



Concurrent validity of the international physical activity questionnaire in outpatients with bipolar disorder: Comparison with the Sensewear Armband

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ABSTRACT

The International Physical Activity Questionnaire (IPAQ) is a self-report questionnaire commonly used in mental health care settings to assess physical activity. However, despite its frequent use, its validity has not been investigated in people with bipolar disorder. The aim of this pilot study was to examine the concurrent validity of the energy expenditure recorded with the IPAQ compared with an objective measure, the Sensewear Armband (SWA). Twenty outpatients with bipolar disorder wore a SWA for 8 full consecutive days and subsequently completed the IPAQ. There was a significant correlation between the active (moderate and vigorous physical activity) energy expenditure as assessed with the IPAQ and SWA (minimum 10 min bouts). The IPAQ overestimated active energy expenditure and underestimated total energy expenditure from physical activity by almost 40% compared with the SWA. Results demonstrate that the IPAQ should be used with caution as a measure for estimating energy expenditure from physical activity in outpatients with bipolar disorder.

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1. Introduction

Physical inactivity is one of several modifiable risk factors contributing to a significant reduction in life expectancy for people experiencing chronic mental illness including bipolar disorder (Lawrence et al., 2013). Therefore monitoring physical activity participation is important for assessing the effectiveness of interventions aimed at increasing physical activity in people with bipolar disorder (Soundy et al., 2007). Objective methods for measuring physical activity, including doubly labeled water, direct calorimetry, accelerometers and pedometers are considered to offer more precise estimates of physical activity and remove many of the issues of recall and response bias associated with self-report measures, such as questionnaires and diaries (Strath et al., 2013). Despite the advantages of using objective assessment tools, these measures are often time-consuming and cost-intensive rendering them difficult to use routinely within mental health care settings (Vancampfort et al., 2015a). From an intervention perspective, it is

pertinent to determine the context in which physical activity occurs. Pedometers or accelerometers do not provide information on those contexts (e.g. active transportation, housework, leisure time activity and sports), which are however crucial for guiding intervention design and delivery (Vancampfort et al., 2015a). Subjective measures, on the other hand, are easier to apply because of their low cost and ease of administration and can provide information about the context in which patients are physically active and in which they are not. The International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) is one such self-report tool frequently used in mental health care settings. The IPAQ is an instrument which was developed by an International Consensus Group in 1998–1999 to establish a standardized and culturally adaptable measurement tool valid across various populations in the world (Craig et al., 2003). The IPAQ is designed to assess the levels of habitual physical activity for individuals ranging from young to middle-aged adults (i.e. 15–69 years old). In addition, there are different forms of the IPAQ based on several variations, which include the length of questionnaire (i.e. short or long form), reference period (i.e. last 7 days or usual week) and mode of administration (i.e. self-report or interviewer-based). It has been demonstrated previously in people with schizophrenia that the IPAQ exhibits measurement properties that are comparable to

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those reported in the general population and therefore can be considered as a surveillance tool to assess levels of physical activity in these patients (Faulkner et al., 2006). However, the authors acknowledged that the IPAQ was not without significant practical limitations. For example the authors utilized an interviewer to assist participants with structured recall and to assist participants to distinguish between the different intensity categories, suggesting that the questionnaire may be difficult for people with schizophrenia, or other psychiatric conditions, to self-complete (Faulkner et al., 2006).

To the best of our knowledge, validity data pertaining to the use of the IPAQ in people with bipolar disorder is lacking, despite its ongoing use in this population (Sodhi et al., 2012; Vancampfort et al., 2015b). In order to evaluate its concurrent validity, the IPAQ can be compared with physical activity output from objective measures. In contrast to physical activity measurement options such as doubly labeled water or direct calorimetry, accelerometers are cheaper, simpler and less invasive and thus can be a feasible objective measure by which questionnaires can be compared (Warren et al., 2010). One such accelerometer is the Sensewear Armband (SWA) which is a multi-sensor physical activity monitor, validated in a wide range of clinical and non-clinical populations (Farooqi et al., 2013; Tierney et al., 2013; Brazeau et al., 2014; Calabró et al., 2014; Reece et al., 2015). Therefore, the aim of this pilot study was to examine the concurrent validity of active and total energy expenditure from physical activity recorded using the IPAQ compared with the SWA in people with bipolar disorder.

2. Methods

2.1. Participants and procedure

Over a 6-month period, adult (18–65 years) outpatients with a DSM-V diagnosis of bipolar disorder I or II (American Psychiatric Association, 2013) of the UPC KU Leuven campus Kortenberg in Belgium were invited to participate. Diagnoses were made by a psychiatrist using the Mini International Neuropsychiatric Interview (Sheehan et al., 1998). Only outpatients with a clinical global impression severity scale (Guy, 1976) score of four or less, as assessed by the psychiatrist and who were able to concentrate for at least half an hour were included. Acutely psychotic patients were excluded. Somatic exclusion criteria included evidence of severe cardiovascular, neuromuscular and endocrine disorders which prevented participants being physically active as per usual. All participants wore the SWA for 8 consecutive days. At the end of day 8, participants completed the International Physical Activity Questionnaire (Craig et al., 2003). The study procedure was approved by the Scientific and Ethical Committee of the UPC KU Leuven, campus Kortenberg, Belgium and conducted in accordance with the principles of the Declaration of Helsinki. All participants gave their informed written consent. There was no compensation for participation in the study.

2.2. Objective physical activity assessment: Sensewear armband (SWA)

The SWA is worn over the right arm triceps muscle and assesses minute to minute movement through multiple sensors, namely a two-axis accelerometer and sensors measuring heat flux, galvanic skin and near body-temperature. Data are combined with gender, age, body weight and height, to estimate active energy expenditure using algorithms developed by the manufacturer (SenseWear Professional software, version 7.0). In accordance with the findings of Corder et al. (2008) who reported that behavioral modification often occurs on the first day of monitoring, data

recorded on the initial day were discounted entirely and only the data obtained during the subsequent 7 full days were used. Several variables were calculated from the SWA data. Physical activity can be expressed in metabolic equivalents (MET; in kcal/hour/kg), an indicator of daily energy expenditure. The unit MET is used to estimate the amount of oxygen used by the body during physical activity. Daily average time spend in moderate (MPA) (3–6MET) and vigorous physical activity (VPA) (≥ 6 MET) were calculated from all minutes with a MET-value. Active energy expenditure (AEE; in kcals: ≥ 3 MET) was calculated based on these 2 assessments. We also calculated the active energy expenditure based on physical activities performed in bouts of at least 10 min. Total energy expenditure (TEE) was calculated including total AEE, resting energy expenditure, and energy expenditure following light intensity and sedentary activities (≤ 3 MET). Data were accepted when the average on-body measuring time was at least 1368 minutes per day (95% of a 24-hour bout).

2.3. Subjective physical activity assessment: International physical activity questionnaire (IPAQ)-long version

A structured format (long version) (Craig et al., 2003) that asked participants to recall activities for each of the last seven preceding days was used (self-report). An active energy expenditure indicator was calculated as a sum of weekly metabolic equivalent (MET)-minutes per week of physical activity. The MET energy expenditure was estimated by weighting the reported minutes per week within each activity category (walking, moderate physical activity, vigorous physical activity) by a MET energy expenditure estimate assigned to each category of activity. The total weighted MET-minutes per week were calculated as duration \times frequency per week \times MET intensity, which were then summed across activity domains to produce a weighted estimate of total energy expenditure from all reported activities per week. We also summed the moderate and vigorous MET-minutes per week in order to correspond with the active energy expenditure recorded by the SWA.

2.4. Anthropometric measurements

Body weight was measured in light clothing to the nearest 0.1 kg using a SECA beam balance scale, and height to the nearest 0.1 cm using a wall-mounted stadiometer.

2.5. Statistical analyses

Statistical analysis was carried out using IBM SPSS statistics software (version 22.0). Descriptive statistics are reported as mean and standard deviation (SD). Associations between active (i.e. moderate and vigorous) and total energy expenditure from physical activity recorded using the IPAQ and the SWA were assessed using Pearson's correlation coefficients. Bland and Altman plots were produced to examine the level of agreement between active and total energy expenditure from physical activity recordings using the IPAQ and the SWA. The significance level was set at 0.05.

3. Results

3.1. Participants

A total of 26 outpatients with bipolar disorder were invited to participate. One person was excluded as a consequence of a severe locomotor disorder preventing the participant from performing usual physical activity. Of the 25 eligible persons with bipolar disorder, 3 declined to participate (i.e., were not interested). One of

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