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Impact of different recruitment strategies on accelerometry adherence and resulting physical activity data: A secondary analysis

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ABSTRACT

Strategies for increasing adherence to physical activity assessments are often linked to extra financial or personal effort. This paper aims to investigate the influence of the recruitment strategy on participants' adherence to accelerometry and resulting PA data. Data were used from two previous studies conducted in 2013 and 2016 in Cologne, Germany, differing in recruitment strategy ($N = 103$, 40.8% male, mean age 20.9 ± 3.7 years, mean BMI 23.7 ± 4.1 kg/m^2). In the passive recruitment (PR) group, vocational students took part in the accelerometry (ActiGraph GT3X+) in line with the main study unless they denied participation. In the active recruitment (AR) group, vocational students were invited to actively volunteer for the accelerometry. Impact of recruitment strategy on adherence and PA data was examined by regression analysis. Average adherence to the accelerometry was 66.7% (AR) and 74.0% (PR). No statistically significant influence of recruitment strategy on adherence and resulting PA was found (all $p > 0.05$). The difference in recruitment strategy did not affect adherence to accelerometry. The data imply that AR may be applicable. Future studies using larger sample sizes and diverse populations should further investigate these trends.

1. Background

The assessment of physical activity patterns is a keystone in many population surveys and in the evaluation of health promotion interventions and rehabilitation programs (Audrey et al., 2013; Weymar et al., 2015). For this reason, a variety of assessment methods have been developed over time; from easy-to-use questionnaires to cost-intensive chemical analyses like the doubly labeled water method, which is the current gold-standard in physical activity assessment (Müller et al., 2010). While questionnaires predominantly show only low to moderate validity (Müller et al., 2010; Helmerhorst et al., 2012), the more strongly valid assessment methods are often linked to a higher consumption of human and financial resources (Roth and Mindell, 2013; Rosenbaum, 2012). As a compromise between validity and practicability, accelerometers have become a method-of-choice in many studies over the last years (Rosenbaum, 2012; Guinhouya et al., 2013; Shiroma et al., 2015; Bornstein et al., 2011; Hansen et al., 2013).

In contrast to questionnaires, the objective measurement with accelerometers does not rely on the participants' memory and self-reporting, thus recall bias and reporting bias are minimized (Reilly et al., 2008; Brown and Werner, 2008). Moreover, the application is simple and not restricted by language knowledge or education. However, the use of accelerometers requires closer participant cooperation in wearing the device for several days and only removing them while sleeping and during water activities (Weymar et al., 2015; Roth and Mindell, 2013). In most cases, data over at least four days, with a minimum of 10 h wear-time, are needed for the analyses of physical activity patterns (Skender et al., 2016; Trost et al., 2005). For this reason, the participants' adherence is essential for recording usable data (Audrey et al., 2013; van Sluijs and Kriemler, 2016).

As the sample size is limited by the number of available accelerometers, which is limited by the device's cost (Audrey et al., 2013; Rosenbaum, 2012), many studies only use small (Brown and Werner, 2008; Vanderloo and Tucker, 2015) or sub-samples (Opdenacker et al., 2008; Prins et al., 2012) for the objective measurement of physical activity. Especially for this scenario, the question arises of how to obtain the most usable accelerometer data. Different participant-based and investigator-based approaches were suggested in order to improve

Abbreviations: AR, active recruitment; CPM, counts per minute; GPAQ, Global Physical Activity Questionnaire; MVPA, moderate-to-vigorous physical activity; PR, passive recruitment

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adherence in accelerometer studies (Trost et al., 2005), however, only a few of these approaches have hitherto been evaluated (Gorczynski et al., 2014; Sirard and Slater, 2009; Belton et al., 2013; Tudor-Locke et al., 2015). Moreover, most of the mentioned strategies involve additional financial burdens (e.g., incentives for wearing the device) or an increased workload for the research team (e.g., reminder calls) or participants (e.g., completing wear time logs). Hence, a resource-saving adherence-improving approach has yet to be found.

For this reason, the current paper aims to investigate the effects of different recruitment strategies on participants' adherence. Assuming that the people who actively volunteer for an objective assessment ("active recruitment") are more likely to provide sufficient accelerometer data than those people who passively accept the assessment in the context of a study ("passive recruitment"), this paper aims to examine whether (1) the manner of participant recruitment (passive vs. active) for objective physical activity assessments has an impact on participants' adherence, and (2) active and passive recruitment result in different physical activity data.

2. Material and methods

The present study was an exploratory, pooled secondary analysis of two main studies on physical activity promotion in 2013 and 2016. In brief, both studies, the Make Move study and the Web App study, aimed at web-based physical activity promotion in vocational school students in Cologne, Germany. Both studies were conducted in compliance with the Helsinki Declaration and were approved by the Ethics Committee of the German Sport University Cologne (Make Move reference: 2013; Web App reference: 118/2015). For further information on Make Move, see Frick et al. (2013), and for further information on Web App see Grieben et al. (2017).

2.1. Study design

For the present evaluation, data from the first week of the two different main studies (Make Move and Web App) was used to compare two groups with different recruitment strategy.

In the Make Move study, a total number of three classes was recruited according to prior agreement with school's principal and teachers. The objective measurement of physical activity was introduced as a component of the study, however, students, who did not want to participate in the measurement, were free to decline participation. In this way, the "passive recruitment" (PR) group was established, in which students were participating unless they freely declined participation.

In Web App the number of available accelerometers was smaller than the number of possible participants. Instead of randomly assigning participants, eligible participants from nine classes (same schools as in Make Move) were invited to participate in the objective physical activity measurement until all accelerometers were distributed. Those volunteers, who were participating of their own accord, form the "active recruitment" (AR) group of this secondary analysis.

All participants were informed that physical activity would be recorded by an accelerometer (ActiGraph GT3X+) that would have to be worn around the waist during waking hours. In addition to this, brief written instructions on accelerometer handling were provided.

The participants were informed that the study focuses on the physical activity behavior during their daily routine and, at the end of the investigation period, a written feedback about objectively measured physical activity would be provided for each individual participant. Exclusion criteria were limited mobility (e.g., orthopedic injuries) and insufficient knowledge of the German language.

No financial incentives for wearing the accelerometers were provided in either group. All participants provided informed consent.

2.2. Measures

All participants were instructed to wear an accelerometer (ActiGraph GT3X+) on the right-side of the waist during waking hours, removing them only while showering, bathing or swimming. The ActiGraph was previously validated for adults against heart rate telemetry (r = 0.66–0.82) (Melanson Jr and Freedson, 1995), indirect calorimetry (r = 0.66–0.88) (Melanson Jr and Freedson, 1995; Kelly et al., 2013) and the doubly labeled water method (r = 0.26–0.58) (Liu et al., 2005).

Accelerometer-data was collected with a sample rate of 30 Hz and saved in 30-s epochs. Prior to evaluation, the data were processed using the Freedson et al. (1998) and Troiano (2007) algorithms to obtain valid data on the duration and intensity of physical activity. Intensity cut-points were set at 0–99 counts per minute (CPM) for sedentary behavior, 100–1951 CPM for light intensity, 1952–5724 CPM for moderate intensity and > 5724 CPM for vigorous physical activity (Freedson et al., 1998). Moderate-to-vigorous physical activity (MVPA, > 1951 CPM) in bouts of at least 10 min with having a maximal interruption of 2 min (Masse et al., 2005), was calculated to interpret the data with regard to physical activity recommendations (World Health Organization, 2010). For this secondary analysis, the first seven days of baseline measurement were evaluated. Days having less than 1 h of recorded data were excluded from further evaluation (Skender et al., 2016; Trost et al., 2005). Adherence was defined as providing at least three days of minimum 10 h wear time.

To control for possible confounders on adherence and objective physical activity, self-reporting questionnaires were completed by each individual on demographics (sex, age, height, weight) and subjective physical activity (Global Physical Activity Questionnaire (GPAQ) (Armstrong and Bull, 2006)). The GPAQ collects information on the duration and intensity (moderate, vigorous) of physical activity and sedentary time in different dimensions (workplace, leisure time and transportation). The GPAQ has moderate validity (r = 0.20–0.40) (Bull et al., 2009; Trinh et al., 2009) and reliability (r = 0.67–0.81) (Bull et al., 2009).

2.3. Statistical analyses

Descriptive statistics (means, standard deviations, frequencies and percentages) were used to describe demographic characteristics and the data from questionnaires and accelerometers. Body mass index (BMI) was calculated using self-reported weight and height. Daily averages of MVPA and sedentary time (minutes in each activity category/number of recorded days) were calculated for GPAQ and accelerometer data.

Normality was checked using Kolmogorov-Smirnov tests with Lilliefors correction. Sex, BMI and age differences between groups (AR vs. PR) were tested by Pearson Chi-Square test and t-test, respectively.

For evaluating the impact of recruitment strategy on adherence (research question 1), a logistic regression model was used. Dichotomized adherence (≥ 3 days of minimum 10 h wear time vs. < 3 days of minimum 10 h wear time) was used as the dependent variable, recruitment strategy (AR vs. PR) as independent variable. To adjust for confounding, sex (female vs. male), BMI and age were included in the model. In a second model, self-reported physical activity (MVPA) was additionally included as an independent variable to explore whether (subjectively) physically active people were more adherent.

To explore the association between recruitment strategy and accelerometer-derived physical activity data (research question 2) a multiple linear regression model was calculated. For this purpose, the sample was restricted to adherent participants, i.e., providing at least three days of 10 h accelerometer wear time. Accelerometer-derived average MVPA per day was used as the dependent variable, since it is a commonly used indicator for health-related physical activity (World Health Organization, 2010). Recruitment strategy (AR vs. PR), sex (female vs. male), age and BMI were included in the model as