



## Psychometric properties of the physical activity questionnaire for older children (PAQ-C) in the UK



Erica L. Thomas\*, Dominic Upton

Department of Psychological Sciences, Institute of Health and Society, University of Worcester, Henwick Grove, WR2 6AJ, UK

### ARTICLE INFO

#### Article history:

Received 25 September 2013

Received in revised form

3 February 2014

Accepted 3 February 2014

Available online 20 February 2014

#### Keywords:

Factor analysis

Measurement

Psychometrics

Reliability

Validity

### ABSTRACT

**Objectives:** The Physical Activity Questionnaire for Older Children (PAQ-C) is a validated self-report questionnaire designed to assess moderate to vigorous physical activity in children. Currently however, there are no data supporting the use of the PAQ-C in British samples.

**Design:** Two studies using independent samples assessed the psychometric properties of the PAQ-C in children aged 9–11 from the UK.

**Method:** Study one ( $N = 336$ ) examined general test score characteristics, internal reliability, factor structure and construct validity of the PAQ-C with the Self-Report Habit Index (SRHI). Study two ( $N = 131$ ) re-examined the factor structure and assessed convergent validity with BMI and cardiovascular fitness (CVF).

**Results:** The PAQ-C had acceptable item distribution, item total correlations ( $>.30$ ) and internal reliability ( $\alpha = .82$  &  $.84$ ). Exploratory factor analyses (EFA) identified two factors which appear to be sensitive to the context in which the activity is performed 'in school' and 'out of school'. The PAQ-C was related to the SRHI ( $r = .30$ ) and inversely related to CVF ( $r = -.38$ ) but not with BMI.

**Conclusions:** With the exception of one problematic item; physical activity during PE, several analyses suggested that the PAQ-C had acceptable measurement properties in this group. Pragmatically, the ease of use and efficient format of the PAQ-C makes it a feasible option for large studies and/or when time, money and manpower are limited. That said, further development of the PAQ-C may be required for younger samples and its usefulness for intervention research has yet to be established.

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Physical activity is a behavioural category that involves a variety of actions including transport related behaviours, work related activities, leisure time activities and sport participation. For this reason self-report instruments are typically complex. The advantage of self-report questionnaires is that they are practical, economical and allow the researcher to test large numbers of participants in a relatively short space of time. Contextual prompts and items that query for location and/or purpose also improve the quality of data and provide important dimensions of physical activity not easily captured using objective measures such as heart rate monitors and accelerometers (Matthews, 2002). There are however concerns regarding the use of self-report instruments particularly in children because of the difficulty they have in correctly interpreting questions and accurately recalling activity

(Janz, Lutuchy, Wenthe, & Levy, 2008). For instance, children's activity is generally sporadic (Baquet, Stratton, Van Praagh, & Berthoin, 2007) and thus may not be memorable in terms of frequency duration and intensity, which is the type of information that self-report questionnaires commonly ask for (Hussey, Bell, & Gormley, 2007). For this reason physical activity questionnaires for use with children need to be designed in such a way that the impact of cognitive, memory and estimation skills is reduced to an acceptable minimum (Kremers, Visscher, Seidell, van Mechelen, & Brug, 2005).

Because of the diversity in available questionnaires, it is not easy for researchers to decide which instrument is most suitable for his or her specific demands (Chinapaw, Mokkink, van Poppel, van Mechelen, & Terwee, 2010). To this end a number of reviews (e.g. Biddle, Gorely, Pearson, & Bull, 2011; Chinapaw et al., 2010; Corder, Ekelund, Steele, Wareham, & Brage, 2008; Sirard & Pate, 2001; Welk, Corbin, & Dale, 2000; Tessier, Vuillemin, & Briançon, 2008; Welk & Wood, 2000) have been conducted attempting to select, synthesize and appraise available evidence concerning the general

\* Corresponding author. School of Sport, Exercise & Rehabilitation Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK. Tel.: +44 0121 414 3344.

E-mail address: [e.l.thomas@bham.ac.uk](mailto:e.l.thomas@bham.ac.uk) (E.L. Thomas).

characteristics and psychometric properties of physical activity questionnaires. These reviews have found that few (if any) self report measures demonstrate validity, reliability and responsiveness (Chinapaw et al., 2010) and have concluded that further development and testing of self report measures in young people is required (Biddle et al., 2011).

One potentially valuable instrument identified by Tessier et al. (2008), Chinapaw et al. (2010) and Biddle et al. (2011) was the PAQ-C (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). The PAQ-C is a self-administered seven-day recall questionnaire designed to assess MVPA in children aged 8–14 years. The purpose of the PAQ-C is to provide a general indication of children's physical activity levels. It consists of ten items, nine of which are used to calculate a summary of activity scores. The other question assesses whether sickness or other events prevented the child from doing his/her regular activity in the last week. The first question in the PAQ-C is an activity checklist consisting of 22 common activities plus two blank spaces for 'other' physical activities. This question is scored as the mean of all activities using a five-point scale, with higher scores indicating higher levels of activity. The primary purpose of this question is to aid memory recall through the use of memory cues. The remaining eight items are organized using a segmented time-of-day or day-of-the-week strategy. These items are also scored using a five-point scale with higher scores indicating higher levels of activity. The summary score for the PAQ-C is the mean of the nine items.

So far the psychometric properties of the PAQ-C have been tested in largely white Canadian samples. There is no data showing its use in Europe (Biddle et al., 2011). In the former group, the PAQ-C has demonstrated good internal consistency, test re-test reliability and sensitivity to detect gender differences (Crocker et al., 1997; Kowalski, Crocker, & Faulkner, 1997). It has also been shown to converge with teachers ratings of children's physical activity ( $r = .45$ ), the Godin and Shephard Leisure Time Exercise Questionnaire ( $r = .41$ ), the Seven Day Physical Activity Recall Interview ( $r = .46, .43$ ), physical activity measured via accelerometry ( $r = .39$ ), the Canadian Home Fitness Test (step test) ( $r = .28$ ), Athletic competence ( $r = .48$ ) and more (Kowalski et al., 1997).

Despite strong preliminary evidence for the PAQ-C in Canadian children, research suggests that it may lack external validity when 'exported' to other racial or ethnic contexts. For example, Moore et al. (2007) found no relationship between the PAQ-C, cardiovascular fitness (measured using a modified version of the Harvard step test) or BMI in African American or Hispanic children. There was however a small significant relationship between the PAQ-C and Athletic competence in European American ( $r = .14$ ) and African American ( $r = .14$ ) children and small to moderate relationships between the PAQ-C, BMI ( $r = .16$ ), systolic blood pressure ( $r = .17$ ) and cardiovascular fitness ( $r = .30$ ) in European American children. The factor structure of the PAQ-C has also been shown to vary by race. For instance Janz et al. (2008) identified a one factor structure in a sample of children from the Midwest, whereas Moore et al. (2007) identified a two factor structure in Hispanic children.

## Aims and objectives

Evidently, there is need for a psychometrically sound self-report instrument that can be used in large scale physical activity research with children. One potentially valuable instrument that has been identified for this purpose is the PAQ-C. What makes the PAQ-C so attractive is that it utilizes memory cues to enhance children's ability to recall their activity. The PAQ-C's measurement of general physical activity is also attractive because of the difficulty measuring intensity, frequency and duration, especially with self-report.

Currently there is no data supporting the use of the PAQ-C in British samples. This article will report on two studies which describe the basic psychometric properties of the PAQ-C in a cohort of children aged 9–11 years from the UK. The data in study one comes from a larger study (Thomas & Upton, *in press*) and reports the general test score characteristics (i.e. distribution of scores, item descriptive statistics, corrected item total correlations [CITCs] and internal reliability), factor structure and construct validity of the PAQ-C with the Self-Report Habit Index (SRHI) (Verplanken & Orbell, 2003). The data in study two was collected from a second independent sample to report the internal reliability, results from confirmatory factor analysis (CFA) and convergent validity of the PAQ-C with BMI and cardiovascular fitness.

Construct validity evidence can be established by testing how well a physical activity measure is correlated with theoretically related constructs (Thomas & Nelson, 1990). In order to explain why the PAQ-C should be related to the SRHI, some features of habit should be highlighted. Verplanken and Aarts (1999) define habits as "learned sequences of acts that have become automatic responses to specific cues and are functional in obtaining certain end goals or states" (p.104). According to this definition then habits are learned. This refers to the fact that habits are established through a history of repetition. Although repetition is not the sole requirement for habit development (functionality and automaticity are also important features of the definition) it certainly plays an important role in the habituation process and this has been demonstrated empirically (e.g. Lally, Van Jaarsveld, Potts & Wardle, 2010). Given the proposed theoretical and empirical relationship between repetition and habit strength it is hypothesised that the PAQ-C and the SRHI will be correlated demonstrating construct validity.

## Method

### Study one

#### Participants

Participants in the study were part of a larger project examining environmental and psychosocial correlates of physical activity in youth. For the purpose of statistical analysis, this study only included participants for whom data were available on both the PAQ-C and SRHI. Schools selected from registers of schools held by the University of Worcester were contacted via e-mail, inviting them to take part in the project. Four state funded primary schools replied to the e-mail and were recruited for the study. From these schools four hundred and fifty eight pupils completed the PAQ-C and the SRHI. The sample consisted of both males ( $N = 239$ ) and females ( $N = 235$ ) aged 9–11 years with a mean age of 9.83 years ( $SD = .89$ ). School statistics indicated that the majority of pupils were of White British ethnicity with only 2% from minority ethnic backgrounds. This is lower than average nationally and for the local authority area which is 27% and 10% respectively (Department for Education, 2011). The ACORN population profile was used as a proxy for socio-economic status. Results indicate that the school was a category three, i.e. populated by children from working families with household incomes around the national average.

#### Measures

PAQ-C: Physical activity was measured using the PAQ-C. In order to assess clarity of wording and comprehensibility a small focus group was conducted ( $N = 10$ ). Based on feedback from participants several minor modifications were made involving item wording (i.e. changing the word recess to break time) and cultural adaptations to the activities listed in the physical activity checklist.

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