Fatigue in children: reliability and validity of the Dutch PedsQL™ Multidimensional Fatigue Scale

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Abstract

Purpose The aim of the study is to report on the feasibility, reliability, validity, and the norm-references of the Dutch version of the PedsQL™ Multidimensional Fatigue Scale. Methods The study participants are four hundred and ninety-seven parents of children aged 2–18 years and 366 children aged 5–18 years from various day care facilities, elementary schools, and a high school who completed the Dutch version of the PedsQL™ Multidimensional Fatigue Scale. Results The number of missing items was minimal. All scales showed satisfactory internal consistency reliability, with Cronbach’s coefficient alpha exceeding 0.70. Test–retest reliability was good to excellent (ICCs 0.68–0.84) and inter-observer reliability varied from moderate to excellent (ICCs 0.56–0.93) for total scores. Parent/child concordance for total scores was poor to good (ICCs 0.25–0.68). The PedsQL™ Multidimensional Fatigue Scale was able to distinguish between healthy children and children with an impaired health condition. Conclusions The Dutch version of the PedsQL™ Multidimensional Fatigue Scale demonstrates an adequate feasibility, reliability, and validity in another sociocultural context. With the obtained norm-references, it can be utilized as a tool in the evaluation of fatigue in healthy and chronically ill children aged 2–18 years.

Keywords Pediatrics · Fatigue · Health-related quality of life · Validation study · PedsQL™

Abbreviations

HRQOL Health-related quality of life
PedsQL™ Pediatric Quality of Life Inventory™
ICC Intraclass correlation coefficient
SPSS Statistical Package for the Social Sciences
SES Socioeconomic status

Introduction

Fatigue is a common symptom in pediatric health conditions and is associated with poorer HRQOL [1–8]. The Pediatric Quality of Life Inventory (PedsQL™) Multidimensional Fatigue Scale was designed by Varni and colleagues to measure fatigue in children. The original American version demonstrated adequate reliability and validity [1–4, 9]. Recently, this questionnaire has been translated into Dutch in accordance with internationally accepted methods [10].

Substantial cultural differences regarding sleep and fatigue in children have been reported, precluding generalization of instruments before assessment in other sociocultural contexts has been performed [11–16]. Accordingly, our objectives were to obtain a norm-reference and to test the psychometric properties of the Dutch version of the PedsQL™ Multidimensional Fatigue Scale.

We hypothesized that the reliability and validity of the Dutch version is comparable to the original version. In addition, we expected adolescents to be more fatigued than younger children [17].
Methods

The PedsQL™ Multidimensional Fatigue Scale was distributed at day care facilities and schools in urban and suburban areas in the Netherlands, between October 2009 and May 2010. The questionnaire was self-administered, but children aged 5–7 years have been assisted by the researcher. One half of the participants were given the option to receive the questionnaire again after 2 weeks to assess test–retest reliability. The other half received two copies of the questionnaire to be completed independently by both parents to test inter-observer reliability.

The 18-item PedsQL™ Multidimensional Fatigue Scale reflects three subscales: general fatigue (GF), sleep/rest fatigue (SRF), and cognitive fatigue (CF). The questionnaire comprises parallel child self-reports for the ages 5–7 years (young child), 8–12 years (child), and 13–18 years (adolescent) and parent proxy-reports, the latter also including 2–4 years of age (toddler). The participants rated how often a particular problem occurred in the past month, using a 5-point Likert scale and for the young child self-report a 3-point scale. Each item is reverse-scored and rescaled to 0–100 scale, so that higher scores indicate fewer symptoms of fatigue.

Feasibility was evaluated from the percentage of missing answers [18]. Range of measurement was based on the percentage of scores at extremes of the scaling range. Scale internal consistency was assessed by calculating Cronbach’s coefficient alpha [19]. Test–retest and inter-observer reliability and the parent/child concordance were assessed by intraclass correlation coefficients (ICCs) [20]. ICCs were designated as <0.40 poor to fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 good agreement, and 0.81–1.00 excellent agreement [21, 22]. The ability of the questionnaire to distinguish between groups differing in health condition was computed using unpaired t-tests. Calculated effect sizes up to 0.20 were considered to be small, about 0.50 moderate and about 0.80 large [23].

The effect of sociodemographic variables was assessed using linear regression analysis. Within-group differences were assessed by analysis of variance with post hoc Bonferroni correction for age and education and t-tests for gender, country of birth, and family structure. Data were analyzed using SPSS 15.0.1. A P value of <0.05 was accepted as statistically significant.

Results

In total, 1,257 parent reports and 1,000 child reports were distributed, of which 497 and 366 reports were returned, respectively (response rates 40 and 37%). Sociodemographic characteristics of the initial test are presented in Table 1. Most reported chronic health conditions were asthma, allergies, and attention-deficit hyperactivity disorder.

PedsQL™ Multidimensional Fatigue Scale scores are summarized in Table 2. Adolescents had more symptoms of GF than the other age ranges (mean difference = 6.20, \(P < 0.001\) for child reports and 5.27, \(P < 0.001\) for parent reports). Boys had more symptoms of CF than girls (mean difference = 3.42, \(P = 0.0034\) for parent reports). Children of immigrants had more problems with SRF compared to children of parents born in the Netherlands (mean difference = 6.12, \(P = 0.017\) for parent reports). Children in a single-parent family had more problems of CF (mean difference = 8.29, \(P = 0.037\) for parent reports) and lower total fatigue scores (mean difference = 5.93, \(P = 0.039\) for parent reports) than children living in a two-parent household. Children of low educated parents had more problems with CF (mean difference = 9.35, \(P = 0.03\) for child reports) and lower total fatigue scores (mean difference = 7.17, \(P = 0.014\) for child reports) than children of high educated parents.

Missing responses for all items were rare: 0.2% in parent reports and 0.3% in child reports. No floor effects were detected. Ceiling effects ranged from 1.4% in child reports to 5.1% in parent reports. All child report and parent report scales approached or exceeded a Cronbach’s alpha of 0.70 (range 0.64–0.93) (Table 3). Forty-three children (12%) and 75 parents (15%) performed the retest. The retest response for the young child was too low for evaluation. Child report and parent report test–retest ICCs had moderate to excellent agreement (range 0.50 to 0.85) (Table 4). At group level, no significant differences emerged between the test- and retest, except for GF which
was reported to be better after 2 weeks by the parents. Fifty-five participants (11%) returned two questionnaires, completed by both parents. Inter-observer reliability ICCs had poor to excellent agreement (range 0.27–0.93) (Table 5). At group level, there were no significant differences between fathers (n = 169) and mothers (n = 440), except for lower SRF scores reported by the mothers. Parent/child concordance ICCs had poor to good agreement (range 0.10–0.68) (Table 6). At group level, means of SRF, CF, and total fatigue of the parent report were significantly higher compared to the child report.

Child report and the parent report total scores and most subscale scores demonstrated a significant difference between the healthy participants (89%) and the participants with an impaired health condition (11%) (Table 7). Effect sizes varied from small to medium, with children with an impaired health condition showing lower scores and thus more fatigue.

### Table 2: Scale descriptives for PedsQL Multidimensional Fatigue Scale

| Scale                    | Age group (years) | Toddler (2–4) | Young child (5–7) | Child (8–12) | Adolescent (13–18) | Total sample |
|--------------------------|------------------|---------------|------------------|--------------|-------------------|--------------|
|                          | N    | Mean CI          | N    | Mean CI          | N    | Mean CI          | N    | Mean CI          | N    | Mean CI          |
| Child report             |      |                 |      |                 |      |                 |      |                 |      |                 |
| Total fatigue            | NA   | 68 76.59 73.16–80.03 | 143 78.70 76.63–80.76 | 155 75.24 73.34–77.14 | 366 76.84 75.54–78.14 |
| General fatigue          | NA   | 68 83.46 79.61–87.30 | 143 82.66 80.53–84.80 | 155 76.72 74.44–78.99 | 366 80.29 78.81–81.77 |
| Sleep/rest fatigue       | NA   | 68 74.00 69.47–78.52 | 143 77.55 75.06–80.03 | 155 71.88 69.63–74.12 | 366 74.49 72.88–76.09 |
| Cognitive fatigue        | NA   | 68 72.24 66.99–77.49 | 143 75.76 72.60–78.92 | 155 77.15 74.72–79.58 | 366 75.69 73.83–77.56 |
| Parent report            |      |                 |      |                 |      |                 |      |                 |      |                 |
| Total fatigue            | 104 82.87 80.77–84.96 | 83 83.01 80.43–85.49 | 149 81.25 79.18–83.31 | 161 79.17 76.99–81.35 | 497 81.21 80.10–82.32 |
| General fatigue          | 104 82.80 80.49–85.10 | 83 84.46 81.76–87.15 | 149 82.27 80.01–84.53 | 161 77.71 75.23–80.19 | 497 81.27 80.01–82.52 |
| Sleep/rest fatigue       | 104 82.92 80.36–85.49 | 83 87.77 85.11–90.43 | 149 85.49 83.35–87.62 | 161 80.87 78.53–83.22 | 497 83.84 82.62–85.06 |
| Cognitive fatigue        | 104 82.77 79.84–85.70 | 83 76.71 72.96–80.46 | 149 75.98 72.80–79.15 | 161 78.93 76.13–81.73 | 497 78.48 76.90–80.06 |

*CI 95% confidence interval*

### Table 3: Internal consistency reliability for PedsQL Multidimensional Fatigue Scale

| Scale                    | Age group (years) | Toddler (2–4) | Young child (5–7) | Child (8–12) | Adolescent (13–18) | Total sample |
|--------------------------|------------------|---------------|------------------|--------------|-------------------|--------------|
|                          | α    |               | α    |               | α    |               | α    |               | α    |               |
| Child report             |      |               |      |               |      |               |      |               |      |               |
| Total fatigue            | NA   | 0.79          | 0.85 | 0.86          | 0.83 |
| General fatigue          | NA   | 0.67          | 0.71 | 0.80          | 0.73 |
| Sleep/rest fatigue       | NA   | 0.66          | 0.67 | 0.64          | 0.64 |
| Cognitive fatigue        | NA   | 0.74          | 0.86 | 0.81          | 0.81 |
| Parent report            |      |               |      |               |      |               |      |               |      |               |
| Total fatigue            | 0.88 | 0.89          | 0.91 | 0.93          | 0.91 |
| General fatigue          | 0.78 | 0.80          | 0.83 | 0.86          | 0.83 |
| Sleep/rest fatigue       | 0.72 | 0.70          | 0.79 | 0.81          | 0.77 |
| Cognitive fatigue        | 0.90 | 0.90          | 0.92 | 0.93          | 0.92 |

*α Cronbach’s coefficient alpha*
Discussion

Our cohort showed that adolescence was associated with more fatigue, which might reflect the decrease in sleep duration at that age [16, 17, 24]. Boys reported more fatigue than girls, indicating socially related gender differences [25]. Fatigue was more common in children living in a single-parent family, which might be explained by the higher prevalence of sleep problems in these children [16]. Being a child of an immigrant was associated with more fatigue, stressing the influence of the sociocultural background on fatigue. Children of low educated parents reported more fatigue, corresponding with lower reported HRQOL in populations with low socioeconomic status [26].
The questionnaire was found to be feasible because of the minimal missing item responses. All scales approached or exceeded a Cronbach’s alpha of 0.70, recommended for comparing groups. Parent report total scores approached or exceeded a Cronbach’s alpha of 0.90, recommended for analyzing individual patient scales [27, 28]. Test–retest reliability was low in the toddler version, suggesting that this version should be applied with caution. The low test–retest accordance in adolescents might be a real variation due to the fluctuations in nocturnal sleep duration. Inter-observer agreement was low in toddlers and adolescents. This observation is difficult to explain and requires further exploration. The father/child agreement and the mother/child agreement were low in the young child, the adolescent and the total sample. This may be due to differences in reasoning and response reactions between parent and child [29]. Children scored lower than their parents. The low parent/child concordance (including the weakest agreement for the young child and lower scores reported by the children) has consistently been observed in HRQOL measurement, particularly for internalizing problems [30–33]. These findings support the need to measure the perspectives of the child and the parent, since both may influence healthcare utilization. The assumption was confirmed that the questionnaire was able to distinguish between healthy children and children with an impaired health condition. It is expected that a clinical sample with more severely ill children will demonstrate worse fatigue scores and higher effect sizes.

Regarding the current study several limitations need to be mentioned. First, we had low response rates, which might lead to non-response bias. Second, the ethnicity of the participants was rather homogenous; only 2% of the children and 6% of the parents were born outside the Netherlands, compared to 10 and 10%, respectively in the Dutch population [34]. A possible explanation is the language problems that immigrants experienced and therefore decided not to participate in this study. Third, the educational background of our parent respondents showed that 42% were highly educated, compared to 18% of the Dutch population [35]. Highly educated parents might have been more aware of the necessity of this study wherefore more willing to participate. Children from immigrants as well as from low educated parents may experience more fatigue; hence, the obtained norm-reference may underestimate fatigue in the general population. Information on nonparticipants was not available, thus generalization of the norm-results should be made with caution.

In conclusion, the Dutch version of the PedsQL™ Multidimensional Fatigue Scale demonstrates overall adequate psychometric properties in another sociocultural context. With the obtained norm-references, it can be utilized as a tool to evaluate fatigue in children.

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