FDI has been found to have positive but moderate correlations with pain and somatic and depressive symptoms, where higher levels of disability are often seen associated with somatic and depressive symptoms [9]. In line with previous research, it is hypothesized that higher levels of functional disability correlate highly positive ($0.7 < r < 0.9$) with higher levels of pain-related disability [5,6]. Pain intensity (VAS), anxiety and depression (CDI) are known to be associated with higher levels of disability in physical fitness, psychological- and social functioning in children [22,23]. However, these constructs belong to the BSF and contextual domain and not to the activity and participation domain in which pain related disability is situated. The authors think that pain intensity, anxiety and depression can as described by Escorpizo et al. [21] influence pain-related disability but this association has not yet been established in adolescents. Therefore, it is hypothesized that DCALI total and subscale scores have weak-to-low positive correlations ($0 < r < 0.5$) with VAS and CDI. All hypothesized strengths and directions of the correlations are expressed in Table 1.

The theoretical construct definitions and the strength of the hypothesized correlations are based on the original validation study [5]. In the original study, the two subscales were found and showed to be correlated with each other ($r = 0.44$). It is expected that in the DCALI has a similar two factor structure with the two subscales correlating moderately with each other.

**Analysis of construct validity**

To assess construct validity, based on formulated hypotheses, correlations between DCALI and the other measurements were calculated. Based on the distribution of the item scores, Spearman correlation coefficients were compared to the hypothesis as stated in Table 2. Construct validity was determined with >75% of the hypotheses confirmed [20].

**Results**

**Clinical characteristics**

Sociodemographic and pain-related characteristics of the participants are presented in Table 2. Twenty participants were excluded from the analysis, because they completed none of the

<table>
<thead>
<tr>
<th>Table 1. Hypothesized strengths of correlations between DCALI-C and construct variables.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>DCALI total</td>
</tr>
<tr>
<td>DCALI active</td>
</tr>
<tr>
<td>DCALI routine</td>
</tr>
</tbody>
</table>
Table 2. Clinical characteristics.

<table>
<thead>
<tr>
<th>Age (mean, SD, range)</th>
<th>Gender (N, % female)</th>
<th>Educational level (N, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 (3), 11–21</td>
<td>66 (89%)</td>
<td>9 (5.5%)</td>
</tr>
<tr>
<td>10 (13.5%)</td>
<td></td>
<td>16 (21.6%)</td>
</tr>
<tr>
<td>15 (20.3%)</td>
<td></td>
<td>12 (16.2%)</td>
</tr>
<tr>
<td>6 (8.1%)</td>
<td></td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td>1 (1.4%)</td>
<td></td>
<td>67 (90.5%)</td>
</tr>
</tbody>
</table>

School absences in the past year (N, %)

- 0–14 days: 15 (20.3%)
- 15–30 days: 14 (18.9%)
- 1–3 months: 15 (20.3%)
- >3 months: 13 (17.6%)
- Missing: 2 (2.7%)

Pain-related characteristics

Onset of current pain complaints (N, %)

- <3 months ago: 2 (2.8%)
- 3–6 months ago: 4 (5.4%)
- 6–12 months ago: 15 (20.3%)
- >1–5 years ago: 38 (51.4%)
- ><5 years ago: 9 (12.2%)
- Missing: 6 (8.1%)

Type of pain problem

- Generalized pain problem/fibromyalgia/ hypermobility syndrome: 24 (32.4%)
- Complex regional pain syndrome: 7 (9.5%)
- Chronic back pain/whiplash: 18 (24.3%)
- Pain in upper extremities: 5 (6.8%)
- Pain in lower extremities: 14 (19.9%)
- Undefined: 5 (6.8%)
- Significant other person with chronic pain complaints (N, %): 23 (31.1%)

Table 3. Descriptive statistics of all study variables.

<table>
<thead>
<tr>
<th>Total N = 74</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>DCALI-C (0–80)</td>
</tr>
<tr>
<td>DCALI-C active (0–50)</td>
</tr>
<tr>
<td>DCALI-C routine (0–30)</td>
</tr>
<tr>
<td>FDI (0–75)</td>
</tr>
<tr>
<td>FDI physical activities (0–40)</td>
</tr>
<tr>
<td>FDI daily activities (0–35)</td>
</tr>
<tr>
<td>CDI (0–54)</td>
</tr>
<tr>
<td>Pain intensity (0–100)</td>
</tr>
</tbody>
</table>

questionnaires in the digital set of questionnaires. Scores of seventy-four participants, (66 girls) with a mean age of 16 years completed the digital set of questionnaires and were included in the analysis. All participants had chronic musculoskeletal pain in varying body parts, in 51% of the participants the pain started between 1 and 5 years ago. Table 3 reports on the average scores on all four measurements used in this study.

Factor structure

Normality within the scoring of the DCALI items was assumed after eyeballing of the data investigating skewness (range –1.12 to 2.96) and kurtosis (range –1.39 to 8.47). An overview of the item scoring is shown in Supplementary Table S1. Items 3, 8, 12, 16 and 17 didn’t use the entire range of the answering scale. On average, 31% (8–85%) of the participants scored in the lowest answering category of the Likert scale. Cumulatively, 50% of the participants scored on the lowest two answering categories, meaning that they either had no difficulties or little difficulties with the type of activities and participation in the items. The highest answering category was answered on average 15% (0–46%).

The correlation matrix was investigated for correlations < 0.2 and > 0.9 with item-total correlations ranged between –0.02 and 0.83. Inter-item correlations above 0.75 are shown in Table 4 and were discussed by the authors. Item correlations between item 2 “Gym” and 5 “Sports” and between 5 and 14 “Running” considered to have overlap as sport is a broader construct. The authors considered that both “Gym” and “Running” are adding clinical relevant information on the type of activity and participation. The constructs of items 7 “Playing with friends” and 12 “Doing things with friends” are similar but the authors consider them to differ between primary school-aged children (item 7) and older children (item 12). Item 1 “Going to school” and item 21 “Being up all day (without a nap or rest)” seemed similar in the DCALI, it is suggested to rephrase item 21 into “Spending the day without a nap”. Because of their clinical relevance these items were kept within the analysis. Item 11 ‘After school practices’ was eliminated from the sample based on collinearity with item 12 and 13 ‘Going to clubs/church activities’ and the limited information in relation to the other items. Many inter-item correlations were < 0.2, but all items correlated with at least one other item [24].

The remaining 20 translated items were entered in the exploratory factor analysis using an extraction method of principal axis factoring with a promax rotation. Results are shown in Table 5. Kaiser-Meyer-Olkin measure was 0.82 and Bartlett’s Test [24] was significant (p < .001). The Cattel’s Elbow criterion identified a two-factor structure explained 50% of the variance. Four items (item 10, 16, 17 and 19) had loadings < 0.4 and were therefore not included in the analysis. This resulted in a 16-item Dutch version of the DCALI, containing 10 items in Factor-1, which could be labeled as “Active” subscale and 6 in Factor-2, which could be labeled as “Routine” subscale.

Internal consistency was calculated, resulting in a Cronbach’s α of 0.91 for the total scale (16 items), Cronbach’s α of 0.90 for Factor 1 and Cronbach’s α of 0.80 for Factor 2.

Hypotheses testing for construct validity

All comparator measurements were positively correlated with higher levels of pain-related disability. The calculated correlations in hypothesis testing were presented in Table 6. As hypothesized, highest positive correlations were found between total and subscale scores of the DCALI and the closest construct within the same ICF domain, activity limitations measured by the FDI. As hypothesized the DCALI total score correlated highly with total activity limitations (FDI; r = 0.85). The DCALI active subscale correlated highly with the physical activity subscale of the FDI (r = 0.83) and the DCALI routine subscale correlated highly with the daily activities subscale of the FDI (r = 0.82) as hypothesized.

Moderate positive correlations between anxiety and depression (CDI) and pain-related disability total scale and subscales were found to be low, DCALI total score; r = 0.34, p < .01, DCAL Routine; r = 0.39, p < .01 and DCAL Active; r = 0.26, p < .05. Correlations between pain intensity and pain-related disability total and subscales were low to moderate, DCALI total score; r = 0.45, p < .01, DCAL Routine; r = 0.39, p < .01 and DCAL Active; r = 0.26, p < .05. Subscales of the DCALI were correlated 0.55 as hypothesized.

Discussion

To enable the use of the CALI21-C in Dutch-speaking adolescents with chronic musculoskeletal pain, the internal consistency and
aspects of construct validity of the Dutch translation of the CALI21-C were evaluated. Exploratory factor analysis showed a two-factor structure in the Dutch version of the CALI21-C. Good internal consistency, Cronbach's $\alpha > 0.80$, was found in the total scale (16 items) and both in the active subscale (10 items) and routine subscale (6 items) of the DCALI [20]. With all nine hypotheses confirmed in hypotheses testing construct validity was evaluated as excellent [20]. Relationships turned out as hypothesized with the Routine subscale having slightly stronger correlation with anxiety and depression symptoms than the Active subscale. Based on consistent psychometric properties, the DCALI is advised in measurement of pain-related disability in adolescents.

### Table 4. Multicollinearity in inter-item correlations.

<table>
<thead>
<tr>
<th>No.</th>
<th>Dutch item</th>
<th>English item</th>
<th>Pearson</th>
<th>Item eliminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Naar school gaan.</td>
<td>Going to school.</td>
<td>0.752</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>De hele dag op school zijn (zonder een dutje te doen of te rusten)</td>
<td>Being up all day (without a nap or rest)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Gymnastiek</td>
<td>Gym</td>
<td>0.757</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sporten</td>
<td>Sports</td>
<td>0.767</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hardlopen</td>
<td>Running</td>
<td>0.847</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Met vrienden spelen/omgaan</td>
<td>Playing with friends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Dingen doen met vrienden</td>
<td>Doing things with friends</td>
<td>0.753</td>
<td>11</td>
</tr>
<tr>
<td>11</td>
<td>Naschoolse activiteiten</td>
<td>After school practices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Naar clubjes/verenigingen gaan</td>
<td>Going to clubs/church activities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Item 21 should be rephrased.
- Both items contain sports, in Dutch 'gym' means sports activities in primary school whereas 'sporten' is mainly focused on sporting activities not related to school.
- 'Hardlopen' is considered both a sporting activity as well as a motoric movement.

### Table 5. CALI exploratory factor analysis results.

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Dutch item</th>
<th>Original English item</th>
<th>Classification Dutch item based on theory</th>
<th>Classification English item based on EFA</th>
<th>Mean (SD) Corrected item-total correlation</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Sporten</td>
<td>Sports</td>
<td>A</td>
<td>A</td>
<td>2.80 (1.29) 0.611</td>
<td>1.023</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hardlopen</td>
<td>Running</td>
<td>A</td>
<td>A</td>
<td>2.89 (1.38) 0.665</td>
<td>0.862</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Gymnastiek</td>
<td>Gym</td>
<td>A</td>
<td>A</td>
<td>2.81 (1.37) 0.625</td>
<td>0.852</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Een of twee blokjes omlopen</td>
<td>Walking one or two blocks</td>
<td>A</td>
<td>A</td>
<td>1.35 (1.24) 0.639</td>
<td>0.742</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Fietsen of scooter rijden</td>
<td>Riding a bike or scooter</td>
<td>A</td>
<td>A</td>
<td>2.05 (1.35) 0.648</td>
<td>0.675</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Het doen van een hobby.</td>
<td>Doing a hobby</td>
<td>–</td>
<td>–</td>
<td>2.08 (1.35) 0.547</td>
<td>0.564</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>De trap oplopen.</td>
<td>Walking up stairs</td>
<td>A</td>
<td>A</td>
<td>1.70 (1.21) 0.557</td>
<td>0.514</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Dingen doen met vrienden</td>
<td>Doing things with friends</td>
<td>–</td>
<td>–</td>
<td>1.43 (1.09) 0.739</td>
<td>0.479</td>
<td>0.430</td>
</tr>
<tr>
<td>11</td>
<td>Naschoolse activiteiten</td>
<td>After school practices</td>
<td></td>
<td></td>
<td>1.65 (1.45) 0.679</td>
<td></td>
<td>0.472</td>
</tr>
<tr>
<td>13</td>
<td>Naar clubjes/verenigingen gaan</td>
<td>Going to clubs/church activities</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Met vrienden spelen/omgaan</td>
<td>Playing with friends</td>
<td>A</td>
<td>A</td>
<td>1.24 (1.11) 0.666</td>
<td></td>
<td>0.425</td>
</tr>
<tr>
<td>3</td>
<td>Lezen</td>
<td>Reading</td>
<td>R</td>
<td>R</td>
<td>0.65 (0.97) 0.380</td>
<td>0.859</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Huiswerk</td>
<td>Schoolwork</td>
<td>R</td>
<td>R</td>
<td>1.30 (1.33) 0.427</td>
<td>0.695</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>TV kijken.</td>
<td>Watching TV</td>
<td>R</td>
<td>R</td>
<td>0.47 (0.62) 0.229</td>
<td>0.607</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>De hele dag op school zijn (zonder een dutje te doen of te rusten)</td>
<td>Being up all day (without a nap or rest)</td>
<td>R</td>
<td>–</td>
<td>2.19 (1.52) 0.626</td>
<td></td>
<td>0.556</td>
</tr>
<tr>
<td>1</td>
<td>Naar school gaan.</td>
<td>Going to school</td>
<td>R</td>
<td>R</td>
<td>1.93 (1.31) 0.640</td>
<td></td>
<td>0.467</td>
</tr>
<tr>
<td>9</td>
<td>Huishoudelijke taken af klusjes.</td>
<td>Housework or chores</td>
<td>A</td>
<td>A</td>
<td>1.54 (1.16) 0.591</td>
<td></td>
<td>0.433</td>
</tr>
</tbody>
</table>

- Based on definitions of constructs. Active (A) and Routine (R).
- Based on factor structure of the original validation. Active (A) and Routine (R).
- The bold values represents the allocation of the item to factor 1 or factor 2.
with chronic pain that were treated in rehabilitation care in the Netherlands.

These findings are in line with the results in the original validation of the CALI21-C [5]. The Dutch version of the CALI21-C resulted after the exploratory factor analysis in a 16-item two-factor structure with an Active subscale of 10 items and a Routine subscale of 6 items. These factor loadings slightly differ from the original child version, which consisted of 13 items with 8 items in the Active subscale and a Routine subscale of 5 items. Item 6 “Doing a hobby”, item 12 “Doing things with friends” and item 13 “going to clubs/church activities” were added to the Active subscale and item 9 “housework or chores” and item 20 “being up all day” loaded in the Routine subscale while it was loaded in the Active subscale in the original version. Item 16 “eating regular meals” did not load in both factors while it was loaded in the Routine factor in the original version whereas item 21 ‘Being up all day without a nap or rest’ did load on the Routine subscale where it was not loaded on any factor in the original version.

Labelling the two factors similar as in the original version seemed legitimate considering that the majority of the items in both Active and Routine subscale met up to the original definitions, respectively physically vigorous activities and routine activities of daily living. Our sample included adolescents with chronic musculoskeletal pain from an academic medical center with chronic musculoskeletal pain on different body parts. The original sample also included pediatric pain patients with headaches and abdominal pain. Furthermore, the majority of our sample chronic musculoskeletal pain patients was female (86%), as similar to the Dutch population. In contrast to the original sample were only 58% of the population was female.

Both subscales as well as the total scale of the DCALI had a high internal consistency, with all a Chronbach’s $\alpha > 0.80$. The small difference in the internal consistency of both subscales and the total scale might be explained by the reduction of items in the DCALI.

It is important to note that within this study there are some limitations. It was chosen to approach the translated DCALI as a “new” measurement tool and therefore exploratory factor analysis was performed to determine the factor structure. The high Kaiser–Meyer–Olkin measure provided foundation to perform factor analysis but due to the limited sample size of only 74 participants a confirmatory factor analysis was not performed [17]. Furthermore, the scoring by the five-point Likert scale of the DCALI was assumed be a continuous variable. Therefore, we used a factor analysis method for continuous data although the data was found to be moderately skewed. Moreover, item 1, 2, 5, 7, 14 and 21 were kept in the analysis despite inter-item correlations $>0.75$. Although the authors discussed these items for similar underlying constructs interpretations of all translated items were not tested in the target population.

Scores on both subscales provide insight in the severity of the pain-related disability in both daily routine activities as well as more physical vigorous activities. Clinicians could also use the DCALI to provide more tailored care specific to a domain with disability.

Next step in the validation of the DCALI is to asses other parts of the methodological quality of measurement instruments [25]. Besides reproducing the results of the EFA by a confirmatory analysis in other populations with chronic pain like recurrent abdominal pain or disease-related pain. Moreover, evaluating the face- and content validity would be valuable. Testing the interpretation of the items of the DCALI by the target population increases the usefulness in daily practice by clinicians. This might also provide an explanation for the items that changed subscale with the original CALI21-C. Furthermore, it is valuable to assess test–retest reliability and the sensitivity to changes of treatment or interventions to enable the measurement to be used as an evaluation in changed levels of activity limitations in research or as a response to treatment.

**Conclusion**

The Dutch version of the Child Activity and Limitation Interview demonstrated good internal consistency and aspects of construct validity in a sample of Dutch-speaking school-aged adolescents seeking help for chronic musculoskeletal pain who are comparable to the study sample. Therefor the DCALI can be used in adolescents with chronic musculoskeletal pain comparable to this study sample to assess the presence and severity of pain-related disability in both daily routine activities and more physically vigorous activities in school-aged children and adolescents with chronic musculoskeletal pain complaints.

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Disclosure statement

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