Preventive Medicine Reports 3 (2016) 250–256

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: http://ees.elsevier.com/pmedr

Validation of the long international physical activity questionnaire: Influence of age and language region

Miriam Wanner [a,*], Nicole Probst-Hensch [b,c], Susi Kriemler [a], Flurina Meier [b,c], Christine Autenrieth [b,c], Brian W. Martin [a]

[a] Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Hirschengraben, 84, 8001 Zurich, Switzerland
[b] Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Socinstrasse 57, 4051 Basel, Switzerland
[c] University of Basel, Basel, Switzerland

ARTICLE INFO

Article history:
Received 21 May 2015
Revised 12 February 2016
Accepted 7 March 2016
Available online 9 March 2016

Keywords:
Measurement properties
Self-report physical activity
Adults
Validity

ABSTRACT

Objective. Little is known about the influence of age, gender and language on the measurement properties of the long International Physical Activity Questionnaire (IPAQ). The aim was to validate the long IPAQ in adults aged 18–84 in the German-, French- and Italian-speaking parts of Switzerland, focusing on differences between gender, age groups and language regions.

Methods. This cross-sectional study was conducted in the frame of SAPALDIA (Swiss Cohort Study on Air Pollution and Lung and Heart Disease in Adults) in 2011. 346 participants (54.6% women, mean age 54.6 years) wore an Actigraph GT3X accelerometer during 8 days and completed the IPAQ. IPAQ and accelerometer data on total physical activity and on different intensities as well as sitting time were compared using Spearman correlations and Bland–Altman plots.

Results. Correlations were highest for vigorous physical activity ($r = 0.41$) and sitting time ($r = 0.42$). Significant gender differences were apparent for leisure-time physical activity (men: $r = 0.35$ versus women: $r = 0.57$, $p = 0.012$) and for sitting time (men: $r = 0.28$ versus women: $r = 0.53$, $p = 0.007$). Differences between age groups were present for sitting time (youngest: $r = 0.72$ versus middle: $r = 0.36$, $p < 0.001$; youngest versus oldest: $r = 0.34$, $p = 0.001$). Differences between language regions were present for vigorous physical activity (German: $r = 0.28$ versus Italian: $r = 0.53$, $p = 0.033$). IPAQ overestimated physical activity but underestimated sitting time.

Conclusion. The long IPAQ showed moderate validity similar to other studies when compared to accelerometer data in a diverse sample of individuals. Some sex, age and regional differences were observed but do not seem to limit its applicability in population sub groups.

1. Introduction

Physical activity questionnaires are commonly used tools that are practicable in large samples (Westerterp, 2009), and therefore questionnaires with known measurement properties in different populations are needed. The International Physical Activity Questionnaire (IPAQ) was developed for adults aged 18 to 65 years with the aim to assess population levels of physical activity across countries (Craig et al., 2003). Its short version (7 items) provides information on the time spent walking, in moderate- and vigorous-intensity physical activity and sitting and is recommended for country-level monitoring (Craig et al., 2003). The long IPAQ (27 items) collects data in different domains (job-related, transport-related, domestic and leisure-time physical activity) and intensities (moderate, vigorous, walking) and includes sitting time. This long format is recommended for research requiring more detailed assessment (Craig et al., 2003).

Initially, the IPAQ has been validated in different countries (Craig et al., 2003). A recent review has summarized 23 validation studies targeting the short IPAQ with mixed results (Lee et al., 2011). Fewer studies have assessed the validity of the long IPAQ, showing conflicting results (Boon et al., 2010; Criniere et al., 2011; De Cocker et al., 2009; Gauthier et al., 2009; Hagstromer et al., 2010; Hallal et al., 2010; Johnson-Kozlow et al., 2006; Macfarlane et al., 2011; Maddison et al., 2007; Nang et al., 2011). A large Swedish study reported significant low to moderate correlations ($r = 0.07$–0.36) between IPAQ and accelerometer data (Hagstromer et al., 2010). Other studies have reported correlations in a similar range. A meta-analysis which included studies on the validity of both the short and the long IPAQ reported overall weighted mean correlation coefficients between 0.27 for moderate

* Corresponding author.
E-mail address: miriam.wanner@uzh.ch (M. Wanner).

http://dx.doi.org/10.1016/j.pmedr.2016.03.003

physical activity and 0.49 for vigorous physical activity (Kim et al., 2013).

Because self-assessment of physical activity is culture-dependent, it is important to provide IPAQ validation results in different language regions. Furthermore, most of the previous IPAQ validation studies were conducted in adults up to 65 years and little is known about its measurement properties in older adults. The short version has been validated only in few studies with older adults (Grimm et al., 2012; Hurtig-Wennlof et al., 2010; Kolbe-Alexander et al., 2006), while to our knowledge no such study exists for the long IPAQ.

The German IPAQ has been validated in its short version in a small sample in Switzerland (Mader et al., 2006) and in an adapted long version in German adolescents (Hagstromer et al., 2008). The IPAQ long in French has been validated in France (Criniere et al., 2011) and the French-speaking part of Canada (Gauthier et al., 2009). No validation study of the long IPAQ in Italian has been found.

In the present study, the long version of the self-administered IPAQ has been validated in adults aged 18–84 years in the German-, French- and Italian-speaking parts of Switzerland, focusing on overall and activity category-specific differences between gender, age groups and language regions. The age range was selected to assess the influence of age on the validity of the IPAQ throughout adulthood. 18 to 84 years corresponds also to the age range of the participants across the three assessments of the SAPALDIA cohort (Swiss Cohort Study on Air Pollution and Lung and Heart Disease in Adults), which forms the basis for this study. At the lower and upper end of the age distribution, a convenience sample was recruited to optimize statistical power.

2. Methods

2.1. Study design, procedure and participants

In Switzerland, the long IPAQ has been introduced in the second follow-up of SAPALDIA (Ackermann-Liebrich et al., 2005). The cohort started in 1991 with 9′651 randomly selected adults aged 18–61 years from eight different regions in Switzerland (Martin et al., 1997). The data for the present cross-sectional validation study were collected within the second follow-up of SAPALDIA 3 in 2010/11. Participants' age range was between 37 and 82 years. In order to include younger age groups and to increase the sample size for those over 65 years, an additional convenience sample of individuals aged 18 to 40 and 65 + was included. Individuals were eligible if they were able to walk, so no individuals in wheel chairs included.

A subsample of the more than 6000 SAPALDIA 3 participants in four of the eight examination centres was asked to participate in the validation study. As the validation study started after the main part of the second SAPALDIA follow-up, not all SAPALDIA participants had the opportunity to participate in this sub study. Participation included wearing an accelerometer during 8 days and completing the long IPAQ. First instructions were given by the field workers in the study centres in the context of participation in the overall study. The convenience sample was recruited by mouth-to-mouth advertising and distribution of written study information. Willing participants completed a consent form. The aim was to include 100 individuals in each language region based on a rule of thumb that at least 50 subjects are considered adequate in studies on the measurement properties of questionnaires (Terwee et al., 2010) and on the interest for further subgroup analyses.

Interested individuals were contacted by telephone. They received detailed instructions on the study and the handling of the accelerometer. The accelerometer and the IPAQ were sent by postal mail. Participants were instructed to complete the IPAQ directly after finishing the accelerometer data assessment and to return the material using a prepaid envelope. Data assessment took place between February 2011 and April 2012. The study was approved by the ethical committees of the Cantons of Aargau, Ticino, Wallis and Zurich and all participants provided written informed consent.

2.2. Measurements

Demographic data was available from the consent form (age, sex, language region) and from the SAPALDIA database, respectively.

2.2.1. Accelerometers

Accelerometer data was collected using Actigraph GT3X (Actigraph, Pensacola, FL, USA) devices with an epoch time of 60 s (Trost et al., 2005). The normal filter option was applied (Wanner et al., 2013). The Actilife 5 software was used to initialize and download the accelerometers. The device was attached to an elastic belt and individuals were asked to wear it on the right hip during waking hours for 8 consecutive days. Individuals were included in the analyses if valid data was available for at least 4 days (Trost et al., 2005) including at least one weekend day. A day was considered valid if at least 10 h of data were recorded. A maximum of 7 days were included in the analyses; if 8 valid days were available (N = 321, 92.5%), the first day of wearing was omitted because wearing the device may affect physical activity behaviour at the beginning of data collection (Esliger et al., 2005).

2.2.2. Questionnaire

The long IPAQ was used in German, French and Italian in a paper-and-pencil version. The German version was based on the Austrian translation (available at https://sites.google.com/site/theipaq/questionnaire_links). The French version was based on the translation used in France (Criniere et al., 2011). The Italian version was kindly provided by the Department of Neuroscience, Section of Kinesiology, School of Exercise and Sport Science at the University of Verona. The questionnaires underwent minor cultural adaptations to the respective Swiss context. For example, instead of “Strassenbahn” (Austria) we used the word “Tram” (Switzerland) for tramway. The German, French and Italian IPAQ that we used are provided in Supplementary Material Document 1.

2.3. Statistical analyses

The individual Actigraph files were cleaned using the MeterPlus software (Santech Inc., version 4.2). Non-wear time was defined as 60 or more minutes of consecutive zeros. In order to classify accelerometer output data into different physical activity intensity categories, cut points were used as follows. We calculated minutes per week spent in sedentary (<150 cpm) (Kozey-Keadle et al., 2011), light (150–2019 cpm), moderate (2020–5998 cpm) and vigorous (≥5999 cpm) physical activity (Metzger et al., 2008) as well as the number of steps per day. The cut points for moderate and vigorous activities were based on those used to analyse NHANES data (Metzger et al., 2008; Troiano et al., 2008).

IPAQ data were processed, cleaned and truncated according to the IPAQ protocol (International Physical Activity Questionnaire team, 2005). Minutes per week spent in moderate- and vigorous-intensity activities, the time spent walking and sitting were calculated. MET-minutes per week (Metabolic Equivalent) were calculated for different intensities and domains of physical activity and for total activity. One MET is equal to the energy expended during rest ($3.5\ ml\ O_2\ kg^{-1}\ min^{-1}$).). Based on frequency, duration and intensity of self-reported physical activity, individuals were categorized into low, moderate and high physical activity groups as suggested by the IPAQ scoring protocol (International Physical Activity Questionnaire team, 2005).

IPAQ and accelerometer outcome variables were reported as means and standard deviations (SD). Spearman correlations were used to compare IPAQ and accelerometer data. 95% confidence intervals (95% CI) based on Fisher's z transformation were calculated and differences between sub groups according to sex, age and language region tested (command “cortesti” in STATA). Bland–Altman plots show the extent of agreement between the two measures.

Different accelerometer output measures (cpm, total min/week in moderate-to-vigorous physical activity, moderate-intensity physical